Macrofinancial Linkages

Trends, Crises, and Policies

Editors
Christopher Crowe, Simon Johnson, Jonathan D. Ostry, and Jeromin Zettelmeyer

INTERNATIONAL MONETARY FUND
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Today we are only too aware that vulnerabilities and excesses built up in financial markets and institutions can affect the wider economy, with sometimes devastating results. By the same token, the health of the financial sector can be severely tested by developments elsewhere in the economy. In fact, these two-way macro-financial linkages all too often create potentially dangerous feedback mechanisms that—without rapid and effective policy interventions—can trigger deep and long-lasting economic downturns.

As economists and policymakers, we should not need reminding of the critical importance of these macrofinancial linkages. But in case we had been tempted to play down their importance, the recent global financial crisis surely provided the necessary corrective.

Analysis of these two-way macrofinancial linkages is not a new field in macroeconomics. In fact, the field is rather like a classic play, perhaps enjoying periodic off-Broadway revivals, sometimes winning critical acclaim, but never reaching a mass audience. Irving Fisher's 1933 model of the debt-deflation mechanism remains the classic text. In fact, the damaging feedback loop between declining house prices, household default, credit contraction, and unemployment evident in the U.S. economy in the last couple of years is simply the latest manifestation of the classic debt-deflation mechanism: Fisher in modern dress.

More recently, economists such as Ben Bernanke and Mark Gertler (1989) have sought to integrate these mechanisms into mainstream macroeconomic models through their analysis of the so-called financial accelerator. Kiyotaki and Moore (1997) represent another key recent contribution. However, mainstream modern macroeconomic models typically used for policy analysis have, until recently, paid insufficient attention to these insights, and analysis of macrofinancial linkages has languished at the fringes of macroeconomics. The recent crisis has brought such analysis to center stage.

The IMF has participated actively in this renewed debate. Even before the global economy felt the full force of the crisis, as part of a wider effort to refocus the work of this institution, I sought to place the analysis of macrofinancial linkages and attendant risks at the center of our mandate. In fact, I felt that this was a key area of comparative advantage for the IMF, and one where we should be doing more. As I have argued elsewhere, with our involvement in the real economy and the financial sector, the IMF stands at the corner of Main Street and Wall Street.

There is a hunger around the world—in both emerging markets and advanced economies—for greater understanding of the links between finance and the wider economy. The IMF, with its global membership—and the legitimacy and breadth of experience that comes from that—is the institution with the greatest capacity to provide insights into this complex web of interactions. We have sought to meet this demand for cutting-edge analysis of macrofinancial linkages through the
research undertaken by IMF staff, as well as in the analysis in our flagship publications and multilateral and bilateral surveillance more generally.

As an example of our renewed focus on macrofinancial analysis, I am very happy to present this collection of research by IMF economists. The papers in this volume are representative of the high caliber of the IMF’s policy-relevant research on financial sector issues and linkages with the real economy—research that is increasingly guiding the IMF’s surveillance and policy advice.

The work in this volume addresses a wide range of topical questions. For instance, do financial crises, of the kind that recently engulfed global markets, have a long-term effect on economic growth? Has financial liberalization gone too far, or can further reforms, appropriately sequenced, aid economic development without creating additional volatility? And how do the significant gross cross-border asset holdings that have built up in recent years affect economic stability? Contributions to the volume also tackle some increasingly relevant policy issues, such as how monetary policy should respond to asset price bubbles, the optimal level of international reserves to insure against the risk of financial crisis, and the design of policies for resolving banking crises.

Although these contributions largely predate the recent crisis, their relevance and topicality is obvious. I am certain that this volume will find a ready audience among policy makers and researchers alike, and I am delighted that researchers here at the IMF are playing an active role in shaping the global debate on these topics. As we seek to learn from the recent crisis and build stronger and more effective global institutions—rewriting the script to better manage risks and vulnerabilities in our increasingly integrated global economy—I hope and expect IMF researchers to remain in the vanguard of this endeavor.

Dominique Strauss-Kahn
Managing Director
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Introduction

The global financial crisis has exposed the numerous and critical interactions between the world of high finance and the real economy of jobs, growth, and development. Although these issues have grabbed the headlines over the past year or two, macrofinancial linkages have long been at the core of the IMF’s mandate to oversee the stability of the global financial system. Research at the IMF on these issues stretches back decades, including significant efforts to improve the availability of data to assess financial sector risks and stock-taking exercises following previous episodes of financial crisis, but has received renewed impetus by recent events, including the long period of boom and rising macrofinancial imbalances in the global economy in the runup to the most recent crisis. Anchoring this work has been the objective of understanding the two-way transmission of shocks between the real and financial sectors as an underpinning of IMF surveillance and policy advice to member countries. With the advent of the crisis, the IMF has drawn on this research in order to contribute to critical debates on the nature of appropriate policy responses at both the national and multilateral levels.

The current juncture offers a good opportunity both to take stock of this body of research by IMF staff, and to share it with a wider audience. This volume brings together 17 papers on macrofinancial topics. The majority has already been published in top journals, while the others represent high-quality unpublished work that we expect to be of wide interest. The papers fit into three broad themes. The first groups a number of papers on financial crises and boom-bust cycles. The second set of papers is focused on the theme of financial integration, financial liberalization, and economic performance. The final set of papers looks at a range of policy issues, in the realm of macroeconomic policy and policies vis-à-vis the corporate and financial sectors—including domestic and external financial liberalization.

FINANCIAL BOOM-BUST CYCLES

The chapters in this section of the volume can broadly be divided into two strands. The first deals with the origin of financial crises, focusing in particular on how misaligned incentives in the banking sector can contribute to unsustainable booms. These chapters seem particularly relevant in the wake of the U.S. subprime crisis, where reckless lending by individual financial institutions appears to have been a critical factor. Dell’Ariccia and Marquez’s contribution, on lending booms and lending standards, outlines a theoretical model of the banking sector that can account for the boom-bust pattern of a lending binge followed by a deterioration in loan quality, losses for the banks, and a credit crunch. In the model, banks face both known
and unknown borrowers, where the latter can be either good or bad credit risks. When the number of unknown borrowers is relatively small, the pool of borrowers unknown to a particular bank will include a significant number of borrowers rejected by other banks as a bad credit risk. In this case, banks will require loans to be collateralized in order to screen out the bad borrowers. However, when there is an increase in credit demand, so that many new unknown borrowers enter the market, the share of bad credit risk borrowers is diluted. In this environment, banks will drop collateral standards, offering credit to all unknown borrowers, in an effort to boost market share. This creates a credit boom (greater than the initial shift in credit demand) but lowers the quality of borrowers, reducing bank profitability and increasing the risks of banking sector insolvency.

Igan and Tamirisa’s chapter on the credit boom in emerging Europe provides an empirical treatment of some similar themes. They analyze whether the pronounced credit boom in a sample of European emerging markets was being driven disproportionately by banks with weak balance sheets. The risk of weak banks driving the credit boom arises from the heightened incentives for excessive risk taking when a bank’s balance sheet is already impaired (so-called “gambling for resurrection”). The authors find some evidence that the role of weak banks in the credit boom did in fact increase over time in some countries in the sample, notably among the Baltic countries. Moreover, weaker banks appeared to be increasing their market share in some particularly risky areas, notably foreign currency lending. Hence, this chapter sheds some light on banking sector trends in emerging Europe that may have contributed to the economic problems that several countries in the region now face.

The second set of chapters within the first section offers contrasting analyses of the effects of boom-bust cycles. The key question is whether financial crises have long-run growth effects.

Cerra and Saxena investigate the growth impact of financial and political crises in a wide-ranging sample of countries. They find that crises are associated with a subsequent period of lower economic growth and hence a permanent decline in economic activity of around 4 percent, an effect that is robust across different crisis definitions and samples. Crises thus appear to be bad for growth.

Čihák and Koeva Brooks focus more narrowly on the impact of the 2007–08 crisis on financial conditions and hence on real activity in the euro area. A decline in bank soundness led to a reduction in bank loan supply, with a subsequent negative impact on economic activity. Similarly, an increase in corporate bond spreads led to a significant decline in industrial output.

Dell’Ariccia, Detragiache, and Rajan’s contribution supports the view that crises are bad for growth. They analyze the impact of banking crises across economic sectors, using the different patterns of dependence on external (bank) financing across sectors to identify whether banking crises have independent effects. This approach overcomes the difficulty of separating out the effect of the banking sector crisis from the general economic downturn (which may have been caused by the banking crisis or alternatively may be causing the crisis). They find that, in the wake of a banking crisis, value added, capital formation, and the number of establishments all grew more slowly in sectors that were more dependent on external
finance. This effect is strongest in developing countries, in countries with less access to foreign finance, and where bank distress is more severe.

However, Rancière, Tornell, and Westermann’s chapter suggests that crises have only limited long-run growth effects. In fact, they show that countries where real bank credit to the private sector is subject to periodic sharp declines (so that the distribution of credit growth is negatively skewed) in general grow more rapidly than countries whose credit growth is more symmetrically distributed. To account for this relationship, they outline a model in which borrowers are credit constrained because of problems enforcing contracts, so that growth is constrained by credit availability. In this model, risk taking can be excessive when the financial sector is liberalized but contract enforceability problems are acute. Hence, growth will be higher, but at the same time the financial system is more vulnerable to intermittent credit crunches and crises. In other words, occasional financial crises may be the price that has to be paid for higher, credit-fueled, economic growth, at least for emerging and developing countries (with relatively weak contract enforcement).

Key to understanding these chapters’ contrasting findings is that, whereas the first three focus on the period of adjustment and recovery following a crisis, Rancière, Tornell, and Westermann’s analysis also takes in the precrisis boom period. Hence, although crises are associated with sharp output declines and only partial recoveries, the precrisis boom more than offsets the postcrisis gloom.

**FINANCIAL INTEGRATION, FINANCIAL LIBERALIZATION, AND ECONOMIC PERFORMANCE**

While the first section is concerned with the runup to and aftermath of crises, the second section focuses on the role of financial factors in longer-run economic performance. In particular, the chapters in this section deal with issues related to financial liberalization in individual countries, financial integration across countries and markets, and the long-run effects of both.

Schindler’s chapter outlines a new dataset that provides de jure measures of financial integration for 91 countries covering the period 1995–2005. The data measure legal restrictions or capital controls on transactions relating to different forms of cross-border capital flows: a key contribution is providing more disaggregated measures of restrictions on different types of flow than has been available in the past.

Lane and Milesi-Ferretti’s chapter outlines a revised and extended version of their dataset covering estimates of countries’ external assets and liabilities (for 145 countries over 1970–2004). The data point to significant increases in financial integration—the de facto counterpart of the de jure moves identified by Schindler—across industrial, emerging market, and developing countries. The authors also identify some interesting additional trends, including a growing reliance on debt financing among industrial countries and on equity financing among emerging markets, and the rapid increase in foreign exchange reserves in emerging market
economies in the wake of the Asian and Russian crises in the mid- to late-1990s. One important implication of the increased financial integration captured in the data is that exchange rate movements imply significant wealth effects across countries arising from the large gross positions that have built up.

The remaining chapters in this section assess whether the claims made in favor of financial liberalization and integration (better-functioning global capital markets, more efficient allocation of resources, and improved cross-border risk sharing, among others) have been achieved in practice. Dell’Ariccia and coauthors document the increase in financial globalization, defined as the extent to which countries are linked through cross-border financial holdings. The chapter finds that financial globalization has been most pronounced in advanced economies, and that these countries have typically gained most in terms of international risk sharing. By contrast, financial globalization appears to have increased the level of macroeconomic volatility in emerging market and developing countries with poor institutional quality. As a result, the authors favor a sequenced process of financial liberalization that stresses complementary reforms to domestic institutions to reap the benefits of external financial liberalization.

Kose and coauthors argue that the benefits of international financial liberalization are mostly indirect, and not via the direct channel of providing access to financing for domestic investment. These indirect benefits include development of the domestic financial sector, greater discipline on macroeconomic policies, and efficiency gains among domestic firms arising from exposure to foreign competition. The authors argue that the mixed picture on the benefits of financial liberalization may simply be because these indirect gains occur only slowly over time, whereas some of the costs accrue relatively quickly. They argue that the long-run benefits of financial liberalization are therefore greater than a casual reading of the evidence would suggest.

The last two chapters in this section analyze more specific questions. Edison and coauthors test whether international financial integration improves long-run growth performance. The authors use a variety of techniques and different measures of financial integration, and find that the evidence suggests there is essentially no growth effect. Abiad, Oomes, and Ueda assess whether financial liberalization improves allocative efficiency in capital markets, by testing whether liberalization reduces the dispersal of Tobin’s Q (as a measure of expected returns) across firms. If liberalization improves allocative efficiency, then expected returns should become more equal as investment flows from less to more profitable firms. The authors test this proposition using firm-level data in five emerging market economies, and find that liberalization did indeed have this “quality effect” of reduced variance of expected returns.

The evidence in favor of financial liberalization therefore appears mixed. In some environments, liberalization is clearly harmful, whereas in others it may be growth-enhancing, especially if collateral benefits are taken into account. This highlights the importance of taking a broad approach to examining the effects of liberalization in order to shed light on the full range of channels through which it may operate.
POLICY ISSUES

The chapters in this final section of the book deal with a range of policy issues relating to macrofinancial linkages, including how to conduct monetary policy faced with these linkages, how to help countries insure themselves against external shocks, and the relationship between reforms at the firm level and macroeconomic performance.

Bordo and Jeanne analyze what is emerging as a fundamental question in the analysis of monetary policy: should central banks take into account asset prices in setting monetary policy and, if so, how? Traditional models used for policy analysis (new Keynesian models with sticky prices but a minimal treatment of financial frictions) have suggested that central bankers should adopt a policy of “benign neglect” toward asset prices, responding to asset price fluctuations only to the extent that they have direct implications for the general price level. However, the authors demonstrate that a more proactive policy stance—increasing interest rates when a boom emerges—can be optimal when macrofinancial linkages are modeled more comprehensively. In particular, intervention is justified when the bust following the bursting of the bubble can be expected to entail a significant output cost, and when the cost of tightening policy is not too high. However, the authors advise against a simple rules-based approach (e.g., augmenting a traditional Taylor rule with a term for asset prices), arguing that the conditions where the authorities should take asset prices into account are too complex to be easily summarized by a simple rule.

De Nicolò, Laeven, and Ueda analyze trends in the quality of corporate governance across a range of countries. They find that corporate governance has tended to improve over time, with a degree of convergence so that the greatest improvements have been in countries where performance was initially worse. They also find that improvements in corporate governance have been associated with improved macroeconomic performance across a range of indicators, including GDP growth, productivity growth, and the level of investment. These correlations are highest for industrial sectors most dependent on external finance, suggesting a causal relationship from improved corporate governance to economic performance via the channel of enhanced access to external finance for better-governed firms.

The next two papers in this section deal with the issue of how countries can insure themselves against macroeconomic and financial shocks. This issue has been a critical one for the IMF’s member countries in recent years, even before the most recent crisis. Becker and coauthors outline the type of shocks that countries typically face, and estimate that certain types of shocks—notably sudden stops for emerging market economies and terms of trade shocks for developing countries—are associated with significant costs in terms of lost output. They go on to analyze what domestic policies (as opposed to regional or multilateral arrangements) can help to minimize these costs. Key policies include improving countries’ external liability structure to reduce currency and maturity mismatches and sharing risks more broadly by moving from debt to equity-like liabilities (e.g., foreign direct investment). Reserves accumulation can also play an important role in country insurance. However, the authors find that some countries’ accumulation of reserves has gone beyond what could be justified on the basis of plausible changes in fundamentals, a conclusion reached also by Jeanne’s
study. Having said this, what is considered plausible may have shifted since these studies were written, and recent evidence from the current crisis—where countries with high levels of reserves appeared to have fared better than others—suggests that the optimal level of reserves remains an open issue.

The final chapter is concerned with crisis resolution policies. Laeven and Valencia draw on a unique database of banking crises and crisis resolution policies to assess which policies have been most effective and in what circumstances. They argue that key determinants of the success of crisis resolution policies include having an effective framework in place prior to the crisis, acting quickly to prevent contagion to previously immune institutions, providing direct support to households and firms where necessary, and putting in place policies to minimize moral hazard. Although the costs of policy interventions can be extremely high, and the benefits uncertain, the costs of inaction are typically even higher. Governments simply do not have time to adequately assess the optimal policy response, and so interventions tend to be second-best almost by definition. Meanwhile, open questions include the appropriate fiscal and monetary policy responses, beyond the immediate fiscal outlays and liquidity injection associated with bank rescues.

The chapters in this volume touch upon a broad range of topics. Nevertheless, it is possible to discern some common themes that are particularly relevant now, in the wake of the deepest financial crisis since the 1930s. First, macrofinancial linkages matter. This is most obviously true in the extreme case of banking crises, where several chapters identify significant real costs, but holds more generally and through a diverse range of channels. Second, macrofinancial linkages seem to have become more salient, as financial globalization has created new opportunities for both sharing and spreading risk. Third, macrofinancial linkages are complicated: difficult to capture using traditional theoretical models, with feedback channels that tend to be highly context-specific, and lacking simple empirical regularities to guide policy. Hence, useful theoretical work in this area needs to take seriously issues of asymmetric or incomplete information, limited commitment, and other financial frictions. Empirical work must be particularly meticulous, in the face of almost intractable identification problems. Most importantly, policy making has become more difficult, as existing problems become more complex and new problems emerge. In other words, macrofinancial linkages are hard to model, hard to measure, and hard to manage. But the chapters in this volume make progress on all three fronts.

The current crisis has come after a long period of increasing financial globalization, with financial systems having become more liberalized domestically and more integrated internationally. As the crisis recedes, a fundamental rethinking about the appropriate balance between regulation and laissez-faire in financial markets is undoubtedly underway, with the aim of improving tradeoffs between efficiency gains from a liberal financial system and volatility costs. It is our hope that research will continue to provide useful pointers to policy makers as they seek to reform financial regulatory policies in order to achieve the right balance between stability and innovation, and that the papers in this volume make a modest contribution in this direction.

Christopher Crowe and Jonathan D. Ostry
SECTION I

Financial Boom-Bust Cycles
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1.1. INTRODUCTION

Banks perform the important role of limiting adverse selection problems in the economy by screening out applicant borrowers that do not meet satisfactory lending standards. Failure to adequately perform this function leads to riskier portfolios and weaker balance sheets, with potentially negative consequences for the stability of credit markets. The focus of this chapter is on how the distribution of information about borrowers across banks interacts with banks’ strategic behavior in determining lending standards, lending volume, and the aggregate allocation of credit.

Our analysis shows that changes in the information structure of the market can have a significant impact on the likelihood of a banking crisis. Specifically, a reduction in the information asymmetries across banks may lead to an easing of lending standards and, in turn, an increase in the volume of lending, a deterioration of bank portfolios, and lower and more volatile profits. Thus, such lending booms can render banks more prone to financial distress in the event the economy experiences a downturn. This finding establishes a new explanation for the relationship between lending booms and episodes of financial distress that recent empirical studies document.2

To study this issue formally, we present a model of a credit market in which banks have private information about the creditworthiness of some borrowers (“known” borrowers) but not others (“unknown” borrowers). For this latter set,
banks can choose to use collateral requirements to sort “good” from “bad” borrowers, or they can choose to lend with no such requirement. The informational asymmetries both across banks and between banks and borrowers generate adverse selection problems that constitute the main incentives for banks to screen loan applicants.

We show that, when the proportion of unknown borrowers in the market is sufficiently low, in equilibrium banks will choose to screen out bad borrowers by demanding a sufficiently high collateral requirement. However, when the proportion of unknown borrowers is high, banks will offer contracts with no collateral requirement, that is, they will grant credit to all borrowers indiscriminately. The intuition is the following. When extending credit, banks are approached either by entrepreneurs with new or untested projects, or by those whose projects have been previously evaluated and rejected by competitor banks. To the extent that banks cannot distinguish between these two groups, as the proportion of new projects in the market increases, the distribution of borrowers applying to each bank improves as well. In this scenario, banks find it profitable to reduce collateral requirements in an effort to undercut their competitors and increase their market share.

These findings have several implications. First, switching from tight lending standards (enforced by collateral requirements) to a looser regime in which all borrowers obtain credit leads to a credit expansion that exceeds the increased demand for credit that triggered the shift in banks’ lending strategies. In other words, the increase in credit demand leads to a lending boom. Moreover, the pooling of borrowers that results is (second-best) efficient because it is optimal exactly when the costs associated with collateral liquidation exceed those associated with the financing of bad borrowers. That is, by avoiding the inefficient liquidation of collateral, booms maximize aggregate surplus. There is a downside, however, in that the reduction in screening results in a banking system with a deteriorated loan portfolio and thus lower profits. Further, the expansion in credit increases the sensitivity of bank profits to aggregate shocks, thereby making the banking system more vulnerable in the event of an economic downturn. To summarize, a lending boom that is induced by a reduction in information asymmetries can lead to a higher probability of a banking crisis. This result demonstrates the existence of a trade-off between overall output and banking system stability.

The analysis in this chapter is relevant for regulatory and competition policy, as it suggests that policies that generate an inflow of borrowers may reduce the amount of screening that banks perform, increasing the probability of systemic financial distress. For instance, this chapter suggests possibly negative aspects of the expansionary phases of the business cycle, periods during which more firms may be seeking credit. In this scenario, the proportion of unknown borrowers (or projects) in a market increases, because, for example, of the introduction of a new technology or to changes in the value of collateralizable assets. As we argue above, banks may respond to the increased proportion of unknown borrowers by reducing their lending standards and expanding credit, which increases aggregate surplus but also increases the probability of a banking crisis.
Our results also suggest that lending booms and the associated weakening of bank portfolios can be the result of financial sector reforms that modify the competitive landscape of credit markets. This is particularly relevant given recent evidence that, in many instances, banking crises and periods of financial distress are preceded by financial reforms that lack a concomitant strengthening of regulatory and supervisory frameworks (see, e.g., Gourinchas, Valdes, and Landerretche, 2001). For example, we show that capital inflows, such as those that often accompany capital account liberalizations, reduce the cost of financing for banks, increasing the likelihood of both a credit boom and a banking crisis. Moreover, we show that the introduction of the threat of competition into a protected monopolistic market may induce the incumbent to switch from screening to borrower pooling. This latter result is important for the analysis of the effects of financial liberalizations that allow new entry into previously regulated credit markets.

Although our initial analysis assumes that banks can make maximal use of their private information, our results continue to hold even if banks share borrower information such as the history of past defaults. The case of default history, or black information, sharing is of particular interest because this information is often available through the credit bureaus. We show that, although this kind of information sharing always increases aggregate output, in many instances it reduces bank profitability and therefore may not emerge endogenously. Furthermore, policies that mandate that banks collect and disseminate black information increase lending volume and reduce bank profitability, and therefore may increase the probability of a banking crisis. For completeness, we also examine the relationship between bank market concentration and borrower screening. We show that adverse selection and, as a consequence, the benefit from screening borrowers, is greater in markets that have a larger number of banks.

By establishing a link between (1) the notion that the willingness of banks to screen borrowers depends on the distribution of these potential borrowers and (2) the idea that under asymmetric information competition generates an adverse selection problem for banks, this chapter provides two main contributions. First, it relates changes in bank lending standards and screening behavior to changes in credit demand and the informational structure of the market. Second, it provides a novel mechanism that links lending booms and banking crises to the quality of the projects financed by banks. Recent papers relate bank screening to an improvement in the prospects of businesses (Ruckes, 2004) and to attrition in the ranks of loan officers skilled at identifying bad loans (Berger and Udell, 2004). We show that changes in the information structure of the market itself may play a role in transmitting macroeconomic shocks to the banking system. Furthermore, we show (in Appendix II) that this effect does not depend on the exact mechanism banks use to acquire information; similar issues arise if banks implement,

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3 For models illustrating the former, see, for example, Bester (1985), Dasgupta and Maskin (1986), Besanko and Thakor (1987), and Hellwig (1987). For the latter, see, for example, Broecker (1990), Dell’Ariccia (2001), Marquez (2002), and von Thadden (2004).
for instance, costly credit screens rather than collateral requirements to generate information about borrowers.

Recent work investigates the issue of credit cycles and variable credit standards. In Rajan (1994), bank managers with short-term concerns select the bank’s credit policies. Rajan finds that when most borrowers are performing well, bank managers relax credit standards to hide losses on bad loans and protect their own reputation, whereas when a common negative shock hits a sector, reputational considerations diminish and bank managers tighten credit standards. Ruckes (2004) presents a model in which variations in the quality of borrowers over the cycle can affect the standards that banks apply in lending. Similarly, Weinberg (1995) shows that an increase in the expected payoff of all borrowers’ projects can lead banks to grant loans to borrowers with a lower success probability. The novelty of our chapter is that banks may switch their screening behavior purely for informational reasons, even if the overall creditworthiness of borrowers remains unchanged.4 Kiyotaki and Moore (1997) study how the interaction between asset prices and credit limits set by collateral amplifies the size and duration of shocks. In their model, the quality of loans that banks finance does not vary over the cycle. Here, in contrast, we identify an additional mechanism that magnifies credit swings through changes in the distribution of information, linking the average creditworthiness of banks’ portfolios to the volume of credit that banks extend. Manove, Padilla, and Pagano (2001) show that the act of sorting borrowers through collateral requirements may reduce additional bank screening. In our model, the reduction in the use of collateral reflects the decrease in lending standards and leads to a credit boom.

Another line of empirical research examines how banks’ lending standards vary over the cycle and how they are related to the volume of lending and output.5 By focusing on the effects of changes in the demand for credit, our model identifies an important channel through which macroeconomic cycles affect the banking system. However, because we purposefully hold fixed the creditworthiness of borrowers in order to isolate the effect of information, our framework does not explicitly address how banks behave over the business cycle (see, however, the discussion in Section 1.5.1). In the concluding section, we discuss how the predictions of our model relate to the findings of recent empirical work on the cyclicality of standards and on loan collateralization.

The chapter proceeds as follows. Section 1.2 presents a model in which banks compete for both known and unknown borrowers. Section 1.3 solves the model and examines its welfare implications. We study the implications of the analysis for banking crises in Section 1.4. Section 1.5 discusses the role of bank market

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4 Our findings are also similar to those of Berlin and Butler (2002), who show that increasingly competitive markets can lead to less stringent collateral requirements. In our model, information asymmetries limit competition, so that reductions in these asymmetries lower the barriers to competition. See also Gorton and He (2003) and Gehrig and Stenbacka (2003), who identify alternative channels for swings in lenders’ standards for granting credit.

5 See, for example, Asea and Blomberg (1998), Lown and Morgan (2006), and Berger and Udell (2004).
structure and contestability, and how our framework can be applied to the analysis of the business cycle. Section 1.6 extends the analysis to incorporate information sharing. In Section 1.7, we examine in greater detail the testable implications of our model as well as the recent empirical evidence. Appendix I contains all proofs, and Appendix II presents an extension to the case where banks conduct costly credit screens.

1.2. MODEL

Consider an economy in which there is a continuum of entrepreneurs of mass $1 + \lambda$, each of which has a known end-of-period endowment $W$. Each entrepreneur is endowed with a project that requires a capital inflow of $1$ and that generates a payoff of $\bar{y} = y > 0$ in the case of success and $\bar{y} = 0$ in the case of failure. There are two types of entrepreneurs, namely, good and bad, with probabilities of success $\theta_g$ and $\theta_b$, respectively, where $\theta_g > \theta_b$. Good entrepreneurs, which comprise a fraction $\alpha$ of the population, are creditworthy whereas bad ones, which comprise the complementary fraction $1 - \alpha$, are not. Formally, this means that $\theta_g y > d$ and $\theta_b y < d$, where $d$ is the (risk-free) cost of funds for the banking system, such as the cost of insured deposits. We also assume that on average borrowers are creditworthy: $\bar{\theta} y > d$, where $\bar{\theta} = \alpha \theta_g + (1 - \alpha) \theta_b$.

The market for loans consists of two groups of borrowers, a mass $\lambda \in [0, \infty)$ of unknown borrowers and a mass $1$ of known borrowers. Known borrowers are those whose type is known to one of the banks, whereas unknown borrowers are those whose type is unknown to any bank; we assume, however, that all borrowers know their own types. Both of these groups have the same distribution over types. When first approached by an applicant borrower, banks are unable to distinguish an unknown borrower from one whose type is known to a competitor bank. We relax this assumption in Section 1.6.

There are $N$ banks competing for borrowers. We consider the symmetric case in which each bank possesses private information about a nonoverlapping mass $1/N$ of borrowers, where the borrowers that each bank knows are different, that is, each borrower’s type is known by only one bank.

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6 We assume throughout that $W \geq \frac{\theta_g y_0 - d}{\alpha \theta_g - (1 - \alpha) \theta_b}$, which is a sufficient condition for borrowers to be able to meet any collateral requirement by the banks in equilibrium. We discuss the effect of loosening this restriction in Section 1.4.3.

7 Henceforth, we use the terms entrepreneur, project, and borrower interchangeably. Similarly, we use the terms lender, intermediary, and bank interchangeably.

8 This is a convenient way of introducing informational asymmetries among financial intermediaries. See Dell’Ariccia (2001) and Marquez (2002) for similar setups. An alternative interpretation is that all borrowers are evaluated in some way, but only a fraction $\frac{1}{1+\lambda}$ of these evaluations yield private information to a particular bank, with $\frac{\lambda}{1+\lambda}$ of them yielding inconclusive information, so that the type of these borrowers is unknown to any lender. Similarly, $\frac{1}{1+\lambda}$ can also represent the probability that the success rate of any given borrower’s project is correlated across time, so that the ratio $\frac{1}{1+\lambda}$ represents the fraction of the population whose type will be unknown to any bank. All results go through exactly as stated under these alternative setups.
The game has three stages. In stage 1, banks compete for the pool of customers whose type is unknown to them. Banks can offer applicant borrowers a menu of loan contracts \((R^k, C^k), k = g, b\), where \(R \geq 0\) represents the repayment a bank obtains when the project succeeds, and \(C \geq 0\) is the collateral a bank can liquidate when a project fails. Collateral liquidation is costly, so the net value of the collateral to the bank is \(\delta C\), with \(\delta < 1\). This constraint can also be interpreted as saying that assets are more productive in use than under liquidation and allows us to exclude the unrealistic case wherein banks pool borrowers by offering a contract that requires positive collateral and pays zero interest rate.

In stage 2, each bank observes the realization of stage 1 and can offer competitive contracts to the borrowers whose types it knows. Borrowers then choose their preferred contract among those offered. This timing assumption captures the idea that borrowers are able to observe public offers made by all banks and can use them to bargain for better conditions from the bank that knows their type. Finally, in the third stage, banks have the opportunity to reject borrowers’ loan applications. In the event that more than one bank offers the same contract to a group of borrowers, the following procedure breaks the tie: all the borrowers that would choose a contract offered by more than one bank are randomly allocated to one of these banks.

Finally, entrepreneurs are risk neutral and seek to maximize their own profit. The expected value to an entrepreneur of accepting a loan contract \((R, C)\) is

\[
\theta_k(y - R) - (1 - \theta_k)C; \text{ for } k = g, b
\]  

(1)

For simplicity, we assume that the reservation utility of the entrepreneurs is zero, as they have no access to nonbank financing. The individual rationality (IR) constraints can therefore be written as

\[
\theta_k(y - R) - (1 - \theta_k)C \geq 0; \text{ for } k = g, b
\]  

(2)

1.3. EQUILIBRIUM

We solve the game by backward induction. Stage 3 is trivial because banks will reject loan applications if and only if the expected quality of the set of borrowers that accept a given contract is too low to provide nonnegative profits.

---

9 For each bank, this pool consists of all the unknown entrepreneurs on the market seeking financing (mass \(\lambda\)), and the entrepreneurs known to competitor banks (mass \(\frac{N-1}{N}\)).

10 The general structure of our model is as in Bester (1985), as extended by Hellwig (1987), with the important addition of asymmetric information among banks. The advantage of this approach is that it guarantees the existence of pure-strategy equilibria.

11 This tie-breaking rule guarantees the existence of an equilibrium for all parameter values. See Simon and Zame (1990) for a general analysis of the role of the sharing rule in establishing the existence of an equilibrium.
Therefore, borrowers cannot coordinate on a contract in a way that would yield losses for the bank offering that contract. We elaborate on this below, because the logic will be useful for distinguishing between the two types of equilibria we discuss.

In stage 2, banks observe the realization of stage 1 and choose to whom they should make competitive offers among the borrowers whose type they know. For each bank $i$, define $(R^{-i}, C^{-i})$ as the contract that good borrowers prefer among those offered in stage 1 by the competitors of bank $i$ and that at least breaks even when accepted by good borrowers only. The following result characterizes the equilibrium of the subgame.

**LEMMA 1:** (1) Each bank $i$ will offer its known good borrowers a contract $(R^g_i, 0)$, where $R^g_i$ is such that good borrowers are indifferent between $(R^g_i, 0)$ and $(R^{-i}, C^{-i})$; (2) each bank $i$ will deny credit to its known bad borrowers.

**Proof:** With respect to part (1), because the bank knows the type of these borrowers, it has no reason to include a costly collateral requirement in the contract. The value $R^g_i$ is the highest interest rate the bank can charge these known good borrowers without losing them to the competition. With respect to part (2), the expected return on bad borrowers is always negative. Hence, under no conditions will a bank lend to known bad borrowers.

We can now solve stage 1. Lemma 1 implies that when banks choose their stage 1 strategy, they have to take into account two facts. First, they will not be able to poach profitably from the pool of borrowers that are known to their rival banks. Second, the pool of potential borrowers unknown to a particular bank will consist of borrowers unknown to all banks as well as bad borrowers known to its competitors. Because our focus is on the case in which banks are symmetric, we limit our analysis to the case of symmetric equilibria. As Besanko and Thakor (1987) describe, a Nash equilibrium here is a profile of sets of contracts such that: (1) each bank earns nonnegative profits on each contract; and (2) there exists no other set of contracts that would earn positive profits in aggregate if offered in addition to the original set, with each individual contract in the set earning non-negative profits. Additionally, we require that the equilibrium be robust in the sense of satisfying the stability criterion of Kohlberg and Mertens (1986), and we restrict our attention to pure strategy equilibria.

### 1.3.1. Equilibrium with Borrower Screening

We first show that, for certain parameter values, the only stable equilibrium is one with screening, that is, only high-quality borrowers obtain credit and all banks offer the same contract (we use the terms separating and screening equilibrium interchangeably). In this separating equilibrium, banks try to attract good borrowers and

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12In principle, other (weaker) refinements of the equilibrium can be used, which deliver the same results because the stable equilibrium we derive is unique.
screen out bad borrowers by offering a menu of contracts that satisfies the incentive compatibility (IC) and individual rationality (IR) constraints. If a set of contracts \((R^k, C^k), k = g, b\), are offered, the IC constraints can be expressed as

\[
\begin{align*}
\theta_g (y - R^g) - (1 - \theta_g) C^g &\geq \theta_b (y - R^b) - (1 - \theta_b) C^b \\
\theta_b (y - R^b) - (1 - \theta_b) C^b &\geq \theta_b (y - R^g) - (1 - \theta_b) C^g
\end{align*}
\]

In the case we study here, the IC constraint for the bad type is the same as its IR constraint because no alternative contract is offered to bad borrowers given that their projects generate negative expected value. Hence, to find the competitive separating contract we only need to satisfy the IC constraint for the bad borrowers, which we achieve by setting their IR constraint to be satisfied with equality. Because we have competitive banks, we also impose the condition that banks make zero profits on the contract. Formally, the competitive separating contract \((\hat{R}, \hat{C})\) is the solution to the following set of equations:

\[
\begin{align*}
\theta_g R - d + (1 - \theta_g) \delta C &= 0 \text{ (zero profit for banks)} \\
\theta_b (y - R) - (1 - \theta_b) C &= 0 \text{ (IC for bad borrowers)}
\end{align*}
\]

Note that we need not be concerned about the good type's IC constraint, because only one contract will be offered: the zero-profit condition guarantees that no bank has an incentive to offer a different separating contract, and the IC constraint guarantees that no bad borrower has an incentive to accept this contract. Solving the two equations, we obtain \(\hat{R} = (1 - \theta_g) d - \delta (1 - \theta_g) y \) and \(\hat{C} = \frac{\theta_b y - \delta - d}{\theta_g - \delta (1 - \theta_g) \theta_b} \). This is a valid solution because the IR constraint for the good type is always satisfied by this contract.

For a strategy profile in which all banks offer the contract \((\hat{R}, \hat{C})\) to be an equilibrium, we also require that no bank can make positive profits by offering some other contract \((R, 0)\) in which all borrowers are pooled. To verify that this condition is met, first consider that, because bad borrowers’ projects generate a negative expected value, any pooling contract must attract unknown good borrowers to be profitable. This is accomplished by setting the repayment on the loan, \(\tilde{R}\), sufficiently low that \(\theta_g (y - \tilde{R}) > \theta_g (y - \hat{R}) - (1 - \theta_g) \hat{C}\) if

\[
\tilde{R} < \hat{R} + \frac{1 - \theta_g}{\theta_g} \hat{C}.
\]

In addition, the payment specified in the contract must be such that the bank at least breaks even when financing all the unknown borrowers plus the bad borrowers rejected by competitor banks, that is, \(\lambda (\theta \tilde{R} - d) + (1 - \alpha) \left(\frac{N - 1}{N}\right) \theta \tilde{R} - d \geq 0\) if \(\theta \tilde{R} - d \geq 0\).
\[ \tilde{R} \geq \tilde{d} \frac{\left( \frac{N-1}{N} \right) (1 - \alpha) + \lambda}{\left( \frac{N-1}{N} \right) (1 - \alpha) \theta_b + \lambda \theta} \]  

(4)

Hence, we can obtain the necessary and sufficient condition for the strategy profile in which all banks offer the single (separating) contract \((\tilde{R}_s, \tilde{C}_s)\) to be a Nash equilibrium by combining conditions (3) and (4), which yields

\[ \frac{\left( \frac{N-1}{N} (1 - \alpha) + \lambda N \right)}{(N-1)(1 - \alpha) \theta_b + \lambda \theta N} \geq \tilde{R}_s + \left( \frac{1 - \theta_s}{\theta_s} \right) \tilde{C}_s \]  

(5)

Note that condition (5) establishes a link between the proportion of unknown borrowers in the economy and the existence of a pure-strategy equilibrium in which borrowers are screened. For \(\lambda\) sufficiently close to zero, condition (5) is always satisfied and offering the separating contract is an equilibrium: in the limit there are no unknown borrowers in the market, so by offering a pooling contract, each bank would attract only the bad borrowers that are rejected by its competitors. As this would always generate losses, no such equilibrium is possible and banks must instead screen borrowers. However, as the distribution of applicant borrowers faced by a deviating bank improves with \(\lambda\), the viability of this equilibrium depends on the proportion of unknown borrowers. If, as the adverse selection problems associated with informational asymmetries among banks vanish, which occurs as \(\lambda \to \infty\), it is profitable to deviate from the separating equilibrium, then the equilibrium set will depend on \(\lambda\). Otherwise, the strategy profile with the separating contract will always be an equilibrium, as it would never be profitable to offer a pooling contract. By letting \(\lambda \to \infty\) in condition (5), we can state the condition for the equilibrium set to depend on \(\lambda\) as

\[ \frac{\tilde{d}}{\theta} \leq \tilde{R}_s + \left( \frac{1 - \theta_s}{\theta_s} \right) \tilde{C}_s \]  

(6)

If this condition is satisfied, a pooling equilibrium will exist for a sufficiently high value of \(\lambda\). High values of \(\theta\) make pooling contracts relatively attractive for banks, whereas high liquidation values of collateral \(\delta\) make separating contracts relatively cheap. It follows that the minimum \(\tilde{\theta}\) for which condition (6) is satisfied is increasing in \(\delta\). This suggests that our analysis applies not only to mature markets with high average borrower quality, but also to riskier markets with relatively high liquidation costs, such as emerging economies with poor enforcement of property rights. We can now state the following result.

**Proposition 1:** If condition (6) holds, then there exists \(0 < \hat{\lambda} < \infty\) such that:

1. for \(\lambda \leq \hat{\lambda}\) the strategy profile in which all banks offer the contract \((\tilde{R}_s, \tilde{C}_s)\) is the unique stable pure-strategy equilibrium of the game;
2. for \(\lambda > \hat{\lambda}\), no stable pure-strategy separating equilibrium exists.

**Proof:** See Appendix I.
For $\lambda$ higher than $\lambda^{\hat{}}$, each bank suffers relatively less from the adverse selection of financing other banks’ poor credit risks and the distribution of unknown applicant borrowers faced by each individual bank becomes too creditworthy for a separating equilibrium to exist. The intuition is the following. For good entrepreneurs, the perfect sorting of the separating equilibrium carries the advantage of a lower interest rate, but also the cost of a higher collateral requirement. The need to post collateral generates an inefficiency because liquidation is costly. This inefficiency is essentially the cost of sorting and, if the average creditworthiness of applicant borrowers is good enough (as is the case for $\lambda > \lambda^{\hat{}}$), it will exceed the benefits of sorting. In that case, the proposed separating contract is strictly dominated by some pooling contract ($R^p$, 0), and no separating equilibrium exists.\(^{13}\) We discuss this case in the next section. Proposition 1 also establishes that the equilibrium is stable (in the sense of Kohlberg and Mertens [1986]). Furthermore, the equilibrium is also robust to most other refinements as it represents the unique stable equilibrium. Finally, it is worth emphasizing that changes in $\lambda$ do not affect the average quality of the total pool of borrowers, but rather that of those applying in equilibrium to each bank. Overall, borrower quality remains constant and all the effects are driven purely by reductions in information asymmetries.

1.3.2. The Pooling Equilibrium

The same conditions that preclude the existence of a pure-strategy separating equilibrium guarantee the existence of an equilibrium that pools all borrowers and offers everyone credit on the same terms. Consider the break-even pooling contract ($R^p$, 0), with

$$
\hat{R}_p = \frac{N - 1}{N} \left( 1 - \alpha \right) + \lambda \\
\frac{N - 1}{N} \left( 1 - \alpha \right) \theta^b + \lambda \theta
$$

PROPOSITION 2: If condition (6) holds, then, for $\lambda > \lambda^{\hat{}}$, the strategy profile in which all banks offer the contract ($R^p$, 0) is the unique stable pure-strategy equilibrium of the game.

Proof: See Appendix I.

As before, whenever condition (5) does not hold, there exists a pooling contract that good borrowers prefer to the zero-profit screening contract such that any bank offering it would make positive profits if no other bank also offers that contract. Hence, there is no separating equilibrium. However, there is a stable pooling equilibrium, as no contract with $C > 0$ can represent a profitable deviation from the pooling equilibrium contract ($R^p$, 0), because all applications to the

\(^{13}\)This is as in Rothschild and Stiglitz (1976), Wilson (1977), and Hellwig (1987).
deviating contract would need to be rejected in the third stage because they would fail to draw a better-than-average pool of borrowers.\footnote{For these parameter values, this model may admit other equilibria supported by beliefs off the equilibrium path that are not robust to most refinements. Indeed, only the proposed zero-profit pooling equilibrium survives the stability criterion of Kohlberg and Mertens (1986). We note that Wilson (1977) proposes an alternative equilibrium concept whereby the zero-profit pooling contract is also the only solution.}

We base the analysis from here forward on the two equilibria characterized in Propositions 1 and 2. Using the fact that in equilibrium bank profits are just the profits from their pool of known borrowers because banks make zero profits on unknown borrowers, we can now compare the these two scenarios.

PROPOSITION 3: Relative to the separating equilibrium, in the pooling equilibrium: (1) Banks’ profits are lower; (2) The average quality of banks’ portfolios is lower; (3) Aggregate credit is larger, even on a per-applicant borrower basis (after dividing by $1 + \lambda$).

Proof: See Appendix I.

The first result in Proposition 3 establishes a link between market information structure and bank profitability. Points (2) and (3) compare the properties of the two equilibria in terms of bank portfolio quality and aggregate credit. When screening takes place, only good borrowers obtain financing. Thus, it is clear that the average quality of bank portfolios will be higher under screening than in a pooling equilibrium, in which case credit is extended to all but a small fraction $1/N$ of bad borrowers.

The same considerations also imply that aggregate credit is larger under pooling than screening, even controlling for differences in market size. For instance, all results so far continue to hold if $\lambda$ instead represents the fraction of unknown borrowers of a fixed market size of 1, with $1 - \lambda$ being the mass of known borrowers. Note as well that the strategic behavior of banks has a multiplier effect on the demand for credit. When demand is low ($\lambda < \hat{\lambda}$), only good borrowers obtain financing, so that aggregate credit increases linearly with demand. However, if demand increases enough ($\lambda > \hat{\lambda}$), the switch in equilibrium strategies from screening to pooling generates a credit boom with both good and bad borrowers obtaining financing.

The intuition for this result is the following. Each bank’s market power is linked to its information, because profits stem solely from the adverse selection each bank generates for its competitors. Essentially, banks are able to extract rents from borrowers whose type they know because it is difficult for these borrowers to credibly signal their quality to other lenders. When the proportion of unknown borrowers in the market increases, adverse selection becomes less severe and, hence, banks’ market power over their known borrowers decreases. The finding that banks reduce their lending standards so that all borrowers obtain credit therefore results from the improvement in the distribution of borrowers applying to any given bank. The result is similar to the finding in de Meza and Webb (1987) that good borrowers may draw in bad ones, with the
important difference that in our model the overall distribution of borrowers in the economy remains constant.

Although we derive the results in this section for a fixed deposit rate, they continue to hold if the deposit rate is increasing in the banking system’s demand for funds as long as the supply of deposits is sufficiently elastic. As long as the deposit rate does not increase too quickly or discretely when aggregate lending increases (as might be the case if the supply of deposits were fixed), there will be a value of \( \lambda \) such that the pooling contract will dominate the separating one even after taking into account the higher deposit rate associated with the increase in aggregate lending.

The negative relationship between aggregate credit and bank portfolio quality established in Proposition 3 sheds some light on why banking crises are often preceded by lending booms, as is well documented empirically. When the proportion of unknown borrowers increases, the strategic interaction of banks may cause both a lending boom and a deterioration of bank portfolios, both of which are accompanied by a reduction in bank profitability. Under these conditions, an aggregate shock to the banking system will be more deleterious than in a situation in which only good borrowers are financed and banks’ profits are higher. We discuss this issue further in Section 1.4.

1.3.3. Welfare Analysis

In a separating equilibrium, economy-wide net output (or surplus) is the sum of the expected returns from good projects minus both the cost of funds and the cost associated with the liquidation of the collateral for those projects that, although good, do not produce a positive return. This can be written as

\[
W_s = \alpha (\theta g y - d) + \lambda \alpha (1 - \delta) (1 - \theta) \hat{C}_s - d - \frac{\lambda}{H} (\theta y - (1 - \delta)(1 - \theta)) \]

In a pooling equilibrium, collateral requirements are zero, in which case expected total surplus is just the sum of the net expected returns of all borrowers who are financed. This can be written as

\[
W_p = \alpha (\theta g y - d) + \left(1 - \alpha \right)(1 - \theta) (\theta g y - d) + \lambda (\theta - \hat{\theta})
\]

Note that in both cases there is no welfare loss associated with financing known good borrowers; for these borrowers, asymmetric information represents a pure transfer from borrowers to lenders in the form of higher interest rates, but no inefficient liquidation of collateral.

We now examine whether the prevailing equilibrium maximizes total surplus or, whether instead, a social planner would want to intervene to restrict banks’ strategies and impose a particular (and potentially different) outcome. In other words, if both equilibria were possible, we ask whether one is superior in terms of maximizing aggregate net output.

**Proposition 4:** If condition (6) is satisfied, then there will exist a \( \lambda^w \) such that: (1) \( W_p > W_s \leftrightarrow \lambda > \lambda^w \); (2) \( \lambda^w < \hat{\lambda} \).

**Proof:** See Appendix I.
The first part of this proposition states that output will be higher with pooling than with screening if and only if the proportion of unknown borrowers in the market is above a certain threshold. The intuition for this result is straightforward. On the one hand, the welfare loss associated with pooling consists of two parts, one because of the financing of some of the competing banks’ known bad borrowers, and the other because of the financing of unknown bad borrowers. Although the latter grows linearly with \( \lambda \), the former is constant, with its weight tending to zero as \( \lambda \) approaches infinity. On the other hand, the welfare loss associated with screening consists entirely of the collateral liquidation cost, which grows linearly with \( \lambda \). As a result of condition (6), pooling of borrowers will Pareto dominate whenever the adverse selection caused by the informational asymmetries among banks is low. Hence, there must be some positive \( \lambda \) such that the loss associated with collateral liquidation costs exceeds that associated with financing bad borrowers.

Proposition 4 also proves that if information asymmetries are low and a pooling equilibrium exists, this equilibrium is also optimal from the perspective of maximizing aggregate output. The fact that \( \lambda^w < \lambda^p \) is not surprising once one considers that at \( \lambda = \hat{\lambda} \), both banks as well as good borrowers are indifferent between the pooling and the separating equilibria, whereas bad borrowers are obviously better off under the pooling equilibrium.

All the results so far apply to the case in which all borrowers have sufficient wealth \( W \) that they are able to post collateral if necessary and therefore no one is underserved in equilibrium (i.e., there is no true credit rationing). However, it is straightforward to show that similar, and in fact stronger, results obtain if instead some borrowers are unable to meet the collateral requirement of the bank and therefore are unable to obtain financing even if they have positive net present value (NPV) investments. To see this, consider a simple extension to the model and assume that some fraction \( \lambda \) of the borrowers has zero wealth (\( W = 0 \)) and can therefore post no collateral. When banks screen via collateral requirements, borrowers with no wealth will be rationed out of the market. However, if \( \lambda \) is sufficiently high that banks instead pool all borrowers, the elimination of the collateral requirement allows good but poor borrowers that would otherwise be rationed to obtain credit. This reinforces our finding that aggregate output is maximized under the pooling equilibrium, even if the average quality of the banks’ portfolios decreases.

The analysis in this section, as well as the other results in this chapter, carry through to a model in which banks screen borrowers through a costly creditworthiness test. In Appendix II, we provide such a model and show that, in a setting in which banks do not duplicate each other’s screening, all our main results hold. However, borrower wealth plays no role in that model, and hence the effect we identify in the paragraph above is absent.

\[\text{An analysis of the additional costs related to duplicated monitoring in banking can be found in von Thadden (1994). In particular, duplicated monitoring can introduce a social cost that is borne primarily by good borrowers.}\]
1.4. MACROECONOMIC SHOCKS AND BANKING CRISES

The results in the previous section demonstrate that strategic interaction among banks creates a link among (1) market information structure, (2) the aggregate amount of credit in the economy, (3) bank portfolio quality, and (4) bank profitability. In this section we show that, once a measure of aggregate uncertainty is incorporated into the model, the market’s information structure has additional implications for the stability of the banking system. In the next section we discuss how business cycles and financial liberalizations, by changing either the information structure or the cost structure of the market, may affect the likelihood of observing a banking crisis.

A natural source of aggregate uncertainty arises from the banking system’s function of maturity transformation, whereby banks convert short-term deposits into longer-term loans. Because the availability, as well as the cost, of banks’ liabilities may fluctuate while their assets are tied up in commitments with longer-term maturity, there is an inherent risk associated with this maturity transformation function. We model this risk by assuming that, at the time they make their lending decisions, banks do not know with certainty their cost of funds, which is a random variable $d$ with mean $\bar{d}$ and distribution $F(d)$. The realized value of $d$ becomes known only at the end of stage 3, after loans have been granted. In terms of the extensive form of this game, this is equivalent to assuming that banks commit themselves to provide a loan before the deposit market has cleared, and thus the realized interest rate on deposits is unknown. Alternatively, one can assume that the deposit rate is a short-term rate that can change before loans are repaid, and that banks need to rollover their liabilities.

For simplicity, we assume that banks have unlimited liability, but that they fail whenever their profits drop below zero. The behavior of banks is therefore fully characterized by the distribution of the average of the cost of funds. Hence, all the results we obtain in the previous sections hold in expectation. However, because there is aggregate uncertainty in the economy, the realized outcome may differ from the expected one. We define a banking crisis as a situation in which the aggregate banking system realizes negative profits, and thus has negative capital.16 This leads us to the main result of this section.

PROPOSITION 5: The probability of a banking crisis is nondecreasing in $\lambda$, the number of unknown borrowers in the market, and is strictly increasing for $\lambda > \bar{\lambda}$.

Proof: See Appendix I.

This result stems from two separate effects. The first is directly linked to the credit boom. When $\lambda$ increases enough, banks stop screening and extend credit to all applicant borrowers. This expansion in lending increases the exposure of banks to shocks to their cost of funds. Because banks earn positive profits only from known borrowers, the sensitivity of total profits to changes in the cost of funds is larger the greater the volume of credit. This effect can most readily be

16 Alternatively, we could define a banking crisis as a situation in which one or more banks realize ex post losses. The main results would be the same.
seen at the cutoff value of $\lambda$, at which point bank profits are the same in the pooling and the separating equilibrium, but credit is discretely larger in the former. Hence, this proposition establishes that small changes in the information structure of the market can cause a discrete increase in the probability of a crisis if they lead banks to reduce their standards and switch from screening borrowers to pooling everyone together.

The second effect is analogous to that behind Proposition 3. When the proportion of unknown borrowers in the economy increases, banks lose some informational capital and the market power that comes with it. Credit markets become more competitive, which lowers banks’ profits on known borrowers and reduces their ability to withstand negative shocks. Then, even within the region in which no bank performs any screening, an increase in the number of unknown borrowers leads to an unambiguous increase in the probability that banks are insolvent. It is worth noting that while this second effect may arise in other models in which bank profits are a buffer against aggregate uncertainty, the first effect is novel and specific to our framework based on an information-generated lending boom.

It bears emphasizing that the result in Proposition 5 holds even though there is no change in the aggregate quality as $\lambda$ increases. The result stems purely from the fact that banks are better able to withstand macroeconomic downturns when they are more profitable, granting loans to fewer, but relatively better, borrowers, than when they earn lower profits, financing all borrowers indiscriminately. We therefore have an increased probability of a crisis that is based on purely strategic reasons, even with rational and competitive banks. In other words, both the credit expansion and the greater possibility of a banking crisis emerge as pure information-based phenomena. It is worth noting, however, that a banking crisis in our framework simply represents a collapse of a sufficiently large number of individual banks, and does not address the possibility of contagion among banks, an issue that has dominated the recent debate on this topic. In particular, bank failures in our model stem from increased fragility at the bank level rather than from some underlying systemic instability.

This result highlights a trade-off between the output generated as a result of bank lending and banking system stability. As pooling borrowers generates higher aggregate output, it is also associated with a higher probability of a banking crisis. Moreover, if banking crises involve an aggregate welfare loss beyond that suffered by the banking system, this analysis suggests that there may be scope for policy intervention. In particular, a social planner averse to volatility is confronted with a trade-off between enhancing either the output or the stability of the banking system when information asymmetries are low. In that context, policies such as risk-based capital requirements that link banks’ costs to the riskiness of their portfolios may help extend the region in which screening is feasible and

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17 This chapter is, therefore, also related to the literature on the effects of competition on the stability of the banking system (see, for example, Matutes and Vives, 1996, and Allen and Gale, 2004).
thus reduce the probability of a crisis. Minimum collateral requirements on bank lending would have a similar effect, but may introduce a distortion if regulators are less informed than banks about market conditions.

As the results in Proposition 5 obtain for the case in which the cost of deposits, \( \tilde{d} \), is independent of bank behavior, one can show that similar results obtain if the deposit rate is endogenized so as to compensate depositors for the possibility of default by the bank. In other words, our qualitative results are unchanged if the deposit rate must be set to compensate depositors for the risk of bank failure, or of a banking crisis. In this instance, the deposit rate in equilibrium would be (weakly) increasing in \( \lambda \), because a larger \( \lambda \) corresponds to an increased probability of bank failure. Thus, an increase in \( \lambda \) further squeezes banks and increases the likelihood of a crisis.

Note that \( \hat{\lambda} \), the upper bound for screening to be feasible, is a decreasing function of the cost of liquidation, \( 1 - \delta \), so that markets with lower liquidation costs should find it easier to support borrower screening. Similarly, reforms aimed at improving bankruptcy laws and clarifying property rights should also increase the incidence of borrower screening by reducing liquidation costs. Furthermore, by reducing the cross-subsidization that occurs under a pooling equilibrium, the overall cost of borrowing can be reduced. Nevertheless, it is likely that some cost of liquidation will always remain as long as collateral is more valuable to the entrepreneur than to the financier.

We can derive two main contributions from the analysis of this section. First, our model proposes a rational bank lending mechanism that explains bank fragility as a function of purely informational factors. The literature on financial accelerators (e.g., Kiyotaki and Moore, 1997) identifies small changes in fundamentals as the initial catalyst for the crisis, which then becomes amplified through the financial system. We identify a new channel that magnifies the impact that changes in macroeconomic conditions have on the probability of banking crises. Second, we provide a simple mechanism that links booms and crises to the quality of the projects that obtain bank financing, for a given aggregate distribution of borrowers. In contrast, recent papers link lending standards to business cycles through changes in aggregate borrower quality (Ruckes, 2004) or attrition in the ranks of loan officers skilled at detecting bad loans (Berger and Udell, 2004). These different effects may coexist with ours to the extent that the factors responsible for an increase in the proportion of new borrowers also affect their aggregate quality.

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18 In addition, it is easy to show that in a model in which banks have some market power in the market for unknown borrowers, policies aimed at limiting banks’ lending capacity would have a similar effect.

19 An example of such a change is the value of durable assets used as collateral. When this value increases, credit constraints are loosened and leverage increases. Because of the higher leverage, the system becomes vulnerable to small shocks, and thus a small drop in the price of collateral may turn the boom into a crisis.
1.5. DETERMINANTS OF EQUILIBRIUM

We now turn to examining factors that, by either changing the proportion of unknown borrowers or changing its threshold value, determine whether borrowers are screened or are pooled together. Changes in the proportion of unknown borrowers can be caused by the business cycle, the introduction of new technology, or by changes in the value of collateralizable assets. From a cross-sectional perspective, differences in the fraction of unknown borrowers may be driven by differences in the maturity of the industry and the banking sector, or by the extent to which past information on project success correlates across time. Similarly, changes in the threshold value may be related to monetary policy, financial sector reforms, and changes in bank market structure. In what follows we study these issues in greater detail.

1.5.1. Business Cycle and Industry Effects

One possible source of changes in the aggregate demand for credit ($\lambda$) is the business cycle. During an upswing in the business cycle, market conditions are favorable for the expansion of existing businesses, yielding an increase in the demand for credit. A sufficiently large swing in the business cycle yields a switch in the equilibrium strategy and a reduction in lending standards, resulting in a lending boom that is more than commensurate to the increase in the demand for credit.\(^{20}\) The entry of new firms over the business cycle may have a similar effect if we assume, as mentioned previously, that banks conduct minimal credit screens of all customers, but such screens generate useful information only with probability $\frac{1}{1+\lambda}$. In such a setting, as new firms enter ($\lambda$ increases), information asymmetries across banks decrease, thus fueling a lending boom.\(^{21}\) Thus, in this model even small business cycle swings can have large effects on the allocation of credit and on aggregate output (see Proposition 3).

Although our model focuses on adverse selection, it is straightforward to add a moral hazard dimension to the problem, as in Kiyotaki and Moore (1997). In this scenario, banks would always demand a minimum amount of collateral to solve moral hazard problems, but collateral requirements would still be higher in the screening equilibrium than in the pooling one. Moreover, the business cycle would have an additional effect through the asset price channel: An increase in the price of collateral would act like an increase in $\lambda$, and grant access to credit to entrepreneurs previously too wealth constrained to post the minimum collateral necessary to apply for a loan.

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\(^{20}\) It is worth noting that upswings in the business cycle are often accompanied by improved prospects for all firms. In our model, this would correspond to an overall improvement in the distribution of borrowers, an issue from which we abstract in order to focus purely on the role of information. See Ruckes (2004) for a study of lending standards as borrower quality changes.

\(^{21}\) If these new firms could be perfectly identified as being unknown to all banks, then their entry would have no effect on the equilibrium incentives to screen. The market may be segmented in this case, with firms identified as being unknown to all banks being pooled separately from all other firms.
The results of this model can also be used to study cross-sectional differences in lending to different market sectors or different industries. It has been alleged that during the high-tech boom of the late 1990s, investors (as well as lenders) were channeling funds to firms about which they had very little information, and that this kind of behavior led to the eventual collapse of these markets. Using $\lambda$ to represent an inverse measure of the extent to which past information about a firm is indicative of future success (i.e., the extent to which the success of a firm’s projects correlate across time), our model predicts precisely this kind of behavior when there is very little extant information about firms. Whereas in this case information asymmetries between banks and borrowers may remain large, those across banks are likely to be small because little of the information gathered from prior experience will be reusable. We should therefore observe fairly competitive markets with loose credit standards, increasing the probability of an eventual collapse.

1.5.2. Financial Sector Reforms and Monetary Policy

Financial reforms, such as capital account liberalizations, are another event that may trigger a change in lending standards by affecting banks’ average cost of funds. We formalize this idea in the following proposition.

**PROPOSITION 6:** The threshold $\lambda$ below which borrower screening is feasible is increasing in the expected cost of funds of the banking system $\bar{d}$.

**Proof:** See Appendix I.

The intuition for this result is that, when the expected cost of funding for the banking system increases, the promised repayment in the pooling equilibrium needs to increase enough to cover the losses associated with the loans to all borrowers, including those with a low probability of repayment. This results in a pass-through of the interest rate that is greater than one. For the case in which borrowers are screened, the pass-through is smaller because only good borrowers obtain financing. Moreover, the collateral that banks obtain helps them absorb some of the losses associated with failed projects. This difference in interest rate pass-throughs implies that when banks’ cost of funds increases, borrower pooling becomes relatively more expensive and less attractive, in which case banks are more likely to retain high standards and screen loan applicants.

This result has two immediate interpretations. First, capital inflows that reduce the interest rate paid by banks to depositors and investors, such as those in the aftermath of a capital account liberalization, may cause a strategic reduction in lending standards and in turn a lending boom. In that context, our model is consistent with the recent literature on the twin crises—balance of payments and banking—that identifies international movements in capital, which often arise as a result of a financial liberalization, as a potential source of banking instability and financial vulnerability (see, e.g., Kaminsky and Reinhart, 1999).\(^2\)

\(^2\)There may, of course, be additional factors that influence the probability of a crisis. A recent paper by Goldstein (2005), for instance, suggests that strategic complementarities between depositors and currency speculators can cause a crisis in one sector to spiral into the other sector. Allen and Gale (2000) examine similar issues.
result matches the empirical finding that lending booms are often preceded by financial reforms that substantially reduce banks’ cost of financing through liberalization of capital flows and reductions of reserve requirements.

Second, this result suggests that changes in monetary policy that affect interest rates, and thus banks’ borrowing costs, may trigger changes in banks’ screening strategies. In our model, a monetary tightening will cause a flight to quality that is similar to that identified in agency cost models. Here, however, this effect is the result of an increase in the costs associated with adverse selection rather than more severe agency problems.

1.5.3. Entry and Contestability

In this section we examine the reaction of a monopolist incumbent to the introduction of a competitive threat. This issue is of importance given the recent literature suggesting that financial sector liberalization may lower the profitability and charter value of domestic banks, thereby increasing systemic vulnerability (see Claessens, Dermigüç-Kunt, and Huizinga, 2001). For this purpose, consider the case of a market that consists of a single bank protected from entry by regulation. It is straightforward to show that this monopolist will always screen out the bad borrowers by offering a separating contract.

LEMMA 2: There exists an \( \varepsilon^* > 0 \) such that for all \( 0 < \varepsilon < \varepsilon^* \), the separating contract \( (\hat{R}_e, \hat{C}_e) \), with \( \hat{R}_e = y - \varepsilon \) and \( \hat{C}_e = \varepsilon \frac{1 - \theta}{\theta} \), is more profitable than the pooling contract \( (y, 0) \).

Now consider a reform that allows new or foreign lenders with no private information about this market to compete with the incumbent. The presence of this competitive threat induces the incumbent to switch to a pooling strategy to exploit its informational advantage. We summarize this result in the following proposition.

PROPOSITION 7: Suppose an incumbent with an informational monopoly over the known borrowers faces a competitive fringe of potential entrants that possess no private information. In the unique stable pure-strategy equilibrium, the potential entrants offer the separating contract \( (\hat{R}_e, \hat{C}_e) \), the incumbent offers the pooling contract \( (\hat{R}_m, 0) \) where \( \hat{R}_m = \hat{R}_e + \left( \frac{1 - \theta}{\theta} \right) \hat{C}_e \), and all borrowers obtain credit from the incumbent.

Proof: See Appendix I.

The result demonstrates that in equilibrium the incumbent maintains its monopolistic position, but with a market power that is now limited by the threat of entry. This result therefore extends the findings of Dell’Ariccia, Friedman, and Marquez (1999) on how an incumbent’s informational advantage can create a limit to competition to a setting in which banks can use alternative screening mechanisms, such as enforcing collateral requirements.

More importantly, Lemma 2 and Proposition 7 show that financial reforms that introduce competition into previously protected monopolistic markets may trigger a change in the lending standards applied by the incumbent. To respond to the threat of entry the monopolist bank switches from screening to pooling so as to make the most of its informational advantage. This causes an increase
in the volume of lending, a deterioration of the bank’s loan portfolio, and a reduction in the incumbent bank’s profits. The results in this section therefore isolate an additional effect that arises purely from the informational structure of the market.

1.5.4. Market Structure

Recent literature emphasizes how changes in financial markets over the last decade have had broad implications for the banking industry, with consequent changes to the behavior and profitability of banks.23 These changes have often led to alterations in the structure of the industry through, for instance, increased incentives for entry or for consolidation. In this section, we analyze how credit market structure interacts with the informational characteristics of the market in determining banks’ strategies.

PROPOSITION 8: For $N > 2$, the threshold proportion of unknown borrowers above which a pooling equilibrium exists is increasing in the number of symmetric banks: $\lambda(N) < \lambda(N + 1)$.

Proof: See Appendix I.

Changing the number of symmetric banks in the market has two competing effects. On the one hand, as the number of competing banks increases, the proportion of borrowers known to each bank shrinks, leading to a more severe adverse selection problem for each bank. This increases the incentive to screen applicant borrowers and reinforces the separating equilibrium. On the other hand, with a larger number of competing banks there is a stronger temptation to deviate from a separating equilibrium because the extra market share a deviating bank can grasp increases. Consequently, there is an increased incentive to reduce lending standards by not screening borrowers. Because in equilibrium banks make zero profits on unknown borrowers, the first effects prevails, and the threshold value $\lambda$ increases with $N$. In other words, markets characterized by lower bank concentration permit a screening equilibrium for a larger proportion of unknown borrowers.

It is also straightforward to see, from inspection of equation (4), that whenever borrowers are pooled, the equilibrium lending rate will be increasing in the number of banks. This somewhat counterintuitive result is the combined product of Bertrand competition and the adverse selection caused by the informational asymmetry among banks. When there are a large number of banks, each bank has less information, and banks must raise the interest rate they charge to break even. This finding is consistent with recent theoretical results in Broecker (1990) and Marquez (2002) on competition in lending markets, and derives some empirical support from the finding that charge-off rates for bank commercial loans increase with the number of competing banks, as documented by Shaffer (1998). However, this evidence should not be seen as a direct test of our

theory, because Proposition 8 also demonstrates that an increase in the number of banks can actually improve their portfolios if the increase leads them to switch to a screening equilibrium. That said, it is worth noting that the empirical results concerning loan chargeoffs and the number of banks do not extend to real estate and consumer loans, for which, as Shaffer argues, collateral may play an important role.

1.6. THE ROLE OF INFORMATION SHARING

The existence of information asymmetries among banks is one key assumption of the framework we present in this chapter. However, recent literature emphasizes that information sharing is a common element in credit markets. In this section, we study some implications of allowing banks to share information about borrowers.

Under full information sharing, whereby banks provide each other all relevant information concerning their known customers, banks would always offer the pooling contract to unknown borrowers and the break-even contract \( (\theta, 0) \) to good known borrowers, but would deny credit to bad known borrowers. Hence, full information sharing among banks would never arise endogenously in this model, because it would lead to an equilibrium with zero profits as banks compete more aggressively when information is symmetric.

However, in a recent paper Bouckaert and Degryse (2004) show that the strategic disclosure of some, but not all, information may enhance profits in settings in which information asymmetries among banks exist. In their model, the sharing of black information, which constitutes the sharing of information about borrower defaults, has two effects. First, it increases bank competition (entry) by reducing adverse selection, because, for each bank, the type distribution of unknown borrowers with no record of defaulting improves. Second, it increases bank market power over those borrowers that, although good in type, are unlucky and default. The net impact on bank profits depends on which of these two effects prevails. Because the most commonly available information through credit bureaus is that on borrower default history, in what follows we extend the main results in this chapter to the case of black information sharing.

Consider the following simple extension of the model. Suppose that, prior to stage 1, there is a stage 0, where each of the \( N \) banks lends to a (nonoverlapping) mass \( 1/N \) of borrowers and, as a consequence, learns their type. Borrowers invest in a project that is independent and identical to that described for stages 1 to 3, which succeeds with probability \( \theta_i, i \in \{g, b\} \). The lending bank also observes the outcome of this initial project. Suppose further that all banks are committed to share information about borrower default. In other words, it becomes common knowledge whether a project of a particular borrower is successful (\( \bar{y} = y \) or

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24For example, see Pagano and Jappelli (1993) and Padilla and Pagano (1997).
results in failure ($\bar{y} = 0$), in which case the loan is not repaid. We now characterize the resulting equilibrium for stages 1 to 3. As before, assume that condition (6) is satisfied.

**PROPOSITION 9:** Under black information sharing, there exists some $\hat{\lambda}^* < \infty$ such that: (1) for $\lambda \leq \hat{\lambda}^*$, the unique stable equilibrium involves screening; (2) for $\lambda > \hat{\lambda}^*$, the unique stable equilibrium involves the pooling of borrowers; (3) banks always offer unknown borrowers known to have defaulted a screening contract $(R_s, C_s)$; and (4) $\hat{\lambda}^* < \lambda$.

**Proof:** See Appendix I.

This proposition extends the main result of this chapter to the case in which banks share borrower default information. The intuition is as follows. The sharing of black information divides the pool of unknown borrowers faced by each bank into two segments characterized by different borrower distributions. In the segment of “black-listed” entrepreneurs for any given bank, there are no new or unknown borrowers. This means that no pooling contract can earn nonnegative profits on this segment of the market, because some other banks that know these borrowers’ exact type will match any viable offer made to good borrowers, but will let bad borrowers go. The other segment consists of all the unknown borrowers and previously evaluated bad borrowers who did not default in the past. Hence, the equilibrium for this segment is similar to that for the game without information sharing. The only difference is that the type distribution of unknown borrowers for this segment is better, which implies that the proportion of unknown borrowers required to support a pooling equilibrium is lower relative to the case without information sharing: $\hat{\lambda}^* < \lambda$.

We can also examine the conditions under which banks would choose whether or not to share black information. To endogenize this choice, assume that, at the beginning of stage 1, banks choose whether they want to share their own information in exchange for that of their competitors.\(^{25}\) This leads to the next result.

**PROPOSITION 10:** (1) Bank profits with black information sharing will exceed profits without information sharing if and only if the proportion of unknown borrowers in the market exceeds a certain threshold, $\hat{\lambda}^* > \lambda^*$; (2) this threshold is greater than that required to support pooling in the absence of information sharing: $\lambda^* > \hat{\lambda}$.

**Proof:** See Appendix I.

From Proposition 9, we know that information sharing lowers the threshold required for pooling to be optimal. Therefore, there is a range of values of $\lambda$ for which, absent information sharing, only an equilibrium in which borrowers are screened exists, but in the presence of information sharing, banks no longer find it feasible to screen and instead pool all borrowers. For this region, banks’ profits are reduced. It follows that it will be profitable for banks to share information.

\(^{25}\) This is equivalent to determining the conditions under which banks would lobby for regulation that forces all banks to participate in an information sharing agreement.
only when, in the absence of information sharing, the equilibrium would pool all borrowers.

The results in Propositions 9 and 10 imply that, when information sharing among banks emerges endogenously, it also increases the aggregate surplus. However, there are values of $\lambda$ for which, although information sharing does not emerge endogenously, it would still increase the aggregate surplus either by expanding the region in which a pooling equilibrium exists (for $\lambda \in (\lambda^*, \hat{\lambda})$), or by reducing the portion of bad borrowers financed in equilibrium whenever the pooling of borrowers is viable (for $\lambda \in (\hat{\lambda}, \lambda^*)$). A policymaker concerned with maximizing aggregate surplus would therefore find it optimal to collect and disseminate black information, perhaps by means of a public credit rating agency.

We note, however, that a policy of forcing the dissemination of black information may not be unambiguously beneficial if one is concerned about banking system stability in addition to pure output. When information sharing among banks emerges endogenously, it increases bank profitability and reduces the volume of credit that is allocated to bad projects, thereby reducing the probability of a banking crisis. However, when such policies do not emerge endogenously among banks, forcing banks to disseminate black information may also reduce banks’ profits, and therefore carries the risk of an increased probability of a crisis. Using the notation of the model, one can show that there is a $\Delta > 0$ such that for $\lambda \in (\lambda^* - \Delta, \lambda^*)$, such a policy would not only increase the aggregate surplus, but would also reduce the probability of a crisis. This is true because, for values of $\lambda$ just below $\lambda^*$, bank profits are only marginally affected by information sharing, whereas the improvement in credit allocation is of the first order. However, for $\lambda$ near $\hat{\lambda}$, forced information sharing has the opposite effect, because it moves the equilibrium away from one in which banks screen their borrowers to one in which all borrowers are pooled. Associated with this is a reduction in bank profits and an increase in the volume of credit to bad borrowers, and in turn an increase in the probability of a crisis.

1.7. CONCLUSION

This chapter presents a framework wherein the strategic behavior of banks interacts with the market information structure in determining bank lending standards. Adverse selection problems that stem from informational asymmetries among lenders induce banks to screen applicant customers to avoid financing those borrowers that are rejected by their competitors. However, when the proportion of unknown projects in the economy increases, as may happen after a deregulation or during the expansionary phase of a business cycle, such adverse selection problems become less severe, reducing banks’ lending standards. This in turn results in lower bank profitability, higher aggregate credit, and higher vulnerability to macroeconomic shocks. These results continue to hold when banks share information about borrower defaults.

The model provides several testable implications that are well in line with existing empirical literature. First, the model predicts a negative relationship
between new loan demand and lending standards. This is established indirectly in Asea and Blomberg (1998), who find that in the United States, lending standards tend to vary systematically over the cycle, with the probability of collateralization increasing during contractions and decreasing during expansions. Lown and Morgan (2006) also find that the lending standards that banks apply vary over the cycle. In particular, they find that higher levels of past loans are associated with a tightening of current standards, which, to the extent that more prior lending reflects more private information, is consistent with the predictions of our model. More recently, Berger and Udell (2004) find evidence for the cyclicity of standards that is consistent with our results concerning changes in the distribution of information. Although their focus is on a testing strategy and explanation at the bank level, they recognize the importance of a system-wide rationale for the easing of lending standards, such as our information-based story.

A second empirical prediction of the model is that loan collateralization should decrease with the existence of a bank-borrower relationship that generates private information for the bank, while interest rates should increase. These findings parallel those in Degryse and Van Cayseele (2000), who examine detailed contract information on nearly 18,000 bank loans to small Belgian firms (see also Degryse and Ongena, 2004). Also consistent with the model's prediction is the evidence in Harhoff and Korting (1998) on credit markets in Germany; the authors use relationship duration as a measure of the importance of the relationship and find that it has a negative effect on collateral requirements, and a positive, although not significant, effect on loan prices.

Finally, our model predicts that episodes of financial distress are more likely in the aftermath of periods of strong credit expansion. This chain of events, of which Argentina in 1980, Chile in 1982, Sweden, Norway, and Finland in 1992, Mexico in 1994, and Thailand, Indonesia, and Korea in 1997 are the most significant examples, has been well documented by a growing literature on banking crises. For example, Demirgüç-Kunt and Detragiache (2002) find evidence that lending booms precede banking crises. Gourinchas, Valdes, and Landerretche (2001) examine a large number of episodes characterized as lending booms and find that the probability of observing a banking crisis significantly increases after such episodes. Moreover, the conditional incidence of having a banking crisis depends critically on the size of the boom. Notably, in our model, when banks screen borrowers, it is only for increases in lending large enough to induce a change in lending strategies that the probability of a banking crisis increases.

We show that the information structure of loan markets plays a crucial role in determining banks’ lending standards and consequently has important implications for systemic stability and the volume of credit provided to the economy. A natural extension is to examine in more detail the factors and mechanisms that determine this information structure; in other words, to endogenize \( \lambda \). We leave that task for future research.
APPENDIX I. PROOFS

Proof of Proposition 1: The contract \((\hat{R}, \hat{C})\) is the solution to the system

\[
\begin{align*}
\theta_b R - \bar{d} + (1 - \theta_b) \delta C &= 0 \quad \text{(zero profit)} \\
\theta_b (y - R) - (1 - \theta_b) C &= 0 \quad \text{(IC)}
\end{align*}
\]  

(A1)  

(A2)

With this contract, the good borrowers’ IR constraint is slack, that is,

\[
\theta_g (y - \hat{R}) - (1 - \theta_g) \hat{C} > 0 \quad \text{(IR)}
\]  

(A3)

which implies that

\[
y > \hat{R} + \left(\frac{1 - \theta_g}{\theta_g}\right) \hat{C}
\]

Because by assumption we have \(\theta_b y < \bar{d}\), it follows that

\[
\frac{\bar{d}}{\theta_b} > \hat{R} + \left(\frac{1 - \theta_g}{\theta_g}\right) \hat{C}
\]

Then, from condition (5), this in turn implies that at \(\lambda = 0\), we always have a separating equilibrium as no bank can profitably deviate from the zero-profit separating contract. Now, it is easy to see that the left-hand side (LHS) of the inequality in (5),

\[
\frac{\bar{d}}{(N - 1) (1 - \alpha) + \lambda N}{(N - 1) (1 - \alpha) \theta_b + \lambda \theta N}
\]  

(A4)

is continuous and decreasing in \(\lambda\), and tends to \(\frac{\bar{d}}{\theta_b}\) as \(\lambda \to \infty\). Hence, if condition (6) holds, there must exist a \(\hat{\lambda} > 0\) such that a separating equilibrium exists if and only if \(\lambda \leq \hat{\lambda}\). Moreover, the zero-profit condition guarantees that no bank can profitably deviate by offering a different separating contract. Finally, if condition (5) is violated, which occurs by assumption as \(\hat{\lambda} \to \infty\), then no pure-strategy separating equilibrium exists because of the standard Rothschild-Stiglitz argument. This demonstrates that the equilibrium described above is the unique stable separating equilibrium, and exists if and only if \(\lambda \leq \hat{\lambda}\).

To show that no pooling equilibrium exists, note that condition (4) implies that the rate \(\bar{R}\) offered on any candidate pooling contract needs to be sufficiently high so as to satisfy \(\lambda(\theta \bar{R} - \bar{d}) + (1 - \alpha) \frac{(N - 1)}{N} \lambda(\theta \bar{R} - \bar{d}) \geq 0\) in order not to lose money. However, for \(\lambda < \hat{\lambda}\), condition (5) establishes that a bank could deviate by offering the contract \((\hat{R}, \varepsilon, \hat{C})\), with \(\hat{R}\) and \(\hat{C}\) as defined above and \(\varepsilon > 0\), attracting only the good borrowers for \(\varepsilon\) sufficiently small, and making a profit. Therefore, no equilibrium that pools borrowers exists for \(\lambda \leq \hat{\lambda}\), thus completing the proof.

Proof of Proposition 2: The proof of the first part of the proposition is identical to that of Proposition 1. Consider what happens when all banks offer the contract \((\bar{R}, 0)\) with

\[
\bar{R} = \bar{d} \left(\frac{N - 1}{N}\right) \frac{(1 - \alpha) + \lambda}{(1 - \alpha) \theta_b + \lambda \theta}
\]  

(A5)
In stage 3, the rationing rule implies that one bank finances all unknown borrowers. This bank makes zero profits on this contract, as do all the other banks whose contracts were not accepted. The bad borrowers known to the winning bank are the only ones that do not obtain financing. It is obvious that no contract \((R, 0)\) with \(R < \hat{R}_p\) can make nonnegative profits. Similarly, no contract \((R, 0)\) with \(R > \hat{R}_p\) can make positive profits, as such a contract would not attract any borrowers. It remains to be shown that no contract with \(C > 0\) can be profitable.

First, consider that, because for \(\lambda > \hat{\lambda}\) condition (5) is violated, good borrowers prefer \((\hat{R}_p, 0)\) to the zero-profit separating contract \((\hat{R}_s, \hat{C}_s)\). Hence, any viable contract \((\tilde{R}_p, \tilde{C}_p)\) with \(C_p > 0\) that is preferred to \((\hat{R}_p, 0)\) by good borrowers would have to violate the bad borrowers’ IC constraint in the absence of \((\hat{R}_p, 0)\). Now, following the argument in Hellwig (1987), we can show that \((\tilde{R}_p, \tilde{C}_p)\) is not a profitable deviation because under the equilibrium strategies all applications to \((\tilde{R}_p, \tilde{C}_p)\) will have to be rejected at stage 3. In order to accept borrowers’ applications, the deviating bank would have to receive applications from an above-average sample of the population. If that were the case, all other banks would reject all applications to \((\tilde{R}_p, 0)\), as that contract just breaks even with the average population. However, taking this fact into account, all borrowers must apply to \((\tilde{R}_p, \tilde{C}_p)\), contrary to the assumption that a better-than-average group of borrowers applied to that contract. Hence, all applications to \((\tilde{R}_p, \tilde{C}_p)\) cannot represent a profitable deviation. Therefore, \((\hat{R}_p, 0)\) constitutes an equilibrium. Moreover, an application of the stability criterion (Kohlberg and Mertens, 1986) establishes that this is the uniquely stable equilibrium.

Proof of Proposition 3: (1) First, note that, because of competition, all banks make zero profits on unknown borrowers under either the pooling or the separating equilibrium. Bank profits therefore stem solely from known borrowers. Denote the rate charged to each good known borrower as \(R_{g, j}\), \(j = s, p\) (separating or pooling). Following Lemma 1, each bank’s profits on known borrowers can be written as

\[
\Pi_k(R_g) = \frac{\alpha}{N} (\theta_g R_g - d), \quad k = 1, \ldots, N \tag{A6}
\]

where \(R_g = R_{g, s} = \hat{R}_s + \frac{1 - \theta_g}{\theta_g} \hat{C}_s\) in the separating equilibrium, and \(R_g = R_{g, p} = \hat{R}_p\) in the pooling equilibrium. From Proposition 2, we know that \(\hat{R}_s + \frac{1 - \theta_g}{\theta_g} \hat{C}_s > \hat{R}_p\) for \(\lambda > \hat{\lambda}\). Hence, \(\Pi_k(R_{g, s}) < \Pi_k(R_{g, p})\). (2) and (3) These results are trivial, because all unknown borrowers obtain financing.

Proof of Proposition 4: To prove the first part, start by noting that at \(\lambda = 0\) we have \(W_p < W_s\). We now show that \(W_p - W_s\) is continuously increasing in \(\lambda\) and \(\lim_{\lambda \to \infty} (W_p - W_s) = +\infty\), so that there must exist a \(\hat{\lambda} > 0\) such that \(W_p < W_s \iff \lambda < \hat{\lambda}\). To see this, consider

\[
\lim_{\lambda \to \infty} (W_p - W_s) = \lim_{\lambda \to \infty} \hat{\lambda} \left[ (\alpha \theta_s y + (1 - \alpha) \theta_b y - d) - \frac{\alpha (\theta_g - \theta_b) \hat{C}_s}{\theta_b} \right] \tag{A7}
\]
and
\[ \frac{\partial (W_p - W_s)}{\partial \lambda} = [\alpha \theta_y + (1 - \alpha) \theta_b y - \bar{d}] - \frac{\alpha (\theta_y - \theta_b) \bar{C}_s}{\theta_b} \]  \hspace{1cm} (A8)

Condition (6) can be written as
\[ \frac{\alpha (\theta_y - \theta_b) \bar{C}_s}{\theta_b} < \frac{\alpha (\bar{\theta}_y - \bar{d})}{\bar{\theta}} \]  \hspace{1cm} (A9)

which, because \( \alpha \theta_y < 1 \), implies that \( \lim_{\lambda \to \infty} (W_p - W_s) = +\infty \) and
\[ \frac{\partial (W_p - W_s)}{\partial \lambda} > 0 \]

For the second part, consider, from the definitions of \( W_s \) and \( W_p \), that
\[ W_s < W_p \iff \lambda \alpha (\theta_y - (1 - \delta)(1 - \theta_g) \bar{C}_s - \bar{d}) < \left( \frac{N - 1}{N} \right) (1 - \alpha) (\theta_b y - \bar{d}) + \lambda (\bar{\theta}_y - \bar{d}) \]  \hspace{1cm} (A10)

We can now rewrite \( \lambda \alpha (\theta_y - (1 - \delta)(1 - \theta_g) \bar{C}_s - \bar{d}) = \frac{\alpha \lambda (\theta_g - \theta_b) \bar{C}_s}{\theta_b} \). Hence, \( W_s < W_p \iff \frac{\alpha \lambda (\theta_g - \theta_b) \bar{C}_s}{\theta_b} \leq \left( \frac{N - 1}{N} \right) (1 - \alpha) (\theta_b y - \bar{d}) + \lambda (\bar{\theta}_y - \bar{d}) \]  \hspace{1cm} (A11)

After substituting, we have
\[ R_s + \frac{1 - \theta_g}{\theta_g} \bar{C}_s = y - \frac{(\theta_g - \theta_b) \bar{C}_s}{\theta_g \theta_b} \]

Therefore, condition (5), with the inequality reversed so that a pooling equilibrium exists, can be expressed as
\[ \left( \frac{N - 1}{N} \right) (1 - \alpha) (\theta_b y - \bar{d}) + \lambda (\bar{\theta}_y - \bar{d}) \geq \frac{N - 1}{N} (1 - \alpha \theta_b + \lambda \bar{\theta}) \frac{(\theta_g - \theta_b) \bar{C}_s}{\theta_g \theta_b} \]  \hspace{1cm} (A12)

Note that we can now also rewrite condition (A11) as
\[ \left( \frac{N - 1}{N} \right) (1 - \alpha) (\theta_b y - \bar{d}) + \lambda (\bar{\theta}_y - \bar{d}) \geq \frac{\alpha \lambda (\theta_g - \theta_b) \bar{C}_s}{\theta_g \theta_b} \]  \hspace{1cm} (A13)

which, because \( \frac{N - 1}{N} (1 - \alpha \theta_b + \lambda \bar{\theta}) > \alpha \lambda \theta_y \), implies that if condition (A12) is satisfied, (A11) will also be satisfied, or in other words, \( \lambda^w < \bar{\lambda} \).

Proof of Proposition 5: We first show that the probability of a banking crisis is greater under the pooling equilibrium than under the separating equilibrium. We then show that, for \( \bar{\lambda} > \bar{\lambda} \) (the region of the pooling equilibrium), the probability of a crisis is strictly increasing in \( \bar{\lambda} \). To begin, define \( d_j^*, j = s, p \), as the realized value of \( d \) at which the entire banking system breaks even under the separating or pooling equilibrium, respectively. Then, the probability of a banking crisis is \( 1 - F(d_j^*) \).
We can write the ex post total profits of the banking system as

\[ \Pi_s(d) = \alpha(\theta \bar{R}_g - d) + \lambda\alpha(\theta \bar{R}_p + \bar{d}(1 - \theta) \bar{C}_s - d) \]  
(A14)

for the separating equilibrium, and as

\[ \Pi_p(d) = \alpha(\theta \bar{R}_p - d) + N - 1(1 - \alpha)(\theta \bar{R}_p - d) \]  
(A15)

for the pooling equilibrium. From Proposition 3, we know that bank profits on known borrowers are higher in the separating equilibrium than in the pooling equilibrium. Thus, as the zero-profit condition on unknown borrowers holds for both equilibria at \( d = \bar{d} \), we have \( \Pi_s(\bar{d}) > \Pi_p(\bar{d}) \). Total profits are linearly decreasing in \( d \), so it is easy to verify that

\[ \frac{\partial \Pi_s(d)}{\partial d} < \frac{\partial \Pi_p(d)}{\partial d} \]

Therefore, because of linearity, we can write

\[ d^*_s = \bar{d} + \frac{\Pi_s(\bar{d})}{\frac{\partial \Pi_s(\bar{d})}{\partial d}} \]  
(A16)

and

\[ d^*_p = \bar{d} + \frac{\Pi_p(\bar{d})}{\frac{\partial \Pi_p(\bar{d})}{\partial d}} \]  
(A17)

so that \( d^*_s > d^*_p \), which implies \( 1 - F(d^*_p) < 1 - F(d^*_s) \).

Next, observe that the change in total profits with respect to an increase in \( \lambda \) under the pooling equilibrium is

\[ \frac{\partial \Pi_p}{\partial \lambda} = \frac{\partial \bar{R}_p}{\partial \lambda} \left[ \alpha \theta_g + \lambda \alpha \bar{\theta} + \frac{N-1}{N} (1 - \alpha) \theta_b \right] - d \]  
(A18)

Because

\[ \frac{\partial \bar{R}_p}{\partial \lambda} = \bar{d} \frac{(\bar{\theta} - \theta_b)(\alpha - 1)(N - 1)N}{(N - 1)(1 - \alpha) \theta_b + \lambda \bar{\theta} N^2} < 0 \]  
(A19)

this implies that \( \frac{\partial \Pi_p}{\partial \lambda} < 0 \) for \( \lambda > \hat{\lambda} \), as desired.

Note finally that the marginal effect of \( \lambda \) on \( \Pi_F \) is magnified by the realized cost of funds, \( d \). In other words, \( \frac{\partial \Pi_F}{\partial d} < 0 \), implying that variability in the cost of funds is of greater consequence for larger values of \( \lambda \), leading to a greater probability of a crisis.

Proof of Proposition 6: The condition that defines \( \hat{\lambda} \) is

\[ \left( \bar{R}_p + \left( \frac{1 - \theta}{\theta} \right) \bar{C}_s \right) - \bar{R}_p = 0 \]  
(A20)
Applying the Implicit Function Theorem, we obtain

\[ \frac{\partial}{\partial d} \left( \hat{R} + \frac{1 - \theta_s}{\theta_s} \hat{C} - \hat{R}_p \right) \]

\[ \frac{\partial \lambda}{\partial d} = - \frac{\frac{\partial}{\partial d} \left( \hat{R} + \frac{1 - \theta_s}{\theta_s} \hat{C} - \hat{R}_p \right)}{\partial \lambda} \quad (A21) \]

We know that the denominator is positive, because \( \hat{R}_p \) is decreasing in \( \lambda \) while \( \left( \hat{R} + \frac{1 - \theta_s}{\theta_s} \hat{C} \right) \) is constant. For the numerator, from the definitions of \( \hat{R} \) and \( \hat{C} \), we have

\[ \frac{\partial}{\partial d} \left( \hat{R} + \frac{1 - \theta_s}{\theta_s} \hat{C} \right) = \frac{\theta_s - \theta_b}{\left( (1 - \theta_b) \theta_s - \delta (1 - \theta_s) \theta_b \right) \theta_s} > 0 \quad (A22) \]

and for the pooling rate \( \hat{R}_p \) we have

\[ \frac{\partial \hat{R}_p}{\partial d} = \frac{\left( \frac{N - 1}{N} \right) (1 - \alpha) + \lambda}{\left( \frac{N - 1}{N} \right) (1 - \alpha) \theta_b + \lambda \theta'} \quad (A23) \]

The numerator of (A21) can therefore be written as

\[ \frac{\partial}{\partial d} \left( \hat{R} + \frac{1 - \theta_s}{\theta_s} \hat{C} - \hat{R}_p \right) = \frac{\theta_s - \theta_b}{\left( (1 - \theta_b) \theta_s - \delta (1 - \theta_s) \theta_b \right) \theta_s} - \frac{\left( \frac{N - 1}{N} \right) (1 - \alpha) + \lambda}{\left( \frac{N - 1}{N} \right) (1 - \alpha) \theta_b + \lambda \theta'} \quad (A24) \]

To sign this expression, consider

\[ \frac{\partial}{\partial d} \left( \hat{R} + \frac{1 - \theta_s}{\theta_s} \hat{C} - \hat{R}_p \right) \]

\[ \bar{d} = \left( \hat{R} + \frac{1 - \theta_s}{\theta_s} \hat{C} \right) - \hat{R}_p \quad (A25) \]

Then, because by definition \( \left( \hat{R} + \frac{1 - \theta_s}{\theta_s} \hat{C} \right) - \hat{R}_p = 0 \) at \( \hat{\lambda} \) and the last
term in the expression is positive, we have \( \frac{\partial}{\partial d} \left[ \frac{1 - \theta}{\theta} \right] \dot{\theta} - \frac{\partial}{\partial d} \left[ \frac{1 - \theta}{\theta} \right] \dot{d} < 0 \), implying that \( \frac{\partial}{\partial d} \dot{\theta} > 0 \), as desired.

Proof of Proposition 7: Because the distribution of borrowers faced by the incumbent is better than that faced by the potential entrants [who face a mass \((1 - \alpha)\) of bad borrowers rejected by the incumbent], the former will always be able to undercut any pooling contract offered by the latter, which would end up financing only rejected borrowers. Competition will then necessarily lead these lenders to offer the zero-profit separating contract \((\hat{R}_s, \hat{C}_s)\). It follows that, by definition, there do not exist any separating contracts with which the incumbent can make positive profits on the pool of unknown borrowers. On the contrary, condition (6) guarantees that there exists a pooling contract with interest rate

\[
R \in \left[ \frac{\hat{d}}{\theta}, \frac{1 - \theta}{\theta} \right] \dot{C}_s
\]

that is preferred by the good type to \((\hat{R}_s, \hat{C}_s)\) and that generates positive profits. Moreover, because of stage 3, this pooling contract cannot be undercut by any profitable separating contract.

Proof of Proposition 8: The right-hand side (RHS) of condition (5) does not depend on \(N\), whereas the LHS clearly does. Define \(\hat{\lambda}_N\) as the proportion of untested borrowers with which (5) holds with equality when \(N\) banks are active in the market. Then, it easy to show that \(\hat{\lambda}_N < \hat{\lambda}_{N+1}\); by definition, we have

\[
\frac{(N - 1)(1 - \alpha) + \hat{\lambda}_N N}{(N - 1)(1 - \alpha) \theta_b + \hat{\lambda}_N \theta N} = \frac{N(1 - \alpha) + \hat{\lambda}_{N+1} (N + 1)}{N(1 - \alpha) \theta_b + \hat{\lambda}_{N+1} \theta (N + 1)}
\]

which, after some rewriting, becomes

\[
\hat{\lambda}_N = \hat{\lambda}_{N+1} \frac{N^2 - 1}{N^2}
\]

thereby establishing that \(\hat{\lambda}\) is increasing in \(N\).

Proof of Proposition 9: First, in equilibrium, because the market for unknown borrowers is now segmented, borrowers who defaulted are offered the separating contract \((\hat{R}_s, \hat{C}_s)\). Moreover, this is the only contract that can be part of a stable equilibrium, as for this market segment no pooling contract can make nonnegative profits because there are no unknown borrowers.

Second, under information sharing, the break-even pooling rate is

\[
\hat{R}_p^* = \frac{d}{\theta} \frac{(N - 1)(1 - \alpha) \theta_b + \hat{\lambda} N}{(N - 1)(1 - \alpha) \theta_b + \hat{\lambda} \theta N}
\]

Banks are now able to identify bad borrowers who defaulted in the past, which means that only a proportion \(\theta_b\) of bad borrowers known to competitor banks
enter the pool of unknown borrowers. This implies $R_\text{\hat{}}^p < R_\text{\hat{}}$, which in turn implies $\lambda^* < \hat{\lambda}$. The rest of the proof is the same as in Proposition 2.

Proof of Proposition 10: Start with the case in which $\lambda < \lambda^* < \hat{\lambda}$, so that the model admits a unique stable separating equilibrium either with or without information sharing. Then, bank profits on good known borrowers who have not defaulted in the past are the same in both cases. Bank profits on black-listed good borrowers are also the same as in the model without information sharing. Indeed, we know that

$$R_\text{\hat{}}^e = \hat{R}_g + \left(1 - \frac{\theta_g}{\theta_e}\right)\hat{C}_e,$$

is the rate charged to these borrowers in equilibrium.

Second, consider the case in which $\lambda^* < \hat{\lambda} < \lambda$, so that both scenarios admit a pooling equilibrium. In this case, profits on good known borrowers who have not defaulted in the past are lower under information sharing than without. Indeed, we know from Proposition 9 that $R_\text{\hat{}}^p < R_\hat{p}$, so that $R_\text{\hat{}}^p g < R_\hat{p} g$, where $R_\text{\hat{}}^p g$ refers to the matching contract that is offered to known good borrowers in the pooling equilibrium of that proposition. However, bank profits on black-listed good borrowers are higher, as under information sharing these borrowers are charged a rate $R_\text{\hat{}}^e g > R^p g$. For each bank, the difference in profits will be

$$\Pi^{\text{sharing}} - \Pi = \frac{\alpha \theta_g}{N} \left[ \Pi(\text{\hat{R}}^p) - \Pi(R_\hat{p}) \right] + \frac{\alpha(1 - \theta_g)}{N} \left[ \Pi(R_\text{\hat{}}^e) - \Pi(R_{\hat{}}g) \right]$$

(A29)

Finally, for $\lambda^* < \hat{\lambda} < \lambda$, the model with information sharing admits a pooling equilibrium, while without information sharing it has a separating equilibrium. In this case the difference in profits can be written as

$$\Pi^{\text{sharing}} - \Pi = \frac{\alpha \theta_g}{N} \left[ \Pi(\text{\hat{R}}^p) - \Pi(R_\hat{p}) \right] + \frac{\alpha(1 - \theta_g)}{N} \left[ \Pi(R_\text{\hat{}}^e) - \Pi(R_{\hat{}}g) \right]$$

(A30)

$$= \frac{\alpha \theta_g}{N} \left[ \Pi(\text{\hat{R}}^p) - \Pi(R_\hat{p}) \right] < 0$$

A necessary condition to have $\Pi^{\text{sharing}} < \Pi$ is therefore that $\lambda^* < \hat{\lambda} < \lambda$. Hence, it must be that $\lambda^* > \hat{\lambda}$.

Now at $\lambda = \hat{\lambda}$, (A29) becomes

$$\Pi^{\text{sharing}} - \Pi = \frac{\alpha \theta_g}{N} \left[ \Pi(\text{\hat{R}}^p) - \Pi(R_\hat{p}) \right] < 0$$

(A31)

In addition, it is easy to see that the difference is increasing in $\lambda$, because $\frac{dR_\text{\hat{}}^e}{d\lambda} < 0$ and $\frac{d(R_e - R_\hat{e})}{d\lambda} < 0$. Also,

$$\lim_{\lambda \to \infty} (\text{\hat{R}}^p - \hat{R}_p) = 0$$

(A32)

and hence,

$$\lim_{\lambda \to \infty} (\Pi^{\text{sharing}} - \Pi) = \frac{\alpha(1 - \theta_g)}{N} \left[ \Pi(R_\text{\hat{}}^e) - \Pi(\frac{d}{\theta}) \right] > 0$$

(A33)
which implies that there exists a $\lambda^*$ such that $\Pi^{\text{sharing}} - \Pi > 0$ if and only if $\lambda \geq \lambda^*$. □

APPENDIX II. AN ALTERNATIVE MODEL OF INFORMATION ACQUISITION

As an alternative to screening via the use of collateral requirements, we consider a variant of the model in which we instead allow banks to obtain information about borrowers directly by conducting creditworthiness tests. Suppose that at a cost of $k$, banks can conduct a creditworthiness test that perfectly and privately reveals the type of the borrower. As before, banks are competitive, and they offer contracts that specify a promised repayment, $R$, as well as whether or not a credit screen will be conducted. If a screen is conducted, the bank incurs the screening cost $k$ and the borrower receives a loan at the promised terms only if the screen reveals him to be of the good type, $\theta_g$. Otherwise, no test is performed. Formally, this means that banks offer contracts $(R, \eta)$, where $\eta = 1$ if a credit screen is conducted, and 0 otherwise. We assume that a borrower who is indifferent between being rejected for a loan and not applying will simply choose to not apply. This set of borrower choices can be easily justified by assuming that there is some (infinitesimally) small cost of applying that a borrower must bear, such as the time and effort of filling out an application, or some reputation (i.e., nonpecuniary) loss to a borrower of being identified as a bad type.

Note that, because banks are competitive and only a borrower revealed to be of the good type will receive a loan if he is screened, the equilibrium rate that must be charged if screening takes place is the break-even rate for a good borrower, which must also compensate the bank for the cost of screening: $R_g = \frac{\bar{x} + k}{\theta_g}$. We maintain the same assumption as before regarding the tie-breaking rule, and assume that all the borrowers that would choose a contract offered by more than one bank are randomly allocated to one of these banks. The equilibrium contract is therefore $(R_g, 1)$, with only good borrowers obtaining financing and paying the cost of screening, $k$.

We can now show that, as in the model we provide in the main text, banks maintain high lending standards when the information asymmetries vis-à-vis each other’s customers are severe, and low standards otherwise. In other words, we proceed to show that for high $\lambda$, banks move away from assessing borrowers’ creditworthiness and toward granting credit to all borrowers indiscriminately. We start by showing that conducting a creditworthiness test can only be optimal if no bank has an incentive to offer credit without incurring the cost of information acquisition $k$. Suppose that some bank offers some other contract $(\bar{R}_g, 0)$ in which no credit screen is conducted and therefore no information is acquired. It is clear

$^{26}$The allocation of the cost of the test to either the bank or the borrower has no effect on the equilibrium incentive to screen a borrower. Specifically, all results go through exactly as stated if instead we assume that the borrower must pay the cost $k$ of the credit screen.
that this contract can only be successful in attracting good borrowers (and bad ones as well) if the rate offered is lower than what is offered by the contract that screens borrowers, that is,

$$\tilde{R} < \frac{d + k}{\theta_g}$$  \hspace{1cm} (B1)

At the same time, the contract must not make losses for the bank that offers it, even assuming that all the unknown borrowers plus the bad borrowers rejected by competitor banks are financed. That is,

$$\lambda(\tilde{R} - d) + (1 - \alpha)\left(\frac{N - 1}{N}\right)(\theta_g \tilde{R} - d) \geq 0 \iff \tilde{R} \geq d + \frac{\lambda(1 - \alpha)\theta_g}{\theta_b + \lambda\theta}$$  \hspace{1cm} (B2)

[Note that (B2) specifies the exact same condition for the existence of an equilibrium with no information acquisition as that specified by condition (4) in the text.] Therefore, much as before, we can now state a necessary and sufficient condition for the strategy profile in which all banks acquire information by offering the contract \((R_g, 1)\) to be a Nash equilibrium by combining conditions (B1) and (B2), which yields

$$\frac{d}{(N - 1)(1 - \alpha)\theta_b + \lambda\theta N} \geq \frac{d + k}{\theta_g}$$  \hspace{1cm} (B3)

We note that as \(\lambda\) converges to zero, condition (B3) becomes

$$\frac{d}{\theta_b} > \frac{d + k}{\theta_g} \iff k < d\left(\frac{\theta_g - \theta_b}{\theta_b}\right)$$

Letting \(\lambda \to \infty\) in condition (B3), we can now state a condition for equilibrium information acquisition to depend on \(\lambda\) as

$$\frac{d}{\tilde{\theta}} < \frac{d + k}{\theta_g}$$  \hspace{1cm} (B4)

Condition (B4) will be satisfied if and only if \(k > d\left(\frac{\theta_g - \tilde{\theta}}{\tilde{\theta}}\right)\).

We can summarize this discussion with the following proposition, which extends the results from the text to the setting in which banks can acquire information directly by conducting a credit screen. The proposition states that as long as the cost of screening is neither too large nor too small, banks will apply high standards in their lending decisions and will grant no loans without first conducting a credit screen on each loan applicant when information asymmetries are high (low values of \(\lambda\)). These standards, however, will decrease as information asymmetries decrease (\(\lambda\) increases), in which case banks will prefer to save on the cost of conducting the screen and therefore obtain no information prior to lending. The proof of this result follows along the lines of Propositions 1 and 2 and is therefore omitted.
PROPOSITION 11: If the cost of screening

\[ k \in \left[ d\left( \frac{\theta_g - \bar{\theta}}{\bar{\theta}} \right), d\left( \frac{\theta_g - \bar{\theta}}{\theta} \right) \right] \]

then, there exists \( 0 < \lambda' < \infty \) such that: (1) the strategy profile in which all banks acquire information by offering the contract \((R_g, 1)\) is the unique stable pure-strategy equilibrium of the game if and only if \( \lambda \leq \lambda' \); and (2) the strategy profile in which all banks offer the contract \((\bar{R}_g, 0)\) is the unique stable pure-strategy equilibrium if and only if \( \lambda > \lambda' \).

Note that, because known borrowers do not have to be screened, each bank can obtain positive profits in equilibrium by offering their known good borrowers a loan package that offers a rate higher than \( R_g \) but that requires no screening, with the rate set such that the borrower is indifferent between this contract and that offered by another lender.

Finally, Proposition 11 shows that an increase in adverse selection leads to increased screening. This differs from other models of bank competition wherein screening is often a decreasing function of adverse selection. In those models the incentive to screen derives from the rents each bank can obtain by acquiring private information, which are decreasing in the degree of adverse selection (see, e.g., Thakor, 1996). In the present model, although banks obtain informational rents from their own known borrowers, competitive screening of unknown borrowers does not provide banks additional rents.

REFERENCES


2.1. INTRODUCTION

In an environment of brisk credit growth, supervisors tend to watch carefully if weak banks are starting to expand rapidly. Sounder banks may have a competitive advantage in meeting the demand for credit owing to their larger capital cushions and better risk management, but weaker banks may have strong incentives to expand aggressively, in an attempt to grow out of problems by boosting their market share and profits. If the pace of expansion overwhelms banks’ ability to manage risk, their asset quality would deteriorate over time. How sound are the banks that are driving credit expansion is a question that is particularly relevant for emerging Europe, where bank credit has been growing rapidly—at average annual rates of 25–40 percent—during the last decade.

This question has remained underexplored in the literature. Most studies on countries’ experiences with credit booms have focused on the other side of the relationship between bank soundness and credit growth—whether credit booms weaken the banking system, and hence, are associated with financial instability (see, for example, Gourinchas, Valdes, and Landerretche, 2001). When examining this question in a...
sample of banks from the new member countries of the European Union (EU) and accession countries, Maechler, Mitra, and Worrell (2007) found that rapid loan growth has been associated with an improvement in bank soundness indicators, except when credit growth accelerated sharply. Macro-level studies on credit growth in eastern European economies focused on assessing whether credit growth in the region has been excessive. These studies tend to conclude that bank intermediation in the new EU member states is still below the equilibrium levels consistent with their levels of economic development and the structural characteristics of their banking sectors, and there is ample room for further financial deepening (see, for example, Schadler and others, 2004; and Cottarelli, Dell’Ariccia, and Vladkova-Hollar, 2005).  

This chapter complements the literature by examining whether credit growth in emerging Europe has been led by weak banks, controlling for the effect of credit growth on bank soundness. The empirical setting is based on a simultaneous equation framework, where bank soundness and credit growth are modeled as functions of each other as well as other bank-specific and macroeconomic factors. The analysis uses detailed bank balance sheet data for the Baltic countries (Estonia, Latvia, and Lithuania) and other central and eastern European countries (CEECs)—the Czech Republic, Hungary, Poland, the Slovak Republic, and Slovenia—for the period from 1994 to 2004. After examining the question of whether credit growth is driven by weak banks, the study explores where the pockets of vulnerabilities are located: in the Baltics or the CEECs, in foreign-owned or domestically owned banks, in banks focusing on household or corporate lending or those that are heavily exposed to foreign or domestic currency-denominated lending. For the latter two parts of the analysis, the publicly available bank-level data are complemented with supervisory data.

The analysis shows that a long spell of credit expansion in emerging Europe has indeed heightened prudential risks. Over time, weaker banks have started to expand at least as fast as, and in some cases faster than, sounder banks. In contrast to the late 1990s, rapid credit growth during 2001–04 was no longer limited to relatively sound and stable banks. These findings are most pronounced in the group of the weakest banks, those in the lowest quintile. They are also robust to alternative measures of bank soundness and alternative model specifications and estimation techniques. The increased prudential risks are most vivid in rapidly growing credit markets: the Baltics and markets for household loans and loans denominated in or indexed to foreign currency. Foreign bank affiliates seem to be taking on more risk than domestically owned banks, although this is commensurate with the strength of their parent banks. All in all, the results suggest that credit booms in some parts of emerging Europe are being led by weak banks.

The rest of the chapter is organized as follows. Section 2.2 describes the simultaneous equation model, estimation method, and data. Section 2.3 discusses results, their robustness, and the main driving factors. Section 2.4 concludes.

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2 The third stream of literature has focused on the role of foreign-owned banks in credit expansion in central and eastern Europe (see, for example, de Haas and van Lelyveld, 2005). These studies generally do not find any significant differences in the rate of loan growth in foreign- and domestically owned banks, whereas confirming that foreign-owned banks have a competitive advantage owing to their higher efficiency and liquidity.
2.2. MODELING HOW BANK SOUNDNESS AFFECTS CREDIT GROWTH

2.2.1. Empirical Model

The general specification of the model is as follows:

\[ BankCreditGrowth_{ijt} = f(DistanceToDefault_{ij,t-1}, BankCreditGrowth_{ij,t-1}, GDPperCapita_{j,t-1}, GDPgrowth_{j,t-1}, RIR_{j,t-1}, \Delta RER_{j,t-1}, CostToIncome_{ij,t-1}, InterestMargin_{ij,t-1}, Liquidity_{ij,t-1}, Size_{ij,t-1}, Foreign_{ijt}, Public_{ijt}); \]  

(1)

\[ DistanceToDefault_{ijt} = f(BankCreditGrowth_{ij,t-1}, GDPperCapita_{j,t-1}, GDPgrowth_{j,t-1}, RIR_{j,t-1}, \Delta RER_{j,t-1}, DistanceToDefault_{ij,t-1}, CostToIncome_{ij,t-1}, InterestMargin_{ij,t-1}, Liquidity_{ij,t-1}, Size_{ij,t-1}, Foreign_{ijt}, Public_{ijt}); \]  

(2)

where \( i \) denotes individual banks, \( j \) denotes countries, and \( t \) is the year index. \( BankCreditGrowth \) is the annual percent change in real bank credit to the private sector. \( RIR \) is the real interest rate and \( \Delta RER \) is the annual percent change in the real exchange rate. \( CostToIncome \) and \( InterestMargin \) stand for the cost-to-income ratio and the net interest margin. \( Public \) and \( Foreign \) are measures of public and foreign ownership.

Distance to default (DD) measures the probability of bank default (i.e., that the value of assets would become smaller than the value of capital [see, for example, Gropp, Vesala, and Vulpe, 2002]). The measure is calculated as \( DD \equiv (k/\sigma) \), where \( k \) is equity capital as percent of assets, \( \mu \) is return on average assets in percent, and \( \sigma \) is the standard deviation of return on average assets as a proxy for return volatility. DD measures the number of standard deviations a return realization has to fall to exhaust equity, assuming that banks' returns are normally distributed. A higher DD corresponds to a lower upper bound of insolvency risk, implying a lower probability of insolvency. We calculate DD using annual balance sheet data on equity capital (valued at end-year market prices) and return on assets. The standard deviation of returns is calculated for the entire sample period to obtain a long-term view on the risks banks face.

While focusing on the importance of bank soundness for credit growth, we control for macroeconomic factors that may affect credit growth. Although there

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3 Typically, market values of equity are used to calculate the value and volatility of assets. However, these calculations assume that bank stocks are traded in well-functioning and liquid markets. As these assumptions may not hold for emerging European banks for the period in question, we use a simpler measure of DD based exclusively on balance sheet and income statement data. This measure is sometimes called z-score, to differentiate it from the market-price-based DD measure.

4 DD is weakly correlated with contemporaneous measures of return on assets and capital. It is primarily driven by the volatility of returns, which is a proxy for the risks faced by the bank.

5 The results are robust to alternative calculation methods of return volatility such as computing the standard deviation over three-year rolling windows.
is some variation in the set of macroeconomic variables used as controls in studies of credit growth, most studies include: (1) GDP per capita, to indicate the catching-up phenomenon, whereby credit growth tends to be slower in countries with a higher level of economic and institutional development; (2) real GDP growth, positively correlated with the demand for bank loans; (3) real interest rates, which tend to be negatively correlated with demand for loans; and (4) real exchange rate depreciation, which is expected to reduce the demand for foreign currency loans. These macroeconomic variables are also included in the feedback equation, as they reflect the risks faced by a bank and may affect its soundness.

Bank-specific factors (other than DD) may also affect the rate at which banks expand their loan portfolios. More profitable (higher net interest margin), liquid, and efficient (lower cost-to-income ratio) banks are likely to be able to expand credit at a faster rate. One might also expect loan growth to be positively correlated with bank size and foreign ownership and negatively correlated with state ownership (the share of capital owned by foreigners and the government, respectively). These variables may indirectly capture the effect of financial and other institutional reforms on banks’ incentives and their ability to lend to the private sector. These bank-level variables can be thought of as reflecting the supply-side determinants of credit growth. They are also included in the feedback equation, to control for bank-level factors that may affect DD. All variables in the model, except for those measuring the degree of foreign and public ownership, are lagged, to mitigate against simultaneity. Lagged dependent variables are also included to allow for persistence in DD and loan growth.

2.2.2. Estimation Method

The model is estimated using the three-stage least squares (3SLS) method—a convenient method for estimating simultaneous-equation models in the presence of dynamic random effects (Zellner and Theil, 1962; and Arellano, 1990). By taking into account the cross-equation correlation, 3SLS yields more efficient estimates for simultaneous-equation systems than two-stage least squares (2SLS) and single-equation ordinary least squares (OLS) while taking care of potential endogeneity issues. In addition, 3SLS has the desirable feature of leaving the autocovariance matrix of errors unrestricted, so that, in contrast to full information maximum likelihood method, 3SLS does not require that the distribution of errors is known. The 3SLS estimates are robust to the residual autocorrelation of an arbitrary form. Hence, 3SLS renders unbiased estimates, in contrast to 2SLS or single-equation OLS, in models with lagged dependent variables.

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6 We consider dummy variables for the share of foreign or public ownership exceeding 50 percent as part of robustness analysis and controlling for the type of foreign ownership (through wholly owned subsidiaries or partial ownership following takeovers of domestic banks during privatization) as part of robustness analysis (see below).

7 The Arellano-Bond (1991) method, which is commonly used for estimating dynamic panel models, does not apply to a simultaneous-equation setting. We use this method on the credit growth equation only, as part of robustness checks (see below).
However, the efficiency advantage can disappear if autocovariances in a 3SLS model with lagged dependent variables and a sufficient number of strictly exogenous variables satisfy some restrictions. Several tests are conducted to examine the covariance structure of the baseline specification and to confirm the absence of specification problems. Testing for unit roots is complicated by the short time dimension of the dataset. Nonetheless, feasible unit root tests for three-dimensional panel data (Kónya and Ohashi, 2005) reject unit roots at the 1 percent significance level. The Hausman specification test, based on a model excluding lagged dependent variables, is inconclusive, but the examination of the residual structure of this model points to nonstationarity problems arising from the failure to capture persistence. These specification analyses confirm that the baseline specification is adequately specified by including lagged dependent variables.

As shown in Woolridge (2002), 3SLS is equivalent to the random effects estimator (RE), provided that the covariance matrix has indeed the random effects structure. From a conceptual point of view, the short time dimension and unbalanced nature of our data, in addition to the fact that the period we are looking at was characterized by enormous structural changes in Eastern Europe, suggest that the RE could be preferred to the fixed effects estimator (FE). Because the FE only uses the within-variation and ignores the between-variation, it is less likely to be suitable for our purposes where information contained in the means across banks and across time are particularly important. From a purely econometric point of view, a Hausman specification test indeed rejects the presence of fixed effects.8

2.2.3. Data

Estimating the model requires bank-level and macroeconomic data. Bank financial ratios are calculated using bank balance sheet data from the Bankscope database published by the Bureau van Dijk.9 Bankscope covers most banks operating in central and eastern Europe (around 80 percent),10 accounting on average for more than 80 percent of total assets of the respective banking systems (Table 2.1). The Bankscope sample of banks is diverse, including domestically and foreign-owned banks; large, medium-sized, and small banks; and subsidiaries and branches. Nonetheless, the sample is somewhat biased toward larger banks, as suggested by the fact that the coverage of banks in many countries (the Czech Republic, Estonia, Hungary, Lithuania, and Poland) is higher when measured as a share of total bank assets than as the share of the total number of banks.

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8 We use robust standard errors in estimation, which renders similar significance levels as standard errors clustered by country.
9 For subsample analyses, total bank loan data from Bankscope were supplemented with supervisory data on breakdowns of bank loan portfolios by the currency of loan denomination or indexation and the type of borrower (household or corporate). These additional data were provided by the central banks of the central and eastern European countries in question (except Hungary and Latvia) for research purposes on the condition of strict confidentiality.
10 Except for Hungary and Poland, where the coverage measured by the number of banks is slightly lower (64 percent and 55 percent, respectively).
The sample used in the study includes 217 commercial banks that operated in central and Eastern Europe during 1995–2004. The average number of observations per bank (around 7) is less than the maximum possible number (10), which is not surprising given significant structural changes in the banking sectors of central and eastern European countries during the last decade. Macroeconomic data needed to calculate real GDP growth, GDP per capita, real interest rates, and real exchange rates were taken from the IMF’s *International Financial Statistics*.  

Sample statistics point to a significant dispersion in credit growth and distance to default at the bank level. The distribution of distance to default is asymmetric, skewed toward positive values. The distribution of credit growth values is more balanced, although, like with distance to default, there is a fat tail corresponding to banks rapidly expanding their balance sheets. Both in the CEECs (the Czech Republic, Hungary, Poland, the Slovak Republic, and Slovenia) and the Baltics (Estonia, Latvia, and Lithuania), banks were lending at higher rates on average during 2001–04 than 1995–2000, and the variation of credit growth rates across banks decreased over time (Table 2.2). Banks in the Baltics on average were growing faster than banks in the CEECs in both periods. Distance to default was higher on average in the CEECs than in the Baltics during both periods in question. (Slovenian banks had the highest distance to default, and Latvian banks the lowest, as shown in Appendix I.) Distance to default increased in both subgroups of central and eastern European countries over time, but the improvement was much more significant in the Baltics. At the same time, the variation in Baltic banks’ distance to default also increased markedly.

This basic statistical analysis implies that CEEC and Baltic banks have grown stronger over time and have stepped up their lending activities; at the same time,

**TABLE 2.1**

<table>
<thead>
<tr>
<th>Number of Banks</th>
<th>Proportion of Banks Included in the Sample</th>
<th>Average Number of Observations per Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td><strong>Bankscope</strong></td>
<td></td>
</tr>
<tr>
<td>Czech Republic</td>
<td>35</td>
<td>74.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>97.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.2</td>
</tr>
<tr>
<td>Hungary</td>
<td>36</td>
<td>63.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>81.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8.3</td>
</tr>
<tr>
<td>Poland</td>
<td>60</td>
<td>55.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>85.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.6</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>21</td>
<td>95.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>83.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.1</td>
</tr>
<tr>
<td>Slovenia</td>
<td>22</td>
<td>81.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>79.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.8</td>
</tr>
<tr>
<td>Estonia</td>
<td>6</td>
<td>83.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>94.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.9</td>
</tr>
<tr>
<td>Latvia</td>
<td>22</td>
<td>95.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>93.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8.0</td>
</tr>
<tr>
<td>Lithuania</td>
<td>13</td>
<td>69.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>93.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.2</td>
</tr>
</tbody>
</table>

*In percent of the total number of banks and total bank assets, respectively.

Sources: European Central Bank; Bankscope; and IMF staff estimates.

For more information on data definitions and sources, see Appendix I.
the heterogeneity of banks in terms of their soundness also increased, especially in the Baltics. Together with the finding of lower variation in bank credit growth, increased heterogeneity in bank soundness suggests that weak and sound banks are expanding at similar rates, especially in the Baltics.

Correlation analysis points in the same direction—weakening relationship between distance to default, especially in the Baltics. In the full sample, the correlation coefficient between bank credit growth and (lagged) distance to default was 0.10 and statistically significant in the earlier period and declined to 0.05 and became statistically insignificant in the later period. The weakening of correlation in the full sample is driven by developments in Latvian, Lithuanian, and Slovak banks. For these countries, the coefficients of correlation between bank credit growth and (lagged) distance to default turned from positive and statistically significant in the earlier period to insignificant in the later. For other countries, no major changes in significance or signs of the correlation coefficients were observed.

When comparing correlations across different types of banks, the relationship between credit growth and (lagged) distance to default is found to be weakening in several groups of banks. Correlations for privately owned banks were positive and statistically significant only in the first period and became statistically insignificant in the latter period. For foreign-owned banks and government-owned banks, correlations were insignificant in both periods, but the signs of coefficients turned from positive in the earlier period to negative. Only in domestically owned banks did the correlations remain positive and statistically significant throughout the period in question.
2.3. ARE WEAK BANKS DRIVING CREDIT EXPANSIONS?

2.3.1. Main Results and Their Robustness

We estimate the model for the entire period, 1995–2004, and for two subperiods, 1995–2000 and 2001–04, focusing on the impact of bank soundness on credit growth (Table 2.3). The main finding is that in the earlier period the coefficient on DD was positive and statistically significant, but in the later period it became insignificant—weaker banks started to expand just as rapidly as sounder banks during 2001–04. The size of the coefficient implies that a one standard deviation

\[ \text{R-squared} = 0.13 \]

\[ \text{Observations} = 881 \]

\[ \text{Simultaneous Modeling of Bank Credit Growth and Distance to Default} \]

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank credit growth</td>
<td>0.096***</td>
<td>0.100***</td>
<td>0.095***</td>
</tr>
<tr>
<td>Distance to default</td>
<td>-0.002</td>
<td>-0.002</td>
<td>0.001</td>
</tr>
<tr>
<td>Real GDP capita</td>
<td>2.646***</td>
<td>2.415***</td>
<td>2.475***</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>-0.116**</td>
<td>-0.301***</td>
<td>0.005</td>
</tr>
<tr>
<td>Net interest margin</td>
<td>0.689</td>
<td>1.757**</td>
<td>1.200**</td>
</tr>
<tr>
<td>Cost-to-income ratio</td>
<td>-0.017</td>
<td>-0.037**</td>
<td>0.046</td>
</tr>
<tr>
<td>Real interest rate</td>
<td>-0.558*</td>
<td>-0.864</td>
<td>-0.999**</td>
</tr>
<tr>
<td>Real depreciation</td>
<td>-4.911*</td>
<td>14.750***</td>
<td>-7.414***</td>
</tr>
<tr>
<td>Public ownership</td>
<td>-0.178***</td>
<td>-0.153**</td>
<td>-0.067</td>
</tr>
<tr>
<td>Liquidity ratio</td>
<td>0.020***</td>
<td>0.013</td>
<td>0.027**</td>
</tr>
<tr>
<td>Bank size</td>
<td>0.311***</td>
<td>0.240***</td>
<td>0.324**</td>
</tr>
<tr>
<td>Foreign ownership</td>
<td>0.008***</td>
<td>0.012***</td>
<td>0.003</td>
</tr>
<tr>
<td>Constant</td>
<td>16.366***</td>
<td>15.992**</td>
<td>12.721*</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.13</td>
<td>0.91</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Notes: Absolute value of z statistics in brackets; *significant at 10 percent; **significant at 5 percent; ***significant at 1 percent. The table reports two equations from a two-equation simultaneous model. The dependent variable in the first equation is annual percentage change in outstanding bank loans. In the second equation, the dependent variable is distance to default (constructed using bank account data). All the right-hand-side variables, except those measuring the degree of foreign and public ownership, are lagged by one year. The model is estimated using three-stage least squares. Source: IMF staff estimates.
increase in distance to default added about 4 percentage points to annual bank credit growth in the earlier period. In the later period, improvements in distance to default had no significant impact on credit growth.

The signs of other coefficients are in line with expectations. Higher real GDP growth has a statistically significant positive impact on credit growth. Similarly, lower real interest rates are found to boost credit growth, although the significance level is marginal. Credit growth also reflects financial catching-up: the coefficient on GDP per capita is negative. Higher bank efficiency, as measured by the cost-to-income ratio, also boosted credit growth, especially in the earlier period. This, together with the significant negative coefficient on the share of bank capital owned by the state, implies that financial sector reforms have given the private sector better access to credit. Bank profitability, as measured by net interest margin, was also a significant driver of credit growth in the entire period. The effect of the real exchange rate on credit growth differed in the two periods: during 1995–2000, real depreciation had a strong positive impact on credit growth, while during 2001–04 real appreciation was associated with stronger credit growth, possibly because of the increased importance of foreign currency lending. Other explanatory variables in the credit growth equation are insignificant. Their coefficients are set to zero, with the validity of the resulting specification confirmed through F-tests for omitted variables. The effect of these variables on credit growth is captured indirectly, through the feedback equation.

In the feedback equation for DD, significant determinants include the bank size and GDP per capita: larger banks and banks in more developed countries are characterized by greater DD. The coefficient on the foreign ownership variable is positive and statistically significant, but only during 1995–2000, suggesting that the opening of the banking sectors to foreign participation helped strengthen banks only in the earlier period. Liquidity also contributed positively to bank soundness. The coefficient on the lagged DD is positive and statistically significant, suggesting that banks that were sound and stable in the past are likely to remain so in the future. (Although the coefficient on the lagged DD is close to unity, statistical tests confirm that it is different from 1.) There is no evidence that credit growth weakened banks—the coefficient on credit growth is statistically insignificant in all periods—possibly because of the lag with which the consequences of faster expansion of weaker banks show up in bank soundness indicators during credit booms.

The main findings concerning the role of weaker banks in credit expansions are robust to alternative definitions of bank soundness. In a sample of weak banks, defined as banks in the bottom quintile of DD distribution, the coefficient on DD becomes statistically significant in the later period, implying that weak banks grew faster than healthy banks in that period (Table 2.4). The results are also preserved if the volatility of returns is calculated for subperiods rather than for the entire sample period.12 In regressions using the share of nonperforming

12Note that this approach to calculating DD implies a more sanguine assessment of the risks facing banks than the baseline approach of calculating the volatility of returns for the entire sample period, as the volatility of returns declined in the later part of the sample in part owing to favorable macroeconomic conditions.
loans in total outstanding loans (the NPL ratio) as a measure of bank soundness, weaker banks are also found to be expanding faster than sounder banks during the later period: the coefficient on the NPL ratio in the credit growth equation is positive and statistically significant during the later period, while during the earlier period it was negative and statistically insignificant. 13

Results are also preserved in alternative specifications of the model. Controlling for time- and country-specific factors, or adding measures of financial and institutional development or regulatory measures does not significantly change the coefficients of interest. Using dummy variables for the share of foreign or public ownership exceeding 50 percent and controlling for the type of foreign

13The NPL ratio is an imperfect measure of bank soundness: it can be manipulated by the bank, for example, by restructuring and refinancing loans, to disguise poor asset quality (the evergreening problem).
ownership (through wholly owned subsidiaries or partial ownership after takeovers of domestic banks during privatization) also preserves the gist of the results. Estimating the DD equation separately using the Arellano-Bond method does not significantly alter the coefficients of interest either, although the short time dimension of the dataset precludes the subsample analysis using the Arellano-Bond method.

2.3.2. What Is Driving the Results?

To understand the factors driving the results, we run the model on various subsamples, split by region (the Baltics and the CEECs), the type of bank ownership (domestically owned and foreign-owned banks), the currency of loans

| TABLE 2.5 |
| Differences in Bank Credit Growth in the Baltics and Other CEECs |
| Bank credit growth | 0.095*** | 0.094*** |
| | (3.64) | (4.70) |
| Distance to default | 0.241 | 0.433*** |
| | (1.23) | (3.01) |
| Distance to default of Baltic banks | 0.684 | −0.961*** |
| | (1.46) | (3.72) |
| Baltic banks | −6.839 | 18.209*** |
| | (0.81) | (2.77) |
| F-test | 2.14 | 15.40 |
| | (0.34) | (0.00) |
| R-squared | 0.16 | 0.17 |
| Observations | 424 | 457 |

Notes: Absolute value of z statistics in brackets; *significant at 10 percent; **significant at 5 percent; ***significant at 1 percent. The table reports one equation from a two-equation simultaneous model. The dependent variable in the reported equation is annual percent change in outstanding loans. The equation includes an interaction term for the distance to default of Baltic banks and a dummy variable for Baltic banks. Only the most relevant coefficients are reported; other coefficients are broadly unchanged (see Table 2.3). All the right-hand-side variables, except those measuring the degree of foreign and public ownership, are lagged by one year. The table also reports chi-squared statistics and probabilities for the F-tests of joint significance of the interaction term and the dummy variable for Baltic banks. The model is estimated on the full sample using three-stage least squares.

Source: IMF staff estimates.

We control for the type of foreign ownership by interacting the continuous foreign ownership variable with a dummy for banks privatized to foreigners. Privatization by selling to foreigners does not have a significant effect on bank soundness over the long run. Even though the coefficient on the interaction term is positive and marginally significant in the earlier period, it becomes negative and insignificant in the later period, suggesting that gains from privatization (at least in terms of enhancing bank soundness) are short-lived.

Results are also robust to excluding Slovenia, the most developed eastern European economy.
(foreign or domestic currency–denominated), and the type of borrower (households or firms). This helps us identify the pockets of vulnerabilities, which account for the result that weaker banks are increasingly driving credit expansions in emerging Europe.

The analysis shows that the role of weaker banks in credit expansion in the Baltics increased over time (Table 2.5). The opposite is true in the CEECs: sounder banks were expanding more rapidly during 2001–04, while during 1995–2000 no statistically significant differences in the rates of credit growth through weaker and sounder banks were identified. These results are robust to excluding the lagged dependent variable and estimating regressions separately on the CEEC and Baltic subsamples. One possible explanation of the more prominent role of weaker banks in credit expansion in the Baltics is that in the context of more rapid Baltic credit growth—10 times higher in real terms than in the CEECs in the later period—ensuring sound credit assessment and risk management at the individual bank level is much more challenging. The fact that more foreign bank affiliates in the Baltics are branches than subsidiaries may also make supervision more difficult, as branches are regulated less than subsidiaries in host countries.

Weaker foreign-owned banks appear to be lending more aggressively than domestically owned banks, possibly because of easy access to funding through their parent banks. Controlling for the DD of parent banks indeed shows that, although rapid credit growth in recent years has become uncorrelated with the DD of central and eastern European affiliates of foreign banks, it remains positively correlated with the DD of their parent banks. Separate regressions, using the samples of foreign- and domestically owned banks, also show that lending by foreign-owned banks does not depend on DD; for domestically owned banks a positive relationship is identified between credit growth and DD. Among foreign-owned affiliates, Nordic banks stand out as the ones whose lending is the least related to DD. This result is consistent with the earlier discussed finding of higher prudential risks in the Baltics, where Nordic banks are particularly active.

Credit growth through banks with large and rapidly expanding foreign currency loan portfolios is negatively correlated with DD, suggesting that weaker banks are expanding at a faster rate in these market segments (Table 2.6). The opposite is true of banks that are not actively engaged in foreign currency lending: loans are growing more rapidly through sounder banks. A similar result is found for banks with large and rapidly growing loan exposures to the household sector. These findings point to more acute prudential risks in the banks that are aggressively lending in foreign currency and to the household sector. However, these results are only preliminary. Owing to data limitation, the analysis had to be restricted to a subset of countries (excluding Hungary and Latvia) and to the dummy measures of exposures, with exposed banks defined as those with a higher-than-average proportion and growth of loans in the respective categories.
### TABLE 2.6

Differences in Credit Growth in Banks with High Exposures to Foreign-Currency Lending and Household Lending

<table>
<thead>
<tr>
<th></th>
<th>Foreign Currency Lending</th>
<th>Household Lending</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank credit growth</td>
<td>0.157***</td>
<td>0.073**</td>
</tr>
<tr>
<td></td>
<td>[4.25]</td>
<td>[2.51]</td>
</tr>
<tr>
<td>Distance to default</td>
<td>0.422**</td>
<td>0.279*</td>
</tr>
<tr>
<td></td>
<td>[2.44]</td>
<td>[1.68]</td>
</tr>
<tr>
<td>Distance to default of exposed banks</td>
<td>0.006</td>
<td>−0.794*</td>
</tr>
<tr>
<td></td>
<td>[0.01]</td>
<td>[1.74]</td>
</tr>
<tr>
<td>Real GDP growth</td>
<td>3.497***</td>
<td>3.495***</td>
</tr>
<tr>
<td></td>
<td>[3.91]</td>
<td>[4.27]</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>−0.225***</td>
<td>−0.118</td>
</tr>
<tr>
<td></td>
<td>[2.77]</td>
<td>[1.32]</td>
</tr>
<tr>
<td>Net interest rate</td>
<td>3.754***</td>
<td>1.242</td>
</tr>
<tr>
<td></td>
<td>[4.54]</td>
<td>[1.00]</td>
</tr>
<tr>
<td>Cost-to-income ratio</td>
<td>0.007</td>
<td>−0.037</td>
</tr>
<tr>
<td></td>
<td>[0.36]</td>
<td>[0.52]</td>
</tr>
<tr>
<td>Real interest rate</td>
<td>−0.133</td>
<td>−1.015*</td>
</tr>
<tr>
<td></td>
<td>[0.23]</td>
<td>[1.94]</td>
</tr>
<tr>
<td></td>
<td>[4.98]</td>
<td>[1.51]</td>
</tr>
<tr>
<td>Public ownership</td>
<td>−0.075</td>
<td>−0.079</td>
</tr>
<tr>
<td></td>
<td>[1.28]</td>
<td>[0.96]</td>
</tr>
<tr>
<td>Exposed bank dummy</td>
<td>23.238</td>
<td>29.541***</td>
</tr>
<tr>
<td></td>
<td>[1.48]</td>
<td>[2.80]</td>
</tr>
<tr>
<td>Constant</td>
<td>−20.243***</td>
<td>18.981*</td>
</tr>
<tr>
<td></td>
<td>[2.85]</td>
<td>[1.90]</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.41</td>
<td>0.22</td>
</tr>
<tr>
<td>Observations</td>
<td>197</td>
<td>258</td>
</tr>
</tbody>
</table>

Notes: Absolute value of z statistics in brackets; *significant at 10 percent; **significant at 5 percent; ***significant at 1 percent. The table reports one equation from a two-equation simultaneous model. The dependent variable in the reported equation is annual percent change in outstanding loans. All the right-hand-side variables, except those measuring the degree of public ownership, are lagged by one year. Banks with high exposure to foreign-currency lending are defined as those with higher-than-average proportion of foreign-currency-denominated loans and higher-than-average rate of growth in the proportion of foreign-currency-denominated loans. Banks with high exposure to household lending are defined as those with higher-than-average proportion of loans to households and higher-than-average rate of growth in the proportion of loans to households. The sample is composed of Czech, Estonian, Lithuanian, Polish, Slovak, and Slovenian banks, based on data availability.

Source: IMF staff estimates.

### 2.4. CONCLUSION

Using data for emerging European banks, this study finds that in an environment of sustained rapid growth of credit, weaker banks start expanding faster than sounder banks over time. Whether these prudential risks materialize or not in the future would depend on the quality of banks’ current lending and risk management decisions, the strength and quality of supervisory and regulatory practices, as well as the stability of...
the broader macroeconomic and financial environment. The fact that rapid credit growth has not weakened banks so far provides some comfort that banks would be able to manage risks well. Yet, on the other hand, higher prudential risks may simply take time to become visible in bank soundness indicators, as loan portfolios take time to mature and emerging Europe is still in the initial stages of the credit cycle.

All in all, the findings of the study highlight the importance of forward-looking and risk-based supervision during credit booms. Supervisors need to carefully monitor the soundness of rapidly expanding banks and stand ready to take measures to limit the expansion of weak banks. If left unchecked, rapid growth of weak banks may eventually undermine systemic stability, at a severe cost to the broader economy and taxpayers.

**APPENDIX I. DATA SOURCES AND METHODOLOGY**

Macroeconomic data were taken from the February 2006 version of the IMF’s *International Financial Statistics*. Bank-level data were downloaded from the February 2006 version of Bankscope and cleaned up by carefully matching bank identities and deleting duplicate entries, as well as the entries with possible measurement errors. The Bankscope dataset was complemented with confidential supervisory data on the composition of bank loans obtained from the central banks of all central and eastern European countries, except Latvia and Hungary, as well as data on bank ownership from various sources, such as *Euromoney* and banks’ Web sites. Details on the coverage and compatibility of different components of the dataset are also presented below. Tables 2.7 and 2.8 present the summary statistics for the final dataset. The definitions of variables and units of measurement for bank-level and macroeconomic data are presented in Table 2.9.

---

The Bankscope dataset for 1995–2002 was provided by Ugo Panizza. These data were used in a study of bank ownership and performance in developing and industrial countries (Micco, Panizza, and Yañez, 2004).
<table>
<thead>
<tr>
<th>Country</th>
<th>Bank credit growth</th>
<th>Distance to default</th>
<th>Net interest margin</th>
<th>Cost-to-income ratio</th>
<th>Liquidity ratio</th>
<th>Bank size</th>
<th>Real GDP growth</th>
<th>GDP per capita</th>
<th>Real interest rate</th>
<th>Real depreciation</th>
<th>Foreign ownership</th>
<th>Public ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Czech Republic</td>
<td>159</td>
<td>25.99</td>
<td>46.19</td>
<td>139</td>
<td>73.58</td>
<td>116.09</td>
<td>7.15</td>
<td>69.28</td>
<td>1.97</td>
<td>−0.14</td>
<td>62.19</td>
<td>11.09</td>
</tr>
<tr>
<td>Slovenia</td>
<td>133</td>
<td>15.93</td>
<td>24.95</td>
<td>133</td>
<td>70.87</td>
<td>37.23</td>
<td>6.18</td>
<td>112.30</td>
<td>0.13</td>
<td>0.07</td>
<td>54.53</td>
<td>8.29</td>
</tr>
<tr>
<td>Hungary</td>
<td>192</td>
<td>20.73</td>
<td>36.11</td>
<td>192</td>
<td>74.61</td>
<td>59.54</td>
<td>6.68</td>
<td>58.40</td>
<td>2.68</td>
<td>−0.09</td>
<td>62.19</td>
<td>5.94</td>
</tr>
<tr>
<td>Estonia</td>
<td>34</td>
<td>40.67</td>
<td>36.64</td>
<td>34</td>
<td>76.94</td>
<td>31.46</td>
<td>5.82</td>
<td>47.25</td>
<td>−1.20</td>
<td>−0.66</td>
<td>54.53</td>
<td>0.00</td>
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</table>

(Continued)
### TABLE 2.8

**Summary Statistics by Country (continued)**

<table>
<thead>
<tr>
<th></th>
<th>Observations</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Observations</th>
<th>Mean</th>
<th>Standard Deviation</th>
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</thead>
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<tr>
<td><strong>Poland</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bank credit growth</td>
<td>262</td>
<td>25.49</td>
<td>36.95</td>
<td>137</td>
<td>36.99</td>
<td>54.27</td>
</tr>
<tr>
<td>Distance to default</td>
<td>262</td>
<td>12.51</td>
<td>9.47</td>
<td>137</td>
<td>8.86</td>
<td>12.76</td>
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<tr>
<td>Net interest margin</td>
<td>262</td>
<td>5.18</td>
<td>3.19</td>
<td>137</td>
<td>4.66</td>
<td>2.57</td>
</tr>
<tr>
<td>Cost-to-income ratio</td>
<td>259</td>
<td>62.45</td>
<td>38.64</td>
<td>137</td>
<td>82.63</td>
<td>95.15</td>
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<tr>
<td>Liquidity ratio</td>
<td>261</td>
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<td>10.40</td>
<td>137</td>
<td>12.22</td>
<td>15.26</td>
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<tr>
<td>Bank size</td>
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<td>6.76</td>
<td>1.49</td>
<td>137</td>
<td>5.09</td>
<td>1.18</td>
</tr>
<tr>
<td>Real GDP growth</td>
<td>262</td>
<td>3.24</td>
<td>2.04</td>
<td>137</td>
<td>6.94</td>
<td>2.18</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>262</td>
<td>49.96</td>
<td>4.60</td>
<td>137</td>
<td>36.40</td>
<td>8.86</td>
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<td>Real interest rate</td>
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<td>2.88</td>
<td>137</td>
<td>−0.31</td>
<td>2.47</td>
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<td>Real depreciation</td>
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<td>0.16</td>
<td>137</td>
<td>−0.14</td>
<td>0.25</td>
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<td>45.04</td>
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<td>23.60</td>
<td>36.12</td>
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<td>Public ownership</td>
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<td>33.08</td>
<td>137</td>
<td>6.40</td>
<td>18.93</td>
</tr>
<tr>
<td><strong>Lithuania</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bank credit growth</td>
<td>51</td>
<td>40.18</td>
<td>50.61</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance to default</td>
<td>51</td>
<td>13.94</td>
<td>15.02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net interest margin</td>
<td>51</td>
<td>4.67</td>
<td>2.28</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost-to-income ratio</td>
<td>51</td>
<td>82.93</td>
<td>21.99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquidity ratio</td>
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<td>38.37</td>
<td>18.44</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Bank size</td>
<td>51</td>
<td>6.48</td>
<td>1.13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real GDP growth</td>
<td>51</td>
<td>1.89</td>
<td>2.60</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>GDP per capita</td>
<td>51</td>
<td>46.50</td>
<td>10.44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real interest rate</td>
<td>51</td>
<td>−0.27</td>
<td>2.72</td>
<td></td>
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</tr>
<tr>
<td>Real depreciation</td>
<td>51</td>
<td>−0.22</td>
<td>0.58</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreign ownership</td>
<td>51</td>
<td>52.95</td>
<td>45.21</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public ownership</td>
<td>51</td>
<td>13.14</td>
<td>31.35</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sources: Bankscope and IMF staff estimates.
Matching bank identifiers. Bankscope uses a unique identifier for each bank. This identifier remains unchanged when the bank’s name changes and sometimes even when the bank is merged with or acquired by another bank. Only if a merger or an acquisition intrinsically changes the bank is a new identifier assigned to the new bank. Data for the banks operating in central and eastern Europe during 2002–04 were first downloaded using the February 2006 update of Bankscope. The data were then merged with the historical dataset provided by Ugo Panizza, using the unique identifiers and cross-checking based on the 2002 data.

Avoiding duplications. Bankscope includes both consolidated and unconsolidated balance sheet data. When both are available for the same bank, a different identifier is assigned to each type of data. Moreover, at the time of mergers, the banks involved might stay in the dataset along with the merged entity. To make sure that observations are not duplicated for the same bank, the following procedure was applied to include information from only one of the balance sheets. First, using the “rank” variable in Bankscope, which ranks the banks within a country, nonranked
banks were dropped to avoid duplications. However, a second step was necessary to make sure that the duplication was not because of a merger event. If a bank was not ranked but had assets greater than the country average, its history of mergers and acquisitions was examined carefully. Next, the premerger banks were reranked to ensure that they were included in the dataset, and the postmerger banks were deranked to exclude them from the premerger period. Many such banks had both consolidated and unconsolidated balance sheets. To be able to identify individual banks, the unconsolidated data were preserved when both balance sheets were available. If unconsolidated data were unavailable, consolidated data were used to avoid dropping the banks from the sample.

**Excluding outliers.** To ensure that the analysis is not affected by potential measurement errors and misreporting, about 4 percent of the observations on the tails of the distributions of the two main variables (bank-level credit growth and distance to default) were dropped.

**Coding ownership.** Bankscope does not provide historical information about bank ownership; it provides only the share held by foreign and public investors in the current year. Thanks to extensive work by Micco, Panizza, and Yañez (2004), the historical ownership data up to 2002 were available for the study. While extending the time coverage to 2004, the most recent ownership information from Bankscope data on central and eastern European banks was obtained. This information was complemented with information from banks’ Web sites and Bankscope data on parent banks to update ownership information for 2003 and 2004.

**Merging in loan breakdowns.** The central banks in six of the eight countries included in the study provided bank-by-bank data on the composition of loans, as collected by supervisory authorities. The data covered the period from 1995 to 2005 (except in the Czech Republic, where the coverage was from 2000 to 2005) and broke down total loans into (1) loans to households in local currency, (2) loans to corporates in local currency, (3) loans to households in foreign currency, and (4) loans to corporates in foreign currency. For confidentiality reasons, most countries were unable to disclose the identity of the banks. Banks from the supervisory dataset and from the Bankscope dataset were matched using data on total loans and total assets. To reduce the likelihood of measurement errors and ensure data consistency, dummy variables identifying banks with rapidly growing household and foreign currency portfolios, rather than actual data on household and foreign currency loans, were used.

**REFERENCES**


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3.1. INTRODUCTION

Although researchers have documented that many financial crises are associated with severe recessions (Kaminsky and Reinhart, 1999), very little attention has been paid to whether countries recover from such large negative shocks in the sense that output losses are reversed. A few recent studies show persistent output loss from financial crises in a small set of countries. For instance, Cerra and Saxena (2005a) demonstrate that six Asian crisis countries suffered permanent output loss from the Asian crisis, and Cerra and Saxena (2005b) show that only a tiny fraction of the output loss from Sweden’s banking crisis in the early 1990s was recuperated. The graphs in Figure 3.1 illustrate persistent output loss for selected countries following the 1997–98 Asian financial crisis and the debt crisis of the early 1980s.

In addition to financial crises, many countries experience large negative political shocks, which could include violent conflicts such as civil wars as well as a deterioration in the country’s governance. Such political shocks have the potential for significant disruption to economic activity, as illustrated for a few episodes of civil war (Figure 3.2).

This chapter systematically documents the behavior of output following financial and political crises in a large set of 190 countries. Whereas the graphs in Figures 3.1 and 3.2 are suggestive, our aim is to formally analyze the impact of financial and political shocks on output in a broad set of countries, particularly whether output losses are recovered. Financial shocks are comprised of currency, banking, and twin financial crises. For political shocks, we examine civil wars, a deterioration in the quality of political governance, and twin political crises comprised of both shocks. We choose civil wars rather than interstate conflicts to ensure that the war occurs on the country’s own soil. The military theater for some interstate conflicts may not directly encompass all parties to the conflict. In addition, the increase in wartime
Figure 3.1  (A) Asian crisis. (B) Debt crisis.
Figure 3.2  Protracted civil wars.
spending for an international conflict may boost economic activity in some countries. We also wish to examine the economic impact of a deterioration in a country’s political governance or institutional quality. Acemoglu, Johnson, and Robinson (2001) and Acemoglu and others (2003) use constraints on the power of the political executive as a measure of institutional quality and find that it is linked to growth and volatility. Thus, we use this measure to study the shock to political governance.

Potential endogeneity of the financial or political crisis is an important issue in estimating the output impact of the crisis. That is, the crisis itself may be a function of a slowdown of economic growth or changes in expectations of future growth. We attempt to address this issue using a few methods, which are far from definite, but nonetheless uncover some interesting facts. In particular, we find that the forecasts of growth from an autoregressive model and from consensus surveys are optimistic relative to actual growth occurring during and after a crisis.

### 3.2. METHODOLOGY

We are interested in examining the impact of financial and political crises on output. We follow the methodology used by Romer and Romer (1989) to identify the impact of monetary policy shocks on output. We construct qualitative indicators of financial and political crises and estimate impulse response functions to the shock. Given that our data consists of a large set of countries, we estimate the models using panel data analysis, and we provide group averages of the impulse responses of output to each type of shock. We are also able to partition the country samples to examine any differential impact of a shock on countries according to their income level or region.

We formally test the statistical relationship between growth and the shock by estimating impulse response functions for each different type of shock. In particular, we estimate a univariate autoregressive model in growth rates, which accounts for the nonstationarity of output (Nelson and Plosser, 1982) and for serial correlation in growth rates.\(^2\) We control for country fixed effects, which F-tests indicate are present.\(^3\) We estimate an AR(4), as we find insignificant coefficients beyond the fourth lag. We estimate the model on all of the available data from 190 countries over the period 1960 through 2001. We then extend the estimation equation to include the current and lagged impacts of the shock. Thus, we estimate the following model:

\[
g_{it} = \alpha_i + \sum_{j=1}^{4} \beta_j g_{i,t-j} + \sum_{i=0}^{4} \delta_i D_{i,t-i} + \varepsilon_{it} \tag{1}
\]

\(^2\) Panel unit roots tests using the data in this study strongly suggest the presence of unit roots in output. Results are available upon request.

\(^3\) The country-fixed effects are correlated with the lagged dependent variables in the autoregressive equation. However, Nickell (1981) shows that the order of bias is 1/T, which is small for this dataset. Indeed, Judson and Owen (1999) calculate that the bias of the least squares dummy variable (LSDV) estimator is approximately 2 to 3 percent on the lagged dependent variable and less than 1 percent on other regressors for a panel of size N = 100, T = 30, and low persistence.
where \( g \) is the percentage change in real GDP and \( D \) is a dummy variable indicating a financial or political crisis. The impulse response functions to each crisis type are shown with one standard error bands drawn from a thousand Monte Carlo simulations.

### 3.3. DATA

We use GDP growth rates from the World Bank’s World Development Indicators (WDI). This dataset contains the largest sample of countries. Our data consists of unbalanced panels of annual observations spanning 190 countries from 1960–2001. We also disaggregate the results based on World Bank classifications. The countries are split into seven regional groups—Africa, Asia, Industrial Countries, Latin America, Middle East, Transition Countries, and Western Hemisphere Islands—and four income groups—low income (per capita real GDP less than or equal to $735), lower middle income (per capita real GDP between $736 and $2935), upper middle income (per capita real GDP between $2936 and $9075), and high income (per capita real GDP over $9075). For robustness, we also use GDP growth rates computed using the Penn World Tables data (Heston, Summers, and Aten, 2006), converting per capita growth to aggregate GDP growth rates using population growth rates.

We form a panel data set for currency crises by constructing an exchange market pressure index (EMPI) for each country. The EMPI is defined as the percentage depreciation in the exchange rate plus the percentage loss in foreign exchange reserves. This formulation makes indices comparable across countries. A dummy variable for a crisis is formed for a specific year and country if the EMPI is in the upper quartile of all observations across the panel.

We obtain banking crisis dates on a large set of countries from Caprio and Klingebiel (2003). We confine the analysis to systemic banking crises. Moreover, because the end of a banking crisis is often highly uncertain, we restrict our analysis to the initial shock stemming from the first year of a banking crisis.

To check the robustness of our results, we also use banking and currency crisis dates from Kaminsky and Reinhart’s (1999) influential study on twin crises. However, the drawback of this source is that there are only 23 countries included in the study, which prevents us from examining the regional and income group disaggregations.

The data for civil war is obtained from Sarkees (2000) Correlates of War Intrastate War Data, 1816–1997 (v3.0; at www.correlatesofwar.org), which updates the work of Singer and Small (1994). The dataset identifies the participants of intrastate wars. We form a dummy variable for internal conflict by assigning a value of unity for a country in the years of conflict and zero otherwise.

The data on the quality of the government comes from Polity International IV data set. The constraint on the executive variable is constructed by the Polity IV

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4 The crisis literature often normalizes reserves and exchange rate movements by their within country standard deviations, but then the magnitudes of the EMPI are only comparable within countries. We dropped interest rates because of the scarcity of data.
project by coding the authority characteristics of states in the world. The variable measures the extent of regular institutional constraints on executive power. These constraints arise from accountability groups, such as legislatures and judiciaries that have equivalent or greater effective authority, or can impose constraints on executive behavior in most activities. The scale ranges from 1 (weak constraints on executive power) to 7 (strong constraints on executive power).

Data on consensus forecasts of economic growth in the current year and next year is obtained from the commercial database produced by Consensus Economics Inc. The data is gathered monthly by surveying the expectations of analysts typically from large banks and financial firms within the country. The data cover 35 high-income, emerging market, and transition countries. Coverage begins in late 1989 for high-income countries, with additional countries added from 1990 to 1995. The frequency is monthly for high-income and Asian emerging market countries and bimonthly for Latin American and transition countries.

3.4. RESULTS

3.4.1. Impulse Responses

The impact of a currency crisis on output is negative and highly persistent (Figure 3.3). The loss in output averages about 4 percent for the entire panel of countries. The depth of the loss varies by income group, with output loss averaging only 1 percent for high-income countries, but close to 5 percent for all other income groups. All groups except countries in the Middle Eastern region experience output loss, which persists even at a 10-year horizon. Indeed, no income group or regional group experiences a rebound in output by more than ½ of a percent relative to the point of deepest loss.

The output impact of a banking crisis is nearly twice as large (7½ percent loss) as a currency crisis and just as persistent (Figure 3.4). Output loss at a 10-year horizon exceeds 6 percent for all groups except the Latin American region and lower-middle-income countries. Whereas currency crises have a modest impact on high-income countries, banking crises lead to severe output loss in this group.

Output loss from twin financial crises is deeper than either of the individual crises (Figure 3.5). By three years after the crisis, output loss reaches and remains at 10 percent. The persistence of the loss is robust to all regional and income groups except for the Latin American subset.

In contrast to the extreme persistence of output loss following financial crises, output partially rebounds from a civil war (Figure 3.6). On average for the panel of countries, output declines by 6 percent initially. Half of the loss is recuperated after four years, but 3 percentage points of cumulative loss remain even after a decade. These results likely reflect the combination of both permanent and temporary effects. Physical infrastructure is damaged in most war situations and constrains output, but infrastructure may be repaired within a short time after the conflict ceases. Also, parameter uncertainty is large, and the standard error bands encompass zero for several groups. This result reflects the wide range of experiences

text continues on p. 69
Figure 3.3  Impulse responses: Currency crises.
Figure 3.4  Impulse responses: Banking crises.
Figure 3.5  Impulse responses: Twin financial crises (currency and banking).
Figure 3.6 Impulse responses: Civil wars.
of different countries to postconflict situations. The positive impact of civil war on output for industrial countries should be treated with caution, as the result is driven by limited episodes for this set of countries.  

The average output loss following a deterioration in constraints on executive power is as large and persistent as that for currency crises, but the impact varies markedly by the different regional and income groups (Figure 3.7). Weaker constraints on executive power (fewer institutional checks and balances) are associated with output gains for Asia and the Middle East, but persistent losses for Africa, Latin America, transition countries, and islands in the Western Hemisphere. The difference by income group is monotonic. High-income countries have significant output gains when executive discretion strengthens. Upper-middle-income countries experience output losses of several percent, but the standard error bands are large. Lower-middle-income and low-income countries experience output losses of about 5 percent. In contrast to the partial rebound in output observed for civil wars, the output loss associated with this measure of a deterioration in governance leads to sustained output loss, averaging 4 percent for the full set of countries. The different impact of changes in executive power on income groups may reflect large differences in initial starting levels. In high-income countries, power is widely distributed among institutions with strong constraining mechanisms. The average level is 6.1 on the scale from 1 to 7. The average level declines monotonically with income groups to 2.8 in low-income countries. The results suggest that an optimal sharing of power may lie between the bounds. Too much power sharing, on the other hand, may cripple decision making.

Twin political crises (civil wars combined with fewer controls on executive discretion) have the most severe overall impact on output of any large negative shock that we study (Figure 3.8). Output declines by about 16 percent on average for our broad set of countries. Moreover, the loss is persistent, with no discernible rebound. The output loss is particularly devastating for low-income countries, reaching 20 percent.

3.4.2. Distribution of Shocks

The results above show that the impact of a crisis varies among different country groups. For several types of shocks, output loss is more severe for lower-income countries than high-income countries. In this section, we calculate the frequency of each type of shock for each country subsample. The analysis consists of all country-year observations in which data on the growth rate and data on the shock indicator are available.

---

5 No civil war episodes were observed for Western Hemisphere islands or high-income countries. The three industrial countries not included in the high-income group are Malta, South Africa, and Turkey. Other civil war results should also be treated with caution, as some episodes of civil war reflect events confined to a small region of a country and therefore may not have a systemic economic impact. For instance, the inclusion of smaller regional conflicts within the definition of civil war could explain the relatively small permanent output effects.
Figure 3.7 Impulse responses: Stronger executive power.
Figure 3.8  Impulse responses: Twin political crises (war and stronger executive power).
The frequency of shocks varies considerably across different country subgroups (Table 3.1). In particular, the frequency increases sharply and nearly monotonically as the income level of the country group falls. Financial crises occur almost twice as often in low-income countries than in high-income countries. Political crises are even more unequally distributed. Civil wars occur in 18 percent of all years in low-income countries, but are not observed in high-income countries. A deterioration of constraints on executive power is not observed in high-income countries in the most recent decade of available data, but occurs in nearly a quarter of the years for low-income countries.

These computations indicate that the higher frequency of crises in lower-income countries relative to high-income countries, especially in the recent decade, compounds the generally larger output loss associated with the crises. Indeed, multiplying full sample estimates for the long-term output loss of a crisis (the loss at the 10-year horizon in the impulse response) by the probability of a crisis in each year, we find that a 10-year accumulation of financial and political shocks could reduce the output level significantly.

### Table 3.1: Probability of Shocks

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Financial Crises</th>
<th>Political Crises</th>
<th>Financial Crises</th>
<th>Political Crises</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Currency</td>
<td>Bank</td>
<td>War</td>
<td>Constraints</td>
</tr>
<tr>
<td>Africa</td>
<td>37</td>
<td>4</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>Asia</td>
<td>23</td>
<td>3</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td>Industrial countries</td>
<td>22</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Latin America</td>
<td>31</td>
<td>5</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Middle East</td>
<td>26</td>
<td>4</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Transition countries</td>
<td>27</td>
<td>6</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Western</td>
<td>21</td>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Hem. islands</td>
<td>20</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>High income</td>
<td>23</td>
<td>5</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Upper middle income</td>
<td>30</td>
<td>5</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Low middle income</td>
<td>36</td>
<td>4</td>
<td>18</td>
<td>6</td>
</tr>
</tbody>
</table>

6 The higher average frequency of currency crises relative to banking crises is partly a matter of data construction. Dummies for currency crises are formed from the highest quartile of EMPI, but banking crisis dummies reflect only the first year of banking crises. This construction, however, does not impact the relative frequency of crises across country groups.

7 The higher frequency and deeper relative output loss for low-income and emerging market countries, combined with the persistence of output loss, implies that such crises contribute to greater volatility of permanent shocks for these countries than for high-income countries. Similarly, Aguiar and Gopinath (2007) find that business cycle fluctuations are driven primarily by permanent shocks in emerging markets. Using parameter estimates from Mexico and Canada as benchmark emerging market and developed countries, respectively, they exploit consumption and net export shares to GDP to identify the underlying productivity processes.
the long-term level of output in low-income countries by as much as 25 percentage
points more than in high-income countries. Currency crises produce the greatest
differential effects between high-income countries and the other three groups
because of significant differences in both frequency and magnitude. In addition, the
considerably higher frequency of governance shocks (less constraints on executive
discretion) in low- and low-middle-income countries in the recent period would
intensify the differences in output loss between the income groups.

3.4.3. Robustness Checks

We also check the robustness of our results using alternative sources of crisis dates
and growth rates, and controls for some common shocks.

The results are robust to the source of data on crisis dates and growth rates.
As a check of the robustness of our results on the persistent output loss from
financial crises, we examine the impulse response functions using the crises dates
from Kaminsky and Reinhart (1999). As shown in Figure 3.9, we continue to
find deep and persistent output loss from currency, banking, and twin financial
crises using this alternative set of crisis dates. The size of the loss is, in fact,
larger by 1–4 percentage points. We also substitute growth rates from the latest
release of the Penn World Tables, and find similar impulse response functions
(Figure 3.10).

The results are also robust to controls for common shocks. In Figure 3.11, we
add oil price changes into the regression. In Figure 3.12, we allow for arbitrary
common shocks by including period effects. The impulse response functions are
not affected much by either of these controls.

In addition to examining robustness, we also note that our estimates of the
extent of output loss may be conservative because of the use of fixed effects esti-
mation. As mentioned, fixed effects estimation provides a downward bias to the
coefficient estimate on a lagged dependent variable in a panel regression (Nickell,
1981), although we argue it should be very small in this dataset given the fairly
long time series. To the extent that true growth rates are more serially correlated
than our estimates, the impact of a shock on output would be magnified com-
pared to our estimates.

Figure 3.9  Impulse responses: Financial crises using Kaminsky and Reinhart (1999) dates.
Figure 3.10  Impulse responses: Penn World Tables dataset.

Figure 3.11  Controlling for oil price changes.
3.5. EXOGENEITY

Our estimating equation from Section 3.2 assumes that we can treat the occurrence of a crisis as a contemporaneously exogenous event with respect to output growth. However, the other polar case—in which output growth is contemporaneously exogenous with respect to the crisis and the crisis has only a lagged effect on output—is also plausible. Second, we estimate equation (1) as a single equation, ignoring any feedback in which the probability of a crisis is affected by output growth. In this section, we discuss the impact of alternative assumptions and provide some evidence to address these issues of exogeneity.

Formally, suppose that we can model the relationship between growth and crisis as a bivariate system of equations, conceptually analogous to a bivariate vector autoregression, although not linear. That is, we augment the growth equation with another equation specifying that the probability of a crisis depends on contemporaneous and lagged growth and lags of the crisis dummy.

\[ g_{it} = \alpha_t + \sum_{j=1}^{4} \beta_j g_{i,t-j} + \sum_{s=0}^{4} \delta_s D_{i,t-s} + \varepsilon_{it} \]  

(1)

\[ \Pr(D_{i,t} = 1) = F\left(\mu + \sum_{j=0}^{4} \gamma_j g_{i,t-j} + \sum_{s=1}^{4} \phi_s D_{i,t-s} + \nu_{it}\right) \]  

(2)

In Section 3.2, we assume zeros for all coefficients in equation (2). This assumption implies that the crisis is strictly exogenous for growth, and serially uncorrelated.
Using this framework, we can modify our assumption in two key ways. First, if \( \delta_0 = 0 \), then output growth is contemporaneously exogenous, and the crisis has only a lagged effect on growth. The original assumption and this modified assumption are similar to the two alternative triangular factorizations that can be imposed for a Cholesky decomposition of a bivariate VAR. The second important modification would be to allow nonzero coefficients in equation (2), so that output growth can affect the probability of a crisis and the crisis dummy can be serially correlated.

The data indicates that lower growth is associated with a higher probability of a crisis within the same year. By assuming that the crisis is exogenous, we attribute the low growth to the impact of the crisis. But if, instead, output growth is exogenous (\( \delta_0 = 0 \)), then the crisis may be a result, rather than a cause, of the low growth. In this case, the impact of the crisis would only be because of the lagged effects in equation (1). The output loss shown in Figures 3.3–3.12 may thus be exaggerated.

The next two sections below provide some evidence to address this question of the contemporaneous relationship between growth and a crisis. In Section 3.5.1, we generate dynamic forecasts from a univariate autoregressive model of growth. We compute errors between forecasts from the model and actual growth following a crisis under each polar case for contemporaneous exogeneity of output growth and crisis. In Section 3.5.2, we analyze consensus forecasts of expected growth in an attempt to disentangle whether a crisis leads to output loss, or whether actual or expected output loss leads to the crisis. The results provide some evidence pointing to growth optimism at the time of a crisis.

In Section 3.5.3, we explicitly impose the alternative assumption that output growth is exogenous by setting \( \delta_0 = 0 \) in the estimation equation. In this case, the crisis has only lagged effects on output growth, and we thus generate impulse response functions that correspond to this alternative assumption.

In Section 3.5.4, we discuss the impact of allowing nonzero coefficients in equation (2). We provide some evidence from probit models showing that low growth would increase the probability of a future crisis. Moreover, crises are serially correlated. The implication of this evidence is that the results for output loss shown in Section 3.4 may be underestimated because we have ignored these feedback effects to the probability of a crisis.

In Section 3.5.5, we consider some additional potential specification errors, such as the impact of expectations and the possibility of third variables driving both growth and crises.

### 3.5.1. Forecast Errors

We compare the actual level of output following a financial or political crisis with the level of output predicted from a univariate AR model that controls for normal business cycle dynamics. The forecast error provides a measure of the impact of the crisis. We show how the results differ under alternative extreme assumptions that all contemporaneous correlation between output and crisis can be attributed to (1) crisis innovations or (2) output innovations.
For the panel of countries, we estimate a univariate autoregressive model in growth rates to account for the business cycle and any ex-ante slowdown in growth:

\[ g_{it} = \alpha_i + \sum_{j=1}^{4} \beta_j g_{i,t-j} + \epsilon_{it} \]  

(3)

For each crisis date, \( t \), in each country, we then compare current and subsequent actual growth rates to those of dynamic forecasts constructed using coefficient estimates from the AR(4) model. However, contemporaneous correlation between current growth and the crisis must be distributed between the two variables, as current growth may be unexpectedly low because of the crisis or the crisis may occur because of the negative innovation in growth. To account for these possibilities, we construct two sets of forecast errors that correspond to each extreme assumption.

Assuming that low growth in time \( t \) occurs because of the crisis innovation in time \( t \), we form 1-, 2-, 3-, and 4-period ahead dynamic growth forecasts using only growth data through time \( t-1 \). The forecast errors are given by:

\[
ferr_{t+1} = g_{it+1} - g^f_{it+1} = g_{it} - \left( \hat{\alpha}_i + \sum_{j=1}^{4} \hat{\beta}_j g_{i,t-j} \right)
\]

\[
\vdots
\]

\[
ferr_{t+4} = g_{i,t+4} - g^f_{i,t+4} = g_{i,t+3} - \left( \hat{\alpha}_i + \sum_{j=1}^{3} \hat{\beta}_j g^f_{i,t+3-j} + \hat{\beta}_4 g_{i,t-1} \right)
\]

(4)

Alternatively, if we fully attribute any slowdown in growth in the year of a crisis (contemporaneous correlation between growth and crisis) to growth innovations, then we can construct forecast errors from our AR(4) model using growth information through time \( t \). Under this assumption, the growth slowdown is responsible for the crisis in time \( t \) and the forecast errors will pick up only lagged effects from the crisis to future growth. Thus, the forecast errors are constructed as:

\[
ferr'_{t+1} = g_{i,t+1} - g^f_{i,t+1} = g_{i,t+1} - \left( \hat{\alpha}_i + \sum_{j=1}^{4} \hat{\beta}_j g_{i,t-j+1} \right)
\]

\[
\vdots
\]

\[
ferr'_{t+4} = g_{i,t+4} - g^f_{i,t+4} = g_{i,t+4} - \left( \hat{\alpha}_i + \sum_{j=1}^{3} \hat{\beta}_j g^f_{i,t+4-j} + \hat{\beta}_4 g_{i,t} \right)
\]

(5)

We compute such sets of forecast errors for each crisis in our panel data, and compute the average forecast error across the sample at each horizon. Figure 3.13 presents forecast errors of the level of output by accumulating the 1-, 2-, 3-, and 4-year ahead forecast errors of output growth as described in equations (4) and (5). Forecast errors shown by solid lines assume that any correlation between growth and a financial or political crisis is attributed to the crisis in the year it occurs, whereas those shown by dashed lines attribute the correlation entirely to the innovation in the growth rate.

The results show that output loss occurs irrespective of which polar assumption is used to attribute contemporaneous correlation between output and crisis
innovations. The magnitude of output loss is smaller if crises have only lagged
effects on growth, corresponding to $\delta_0 = 0$ in equation (1). The attribution of
contemporaneous correlation to growth versus crisis innovations impacts the
magnitude of output loss more for political crises than for financial crises.
However, on average across the panel of countries, actual growth rates fall short
of those that are projected to account for normal business cycle fluctuations for
all four types of shocks, regardless of alternative assumptions on contemporane-
ous exogeneity.

### 3.5.2. Consensus Growth Forecasts

We consider the possibility that a crisis may occur not only because of an ex-ante
decline in output growth, but also because economic agents may expect a future slowdow. For instance, suppose that economic agents revise downward their
forecast of growth, and as a result, they take actions that induce a financial crisis,
start a civil war, or weaken the constraints on executive power. In this situation,
the contemporaneous correlation between the crisis and growth should be attrib-
uted to growth, and the crisis would have only a lagged impact on growth.

To account for changes in growth forecasts, we collect consensus forecasts of
economic growth in the crisis year and subsequent year for a set of industrial and
emerging market countries. For each type of financial and political crisis, we
regress the crisis dummy indicator on the difference between the midyear consen-
sus forecast of growth in the current crisis year and the actual growth outturn, as
well as the difference between the midyear forecast of growth in the following year.
We also compare the timing of revisions to expected growth using a difference of differences specification. We regress the crisis dummy on the changes in consensus forecasts \( \left( \frac{F_{i,t}}{\Delta F_{i,t}} \right) \) where \( F_{i,t} \) denotes the consensus forecast of country \( i \) in the middle of year \( t \). If the revision to growth forecasts occurs before the crisis, the first term would be negative and the second term zero. In contrast, the first term would be zero and the second part of the expression would be positive if growth forecasts are revised downward after the crisis (that is, if \( F_{i,t} g_{i,t+1} < F_{i,t} g_{i,t+1} \)).

For financial crises, we find robust evidence of growth optimism. Table 3.2 shows that the midyear consensus forecast of growth in the year of a crisis is 0.8 percentage points higher than the actual outturn for currency crises and 2.4 percentage points higher for banking crises. The expectational error is even larger for growth in the subsequent year: 1.9 percentage points too optimistic for currency crises and 4.7 percentage points too optimistic for banking crises. Moreover, growth revisions lag, rather than lead, a financial crisis, especially for banking crises. Growth is revised downward by 6 percentage points more after the banking crisis starts compared with any ex-ante revision.

The evidence on consensus forecasts for political crises is insignificant. The weak results may reflect that the sample of countries and time period available for consensus forecast data is quite restricted compared with the broad sample of countries available for the impulse response analysis. The consensus forecast sample includes only one low-income country. Thus the results tend to be biased toward higher-income countries, which do not suffer as large output losses from political crises, especially from the decline in constraints on executive power.

### Table 3.2

<table>
<thead>
<tr>
<th>Table 3.2</th>
<th>Consensus Forecast Errors for Growth</th>
<th>Financial Crisis</th>
<th>Political Crisis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Currency</td>
<td>Bank</td>
<td>War</td>
</tr>
<tr>
<td>Current year expectation error</td>
<td>0.83***</td>
<td>2.43***</td>
<td>−0.10</td>
</tr>
<tr>
<td>Standard errors</td>
<td>0.31</td>
<td>0.52</td>
<td>1.03</td>
</tr>
<tr>
<td>Number of countries</td>
<td>34</td>
<td>33</td>
<td>34</td>
</tr>
<tr>
<td>Number of observations</td>
<td>408</td>
<td>352</td>
<td>229</td>
</tr>
<tr>
<td>Next year expectation error</td>
<td>1.88***</td>
<td>4.47***</td>
<td>−0.59</td>
</tr>
<tr>
<td>Standard errors</td>
<td>0.51</td>
<td>0.84</td>
<td>0.87</td>
</tr>
<tr>
<td>Number of countries</td>
<td>34</td>
<td>30</td>
<td>34</td>
</tr>
<tr>
<td>Number of observations</td>
<td>376</td>
<td>328</td>
<td>205</td>
</tr>
<tr>
<td>Revision of expectations</td>
<td>0.38</td>
<td>5.84***</td>
<td>0.70</td>
</tr>
<tr>
<td>Standard errors</td>
<td>0.56</td>
<td>10.7</td>
<td>1.28</td>
</tr>
<tr>
<td>Number of countries</td>
<td>34</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>Number of observations</td>
<td>378</td>
<td>326</td>
<td>199</td>
</tr>
</tbody>
</table>

Notes: Sample is 1990–2004, as available. July is used for consensus forecasts, except for Latin American countries, where June is used. Regressions include fixed effects. Asterisks (***;; denote significance at the 1 percent level.

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8 The regressions in this section include fixed effects.
3.5.3. Output Growth Contemporaneously Exogenous

In this section, we consider the case that a crisis has only a lagged effect on output growth. That is, we impose a zero restriction on the coefficient of the contemporaneous value of the dummy variable in equation (1), $\delta_0 = 0$. This assumption implies that output is contemporaneously exogenous with respect to a crisis. We examine the output loss associated with this alternative specification. In particular, we estimate a revised equation in which crises impact GDP growth only through lags, and we control for the dynamics of growth rates:

$$g_{it} = \alpha_i + \sum_{j=1}^{4} \beta_j g_{i,t-j} + \sum_{j=1}^{4} \delta_j D_{i,t-j} + \varepsilon_{it} \quad (6)$$

Figure 3.14 shows the impulse responses from this regression. The change in the assumption of contemporaneous exogeneity has a smaller impact on the results for financial crises than political crises. The finding of persistent output loss remains robust for financial crises. On the other hand, the magnitude of loss is dampened when the contemporaneous decline in output is attributed to the output innovation. But even under this assumption, the lagged effects of currency, banking, and twin financial crises still result in 2½ percent, 4 percent, and 5 percent of output loss, respectively, by the end of 10 years. For wars and the weakening of executive constraints, output falls initially, but at the end of 10 years it is only one percentage point lower than its initial level. Output loss from twin political crises remains at 4 percent at the end of 10 years, but the uncertainty bands are large.
3.5.4. Feedback to the Probability of Crisis

The results presented in Section 3.4 ignore the possibility that growth affects the probability of a future crisis or that crises are serially correlated. We relax this assumption by estimating a probit model for equation (2), using each type of crisis indicator as a dependent variable. We impose only the restriction that \( \gamma_0 = 0 \), so that the crisis is contemporaneously exogenous. The results in Table 3.3 show that even when controlling for lags of the crisis itself,\(^9\) the first lag of growth has a significant inverse relationship with the probability of each type of crisis. That is, lower (lagged) growth leads to a higher probability of crisis. Moreover, currency crises and civil wars are positively serially correlated. Under the assumption that \( \gamma_0 = 0 \), the omission of such feedback effects—higher probability of crisis resulting from both lower lagged growth and positive serial correlation—from the results shown in Section 3.4 imply that the impulse responses underestimate the overall impact of a crisis on output.

<table>
<thead>
<tr>
<th>Dep var/shock type</th>
<th>Financial Crisis</th>
<th></th>
<th>Political Crisis</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>−0.783***</td>
<td>−0.906***</td>
<td>−1.767***</td>
<td>−1.815***</td>
</tr>
<tr>
<td></td>
<td>0.032</td>
<td>0.220</td>
<td>0.045</td>
<td>0.318</td>
</tr>
<tr>
<td>Shock (−1)</td>
<td>0.326***</td>
<td>0.525***</td>
<td>0.044</td>
<td>0.209</td>
</tr>
<tr>
<td>Shock (−2)</td>
<td>0.160***</td>
<td>0.047</td>
<td>0.045</td>
<td>0.223</td>
</tr>
<tr>
<td>Shock (−3)</td>
<td>0.169***</td>
<td>0.074</td>
<td>0.045</td>
<td>0.212</td>
</tr>
<tr>
<td>Growth</td>
<td>−0.093</td>
<td>−0.169***</td>
<td>0.031</td>
<td>0.042</td>
</tr>
<tr>
<td>Growth (−1)</td>
<td>−0.010***</td>
<td>−0.016</td>
<td>−0.028***</td>
<td>−0.030</td>
</tr>
<tr>
<td></td>
<td>0.003</td>
<td>0.029</td>
<td>0.006</td>
<td>0.037</td>
</tr>
<tr>
<td>Next year growth expectations</td>
<td>0.054</td>
<td>0.192*</td>
<td>0.071</td>
<td>0.102</td>
</tr>
<tr>
<td>Number of observations</td>
<td>4,691</td>
<td>312</td>
<td>3,043</td>
<td>286</td>
</tr>
</tbody>
</table>

**Notes:** Standard errors are shown below coefficient values. *** significant at, or below, 1 percent; ** significant at, or below, 5 percent; * significant at, or below, 10 percent.

3.5.5. Expectations and Omitted Variables

To summarize, we provide some evidence of growth optimism at the time of a crisis, suggesting that the crisis is contemporaneously exogenous with respect to

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\(^9\) Lags of banking crises are not included because by construction the variable measures only the first year in a string of possible banking crisis years.

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output growth. If this finding is invalid, and instead growth is contemporaneously exogenous, we then show that even the lagged effects of the crisis would reduce output. Lower output and serial correlation of crises would act to further reduce output by feedback effects that increase the probability of a future crisis.

Nevertheless, other potential specification errors need to be considered. Even the lagged impact of a crisis on growth could overstate the output loss from crisis innovations if we allow for expectational factors and omitted variables. For instance, suppose that the crisis impacts output growth with a lag, as in Section 3.5.3 previously, where $\delta_0 = 0$. But suppose also that the probability of a crisis depends on expectations of lower future growth and growth depends on some omitted variable, $Z$, that relevant economic agents can observe. The system of equations becomes

$$
g_{it} = \alpha_i + \sum_{j=1}^{4} \beta_j g_{i,t-j} + \sum_{s=1}^{4} \delta_s D_{i,t-s} + Z_{i,t-1} + \varepsilon_{it}$$  \hspace{1cm} (7)$$

$$
\Pr(D_{i,t} = 1) = F\left(\mu + \sum_{j=0}^{4} \gamma_j g_{i,t-j} + \sum_{s=1}^{4} \phi_s D_{i,t-s} + E_{i,t} g_{i,t-1} + \nu_t\right)$$  \hspace{1cm} (8)

Even though the crisis dummy is predetermined with respect to output growth in equation (7), it can still be correlated with the error term that contains the omitted variable. We make use of our consensus forecast data to test the specification of equation (8), although the consensus forecast data limits the countries and time periods and we can only show results for financial crises. This information suggests that the expectation of future growth is not a significant determinant of a currency crisis once we include actual growth in the regression equation (shown in the second column of results in Table 3.3). The expectation of future growth is significant at the 10 percent level for the probability of a banking crisis (column 4 of Table 3.3), but the sign is perversely positive, again suggesting excessive growth optimism.

Finally, we cannot rule out the possibility of an omitted variable in both equations that causes a crisis and reduces growth:

$$
g_{it} = \alpha_i + \sum_{j=1}^{4} \beta_j g_{i,t-j} + \sum_{s=1}^{4} \delta_s D_{i,t-s} + Z_{i,t-1} + \varepsilon_{it}$$  \hspace{1cm} (9)$$

$$
\Pr(D_{i,t} = 1) = F\left(\mu + \sum_{j=0}^{4} \gamma_j g_{i,t-j} + \sum_{s=1}^{4} \phi_s D_{i,t-s} + \theta Z_{i,t} + \nu_t\right)$$  \hspace{1cm} (10)

In this situation, omitting variable $Z$ implies that the coefficient on the crisis dummy variable may be overestimated as it captures the correlation with the error term rather than the pure effect of the (lagged) crisis on growth. This possibility is quite plausible, given that crises and growth are likely to be related to or driven by other macroeconomic variables.

### 3.6. CONCLUSION

Using panel data for a large set of high-income, emerging market, developing, and transition countries, this chapter documents that the large output loss associated
with financial crises and some types of political crises is highly persistent. Impulse response functions show that less than 1 percentage point of the deepest output loss is regained by the end of 10 years following a currency crisis, banking crisis, deterioration in political governance, twin financial, or twin political crisis. Of the large negative shocks examined, a partial rebound in output is observed only for civil wars. Moreover, the magnitude of persistent output loss ranges from around 4 percent to 16 percent for the various shocks.

The chapter provides some suggestive, although not definitive, evidence of causality. Financial crises are associated with growth optimism. Forecasts of economic growth, whether measured by projections from a univariate autoregressive model or by consensus forecasts of financial experts, tend to be higher than actual growth outturns. However, this evidence cannot rule out the possibility of a third factor that precipitates a crisis and leads to a reversal of growth optimism.

The results pose a challenge to explain the observed behavior of output following the various negative shocks. Temporary output losses could be explained by allowing for variable capacity utilization or other elements of business cycle models, but the puzzle is to explain the permanent effects. It would be useful, therefore, to develop theoretical models with propagation mechanisms that are persistent, especially for low-income and emerging market economies.

REFERENCES


4.1. INTRODUCTION

The global financial crisis has underscored the importance of financial linkages among countries and the impact of financial conditions on real economic activity (e.g., Strauss-Kahn, 2008). This chapter empirically studies linkages between the financial and real sectors in the euro area, focusing on the credit channel. To assess the robustness of the main results, we use a battery of possible estimation approaches.

Since mid-2007, the subprime mortgage crisis in the United States has sparked a reassessment of risk across global markets. Risk premiums in money and credit markets have spiked, raising the cost of interbank and corporate financing, including in the euro area. The situation worsened substantially in September and October 2008, when key money market indicators—the three-month spreads over policy rates, use of central bank facilities, and measures of market segmentation on the basis of credit risk—all rose to unprecedented levels.

The impact of the global financial crisis on the euro area real sector is an important, and still open, question. It is still too early to observe the full effect of the deteriorated financial conditions on the euro area economy. Nonetheless, it is useful to examine the linkages between the financial and real sectors in the euro area, using a combination of past and recent data.

The tight financial conditions associated with the crisis affect euro area activity through four main channels:

- First, the increase in bank funding costs (arising from higher money market premiums and rates) may be passed on to firms and consumers via higher lending rates. Indeed, retail lending rates have gone up somewhat

1 This chapter is based on IMF Working Paper 09/69 and reflects data up to late 2008.

1 We thank, without implicating, Jörg Decressin and Luc Everaert for guidance; Chanpheng Dara for research assistance; Thomas Walter for editorial help; and Marie Donnay, Heiko Hesse, Luc Laeven, Kevin Ross, James Vickery, Lorenzo Cappiello, Boris Hofmann, and participants in the IMF’s Annual Research Conference and seminars at the European Central Bank, the European Commission, and the IMF for useful comments on earlier versions of the paper. All remaining errors are our own.
since mid-2007, even though this has been largely a continuation of a previous trend (Figure 4.1).

- Second, in response to their own deteriorated balance sheets and financial conditions, banks may limit the amount of credit available to borrowers for a given price. This could be in the form of stricter lending standards. Bank lending surveys indicate a considerable tightening in quantitative bank lending conditions since mid-2007, suggesting that the credit cycle has turned (Figure 4.2).

- Third, the costs of corporate bond and equity financing may also be higher, limiting the scope for substitution from bank financing. The corporate bond

![Figure 4.1](image_url)
and credit default spreads of all maturities and ratings have widened sharply, and the stock market has fallen since the start of the crisis (Figure 4.3).

- Fourth, tighter financing conditions could create financial accelerator effects by depressing asset prices and reducing the value of collateral. Available data confirm that asset prices have declined precipitously (see Figure 4.3); this has an impact on collateral values.

The data as of late 2008 show that monetary aggregates have decelerated, as has bank credit to the private sector. This is a combination of a continued slowdown of bank credit to households and an incipient slowdown in the (still relatively rapid)
growth of corporate credit. Equity and bond issuance by nonfinancial firms has also decelerated (Figure 4.4).

To preview our findings, we find that the financial tightening affects euro area activity through several channels, including an increase in bank funding costs, more bank credit rationing, increased costs of corporate bond and equity financing, and depressed collateral values. Based on a set of closely linked empirical approaches, we find that (1) bank loan supply responds negatively to declines in banks’ soundness; (2) a cutback in bank loan supply is likely to weaken economic activity; (3) a positive
shock to the corporate bond spread lowers industrial output; and (4) risk indicators for the banking sector, the nonbank corporate sectors, and the public sector show a steady improvement beginning in 2002–03, followed by a major deterioration since 2007. Combining the existing expert estimates of financial sector losses with our econometric estimates of the relationship between financial sector losses and aggregate output, we conclude that the currently estimated banking sector losses would translate into a negative 2 percentage point impact on real output in the euro area (with considerable uncertainty around this estimate).
The remainder of the chapter is structured as follows. Section 4.2 analyzes the empirical evidence on the financial-real sector linkages, using a battery of approaches. Section 4.3 puts the individual approaches together and quantifies the implications of the results. Section 4.4 concludes.

4.2. EMPIRICAL EVIDENCE

We examine empirically the linkages between the financial and real sectors in several alternative but complementary ways. In the next four subsections, we focus on the following:

- **Linkages between bank characteristics and lending behavior.** This analysis helps us understand how financing conditions for banks, which are a crucial part of the financial intermediation in Europe, translate into banks’ lending behavior, and thereby into financial conditions of banks’ clients.

- **Linkages between bank loan supply and aggregate output.** This part of the analysis allows us to examine the relationship between the supply of bank credit and economic activity. Subsequently, we link the analysis in Section 4.2.2 with the analysis in Section 4.2.1 to examine the linkages among bank characteristics, bank lending, and aggregate output performance (the so-called bank lending channel).

- **Linkages between corporate sector financing conditions and economic activity**, using data on corporate bond spreads and output. This part of the analysis allows us to gauge how a change in corporate sector financing conditions affects industrial output.

- **Risk transfers among banks, nonbank companies, and the public sector**, using a combination of sectoral balance sheets and market-based data.

4.2.1. Linkages Between Bank Characteristics and Lending Behavior

Is bank loan supply in the euro area adversely affected by deteriorating financing conditions? If so, it means that banks are not able to fully shield their loan portfolios from changes in financing costs.

Most of the literature on the bank lending channel deals with the U.S. economy (e.g., Bernanke and Blinder, 1988; and Bernanke and Gertler, 1995). It generally finds strong evidence that banks decrease their loan supply in response to tighter financing conditions (in particular for small, balance-sheet-constrained banks), although there is limited evidence that the cutback in bank loan supply reduces real activity (e.g., Driscoll, 2004).

The fact that banks still finance the bulk of investment in Europe constitutes a good reason for investigating the bank lending channel. However, the empirical evidence on the bank lending channel in Europe has been mixed. Several studies have tested for the existence of a bank lending channel across euro area countries (De Bondt, 1999; Favero, Giavazzi, and Flabbi, 1999; Altunbaş, Fazylov, and
Molyneux, 2002; and Angeloni and Ehrmann, 2003), and a number of studies have examined the bank lending channel for individual countries (Angeloni, Kashyap, and Mojon [2003], for several countries; Kakes and Sturm [2002] for Germany; and Iacoviello and Minetti [2008] on four European housing markets). The results from these studies are inconclusive, suggesting that the bank lending channel may be operating significantly in Germany, Italy, and Greece, although it appears not to be important in some other euro area countries. Most of these studies focus on the first (necessary) condition for the existence of a bank lending channel (i.e., that bank loan supply is affected by higher financing costs), without examining whether the decline in credit supply has an adverse effect on the real economy.

Identifying the determinants of credit developments is complicated by the interplay of cyclical and long-term factors that influence both credit demand and credit supply. On the credit demand side, these include a combination of cyclical developments and structural shifts. On the credit supply side, the impact of the economic downturn on financial markets and the financial situation of the banks seem to have influenced their lending. Moreover, banks in the euro area have gone through important structural changes, including a move from relationship-based banking to more market-based banking, and a growing role for securitization (e.g., Gambacorta, Altunbas, and Ibañez, 2008).

A rough tool for distinguishing credit supply and demand factors is the bank lending surveys. These surveys, organized by the European System of Central Banks since 2003, summarize responses of senior loan officers regarding loan demand and changes in their banks’ lending policies in the previous quarter. The changes in demand conditions and credit standards in a preceding quarter are summarized by a difference between positive and negative responses, in percent of all responses (“net percentage”). When interpreting the results of the survey, one needs to take into account the qualitative, subjective nature of the survey data. In particular, experience from similar surveys suggests that bankers’ responses may be biased toward tightening, and therefore a zero net percentage may in fact mean a slight easing. With that in mind, the latest survey data indicate that bank credit standards have tightened considerably since mid-2007, both for households and for enterprises (see Figure 4.2). The three most important factors listed by banks when explaining changes in credit standards were those related to the perception of risk.

Empirically, there is some basic evidence that the bank lending surveys contain useful information about subsequent macroeconomic developments. For example, there is a positive correlation between the quarter-to-quarter growth of real GDP

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2 In addition, other studies cover banking intermediation in the euro area, but focus on other issues than the bank lending channel. For instance, Bruggeman and Donnay (2003) estimate a monthly monetary model with banking intermediation for the euro area in 1981–2001, but, instead of the bank lending channel, focus on the relationships among short-term market interest rates, retail interest rates, and inflation.

3 A positive net balance on the demand side means more demand, whereas on the supply side, it means less supply. See Berg and others (2005) for an overview of the methodology of the surveys.
and lagged values of the net percentage balance of loan demand (interestingly, the correlation coefficient is the same, 0.41, for both household lending and enterprise lending); also, there is a negative correlation between the quarter-to-quarter growth of real GDP and the lagged net percentage balance reflecting credit standards (the correlation coefficient being −0.40 for household lending and −0.43 for enterprise lending). This suggests that both the loan demand and the lending standards are procyclical. The time series of lending surveys are too short to allow for a more elaborate analysis or to test for breaks in the correlations.

To analyze the bank lending channel in the euro area, we use a supply-demand disequilibrium model. Equilibrium approaches, such as vector error correction/vector autoregression models or single-equation estimates, can provide only a limited answer to the causes of credit slowdown because they do not address the question of whether the demand or supply function determines the credit. Following the examples of Pazarbasioglu (1997) and Barajas and Steiner (2002), a credit demand- and a credit supply-function are estimated under the restriction that the minimum of the two determines the credit. This strategy avoids the identification problem of equilibrium models, and allows us to make a statement on the existence of a credit crunch.

The disequilibrium model is estimated with bank-by-bank panel data for the 50 largest euro area banks from 1997 to 2007.\(^4\) The specification of the demand side follows the Bundesbank (2002). The specification of the supply side is close to Pazarbasioglu (1997), but with the distance to default (DD) among the supply-side variables. The DD was used to approximate banking sector vulnerability as a possible source of credit supply strain (see Appendix I for details). The DD for this estimate was calculated for each individual bank. The advantage of using individual bank data is that it allows for testing whether weaker banks are more likely to restrain their credit. Nonetheless, we have also calculated the aggregate DD for a portfolio of euro area banks (using a methodology explained in Appendix I and also in De Nicolò and others [2005] and Čihák [2007]). To provide an illustration of the overall developments in the DD, Figure 4.5 shows the development of the portfolio DD for daily data since the early 1990s. The portfolio DD has generally been above two, except for a brief period in 2003 (which can be linked to weaknesses in German banks), and except for the most recent period: in late 2008, the portfolio DD reached zero, its lowest recorded value.

The estimated model provides a plausible explanation of the factors contributing to credit developments in the major euro area banks (Table 4.1). All the key coefficients have the expected signs and are significant. The model explains year-on-year real growth rates of customer loans as a function of a bank’s DD (with an expected positive sign, as higher DD is associated with greater soundness, making it easier for banks to expand lending), real GDP growth rate as a proxy for overall

\(^4\) Data are from the Bankscope database by Bureau van Dijk for 1997–2007. To explain the factors contributing to credit developments, the following variables are used: total bank assets, total loans, shareholders’ equity, short-term liabilities, long-term liabilities, liquid holdings (cash, European Central Bank and other financial institutions’ securities, government securities), equity price data (“last price,” daily), and equity shares outstanding (daily).

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economic activity (positive sign), lending rate and net interest margin (expected negative signs, reflecting more expensive lending for borrowers), and bank size approximated by total value of loans (expected negative sign). The key variable of interest is the DD, which captures the effect of bank financial conditions on credit supply.

Based on the estimated coefficients, the effect of bank soundness on loan supply is significant. The estimate implies that a one-standard-deviation drop in the DD is associated with a year-on-year real growth of credit that is 1.5 percentage points lower than otherwise.

Figure 4.6 illustrates the development of the excess demand for credit in the model. It is an aggregate number, calculated by aggregating the demand and supply estimates for all the individual banks. The figure suggests that 2000 was a period of excess supply of credit, whereas 2003 and 2004 were characterized by excess demand for credit. Since then, demand and supply have been relatively balanced.

TABLE 4.1
Demand and Supply in the Disequilibrium Model, 1997–2007*
(Dependent variable: year-on-year real growth rate of a bank’s total credit)

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Demand</th>
<th>Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parameter</td>
<td>Standard Error</td>
</tr>
<tr>
<td>Constant</td>
<td>−10.24</td>
<td>0.48</td>
</tr>
<tr>
<td>Real GDP growth</td>
<td>1.18</td>
<td>0.09</td>
</tr>
<tr>
<td>Lending rate</td>
<td>−0.03</td>
<td>0.01</td>
</tr>
<tr>
<td>Net interest margin</td>
<td>−0.09</td>
<td>0.05</td>
</tr>
<tr>
<td>Distance to default</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log (total loans)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors’ calculations based on data from Datastream and Bankscope.

As a robustness test, we ran the same model, replacing the DD by the probability of distress (PD) calculated in Poghosyan and Čihák (2009). The PD has the expected (negative) sign in the loan supply (higher PD, that is, lower soundness, implies lower supply of loans), and the coefficients of the other variables are largely unaffected.

As another robustness check, we have also performed this analysis at the level of countries rather than the level of individual banks. Specifically, this means that instead of individual bank DDs, we have used the aggregated DDs for portfolios of banks in the individual euro area countries (see Appendix I). This reduces the number of available observations, but it allows for an easier link to the subsequent analysis (of linkages to aggregate output), which is also carried out at the level of countries rather than banks.

In addition to the disequilibrium model presented in Table 4.1, a series of pairwise Granger causality tests were run to assess the relationships among real credit growth, real output growth, and banking sector vulnerability (approximated again by the DD). The results of the exercise suggest that banking sector vulnerability, measured by the DD, is influenced by real GDP and real credit on a horizon of two to four quarters. The DD influences real credit, but not GDP, with a lag of six quarters (detailed results available upon request).

### 4.2.2. Linkages Between Bank Loan Supply and Aggregate Output

Our next step is to examine the relationship between the supply of bank credit and economic activity. Declining loan supply may suppress economic activity if firms and households cannot replace completely the “missing” loans with other funding. For this to take place, a substantial group of borrowers (firms or households) must be unable to insulate their spending from the reduction in bank credit.
As the data illustrate, bank credit to the private sector and output do move together (Figure 4.7). But this does not necessarily mean that the supply of bank loans has a significant effect on output. An alternative (and equally plausible) possibility is that as economic activity slows, the demand for bank loans declines, creating a positive relationship between the two series. Disentangling the demand and supply effects (i.e., solving the identification problem) is very hard, because these effects tend to occur at the same time but only the equilibrium outcome is observed.

The identification problem can be addressed by using an instrumental variables technique to isolate the loan supply effect on real output. We use shocks to country-specific money demand as an instrument for shocks to the loan supply, as first proposed by Driscoll (2004) in addressing a similar question for the United States. The logic behind this approach is based on the premise that country-specific shocks to money demand should lead to country-specific changes in the supply of loans, and therefore changes in output. This would allow us to isolate the effect of loan supply on real activity.

The identification scheme involves the following three steps, with all variables used in the regressions constructed as deviations from their cross-sectional mean values, as implied by the identification scheme (see Appendix II for details).

- The overall effect of bank credit on output is investigated by regressing output growth on the growth rate of bank loans (and its lagged value), as well as on its own lagged values. The resulting coefficient will reflect both the supply and demand effects of bank credit on real activity.
- The shocks to money demand are recovered after estimating money demand functions for each euro area country in the sample. Then the growth rate of bank loans is regressed on its lagged values and the estimated money demand shocks, in order to establish whether the latter are a good instrument for shocks to the loan supply.

Figure 4.7  Euro area: Growth in real output and bank loans, 2000–08. (Source: Authors’ calculations based on data from European Central Bank and Eurostat.)
The effect of bank credit on output (see first bullet) is reestimated using the country-specific shocks to money demand as instruments. The resulting coefficient of bank loans is indicative of the supply effect, as the demand effect has been stripped out.\(^5\)

The estimations are done using country-level data from the first quarter of 1999 to the third quarter of 2008. The sample includes 11 euro area countries (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, and Spain).\(^6\) The key variables used in the analysis are: real GDP, money supply (M3), deposit rates, and bank loans to nonfinancial corporations. For each country, the M3 and bank loan variables are deflated by the corresponding GDP deflator. Except for deposit rates, all other variables are in logarithmic form.

One issue when doing any analysis for euro area banks involving interest rate statistics is that harmonized data on interest rates are available from the European Central Bank only from January 2003. For the earlier period, we have to rely on nonharmonized country-level data, available since January 1999. To address this issue, we carry out a robustness check by performing the same analysis only for the subperiod for which harmonized deposit rate data are available, that is for the period since the first quarter of 2003.

The estimation results from the first step confirm the positive relationship between bank credit and economic activity. As shown in Table 4.2, real bank credit has a significant and positive effect on output. The size of the coefficient suggests that an increase in bank credit (in real terms) of 10 percentage points is associated with an increase in real GDP of about 1.5 percentage points.

Turning to the second step, we find that positive money demand shocks are associated with higher growth in bank loans. The shocks to money demand are constructed using estimates of country-specific money demand functions (see Appendix II). Their impact on bank loans is illustrated by the positive and significant coefficient of the (country-specific) residuals from the estimated money

\(^5\) Assuming that shocks to loan demand and supply are positively correlated, we would expect the instrumented coefficient of bank loans to be smaller than those from the regression without instruments.

\(^6\) Cyprus, Malta, Luxembourg, and Slovenia are not included because of data limitations.
demand functions on the growth of bank loans, even after controlling for lagged values of output (Table 4.3). Therefore, the money demand shocks can be used as an instrument for loan demand in the next step.

Once demand effects have been taken into account in the second step, the loan supply effect on output is positive and statistically significant. As the results show (Table 4.4), the coefficient of the bank loan variable becomes somewhat smaller than in the first step (0.10 instead of 0.15) when the instrumental variables estimation is implemented. Nonetheless, it is still significantly positive. This is an interesting difference from Driscoll (2004), who found that for the United States, the impact of loan growth on GDP growth is not significantly different from zero. This difference in results may be because of the different financial structures of the two economies: whereas the U.S. financial structure is relatively more market-based, the euro area’s is more bank-based.

As another robustness check, we have tried an alternative approach in which we have introduced the difference between unsecured and government-backed deposit rates as an additional instrument for credit risk. This is motivated by the approach of Greenlaw and others (2008), who used the Treasury-Eurodollar (TED) spread as an instrument for credit supply in the United States. A weakness of the

TABLE 4.3
First Stage IV Regression: Loans on Money Demand Shocks*
Dependent Variable $\Delta I_t$  

<table>
<thead>
<tr>
<th>Regressors</th>
<th>Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta y_{t-1}$</td>
<td>-0.2478</td>
<td>(0.3474)</td>
</tr>
<tr>
<td>$\Delta y_{t-2}$</td>
<td>-0.0119</td>
<td>(0.3287)</td>
</tr>
<tr>
<td>$\Delta y_{t-3}$</td>
<td>0.0679</td>
<td>(0.0466)</td>
</tr>
<tr>
<td>$\Delta y_{t-4}$</td>
<td>0.2205</td>
<td>(0.0492)**</td>
</tr>
<tr>
<td>Number of observations</td>
<td>232</td>
<td></td>
</tr>
<tr>
<td>R-squared</td>
<td>0.08</td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors’ calculations, based on data from the European Central Bank and Eurostat.
*All variables are demeaned by their cross-sectional averages. Critical values for 1 percent are denoted by **. 
†Output shocks. 
‡Money demand shocks.

TABLE 4.4
Second Stage IV Regression of Output on Loans 
Dependent Variable $\Delta y_{t}$

<table>
<thead>
<tr>
<th>Regressors</th>
<th>Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta y_{t-1}$</td>
<td>-0.1514</td>
<td>(0.0582)**</td>
</tr>
<tr>
<td>$\Delta y_{t-2}$</td>
<td>-0.0178</td>
<td>(0.0447)</td>
</tr>
<tr>
<td>$\Delta \delta_{t}$</td>
<td>0.0955</td>
<td>(0.0496)**</td>
</tr>
<tr>
<td>$\Delta \epsilon_{t}$</td>
<td>0.0178</td>
<td>(0.0447)</td>
</tr>
<tr>
<td>Number of observations</td>
<td>232</td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors’ calculations, based on data from the European Central Bank and Eurostat.
*All variables are demeaned by their cross-sectional averages. Critical values for 5 percent are denoted by **. 
Country-level money demand shocks are used as instruments.
TED spread is that it may be influenced by “flight to quality” flows that move Treasury bill yields, as well as the funding pressures that drive London interbank offered rates (LIBOR). Nonetheless, as the difference between unsecured and government-backed deposit rates, the TED spread could potentially provide a measure of credit risk, which is likely to be correlated with credit supply. Using a similar line of argumentation, we have introduced in our regressions the spread between the three-month euro LIBOR and the German government bund rate to instrument for credit risk. This robustness check has not affected the quantitative predictions from the main regression.

Overall, the estimation results suggest that an increase in the supply of bank loans of 10 percentage points is likely to lead to an increase in real GDP of about 1 percentage point. Therefore, our analysis implies that a cutback in bank loan supply is likely to have a negative impact on economic activity.

4.2.3. Linkages Between Corporate Financing Conditions and Economic Activity

Turning to the question of how corporate sector financing conditions affect activity, we analyze the relationship between the corporate bond spread and the euro area output. The corporate bond spread is defined as the difference between the yield on a corporate bond (risky asset) of a given maturity and quality and the yield on a government bond (riskless asset) of the same maturity. The corporate bond risk premium has been shown to be a good predictor of real activity in the United States (Chan-Lau and Ivaschenko, 2002; and Mody and Taylor, 2004), and there were some early results suggesting a similar relationship for the euro area (De Bondt, 2002).

There are a number of reasons why the corporate bond spread can be a good predictor of real activity. First, financial instruments, such as corporate bonds, ultimately represent claims on the real economy. Financial information is readily available at high frequencies and transmitted more rapidly than economic information, such as that on output. Therefore, financial prices, such as corporate bond spreads, could provide useful leading information on economic activity. Second, corporate-sovereign bond spreads are a key measure of the credit terms. Their role in predicting output is consistent with the presence of a financial accelerator in the economy (i.e., with the presence of a mechanism linking the condition of borrower balance sheets to the terms of credit) and hence to the demand for capital. Third, the bond market has become a relevant source of corporate financing in the euro area. Since 1999, the euro area market for corporate debt securities has grown tremendously (Figure 4.8). Fourth, as corporate bond spreads tend to move together with the tightness of bank lending standards (for evidence in the United States, see Duca, 1999; and Gertler and Lown, 2000), they can also be treated as a proxy for corporate sector financing conditions.

At the euro area level, aggregate data on corporate bond yields are available for securities of different maturities and quality. The spreads for AAA, AA, A, and BBB seven-year corporate bonds in the euro area (in relation to a seven-year
government bond) are shown in Figure 4.3. Given the high frequencies of these data, we use monthly industrial production (rather than real GDP) as an indicator for economic activity.

The analysis is conducted using vector autoregression (VAR) estimates run over the period from January 1999 to January 2009. The key variables in the regressions are the corporate bond spread, the annual growth in industrial production, and the annual change in the real effective exchange rate. Our baseline specification of the VAR includes three lags; as a robustness check, we also experiment with increasing the number of lags in the VAR. The corporate bond spread is defined as the BBB yield minus government bond yield in the benchmark regressions; as a sensitivity analysis, we also conduct the same analysis for AA- and A-rated bonds.

The estimation results show that a positive shock to the corporate bond spread leads to a significant negative response of industrial output. The impulse responses of the baseline regressions are shown in Figure 4.9.7 The results illustrate that a one-standard-deviation shock to the corporate bond yield (about 60 basis points) has an adverse effect on the growth rate of industrial output, which peaks at about 0.25 percent in 8–20 months. This effect is statistically significant, as shown by the 95 percent confidence bands.

A limitation of these estimates is that simultaneity might be an issue in the basic VAR estimation (we are not using a structural VAR). Nonetheless, these results are fairly robust across alternative specifications.

4.2.4. Risk Transfers Between Banks and Other Sectors: Contingent Claims Analysis

How are risks transmitted among the corporate sector, the financial sector, and the public sector in the euro area? One way of addressing this question is to employ a contingent claims analysis (CCA). CCA is an improved version of the

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7 These are obtained using a generalized impulse response function (Pesaran and Shin, 1998).
balance sheet approach, which incorporates not only accounting data, but also information contained in market prices. It starts with information on the size and structure of assets and liabilities of key economic sectors, with the aim of assessing the extent of currency and maturity mismatches, or imbalances in the debt and equity structure. Given that economy-wide balance sheet data do not provide a full picture of all the risks (because of the contingent nature of many risks), and given that they are usually valued at book value, such balance sheet data do not capture changes in the likelihood of default related to recent market developments. To provide a more complete picture of the risks inherent in a balance sheet, CCA values assets using marked-to-market prices and incorporates contingent liabilities.

To the best of our knowledge, this is the first time in the literature that CCA has been used to identify vulnerabilities in the corporate, banking, and public sectors in the euro area (and to estimate the associated value of risk transfer across the balance sheets). Appendix III provides more details on the CCA methodology employed in this study.

Default indicators for both the banking system and nonbank corporate sector show an improvement from the lows of 2002–03, followed by a major deterioration in the second half of 2007 and 2008 (Figure 4.10). The distribution of default risk by assets confirms the general improvement in both banking system and nonbank corporate sector indicators, with the riskiest banks (those with the highest default probability) accounting for a smaller percentage of total assets over time. Expected losses for the banking system have been declining steadily since 2002–03; the indicator, however, deteriorated in 2007–08. The generally positive trend of the last five years reflected rising equity valuations and declining volatilities, as balance sheet structures improved and nonperforming assets declined (the measure of expected losses for the largest banks moves closely with the overall nonperforming loan ratio and tends to lead changes in the nonperforming loan ratio by one to two quarters).

Figure 4.9  Euro area: Response of annual growth in industrial production to one-standard-deviation innovation in corporate bond spread (based on a generalized impulse response). (Source: Authors’ calculations based on data from Datastream.)
For the public sector balance sheets, Figure 4.11 shows an improvement in the soundness since 2002–03. It shows the estimated default probability when 100 percent of expected losses of the banks are assumed to be guaranteed by the sovereign (solid line) and when expected losses are excluded (dashed line). The figure suggests a gradual decline in default probabilities beginning in 2002–03. For the later period for which daily information is available, however, the default probabilities spike up, reflecting the sharp increase in spreads on government debt quoted by the market.

The estimated probability of default for the public sector is substantially lower than those reported in previous CCA studies. This reflects the fact that previous applications of CCA (surveyed in Appendix III) have covered emerging market economies (e.g., Brazil, Turkey, Thailand, Indonesia), whereas this analysis focuses on an advanced economy (or, more specifically, the set of advanced economies that form the euro area). For example, Gray and Jones (2006) examined the one-year
sovereign default probability in Indonesia in 1999–2006, and found that, for most of the period, it was in the range of 2–6 percent (with a spike to 11 percent in 2001). The other studies surveyed in Appendix III found numbers in a similar range. The numbers reported for the euro area in Figure 4.11 are lower by an order of magnitude, being generally below 0.2 percent. This is consistent with the high sovereign ratings of euro area countries.

The global financial turbulence, which started in mid-2007 and intensified in September 2008, has increased volatility in a variety of risk indicators. Figure 4.10 shows the development in the estimated probabilities of default for the large banks and nonbank corporations in the euro area. The two move broadly in line, but banks have so far been affected much more by the recent financial turmoil. The global market turmoil experienced since mid-2007 has substantially worsened risk indicators for the banking system. A combination of reduced market capitalization and an increase in its volatility has decreased implied assets and increased their volatility, leading to a decline in DD measures and increases in expected losses. These developments reflect the increased market volatility, as well as declining capitalization and lower earnings.

Figure 4.11 illustrates the impact of financial sector instability on the estimated public sector default probabilities. The public sector probability of default is low, but if the public sector were to guarantee the large banks, the impact on public sector default probabilities (indicated by the line “with guarantees”) would be considerable.

4.3. QUANTITATIVE IMPLICATIONS

What do the calculations imply quantitatively for euro area developments? Based on the estimates presented in the preceding section, we can calculate the potential impact of banking sector losses on future economic growth in the euro area. Specifically, the current estimates of losses in the banking sector would imply a loss of 2 percentage points in euro area GDP. Here is how this estimate is derived:

- A natural starting point is estimated losses in euro area commercial banks. These losses have been somewhat of a moving target, as the crisis evolved from the subprime crisis in the United States into a global crisis. The estimated subprime-related losses in euro area banks as of March 2008 were “only” US$45 billion, as reported in IMF’s April 2008 Global Financial Stability Report (IMF, 2008a); the latest estimates of the total exceptional losses in euro area global banks (which combines the subprime-related losses with the exceptional part of losses generated on European assets) may be as large as ten times that amount. The estimated losses for the whole of Europe were even larger, but substantial chunks of these losses were in global banks based in the United Kingdom and Switzerland.8

8 The calculations underlying the October 2008 Global Financial Stability Report (IMF, 2008b) suggest total exceptional losses in large banks in continental Europe of close to US$500 billion.
These estimated losses correspond to about 14 percent of the euro area banks’ capital and reserves. If nothing else happened, the ratio of capital to total (unweighted) assets in euro area banks, currently at 5.6 percent (Figure 4.12), would decline to 4.8 percent, and the banks’ leverage would increase correspondingly.

One way to translate these losses into the potential impact on asset growth is to ask how much assets would have to shrink to prevent the leverage ratio from declining. Keeping the leverage ratio at 5.6 percent would at the new (decreased) level of capital require that assets go down by 14 percent.

The impact of bank losses on lending (and thereby on output) can be larger if banks (or their regulators) aim to deleverage, that is decrease their leverage target, which is quite likely given the overall increase in risk aversion (see, e.g., IMF, 2008b), and if they get hit by additional shocks, such as stock price declines. To increase the leverage ratio to 5.9 percent (the sample maximum in Figure 4.12), assets would have to go down by 19 percent. To illustrate the sensitivity of this result, increasing the leverage ratio to 7 percent (which, although beyond the recent historical experience, is not implausible) would in this situation imply a decline in assets of 31 percent.

From the estimate in Section 4.2.2, a decline in the supply of bank loans of 10 percentage points is likely to lead to a decline in real GDP of about 1 percentage point. Following up on the calculations from the previous bullet point, a loan decline of 14 percent therefore corresponds to a loss of 1.4 percentage points in real GDP; a loan decline of 19 percent corresponds to a loss of 1.9 percentage points in real GDP; and a loan decline of 31 percent corresponds to a loss of 3.1 percentage points in real GDP.

On the other hand, these effects can be mitigated to some extent if banks increase their capital-to-asset ratios (decrease leverage) through capital injections rather than (or in addition to) adjustments in assets.

Figure 4.12 Capitalization in euro area banks, 1997–2008 (capital and reserves as percentage of total assets). (Source: Authors’ calculations based on data from Datastream and Bankscope.)
An alternative approach to analyzing the recent developments is to start from the recent changes in the DD and their estimated impact on loan supply. As previously discussed, DD is a market-based indicator that incorporates market participants’ views on banks’ situations and outlooks. It can therefore provide an alternative assessment of the likely impact of the shocks that hit the banks.

To calculate the impact on banks’ lending, one can use the results of the DD calculations in Section 4.2.1. The average DD was 0.0 in late 2008 (see Figure 4.5), compared with 8.0 in mid-2007. Using the estimates in Section 4.2.1, this translates into a decline in real credit of 19 percentage points. Using the estimates from Section 4.2.2, this in turn translates into a real GDP decline of some 1.9 percentage points. This method therefore yields an estimate of the likely GDP impact that is broadly similar to that from the method based on projected capital losses. The difference between the two approaches reflects a variety of factors, such as the extent to which the banks will (or will not) be recapitalized. The extent of recapitalization is not trivial to estimate, making the market’s guess a useful alternative input.

The above calculations illustrate that there are linkages between the financial sector’s soundness and real economic developments. They also illustrate the challenges of quantifying the exact relationship and the uncertainties surrounding the estimates. We find that, based on current information, the likely impact of the recent and projected banking losses on output to be about 2 percentage points (with substantial uncertainty relating to the impact of the recapitalization and, more generally, to the impact on market confidence).

4.4. CONCLUSION

This chapter examines the impact of financing conditions on real economic activity in the euro area, exploring some key linkages between the financial and real sectors. To explore the evidence, it applies a broad range of empirical approaches and estimation methods to bank-level, country-level, and aggregate data.

We find that a deterioration in the financial health of banks could translate into a lower bank loan supply; this effect is statistically significant. A cutback in bank loan supply is likely to have a negative impact on economic activity in the euro area; again, this effect is statistically significant. These findings are not dissimilar to the literature on the bank lending channel in the United States, which generally finds strong evidence that banks decrease their loan supply in response to tighter financing conditions, but little evidence that the cutback in bank loan supply lowers real activity.

Turning from bank lending to corporate bond financing (which could also reflect broader financial conditions in the economy), we find that higher costs of bond financing tend to weaken industrial production. Finally, risk indicators for the banking, corporate, and public sectors in the euro area show a steady improvement in balance sheets beginning in 2002–03, followed by a major deterioration in 2007 and especially 2008, reflecting a combination of the increased market
volatility and lower capitalization. Conditions as of late 2008 were the worst in the whole sample (since the early 1990s).

The estimates of this chapter can be used to calculate the potential impact of the banking sector losses on future economic growth in the euro area. They suggest that current estimates of losses in the banking sector would mean a loss of 2 percentage points in euro area GDP, but with substantial uncertainty around this estimate.

**APPENDIX I. CALCULATING THE DISTANCE TO DEFAULT**

The DD measure is based on the structural valuation model of Black and Scholes (1973) and Merton (1974). The authors first drew attention to the concept that corporate securities are contingent claims on the asset value of the issuing firm.10 This insight is clearly illustrated in the simple case of a firm issuing one unit of equity and one unit of a zero-coupon bond with face value \( D \) and maturity \( T \). At expiration, the value of debt, \( B_T \), and equity, \( E_T \), are given by

\[
B_T = \min(V_T, D) = D - \max(D - V_T, 0) \quad (A1)
\]

\[
E_T = \max(V_T - D, 0) \quad (A2)
\]

where \( V_T \) is the asset value of the firm at expiration. The interpretation of equations (A1) and (A2) is straightforward. Bondholders get paid fully only if the firm’s assets exceed the face value of debt; otherwise, the firm is liquidated and assets are used to partially compensate bondholders. Equity holders thus are residual claimants in the firm because they get paid only after bondholders.

Note that equations (A1) and (A2) correspond to the payoff of standard European options. The first equation states that the bond value is equivalent to a long position on a risk-free bond and a short position on a put option, with the strike price equal to the face value of debt. The second equation states that equity value is equivalent to a long position on a call option with strike price equal to the face value of debt. Given the standard assumptions underlying the derivation of the Black-Scholes option pricing formula, the default probability in period \( t \) for a horizon of \( T \) years is given by the following formula.

\[
p_t = N \left[ -\frac{\ln \frac{V_t}{D} + \left( r - \frac{\sigma^2_t}{2} \right) T}{\sigma_A \sqrt{T}} \right] \quad (A3)
\]

where \( N \) is the cumulative normal distribution, \( V_t \) is the value of assets in period \( t \), \( r \) is the risk-free rate, and \( \sigma_A \) is the asset volatility.

---

10 Models built on Black and Scholes (1973) and Merton (1974) are usually called structural models.
The numerator in equation (A3) is referred to as DD. An examination of equation (A3) indicates that estimating default probabilities requires knowing both the asset value and asset volatility of the firm. The required values, however, correspond to the economic values rather than the accounting figures. It is thus not appropriate to use balance sheet data for estimating these two parameters. Instead, the asset value and volatility can be estimated. It is possible to solve the following equations (A4) and (A5) for the asset value and volatility.

\[ E_t = V_t N(d_1) - e^{-rT}DN(d_2) \]  
\[ \sigma_E = \frac{V_t}{E_t} N(d_1) \]

if \( E_n \), the value of equity; \( \sigma_E \), the equity price return volatility; and \( D \), the face value of liabilities, are known; and \( d_1 \) and \( d_2 \) are given by

\[ d_1 = \frac{\ln \frac{V_t}{D} + \left( r - \frac{\sigma_A^2}{2} \right) T}{\sigma_A \sqrt{T}} \]  
\[ d_2 = d_1 - \sigma_A \sqrt{T} \]

The parameters can be calibrated from market data:

- The time horizon, \( T \), is usually fixed at one year.
- The value of equity, \( E_n \), corresponds to the market value of the firm. The data are obtained from Bloomberg by multiplying the number of shares outstanding for a firm by the closing share price on a particular day.
- The equity volatility, \( \sigma_E \), corresponds either to historical equity volatility or implied volatility from equity options. This is derived by calculating the standard deviation of daily share price returns over a one-year period (around 260 days).
- The face value of liabilities, \( D \), is usually assumed equal to the face value of short-term liabilities plus half of the face value of long-term liabilities.\(^{11}\) This number represents the so-called default barrier. The liability data are obtained from Bankscope. The item, “Deposits and Short-Term Funding,” is used to represent short-term liabilities, whereas the long-term liabilities are derived by deducting the short-term liabilities from the “Total Liabilities” item. To obtain daily liability data from annual balance sheets, the data are intrapolated between two year-end balances.
- The risk-free rate, \( r \), is the one-year government bond yield, in the same currency as those of the market and balance sheet data.

Once the asset value and volatility are estimated, the default probability of the firm can be derived from equation (A3).

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\(^{11}\)This is based on work done by Moody’s KMV (see Crosbie and Bohn, 2003).
In addition to the individual bank DDs, we also calculate the so-called portfolio DD. Following, for example, De Nicolò and others (2005), the portfolio DD is defined as

$$DD_t = \frac{\ln(A^P_t/L^P_t) + (\mu_p - 0.5 \sigma_p^2)}{\sigma_p}$$

where $A^P = \sum_i A^i$ and $L^P = \sum_i L^i$ are the total values of assets and liabilities, respectively, for all financial institutions in the portfolio. The mean and variance of the portfolio are given respectively by $\mu_p = \sum_i w_i \mu^i$ and $\sigma_p^2 = \sum_i \sum_j w_i w_j \sigma_{ij}$, where $w_i = A_i^P/\sum_i A^i$ and $\sigma_{ij}$ is the asset return covariance of financial institutions $i$ and $j$. Thus, the portfolio DD to some extent embeds the structure of risk interdependencies among the financial institutions. “Default” at date $t+1$ occurs if $A^P_t < L^P_t$. Thus, the DD indicates how many standard deviations $\ln(A^P_t/L^P_t)$ has to deviate from its mean for default to occur. Because $A^P_t = L^P_t + E^P_t$, declines in $A^P_t/L^P_t$ are equivalent to declines in capitalization, $E_t^P/L^P_t$. The portfolio DD can be viewed as a risk profile measure tracking the evolution of the joint risks of failure of the firms composing a portfolio. Lower (higher) levels of the DD imply a higher (lower) probability of firms’ joint failure. Because variations in the individual firms’ DD are allowed to offset each other, the DD of a portfolio is always higher than the (weighted) sum of the DDs of the individual firms. As a result, the probability of default associated with the portfolio DD is always lower than that associated with the actual probability of joint failures of sets of firms in the portfolio. Thus, the portfolio DD tracks the lower bound to the joint probabilities of failure (for an in-depth discussion of the pros and cons of the portfolio DD, see, for example, Čihák, 2007).

APPENDIX II. IDENTIFYING THE LINKAGE BETWEEN BANK LOAN SUPPLY AND AGGREGATE OUTPUT

The theoretical framework used to derive the empirical specification of the model is a version of the investment saving/liquidity preference money supply model that adds a credit channel of monetary transmission to the traditional interest rate channel (Bernanke and Blinder, 1988). A possible solution to the problem of identifying loan supply effects within this framework is offered by Driscoll (2004) in investigating the analogous question for the U.S. economy. As noted by Driscoll, “the approach could also be applied to regions in other countries, or other collections of small open economies under fixed exchange rates, such as the European Union” (2004, p. 469).

The basic model consists of four equations for each country $i$ in the euro area. There are three markets: a loan market, a money market, and a goods market.

On the loan market, banks face the following loan demand $l^d_t$ from households and firms.

$$l^d_t = \tau r_t - \chi \rho_t + \sigma y_{it} + v_{it}, \quad (A8)$$

where $y_{it}$ denotes output, $\rho_t$ is the interest rate on loans, $r_t$ is the interest rate on bonds (i.e., the price of financing expenditures from an alternative source), and
\( \nu_{it} \) is a demand shock. The loan rate is allowed to vary across euro area countries, but the bond rate is assumed to be the same for all countries. This is consistent with the evidence on a well-integrated bond market and segmented loan markets.

The loan supply function is specified by the following equation

\[
l_{it}^s = -\lambda r_t + \mu \rho_{it} + \beta (m_{it} - p_{it}) + w_{it}, \quad (A9)
\]

where \((m_{it} - p_{it})\) denotes money supply, and \(w_{it}\) is the shock to loan supply. The supply of loans depends on deposits as a way to generate loans and the interest rates on loans \((\rho_{it})\) and bonds \((r_t)\). The underlying assumption is that loans and bonds are imperfect substitutes.

The money market equilibrium for each country is given by

\[
m_{it} - p_{it} = \gamma y_{it} - \delta (r_t - r_{it}^d) + \varepsilon_{it}, \quad (A10)
\]

where \(r_{it}^d\) is the country-specific rate on deposits, and \(\varepsilon_{it}\) is a country-specific money demand shock. Note that the money supply \(m_{it}\) is determined by the European Central Bank. (This is a reasonable simplification even though in practice the European Central Bank controls money supply indirectly by setting the money market rate.)

Finally, aggregate output is specified as a function of the interest rate on bond \((r_t)\), the interest rate on loans \((\rho_{it})\), and a country-specific shock \((z_{it})\):

\[
y_{it} = -\theta r_t - \alpha \rho_{it} + z_{it}. \quad (A11)
\]

Then the model is solved for output and loans, producing the following relationships:

\[
y_{it} = \frac{\theta}{\chi + \sigma \alpha} r_t + \frac{\alpha}{\chi + \sigma \alpha} l_{it} - \frac{\alpha}{\chi + \sigma \alpha} \nu_{it} + \frac{X}{\chi + \sigma \alpha} z_{it}
\]

\[
l_{it} = \frac{\theta}{\chi + \sigma \alpha} r_t + \frac{\chi \beta}{\chi + \mu} \varepsilon_{it} + \frac{\chi \beta \gamma + \sigma \mu}{\chi + \mu} y_{it} - \frac{\mu}{\chi + \mu} \nu_{it}
\]

\[
+ \frac{X}{\chi + \mu} u_{it} + \frac{\chi \delta \beta}{\chi + \mu} r_{it} \quad (A13)
\]

These two equations illustrate the problem of identifying demand-and-supply effects in bank lending (i.e., separating the bank lending and interest rate channels), as bank loans and output are endogenous (jointly determined) as described above.

To solve the identification problem, Driscoll (2004) proposes to demean each variable with its cross-sectional mean. This effectively “shuts down” the interest rate channel, as illustrated below.

After transforming each variable \(x_{it}\) into a deviation from its cross-sectional mean, \(\bar{x}_{it} = \frac{1}{N} \sum_{i=1}^{N} x_{it}\), the model can be rewritten as follows.

\[
\bar{l}_{it}' = -\chi \bar{\rho}_{it} + \sigma \bar{y}_{it} + \nu_{it} \quad (A8')
\]

\[
\bar{l}_{it}' = \mu \bar{\rho}_{it} + \beta (\bar{m}_{it} - \bar{p}_{it}) + w_{it} \quad (A9')
\]
\[ \bar{m}_{it} - \bar{p}_{it} = \gamma \bar{y}_{it} + \delta \bar{d}_{it} + \varepsilon_{it} \quad (A10') \]
\[ \bar{y}_{it} = -\alpha \bar{p}_{it} + z_{it} \quad (A11') \]

The corresponding expressions for the (demeaned) country-specific output and loan variables are
\[ \bar{y}_{it} = \frac{\alpha}{\chi + \sigma \alpha} \tilde{I}_{it} - \frac{\alpha}{\chi + \sigma \alpha} v_{it} + \frac{\chi}{\chi + \sigma} z_{it} \quad (A12') \]
\[ \tilde{I}_{it} = \frac{\chi \beta}{\chi + \mu} \varepsilon_{it} + \frac{\chi \beta}{\chi + \mu} \bar{y}_{it} - \frac{\mu}{\chi + \mu} v_{it} + \frac{\chi}{\chi + \mu} w_{it} + \frac{\chi \delta \beta}{\chi + \mu} \bar{y}_{it} \quad (A13') \]

The last two relationships indicate that the money demand shock \( \varepsilon_{it} \) is correlated with \( \tilde{I}_{it} \) but does not affect \( \tilde{y}_{it} \) independently of its effect on \( \tilde{I}_{it} \). That is, it is uncorrelated with the disturbance terms in equation (A12'). This makes money demand shocks a good candidate for an instrumental variable.

The shocks \( \varepsilon_{it} \) are obtained by estimating a money demand function for each euro area country. In the first stage, an instrumental variable estimation, we estimate if money demand shocks have a significant effect on aggregate lending in a pooled panel ordinary least squares regression using the demeaned values of all variables. In the second stage, the money demand shocks are used as an instrument in a regression of loans on output, which helps isolate the supply effect of bank lending on real activity.

**APPENDIX III. CONTINGENT CLAIMS ANALYSIS: A PRIMER**

In the main text, risk transfers among banks, the nonbank corporate sector, and the public sector in the euro area are examined using CCA. This appendix provides more details on the method.

CCA is a type of the balance sheet approach (Allen and others, 2002). It starts by collecting information on the size and structure of assets and liabilities of key sectors of an economy in order to assess the extent of currency and maturity mismatches, or imbalances in the debt and equity structure. However, balance sheet data do not provide a full picture of all the risks facing a country because of the contingent nature of many risks. Balance sheets at the economy-wide level are typically valued at book value, without adjusting for fluctuations in market prices or changes in the likelihood of default. CCA attempts to provide a more complete picture of the risks in a balance sheet by using marked-to-market prices and incorporating contingent claims.

Approaches similar to CCA have been used for some time by risk managers and investors for analyzing individual institutions; these approaches have recently been extended to the systemic level (Gray, Merton, and Bodie, 2007). CCA has been

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12An important example of private sector application of CCA has come from Moody’s KMV (see, e.g., Crosbie and Bohn, 2003). Using 30 years of extensive data on corporate defaults, Moody’s KMV uses firm asset value, asset volatility, and the default barrier to derive firm-specific probabilities of default.
performed on emerging markets, such as Brazil and Thailand (Gapen and others, 2004), Indonesia (Gray and Jones, 2006), and Turkey (Keller, Kunzel, and Souto, 2007). This may be the first time, as far as we know, that CCA-style analysis is attempted for advanced Europe. The application of CCA at the sovereign or industry level is for illustrative purposes only, because there are numerous challenges involved in calibrating the methodology without extensive cross-sectional or historical databases, such as those available for models of the corporate sector.

The basic idea of CCA is that changes in observed variables (e.g., the value of securities in the capital structure) can be used to infer changes in unobserved variables (e.g., the value of the firm). The basic tool of CCA is the risk-adjusted balance sheet, which shows the sensitivity of the enterprise's assets and liabilities to external shocks. At the national level, the sectors of an economy are viewed as interconnected portfolios of assets, liabilities, and guarantees. Traditional approaches have difficulty analyzing how risks can accumulate gradually and then suddenly erupt in a full-blown crisis. CCA is well-suited to capturing such nonlinearities and to quantifying the effects of asset-liability mismatches within and across institutions. Risk-adjusted CCA balance sheets facilitate simulations and stress testing to evaluate the potential impact of policies to manage systemic risk.

CCA can be used to derive a set of risk indicators that can serve as barometers of risk and financial sector vulnerability. Specifically, two useful credit risk indicators that arise from the implementation of CCA are the DD and PD.

To understand changes in the overall level of risk facing a balance sheet, an estimate of the value of total assets and their volatility is needed, because they are typically not observable directly. Because many of the assets on the balance sheet are not traded and are observed only at infrequent intervals, it is difficult to derive marked-to-market balance sheets. In contrast, many liabilities are traded, and thus can be valued more readily by methods from finance theory to impute the value and volatility of assets, using the liability side of the balance sheet. Merton’s (1974) key insight in option pricing theory was that liabilities are contingent claims on total assets, with each liability having a different priority and maturity structure. The most junior liability on the balance sheet can be valued as an implicit call option on total assets. When the value of assets declines relative to the face value of debt, the value of the junior claims declines. Because the liability structure is observed, and many of the liabilities are traded, market prices of different liabilities can be used to derive information on the evolution of total assets. The framework can be applied to individual firms, or at a more aggregated level for an industry or for the sovereign.

The following figure provides an illustration of CCA for the sovereign. To estimate the risks to the euro area public sector balance sheets, we follow the approach of Gray, Merton, and Bodie (2007) and Gapen and others (2004), dealing with the added complications of working in a multicountry rather than a single sovereign context. The main elements on the asset side of the public sector balance sheet include international reserves, the net present value of primary surpluses, and the public sector's monopoly on the issuance of money. These assets are net of any guarantees the public sector may implicitly or explicitly provide to the
private sector. The main elements on the liability side of the public sector balance sheet are domestic currency liabilities (domestic currency debt and base money) and foreign currency debt.

Estimating the observed value and volatility of sovereign assets directly is difficult because only international reserves are observable on the asset side of the public sector balance sheet. In contrast, each entry on the liability side of the balance sheet is directly observable on a high-frequency basis. CCA uses observed
liabilities, together with well-known option pricing techniques, to derive implied estimates for sovereign asset value and asset volatility.

Domestic currency liabilities of the sovereign can be modeled as junior claims, whereby holders of these liabilities have a residual claim on sovereign assets above what is necessary to service foreign currency debt. If sovereign assets fall to a level where foreign currency debt payments cannot be made, then default is the result. This level is referred to as the “distress barrier” and is equivalent to the default-free value of debt. Therefore, the value of domestic currency liabilities can be viewed as a call option on sovereign assets with a strike price equal to the level of the distress barrier. Holders of such liabilities receive the maximum of either sovereign assets minus the distress barrier, or nothing in default. The Black-Scholes option-pricing formulas can be used to estimate sovereign asset value and volatility with only a few select variables: the value and volatility of domestic currency liabilities, the distress barrier, the risk-free interest rate, and time. Once the implied asset values and volatilities have been calculated, a range of risk indicators can be derived, including the distance to distress (the number of standard deviations away from the distress barrier), the probability of default, and the credit spread on sovereign assets.

The process of estimating total assets and their volatility for the banking system is similar to that for the sovereign, but instead of focusing on the value of domestic currency liabilities, the market value of equity and its volatility, together with the distress barrier, are used to calculate implied assets and their volatility. We include data from Moody’s KMV for the 50 largest euro area banks. The daily market capitalization based on traded stock prices is used to calculate the volatility of bank equity for all banks. The book values of short- and long-term obligations are used to calculate the distress barrier for the bank. The distress barrier, market capitalization, and volatility of market capitalization can be used to calculate the implied asset value and implied asset volatility. These are then used to calculate the distance to distress and the probability of default, as well as the expected losses of the individual banks. Aggregated figures for all banks are then derived by summing the respective balance sheets and calculating the risk indicators for the banks.

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5.1. INTRODUCTION

Banks are thought to be central to business activity. Therefore, when they experience financial distress, governments usually come to the rescue, offering emergency liquidity and various forms of bailout programs. The case for generous bank support, however, is murky for a number of reasons. First, we have the standard identification problem: if bank distress and economic distress occur at the same time, how can we tell the direction of causality? Second, if bank distress does in fact impair economic activity, under what circumstances is this likely to be most harmful? Third, whereas interventions may save banks, they may not necessarily prevent the distressed banks from affecting economic activity. So do any interventions prevent banks from impairing economic activity, and if so, which ones are they? Fourth, how do the costs of intervention weigh up against the benefits? This chapter focuses on the first two questions, shedding limited light on the last two issues.

Empirical studies show that credit to the private sector and aggregate output do in fact decelerate during banking crises (see, for example, Kaminsky and Reinhart, 1999; Eichengreen and Rose, 1998; and Demirgüç-Kunt and others, 2006). However, this is not necessarily evidence that banking problems contribute to the decline in output: first, the same exogenous adverse shocks that trigger banking problems may also cause a decline in aggregate demand, leading firms to cut investment and working capital and, ultimately, demand for bank credit. These same shocks may also cause a temporary increase in uncertainty, leading firms to delay investment and borrowing decisions. In addition, adverse shocks might hurt borrower balance sheets and exacerbate the effects of asymmetric information and limited contractibility, prompting banks—even healthy ones—to curtail lending to riskier borrowers (“flight to quality”) or raise lending spreads. To summarize, output...
and bank credit are likely to decelerate around banking crises even in the absence of a feedback effect from bank illiquidity and insolvency to credit availability.\(^2\) To identify the real effects of banking crises it is necessary to sort out this joint endogeneity problem.

Problems of joint endogeneity are familiar in studies of whether finance matters to the real economy. They are central to the literature on financial development and growth (Levine, 2005) and to the work on whether financial market imperfections worsen economic downturns (the so-called credit channel literature). To test whether banking crises have real effects, we adopt the “difference-in-difference” approach used by Rajan and Zingales (1998) to study the effects of finance on growth.\(^3\) Our premise is that, if industries more dependent on external finance are hurt more severely after a banking crisis, then it is likely that banking crises have an independent negative effect on real economic activity. Using panel data from 41 countries from 1980 to 2000, we test whether more financially dependent industries experienced slower growth in banking crisis periods, after controlling for industry-year, country-year, and industry-country fixed effects. This profusion of dummy variables controls for all possible time-specific, country-specific, and industry-specific shocks that may affect firm performance, thereby avoiding the usual difficulties of choosing an appropriate set of control variables.

In Rajan and Zingales (1998) industry dependence on external finance is measured by the fraction of investment not financed through retained earnings. We use the same index in our main specification.\(^4\) As an alternative measure of bank dependence, we use average establishment size in a sector, under the assumption that sectors dominated by small firms are more dependent on domestic bank financing.\(^5\) In the credit channel literature, identification based on firm size has been used, for instance, by Gilchrist and Himmelberg (1995).

The results are supportive of the joint hypothesis that banking crises have real effects, and at least part of this effect is through the lending channel. More financially dependent sectors perform significantly worse during banking crises, and the magnitude of the effect is nontrivial: more financially dependent sectors

\(^2\) There are also measurement issues. Specifically, changes in the aggregate stock of real credit to the private sector are not a good measure of the flow of credit available to the economy, especially around banking crises. The stock may fall because a jump in inflation erodes the value of nominal contracts, or because restructuring operations transfer nonperforming loans to agencies outside the banking system. On the other hand, a devaluation increases the domestic currency value of foreign-currency denominated debt (Demirgüç-Kunt and others, 2006).

\(^3\) The “difference-in-difference” methodology has also been used in a variety of related problems (see, for example, Cetorelli and Gambera, 2001; Beck, 2003; and Bonaccorsi di Patti and Dell’Ariccia, 2004).

\(^4\) For several countries in our sample banks are overwhelmingly the main (and often the sole) source of external capital for firms. On average, in our sample the stock of bank credit is about seven times larger than equity market capitalization.

\(^5\) An establishment is better thought of as a plant rather than a firm. In general, the majority of firms in any sector consist of single-plant firms, so there will be a strong correlation between establishment size and firm size.
(in the fourth quartile of the dependence distribution) lose about 1 percentage point of growth in each crisis year compared to less financially dependent sectors (in the first quartile of the dependence distribution). Of course, not all doubts about causality are laid to rest by this methodology, and we conduct a number of additional tests.

In particular, one criticism of our testing strategy is that because of balance sheet effects or other financial market imperfections, externally dependent sectors may grow more slowly during any economic downturn, whether a banking crisis exists or not (Braun and Larraín, 2005). A related concern is that the differential effect might be driven by balance sheet effects following currency crises (which often accompany banking crises). This may happen if more externally dependent sectors tend to have more foreign currency debt. When we allow for separate differential effects during recessions or currency crises, however, the differential effect during banking crises remains significant, suggesting that we are not simply picking up balance sheet effects.

We also address the issue of the residual endogeneity of the banking crisis variable. If bank dependent sectors are relatively more represented in bank portfolios, asymmetric sectoral shocks affecting these sectors might cause both the banking crisis and the relative underperformance of these sectors. However, we find that more external dependent industrial sectors perform poorly during banking crises even in countries/crises where they are likely to represent a smaller share of bank portfolios. This suggests that our correlations are not driven only by asymmetric sectoral shocks.

Another criticism may be our reliance on the Rajan-Zingales measure of external dependence. When instead we differentiate across industries based on average establishment size, our tests show that small-scale sectors suffer more during crises, consistent with the hypothesis that the lending channel is operative.

Tornell and Westermann (2002, 2003) have argued that asymmetries in the response to financial crises in emerging markets are not just between large and small firms, but also between firms in traded and nontraded sectors, because the firms in traded sectors have better access to alternative sources of financing (especially foreign finance) when domestic credit is depressed. We also examine if such asymmetric effects are present in our data. We do not, however, find significant differences across manufacturing sectors during banking crises based on their propensity to export, though we do find such differences during currency crises.

The second question we posed at the outset is to examine where the differential effect is stronger. On the one hand, this gives us a sense of where intervention may be more critical; on the other, if the differential effect is stronger where the theory plausibly suggests the costs of banking crises are likely to be larger, the differential effect itself gains credibility as a measure of the impact of the crisis. We find the differential effects to be stronger in developing countries, in countries where the private sector has less access to foreign finance, and where the crises are more severe (in a way we will make more precise). These results make intuitive sense: externally dependent sectors should suffer less from a banking crisis if they
can tap domestic bond or stock markets (as in developed countries) or foreign capital markets. Also, the more severe the disruption in the banking sector, the stronger should be the differential effect.

We turn next to the question of how different government intervention policies might affect the bank lending channel. Using data on intervention policies for 22 crisis episodes from Honohan and Klingebiel (2003), we find some evidence that regulatory forbearance is associated with a lower cost of crisis. Because the sample is small, however, the evidence is only suggestive. Nonetheless, the finding is consistent with our hypothesis: if banks are special, keeping them alive is essential for credit to flow to financially dependent industries. Moreover, banks that are kept alive might focus on squeezing borrowers in order to regain liquidity. That they do not seem to do so when given maneuvering room is interesting.

Of course, policymakers are particularly interested in whether the benefits of an intervention outweigh the cost. Because our methodology allows us only to identify the differential effect of an intervention and not the aggregate effect (for instance, if spillovers from the increased growth of financially dependent industries prevents the whole economy from falling into recession) we have little to say here other than interventions that do not affect the differential are unlikely to affect activity through the lending channel, and therefore have to be justified for other reasons.

The chapter is structured as follows. In Section 5.2, we review the related literature; in Section 5.3, we explain the empirical methodology and the data; in Section 5.4, we present the results; Section 5.5 concludes.

5.2. RELATED LITERATURE

There is a long literature focusing on the effects of banking crises. For example, Lindgren, Garcia, and Saal (1996) summarizes many early experiences, and concludes that “episodes of fragility in the banking sector have been detrimental to economic growth in the countries concerned” (p. 58). Cross-country studies of banking crises have also shown that output growth and private credit growth drop significantly below normal levels in the years around banking crises, but do not attempt to sort out the direction of causality (Kaminsky and Reinhart, 1999; Eichengreen and Rose, 1998; Demirgüç-Kunt and others, 2006).

In their study of the so-called capital crunch in the United States in 1990, Bernanke and Lown (1992) in fact express skepticism that the credit crunch played a major role in the recession of 1990. Instead, they stress demand effects, pointing to the fact that there was little relation between bank capital ratios and employment growth across states, and all types of credit, not just bank credit, fell.

The question of whether banking crises cause a credit crunch was resurrected once more following the Asian crises of 1997–98. Some studies attempted to provide answers, reaching different conclusions. For instance, Domaç and Ferri (1999) interpreted evidence that small- and medium-sized enterprises were hurt
disproportionately in Malaysia and Korea as indicative of a credit crunch, whereas most Thai firms surveyed after the crisis attributed low production levels not to lack of credit, but to poor demand (Dollar and Hallward-Driemeier, 2000).

A number of studies have tried to tackle the identification problem in clever ways. Some have examined the issue from the side of banks. Peek and Rosengren (2000) use geographical separation as their means of identifying supply shocks: Japanese banks lost capital as a result of bad loans made in Japan. The authors then show that the withdrawal of these banks from lending to real estate in the United States had a strong dampening effect on U.S. commercial real estate markets. Clearly, it is hard to attribute the fall in real activity to demand-side effects. Kashyap and Stein (2000) suggest a lending channel for monetary policy by pointing out that small, less liquid banks seem to curtail credit more in response to tight monetary conditions than large, liquid banks.

Our study differs from these in that it attempts to identify supply effects by looking to see if borrowing sectors that are more likely to be sensitive to a supply shock are indeed disproportionately affected by it. In this, our study is closely related to two recent papers. Braun and Larraín (2005) test whether industries more dependent on external finance experience a sharper output contraction than other industries during economic downturns, and find a large positive differential effect. They also find this effect to be larger in countries with poor accounting standards and for industries whose assets are less tangible, supporting the interpretation that financial frictions are at work, and thus may amplify economic fluctuations especially for industries more dependent on external finance. In contrast, in the present chapter, we focus more narrowly on the effects of banking sector distress on the real economy. This allows us to identify the presence of a bank lending channel to the extent that the effects of the disruption in loan supply associated with the crises are greater than those stemming from the deterioration of firm balance-sheet quality (possibly also associated with the crisis).

In a contemporaneous and closely related paper, Krozner and others (2007) study whether banking crises impact sectors dependent on external finance more severely in countries with a less developed financial system. Although both studies investigate how banking crises affect the real economy, they examine two different aspects of this relationship. Here, we first present evidence in support of the assumption that banking crises have real effects by showing that it is the sectors more dependent on external finance that suffer the most during these crises. Then, we consider how several country characteristics influence these effects.

In other words, we are interested in the differences within a country over time of the relative growth of financially dependent industries. We find they do particularly badly during a banking crisis, suggesting that these are periods of low availability of finance. By contrast, Krozner and others (2007) examine the effects of the financial development of a country on the relative growth of financially dependent industries in noncrisis and crisis periods. They find that the relative growth in value added of financially dependent industries is faster in financially developed countries in precrisis periods but slower in crisis periods. This has
implications for the effects of financial development in different states of the economy, but has little light to shed on the effects of the different states of the economy themselves. Econometrically speaking, we look for a within-country across-industry effect over time (including country-industry indicators along with the usual panoply of country and industry indicators), while they examine the differential effect between industries across countries for two different states of these countries (not including country-industry indicators). Their finding is that the differential effect found by Rajan and Zingales is present in precrisis periods, but becomes insignificant (and even changes sign) during crises. The interpretation is that operating in an environment where financial markets are well developed is an advantage for more financially dependent industries in good times, but a disadvantage in times of banking crises.

The problem of separating out the effect of bank distress from other contemporaneous shocks hinders efforts to measure the economic cost of banking crises and to understand the determinants of these costs. Most existing studies have looked at the decline in output as a yardstick to differentiate across crises. For instance, Bordo and others (2001) argue that financial crises (currency crises, banking crises, or both) have entailed similar-sized output losses in recent years as compared to previous historical periods, although they are more frequent now than during the gold standard and Bretton Woods periods and as frequent as in the interwar years. Hoggarth and others (2002) claim that, contrary to popular belief, output losses associated with banking crises are not more severe in developing countries than in developed countries.

More recently, Claessens, Klingebiel, and Laeven (2003) study how output losses following banking crises are affected by institutions and policy interventions. As in our study, the latter are identified through the Honohan-Klingebiel dataset. The main finding is that generous support to the banking system does not reduce the output cost of banking crises. This conclusion, however, does not take into account that omitted exogenous shocks may cause both a stronger output decline and more generous intervention measures. Using a measure of the cost of crises less marred by this problem, we find that depositor protection and forbearance may indeed be effective in reducing the real cost of crises.

5.3. THE BASIC TEST

5.3.1. Methodology

To study whether banking crises have real effects, we ask whether industries more dependent on external finance experience a more severe output loss following a banking crisis. In the benchmark specification, value-added growth in industry $j$ at time $t$ in country $i$ is regressed on three sets of fixed effects (industry-year, country-year, and industry-country) and the variable of interest, an interaction term equal to the product of the financial dependence measure for industry $j$ and the banking crisis dummy for year $t$ and country $i$. Following Rajan and
Zingales (1998), we also include the lagged share of industry $j$ in country $i$ to account for “convergence” effects (i.e., the tendency of larger industries to experience slower growth). The benchmark regression is:

$$y_{i,j,t} = \sum q \alpha_{i,j} d_{i,j} + \sum t_j \beta_{i,t} d_{i,t} + \sum j \gamma_{j,t} d_{j,t}$$

$$+ \delta \text{FINDEP}_{j} \cdot \text{BANK\_CRISIS}_{i,t} + \varphi \text{SHARE}_{i,j,t-1} + \epsilon_{i,j,t}$$

where $d$ denotes dummy variables. A negative and significant $\delta$ indicates that banking crises have a relatively worse impact on industries that depend more heavily on external finance. The three sets of fixed effects should control for most shocks affecting firm performance, including—for instance—the severity of the banking crisis, the level of financial development, global shocks to the industry, and aggregate country-specific shocks. This gets around the usual difficulties with omitted variable bias. Indeed, the only shocks not controlled for are those varying simultaneously across countries, industrial sectors, and time. Standard errors are clustered by industry and country. As robustness tests, we also use gross capital formation, employment, and number of establishments as the dependent variable instead of value added.

5.3.2. Data

Data on manufacturing value added, investment, and number of establishments are disaggregated at the three-digit ISIC level and come from the UNIDO, Industrial Statistics, 2003 (summary statistics for these variables are in Table 5.1). There are 28 industries at this level of disaggregation. Value added is deflated using consumer price indices from the International Financial Statistics. External dependence is defined as the share of capital expenditure not financed with cash-flow from operations. The data come from Rajan and Zingales (1998), who take them from Compustat. Following Krozner and others (2007), and in contrast with Rajan and Zingales, to preserve sample size we include only the three-digit ISIC level sector rather than a mixture of three- and four-digit level sectors. The figures are for U.S. manufacturing firms and reflect industry medians during the 1980s (see Table 5.11 in the Appendix). An important assumption underlying our approach is that external dependence reflects technological characteristics of the industry that are relatively stable across space and time (see Rajan and Zingales, 1998, for a discussion of this assumption). In Section 5.5 we explore alternative proxies for a sector’s reliance on bank finance: average establishment or plant size and export orientation (Table 5.12 in the Appendix reports the correlations between these measures).

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6 The producer price index would be a more appropriate measure of prices in manufacturing, but it was not available for a number of countries in our sample. In any case, the price index does not affect differences in growth rates across sectors, which is what matters to our tests.

7 Table 5.10 in the Appendix reports the Rajan and Zingales index.

8 It should be emphasized that, if the Rajan-Zingales index does not capture meaningful differences across sectors in our sample, then our coefficient estimates should be insignificant and not biased toward overrejection.
### Summary Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>Standard Dev.</th>
<th>Max</th>
<th>Min</th>
<th>No. of obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal Crisis</td>
<td>Normal Crisis</td>
<td>Normal Crisis</td>
<td>Normal Crisis</td>
<td>Normal Crisis</td>
<td>Normal Crisis</td>
</tr>
<tr>
<td>Value-added growth (in percent)</td>
<td>4.20 1.70</td>
<td>2.22 −0.42</td>
<td>22.26 24.63</td>
<td>107.44 107.40</td>
<td>−54.12 −54.09</td>
<td>13168 3059</td>
</tr>
<tr>
<td>Growth in capital formation</td>
<td>12.75 10.60</td>
<td>2.76 −1.09</td>
<td>55.91 57.49</td>
<td>240.70 239.99</td>
<td>−80.51 −79.70</td>
<td>7858 1894</td>
</tr>
<tr>
<td>(in percent)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment growth (in percent)</td>
<td>1.23 −0.83</td>
<td>0.49 −1.22</td>
<td>8.58 9.19</td>
<td>29.00 28.88</td>
<td>−20.43 −20.36</td>
<td>13053 2887</td>
</tr>
<tr>
<td>Growth in number of establishments (in percent)</td>
<td>2.13 0.68</td>
<td>0.00 0.00</td>
<td>9.96 10.38</td>
<td>45.77 45.95</td>
<td>−22.12 −22.14</td>
<td>7598 2086</td>
</tr>
</tbody>
</table>

Crisis refers to observations that correspond to the year of inception of a banking crisis or the two subsequent years. Normal refers to all other observations.
To identify banking crisis inception dates, we rely on information from case studies, including Lindgren and others (1996) and Caprio and Klingebiel (2003). Following Demirgüç-Kunt and Detragiache (1998), we consider episodes of bank distress to be systemic crises when at least one of the following conditions holds: there were extensive depositor runs; the government took emergency measures to protect the banking system, such as bank holidays or nationalization; the fiscal cost of the bank rescue was at least 2 percent of GDP; or nonperforming loans reached at least 10 percent of bank assets. A list of banking crises is in Table 5.13 in the Appendix.

The crisis dummy variable takes the value 1 for the crisis inception year and the two following years, under the hypothesis that the real effect of the crisis dissipate after three years or so. Table 5.14 in the Appendix shows that if crises are set to last four years there is not much difference in aggregate value-added growth rates between crisis and noncrisis periods, whereas for shorter durations crisis years have lower growth. Also, in a sample of 36 crises, Demirgüç-Kunt and others (2006) find that GDP growth returns to its precrisis level in the fourth year of a crisis. For robustness, we also consider narrower and wider crisis windows.

To maximize sample size we use an unbalanced panel in which some country/year/sector observations are missing. We exclude, however, country/years for which less than 10 industrial sectors are available to ensure that there is enough information to estimate the differential effect. Constraints on the availability of banking crisis and sectoral value-added information leave us with data from 41 countries from 1980 to 2000 for a total of over 16,000 observations, after excluding 2 percent of outliers on either tail of the distribution. Summary statistics for the alternative dependent variables (manufacturing value added, investment, employment, and number of establishments) for crisis and noncrisis observations are in Table 5.1.

### 5.4. RESULTS

#### 5.4.1. The Benchmark Test

Estimates from the benchmark regression support the hypothesis that banking crises have an exogenous effect on the real economy. The coefficient of the interaction term is negative and significant at the 5 percent level, indicating that the growth rate of sectors that rely more heavily on external finance is relatively more affected in crisis years compared to sectors that rely less on external finance (Table 5.2, Column 1). The economic magnitude of this effect is substantial. On average, in a country experiencing a banking crisis, the difference in value-added growth between a sector at the 25th percentile and one at the 75th percentile of the external dependence distribution is 1.1 percentage point per year of crisis. This compares with an average rate of growth of 3.7 percent in the sample as a whole and 1.7 percent during crisis years.

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9 Countries that did not experience banking crises during the 1980s or 1990s are excluded from the sample. Including these observations would only serve to estimate more accurately the time-industry dummies, but would sharply increase the already large number of parameters to be estimated.
As sensitivity analysis, we drop from the sample the 5 percent tails of the dependent variable distribution. When this is done, the coefficient of the interaction term remains negative and significant. The results are also robust to correcting standard errors for first-order autocorrelation in the residuals and to clustering standard errors by country.

### 5.4.2. Are the Result Driven by Asymmetric Sector-Specific Shocks?

The methodology employed in this chapter greatly reduces the concern for simultaneity biases in the relationship between growth and banking crises. However, the endogeneity of the banking crisis variable is still an issue as bank-dependent sectors are likely to be more heavily represented in bank portfolios than less bank-dependent sectors. Asymmetric sectoral shocks concentrated in bank-dependent sectors could cause both the banking crisis and relatively poor growth in those sectors.

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We also change the sample by considering only observations for which data for all the 28 sectors are available. The sample size drops by almost one half. For the baseline specification the coefficient of the interacted term remains negative but is no longer significant. However, when we allow the effect of a crisis to vary between advanced economies and developing countries, the coefficient for the latter is significant. Similar results arise if the crisis window is changed from three to four years. These results are not reported.
To address these concerns, we proceed as follows. We do not have data about the sectoral composition of bank portfolios, but we conjecture that, in each country, sectors are relatively more represented in bank portfolios if they are relatively large and they are relatively more dependent on external finance. For each country and year, we compute the correlation between the sectoral share and the external dependence variable. In countries where this correlation is high, bank-dependent sectors are likely to account for a significant share of bank balance sheets, whereas in countries with low correlation, they are not. Then, under the null hypothesis of asymmetric sectoral shocks, crisis episodes in which this correlation is high should exhibit larger differential costs of crises than crisis episodes in which this correlation is low. In other words, because countries with a high correlation are ones where external-finance-dependent industries account for a large share of the economy, it is more plausible that the banking crises in these countries were caused by problems originating in externally dependent industries. A finding that our interaction coefficient is significant in these countries but not in countries with a low correlation would lend support to the reverse causality explanation, that is, it is the slow growth of dependent industries that caused the banking crisis rather than vice versa.

To test this, we split the sample around the cross-country median of the distribution of the correlation between external dependence and relative size, and rerun the baseline specification allowing the coefficient of the interaction term to differ between the two groups (Table 5.2, Column 2). We find that the coefficient for the crises where bank-dependent sectors represent a relatively smaller portion of bank portfolios is larger than that in our baseline regression and remains significant at the 10 percent level. The coefficient for the other crises, on the other hand, is not significant. This evidence suggests that the hypothesis of asymmetric sectoral shocks should be rejected.

### 5.4.3. Bank Distress or Balance Sheet Effects?

A concern with our interpretation of the basic regression is that the differential effects we document may reflect balance sheet problems among borrowers rather than their banks. In other words, banking crises often coincide with economic downturns which worsen firm balance sheets. This, in turn, aggravates agency problems and other financial frictions, causing all banks (even healthy ones) to cut back on lending, presumably hurting bank-dependent sectors disproportionately more.11 As discussed in Section 5.2 previously, Braun and Larraín (2005) find that during recessions output declines disproportionately more in sectors more reliant on external finance.

To separate out the effect of financial frictions during recessions from the specific effect of banking crises, we construct a recession dummy variable using GDP data from the World Bank World Development Indicators. Following the peak-to-trough criterion (Braun and Larraín, 2005), we date recessions as

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11 On a related point, we find a very low correlation between sectoral cyclicality (measured as the correlation between the cyclical components of real GDP and sector-specific value added) and external dependence (about 0.1 on average). This addresses the potential concern that our interacted term picks up the effects of sectoral cyclicality rather than the effect of banking crises.
follows: first, a trough is identified when GDP falls more than one country-specific standard deviation below its trend level (where trend is computed with a standard Hodrick-Prescott filter). Then, a peak is identified as the last year with positive GDP growth before the trough. The recession dummy variable takes the value of one from the year after the peak to the year of the trough. Using this dummy variable, we estimate the following equation:

\[ \frac{y_{i,j,t}}{H_11005} = \sum \alpha_{i,j} d_{i,j} + \sum \beta_{i,t} d_{i,t} + \sum \gamma_{j,t} d_{j,t} + \delta \text{FINDEP}_j \cdot \text{BANK\_CRISIS}_{i,t} + \varphi \text{SHARE}_{i,j,t-1} + \xi \text{FINDEP}_j \cdot \text{RECESSION}_{i,t} + \varepsilon_{i,j,t} \]  \tag{2}

If the coefficient \( \delta \) captures the differential effect of recessions rather than the banking crises, it would lose significance in this specification, whereas \( \xi \) would be negative and significant.

As it turns out, there is an overlap between recessions and banking crises, but the overlap is far from perfect: not all recessions coincide with banking crises and not all banking crises occur during economic downturns. When we estimate the regression with both interaction terms, the coefficient of the crisis/dependence interaction term becomes a bit smaller, as one might expect, but remains significant at 5 percent in both specifications (Table 5.2, Column 3). On the other hand, the coefficient of the recession/dependence interaction term has the expected sign (negative), but it is not significant. This finding supports the interpretation that we are picking up not only balance sheet effects, but also disruptions in credit supply because of the banking crisis.\(^{12}\)

This result may be in part driven by the fact that we consider only countries that experienced at least one crisis, whereas Braun and Larraín consider a broader sample. This may also reflect different mechanisms in advanced economies and developing countries because these represent the majority in our sample (more on this in the next section).

Similar arguments apply to currency crises. These events, especially in countries where the corporate sector has large unhedged foreign currency exposures, may cause large balance sheet effects. If more leveraged firms are also more dependent on external finance, and if large currency depreciations occur in association with banking crises (the “twin crises”), then the differential effect found in the baseline regression may reflect the balance sheet channel rather than distress in the banking sector. To sort out this issue, we rerun the benchmark regressions by adding an interaction term between external dependence and a currency crisis dummy. Following Milesi-Ferretti and Razin (1998), a currency crisis is defined as a year in which the exchange rate satisfies the following three conditions: it depreciates (vis-à-vis the U.S. dollar) at least 25 percent; it depreciates at least twice as fast as in the previous year; and the previous year it depreciated by less than 40 percent.\(^{13}\)

\(^{12}\) This result is also consistent with what is reported by Krozner and others (2007) in their Table 10.\(^{13}\) The latter condition serves to eliminate cases of chronically high inflation countries, in which large rates of depreciation are recorded on a regular basis. This definition corresponds to the second of the four definitions of crisis considered by Milesi-Ferretti and Razin (1998).
When currency crises are controlled for, the coefficient of the bank-crisis/dependence interaction term remains negative and significant and of similar magnitude as in the baseline regression (Table 5.2, Column 4). The coefficient of the currency-crisis/dependence interaction term has a positive sign, perhaps because more externally dependent sectors tend to be exporting sectors which benefit from a devaluation, but is not significant. It could also be that twin crises are banking crises in which the government provides banks with more extensive liquidity support. Whereas the exchange rate depreciates as a result of the liquidity injections, the real effects of the crisis may be mitigated.

5.4.4. Where Do Crises Matter Most?

In our baseline specification all banking crises are treated as having the same differential effect on industries. In practice, this is unlikely to be the case, as different characteristics of the economy may affect the impact of the banking crises, and the crisis itself may be of different nature and magnitude. So the question we now turn to is if bank distress does in fact impair economic activity, under what circumstances is this likely to be most harmful?

Banking crises are likely to have relatively larger real effects in developing countries where bond and equity markets are less developed and where governments may find it more difficult to provide support for troubled banks. For this reason we consider an alternative specification where the coefficient of the interaction term is allowed to differ across advanced and developing countries (as defined by the IMF’s World Economic Outlook). The results confirm this conjecture (Table 5.3, Column 1). Whereas the coefficient for advanced countries is not significant, that for developing countries is larger than in the benchmark specification and significant at the 5 percent level. The difference in value-added growth between a sector at the 25th percentile and one at the 75th percentile of the external dependence distribution becomes 1.5 percentage points per year of crisis. For robustness, we ran alternative specifications with different crisis windows and with and without outliers (Table 5.3, Columns 2 and 3).

Interestingly, the Braun and Larraín coefficient of the recession/dependence interaction term is larger (and almost significant) for advanced economies where banking crises tend to be less common and for which the crisis/dependence interaction term is not significant (Table 5.3, Column 4). This suggests that in advanced economies, possibly because of the existence of sources of external finance other than the banking system, overall macroeconomic conditions are more important than the health of the banking system in determining how funds are allocated to the real sector. In emerging markets and developing countries, the absence of alternative sources of finance may make growth differentials among sectors with different reliance of external finance more sensitive to banking crises than to the business cycle.

In a related vein, the effects of banking crises should differ across countries with different access to foreign finance, under the hypothesis that industries dependent on external finance should be more severely affected by banking crises in countries with more limited access to foreign sources of capital.
To proxy for access to alternative sources of finance we use data on disbursement of foreign loans and bonds to the private sector (scaled by the sum of imports and exports). The data come from the Global Development Finance database of the World Bank. Because developed countries are not covered by this database, we arbitrarily set the value for these countries at the largest sample observation, under the assumption that developed country firms have broad access to alternative finance. We then allow for separate interaction coefficients between crisis and external dependence for countries with access above the sample median and countries with access below the sample median. The estimation results suggest that the real effects of banking crises are more pronounced when access to foreign finance is more limited (Table 5.4, Column 1). This suggests that access to foreign finance can help mitigate the real effects of banking crises.14

| TABLE 5.3 |
| Differential Effects of Banking Crises on Value-Added Growth: Differences between Developed and Developing Countries |

<table>
<thead>
<tr>
<th></th>
<th>Three-Year Window</th>
<th>Four-Year Window</th>
<th>Excluding 5 Percent Outliers</th>
<th>Recessions</th>
<th>Currency Crises</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crisis3<em>Dep</em>DC</td>
<td>−0.07</td>
<td>−1.43</td>
<td>0.72</td>
<td>−0.02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.04]</td>
<td>[1.00]</td>
<td>[0.37]</td>
<td>[0.01]</td>
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<tr>
<td>Crisis3<em>Dep</em>LDC</td>
<td>−3.73</td>
<td>−2.24</td>
<td>−3.66</td>
<td>−4.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[2.46]**</td>
<td>[1.74]*</td>
<td>[2.30]**</td>
<td>[2.56]**</td>
<td></td>
</tr>
<tr>
<td>Crisis4<em>Dep</em>DC</td>
<td>0.52</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>[0.36]</td>
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<tr>
<td>Crisis4<em>Dep</em>LDC</td>
<td>−2.58</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>[1.91]*</td>
<td></td>
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<tr>
<td>Recession<em>Dep</em>DC</td>
<td></td>
<td>−2.07</td>
<td></td>
<td></td>
<td></td>
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<td>[1.38]</td>
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<td></td>
</tr>
<tr>
<td>Recession<em>Dep</em>LDC</td>
<td></td>
<td>−0.34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[0.23]</td>
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<td></td>
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<tr>
<td>Currency Crisis<em>Dep</em>DC</td>
<td></td>
<td></td>
<td>−1.66</td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[0.98]</td>
<td></td>
<td></td>
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<tr>
<td>Currency Crisis<em>Dep</em>LDC</td>
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<td></td>
<td>2.41</td>
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<td></td>
<td></td>
<td></td>
<td>[1.35]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share (t-1)</td>
<td>−2.44</td>
<td>−2.44</td>
<td>−1.69</td>
<td>−2.44</td>
<td>−2.45</td>
</tr>
<tr>
<td></td>
<td>[7.52]***</td>
<td>[7.51]***</td>
<td>[7.18]**</td>
<td>[7.52]***</td>
<td>[7.53]***</td>
</tr>
<tr>
<td>Constant</td>
<td>8.41</td>
<td>8.37</td>
<td>10.82</td>
<td>3.90</td>
<td>8.04</td>
</tr>
<tr>
<td></td>
<td>[1.44]</td>
<td>[1.43]</td>
<td>[1.43]</td>
<td>[0.76]</td>
<td>[1.25]</td>
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<tr>
<td>Observations</td>
<td>16227</td>
<td>16227</td>
<td>15213</td>
<td>16227</td>
<td>16227</td>
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<tr>
<td>R-squared</td>
<td>0.35</td>
<td>0.35</td>
<td>0.36</td>
<td>0.35</td>
<td>0.35</td>
</tr>
</tbody>
</table>

t-statistics are in parentheses. ***, **, and * denote significance levels of 1 percent, 5 percent, and 10 percent, respectively. Crisis3 is a dummy variable for the year of banking crisis inception and two following years. Crisis4 is a dummy variable for the year of a banking crisis and the following three years. Dep is a parameter measuring an industry’s dependence on external finance (Rajan and Zingales, 1998). DC is a dummy for developed countries. LDC is a dummy for developing countries. Recession is a dummy for recession years. Currency crisis is a dummy for currency crisis years. Lagged share is the share of the sector’s value added in total value added lagged by one period. Lagged share is the share of the sector’s value added in total value added lagged by one period. Regressions are estimated with OLS. Standard errors are clustered by industry-country, and regressions also include time-country, time-industry, and industry-country dummy variables.

14 An intriguing question is whether the presence of foreign banks can mitigate crisis costs. Unfortunately, measures of foreign bank presence for a cross-section of countries are available only beginning in the mid-1990s. In a study of the Malaysian crisis of 1997–98, Detragiache and Gupta (2006) find that foreign banks from outside the region performed better than domestic banks or foreign banks with a regional focus.
If our hypothesis is correct, banking crises should have more significant real effects in those cases where they are more pervasive and involve the disruption of the orderly functioning of the banking system. We consider three indicators of crisis severity: the fiscal cost of the crisis, the share of nonperforming loans in total loans, and the fraction of insolvent bank assets in total bank assets. The sample is then split according to whether the severity ranking (an average of these three measures) is above or below its median, and the usual regression is estimated with two separate interaction terms, one for more severe and one for milder crises. As expected, we find that externally dependent sectors suffer more in more severe crises (Table 5.4, Column 2). Similar results are obtained if we split the sample according to the aggregate output loss experienced during the crisis, where the loss is computed as the difference in average GDP growth between the three years preceding a crisis and the three years of the crisis (Table 5.4, Column 3).

Another interesting question is whether the differential effects of crises are more pronounced when bank distress is accompanied by a currency crisis, as has been the...
case in a number of well-known episodes. When we split the sample between “twin crises” and stand-alone crises, differential effects are significant only for the latter episodes. This might be explained by the fact that during twin crises, the adverse effects on the bank lending channel might be offset by the (favorable) effects of exchange rate devaluation on exports and profitability (Table 5.4, Column 4).

Finally, thus far we have looked at overall value-added growth. One might expect the effects of lending to be more direct and pronounced on capital formation. Using investment growth as the dependent variable (dropping 5 percent of outliers, because this variable is noisier) in the baseline regression, the coefficient on the interaction term remains negative and statistically significant at the 5 percent level (Table 5.5). The differential effect is economically more significant than in the case of value added: an industry at the 25th percentile of the external dependence distribution has investment growth 4 percentage points higher than one at the 75th percentile during crisis years.

Another measure that is likely to be sensitive to bank lending is employment. This variable has the advantage of not being affected by changes in relative prices across sectors, which we cannot control for because of lack of data. Consistent with the importance of the bank lending channel, we find that employment growth is slower in more financially dependent sectors during banking crises. When we differentiate between developed and developing countries, the effect on employment seems to be more pronounced in the latter, consistent with the result for value added.

A third alternative dependent variable is growth in number of establishments. To the extent that this variable reflects the birth of new firms, it has the advantage

<table>
<thead>
<tr>
<th>TABLE 5.5</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Differential Effects of Banking Crises on Growth in Capital Formation and the Number of Establishments</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Capital Formation</th>
<th>Employment</th>
<th>Number of Establishments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Benchmark DC-LDC Split</td>
<td>Benchmark DC-LDC Split</td>
<td>Benchmark DC-LDC Split</td>
</tr>
<tr>
<td>Crisis3*Dependence</td>
<td>−9.85</td>
<td>−1.47</td>
<td>−1.11</td>
</tr>
<tr>
<td>[2.31]**</td>
<td>[2.01]**</td>
<td>[2.27]**</td>
<td></td>
</tr>
<tr>
<td>Crisis3<em>Dependence</em></td>
<td>−9.32</td>
<td>−0.93</td>
<td>−1.25</td>
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<tr>
<td>Developed</td>
<td>[1.83]*</td>
<td>[0.89]</td>
<td>[1.57]</td>
</tr>
<tr>
<td>Crisis3<em>Dependence</em></td>
<td>−10.12</td>
<td>−1.71</td>
<td>−1.06</td>
</tr>
<tr>
<td>Developing</td>
<td>[1.77]*</td>
<td>[1.79]*</td>
<td>[1.72]*</td>
</tr>
<tr>
<td>Share (t−1)</td>
<td>−2.21</td>
<td>−0.47</td>
<td>−0.83</td>
</tr>
<tr>
<td>[3.53]***</td>
<td>[2.54]**</td>
<td>[7.46]***</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>28.52</td>
<td>17.80</td>
<td>18.73</td>
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<td>[1.20]</td>
<td>[1.14]</td>
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<tr>
<td>Observations</td>
<td>15940</td>
<td>15940</td>
<td>15940</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.32</td>
<td>0.44</td>
<td>0.38</td>
</tr>
</tbody>
</table>

Robust t-statistics are in parentheses. ***, **, and * denote significance levels of 1 percent, 5 percent, and 10 percent, respectively. Crisis3 is a dummy variable for the year of banking crisis inception and two following years. Dep is a parameter measuring an industry’s dependence on external finance (Rajan and Zingales, 1998). DC is a dummy for developed countries. LDC is a dummy for developing countries. Lagged share is the share of the sector’s value added in total value added lagged by one period. Regressions are estimated with OLS. Standard errors are clustered by industry-country, and regressions also include time-country, time-industry, and industry-country dummy variables.
of being less sensitive to balance sheet effects than value added (see earlier): a new firm is unencumbered by past liabilities, and therefore growth in the number of firms will not be influenced by how the roots of the crisis affect firm balance sheets. In addition, like employment growth this variable is not muddled by relative price changes. The differential effect is again negative and significant in developing countries, though it is not significant in advanced economies. An industry at the 25th percentile of the external dependence distribution has growth in establishments 0.6 percentage points higher than one at the 75th percentile during crisis years. This result is consistent with the hypothesis in Aguiar and Gopinath (2005) that firm liquidity may play a role in determining the cross-industry pattern of mergers and acquisitions. To the extent that illiquid firms make easier targets, and conditionally on sufficient variability of liquidity within sectors, one banking crisis may lead to industry consolidation in more bank-dependent sectors.

In sum, our methodology suggests that banking crises have the most effect where we would expect from the theory that the lending channel to be most operative. Next we turn to alternative ways of identifying differences in reliance on domestic banking across industries.

5.4.5. Differences Among Sectors Based on Firm Size

In corporate finance it is well known that small firms tend to rely more on domestic bank finance than large firms, as the latter can raise capital through domestic securities markets or international capital markets. Thus, other things being equal, sectors dominated by small firms should be more severely affected by disruptions in the domestic banking sector. The distinction between small and large firms, therefore, can provide an identification strategy alternative to the Rajan-Zingales index.

Although we do not have cross-country panel data on value added by firm size, we construct a proxy for this variable using industry level data on employment and number of establishments. We conjecture that industries with a larger average number of employees per establishment are dominated by large, less bank-dependent firms. As such, they should experience a less pronounced contraction during banking crises than industries with a smaller average plant size. To avoid endogeneity issues, we measure plant size as the logarithm of the average over the sample period.15 In contrast to the Rajan-Zingales index, which is common to all countries, this measure of bank dependence is country specific, and can thus capture differences in technology and product mix across countries.

Table 5.6 presents the results of regressing value-added growth on country-time, industry-time, and country-industry dummies and an interaction term between average industry plant size and the banking crisis dummy. The positive and significant coefficient for the interaction term indicates that industries with larger plant size tend to grow faster during banking crises, which we interpret as evidence of the bank lending channel. This result is robust to controlling for

15 The results are robust to using plant size at the beginning of the sample to identify bank dependence.
differential effects during currency crises, but loses significance when controlling for recessions (more on this below), during which large scale sectors do relatively better, consistent with the credit channel literature (Gertler and Gilchrist, 1994).

When we introduce separate interaction terms for developed and developing countries, once again we find the differential effects to be larger and statistically significant in developing countries. This may indicate that asymmetries in access to finance between large and small firms are stronger in developing countries, or that shocks leading to crises, on average, are more severe in developing countries, which magnifies the effect of asymmetries.

Notably, these estimates also confirm the prevalence of the effect of recessions (as identified by Braun and Larraín, 2005) in advanced economies and of the effect of banking crises in developing countries and emerging markets. When we control for recessions, the differential effect during banking crises is borderline significant in developing countries, but essentially zero for developed economies.

### Table 5.6

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Currency Crises</th>
<th>Recessions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Benchmark</td>
<td>DC-LDC Split</td>
<td>Benchmark</td>
</tr>
<tr>
<td>Size*Crisis3</td>
<td>1.52</td>
<td>[2.09]**</td>
<td>1.36</td>
</tr>
<tr>
<td>Size<em>Crisis3</em>DC</td>
<td>1.04</td>
<td>[0.88]</td>
<td>1.03</td>
</tr>
<tr>
<td>Size<em>Crisis3</em>LDC</td>
<td>1.67</td>
<td>[1.86]*</td>
<td>1.45</td>
</tr>
<tr>
<td>Currency Crisis*Size</td>
<td>0.99</td>
<td>[1.13]</td>
<td></td>
</tr>
<tr>
<td>Currency Crisis<em>Size</em>DC</td>
<td>0.67</td>
<td>[0.72]</td>
<td></td>
</tr>
<tr>
<td>Currency Crisis<em>Size</em>LDC</td>
<td>1.06</td>
<td>[0.95]</td>
<td></td>
</tr>
<tr>
<td>Recession*Size</td>
<td>1.29</td>
<td>[1.87]*</td>
<td></td>
</tr>
<tr>
<td>Recession<em>Size</em>DC</td>
<td>2.84</td>
<td>[2.99]***</td>
<td>0.65</td>
</tr>
<tr>
<td>Recession<em>Size</em>LDC</td>
<td></td>
<td></td>
<td>0.65</td>
</tr>
<tr>
<td>Lagged Share</td>
<td>−2.46</td>
<td>[7.41]***</td>
<td>−2.46</td>
</tr>
<tr>
<td>Constant</td>
<td>7.72</td>
<td>[5.54]***</td>
<td>6.67</td>
</tr>
<tr>
<td>Observations</td>
<td>15985</td>
<td>15985</td>
<td>15985</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
</tr>
</tbody>
</table>

* t-statistics are in parentheses. ***, **, and * denote significance levels of 1 percent, 5 percent, and 10 percent, respectively. Crisis3 is a dummy variable for the year of banking crisis inception and two following years. Size is average employees per establishment in sector j in country i averaged over the sample period. DC is a dummy for developed countries. LDC is a dummy for developing countries. Recession is a dummy for recession years. Currency crisis is a dummy for currency crisis years. Lagged share is the share of the sector’s value added in total value added lagged by one period. Regressions are estimated with OLS. Standard errors are clustered by industry-country, and regressions also include time-country, time-industry, and industry-country dummy variables.
The recession coefficient is strongly significant for developed countries, but, as before, is not significant for developing countries. Again, a possible explanation is that in developed countries banks are not special because firms have alternative sources of finance. As a result, asymmetries between large and small firms are only driven by differential access to finance, which gets accentuated by weakened small borrower balance sheets and consequent borrower agency problems in recessions. In developing countries, by contrast, small firms may be restricted to borrowing only from banks so bank financial distress accentuates large-firm/small-firm growth differentials.

5.4.6. Differences Among Sectors Based on Export Orientation

As argued in Tornell and Westermann (2002 and 2003), firms in the traded sector may have better access to alternatives to domestic bank finance, especially foreign finance, and thus suffer less than firms in nontraded sectors during financial crises. If this conjecture is true, trade orientation can provide an identification strategy to test for the presence of a bank lending channel.

In the next set of regressions (Table 5.7), we interact the banking crisis dummy with the ratio of exports to value added for each industry and country.

<table>
<thead>
<tr>
<th>TABLE 5.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential Effects of Banking Crises on Value-Added Growth: Industries Differentiated Based on Export Orientation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Baseline</th>
<th>Currency Crises</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchmark</td>
<td>DC-LDC Split</td>
</tr>
<tr>
<td>Crisis3*Export/VA</td>
<td>0.78</td>
</tr>
<tr>
<td>Crisis3<em>Export/VA</em>DC</td>
<td>0.98</td>
</tr>
<tr>
<td>Crisis3<em>Export/VA</em>LDC</td>
<td>0.71</td>
</tr>
<tr>
<td>Currency Crisis*Export/VA</td>
<td>2.11</td>
</tr>
<tr>
<td>Currency Crisis<em>Export/VA</em>DC</td>
<td>2.44</td>
</tr>
<tr>
<td>Currency Crisis<em>Export/VA</em>LDC</td>
<td>3.60</td>
</tr>
<tr>
<td>Constant</td>
<td>0.35</td>
</tr>
</tbody>
</table>

| t-statistics are in parentheses. ***, **, and * denote significance levels of 1 percent, 5 percent, and 10 percent, respectively. Crisis3 is a dummy variable for the year of banking crisis inception and two following years. Export/VA is the ratio of export to value added in industry j and country i averaged over the sample period. DC is a dummy for developed countries. LDC is a dummy for developing countries. Currency crisis is a dummy for currency crisis years. Lagged share is the share of the sector’s value added in total value added lagged by one period. Regressions are estimated with OLS. Standard errors are clustered by industry-country, and regressions also include time-country, time-industry, and industry-country dummy variables. |
The coefficient of the interaction term has the correct sign, but is far from being statistically significant. This remains the case when we control for currency crises, when export sectors can be expected to perform better on account of the real exchange rate depreciation. Interestingly, the interaction term of export orientation with currency crises is positive and significant, so our regressions do pick up this effect. During banking crises, however, we find no evidence that more export-oriented sectors perform better, casting doubt on a credit channel interpretation of asymmetries across industry based on export orientation. We should note that one reason we may not find strong support for the hypothesis is that our data are confined to the manufacturing sector, leaving out important segments of nontraded productive activities, such as construction and services.

### 5.4.7. Interventions and the Lending Channel

We now turn to estimating the effect of different forms of intervention on the lending channel. We obtain a list of policy interventions undertaken in each of 22 crises in our sample from Honohan and Klingebiel (2003) (Table 5.8). These

---

**Table 5.8**

<table>
<thead>
<tr>
<th>Episode</th>
<th>Blanket Guarantee</th>
<th>Liquidity Support</th>
<th>Forbearance A</th>
<th>Forbearance B</th>
<th>Repeated Recaps</th>
<th>Relief to Debtors</th>
<th>Total</th>
</tr>
</thead>
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<td>Ghana 1982</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Turkey 1994</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Malaysia 1997</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Brazil 1994</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Finland 1991</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Korea 1997</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Colombia 1982</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>United States 1980</td>
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<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
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<tr>
<td>Turkey 1982</td>
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<td>0</td>
<td>0</td>
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<td>Philippines 1981</td>
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<td>1</td>
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<td>0</td>
<td>1</td>
<td>4</td>
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<tr>
<td>Ecuador 1995</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Mexico 1994</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
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<tr>
<td>Argentina 1995</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>Malaysia 1985</td>
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<td>Sweden 1990</td>
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<td>Sri Lanka 1989</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Indonesia 1992</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Chile 1981</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Venezuela 1993</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Total episodes</td>
<td>12</td>
<td>12</td>
<td>6</td>
<td>18</td>
<td>6</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

Blanket guarantee is a dummy for extensive depositor protection. Forbearance A is a dummy for letting insolvent banks operate unrestricted. Liquidity support is a dummy for providing extensive liquidity to troubled banks. Forbearance B is a dummy for letting insolvent banks operate unrestricted or not enforce some regulations. Repeated recaps is a dummy for repeated government recapitalizations of banks. Debtor relief is a dummy for government programs to subsidize bank debtors.

(averaged over the sample period). The coefficient of the interaction term has the correct sign, but is far from being statistically significant. This remains the case when we control for currency crises, when export sectors can be expected to perform better on account of the real exchange rate depreciation. Interestingly, the interaction term of export orientation with currency crises is positive and significant, so our regressions do pick up this effect. During banking crises, however, we find no evidence that more export-oriented sectors perform better, casting doubt on a credit channel interpretation of asymmetries across industry based on export orientation. We should note that one reason we may not find strong support for the hypothesis is that our data are confined to the manufacturing sector, leaving out important segments of nontraded productive activities, such as construction and services.

Export data by sector are from the World Bank’s World Integrated Trade Solution (WITS) database.
authors classify interventions into six categories: blanket depositor protection (including both explicit blanket guarantees to depositors and cases in which depositors are implicitly protected because most of the banking sector is publicly owned); prolonged and extensive liquidity provision to banks; forbearance of type A (when insolvent/illiquid banks are allowed to continue operating without restriction for at least 12 months); forbearance of type B (either there is forbearance of type A or some regulations, such as loan classification and provisioning, are not enforced); repeated recapitalizations; and, finally, government-sponsored debt relief initiative for corporate or private borrowers. All these variables are captured by simple zero-one dummies.

To test whether the differential effect of banking crises depends on policy intervention, we interact the intervention dummies of Honohan and Klingebiel with the interaction term between crisis and external dependence (Table 5.9). First, we establish that financially dependent sectors grow less during crises also in this drastically restricted sample of 22 crises (Column 1). Next, we test

<table>
<thead>
<tr>
<th>TABLE 5.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential Effects of Banking Crises and Intervention Policies</td>
</tr>
<tr>
<td>(1)</td>
</tr>
<tr>
<td>Crisis3*Dep</td>
</tr>
<tr>
<td>[1.89]*</td>
</tr>
<tr>
<td>Crisis<em>Dep</em>Relief</td>
</tr>
<tr>
<td>to Debtors</td>
</tr>
<tr>
<td>Crisis<em>Dep</em></td>
</tr>
<tr>
<td>Repeated Recap</td>
</tr>
<tr>
<td>Crisis<em>Dep</em></td>
</tr>
<tr>
<td>[0.67]</td>
</tr>
<tr>
<td>Crisis<em>Dep</em></td>
</tr>
<tr>
<td>[1.45]</td>
</tr>
<tr>
<td>Crisis<em>Dep</em></td>
</tr>
<tr>
<td>[1.02]</td>
</tr>
<tr>
<td>Crisis<em>Dep</em></td>
</tr>
<tr>
<td>[0.79]</td>
</tr>
<tr>
<td>Crisis3<em>Dep</em>Number</td>
</tr>
<tr>
<td>[0.29]</td>
</tr>
<tr>
<td>Lagged share</td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>[0.41]</td>
</tr>
<tr>
<td>Observations</td>
</tr>
<tr>
<td>R-squared</td>
</tr>
</tbody>
</table>

*–statistics are in parentheses. ***, **, and * denote significance levels of 1 percent, 5 percent, and 10 percent, respectively. Crisis3 is a dummy variable for the year of banking crisis inception and two following years. Dep is a parameter measuring an industry’s dependence on external finance (Rajan and Zingales, 1998). Blanket guarantee is a dummy for extensive depositor protection. Forbearance A is a dummy for letting insolvent banks operate unrestricted. Liquidity support is a dummy for providing extensive liquidity to troubled banks. Forbearance B is a dummy for letting insolvent banks operate unrestricted or not enforce some regulations. Repeated Recap is a dummy for repeated government recapitalizations of banks. Debtor relief is a dummy for government programs to subsidize bank debtors. Regressions are estimated with OLS. Standard errors are clustered by industry-country, and regressions also include time-country, time-industry, and industry-country dummy variables.

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whether differential effects were smaller in countries with a larger number of interventions (Column 2). This does not appear to be the case. When we examine the effects of each type of intervention in isolation, the policy with the largest positive coefficient is forbearance A. Other policies have much smaller or even negative coefficients. Although none of the coefficients is statistically significant at the usual confidence levels, we still think that this evidence is suggestive that allowing insolvent banks to continue operating during the initial phase of a crisis may help alleviate the real cost of the crisis. Obviously, more research is necessary to understand what are successful crisis mitigation strategies.

5.5. CONCLUSION

We have studied the effects of banking crises on growth in industrial sectors and find that in sectors that are more dependent on external finance value added, capital formation, and the number of establishments grew relatively less than in sectors less dependent on external finance. We interpret this finding as evidence that there is a real cost to banking crises. Specifically, although adverse shocks cause both poor economic performance and bank distress, bank distress has an additional, adverse effect on growth, as banks must cut back their lending. As might be expected, the differential effect is stronger in developing countries (where alternatives to bank financing are more limited), in countries with less access to foreign finance, and where bank distress is more severe. In addition, we find that the effect we have measured is not just the reflection of balance sheet effects during recessions or currency crises, but appears to be special to periods in which banks experienced liquidity and solvency problems.

These results lend support to the view, often expressed by policymakers, that banks need more support than other commercial enterprises in times of financial distress. If bank credit cannot be easily replaced by other sources of finance, at least for some businesses, then profitable production activities may have to be cut back and viable investment projects abandoned, leading to a misallocation of resources. In addition, the bank lending channel can ratchet up the macroeconomic effects of an adverse shock, leading to a downward spiral in which a contraction in economic activity and bank distress reinforce each other.

How to design and implement appropriate policies to support banks during crises, however, remains difficult in practice. With our results it is possible to study how the differential effect of crises changes with different intervention policies. Unfortunately, data on interventions are hard to come by and quantify and, perhaps more importantly, unobservable shocks affect both the lending channel impact and the propensity and modalities of intervention. Future research to tackle these difficulties would undoubtedly be very valuable.
## DATA APPENDIX

### TABLE 5.10
**External Dependence Index**

<table>
<thead>
<tr>
<th>Industrial Sector</th>
<th>External Dependence</th>
<th>Industrial Sector</th>
<th>External Dependence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco</td>
<td>−0.45</td>
<td>Rubber products</td>
<td>0.23</td>
</tr>
<tr>
<td>Pottery</td>
<td>−0.15</td>
<td>Furniture</td>
<td>0.24</td>
</tr>
<tr>
<td>Leather</td>
<td>−0.14</td>
<td>Metal products</td>
<td>0.24</td>
</tr>
<tr>
<td>Footwear</td>
<td>−0.08</td>
<td>Industrial chemicals</td>
<td>0.25</td>
</tr>
<tr>
<td>Nonferrous metal</td>
<td>0.01</td>
<td>Wood products</td>
<td>0.28</td>
</tr>
<tr>
<td>Apparel</td>
<td>0.03</td>
<td>Petroleum and coal products</td>
<td>0.33</td>
</tr>
<tr>
<td>Petroleum refineries</td>
<td>0.04</td>
<td>Transportation equipment</td>
<td>0.36</td>
</tr>
<tr>
<td>Nonmetal products</td>
<td>0.06</td>
<td>Other industries</td>
<td>0.47</td>
</tr>
<tr>
<td>Beverages</td>
<td>0.08</td>
<td>Glass</td>
<td>0.53</td>
</tr>
<tr>
<td>Iron and steel</td>
<td>0.09</td>
<td>Machinery</td>
<td>0.6</td>
</tr>
<tr>
<td>Food products</td>
<td>0.14</td>
<td>Other chemicals</td>
<td>0.75</td>
</tr>
<tr>
<td>Paper and products</td>
<td>0.17</td>
<td>Electric machinery</td>
<td>0.95</td>
</tr>
<tr>
<td>Textile</td>
<td>0.19</td>
<td>Professional goods</td>
<td>0.96</td>
</tr>
<tr>
<td>Printing and publishing</td>
<td>0.2</td>
<td>Plastic products</td>
<td>1.14</td>
</tr>
</tbody>
</table>

**Sources:** Rajan and Zingales (1998) and Krozner and others (2007).

### TABLE 5.11
**Summary Statistics**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>Standard Dev.</th>
<th>Max.</th>
<th>Min.</th>
<th>No. of Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>VA growth (in percent)</td>
<td>3.7</td>
<td>1.8</td>
<td>22.7</td>
<td>107.4</td>
<td>−54.1</td>
<td>16227</td>
</tr>
<tr>
<td>Growth in capital formation</td>
<td>12.3</td>
<td>2.0</td>
<td>56.2</td>
<td>240.7</td>
<td>−80.5</td>
<td>9752</td>
</tr>
<tr>
<td>(in percent)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment growth</td>
<td>0.9</td>
<td>0.1</td>
<td>8.7</td>
<td>29.0</td>
<td>−20.4</td>
<td>15940</td>
</tr>
<tr>
<td>(in percent)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth in number of</td>
<td>1.8</td>
<td>0.0</td>
<td>10.1</td>
<td>45.9</td>
<td>−22.1</td>
<td>9684</td>
</tr>
<tr>
<td>establishments (in percent)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to foreign financing</td>
<td>1.8</td>
<td>0.6</td>
<td>3.0</td>
<td>25.5</td>
<td>0.0</td>
<td>482</td>
</tr>
<tr>
<td>(in percent of trade volume)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output loss during crisis</td>
<td>1.8</td>
<td>2.0</td>
<td>3.9</td>
<td>12.0</td>
<td>−7.4</td>
<td>46</td>
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<tr>
<td>(in percent; by episode)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rajan-Zingales index</td>
<td>0.3</td>
<td>0.2</td>
<td>0.4</td>
<td>1.1</td>
<td>−0.5</td>
<td>28</td>
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<tr>
<td>(by industry)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average plant size</td>
<td>125.3</td>
<td>65.6</td>
<td>232.3</td>
<td>4197.7</td>
<td>1.5</td>
<td>1012</td>
</tr>
<tr>
<td>(by country/industry)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Export/value-added</td>
<td>71.2</td>
<td>41.3</td>
<td>73.1</td>
<td>297.8</td>
<td>0.0</td>
<td>872</td>
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<tr>
<td>(by country/industry) (in percent)</td>
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<td></td>
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</table>

### TABLE 5.12
**Correlations Between Measures of External Dependence**

<table>
<thead>
<tr>
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<th>Rajan-Zingales</th>
<th>Average Plant Size</th>
<th>Exports/VA</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
</tr>
<tr>
<td>Average plant size</td>
<td>−0.16</td>
<td>1.00</td>
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<tr>
<td>Exports/VA</td>
<td>0.02</td>
<td>0.03</td>
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</table>
TABLE 5.13
Banking Crises Inception Dates

<table>
<thead>
<tr>
<th>Countries</th>
<th>Banking Crisis Inception</th>
<th>Countries</th>
<th>Banking Crisis Inception</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>1989</td>
<td>Malaysia</td>
<td>1997</td>
</tr>
<tr>
<td>Argentina</td>
<td>1995</td>
<td>Mexico</td>
<td>1994</td>
</tr>
<tr>
<td>Bolivia</td>
<td>1986</td>
<td>Nepal</td>
<td>1988</td>
</tr>
<tr>
<td>Bolivia</td>
<td>1994</td>
<td>Nigeria</td>
<td>1991</td>
</tr>
<tr>
<td>Brazil</td>
<td>1994</td>
<td>Norway</td>
<td>1987</td>
</tr>
<tr>
<td>Cameroon</td>
<td>1995</td>
<td>Panama</td>
<td>1988</td>
</tr>
<tr>
<td>Chile</td>
<td>1981</td>
<td>Peru</td>
<td>1983</td>
</tr>
<tr>
<td>Colombia</td>
<td>1982</td>
<td>Philippines</td>
<td>1981</td>
</tr>
<tr>
<td>Colombia</td>
<td>1999</td>
<td>Portugal</td>
<td>1986</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>1994</td>
<td>Senegal</td>
<td>1983</td>
</tr>
<tr>
<td>Ecuador</td>
<td>1995</td>
<td>South Africa</td>
<td>1985</td>
</tr>
<tr>
<td>Finland</td>
<td>1991</td>
<td>Sri Lanka</td>
<td>1989</td>
</tr>
<tr>
<td>Ghana</td>
<td>1982</td>
<td>Swaziland</td>
<td>1995</td>
</tr>
<tr>
<td>India</td>
<td>1991</td>
<td>Sweden</td>
<td>1990</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1992</td>
<td>Tanzania</td>
<td>1988</td>
</tr>
<tr>
<td>Israel</td>
<td>1983</td>
<td>Tunisia</td>
<td>1991</td>
</tr>
<tr>
<td>Italy</td>
<td>1990</td>
<td>Turkey</td>
<td>1982</td>
</tr>
<tr>
<td>Japan</td>
<td>1992</td>
<td>Turkey</td>
<td>1991</td>
</tr>
<tr>
<td>Jordan</td>
<td>1989</td>
<td>Turkey</td>
<td>1994</td>
</tr>
<tr>
<td>Kenya</td>
<td>1993</td>
<td>Turkey</td>
<td>2000</td>
</tr>
<tr>
<td>Korea</td>
<td>1997</td>
<td>United States</td>
<td>1980</td>
</tr>
<tr>
<td>Madagascar</td>
<td>1988</td>
<td>Uruguay</td>
<td>1981</td>
</tr>
<tr>
<td>Malaysia</td>
<td>1985</td>
<td>Venezuela</td>
<td>1993</td>
</tr>
</tbody>
</table>

Total number of crises = 48.

TABLE 5.14
Average Growth of Real Value Added in Crisis and Noncrisis Years

<table>
<thead>
<tr>
<th>Crisis Duration</th>
<th>Crisis</th>
<th>No. of Obs.</th>
<th>Noncrisis</th>
<th>No. of Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-year dummy</td>
<td>0.10</td>
<td>1130</td>
<td>4.00</td>
<td>15097</td>
</tr>
<tr>
<td>Two-year dummy</td>
<td>−0.92</td>
<td>2167</td>
<td>4.45</td>
<td>14060</td>
</tr>
<tr>
<td>Three-year dummy</td>
<td>1.70</td>
<td>3059</td>
<td>4.20</td>
<td>13168</td>
</tr>
<tr>
<td>Four-year dummy</td>
<td>3.33</td>
<td>4012</td>
<td>3.86</td>
<td>12215</td>
</tr>
<tr>
<td>Five-year dummy</td>
<td>3.84</td>
<td>4851</td>
<td>3.69</td>
<td>11376</td>
</tr>
</tbody>
</table>

REFERENCES


6.1. INTRODUCTION

In this chapter we show that over the last four decades countries that have experienced financial crises have, on average, grown faster than countries with stable financial conditions. To explain this fact we present a theoretical mechanism in which systemic risk taking mitigates financial bottlenecks and increases growth in countries with weak institutions. Systemic risk, however, also leads to occasional crises. We then show that the set of countries to which our mechanism applies in theory is closely identified with the countries that have experienced fast growth and crises in the data.

We use the skewness of real credit growth as a de facto measure of systemic risk. During a systemic crisis there is a large and abrupt downward jump in credit growth. Because crises only happen occasionally, these negative outliers tilt the distribution to the left. Thus, in a large enough sample, crisis-prone economies tend to exhibit lower skewness than economies with stable financial conditions. We provide evidence of a strong correspondence between skewness and several crisis indexes. In particular, we show that crises are the principal source of negative
skewness once we have controlled for major exogenous shocks such as wars and large scale deterioration in the terms of trade.

We choose not to use variance to capture the uneven progress associated with financial fragility because high variance captures not only rare, large, and abrupt contractions, but also frequent or symmetric shocks. In contrast, skewness specifically captures asymmetric and abnormal patterns in the distribution of credit growth and thus can identify the risky paths that exhibit rare, large, and abrupt credit busts.

We estimate a set of regressions that adds the three moments of credit growth to standard growth equations. We find a negative link between per capita GDP growth and the skewness of real credit growth. This link is robust across alternative specifications and sample periods. It can be interpreted as a positive effect of systemic risk on growth, and it is confirmed when banking crisis indicators are used instead of skewness. We also find that the link between skewness and growth is independent of the negative link between variance and growth that is typically found in the literature.

Thailand and India illustrate the choices available to countries with weak institutions. Whereas India followed a path of slow but steady growth, Thailand experienced high growth, lending booms, and crisis (Figure 6.1). GDP per capita grew by only 114 percent between 1980 and 2002 in India, whereas Thailand’s GDP per capita grew by 162 percent, despite the effects of a major crisis.

The link between skewness and growth is economically important. Our benchmark estimates indicate that about a third of the difference in growth between India and Thailand can be attributed to systemic risk taking. Needless to say this finding does not imply that financial crises are good for growth. It suggests, however, that high growth paths are associated with the undertaking of systemic risk and with the occurrence of occasional crises.

To interpret the link between skewness and growth we present a model in which high growth and a greater incidence of crises are part of an internally consistent mechanism. In the model, contract enforceability problems imply that

![Graph showing real credit and GDP per capita for India and Thailand](image)

**Figure 6.1** Safe versus risky growth path: A comparison of India and Thailand, 1980–2002.

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growth is stymied by borrowing constraints. In a financially liberalized economy, systemic risk taking reduces the effective cost of capital and relaxes borrowing constraints. This allows for greater investment and growth as long as a crash does not occur. Of course, when a crash does occur the short-term effects of the sudden collapse in financial intermediation are severe. Because a crash is inevitable in a risky economy, whether systemic risk taking is growth enhancing or not is open to question. The key contribution of our model is to show that whenever systemic risk arises, it increases mean growth even if crises have arbitrarily large output and financial distress costs.

Our theoretical mechanism implies that the link between systemic risk and growth is strongest in the set of financially liberalized economies with a moderate degree of contract enforceability. In the second part of our empirical analysis, we test this identification restriction and find strong support for it.

This paper is structured as follows. Section 6.2 presents the model. Section 6.3 presents the empirical analysis. Sections 6.4 and 6.5 present a literature review and our conclusions. Finally, an unpublished appendix contains the proofs, the description of the data used in the regression analysis, and presents some additional empirical results.

6.2. MODEL

Here, we present a stochastic growth model where growth depends on the nature of the financial system. We consider an economy where imperfect contract enforceability generates borrowing constraints as agents cannot commit to repay debt. This financial bottleneck leads to low growth because investment is constrained by firms’ internal funds. When the government promises—either explicitly or implicitly—to bail out lenders in case of a systemic crisis, financial liberalization may induce agents to coordinate in undertaking insolvency risk. Because taxpayers will repay lenders in the eventuality of a systemic crisis, risk taking reduces the effective cost of capital and allows borrowers to attain greater leverage. Greater leverage allows for greater investment, which leads to greater future internal funds, which in turn will lead to more investment and so on. This is the leverage effect through which systemic risk increases investment and growth along the no-crisis path. Systemic risk taking, however, also leads to aggregate financial fragility and to occasional crises.

Crises are costly. Widespread bankruptcies entail severe deadweight losses. Furthermore, the resultant collapse in internal funds depresses new credit and investment, hampering growth. But is it possible for systemic risk taking to increase long-run growth by compensating for the effects of enforceability problems? Yes. Notice, however, that the positive effects of systemic risk do not arise in just any economy. It is necessary that contract enforceability problems are severe—so that borrowing constraints arise—but not too severe—so that the leverage effect is strong. Furthermore, in the presence of decreasing returns, if an economy is rich enough, systemic risk does not arise. When income reaches a certain threshold, the economy must switch to a safe path.
Finally, notice that the bailouts are financed by taxing firms in no-crisis times. We establish conditions for the expected present value of income net of taxes to be greater in a risky than in a safe equilibrium.

Setup. The economy can be either in a good state ($\Omega_t = 1$), with probability $u$, or in a bad state ($\Omega_t = 0$). To allow for the endogeneity of systemic risk, we assume that there are two production technologies: a safe one and a risky one. Under the safe technology, production is perfectly uncorrelated with the state, while under the risky one, the correlation is perfect:

$$ q_{t+1}^{safe} = g(I_s), \quad q_{t+1}^{risky} = \begin{cases} f(I_r) \text{ prob } u, \\ 0 \text{ prob } 1 - u \end{cases} \quad u \in (0,1) $$

where $I_s$ is the investment in the safe technology and $I_r$ is the investment in the risky one. Production is carried out by a continuum of firms with measure one. The investable funds of a firm consist of its internal funds $w_t$ plus the one-period debt it issues $b_t$. Thus, the firm’s budget constraint is

$$ w_t + b_t = I_s + I_r $$

The debt issued by firms promises to repay $L_{t+1} := b_t[1 + \rho_t]$ in the next period. It is acquired by international investors who are competitive risk-neutral agents with an opportunity cost of funds equal to the international interest rate $r$.

In order to generate both borrowing constraints and systemic risk, we follow Schneider and Tornell (2004, 2005) and assume that firm financing is subject to two credit market imperfections: contract enforceability problems and systemic bailout guarantees. We model these imperfections by assuming that firms are run by overlapping generations of managers who live for two periods and cannot commit to repay debt. In the first period of her life, for example $t$, a manager chooses investment and whether to set up a diversion scheme. At $t + 1$, the firm is solvent if revenue is greater than the promised debt repayment:

$$ \pi_{t+1} = q_{t+1} - L_{t+1} > 0 $$

If the firm is solvent at $t + 1$ and there is no diversion, the now old manager receives $[d - \tau]\pi_{t+1}$ and consumes it, the government is paid taxes of $\tau\pi_{t+1}$, the young manager receives $[1 - d]\pi_{t+1}$, and lenders get their promised repayment. If the firm is insolvent at $t + 1$, all output is lost in bankruptcy procedures. In this case, old managers get nothing, no tax is paid, and lenders receive the bailout if any is granted. If the firm is solvent and there is diversion, the firm defaults strategically, the old manager takes $[d - \tau]q_{t+1}$, and the rest of the output is lost in bankruptcy procedures. Lenders receive the bailout if any is granted. Finally, if the firm defaults, the young manager receives an aid payment from the

---

2 Because we will focus on symmetric equilibria, we will not distinguish individual from aggregate variables.
government \((a_{t+1})\) that can be arbitrarily small.\(^3\) Thus, a firm’s internal funds evolve according to

\[
 w_{t+1} = \begin{cases} 
 (1 - d) \pi_{t+1} & \text{if } q_{t+1} > L_{t+1} \text{ and no diversion} \\
 a_{t+1} & \text{otherwise} 
\end{cases}
\]  (4)

In the initial period internal funds are \(w_0 = (1 - d) w_{-1}\) and the tax is \(\tau w_{-1}\). For concreteness, we make the following two assumptions.

**Contract Enforceability Problems.** If at time \(t\) the manager incurs a non-pecuniary cost \(b \cdot [w_t + b_t][d - \tau]\), then at \(t + 1\) he or she will be able to divert provided the firm is solvent.

**Systemic Bailout Guarantees.** If a majority of firms becomes insolvent, the government pays lenders the outstanding debts of all defaulting firms. Otherwise, no bailout is granted.

Because guarantees are systemic, the decisions of managers are interdependent and are determined in the following credit market game. During each period, every young manager proposes a plan \(P_t = (I_t^r, I_t^s, b_t, \rho_t)\) that satisfies the budget constraint (2). Lenders then decide whether to fund these plans. Finally, every young manager makes a diversion decision \(\eta_t\), where \(\eta_t = 1\) if the manager sets up a diversion scheme, and zero otherwise. The problem of a young manager is thus to choose an investment plan \(P_t\) and a diversion strategy \(\eta_t\) to maximize his or her expected payoff:

\[
 \max_{P_t, \eta_t} \left[ E_t \xi_{t+1} [(1 - \eta_t[q_{t+1} - L_{t+1}] + \eta_t q_{t+1}) - b[w_t + b_t][d - \tau] \right] \text{ subject to (2)}
\]  (5)

where \(\xi_{t+1} = 1\) if \(q_{t+1} > L_{t+1}\), and zero otherwise.

Bailouts are financed by taxing solvent firms’ profits at a rate \(\tau < d\). The tax rate is set such that the expected present value of taxes equals the expected present value of bailout plus aid payments. To ensure that the bailout scheme does not involve a net transfer from abroad, we impose the following fiscal solvency condition

\[
 E_t \sum_{j=0}^{\infty} \delta^{-j} \left\{ \xi_{t+j+1} \pi_{t+j+1} \tau - \left[ 1 - \xi_{t+j+1} \right] \right\} \mid_{\tau < d} = 0, \quad \delta = \frac{1}{1 + r}
\]  (6)

Finally, we define financial liberalization as a policy environment that does not constrain risk taking by firms and thus allows firms to finance any type of investment plan that is acceptable to international investors.

6.2.1. Discussion of the Setup

The mechanism linking growth with the propensity to crisis requires that both borrowing constraints and systemic risk arise simultaneously in equilibrium in a financially liberalized economy. In most of the literature, there are models with either borrowing constraints or systemic risk, but not both. In our setup, in order to have

\(^3\) The aid payment is necessary to restart the economy in the wake of a systemic crisis.
both it is necessary that enforceability problems interact with systemic bailout guarantees. If only enforceability problems were present, lenders would be cautious and the equilibrium would feature borrowing constraints, but lenders would not allow firms to risk insolvency. If only systemic guarantees were present, there would be no borrowing constraints, so risk taking would not be growth enhancing.

It is necessary that guarantees be systemic. If bailouts were granted whenever there was an idiosyncratic default, borrowing constraints would not arise because lenders would always be repaid—by the government.

The government’s only role is to transfer fiscal resources from no-crisis states to crisis states. The fiscal solvency condition (6) implies that in crisis times the government can borrow at the world interest rate—or that it has access to an international lender of last resort—to bail out lenders, and that it repays this debt in no-crisis times by taxing solvent domestic firms. In the appendix, we present evidence on bailouts that supports these assumptions.

Managers receive an exogenous share $d$ of profits. The advantage of this assumption and of the overlapping generation’s structure is that we can analyze financial decisions period-by-period. Among other things, we do not have to take into account the effect of the firm’s value (i.e., the future discounted profits of the firm) on a manager’s decision to default strategically. This is especially useful in our setting, where financial decisions are interdependent across agents because of the systemic nature of bailout guarantees.

There are only two states of nature, and the agents’ choice of production technology determines whether or not systemic risk arises. This is a simple way to represent the basic mechanism underlying more realistic situations like currency mismatch, where insolvency risk arises endogenously because firms that produce for the domestic market issue debt denominated in foreign currency. Modeling currency mismatch makes the analysis more complicated because one needs to consider two sectors and characterize the behavior of their relative price. In Ranciere and others (2003), we describe how a mechanism analogous to ours emerges in a two-sector economy where systemic risk is generated by currency mismatch.

We will consider two types of production technologies: one with constant and one with decreasing returns to investment. The constant returns setup allows us to simplify the presentation dramatically, but it has implausible implications for the world income distribution and the world interest rate in the very long run. We then show that with decreasing returns systemic risk accelerates growth if the level of income is sufficiently low, but does not increase growth indefinitely. When the economy becomes rich, it must switch to a safe path.

### 6.2.2. Constant Returns Technologies

Here, we consider the case in which the production functions in (1) are linear:

$$
g(I) = \sigma I, f(I) = \theta I, \quad \text{with } \delta^{-1} = 1 + r \leq \mu \theta < \sigma < \theta\quad (7)
$$

In the good state the risky return ($\theta$) is greater than the safe one ($\sigma$). However, to make it clear that the positive link between growth and systemic risk in our
mechanism does not derive from the assumption that risky projects have a greater mean return than safe ones, we restrict the risky technology to have an expected return \( \frac{u}{H} \) that is lower than the safe one \( \frac{\omega}{H} \). The condition \( 1 + r \leq u \) guarantees that both projects have a positive net present value.

### 6.2.2.1. Equilibrium Risk Taking

Here, we characterize the conditions under which borrowing constraints and systemic risk can arise simultaneously in a symmetric equilibrium. Define a systemic crisis as a situation where a majority of firms goes bust, and denote the probability at date \( t \) that this event occurs in the next period by \( 1 - \xi_{t+1} \), where \( \xi_{t+1} \) equals either \( u \) or 1. Then, a plan \( (I_t, I_s, b_t, w_t) \) is part of a symmetric equilibrium if it solves the representative manager’s problem, taking \( \xi_{t+1} \) and \( w_t \) as given.

The next proposition characterizes symmetric equilibria at a point in time. It makes three key points. First, binding borrowing constraints arise in equilibrium, and investment is constrained by internal funds only if contract enforceability problems are severe:

\[
0 \leq h < [1 + r] \xi_{t+1} \equiv \bar{h}_{t+1}, \quad \xi_{t+1} \in \{1, u\}
\]  

(8)

Lenders are willing to lend up to the point where borrowers do not find it optimal to divert. When (8) does not hold, the expected debt repayment is lower than the diversion cost \( h[w_t + b_t] \) for all levels of \( b_t \), and no diversion takes place. Thus, when (8) does not hold, lenders are willing to lend any amount. Secondly, systemic risk taking eases, but does not eliminate, borrowing constraints and allows firms to invest more than under a safe plan. This is because systemic risk taking allows agents to exploit the subsidy implicit in the guarantees and thus they face a lower expected cost of capital. Thirdly, systemic risk may arise endogenously in a liberalized economy only if bailout guarantees are present. Guarantees, however, are not enough. It is also necessary that a majority of agents coordinates in taking on insolvency risk, that crises be rare, and that contract enforceability problems are not “too severe” \( (h > \bar{b}) \):

\[
h := \frac{\sigma - \theta u^2}{2(1 - u)} - \frac{[(\sigma - \theta u)^2 - 4\omega \delta^{-1}(1 - u)(\sigma - \theta u)]^{1/2}}{2(1 - u)}
\]  

(9)

When \( h \) is too small, taking on risk does not pay because the increase in leverage is too small to compensate for the risk of insolvency.

**Proposition 1 (Symmetric Credit Market Equilibria [CME])** Borrowing constraints arise in equilibrium only if the degree of contract enforceability is not too high: \( h < \bar{h}_{t+1} \). If this condition holds, then:

1. There always exists a “safe” CME in which all firms only invest in the safe technology and a systemic crisis in the next period cannot occur \( (\xi_{t+1} = 1) \).

---

4 In other words, because higher average growth derives from an increase in borrowing ability because of the undertaking of systemic risk, the mechanism does not depend on the existence of a “mean-variance” channel. That is, the mechanism does not require that high-variance technologies have a higher expected return than low-variance technologies.
2. Under financial liberalization there also exists a “risky” CME in which \( \xi_{t+1} = u \) and all firms invest in the risky technology if and only if crises are rare events (\( u > 1/2 \)) and \( h > b \).

3. In both safe and risky CMEs, credit and investment are constrained by internal funds:

\[
b_t = [m_t - 1]w_t, \quad I_t = m_tw_t, \quad \text{with} \quad m_t = \frac{1}{1 - h\delta(\xi_{t+1})^{-1}}
\]

The intuition underlying the safe equilibrium is the following. Given that all other managers choose a safe plan, a manager knows that no bailout will be granted next period. Because lenders must break even, the manager must internalize the insolvency risk. Thus, she will choose a safe technology, which has a greater expected return than the risky technology (i.e., \( \sigma > u\theta \)). Because the firm will not go bankrupt in any state, the interest rate that the manager has to offer satisfies \( 1 + \rho_t = 1 + r \). It follows that lenders will be willing to lend up to an amount that makes the no diversion constraint binding: \( (1 + r)b_t \leq h(w_t + b_t) \).

By substituting this borrowing constraint in the budget constraint we can see that there is a financial bottleneck: investment equals internal funds times a multiplier \( [I_t = w_tm'] \), where \( m' = (1 - h\delta)^{-1} \).

Consider now the risky equilibrium. Given that all other managers choose a risky plan, a young manager expects a bailout in the bad state, but not in the good state. The key point is that because lenders will get repaid in full in both states, the interest rate allowing lenders to break even is again \( 1 + \rho_t = 1 + r \). It follows that lenders will be willing to lend up to an amount that makes the no diversion constraint binding: \( (1 + r)b_t \leq h(w_t + b_t) \).

By substituting this borrowing constraint in the budget constraint we can see that there is a financial bottleneck: investment equals internal funds times a multiplier \( [I_t = w_tm'] \), where \( m' = (1 - h\delta)^{-1} \).

Finally, there is no CME in which both \( I^r > 0 \) and \( I^s > 0 \). The restrictions on returns and the existence of bankruptcy costs rule out such an equilibrium. Because in a safe equilibrium no bailout is expected, a firm has no incentive to

---

5 This is a standard result in the macroeconomics literature on credit market imperfections (e.g., Bernanke and others [1999] and Kiyotaki and Moore [1997]).
invest any amount in the risky technology as its expected return, \( u \), is lower than the safe return, \( \sigma \). In a risky equilibrium, firms have no incentive to invest any amount in the safe technology as in the bad state all output is lost in bankruptcy procedures, and in the good state the risky return is greater than the safe (\( \sigma < \theta \)).

**6.2.2.2. Economic Growth**

We have loaded the dice against finding a positive link between growth and systemic risk. First, we have restricted the expected return on the risky technology to be lower than the safe return (\( \theta u < \sigma \)). Second, we have allowed crises to have large financial distress costs as internal funds collapse in the wake of crisis (i.e., the aid payment \( [a_{t+1}] \) can be arbitrarily small.

Here, we investigate whether systemic risk is growth enhancing in the presence of borrowing constraints by comparing two symmetric equilibria, safe and risky. In a safe (risky) equilibrium in every period agents choose the safe (risky) plan characterized in Proposition 1. We ask whether average growth in a risky equilibrium is higher than in a safe equilibrium. The answer to this question is not straightforward because an increase in the probability of crisis, \( 1 - u \), has opposing effects on growth. One the one hand, when \( 1 - u \) increases, so does the subsidy implicit in the bailout guarantee. This in turn raises the leverage ratio of firms and the level of investment and growth along the lucky no-crisis path. On the other hand, an increase in \( 1 - u \) also makes crises more frequent, which reduces average growth.

In what follows, we assume that the aid payment is a share \( \alpha \) of the internal funds that the firm would have received had no crisis occurred:

\[
a_{t+1} = \alpha[1 - d] \pi_{t+1} \big|_{(\Omega_{t+1}=1)}, \quad \alpha \in (0,1)
\]  

The smaller \( \alpha \), the greater the financial distress costs of crises. Assumption (11) implies that although a richer economy experiences a greater absolute loss than a poor economy, in the aftermath of crisis the richer economy remains richer than the poor economy. Below, we discuss the implications of assuming instead that \( a_{t+1} \) is a constant.

In a safe symmetric equilibrium, crises never occur; that is, \( \zeta_{t+1} = 1 \), in every period. Thus, internal funds evolve according to \( w'_{t+1} = [1 - d] \pi'_{t+1} \), where profits are \( \pi'_{t+1} = [\sigma - h] m' w_r \). It follows that the growth rate, \( g^s \), is given by

\[
1 + g^s = [1 - d][\sigma - h] m' w_r \equiv \gamma', \quad m' = \frac{1}{1 - h\delta}
\]  

Because \( \sigma > 1 + r \), the lower \( h \), the lower the growth rate. Consider now a risky symmetric equilibrium. Because firms use the risky technology, \( \zeta_{t+1} = u \) every period. Thus, there is a probability \( u \) that firms will be solvent at \( t + 1 \) and

---

6 Taxes in our current setup do not distort the incentives to divert income. In the proof of Proposition 1, we also consider an extension with a distortionary setup where old managers of solvent non-diverting firms are taxed, but those of diverting firms are not taxed. We find that the equilibria of Proposition 1 exist provided \( \tau^{old} < dh / u\theta \) and \( u \) is large enough.
their internal funds will be \( w_{t+1} = [1 - d]\pi'_{t+1}, \) where \( \pi'_{t+1} = [\theta - u^{-1}h]m'w_r. \) However, with probability \( 1 - u \), firms will be insolvent at \( t + 1 \) and their internal funds will equal the aid payment: \( w_{t+1} = a_{t+1}. \) Because crises can occur in consecutive periods, growth rates are independent and identically distributed over time. Thus, the mean growth rate is

\[
E(1 + g) = [u + \alpha(1 - u)]\gamma^u \equiv \gamma', \\
\gamma^u = [1 - d][\theta - u^{-1}h]m', \\
m' = \frac{1}{1 - u^{-1}h} \delta \tag{13}
\]

The following proposition compares the mean growth rates in (12) and (13) and establishes conditions for systemic risk to be growth enhancing.\(^7\)

**Proposition 2 (Growth and Systemic Risk)** Given the proportional aid payment (11), for any financial distress costs of crisis (i.e., for any \( \alpha \in (0, 1) \)):

1. A financially liberalized economy that follows a risky path experiences higher average growth than one that follows a safe path.
2. The greater the degree of contract enforceability within the bounds \((h, \bar{h})\), the greater the growth enhancing effects of systemic risk.
3. Guarantees are fundable via domestic taxation.

**The Leverage Effect.** A shift from a safe to a risky equilibrium increases the likelihood of crisis from 0 to \( 1 - u \). This shift results in greater leverage \( \left( \frac{b'_r}{w_r} - \frac{b'_s}{w_s} = m' - m' \right) \), which increases investment and growth in periods without crisis. We call this the leverage effect. However, this shift also increases the frequency of crises and the resultant collapse in internal funds and investment, which reduces growth. Proposition 2 states that the leverage effect dominates the crisis effect if the degree of contract enforceability is high, but not too high. If \( h \) is sufficiently high, the undertaking of systemic risk translates into a large increase in leverage, which compensates for the potential losses caused by crises. Of course, if \( h \) were excessively high, there would be no borrowing constraints to begin with and risk taking would not enhance growth.

An increase in the degree of contract enforceability—a greater \( h \) within the range \((h, \bar{h})\)—leads to higher profits and growth in both risky and safe economies. An increase in \( h \) can be seen as a relaxation of financial bottlenecks allowing greater leverage in both economies. However, such an institutional improvement benefits the risky economy to a greater extent as the subsidy implicit in the guarantee amplifies the effect of better contract enforceability.\(^8\)

---

\(7\) Although expected profits are greater in the risky than in the safe equilibrium, it does not follow that the risky equilibrium must be played every period. Proposition 2 simply compares situations where a safe equilibrium is played every period with situations where a risky equilibrium is played every period.

\(8\) Needless to say, the first best is to improve financial institutions dramatically, so that \( h \) exceeds \( \bar{h} \) and borrowing constraints are no longer binding. However, we are considering economies where such institutional changes may not be possible in the medium run.
Notice that whenever systemic risk arises, it is growth enhancing. This is because the thresholds $h$ and $-h$ in Propositions 1 and 2 are the same. Managers choose the risky technology when the expected return of the risky plan is greater than that of the safe plan. The resulting systemic risk is associated with higher mean growth because in an $Ak$ world with an exogenous savings rate, the expected growth rate of the economy equals the expected rate of return times the savings rate. The tiny aid payment after a crash does not undermine this result because it does not affect the return expected ex ante by managers.

### 6.2.2.3. Skewness and Growth

In a risky equilibrium, firms face endogenous borrowing constraints and credit is constrained by internal funds. As long as a crisis does not occur, internal funds accumulate gradually. Thus, credit grows fast but only gradually. In contrast, when a crisis erupts there are widespread bankruptcies, internal funds collapse, and credit falls abruptly. The upshot is that in a risky equilibrium the growth rate can take on two values: low in the crisis state or high in the no-crisis state.

Figure 6.2 illustrates the limit distribution of growth rates by plotting different paths of $\log(w_t)$ corresponding to different realizations of the risky growth process. This figure makes it clear that greater long-run growth comes at the cost of occasional busts. We can see that over the long run the risky paths generally out-
perform the safe path, with the exception of a few unlucky risky paths. If we increased the number of paths, the cross-section distribution would converge to the limit distribution. The choice of parameters used in the simulation depicted in Figure 6.2 is detailed in the appendix. The probability of crisis (4.13 percent) corresponds to the historical probability of falling into a systemic banking crisis in our sample of 58 countries over 1981–2000. The financial distress costs are set to 50 percent, which is a third more severe than our empirical estimate derived from the growth differential between tranquil times and a systemic banking crisis. The degree of contract enforceability is set just above the level necessary for risk taking to be optimal (β = 0.5). Finally, the mean return on the risky technology is 2 percent below the safe return. Nevertheless, growth in the risky equilibrium is on average 3 percent higher than in the safe equilibrium.

Using equation (13), the credit growth process in the risky equilibrium satisfies \( \log(b_t) - \log(b_{t-1}) = \log(y^\ast) + c_t \), where \( \log(y^\ast) \) is the credit growth in tranquil times and \( c_t \) is the growth decrease during crisis: it equals 0 with probability \( u \), and \( \log(\alpha) \) with probability \( 1 - u \). We show in the appendix that the skewness of credit growth in the risky equilibrium is

\[
sk = \left( \frac{1 - u}{u} \right)^{1/2} - \left( \frac{u}{1 - u} \right)^{1/2}
\]

We know from Proposition 1 that a risky equilibrium exists only if crises are rare events. In particular, the probability of crisis \( 1 - u \) must be less than half. Thus, the distribution of growth rates must be negatively skewed in a risky equilibrium. In contrast, in the safe equilibrium there is no skewness as the growth process is smooth. Because systemic risk arises in equilibrium only when it is growth enhancing (by Proposition 2), our model predicts that there is a positive link between mean growth and negative skewness. Because the probability of falling into a systemic banking crisis in our sample is 4.13 percent (14) implies that the credit growth distribution in the risky equilibrium exhibits large negative skewness: \(-4.6\).

6.2.2.4. Net Expected Value of Managers’ Income

There are fiscal costs associated with systemic risk because along a risky path bailouts must be granted during crises, and these bailouts are financed by taxing
firms during good times. Proposition 2 states that bailouts are fundable, but is the expected present value of managers’ income net of taxes greater along a risky path than along a safe path? To address this question consider the present value of managers’ net income in a risky and in a safe equilibrium:

\[
Y^r = w + \delta(1 - d)(\theta u - (1 + r)m' \frac{w}{1 - \delta \gamma'}) \\
Y^s = w + \delta(1 - d)(\sigma - (1 + r)m' \frac{w}{1 - \delta \gamma'}) \tag{15}
\]

The net expected present value of income depends on three factors: the expected excess return on investment \((\theta u - (1 + r), \sigma - (1 + r))\), the degree of leverage \((m', m')\), and the mean growth rate of the economy \((\gamma', \gamma')\).\(^{11}\) Because we have imposed the condition \(u\theta < \sigma\), the following trade-off arises. Projects have a higher expected rate of return in a safe equilibrium than in a risky one, but leverage and scale are smaller \((m' < m')\). In a risky economy, the subsidy implicit in the guarantees attracts projects with a lower expected excess return but permits greater scale by relaxing borrowing constraints. This relaxation of the financial bottleneck is dynamically propagated at a higher growth rate \((\gamma' > \gamma')\). The next corollary shows that if the leverage effect is strong enough, the increase in expected income generated by systemic risk is greater than the associated expected bailout cost.

**Corollary 1** When bailouts are financed by taxing nondefaulting firms, there exists a unique threshold for the degree of contract enforceability \(\hat{h} < u\delta^{-1}\) such that the expected present value of managers’ income net of taxes is greater in a risky than in a safe equilibrium for any financial distress cost of crisis (i.e., for all \(\alpha \in (0, 1)\)) if and only if \(h > \hat{h}\).

Because of the leverage effect introducing a (small) likelihood of financial crises can actually increase managers’ income net of taxes. The reason is that because firms are credit constrained, taking on insolvency risk allows them to borrow and invest more. Because crises are rare, if \(h\) is large the resulting increase in income more than compensates for the expected bailout costs. Crises must be rare in order for them to occur in equilibrium. If the probability of crisis were high, agents would not find it profitable to take on risk in the first place. Notice that because the threshold \(\hat{h}\) might be higher than the risk taking threshold \(h\), there may be a range \((\hat{h}, \hat{h})\) where systemic risk increases mean growth but reduces \(Y\).

Finally, we would like to stress that our risk-neutral setup is not designed to analyze the welfare effects of a greater propensity to crisis. For such analysis it would be more appropriate to consider a setup with risk aversion, so that one could trade off the growth-enhancing effect of systemic risk taking against the costs of greater income uncertainty.\(^{12}\)

\(^{11}\)The sums \(Y^r\) and \(Y^s\) converge if and only if the manager’s payout rate \(d\) is greater than \(d\) defined in the appendix.

\(^{12}\)Barro (2007) considers a rare disasters setup and shows that, in the presence of risk aversion, changes in the probability of disaster have major implications for welfare.
6.2.3. Decreasing Returns Technologies

Here, we consider the case in which the production functions in (1) are concave. We show that systemic risk may accelerate growth in a transition phase, but not indefinitely. At some point, an economy must switch to a safe path.

To capture the parameter restrictions in (1) we let the safe production function be proportional to the risky one \( g(I) \equiv \chi \cdot f(I) \) and use the following parametrization:

\[
f(I) = I^\lambda, \quad g(I) = \chi \cdot I^\lambda, \quad \lambda \in (0, 1), \quad 0 < u < \chi < 1
\]

Because \( u < \chi < 1 \), the risky technology yields more than the safe technology in the good state but has a lower expected return. This captures the same idea as (16).

In order to reduce the number of cases we need to consider, we assume that at any point in time, either the risky or the safe technology can be used but that both cannot be used simultaneously. Also, we assume that when a majority of firms is insolvent a bailout is granted to the lenders of insolvent firms that did not divert funds. The rest of the model remains the same. Under these assumptions one can derive the following proposition, which is the analogue of Proposition 1.

**Proposition 3** Borrowing constraints arise in equilibrium only if the degree of contract enforceability is not too high \( h > \xi_{r+1} \delta^{-1} \). If this condition holds, then:

1. For all levels of \( w \) there exists a “safe” CME in which all firms only invest in the safe technology and a systemic crisis in the next period cannot occur: \( \xi_{r+1} = 1 \).
2. There is a unique threshold for internal funds \( w^* \in \left( \frac{I_m}{m}, \frac{I_r}{m} \right) \), such that there also exists a risky CME in which \( \xi_{r+1} = u \) if and only if \( w < w^* \) and \( h \in (h^*, h) \), where \( h^* \) is defined in the appendix.
3. In the safe and risky CME borrowing constraints bind for internal funds lower than \( \frac{I_m}{m} \) and \( \frac{I_r}{m} \), respectively. Investment is given by

\[
I' = \begin{cases} \frac{m' w}{m} & \text{if } w < \frac{I_m}{m'} \\ I & \text{if } w \geq \frac{I_m}{m'} \end{cases}, \quad I'' = \begin{cases} m' w & \text{if } w < \frac{I_r}{m'} \\ \frac{I_r}{m} & \text{if } w \geq \frac{I_r}{m'} \end{cases}
\]

where \( g'(I) = 1 + r \) and \( f'(I) = 1 + r' \).

This proposition identifies two levels of capital: the “efficient level” \( \hat{I} \), which is the one that would be attained in a standard neoclassical economy, and the “Pangloss level” \( \bar{I} \), which equalizes the marginal return of the risky technology in the good state to \( 1 + r \). Clearly, \( \bar{I} \) is larger than \( \hat{I} \). In a risky (safe) CME, borrowing constraints bind up to \( w = \hat{I}/m' (\bar{I}/m') \). As long as borrowing constraints bind, investment is equal to the one in the \( Ak \) setup: \( I' = w m'/I' \). However, when borrowing constraints cease to bind, investment remains unchanged as \( w \) increases.
The key point made by Proposition 3 is that although a safe CME always exists, a risky CME exists only for levels of internal funds lower than $w^*$. This threshold, however, is high enough that whenever borrowing constraints bind, a risky CME exists. This is because $w^*$ is larger than $I/m'$. The intuition is the following. As in the $Ak$ setup, there is a leverage effect and an efficiency effect. At low levels of $w$, the increase in leverage more than compensates for the lower expected productivity of the risky technology. This advantage, however, weakens as $w$ increases because there are decreasing returns in production. Thus, at some point, $w^*$, the advantage disappears and the risky CME ceases to exist.

Notice that a poor economy behaves like an $Ak$ economy. If $w < I/m'$, borrowing constraints bind and firms have incentives to take on risk as a way to increase leverage. In fact, if we replace the production function $I^A$ by $\theta I$, we can see that internal funds evolve identically as in Section 6.2.2. Next, we derive a result analogous to Proposition 2 by comparing the expected growth rate \( \frac{g_t}{1 + \delta} = E_t (w_{t+1}/|w_t|) \) of an economy that travels from a risky to a safe phase—a “risky economy”—with an economy that is always on the safe path—a “safe economy.” We assume that a risky CME is played whenever it exists (i.e., for all $w < w^*$).

**Proposition 4** Under the proportional aid assumption (11), there exists a threshold for the degree of contract enforceability $h^*$, such that for any financial distress cost of crises (i.e., for any $\alpha \in (0, 1)$):

- Systemic risk arises in equilibrium only if $w_t < w^*$ and $h \in (h^*, 1)$.
- Whenever systemic risk arises, it increases the expected growth rate.
- If $w_t$ reaches $w^*$, there is a shift to a safe path. Furthermore, if $\delta \leq 1 - \delta$, output converges to the efficient level $q_{t+1} = g(\hat{I})$.

This proposition makes two points. First, whenever systemic risk arises, it accelerates expected growth.\(^{13}\) Second, systemic risk and the increase in expected growth cannot last forever, but only during a transition phase. As the economy becomes richer, there must be a shift to a safe path before $w$ reaches the Pangloss level $I$. This shift is a key difference with respect to the results derived in the $Ak$ setup. This result follows because as the risky economy becomes sufficiently rich, borrowing constraints cease to bind, so the leverage benefits arising from risk taking go away. Recall that on a risky path, borrowing constraints are binding up to $w = I/m'$, which is less than $w^*$. Finally, we show in the proof that under the condition $\delta \leq 1 - \delta$, the transition curve is always above the 45-degree line in the $(w_t, w_{t+1})$ space. Thus, the economy will not cycle between the safe and risky phases. Once it reaches the safe phase, it stays there forever. In this case, output converges to $g(\hat{I})$ and the excess of $w$ over $\hat{I}$ is saved and thus earns the world interest rate.

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\(^{13}\)This follows because the thresholds for $w_t$ and $h$ are the same as those in Proposition 3. The intuition is the same as in Proposition 2.
6.3. SYSTEMIC RISK AND GROWTH: THE EMPIRICAL LINK

The empirical analysis of the link between systemic risk and growth faces several challenges. The first challenge is measurement. In Section 6.3.1, we discuss why skewness of credit growth is a good de facto measure of systemic risk and how skewness is linked to financial crisis indexes. The second challenge is the identification of a channel linking systemic risk and growth. In Section 6.3.2, after having established a robust and stable partial correlation between the skewness of credit growth and GDP growth, we test an identifying restriction derived from our theoretical mechanism: the link between skewness and growth is strongest in the set of financially liberalized countries with moderately weak institutions. The third challenge is robustness. In Section 6.3.3, we present an alternative analysis of the link between systemic risk and growth based on several indexes of financial crises. In Section 6.3.4, we test a further implication of our theoretical mechanism which is that skewness increases growth via its effect on investment. Finally, Section 6.3.5 presents a set of additional robustness tests.

6.3.1. Measuring Systemic Risk

We use the skewness of real credit growth as a de facto indicator of financial systemic risk. The theoretical mechanism that links systemic risk and growth implies that financial crises are associated with higher mean growth only if they are rare and systemic. If the likelihood of crisis were high, there would be no incentives to take on risk. If crises were not systemic, borrowers could not exploit the subsidy implicit in the guarantees and increase leverage. These restrictions—rare and systemic crises—are the conditions under which negative skewness arises. During a crisis there is a large and abrupt downward jump in credit growth. If crises are rare, such negative outliers tend to create a long left tail in the distribution and reduce skewness. When there are no other major shocks, rare crisis countries exhibit strictly negative skewness.

To illustrate how skewness is linked to systemic risk, the kernel distributions of credit growth rates for India and Thailand are given in Figure 6.3. India, the

---

14 Skewness is a measure of the degree of asymmetry of a distribution and is computed as

\[ sk = \frac{1}{n} \sum_{i=1}^{n} \left( \frac{y_i - \bar{y}}{\text{var}^{3/2}} \right)^3 \]

where \( \bar{y} \) is the mean and \( \text{var} \) is the variance. If the left tail is more pronounced that the right tail, the distribution is said to have negative skewness. If the reverse is true, it has positive skewness.

15 We use the skewness of real credit rather than GDP growth because the former reflects more accurately the effects of crisis on credit constrained firms. In middle-income countries, there is a pronounced sectoral asymmetry in the response to crisis; although large export-oriented firms expand because of the real depreciation, small nontradables firms contract. Because the former have access to world financial markets, though the latter are bank-dependent, this asymmetry dampens GDP fluctuations more than credit fluctuations.

16 The kernel distributions are smoothed histograms. They are estimated using an Epanechnikov kernel. For comparability we choose the same bandwidth for both graphs.
safe country, has a lower mean and is quite tightly distributed around the mean, with skewness close to zero. Meanwhile, Thailand, the risky fast-growing country, has a very asymmetric distribution with large negative skewness.

Negative skewness can also be caused by forces other than financial systemic risk. We control explicitly for the two exogenous events that we would expect to lead to a large fall in credit: severe wars and large deteriorations in the terms of trade. Our data set consists of all countries for which data are available in the *World Development Indicators* and *International Financial Statistics* for the period 1960–2000. Out of this set of 83 countries we identify 25 as having a severe war or a large deterioration in the terms of trade. 17

Crisis are typically preceded by lending booms. However, the typical boom-bust cycle generates negative, not positive, skewness. Even though during a lending boom credit growth rates are large and positive, the boom typically takes place for several years and in any given year is not as large in magnitude as the typical bust. 18

<table>
<thead>
<tr>
<th></th>
<th>India</th>
<th>Thailand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.064</td>
<td>0.094</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.055</td>
<td>0.126</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.132</td>
<td>-0.824</td>
</tr>
</tbody>
</table>

**Figure 6.3** Kernel distributions of real credit growth, 1980–2002.

---

17 The severe war cases are: Algeria, Congo, Rep., Congo, Dem. Rep., El Salvador, Guatemala, Iran, Nicaragua, Peru, Philippines, Sierra Leone, South Africa, and Uganda. The large terms of trade deterioration cases are: Algeria, Congo, Rep., Congo, Dem. Rep., Côte d’Ivoire, Ecuador, Egypt, Ghana, Haiti, Iran, Pakistan, Sri Lanka, Nicaragua, Nigeria, Sierra Leone, Syria, Togo, Trinidad and Tobago, Uganda, Venezuela, and Zambia. A detailed description of how these countries were identified is given in the appendix.

6.3.1.1 Correspondence Between Skewness and Crisis Indexes

In principle, the sample measure of skewness can miss cases of risk taking that have not yet led to crisis. This omission, however, makes it more difficult to find a negative relationship between growth and realized skewness. Thus, it does not invalidate our empirical strategy. What is important, though, is that skewness captures mostly financial crises once we control for wars and large terms of trade deteriorations. To investigate this correspondence, we consider nine standard indexes: three of banking crises, four of currency crises, and two of sudden stops.\textsuperscript{19} We then identify two types of crises: coded crises, which are classified as a crisis by any one of the indexes, and consensus crises. The latter are meant to capture truly severe crises and are defined as follows: First, the episode is identified by at least two banking crises indexes or two currency crises indexes or two sudden stop indexes. Second, it has not been going on for more than 10 years, and, third, it does not exhibit credit growth of more than 10 percent.\textsuperscript{20}

First, we find that our skewness measure captures mostly coded crises as: (1) the elimination of two (or three) extreme negative credit growth observations suppresses most of the negative skewness; and (2) at least 79 percent of these extreme observations correspond to coded crises. Table 6.1, Panel A, shows that among the countries with negative skewness, 90 percent (79 percent) of the two (three) extreme negative observations are coded as a crisis. Moreover, if we eliminate the two (three) extreme observations, skewness increases on average from $-0.7$ to $+0.16$ (0.36), and in 79 percent (90 percent) of the cases, skewness increases to more than $-0.2$, which is close to a symmetric distribution. These are particularly high numbers given the fact that we forced each country to have two (three) outliers. It remains, in theory, a possibility that skewness is affected by nonextreme observations. To consider this possibility, for each country we eliminate the three observations whose omission results in the highest increase in skewness. Panel B in Table 6.1 shows that this procedure eliminates virtually all negative skewness. Moreover, 79 percent of the omitted observations correspond to coded crises.\textsuperscript{21}

Second, there is significantly less negative skewness once we exclude consensus crises. Table 6.1, Panel C, shows that if we eliminate the observations with a consensus crisis, skewness increases in 32 out of the 35 crisis countries.\textsuperscript{22} On average,\textsuperscript{19}These indexes are described in the appendix.\textsuperscript{20}This last criterion ensures that the beginning of the crisis is the year in which it actually starts having macroeconomic consequences. For example, the indexes of Caprio and Klingebiel (CK) and Detragiache and Demirgüç-Kunt (DD) report 1997 as the start of the crisis in Thailand when credit growth was still strong ($+12$ percent) before contracting abruptly in 1998 ($-12$ percent). The application of this criterion adjusts the start date in nine cases (all banking crises): Argentina (1981, 1989), Brazil (1994, 1998), Korea (1997), Mexico (1994), Norway (1987), and Thailand (1982–83, 1997).\textsuperscript{21}Table EA4 in the appendix details for each country the list of extreme observations, the associated coded or consensus crises, and the effect on skewness of eliminating two (three) observations.\textsuperscript{22}This procedure eliminates on average 2.9 observations for each country.
<table>
<thead>
<tr>
<th>TABLE 6.1</th>
<th>Skewness, Crises, and Extreme Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PANEL A. EXTREME OBSERVATIONS, CODED CRISSES, AND SKEWNESS</strong></td>
<td></td>
</tr>
<tr>
<td>Sample: 29 countries with negative skewness (1981–2000)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Observations Eliminated</th>
<th>Percentage of Crisis Years</th>
<th>Average Skewness</th>
<th>Average Skewness with Skewness &gt; 0.2</th>
<th>Share of Countries with Skewness &gt; 0.2</th>
<th>Share of Countries with Skewness &gt; 0 or Reduced by 80% in Absolute Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>90</td>
<td>−0.70</td>
<td>0.16</td>
<td>79%</td>
<td>65%</td>
</tr>
<tr>
<td>3</td>
<td>79</td>
<td>−0.70</td>
<td>0.36</td>
<td>90%</td>
<td>87%</td>
</tr>
</tbody>
</table>

Note: Panel A assesses whether extreme credit growth observations drive negative skewness. We consider the countries with negative skewness, and for each country we eliminate the two (or three) lowest credit growth observations. We then compute the effect of these extreme observations on skewness and determine whether they are coded as a crisis by any of the 10 crisis indexes we list in the appendix. Average skewness figures correspond to cross-country averages across the sample of 29 countries with negative skewness.

Source: Table EA4 in the appendix.

| **PANEL B. OBSERVATIONS WITH HIGHEST IMPACT ON SKEWNESS, CODED CRISSES, AND SKEWNESS** |
| Sample: 29 countries with negative skewness (1981–2000) |

<table>
<thead>
<tr>
<th>Observations Eliminated</th>
<th>Percentage of Crisis Years</th>
<th>Average Skewness</th>
<th>Average Skewness with Skewness &gt; 0.2</th>
<th>Share of Countries with Skewness &gt; 0.2</th>
<th>Share of Countries with Skewness &gt; 0 or Reduced by 80% in Absolute Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>75</td>
<td>−0.70</td>
<td>0.22</td>
<td>86%</td>
<td>72%</td>
</tr>
<tr>
<td>3</td>
<td>79</td>
<td>−0.70</td>
<td>0.45</td>
<td>97%</td>
<td>97%</td>
</tr>
</tbody>
</table>

Note: Panel B considers the possibility that negative skewness can also be affected by nonextreme credit growth observations. We look at the countries with negative skewness, and for each country we eliminate the two (three) observations whose joint omission results in the highest increase in skewness.

| **PANEL C. CONSENSUS CRISIS YEARS AND SKEWNESS** |
| Sample: 35 countries with at least one consensus crisis (1981–2000) |

<table>
<thead>
<tr>
<th>No. of Countries with Increased Skewness after Elimination of Crisis Years</th>
<th>Average Skewness of Credit Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete Distributions</td>
<td>Distributions without Crisis Years</td>
</tr>
<tr>
<td>32</td>
<td>−0.41</td>
</tr>
</tbody>
</table>

Note: Panel C assesses whether the exclusion of crises increases skewness. For each country we exclude consensus crises and compute the effect on skewness. Average skewness figures correspond to cross-country averages across the sample of 35 countries with at least one consensus crisis. Consensus crises are meant to capture truly severe crises. They are defined in Section 6.3.1.

Source: Table EA5 in the appendix.
skewness increases from $-0.41$ to $0.32$ and the percentage of crisis countries with skewness below $-0.2$ shrinks from 63 percent to 11 percent.\(^2\)

In sum, there is a fairly close correspondence between both measures. There are, however, advantages and disadvantages to the use of both skewness and crisis indexes as proxies for systemic risk. On the one hand, skewness simply looks for abnormal patterns in an aggregate financial variable and does not use direct information about the state of the financial system. On the other hand, it is objective and can be readily computed for large panels of countries over long time periods. Furthermore, skewness signals in a parsimonious way the severity of rare credit busts. In contrast, de jure banking crisis indexes are based on more direct information. Unfortunately, they are subjective, limited in their coverage over countries and time, and do not provide information on the relative severity of crises.\(^4\) Other financial crisis indexes (e.g., currency crisis and sudden stops) are, like skewness, de facto indexes.\(^5\) However, the rules followed to construct these indexes differ from one author to another. As a result, it is not unusual for these crisis indexes to identify different episodes.

Finally, consider Thailand as an example to illustrate the two procedures. Figure 6.4, panel A exhibits Thailand’s credit growth rates. We see two severe busts with negative growth rates (1980 and 1998–2000), and a slowdown with small positive growth rates (1985–86). Figure 6.4B displays the same information using histograms and kernel distributions, which are smoothed histograms. The first panel covers the entire sample, in which skewness is $-0.90$. The second panel eliminates the consensus crisis years: 1998–2000 and 1985–87. We see that although coded crises indexes capture the well-known 1998–2000 crisis, they do not report the severe 1980 bust and place the mild 1985–86 episode on an equal footing with the severe 1998–2000 crisis episode.\(^6\) As a result, when 1985–87 and 1998–2000 are eliminated, skewness remains almost unchanged at $-0.99$. If instead we eliminate the major negative outliers (1998–2000 and 1980), the third panel shows that skewness shrinks abruptly to $-0.196$. If we also

\(^{23}\)Table EA5 in the appendix presents for each country the list of consensus crises and skewness with and without consensus crises.

\(^{24}\)To illustrate the difficulty of measuring banking crises, consider the well-known indexes of Caprio and Klingebiel (CK) and Detragiache and Demirgüç-Kunt (DD). They report 35 and 42 crises, respectively, over 1981–2000 in our sample of 58 countries. Although DD is in part built on CK, there is a striking mismatch between the two: out of a total of 46 crisis episodes reported by at least one index, there are 16 episodes in which they do not agree at all on the existence of a crisis episode. Out of the remaining 30 crisis episodes, there are only 17 cases where the timing of crisis is the same. \(^{25}\)The appendix describes the crisis indexes.

\(^{26}\)Kaminsky and Reinhart (1999) in their well-known study on twin banking and currency crises do record a crisis in 1979. Moreover, the 1980 International Monetary Fund Article IV Mission in Thailand reports a credit crunch, a rapid deterioration of the financial position of financial institutions, and the collapse of a major finance company. It also mentions that the Central Bank reacted aggressively by providing emergency lending to the financial sector and by injecting liquidity through the newly created repurchase market.
eliminate 1986, the year with the next smallest growth rate, skewness becomes virtually zero (+0.04).

6.3.1.2. Variance and Excess Kurtosis

Rare and severe crises are associated not only with negative skewness but also with high variance and excess kurtosis. We consider each in turn.
Variance is the typical measure of volatility. For the purpose of identifying systemic risk there are, however, two key differences between variance and skewness. First, variance reflects not only large and abrupt busts that occur during crises, but may also reflect other more symmetric shocks. In contrast, skewness captures specifically asymmetric and abnormal patterns in the distribution of credit growth. Second, if crises were not rare but the usual state of affairs, unusually high variance, not large negative skewness, would arise. Therefore, unlike variance, skewness isolates the incidence of severe and rare crises from other sources of more frequent or more symmetric volatility.

Our model does not make predictions on how symmetric shocks affect growth. As we shall show below, our regression results do not contradict the negative link between variance and growth found by Ramey and Ramey (1995) and others.

Excess kurtosis captures both the fatness of the tails and the peakedness of a distribution relative to those of a normal distribution. Positive excess kurtosis can be generated either by extreme events or by a cluster of observations around the mean that affect the peakedness of the distribution. Consider the sample of 35 countries with at least one consensus crisis. For the vast majority of countries, excess kurtosis is driven by extreme observations associated with crises. In about one fifth of the sample, however, excess kurtosis is predominantly affected by observations near the center of the distribution. As a result, in our sample, the link between skewness and crises is empirically stronger than the link between excess kurtosis and crises.

6.3.2. Skewness and Growth

We start by presenting baseline evidence of the link between skewness and growth based on cross-section regressions estimated by OLS, and panel regressions.
estimated by GLS using 10-year nonoverlapping windows. We then test the identifying restriction of our theoretical mechanism by introducing interaction term effects in the growth regressions. The sample used in the regressions consists of the 58 countries that have experienced neither a severe war nor a large deterioration in the terms of trade.

6.3.2.1. Baseline Estimation

In the first set of equations we estimate, we include the three moments of credit growth in a standard growth equation:

\[ \Delta y_{it} = \gamma X_{it} + \beta_1 \mu_{\Delta B_{it}} + \beta_2 \sigma_{\Delta B_{it}} + \beta_3 k_{\Delta B_{it}} + \eta_t + \epsilon_{it} \]  

(17)

where \( \Delta y_{it} \) is the average growth rate of per capita GDP; \( \mu_{\Delta B_{it}}, \sigma_{\Delta B_{it}}, \) and \( k_{\Delta B_{it}} \) are the mean, standard deviation, and skewness of the growth rate of real bank credit to the private sector, respectively; \( X_{it} \) is a vector of control variables; \( \eta_t \) is a period dummy; and \( \epsilon_{it} \) is the error term. 34 Here, we consider a simple control set that includes initial per capita GDP and the initial ratio of secondary schooling. In Section 6.3.5, we show that similar results are obtained with an extended control set that includes the simple set plus the inflation rate, the ratio of government consumption to GDP, a measure of trade openness, and life expectancy at birth. 35 We do not include investment in (17) as we expect the three moments of credit growth, our variables of interest, to affect GDP growth through investment. 36

We consider three sample periods: 1961–2000, 1971–2000, and 1981–2000. 37 In the cross-sections, the moments of credit growth are computed over the sample period and initial variables are measured in 1960, 1970, or 1980. In the panels, the moments of credit growth are computed over each decade and the initial variables are measured in the first year of each decade. 38 All panel regressions are estimated with time effects. 39

Table 6.2 reports the estimation results. The novel finding is the negative partial correlation between the skewness of real credit growth and real GDP growth.
Systemic Crises and Growth

Skewness always enters with a negative point estimate that ranges between \(-0.244\) and \(-0.334\). These estimates are significant at the 5 percent level in the cross-section regressions and at the 1 percent level in the panel regressions. The positive partial correlation between the mean of credit growth and GDP growth is standard in the literature (e.g., Levine and Renelt [1992]). The negative partial correlation between the standard deviation and GDP growth is consistent with the finding of Ramey and Ramey (1995) on the negative link between growth and variance.

Are these estimates economically meaningful? To address this question consider India and Thailand over the period 1981–2000. India has near zero skewness, and Thailand a skewness of about \(-1\). The cross-sectional estimate of \(-0.32\) for 1981–2000 implies that a one-unit decline in skewness (from 0 to \(-1\)) is associated with a 0.32 percent increase in annual real per capita growth. This figure corresponds to a little less than a third of the per capita growth differential between India and Thailand over the same period.

### TABLE 6.2

**Skewness and Growth: Baseline Estimations**

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Estimation Technique</strong></td>
<td>OLS</td>
<td>FGLS</td>
<td></td>
<td>OLS</td>
<td>FGLS</td>
<td></td>
</tr>
<tr>
<td><strong>Unit of Observations</strong></td>
<td>Cross-Section</td>
<td>Nonoverlapping 10-Year Windows</td>
<td></td>
<td>Cross-Section</td>
<td>Nonoverlapping 10-Year Windows</td>
<td></td>
</tr>
<tr>
<td><strong>Moments of real credit growth:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real credit—mean</td>
<td>0.339***</td>
<td>0.348***</td>
<td>0.313***</td>
<td>0.156***</td>
<td>0.149***</td>
<td>0.159***</td>
</tr>
<tr>
<td>(0.05)</td>
<td>(0.056)</td>
<td>(0.053)</td>
<td>(0.011)</td>
<td>(0.011)</td>
<td>(0.012)</td>
<td></td>
</tr>
<tr>
<td>Real credit—standard deviation</td>
<td>-0.032</td>
<td>-0.068**</td>
<td>-0.071**</td>
<td>-0.049***</td>
<td>-0.064***</td>
<td>-0.048***</td>
</tr>
<tr>
<td>(0.024)</td>
<td>(0.03)</td>
<td>(0.029)</td>
<td>(0.01)</td>
<td>(0.009)</td>
<td>(0.009)</td>
<td></td>
</tr>
<tr>
<td>Real credit—skewness</td>
<td>-0.274**</td>
<td>-0.334**</td>
<td>-0.315**</td>
<td>-0.333***</td>
<td>-0.244***</td>
<td>-0.268***</td>
</tr>
<tr>
<td>(0.129)</td>
<td>(0.131)</td>
<td>(0.143)</td>
<td>(0.073)</td>
<td>(0.075)</td>
<td>(0.071)</td>
<td></td>
</tr>
<tr>
<td><strong>Control variables:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial secondary schooling</td>
<td>0.031**</td>
<td>0.024*</td>
<td>0.019</td>
<td>0.016***</td>
<td>0.021***</td>
<td>0.026***</td>
</tr>
<tr>
<td>(0.013)</td>
<td>(0.013)</td>
<td>(0.018)</td>
<td>(0.004)</td>
<td>(0.004)</td>
<td>(0.003)</td>
<td></td>
</tr>
<tr>
<td>Initial income per capita (in logs)</td>
<td>-0.222</td>
<td>-0.283</td>
<td>-0.344</td>
<td>-0.022</td>
<td>-0.182*</td>
<td>-0.209***</td>
</tr>
<tr>
<td>(0.247)</td>
<td>(0.273)</td>
<td>(0.348)</td>
<td>(0.093)</td>
<td>(0.095)</td>
<td>(0.062)</td>
<td></td>
</tr>
<tr>
<td>No. countries/No. observations</td>
<td>58/58</td>
<td>58/58</td>
<td>58/58</td>
<td>58/209</td>
<td>58/166</td>
<td>58/114</td>
</tr>
</tbody>
</table>

* significant at 10%; ** significant at 5%; *** significant at 1%.

Note: Regressions 1 to 3 are cross-section regressions estimated by Ordinary Least Squares (OLS). Heteroskedasticity robust standard errors are reported. Regressions 4 to 6 are panel regressions estimated by Feasible Generalized Least Square (FGLS). All the FGLS specifications include time effects. Coefficients for period dummies are not reported.

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A one-unit increase in skewness also corresponds to the average change resulting from eliminating, for each country, the three lowest observations in the set of countries with negative skewness. See Table 6.1.
The negative partial correlation between skewness and growth is consistent with our model’s prediction that a risky economy grows, on average, faster than a safe one. This is because the former exhibits negative skewness, although the latter has no skewness. The baseline estimation assumes a homogenous and linear effect of skewness on growth. Below we relax the homogeneity assumption and test whether the link between skewness and growth depends on the degree of financial liberalization and on contract enforceability. In the robustness subsection, we relax the linearity assumption and enter negative and positive skewness separately in the growth regression.

6.3.2.2. Identification of the Mechanism

Here, we test an identification restriction implied by the equilibria of our model. Namely, whether the link between skewness and growth is stronger in the set of financially liberalized countries with a medium degree of contract enforceability than in other countries.  

In the model, systemic guarantees are equally available to all countries. However, countries differ crucially in their ability to exploit these guarantees by taking on systemic risk. First, an equilibrium with systemic risk exists and is growth enhancing only in the set of financially liberalized countries with a “medium” degree of contract enforceability \( h \). On the one hand, borrowing constraints arise in equilibrium only if contract enforceability problems are “severe”: \( h < \bar{h} \) so borrowers may find it profitable to divert funds. On the other hand, risk taking is individually optimal and systemic risk is growth enhancing only if \( h > \bar{h} \). Only if \( h \) is large enough can risk taking induce enough of an increase in leverage to compensate for the distress costs of crises. Second, the mechanism requires not only weak institutions but also policy measures that are conducive to the emergence of systemic risk. Financial liberalization can be viewed as such a policy measure. In nonliberalized economies, regulations do not permit agents to take on systemic risk. Next, we exploit cross-country differences in financial liberalization and contract enforceability to test this identifying restriction.

We use the law and order index of the Political Risk Service Group in 1984 to construct the set of countries with a medium degree of contract enforceability (MEC).  

We classify as MECs the countries with an index in 1984 ranging between 2 and 5.  

We use three alternative indexes of financial liberalization: First, a de facto binary index based on the identification of trend breaks in capital flows, which is equal to one if a country is liberalized in a given year and zero

---

41 A similar empirical strategy is followed by Rajan and Zingales (1998) to analyze the effect of financial development on growth.

42 This index rates countries on a 1 to 6 scale according to the quality of enforceability of the legal system. We use the index in 1984 as it is the earliest available date. For a small number of countries for which the index is not available in 1984, we use 1985 instead.

43 Table EA9 in the appendix shows that our estimation results are robust to alternative definitions of the MEC set.
otherwise. By averaging this index over 10 years, we obtain the share of liberalized years in a given decade. Second, the de jure index of Quinn (1997) that reports on a zero to one scale the intensity of capital account liberalization based on the IMF report on capital account restrictions. Third, the de jure index of Abiad and Mody (2003). The de facto index is computed for the full sample of 58 countries for the period 1981–2000. The two other indexes cover fewer countries, but are available for a longer time period.44

We generate a composite index by combining an MEC dummy—that equals one for MEC countries and zero otherwise—with one of the liberalization indexes. For each country \( i \) and each of our nonoverlapping 10-year windows \((t, t + 9)\), the index equals

\[
MEC_{i,FL,t} = MEC_i \cdot \frac{1}{10} \sum_{j=0}^{9} f_{i,t+j} \quad t \in \{1961, 1971, 1981, 1991\} \quad (18)
\]

For each liberalization index, we interact the MEC_FL index with the three moments of credit growth and add them to the regression equation (17).45 Table 6.3 shows that, consistent with the restrictions imposed by the model, the effect of skewness on growth is strongest among MEC_FL countries. The interaction term skewness \( \cdot MEC_{FL} \) enters negatively and significantly at the 1 percent level in the three regressions. Its point estimate ranges between \(-1.00\) and \(-0.75\). By contrast, the coefficient of skewness is not significantly different from zero. It ranges between \(-0.08\) and \(-0.01\). The difference between the two estimates indicates that the link between skewness and growth is not only stronger in the MEC_FL set, but that it also only exists within this set.

By adding up the interacted and noninteracted skewness coefficients, we obtain the effect of skewness on growth for a fully liberalized MEC country. The point estimates of this effect—reported at the bottom of Table 6.3—range between \(-1.02\) and \(-0.81\) and are significant at the 1 percent level. An estimate of \(-0.81\) means that a one-unit increase in negative skewness for a fully liberalized MEC country is associated with a 0.81 percentage point increase in annual GDP growth. This effect is three times larger than the homogenous effect estimated in Table 6.2.

We have shown that the negative link between skewness and growth emerges only in the set of financially liberalized countries with a medium level of contract enforceability. By validating the identifying restrictions of our theoretical mechanism, this finding supports our hypothesis that systemic risk is growth enhancing.

### 6.3.3. Crisis Indexes and Growth

In Section 6.3.1, we showed that our skewness measure coincides closely with several financial crisis indexes. Here we show that, for the subsamples covered by crisis indexes, the same link is also evident when we replace skewness with crisis indexes in our growth regressions.

---

44 See the appendix for a detailed description of the three financial liberalization indexes.

45 For each regression, the estimation period corresponds to the time coverage of the liberalization index.
We consider three banking crisis indexes (Caprio-Klingebiel, Demirgüç-Detragiache, and a consensus index), a sudden stop consensus index, and a currency crisis consensus index. For each crisis index we set a dummy equal to one if the country has experienced a crisis during the decade and zero otherwise. Using a crisis dummy computed over ten years allows us to capture the average medium-run growth impact of crises rather than just the growth shortfall experienced during a crisis.

TABLE 6.3
Skewness and Growth: Country Grouping Estimates

<table>
<thead>
<tr>
<th>Dependent variable: Real per capita GDP growth</th>
<th>Estimation: Panel feasible GLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Standard errors are presented below the corresponding coefficient.)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit of Observations</td>
<td>Nonoverlapping 10-Year Windows</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial Liberalization Indicator</td>
<td>De Facto</td>
<td>De Jure (Quinn)</td>
<td>De Jure (Mody)</td>
</tr>
<tr>
<td>[1]</td>
<td>[2]</td>
<td>[3]</td>
<td></td>
</tr>
<tr>
<td><strong>Moment of credit growth:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real credit growth—mean</td>
<td>0.105***</td>
<td>0.091***</td>
<td>0.091***</td>
</tr>
<tr>
<td>(0.018)</td>
<td>(0.025)</td>
<td>(0.033)</td>
<td></td>
</tr>
<tr>
<td>Real credit growth—standard deviation</td>
<td>−0.058***</td>
<td>−0.077***</td>
<td>−0.098***</td>
</tr>
<tr>
<td>(0.009)</td>
<td>(0.014)</td>
<td>(0.016)</td>
<td></td>
</tr>
<tr>
<td>Real credit growth—skewness</td>
<td>−0.011</td>
<td>−0.081</td>
<td>−0.019</td>
</tr>
<tr>
<td>(0.085)</td>
<td>(0.109)</td>
<td>(0.133)</td>
<td></td>
</tr>
<tr>
<td><strong>Moment of credit growth interacted:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean credit growth * MEC_FL</td>
<td>0.131***</td>
<td>0.170***</td>
<td>0.151***</td>
</tr>
<tr>
<td>(0.034)</td>
<td>(0.044)</td>
<td>(0.055)</td>
<td></td>
</tr>
<tr>
<td>Standard deviation of credit growth * MEC_FL</td>
<td>0.047**</td>
<td>0.020</td>
<td>0.043</td>
</tr>
<tr>
<td>(0.018)</td>
<td>(0.028)</td>
<td>(0.030)</td>
<td></td>
</tr>
<tr>
<td>Skewness of credit growth * MEC_FL</td>
<td>−0.802***</td>
<td>−0.750***</td>
<td>−1.002***</td>
</tr>
<tr>
<td>(Medium contract enforceability * financial liberalization)</td>
<td>−0.145</td>
<td>−0.026</td>
<td>−0.048</td>
</tr>
<tr>
<td>(0.230)</td>
<td>(0.376)</td>
<td>(0.412)</td>
<td></td>
</tr>
<tr>
<td><strong>Control variables:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial secondary schooling</td>
<td>0.019***</td>
<td>0.013***</td>
<td>0.000</td>
</tr>
<tr>
<td>(0.006)</td>
<td>(0.005)</td>
<td>(0.008)</td>
<td></td>
</tr>
<tr>
<td>Initial income per capita (in logs)</td>
<td>−0.236*</td>
<td>−0.164</td>
<td>−0.074</td>
</tr>
<tr>
<td>(0.140)</td>
<td>(0.123)</td>
<td>(0.152)</td>
<td></td>
</tr>
<tr>
<td>Skewness (fully liberalized MEC countries; MEC_FL = 1):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient</td>
<td>−0.180</td>
<td>−1.020</td>
<td>−0.850</td>
</tr>
<tr>
<td>Standard error</td>
<td>0.120</td>
<td>0.040</td>
<td>0.210</td>
</tr>
<tr>
<td>F-test H₀: Coefficient = 0 (P-value)</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>No. countries/No. observations</td>
<td>58/114</td>
<td>49/163</td>
<td>32/963</td>
</tr>
</tbody>
</table>

* significant at 10%; ** significant at 5%; *** significant at 1%.

Note: See Section 6.3.2 for the construction of the composite index of medium enforceability of contracts and financial liberalization (MEC_FL). Coefficients for period dummies are not reported.

---

46 As described before, consensus indexes are designed to capture systemic crisis events. For each crisis type, they record episodes that are confirmed by at least two indexes.

47 Using panel regression with five-year windows, Barro (2001) finds that a negative contemporaneous link between crisis and growth can coexist with a positive link when the same crisis dummy is lagged by one five-year interval.
Systemic Crises and Growth

The empirical specification is the same as in the panel analysis of Table 6.2, substituting the crisis dummies for skewness. Table 6.4 shows that the three banking crisis dummies enter positively (with point estimates ranging from $+0.22$ to $+0.26$) and significantly at the 5 percent level. Thus, we find that countries that experienced a systemic banking crisis in a given decade also experience on average a 0.24 percent annual increase in per capita GDP growth. Interestingly, this effect is similar in magnitude to that of a one unit change in skewness (see Table 6.2). Turning to the other crisis indexes, we find a similar positive growth effect of sudden stops, but we do not find any significant growth effect of currency crises. Finally, in Table EA1 in the appendix, we show that the results of Table 6.4 persist when the estimation is done with the full set of control variables.

---

**TABLE 6.4**

<table>
<thead>
<tr>
<th>Crisis Indexes and Growth</th>
<th>Dependent variable: Real per capita GDP growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimation: Panel feasible GLS</td>
<td>(Standard errors are presented below the corresponding coefficient.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Estimation Period</th>
<th>1981–2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit of Observations</td>
<td>Nonoverlapping 10-Year Windows</td>
</tr>
<tr>
<td><strong>Moment of credit growth:</strong></td>
<td></td>
</tr>
<tr>
<td>Real credit growth—mean</td>
<td>0.178*** (0.005)</td>
</tr>
<tr>
<td>Real credit growth—standard deviation</td>
<td>-0.064*** (0.007)</td>
</tr>
<tr>
<td><strong>Crisis indexes:</strong></td>
<td></td>
</tr>
<tr>
<td>Banking crisis: Caprio</td>
<td>0.258** (0.127)</td>
</tr>
<tr>
<td>Klingebiel index</td>
<td></td>
</tr>
<tr>
<td>Banking crisis: Detragiache and others index</td>
<td>0.223** (0.105)</td>
</tr>
<tr>
<td>Banking crisis: Consensus index</td>
<td>0.228*** (0.11)</td>
</tr>
<tr>
<td>Sudden stop: Consensus index</td>
<td>0.464** (0.201)</td>
</tr>
<tr>
<td>Currency crisis: Consensus index</td>
<td></td>
</tr>
<tr>
<td><strong>Set of control variables</strong></td>
<td>Simple set</td>
</tr>
<tr>
<td><strong>No. countries/No. observations</strong></td>
<td>58/114</td>
</tr>
</tbody>
</table>

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: A crisis index is equal to one if a country-decade experienced a crisis, zero otherwise. See Section 6.3.1 for the construction of the consensus crisis indexes. The coefficients for the control variables (initial income per capita and secondary schooling) and period dummies are not reported.

---

48 Aghion and others (2009) also find that, on average, there is no significant growth effect associated with exchange rate regime collapses.
6.3.4. Skewness and Investment

In our mechanism, systemic risk taking leads to higher mean growth because it helps relax borrowing constraints and thus allows firms to invest more. Although the link between investment and growth has been extensively analyzed in the literature, the link between systemic risk and investment has not. Here we analyze this link by adding the skewness of credit growth to a panel investment regression. Following Barro (2001), we regress the investment-to-GDP ratio on our controls and the lagged investment rate, which captures the high degree of serial correlation in the investment rate. We calculate investment rates in two ways: using real PPP-converted prices and using domestic prices.

Table 6.5, Panel A presents the results of the GLS and GMM panel estimations performed over the period 1971–2000 for the two investment rates using the simple set of control variables. The estimation yields very similar results for the two investment rates. Skewness enters negatively and is significant at the 1 percent level in the GLS estimations and at the 5 percent level in the GMM estimation. Furthermore, investment is positively correlated with the mean of credit growth and negatively with the standard deviation. The effect of skewness on investment is slightly larger in the GMM estimation. In the GMM (GLS) estimation, a one-unit increase in skewness is associated with a 1.1 (0.77) percentage point direct effect on the investment rate at domestic prices.

In order to relate the investment effects to growth outcomes, we present in Table 6.5, panel B, a set of growth regressions in which the investment rate replaces the moments of credit growth. Investment enters significantly at the 1 percent level with point estimates close to 0.2, a standard value in the growth literature (e.g., Levine and Renelt [1992]). By combining the effect of skewness on investment (0.77) with the corresponding effect of investment on growth (0.22), one obtains −0.17. This figure is of the same order of magnitude as the direct effect of skewness on growth in the panel regression presented in Table 6.2 for the same sample period (−0.24), although it is slightly lower.

The identification of a negative link between skewness and investment and a positive link between investment and growth reinforces the support we have found for our theoretical mechanism where systemic risk taking affects growth through an investment channel.

49 The specification with lagged investment prevents us from estimating the investment regression over 1960–2000. In Table EA2 in the appendix, we present similar results obtained with the extended set of control variables.

50 The GMM estimation is performed using the GMM system estimator proposed by Blundell and Bond (1998). The details of the estimation technique are presented in the appendix.

51 This number amounts to a long run effect of 2.9 (2.7) percentage points, given the dynamic nature of the investment regression. This long run effect is computed as \( \alpha \beta / (1 - \beta) \) with \( \alpha \) the skewness coefficient and \( \beta \) the coefficient of the lagged investment rate.

52 Note that by combining the two coefficients, we only consider the direct effect of skewness on investment and ignore the additional dynamic effect stemming from the persistence in the investment rate. More importantly, this figure (−0.17) is not an estimate of the indirect effect of skewness on growth through an investment channel. Such an estimation would require us to estimate jointly a growth and an investment equation in a dynamic setup and goes beyond the purpose of this section.
### TABLE 6.5
Skewness, Investment, and Growth

#### PANEL A. INVESTMENT AND SKEWNESS REGRESSIONS

Estimation Period: 1971–2000
Unit of observation: Nonoverlapping 10-Year Windows

(Standard errors are presented below the corresponding coefficient.)

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Domestic Price-Investment Rate</th>
<th>PPP-Investment Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FGLS</td>
<td>GMM System</td>
</tr>
<tr>
<td></td>
<td>[1]</td>
<td>[2]</td>
</tr>
<tr>
<td><strong>Estimation Technique</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FGLS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GMM System</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Moment of real credit growth:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real credit growth—mean</td>
<td>0.332***</td>
<td>0.499***</td>
</tr>
<tr>
<td>(0.036)</td>
<td>(0.096)</td>
<td>(0.028)</td>
</tr>
<tr>
<td>Real credit growth—standard deviation</td>
<td>−0.081***</td>
<td>−0.125</td>
</tr>
<tr>
<td>(0.024)</td>
<td>(0.175)</td>
<td>(0.023)</td>
</tr>
<tr>
<td>Real credit growth—skewness</td>
<td>−0.765***</td>
<td>−1.127***</td>
</tr>
<tr>
<td>(0.191)</td>
<td>(0.543)</td>
<td>(0.149)</td>
</tr>
<tr>
<td><strong>Lagged investment rates:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lagged investment rate (domestic price)</td>
<td>0.718***</td>
<td>0.608***</td>
</tr>
<tr>
<td>(0.036)</td>
<td>(0.104)</td>
<td></td>
</tr>
<tr>
<td>Lagged investment rate (PPP)</td>
<td></td>
<td>0.753***</td>
</tr>
<tr>
<td>(0.031)</td>
<td>(0.132)</td>
<td></td>
</tr>
<tr>
<td><strong>Control set of variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. countries/No. observations</td>
<td>Simple set</td>
<td>Simple set</td>
</tr>
<tr>
<td>57/163</td>
<td>57/163</td>
<td>57/163</td>
</tr>
<tr>
<td><strong>SPECIFICATION TEST (p-values)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Sargan-Hansen Test:</td>
<td>0.16</td>
<td>0.14</td>
</tr>
<tr>
<td>(b) Second-order serial correlation:</td>
<td>0.23</td>
<td>0.24</td>
</tr>
</tbody>
</table>

* significant at 10%; ** significant at 5%; *** significant at 1%.

Note: The coefficients for the control variables (initial income per capita and secondary schooling) and period dummies are not reported.

#### PANEL B. GROWTH AND INVESTMENT REGRESSIONS

Estimation Period: 1971–2000
Unit of observation: Nonoverlapping 10-Year Windows

(Standard errors are presented below the corresponding coefficient.)

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Real Per Capita GDP Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FGLS</td>
</tr>
<tr>
<td></td>
<td>[1]</td>
</tr>
<tr>
<td>Investment rate domestic price</td>
<td>0.217***</td>
</tr>
<tr>
<td>(0.015)</td>
<td>(0.041)</td>
</tr>
<tr>
<td>Investment rate PPP price</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.176***</td>
</tr>
<tr>
<td>(0.011)</td>
<td>(0.046)</td>
</tr>
<tr>
<td>Control set of variables</td>
<td></td>
</tr>
<tr>
<td>No. countries/No. observations</td>
<td>Simple set</td>
</tr>
<tr>
<td>57/171</td>
<td>57/171</td>
</tr>
<tr>
<td><strong>SPECIFICATION TEST (p-values)</strong></td>
<td></td>
</tr>
<tr>
<td>(a) Sargan-Hansen Test:</td>
<td>0.47</td>
</tr>
<tr>
<td>(b) Second-order serial correlation:</td>
<td>0.4</td>
</tr>
</tbody>
</table>

* significant at 10%; ** significant at 5%; *** significant at 1%.

Note: The coefficients for the control variables (initial income per capita and secondary schooling) and period dummies are not reported.
6.3.5. Robustness

Here, we summarize a series of robustness tests of the link between skewness and growth.

**Generalized Method of Moments System Estimation.** In order to control for unobserved time- and country-specific effects, and account for some endogeneity in the explanatory variables, we use a GMM system estimator developed by Blundell and Bond [1998]. The system is estimated over the period 1970–2000. Tables EA6 and EA7 in the appendix show that (1) the negative link between skewness and growth is significant in the GMM estimation and its point estimate is actually larger than in the GLS estimation; (2) relaxing the exogeneity on skewness while treating the other regressors as jointly endogenous, has little effect on the estimates; and (3) the interaction effects presented in Section 6.3.2 are also significant in the GMM specification. The details of the GMM estimation are presented in the appendix.\(^{53}\)

**Extended Set of Control Variables.** Table EA8 in the appendix presents the panel estimates obtained with the extended control set for the three estimation periods. The coefficients of the moments of credit growth are very similar to the panel estimates obtained in Table 6.2. Notice also that in most of the regressions, the control variables enter with the expected sign and their point estimates are significant.\(^{54}\)

**Alternative MEC Sets.** Table EA9 in the appendix shows the results of Section 6.3.2 are robust to alternative definitions of the set of countries with a medium degree of contract enforceability. In the three regressions presented in Table EA9, we exclude successively from the MEC set: (1) countries with an index of 2, (2) countries with an index of 5, and (3) countries with an index equal to either 2 or 5. In the first regression, the link between skewness and growth is only present in the MEC_FL set, while in the two other regressions, this negative link is at least three times larger in this set.\(^{55}\)

**Negative Skewness and Growth.** Table EA10 in the appendix shows that the negative link between skewness and growth reflects mainly a positive relationship between the magnitude of negative skewness and growth. The magnitude of negative (positive) skewness is computed as a variable equal to the absolute value of skewness if skewness is negative (positive) and equal to zero otherwise. When these two variables are introduced in place of skewness in our benchmark panel estimations (Table 6.2, regressions 4 to 6), we find that (1) the magnitude of negative skewness enters positively and significantly at the one percent confidence level, with point estimates ranging between 0.48 and 0.55; and (2) the magnitude of positive skewness enters negatively but not significantly different from zero.

---

\(^{53}\)Table EA3 in the appendix shows that similar results are obtained with a three-stage least squares estimation procedure.

\(^{54}\)An exception is initial secondary schooling that is only significant with the simple set of controls.

\(^{55}\)The significant link between skewness and growth outside the MEC_FL set is the consequence of having a more restrictive definition of the MEC set: it excludes some countries for which the systemic risk-taking mechanism may be at play.
Systemic Crises and Growth

Skewness versus Crises Indexes. In order to run a horse race between coded crisis indexes and skewness, we add the skewness of credit growth to each of the regressions presented in Table 6.4. The results are presented in Table EA11 of the appendix. The skewness coefficients are significant and their point estimates are only slightly lower than the coefficient estimated in the baseline regression (Table 6.2, regression 6). In contrast, the coefficients of systemic banking crises indexes and the coefficient of the sudden stops index lose their significance, and their point estimate fall sharply once skewness is introduced.

The Full Sample of Countries. In order to interpret the link between skewness and growth as the result of endogenous systemic risk taking, in our benchmark estimation we have controlled for two other main sources of skewness: war and large terms-of-trade shocks. These shocks are exogenous and we do not expect them to reflect the relaxation of financial bottlenecks induced by systemic risk taking. Nevertheless, to investigate whether the negative link between skewness and growth is observed in an unconditional sample, we re-estimate the panel regression presented in Table 6.2 including the full sample of 83 countries for which we have available data. Table EA12 shows that skewness still enters negatively and remains statistically significant at the 1 percent level, although the magnitude of the average point estimate is reduced from −0.29 to −0.22.

Outliers. To test whether the link between skewness and growth may be driven by outliers, we consider the GLS panel regression performed with the simple control set over 1961–2000 (Table 6.2, regression 4). There are 13 country-decades whose residuals deviate by more than two standard deviations from the mean.56 As Table EA13 shows, the exclusion of outliers does not change our results. In particular, the coefficient on skewness ranges between −0.30 and −0.35, excluding individual outliers, and is −0.24 when all outliers are excluded. These estimates are significant at the 1 percent confidence level and are quite similar to our benchmark estimate of −0.33.

6.4. RELATED LITERATURE

A novelty of this paper is to use skewness to analyze economic growth. In the finance literature, skewness has been used to capture asymmetry in risk in order to explain the cross-sectional variation of excess returns. If, holding mean and variance constant, investors prefer positively skewed to negatively skewed portfolios, the latter should exhibit higher expected returns. Kraus and Litzenberger (1976) show that adding skewness to the CAPM model improves its empirical fit. Harvey and Siddique (2000) find that coskewness has a robust and economically important impact on equity risk-premia even when factors based on size and book-to-market are controlled for.57 Veldkamp (2005) rationalizes the existence


57 Coskewness is the component of an asset’s skewness that is related to the skewness of the market portfolio.
of skewness in assets markets in a model with endogenous flows of information. In the macroeconomic literature, Barro (2006) measures the frequency and size of large GDP drops over the twentieth century and shows that these rare disasters can explain the equity premium puzzle.

In our empirical analysis, the negative link between skewness and growth coexists with the negative link between variance and growth identified by Ramey and Ramey (1995), Fatas and Mihov (2003), and others. The contrasting growth effects of different sources of risk are also present in Imbs (2007), who finds that aggregate volatility is bad for growth, while sectoral volatility is good for growth.

Most of the empirical literature on financial liberalization and economic performance focuses either on growth or on financial fragility and excess volatility. On the one hand, Bekaert, Harvey, and Lundblad (2005) find a robust and economically important link between stock market liberalization and growth; Henry (2002) finds similar evidence by focusing on private investment; whereas Klein (2005) finds that financial liberalization is growth enhancing only among middle-income countries. On the other hand, Kaminsky and Reinhart (1998) and Kaminsky and Schmukler (2003) show that the propensity to crisis and stock market volatility increase in the aftermath of financial liberalization. Our findings help to integrate these contrasting views.

Obstfeld (1994) demonstrates that financial openness increases growth if international risk-sharing allows agents to shift from safe to risky projects with a higher return. In our framework, risky projects have a lower expected return than safe ones. The growth gains are obtained because firms that take on more risk can attain greater leverage.

In our paper, liberalization policies that discourage hedging can induce higher growth because they help ease borrowing constraints. Tirole and Pathak (2006) reach a similar conclusion in a different setup. In their framework, a country pegs the exchange rate as a means to signal a strong currency and attract foreign capital. Thus, it must discourage hedging and withstand speculative attacks in order for the signal to be credible.

By focusing on the growth consequences of imperfect contract enforceability, this paper is connected with the growth and institutions literature. For instance, Acemoglu and others (2003) show that better institutions lead to higher growth, lower variance, and less frequent crises. In our model, better institutions also lead to higher growth, and it is never optimal for countries with strong institutions to undertake systemic risk. Our contribution is to show how systemic risk can enhance growth by counteracting the financial bottlenecks generated by weak institutions.

The cycles in this paper are different from Schumpeterian cycles in which the adoption of new technologies and the cleansing effect of recessions play a key role. Our cycles resemble Juglar’s credit cycles in which financial bottlenecks play a dominant role. Juglar (1862) characterized asymmetric credit cycles along with the periodic occurrence of crises in France, England, and the United States during the nineteenth century.
6.5. CONCLUSION

Our finding that fast-growing countries tend to experience occasional crises sheds light on two contrasting views of financial liberalization. In one view, financial liberalization induces excessive risk taking, increases macroeconomic volatility, and leads to more frequent crises. In another view, liberalization strengthens financial development and contributes to higher long-run growth. Our findings indicate that, although liberalization does lead to systemic risk taking and occasional crises, it also raises growth rates, even when the costs of crises are taken into account.

In order to uncover the link between systemic risk and growth, it is essential to distinguish between booms punctuated by rare, abrupt busts and up-and-down patterns that are more frequent or more symmetric. Although both of these patterns will increase variance, only the former causes a decline in skewness. This is why we use the skewness of credit growth, not variance, to capture the volatility generated by crises. An innovation in this paper is the use of skewness as a de facto indicator of financial systemic risk in order to study economic growth.

We analyze the relationship between systemic risk and growth by developing a theoretical mechanism based on the existence of financial bottlenecks. In countries with institutions that are weak—but not too weak—financial liberalization may give rise to systemic risk, enabling financially constrained firms to attain greater leverage and to increase investment and growth along a path without crises. This is the leverage effect. We show that in the set of financially liberalized countries with moderate institutional problems, the leverage effect is strong enough that the gains from larger investment will dominate the losses from occasional financial crises.

The data strongly support the empirical hypotheses associated with these theoretical results: over the last four decades, the link between skewness and growth is strongest in financially liberalized countries with a moderate degree of contract enforceability. Furthermore, investment is the main channel through which skewness affects growth.

We would like to emphasize that the fact that systemic risk can be good for growth does not mean that it is necessarily good for welfare. Furthermore, as the decreasing returns version of the model demonstrates, systemic risk taking is not a strategy for increasing growth that can be pursued in the very long run. Once a country becomes rich enough, it must shift to a safe path.

Finally, within the model there are several policies that could increase investment without incurring crisis costs. A major improvement in the contract enforceability environment eliminates financial bottlenecks. However, it often takes a long time for this institutional reform to be achieved. An alternative policy is to grant failure-unrelated subsidies to firms. However, in the real world, such a policy might lead to cronyism and rampant corruption.

REFERENCES


SECTION II

Financial Integration, Financial Liberalization, and Economic Performance
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7.1. INTRODUCTION

The magnitude of cross-border financial assets holdings has grown in recent years at rising speed, from under 50 percent of world GDP in 1970 to over 300 percent in 2006, and doubling over just the last 10 years (see Figure 7.1). A more financially integrated global economy brings many opportunities, such as improved access to capital and more potential for risk diversification, but the increasing ease at which capital can flow into and out of countries may also carry risks: reversals of capital flows, for example, have contributed to financial crises, and more recently, large net capital flows into the United States may have contributed to the U.S. housing bubble. The ensuing recent subprime mortgage crisis underscored the fact that financial integration binds different parts of the world in good times and bad—in a financially integrated world, market participants in one part of the global economy are no longer sheltered from events emanating in another.

As a consequence, there is great interest in both the academic and the policy community in studying the determinants of financial globalization and its consequences for economic welfare. For example, policymakers averse to the risks of increased financial integration may consider imposing restrictions on cross-border capital flows. Assessing the optimality of such restrictions requires answering (at least) two questions: First, do the risks from increased financial integration outweigh their benefits and, therefore, should one attempt to restrict them in the...
Figure 7.1 De facto financial globalization, 1970–2006 (in percent of GDP). Notes: Based on the data provided in Lane and Milesi-Ferretti (2010), updated through 2006. The figure depicts the sum of countries’ total equity, foreign direct investment (FDI), debt, and other assets and liabilities relative to total GDP.
first place? And second, even if the answer to the previous question is yes, are capital controls an effective tool? It is probably fair to say that economists do not yet have clear answers to these questions. Although a large and growing literature exists on the first question, less work has been done on the second.\textsuperscript{2} A key reason for this is the paucity of detailed and reliable measurement of countries’ financial globalization strategies, that is, of data on countries’ de jure policies.

By contrast, de facto measures of financial globalization, such as those presented in the Lane and Milesi-Ferretti chapter (see Figure 7.1), are publicly available for a large number of countries and years. Which type of measure is preferable depends on the research context: for the purpose of policy analysis, de jure measures, which are under the policy maker’s direct control, are more relevant, whereas in other applications, only outcome (de facto) measures may matter. In still other situations, both may be necessary, for example, if one wants to study the extent to which de jure controls affect de facto outcomes. However, given the limited availability of detailed de jure data—available data are often too coarse, have limited time and/or country coverage, or are unavailable to the public—many authors have resorted to using de facto measures even when they were interested in studying policies. This chapter documents, and makes publicly available, a detailed panel data set on countries’ disaggregated de jure measures, in the hope that it will allow more progress to be made in answering some of the important questions in this field.\textsuperscript{3}

\section*{7.2. THE DATA SET}

\subsection*{7.2.1. Methodology}

The data set is a balanced panel, covering 91 countries on an annual frequency during the time period from 1995 to 2005. It provides novel detail on the various dimensions in which countries impose restrictions on financial transactions, and the sample of countries it covers is diverse in terms of regions and income levels, covering 35 high-income countries, 42 middle-income countries, and 14 low-income countries (see Table 7.1 for the full country list by region).

Common to nearly all existing de jure capital control indices is their reliance on information contained in the IMF’s \textit{Annual Report on Exchange Arrangements and Exchange Restrictions} (AREAER). Thus, although drawing on the same source, these indices differ in how, and to what extent, they extract the information provided in the AREAER. Until 1995, the AREAER summarized a

\begin{footnotesize}
\begin{enumerate}
\item Even so, however, no clear consensus has emerged on the effects of financial cross-border flows on economic growth and other outcome variables, unlike, for example, the literature on the cross-border trade of goods and services. For recent reviews of the state of the financial globalization literature, see, for example, the chapters by Kose and others (2010) and Dell’Ariccia and others (2010).
\item Taking a disaggregated approach appears to be promising. As Henry (2007) notes, existing evidence suggests that opening equity markets to foreign investors may avoid some of the problems associated with the liberalization of debt flows, and so “[a]t a minimum, the distinction between debt and equity is critical” (p. 889). The data set documented here allows researchers to investigate such differences.
\end{enumerate}
\end{footnotesize}
### TABLE 7.1
List of Countries in the Data Set

<table>
<thead>
<tr>
<th>High Income</th>
<th>Middle Income</th>
<th>Low Income</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>East Asia and Pacific</strong></td>
<td><strong>East Asia and Pacific</strong></td>
<td><strong>Europe and Central Asia</strong></td>
</tr>
<tr>
<td>Australia</td>
<td>China</td>
<td>Kyrgyz Republic</td>
</tr>
<tr>
<td>Hong Kong SAR</td>
<td>Indonesia</td>
<td>Uzbekistan</td>
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<tr>
<td>Japan</td>
<td>Malaysia</td>
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</tr>
<tr>
<td>Korea</td>
<td>Philippines</td>
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<tr>
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<td>Thailand</td>
<td>Yemen, Republic of</td>
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<tr>
<td>Singapore</td>
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<tr>
<td><strong>Europe and Central Asia</strong></td>
<td><strong>Europe and Central Asia</strong></td>
<td><strong>South Asia</strong></td>
</tr>
<tr>
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<td>Bangladesh</td>
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<tr>
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<td>Czech Republic</td>
<td>India</td>
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<td>Slovenia</td>
<td>Georgia</td>
<td>Pakistan</td>
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<tr>
<td><strong>Middle East and North Africa</strong></td>
<td><strong>Latin America and Caribbean</strong></td>
<td><strong>Sub-Saharan Africa</strong></td>
</tr>
<tr>
<td>Bahrain</td>
<td>Latvia</td>
<td>Burkina Faso</td>
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<td>Brunei Darussalam</td>
<td>Moldova</td>
<td>Côte d’Ivoire</td>
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<td>Israel</td>
<td>Romania</td>
<td>Ghana</td>
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<td>Kuwait</td>
<td>Russia</td>
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<td>Saudi Arabia</td>
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<td>United Arab Emirates</td>
<td>Argentina</td>
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<td>Zambia</td>
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<td>Netherlands</td>
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<td><strong>South Asia</strong></td>
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<td>Swaziland</td>
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country’s openness to capital flows using a binary dummy variable, where 1 represents a restricted capital account and 0 represents an unrestricted capital account. Since 1995, the AREAER has utilized a more structured approach, providing detailed information on restrictions on capital transactions in a number of subcategories.

The data set documented here contains information from a subset of these subcategories in broad correspondence to the standard presentation of de facto assets and liabilities (as, for example, in Lane and Milesi-Ferretti, 2010). The asset categories covered here constitute the lion’s share of global cross-border asset holdings; thus, focusing on these categories allows for the construction of a data set that broadly reflects the structure of global de facto financial integration. The main categories covered in this data set are as follows (with the names in square brackets reflecting those used in the published data set):

1. Shares or other securities of a participating nature [eq];
   a. Purchase locally by nonresidents [eq_plbn];
   b. Sale or issue abroad by residents [eq_siar];
   c. Purchase abroad by residents [eq_pabr];
   d. Sale or issue locally by nonresidents [eq_siln];
2. Bonds or other debt securities [bo];
   a. Purchase locally by nonresidents [bo_plbn];
   b. Sale or issue abroad by residents [bo_siar];
   c. Purchase abroad by residents [bo_pabr];
   d. Sale or issue locally by nonresidents [bo_siln];
3. Money market instruments [mm];
   a. Purchase locally by nonresidents [mm_plbn];
   b. Sale or issue abroad by residents [mm_siar];
   c. Purchase abroad by residents [mm_pabr];
   d. Sale or issue locally by nonresidents [mm_siln];
4. Collective investments [ci];
   a. By residents to nonresidents [cio];
   b. By nonresidents to residents [cii];
5. Financial credits[fi];
   a. By residents to nonresidents [fco];
   b. By nonresidents to residents [fci];

Not all categories reported in the AREAER are coded here, given their limited importance in the composition of de facto flows and resource constraints in the data collection process. These categories include: derivatives and other instruments, credit operations (except for the subcategory financial credits, see main text), real estate transactions, and personal capital transactions.

Restrictions on bonds transactions were not recorded in the AREAER in 1995 and 1996.
6. Direct investment [di];
   a. Outward investment [dio];
   b. Inward direct investment [dii];
   c. Liquidation of direct investment [ldi].

To allow for a flexible use of the data, the information contained in the AREAER is coded at the level of resident/nonresident restrictions, in binary form, taking a value of 0 (unrestricted) or 1 (restricted) (see below for the slightly different cases of restrictions on collective investments, financial credits, and direct investment). In each case, restrictions on capital transactions are coded as a 0 if there are none in a given year, or if they consist merely of registration or notification requirements. They are also coded as 0 if a country is generally open but imposes restrictions on investments in only a small number of selected industries, for example, for national security purposes, or on financial transactions with only a small number of countries, typically for political reasons.

Given that capital account restrictions are coded at the level of individual transactions, the data can be aggregated in different ways, providing information along different dimensions. In particular, the coded data allow for the construction of capital control subindices by asset category, by residency, and by the direction of flows (inflows versus outflows). The simplest way of aggregating subindices, and the one followed here, is by taking unweighted averages of the appropriate subcategories. Thus, for example, a country’s restrictiveness of individual asset categories would be captured by averaging across each asset category’s various subcomponents to obtain

\[
\text{Controls on Asset Category } i = \frac{(i_{plbn} + i_{siar} + i_{pabr} + i_{siln})}{4}
\]

for \(i \in \{eq, bo, mm\}\). Given that each of the subcategories is coded as a binary variable, the resulting asset-specific aggregate can take on five different values. For collective investments and financial credits, where the AREAER provides less disaggregated information on restrictions, the aggregated index is simply the average of the two subcategories, implying that each of these can take on only three different values (0, 0.5, and 1).

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6 For example, in 1999, Bulgarian residents’ purchases abroad of capital market securities (shares and bonds) only required “[p]rior registration with the BNB” (IMF, 2000, p. 150) and were therefore coded as 0 (unrestricted).

7 For example, in 2005, in the United States local purchases by nonresidents of shares or other securities of a participating nature were free from restrictions except for investments “in the nuclear energy, maritime, communications, air and land transport, and shipping industries” (IMF, 2006, p. 1258); transactions were also prohibited with “Cuba and Cuban nationals; the Islamic Republic of Iran; Myanmar; Sudan” (IMF, 2006, p. 1259). These transactions were coded as 0 (unrestricted).

8 The definition of residence in the Balance of Payments is based on the “transactor’s center of economic interest” (IMF, 1993, p. 20) and may therefore differ from other definitions based on nationality or (other) legal criteria, such as tax laws.

9 The interpretation of directionality is a complex issue—see below for a more detailed discussion.
For direct investment, in addition to information on inward and outward restrictions, the AREAER provides a third category regarding the “liquidation of direct investment.” To maintain symmetry to other categories in terms of the values the subindex can take on, the published data set is calculated as the average between $dio$ and the maximum of $dii$ and $ldi$. This aggregation recognizes that liquidation restrictions make reversals more costly, and thus indirectly impose costs on direct investment inflows. However, different aggregations will be appropriate in different contexts, such as a simple average of all three subcategories, and the modular structure of the data set provides researchers with the option of exploring these alternatives.

Variables summarizing controls according to residency can be obtained by calculating the average of “sale or issue abroad by residents” and “purchase abroad by residents” for resident restrictions, and the average of “purchase locally by nonresidents” and “sale or issue locally by nonresidents” for nonresident restrictions. In this context, controls on direct investment inflows (as described above) can be interpreted as nonresident restrictions, and those on direct investment outflows as resident restrictions.\(^{10}\)

In each asset category, indicators can also be grouped according to the direction of flows. With the exception of direct investment (see footnote 11), the direction of flows is conceptually independent of the residency status of the transacting individual. For example, a capital inflow may arise from a nonresident purchasing domestic assets (increasing the country’s stock of external liabilities), or from a domestic resident’s sale of assets abroad (decreasing the country’s stock of external assets). Thus, inflow restrictions are calculated here as the average of the restriction dummies on “purchase locally by nonresidents” and “sale or issue abroad by residents,” whereas outflow restrictions are calculated as the average of the restriction dummies on “purchase abroad by residents” and “sale or issue locally by nonresidents.”\(^{11}\)

Further aggregation across asset categories yields broader indices of a country’s restrictiveness of capital account transactions. Again, the modular nature of the data set provides flexibility for a variety of different aggregations—researchers using these data will have to make a determination as to which aggregation is most appropriate given the research question at hand. It is also worth noting that although the basic coding at the level of individual transactions consists of a

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\(^{10}\)This view follows the Balance of Payments Manual which notes that “[d]irect investment is classified primarily on a directional basis—resident direct investment abroad and nonresident investment in the reporting economy” (IMF, 1993, p. 81). Thus, unlike the other categories, direct investment inflows and outflows can be equated with nonresident and resident transactions, respectively. For symmetry, the analogous approach is taken for the collective investment and financial credit categories.

\(^{11}\)Matching these inflow/outflow aggregates with their de facto counterparts is nontrivial: capital flows data are typically reported as the net changes in external assets (outflows) and liabilities (inflows), which mixes different types of transactions. For example, a reduction in liabilities because of nonresidents selling domestic bonds is effectively counted as a negative inflow, whereas it would be considered a (positive) outflow in the de jure aggregation discussed here. Transforming the de facto data by defining $Outflows = \max(\Delta Assets, 0) - \min(\Delta Liabilities, 0)$ and $Inflows = -\min(\Delta Assets, 0) + \max(\Delta Liabilities, 0)$ is a possible solution.
binary indicator, the cross-sectoral and time variation that results from aggregating indices along various dimensions can be interpreted as a measure of the intensity of a country’s capital controls, because such aggregations effectively “count” how many subcategories are restricted, and within each category, how many types of transactions.12

7.2.2. Comparison with Existing Indices

A comparison of the new index with existing indices highlights the trade-offs one faces in their construction. Between a broad country coverage, long time coverage, and detailed information on the types of restrictions, typically only two can be achieved. As discussed in the previous section, the new index documented in the previous section strikes a relatively favorable balance regarding country coverage and the level of detail, but is constrained by a relatively short time series dimension because of the limited information provided by the AREAER prior to 1995. Authors of other capital account indices have made different choices.

Most closely related to the index presented here is the work done by Tamirisa (1999) who followed a similar approach. Although her index has a broad country coverage, it covers only one year.13 By contrast, Miniane (2004) aimed to extend the time series dimension, at the cost of a more limited country coverage and less detail. His sample includes 34 countries covering the period 1983–2000. Given the more limited information available in the AREAER prior to 1995, his index cannot distinguish between inflow and outflow restrictions.

Other authors have aimed to maximize time and country coverage, at the expense of less detail at the country level. Four binary indicators that were reported in the AREAER prior to 1995 include (1) the openness of a country’s capital account; (2) the openness of the current account; (3) the stringency of requirements for the repatriation and/or surrender of export proceeds; and (4) the existence of multiple exchange rates for capital account transactions. Many authors simply use the capital account dummy under (1) as a measure of a country’s capital account openness. Given its binary nature, this is a crude approximation of a country’s capital account restrictiveness, although it has the advantage of a broad country and time coverage, being available for up to 184 countries at an annual frequency starting in 1966.

Mody and Murshid (2002) extend these dummies into the years after 1995, thus covering the years 1966–2000 and 184 countries. They calculate a “financial integration index” as the sum of the four binary variables ranging from 0 to 4, with 4 denoting the least restricted. Chinn and Ito (2007) also construct a composite measure from these four dummy variables taking a principal components

12 This is only one aspect of intensity. A broader intensity measure would reflect the different types of restrictions (such as approval vs. taxation vs. prohibition) as well as the degree to which de jure restrictions are actually enforced in practice. Quinn (1997) attempts to tackle the former aspect, described in more detail in the next section.

approach. In an updated version of their data set, Chinn and Ito apply this procedure to 182 countries for 1970–2006. Although the Mody-Murshid and the Chinn-Ito measures provide more finely graded information than the simple IMF dummy, it is less clear to what extent these indicators are measures of capital account openness in a narrow sense, given that three of the four indices underlying these indicators represent information that is not directly related to capital account transactions. By contrast, some authors have chosen a narrow approach. For example, Bekaert, Harvey, and Lundblad (2005) focus on only equity controls and attempt to date equity liberalization episodes for a sample of 42 countries during 1960–2006. Edison and Warnock (2003) focus on de facto equity restrictions for a sample of 31 countries during 1989–2006 at a monthly frequency, by measuring the fraction of a country’s market capitalization that is open to foreign investment.

None of the above indices captures the intensity of controls or distinguishes between asset categories, inflows and outflows, or residents versus nonresidents. For example, regarding the intensity of restrictions, whether a financial transaction is prohibited, limited, taxed, or only requires notification/registration is likely to have different economic consequences. Quinn (1997) constructs a data set that contains information on the intensity of controls and covers 94 countries during 1950–1999. He captures the intensity of controls by ranking different control instruments by their (assumed) economic importance and it is the only index doing so for a large number of countries and years. His index also distinguishes between restrictions on residents and nonresidents. A recently updated version extends the data coverage through 2005. Similar to Miniane, given the less structured nature of the AREAER prior to 1995, consistency and comparability requirements across country-years imply that Quinn’s (1997) index cannot distinguish between inflows and outflows (see the discussion in the previous section) or between different asset categories.

Table 7.2 shows pairwise correlations of the various indices at their most aggregated levels. The correlations are reassuringly high, and particularly so between the new index and those by Miniane and Tamirisa—this is not surprising given that these indices employ similar methodologies. By contrast, the equity liberalization index by Edison-Warnock is based on a rather different methodology, and effectively is a de facto measure, but, at around 0.47, the correlation is still

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14 This is not to say, however, that these other three variables have no bearing on capital account restrictions; for example, multiple exchange rate practices may make capital account transactions more costly even in the absence of other, more direct restrictions on capital account transactions.

15 Such a ranking is difficult as the relative importance of restrictions likely depends on the specific context. For example, whether “approval required but frequently granted” is equally restrictive as “approval not required, but heavily taxed” (as assumed in Quinn, 1997) will depend on the level of the tax rate and the precise definition of “frequently granted.”

16 A possible exception is Brune (2006) who, as described in Brune and Guisinger (2007), constructed a data set covering 187 countries during 1965–2004 and containing separate information on inflow and outflow restrictions in five categories. She reports high correlations with the IMF dummy and the indices by Tamirisa (1999), Miniane (2004), and Quinn (1997); however, her data set has not been available to the author.
## TABLE 7.2

**Pairwise Correlations of Alternative Capital Control Indices**

<table>
<thead>
<tr>
<th></th>
<th>New Index</th>
<th>IMF Dummy</th>
<th>Bekaert and Others</th>
<th>Chinn-Ito</th>
<th>Edison-Warnock</th>
<th>Mody-Murshid</th>
<th>Miniane</th>
<th>Tamirisa</th>
<th>Quinn</th>
</tr>
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<tbody>
<tr>
<td><strong>New Index</strong></td>
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<td></td>
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<tr>
<td><strong>IMF Dummy</strong></td>
<td>0.749</td>
<td>1</td>
<td>(0.000)</td>
<td>0.749</td>
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<td>0.622</td>
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<td></td>
<td>819</td>
<td></td>
<td>(0.000)</td>
<td>0.359</td>
<td>0.379</td>
<td>0.951</td>
<td>0.751</td>
<td>0.878</td>
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</tr>
<tr>
<td><strong>Bekaert and Others</strong></td>
<td>-0.062</td>
<td>0.222</td>
<td>(0.219)</td>
<td>1</td>
<td>0.269</td>
<td>0.322</td>
<td>0.285</td>
<td>1</td>
<td>0.839</td>
</tr>
<tr>
<td><strong>Chinn-Ito</strong></td>
<td>0.767</td>
<td>0.843</td>
<td>0.859 (0.000)</td>
<td>1</td>
<td>0.269</td>
<td>0.322</td>
<td>0.285</td>
<td>0.859</td>
<td>0.859</td>
</tr>
<tr>
<td><strong>Edison-Warnock</strong></td>
<td>0.465</td>
<td>0.269</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>0.367</td>
<td>0.951</td>
<td>0.252</td>
<td>1</td>
<td>0.839</td>
</tr>
<tr>
<td><strong>Mody-Murshid</strong></td>
<td>0.622</td>
<td>0.758</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>0.252</td>
<td>0.285</td>
<td>1</td>
<td>0.839</td>
</tr>
<tr>
<td><strong>Miniane</strong></td>
<td>0.911</td>
<td>0.751</td>
<td>0.439 (0.000)</td>
<td>0.808</td>
<td>0.381</td>
<td>0.773</td>
<td>1</td>
<td>0.878</td>
<td>0.839</td>
</tr>
<tr>
<td><strong>Tamirisa</strong></td>
<td>0.928</td>
<td>0.833</td>
<td>-0.209 (0.000)</td>
<td>0.879</td>
<td>0.22680</td>
<td>0.832</td>
<td>0.922</td>
<td>0.878</td>
<td>0.922</td>
</tr>
<tr>
<td><strong>Quinn</strong></td>
<td>0.886</td>
<td>0.728</td>
<td>0.471 (0.000)</td>
<td>0.789</td>
<td>0.379</td>
<td>0.742</td>
<td>0.874</td>
<td>0.904</td>
<td>0.904</td>
</tr>
<tr>
<td><strong>Quinn</strong></td>
<td>637</td>
<td>2300</td>
<td>1467 (0.000)</td>
<td>2035</td>
<td>394</td>
<td>2064</td>
<td>576</td>
<td>39</td>
<td>2981</td>
</tr>
</tbody>
</table>

**Notes:** The indices and their sources are described in the text. All indices are normalized to the unit interval, with higher values indicating higher restrictiveness. For each pair, the table lists the correlation coefficient, the level of significance (in parentheses), and the number of pairwise observations.
relatively high. Overall, the high correlations with other indices at the aggregate level instill confidence that the new index also captures meaningful information at more disaggregated levels that existing indices cannot provide.

7.3. EMPIRICAL APPLICATIONS

The new index can be used to study a broad range of questions of interest that could not be examined previously. In particular, by exploiting novel features of the index, specifically the possibility of separately considering controls by asset categories, resident status, and direction of flows, new research avenues open up. This section highlights some of these features and outlines possible directions for future research.

7.3.1. Trends and Cross-Country Comparisons

Although other indices with longer time coverage are better able to present long-term trends, the new index extends into 2005 and thus can capture more recent trends. Figure 7.2 plots average trends for some of the main indices: Miniane’s, Chinn-Ito’s, the IMF dummy, Quinn’s, and the new index. The various indicators are all fairly consistent in their time series variation and all document a broad trend toward increased de jure liberalization of financial flows over most of the past decade. All of the indices also point toward a slowdown in the pace at which countries are liberalizing their capital accounts. In fact, the indices point to a possible reversal in 2005, although additional time coverage will be necessary to draw more meaningful conclusions. Although there were, in nearly all regions, both countries increasing and decreasing their average degree of restrictiveness in 2005, many European countries were among those with the highest increases in capital account restrictions, such as Austria, Kyrgyz Republic, Belgium, Czech Republic, and Uzbekistan.

Compared to previous indices based on the IMF’s binary capital controls dummy, the new index also allows for a more meaningful comparison of the levels of capital account restrictiveness across regions and income groups. Considering sample averages of the IMF dummy is equivalent to counting the number of countries that exceed a certain (undefined) threshold of capital account controls, without quantifying how restrictive individual countries in a group are, making cross-country rankings of capital account restrictiveness difficult to interpret. Figure 7.3 provides regional averages for 1995 (the last year the IMF dummy was officially reported) and illustrates that these differences in indices may indeed lead to different rankings. The simple dummy overstates

17 The correlation with the binary equity liberalization index by Bekaert, Harvey, and Lundblad (2002) (switching from 1 to 0 when equity markets are liberalized) is statistically insignificant as their data set reports only six liberalization episodes that fall in the sample of the new index: Côte d’Ivoire, Kenya, and Tunisia in 1995, South Africa in 1996, and Oman and Saudi Arabia in 1999.

18 The 2005 reversal is also reflected in individual asset categories except for FDI where the trend toward fewer restrictions continues even into 2005; inflow restrictions on average also continued to decrease (see Figure 7.4).
Figure 7.2  Trends in de jure financial openness, 1975–2005. Notes: The indices and their sources are described in the text. Where applicable, they were rescaled and normalized to $[0,1]$, with higher values indicating higher restrictiveness.
Figure 7.3 Regional averages of de jure financial openness, 1995. Notes: The indices and their sources are described in the text. Higher values indicate higher restrictiveness.
restrictiveness in most regions, particularly in Asia, sub-Saharan Africa, and Latin America, whereas it understates average capital account restrictiveness in North America and, to a lesser extent, Europe. Thus, the new index arguably provides a more realistic and meaningful comparison across regions (and countries).

7.3.2. Compositional Changes

A key strength of the new index is its ability to provide information on a country’s composition of capital account restrictions in addition to simply measuring the country’s overall restrictiveness. Figure 7.4 shows a decomposition by asset categories, by the direction of flows, and by residency. The figure exhibits substantial changes in the relative importance of controls across asset categories, with an overall trend of convergence across asset groups. This convergence may be a response to growing market sophistication which increasingly enables market participants to circumvent differential treatment of different asset categories—equal restrictions across asset categories may thus facilitate their enforcement. Although the relative levels of resident/nonresident and inflow/outflow restrictions have been fairly stable during most of the decade, the 2005 data points to a divergence in relative inflow and outflow controls, with countries imposing more restrictions on outflows than on inflows.

Recent research has started to take advantage of the information on the composition of capital controls. For example, Prati, Schindler, and Valenzuela (2009), among other things, exploit the inflow/outflow distinction in combination with firm-level credit ratings data to identify the channel through which capital account liberalization affects an economy. Dell’Ariccia and others (2010) investigate the link between de facto financial integration and de jure capital account restrictiveness using a gravity approach. To do this, they combine a country’s outflow controls with its partner country’s inflow controls to construct a measure of bilateral capital controls.

7.3.3. Event Studies

Another important feature of the index is its relatively fine gradation, allowing researchers to identify large changes in de jure regimes, thus being able to date reform events. This type of approach has been advocated by Henry (2007). For example, in assessing the existing literature on effects of capital account liberalization on economic growth, he argues that attempting to find long-term growth benefits is ill-conceived, as simple growth theory would predict only temporary growth effects during the transition to a new steady state. Event studies focusing on the immediate period around liberalization episodes may, therefore, be a more appropriate framework for testing for growth effects.

An application of this approach to the effects of de jure liberalization on de facto financial integration is illustrated in Figure 7.5 where large capital account reforms and reversals are identified both in the aggregate and by asset category.

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19The capital controls index for the United States, for example, is coded as non-zero in the new index because of restrictions on foreign mutual funds (“sale or issue locally by nonresidents”) under the Investment Company Act (see IMF, 1996).
Figure 7.4 The composition of capital controls, 1995–2005. (A) Asset categories. (B) Inflows vs. outflows. (C) Residents vs. nonresidents. Notes: The debt category in panel (A) is defined as the average of the bond and money market restriction indices.
Figure 7.5  Changes in de facto financial integration following large de jure reforms/reversals (in percent). Notes: Based on Lane and Milesi-Ferretti (2010) and the new de jure index. The figure plots the percent difference between countries’ average financial integration, defined as the ratio of external assets and liabilities to GDP, three years before and after reforms (reversals). Reforms (reversals) are defined as annual changes in the new de jure index exceeding the median positive (falling below the median negative) annual change in the index.
The dating of such events can, for example, help answer questions regarding the effectiveness of controls in enabling or reducing de facto capital movements. The figure suggests that there may indeed be an association. The strength of this association varies between asset categories and also between reform and reversal episodes. Broadly speaking, countries’ de facto integration jumps up substantially around the time of reform episodes. De facto integration also increases following reversal episodes, but to a much lesser extent. One interpretation is that liberalizing the capital account can substantially help a country attract foreign capital, but that the reverse is not true: that is, countries may not be able to completely insulate themselves from financial flows by imposing restrictions.

Figure 7.5 is also suggestive of another result, namely, that capital controls for some asset categories are more effective than for others. For example, lifting equity controls (and, to a lesser extent, debt controls) coincides with dramatic increases in de facto integration, whereas there is virtually no such association for FDI. Although such correlations do not establish a causal relationship, they are suggestive of a link and warrant more careful investigation.

7.4. CONCLUSION

This chapter has presented and documented a new data set of countries’ de jure restrictions on cross-border financial transactions. As any measure of capital account restrictions, its construction required striking a balance between various features of the data, such as breadth (information by assets, direction of flows, and residency), depth (the intensity of controls), and country and time coverage. Besides a fairly broad country coverage, the distinguishing feature of the data set presented here is its level of disaggregation, not found in other indices. By coding the data at the level of individual types of transactions, the data set has a modular setup which allows researchers to “mix and match” by averaging across the various subcategories in ways that best fit their research objectives. The chapter also outlined several research avenues that the new index makes possible and that could help make progress in better understanding the many facets of financial globalization.

REFERENCES


The External Wealth of Nations
Mark II: Revised and Extended

PHILIP R. LANE • GIAN MARIA MILESI-FERRETTI

8.1. INTRODUCTION

The dramatic increase in international financial integration has been one of the salient global economic developments in recent years. Countries have accumulated substantial cross-border holdings, and there have been sizable shifts in the composition of asset and liability positions, with attendant revisions in the risk profiles of individual economies. In particular, the size of countries’ external portfolios is now such that fluctuations in exchange rates and asset prices cause very significant reallocations of wealth across countries. And the emergence of large external imbalances—itself made easier by the decline in home bias—has led to renewed interest in the international adjustment mechanism and the dual role played by exchange rates in influencing both net capital flows and net capital gains on external holdings.²

To improve our understanding of these phenomena, we assembled a comprehensive and up-to-date dataset on the foreign assets and liabilities of advanced, emerging, and developing countries for the period 1970–2004. This updates and extends our earlier work (Lane and Milesi-Ferretti, 2001a), which included

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¹ We thank Marco Arena, Vahagn Galstyan, and Agustin Benetrix for excellent research assistance. We are also grateful to Giancarlo Corsetti and an anonymous referee for useful comments, and to Michael Connolly, John Fitzgerald, Patrick Honohan, Neil Humphries, Per-Martin Roer, Nicholas Tsavas, Frank Warnock, and many IMF colleagues for help with data. Parts of this chapter were written while Lane was a visiting scholar at the IMF, the LSE’s Centre for Economic Performance, and Harvard-NBER. Lane gratefully acknowledges the financial support of a Government of Ireland Research Fellowship, the Irish Research Council on Humanities and Social Sciences (IRCHSS) and the HEA-PRTLI grant to the IIIS.

² On shifts in portfolio composition, see Lane and Milesi-Ferretti (2007). On the adjustment mechanism and valuation changes, see Lane and Milesi-Ferretti (2001a, 2003, 2005), Tille (2003), and Gourinchas and Rey (2007).
estimates for external holdings of 67 countries over 1970–98. The new *External Wealth of Nations Mark II (EWN II)* dataset covers over twice as many countries (145 in total), incorporates an extensively revised methodology, and draws upon a richer range of data sources.

In this chapter, we describe the construction of the dataset and provide illustrative stylized facts. The virtually global coverage allows us to define “world” trends and investigate the “global discrepancy” between foreign asset and liability positions. Among key stylized facts, we highlight the further increase in financial globalization during the past decade for both industrial and developing countries, despite the several financial crises and the reversal in global stock market values in 2001–02. Marked shifts in the composition of external balance sheets are also noteworthy: major debtors (most notably, the United States) have increasingly relied on debt as a source of external finance, whereas emerging markets have increased the equity component in their external liabilities and accumulated significant official reserves.

In terms of net foreign asset positions, the cross-sectional distribution among industrial countries has changed little: with the exception of the increased U.S. indebtedness, major creditors and debtors in 2004 are the same as in 1996. Countries in emerging Europe, the Commonwealth of Independent States (CIS), and Latin America have experienced a large increase in net external liabilities, whereas Africa, emerging Asia, and the Middle East have seen significant improvements in their net external positions.

We also highlight differences in the composition of countries’ external portfolios. At end-2004, many industrial countries—such as the United Kingdom and the United States—are “short debt, long equity.” In contrast, emerging markets and developing countries are typically “short equity,” with many having net liabilities in both debt and equity categories. Finally, we emphasize the importance of the valuation channel—changes in net foreign assets are significantly more volatile than the current account. Differences between changes in net foreign assets and the current account balance are quite persistent in many countries and represent an important source of long-term shifts in net external positions.

The rest of the chapter is structured as follows. Section 8.2 presents the estimation methodology. The scale and scope of the data are described in Section 8.3 and selected empirical findings in Section 8.4, with concluding remarks provided in Section 8.5. A Web appendix provides detailed country data notes (see also Appendix I).3

### 8.2. METHODOLOGY

In the Mark I version of this dataset, we employed a broadly uniform methodology to construct estimates of foreign asset and liability positions for 67 countries over 1970–98, which relied extensively on cumulative flow data with valuation

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3 The data and appendix are also available via Internet: http://www.imf.org/external/pubs/ft/wp/2006/data/wp0669.zip

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adjustments. Since then, a much broader group of countries has begun to publish estimates of external assets and liabilities—the so-called International Investment Position (IIP)—following the methodology described by the International Monetary Fund (IMF) (1993).

We take these developments into account by incorporating national estimates of IIPs into our estimation methodology. For most countries, we use as a benchmark the official IIP estimates for recent years.\(^4\) We then work backward with data on capital flows and calculations for capital gains and losses to generate estimates for stock positions for earlier years, back to 1970 in most cases. Because there is much cross-country variation in the reliability of the data on capital flows and estimated stock positions, we employ a range of valuation techniques to obtain the most appropriate series for each country.

To start, it is useful to clarify the nature of the balance of payments and international investment position (IIP) data which form the backbone of our database. The fifth revision of the Balance of Payments Manual (IMF, 1993) works on the basis of the residence principle—hence external assets and liabilities, as well as capital inflows and outflows, are claims and transactions between a country’s residents and nonresidents. International holdings and transactions are classified in the following broad categories:

- Portfoliazio investment, subdivided into equity securities and debt securities;
- Foreign direct investment, which refers to equity participations above 10 percent;\(^5\)
- Other investment (which includes debt instruments such as loans, deposits, and trade credits);
- Financial derivatives; and
- Reserve assets.

For each of these categories, balance of payments data measure net capital inflows and outflows during a recording period, and the IIP data measure the stocks of external assets and liabilities at the end of the recording period. More specifically, capital inflows measure net purchases or sales by nonresidents of domestic assets, whereas outflows measure net purchases or sales of foreign assets by residents. Hence both capital inflows and capital outflows can also take negative values—for example, if nonresidents are net sellers of domestic shares in a given year, portfolio equity inflows will be negative, and if a government repays part of its external debt, the reduction in nonresidents’ claims on the country is a negative inflow.

Stocks of external assets and liabilities are generally positive. Among the few exceptions, the most common one relates to foreign direct investment. For example, if a company invests $100 in equity of a firm overseas and borrows $110 from that firm via an intracompany loan, the stock of FDI abroad would be $10 (see BPM5 and IMF, 2003a). Also, domestic residents may “short” equities

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\(^4\) When the reported IIP has only partial coverage, we use alternative methods and sources to form our estimates.

\(^5\) Once an FDI investment is established, all subsequent financial transactions between the parent and affiliate are classified under FDI, including intrafirm debt assets and liabilities.
in a foreign country, in which case equity assets would be negative. However, these are rare occurrences in our data.

Our data presentation groups together portfolio debt and other investment, reporting total external debt assets and liabilities. The decomposition between bonds and other investment is only available for countries that report the IIP—typically for a shorter period than the time span of our database.

Our methodology relies both on direct measures of stocks and on cumulative flows with valuation adjustments, which are constructed as follows. Let $D$ be the stock of holdings at the end of year $t$ and $d$ net purchases during year $t$. Let $p_t$ be the U.S. dollar price of asset $D$ at the end of $t$ (for example, the end-of-year stock market price index in dollars), and $\bar{p}$, the average price of asset $D$ during year $t$. Then

$$D_t = \frac{p_t}{p_{t-1}} D_{t-1} + \frac{p_t}{\bar{p}_t} d_t$$  (1)

That is, holdings at the end of period $t$ are the sum of holdings at the end of $t - 1$, adjusted for valuation changes, and net purchases during $t$, evaluated at end-of-year prices. This formula can be used to obtain holdings $D_t$ given an estimate of $D_{t-1}$, flows $d_t$, and prices $p_t$, or to back out $D_{t-1}$ given $D_t$, $d_t$, and $p_t$.

When series are constructed cumulating flows forward, we need initial values for 1970 (or later starting years). Our main source for this purpose is the pioneering work of Sinn (1990) who estimated external asset and liabilities for 145 countries over 1970–87. For countries where we construct data by cumulating flows backward, the Sinn data provide a useful check on the reliability of the estimates.

The following subsections explain in more detail the construction of the data. Details on individual country estimates are provided in the Web appendix (see Appendix I).

### 8.2.1. Portfolio Equity Assets and Liabilities

Portfolio equity holdings measure ownership of shares of companies and mutual funds below the 10 percent threshold that distinguishes portfolio from direct investment. Our three primary data sources are:

- Stock estimates as reported in the IIP section of the IMF’s *International Financial Statistics (IFS)* and *Balance of Payments Statistics (BOPS)*, mostly reported at market value;
- The IMF’s *Coordinated Portfolio Investment Survey (CPIS)*, covering the geographical allocation of portfolio investment of over 60 investor countries in over 220 destination territories;
- Bilateral estimates on foreign holdings of U.S. portfolio equity and U.S. holdings of portfolio equity overseas, constructed by Frank Warnock on the basis of U.S. Treasury data.\(^6\)

For each country, equity liabilities derived from the CPIS provide a lower bound on total equity liabilities, and holdings in the United States provide a lower bound on total equity asset holdings. Only very few countries have reported their IIP over the whole period (the majority of countries started to report after 1990). As in Lane and Milesi-Ferretti (2001a), we therefore integrate these measures with market-value estimates of portfolio equity assets and liabilities constructed by cumulating outflows (for assets) and inflows (for liabilities), adjusted for changes in stock prices. These prices are measured with domestic and international stock market indices, implicitly assuming that a country invests its foreign equity holdings in a “world” portfolio with weights identical to the Morgan Stanley Capital International’s world index. For portfolio equity liabilities, we assume that foreign investors hold a broadly-based index of domestic shares, so that their value moves in line with the domestic stock market.

In this chapter we construct estimates using cumulative flows not only forward from an initial value, as in Lane and Milesi-Ferretti (2001a), but also backward from a recent estimate. In some cases, cumulating flows forward yields estimates in line with the reported stock. In other cases, however, the reported stock is much larger than cumulative flows, suggesting an underreporting of past capital flows. Calculating past holdings using cumulative flows backward would imply implausibly large initial stocks. In these cases, we assume that the growth rate of the stock can be proxied by the percentage change in adjusted cumulative flows or, in some cases, in holdings vis-à-vis the United States.

For countries that do not publish IIP data, we can proxy the stock of portfolio equity liabilities for 2001–04 with the holdings in that country reported by participants to the CPIS. Those holdings can then be extended backwards using adjusted flows or the percentage change in the adjusted cumulative flow series. For portfolio equity assets, we can use estimated holdings in the United States as a lower bound.

8.2.2. Direct Investment Assets and Liabilities

The FDI category includes controlling stakes in acquired foreign firms (at least 10 percent of an entity’s equity—in practice, however, most FDI holdings reflect majority control), as well as greenfield investments. In addition, at least for some countries, an increasingly important component of FDI is foreign property investment. Our main data sources for the stocks of foreign direct investment are IIP estimates, and estimates reported by UNCTAD’s World Investment Report.

The majority of countries provide book-value estimates of FDI assets and liabilities, with only a small number reporting market-value estimates. We complement existing stock estimates with cumulative flow measures, with valuation changes designed to capture shifts in relative prices across countries.

7 For countries with large stock markets, we use the world index excluding the home country. Lane and Milesi-Ferretti (2008) show that the composition of foreign equity portfolios is affected by bilateral factors such as trade linkages and gravity-type variables; however, the global index is a broadly appropriate valuation benchmark.
• For market-value series, we adjust positions for shifts in stock market price indices, similar to our method for portfolio equity holdings.\(^8\)

• For book-value series, we use two alternative methods: either cumulative U.S. dollar flows (for countries with either very volatile real exchange rate measures or FDI concentrated in commodity-producing sectors or extractive industries); or cumulative flows adjusting outstanding holdings for fluctuations in real exchange rates (as in Lane and Milesi-Ferretti, 2001a). For example, if the real exchange rate of a country appreciates relative to the U.S. dollar we assume that the U.S. dollar value of FDI holdings in the country correspondingly increases.

As in Lane and Milesi-Ferretti (2001a), our initial values are based on estimates by Sinn (1994) or, for several emerging markets, on their 1967 position derived from the Organisation for Economic Co-operation and Development (OECD; 1972) and flows between 1967 and 1970. Data on FDI flows is from the IMF’s Balance of Payments Statistics or, in a few cases, from UNCTAD. For a few countries we extrapolate the evolution of FDI flows and stocks from their bilateral positions and transactions vis-à-vis the United States, reported by the Bureau of Economic Analysis.

### 8.2.3. Debt Assets and Liabilities

The debt category offers the greatest data challenges, particularly in the measurement of foreign debt assets. This category includes portfolio debt securities, plus bank loans and deposits and other debt instruments. Our main data sources are:

• The country’s reported IIP;

• The World Bank’s Global Development Finance database (only for external debt liabilities of developing countries and emerging markets);

• The IMF’s *World Economic Outlook (WEO)* database (only for external debt liabilities of developing countries and emerging markets);

• The Quarterly External Debt Database (QEDS), jointly developed by the World Bank and the IMF, and available at the link http://www.jedh.org/jedh_dbase.html;

• The IMF’s *CPIS* (for portfolio debt assets and, indirectly, portfolio debt liabilities);

• The Bank of International Settlements (BIS) data on a country’s assets and liabilities vis-à-vis BIS-reporting banks;

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\(^8\) This correction is subject to several caveats. First, if a country’s FDI liabilities take the form of greenfield investments, these may bear little relation to the activities represented by the firms on the domestic stock market. Second, some proportion of FDI is attributable to investment in residential and commercial properties. Third, the value of FDI includes the value of accumulated cash and liquid assets held by an affiliate—the value of such treasury holdings again will not have a direct relationship with the stock market.
• Data on foreign assets and liabilities of banks and other banking institutions reported by IFS (lines 7a.d, 7b.d, 7c.d, 7f.d, 7k.d, 7m.d);
• National sources.

For industrial countries, our previous work did not provide direct estimates of gross debt positions. In this chapter, we use existing estimates of debt holdings overseas, extended backward with capital flows with valuation adjustments, often complemented with data from national sources. The valuation adjustment is based on available information on the currency composition of debt assets and liabilities. For example, if a country’s debt holdings are estimated to be entirely denominated in euros, the value of holdings is estimated adjusting the past (or subsequent) holdings for changes in the end-of-year exchange rate between the euro and the U.S. dollar, and adding (or subtracting) the flows occurring during the year.

For emerging markets and developing countries, data on external debt liabilities are typically available from the World Bank and/or the WEO for most of the entire sample period. When necessary, these series are extended with cumulative flows, with valuation adjustments to reflect the currency composition of debt. Especially in recent years, these series may include FDI-related intercompany debt (which in the IIP and in our data is classified as FDI) and it is hence important to net such holdings out.

Measuring debt assets is, however, much more complex. The only comprehensive series of domestic holdings of debt assets overseas is the IIP; although it is now reported by around 100 countries, it is often available only for recent years. In addition, historical capital outflows data are often incomplete—indeed, some countries only report data on “net” other investment flows for most of the sample period. To address these shortcomings, we again use a variety of methods. For several countries we estimate debt assets as the sum of claims by nonbank domestic residents on BIS-reporting banks (available from 1977 onward) plus foreign assets by commercial banks and other banking institutions (reported by IFS). The BIS series in particular may contain holdings accumulated through unrecorded financial flows (for example, capital flight). We also construct series based on cumulative capital outflows backward, in cases when the country starts reporting its IIP late in the sample, and forward (when no IIP data on debt assets are reported or such value appears too low relative to underlying capital outflows), and make use of data on errors and omissions for countries with significant unrecorded outflows. Finally, in some cases we estimate debt assets combining holdings data from IFS, BIS, and national sources with capital flow data.

8.2.4. Financial Derivatives

The stock of financial derivatives corresponds to the market value of the outstanding derivatives’ contracts. Only a few countries report separately data on the value of the outstanding stock of financial derivatives. Whenever such data are available, we include them in our dataset.

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9 The extensive literature on capital flight (Cuddington, 1986; Dooley, 1988; Claessens, 1997) constitutes an early attempt to provide estimates of foreign asset holdings by domestic residents, particularly for developing countries.
8.2.5. Official Reserves

As in our previous work, we use IMF data on total reserves minus gold (which include foreign exchange, SDR holdings, and the reserve position in the IMF), supplemented by data from national sources. Gold holdings are excluded, because they do not constitute a liability of another country.

8.2.6. Measurement Error

Clearly measurement error in our dataset is substantial, for two main reasons. The first is the incomplete reporting of balance of payments and especially IIP data, and the second is the difficulty of tracking increasingly complex international financial transactions. The first problem is particularly acute for countries in the Middle East, sub-Saharan Africa, and small financial centers (for which small measurement errors in gross positions translate into large measurement errors in net positions). An additional source of error arises because of the discrepancy between current account transactions and financial flows (the so-called net errors and omissions), an issue discussed at length in Lane and Milesi-Ferretti (2001a).

In this dataset we do not make systematic use of net errors and omissions in calculating a country’s net external position, but report their cumulative value separately. In some cases, our alternative data sources (such as holdings by a country’s residents in BIS-reporting banks for unrecorded outflows, or a country’s survey of its liabilities for unrecorded inflows) may capture part of these holdings.

The second problem is because of the increased complexity of financial instruments and the financial structure of companies, and the growing integration of international financial markets, which complicate the measurement of external positions. In some cases, the increase in cross-border transactions may overstate the extent of international financial interdependence. For example, a U.S. financial institution can set up a mutual fund in an offshore center, which in turn buys U.S. assets, and whose shares are purchased by, say, euro area residents. Rather than simply measuring an equity inflow in the United States from the euro area, the data will record an equity inflow in the offshore center from the euro area, and a corresponding outflow from the offshore center to the United States. These developments are reminiscent of trends in goods’ trade, where the ratio of value added to total exports may be very small.

Although these problems need to be taken into account when interpreting the data, understanding recent trends in global financial integration and international borrowing and lending requires a global perspective. In that light, we view the construction of (albeit imperfect) estimates of external positions for all major “players” in the international financial system as a crucial first step.

8.3. THE DATASET: A GLOBAL OVERVIEW

Our dataset covers 145 countries over 1970–2004, plus the euro area as a whole. We include all countries with income above US$1 billion in 2000 or US$2 billion in 2004. The only exceptions are three small financial centers—the Bahamas,
Barbados, and the Netherlands Antilles—plus Iraq and Afghanistan. We report aggregate foreign assets and liabilities, and the breakdown between direct investment, portfolio equity, and debt. We provide a complete span of data over 1970–2004 for 91 countries. For a further 54, we report data for shorter periods. All data are in millions of U.S. dollars, as in the IMF’s Balance of Payments Statistics. Holdings are measured at year-end, and hence converted in U.S. dollars at the year-end exchange rate. GDP—like all flow variables—is instead converted in dollars at the average exchange rate for the year. As a result, the ratios of external assets and liabilities to GDP we present can differ from those measured in domestic currency, with the difference proportional to the size of the ratio and to the difference between the year-end and period-average exchange rate vis-à-vis the dollar for a given year.

8.3.1. Differences with Respect to EWN I

Differences relative to our earlier dataset on external assets and liabilities (Lane and Milesi-Ferretti, 2001a—henceforth EWN I) are in terms of country coverage, time period, and data construction.

In terms of country coverage, EWN I covered 67 countries for the period 1970–98. EWN II covers over twice as many countries (145). The extended coverage reflects the inclusion of 27 countries in emerging Europe and the former Soviet Union (not included in EWN I), more extensive coverage of sub-Saharan Africa (35 countries versus 7 in EWN I), as well as 7 additional Middle-Eastern and 8 Asian countries. The extension allows us to include two of the largest 6 creditors in absolute terms (Hong Kong and the U.A.E.) and two of the largest 14 debtors (Hungary and Poland), as well as 6 out of the 10 largest creditors and 9 of the largest 10 debtors in relation to GDP that were absent from EWN I.

In terms of time coverage, EWN I covered the period 1970–98. EWN II extends the coverage to 2004. During these six additional years, international financial integration (measured by the sum of countries’ external assets and liabilities, scaled by world GDP) increased by close to 50 percent.

As for data construction, only around 20 countries in our sample were publishing IIP data when EWN I was constructed—hence, our estimates were based on cumulative flows adjusted for valuation effects. Currently, around 80 countries in our database provide IIP estimates and their number is growing rapidly. This allows us to use flows to extend the time series backwards, rather than having to rely only on cumulative flows going forward. In addition, the availability of alternative data sources—such as the CPIS—allows us to estimate a country’s external position more accurately than previously possible.

A couple of examples illustrate the improvements in data coverage. First, EWN II reports debt assets and liabilities of advanced economies, rather than the...
net debt position, as in EWN I. This reflects both increased availability of IIP estimates and careful estimation work using a variety of data sources, explained in the Web data appendix (see Appendix I). Second, the availability of data from the CPIS—as well as of bilateral U.S. holdings of foreign equities and foreign holdings of U.S. equities—have improved our estimates of portfolio equity holdings. For example, Ireland started to report data on equity inflows and outflows in the year 1998 (and hence EWN I did not contain data for the underlying stocks). Our current estimates of the stocks of portfolio equity assets and liabilities for 1997, based on the CPIS and data from the Irish Central Statistical Office, are 45 percent of GDP and 78 percent of GDP, respectively.

8.3.2. The World NFA Discrepancy

Given the global coverage of the data, we can document not only regional and country trends, but also address for the first time consistency issues between the world data on foreign assets and liabilities. Although the existence of a world current account discrepancy is well known (see the IMF's *Balance of Payments Statistics Yearbook* and Marquez and Workman, 2001), lack of data has so far prevented a similar analysis for external assets and liabilities. The world current account discrepancy, the systematically negative difference between world investment income earnings and payments, and anecdotal evidence of underreporting of foreign assets, suggest that measured world external liabilities will exceed assets.

Figure 8.1 shows that this is indeed the case. The figure plots the cumulative value of the world current account discrepancy, together with the difference between total external assets and liabilities measured in our dataset, scaling both series by world GDP. The comovement between the two series is striking, all the more so in light of the fact that, as described in the previous section, the new version of our dataset is based to a much weaker extent on cumulative capital flows than the previous one. The figure also includes the cumulative value of the financial account, with a minus sign. As a measure of cumulative net capital outflows this is the closest proxy to a flow-based measure of the NFA discrepancy. The difference with the cumulative current account reflects primarily net errors and omissions.

In Figure 8.2 we decompose the global stock gap between the underlying asset categories, showing that portfolio equity holdings account for almost half of the world NFA discrepancy, with the remainder accounted for by the debt category. Thanks to the results of the CPIS, we can shed some more light on the equity discrepancy by comparing total liabilities reported by a country with the assets that other countries claim to be holding in that location (derived from the CPIS). This is done in Table 8.1, which highlights how the portfolio equity liabilities

11 Some offshore centers not included in the dataset hold large assets and liabilities, but are de facto pure intermediaries, with trivial net positions. Therefore they would not alter the picture with regard to differences between “global” assets and liabilities, although they may affect the breakdown between equity and debt.

12 Foreign direct investment is the most problematic series from the point of view of measurement, given that some countries report it at book value and others at market value.
Figure 8.1 World NFA discrepancy and cumulative current account discrepancy, 1980–2004 (share of world GDP). Note: the cumulative current account discrepancy is the cumulative sum of the world current account “residual,” given by the sum of current accounts of all countries (from the World Economic Outlook database). The NFA discrepancy is given by the difference between total assets and total liabilities of the 145 countries in the sample. The cumulative financial account discrepancy variable is the cumulative sum of net capital outflows, where capital outflows are defined as the sum of the current account, capital transfers, and errors and omissions. All variables are scaled by world GDP.

Figure 8.2 Composition of the world NFA discrepancy, 1980–2004 (share of world GDP). Note: All plotted series are the difference between world assets and world liabilities in the specific categories, scaled by world GDP.
reported by Ireland, Luxembourg, and the United States are much higher than the reported portfolio equity holdings in these economies by CPIS-reporting countries.

This suggests that the source of the problem is the underreporting of claims on these countries. For Ireland and the United States, additional evidence can be obtained by comparing their surveys on foreign holders of domestic equities with the CPIS. As shown in Table 8.2, U.S.-reported data on holders of U.S. equities are much higher for financial centers (such as Singapore, Switzerland, and the United Kingdom) than holdings reported by these centers.13 This is to be expected—these shares may be held by custodians in these countries on behalf of nonresidents—as such, they would not be considered domestic holdings of foreign equities by the financial center’s asset surveys. There is also a large discrepancy between Canadian holdings reported by the United States and by Canada. As for Ireland, the largest discrepancies are those with the United Kingdom and the United States, which total over US$200 billion.

In sum, whereas some progress can be made in determining where some of the underreported external assets are held, it is much more difficult to establish which countries’ residents hold such claims. Looking forward, increased availability of bilateral data should allow countries to refine and widen the scope of their estimates, particularly for assets held overseas.

**8.4. SELECTED EMPIRICAL FINDINGS**

In this section, we present evidence on indicators of financial globalization; the composition of external balance sheets; the evolution of net foreign asset positions; and the role of valuation changes in explaining net foreign assets. We divide countries into two groups: long-standing OECD countries, which we denote as “industrial,” and the remaining economies, which we denote as “emerging” and developing (Appendix I). The separation does not always reflect the current level of development—for example, Hong Kong SAR and Singapore have considerably higher GDP per capita than several of the “industrial” countries.

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13 The large difference for holdings in Caribbean offshore centers is explained by the partial participation of these centers in the CPIS. For example, the survey for the Cayman Islands did not cover mutual funds.
8.4.1. The Scale of International Financial Integration

In Lane and Milesi-Ferretti (2003), we constructed a measure of international financial integration, defined as

\[
IFIGDP_t = \frac{FA_t + FL_t}{GDP_t}
\]

(2)

where \( FA \) (\( FL \)) denotes the stock of external assets (liabilities). Figure 8.3 plots this ratio for both industrial and developing countries from 1970 to 2004.\(^{14}\) During this period, the ratio has increased by a factor of seven, from 45 percent in 1970 to over 300 percent in 2004. During the 1970s and 1980s, the increase was fairly gradual (\( IFIGDP \) reached 100 percent only in 1987), but then accelerated in the mid-1990s: \( IFIGDP \) passed 200 percent in 1998 and 300 percent in 2004.\(^{15}\)

International financial integration for the emerging markets/developing countries group has also increased steadily over time, closely tracking trends for industrial countries until the early 1990s.\(^{16}\) From then on, however, the acceleration in cross-border asset trade by industrial countries was not matched by the emerging markets and developing country group, where the pace has been much more gradual.

The difference between the two country groups is even starker when international financial integration is compared with trade integration. Figure 8.4 displays the sum of external assets and liabilities scaled by the sum of imports and exports.

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\(^{14}\) Excluding Luxembourg (where data are available only from 2000 onward) lowers \( IFIGDP \) for industrial countries over the past five years by 15–20 percentage points, without altering the trend. Similarly, excluding Hong Kong SAR (data available since 1989) lowers \( IFIGDP \) for emerging markets, without altering the trend.

\(^{15}\) A test for a trend break is significant, starting in 1994. If a single trend break is permitted over 1970–2004, the statistical test identifies 1998 as the most significant year.

\(^{16}\) The sample composition changes over time, as some country data are missing for the early years of the sample.

Figure 8.4  Financial integration versus trade integration, 1970–2004. Note: Sum of external assets and liabilities in percent of sum of exports and imports.
of goods and services. For both country groups, the growth of asset trade outstripped the growth of product trade from the mid-1970s to the late 1980s. From then onward the increase in the ratio for industrial countries accelerated, with the spectacular increase in asset trade outpacing the expansion in goods’ trade. For emerging markets trade in goods increased much more rapidly than for industrial countries during this period, but the growth in asset trade was instead much slower, and therefore the ratio has remained broadly stable over the past 20 years.

To explore whether these stylized facts hold for equity instruments as well, we report a second financial integration measure based on portfolio equity and FDI stocks (Lane and Milesi-Ferretti, 2003):

\[
GEQY_{it} = \frac{(PEQA_{it} + FDIA_{it} + PEQL_{it} + FDIL_{it})}{GDP_{it}}
\]

(3)

where \(PEQA\) (\(PEQL\)) denotes the stock of portfolio equity assets and \(FDIA\) (\(FDIL\)) denotes the stock of direct investment assets (liabilities). Figure 8.5 shows the evolution of \(GEQY\) for both country groups. For the industrial group, the figure shows three phases—until 1985, the \(GEQY\) ratio was broadly stable; from 1985 to 1995, it gradually increased; since 1996, it increased much more rapidly, save for the 2001–02 reversal in global equity valuations. The trend has been reasonably similar for emerging markets and developing countries, with cross-border equity positions growing strongly during the 1990s. Indeed, equity integration for these countries has grown not only with respect to their GDP, but also with respect to trade (graph not shown), unlike their total financial assets and liabilities. This suggests a significant shift in the structure of these countries’ external portfolios, an issue we take up in the next subsection.

Figure 8.5  International equity integration, 1970–2004. Note: Ratio of sum of foreign portfolio equity and FDI assets and liabilities to GDP.
8.4.2. Trends in External Capital Structure

The composition of international balance sheets has been widely discussed in recent years, with an excessive reliance on debt finance perceived as increasing vulnerability and equity-based financing promoted as improving international risk sharing (Rogoff, 1999; Lane and Milesi-Ferretti, 2001b). We first consider the share of equity (portfolio and FDI) liabilities in total liabilities

$$EQSH_{it} = \frac{PEQL_{it} + FDIL_{it}}{FL_{it}}$$

Figure 8.6 shows the dynamics of $EQSH_{it}$ for the two country groups. The trends are broadly similar—a decline during the 1970s (the flip-side of the explosion in international debt flows during that decade), and an increase in the 1980s and especially the 1990s. For industrial countries, the past five years have seen a partial reversal in this ratio. As explained in Lane and Milesi-Ferretti (2007), this reflects not only the decline in stock prices during 2000–02, but also the increased importance of debt flows in recent years. Equity liabilities have instead continued to grow in importance in developing countries, and in 2004 accounted for half of their total external liabilities. Underlying this trend is a steady increase in the share of FDI, now accounting for about ¾ of equity liabilities, as well as a sharp increase in portfolio equity liabilities, particularly during the past decade, in line with local financial market development.  

$^{17}$The share of portfolio equity liabilities may be overstated in part because many countries report FDI liabilities at book value rather than at market value (IMF, 2003a).
The decline in the relative weight of debt in the external portfolio of developing countries and emerging markets has been accompanied on the asset side by rapid accumulation of official reserves. Figure 8.7, which reports the ratio of external debt and official reserves to exports for the entire group of emerging and developing economies, highlights these trends. The dramatic decline in the aggregate ratio of debt to exports since the late 1980s is remarkable, and holds also if we take the average or the median external debt-to-export ratio, rather than the aggregate one. As a result of these developments, the ratio of official reserves to total debt liabilities has increased from 29 percent in 1998 to 64 percent in 2004. The growth in reserve holdings by emerging markets and developing countries stands out also when compared with developments in industrial countries: while total holdings of reserves by both country groups were virtually the same in 1995 (over $700 billion), by 2004 total reserve holdings by emerging markets and developing countries (just under $2.5 trillion) exceed holdings in industrial countries by $900 billion.

8.4.3. Net Foreign Asset Positions

Figure 8.8 characterizes the distribution of net external positions at end-2004 by plotting the ratio of net foreign assets to GDP against (log) GDP per capita. The correlation is significantly positive at 0.45, but there is considerable variation in positions at all levels of development, particularly for high-income countries. The
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Variation of GDP per capita explains over 40 percent of the cross-sectional variance for industrial countries, and less than 30 percent for developing countries. Among the latter, the largest creditor positions are disproportionately identified with oil producers and richer Asian countries.

Figure 8.9, we examine the evolution of net external positions over time, separating out the United States from other industrial countries. In addition to the worsening in the U.S. position, the chart also highlights the dramatic improvement in the external position of developing countries since the late 1990s. The upward trend in net foreign assets of other industrial countries was reversed since 2001, primarily because of a deterioration in Spain, Italy, Australia, and the United Kingdom.

Figure 8.10 shows the evolution of net foreign assets between 1996 and 2004. There was relatively little change on average for industrial countries—no country switched between creditor and debtor status, with the most remarkable shift being the increased U.S. indebtedness. Elsewhere, emerging Europe, the CIS, and several Latin American countries experienced an expansion in net external liabilities over 1996–2004. However, other regions underwent a significant

---

18 Broad trends are analogous if we scale net foreign assets by world GDP (net positions do not sum to zero because of the global discrepancy). The U.S. and emerging markets’ positions are scaled down relative to other industrial countries, because the latter group is larger. Lane and Milesi-Ferretti (2007) discuss recent trends in global imbalances.
improvement in their net positions—the Middle East experienced the most dramatic gain, followed by emerging Asia and Africa. Although the recent increase in oil prices is certainly important for the Middle East group, the main factor for emerging Asia has been the focus on improving the external balance sheet in the wake of the 1997–98 financial crisis.

We conclude the discussion of net external positions by returning to the issue of measurement error (see Section 8.2.6). Table 8.3 provides data on the cumulative value of net errors and omissions as of the end of 2004. For the purpose of this discussion, we will refer to positive (negative) net errors and omissions as unrecorded capital inflows (outflows). On the one side, Switzerland is by far the largest receiver of unrecorded capital inflows. On the other side, a number of countries—Russia, Norway, and Kuwait—have experienced unrecorded outflows of 20 percent of GDP or more. Although for Switzerland this does not necessarily bias its IIP estimate, because unrecorded inflows may well be captured by the survey data used to calculate the IIP, for countries experiencing unrecorded outflows their cumulative value is unlikely to be captured in estimates of external assets. For example, Russian outflows attributed to “nonrepatriated export proceeds” are not included in the estimates of Russian external holdings. More generally, these figures provide a sense of the margins of uncertainty surrounding external accounts.

The composition of the external portfolio is an important factor determining the average returns and risk profile associated with a given net foreign asset.

Figure 8.9 Net foreign assets by country group (percent of group GDP), 1980–2004. Note: The chart plots aggregate net foreign assets for the two country groups and the United States, divided by each group/country’s GDP. The group “other industrial countries” includes all industrial countries except the United States.
Figure 8.10  NFA to GDP ratio: 1996 and 2004. Note: Switzerland is not displayed (NFA of 108% of GDP in 1996 and 125% of GDP in 2004). Figure for Latin America excludes Nicaragua (NFA of −172% of GDP in 1996 and −164% in 2004). (continued)
Figure 8.10  (Continued)
TABLE 8.3

<table>
<thead>
<tr>
<th>Country</th>
<th>Cumulative Net Errors and Omissions</th>
<th>Billions US$</th>
<th>Percent of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switzerland</td>
<td></td>
<td>140.8</td>
<td>39.2</td>
</tr>
<tr>
<td>Mauritius</td>
<td></td>
<td>1.5</td>
<td>25.5</td>
</tr>
<tr>
<td>Nepal</td>
<td></td>
<td>1.7</td>
<td>25.0</td>
</tr>
<tr>
<td>Albania</td>
<td></td>
<td>1.5</td>
<td>19.8</td>
</tr>
<tr>
<td>Bahrain</td>
<td></td>
<td>2.2</td>
<td>19.7</td>
</tr>
<tr>
<td>United Kingdom</td>
<td></td>
<td>133.8</td>
<td>6.3</td>
</tr>
<tr>
<td>Germany</td>
<td></td>
<td>150.6</td>
<td>5.5</td>
</tr>
<tr>
<td>United States</td>
<td></td>
<td>295.1</td>
<td>2.5</td>
</tr>
<tr>
<td>China</td>
<td></td>
<td>−97.3</td>
<td>−5.0</td>
</tr>
<tr>
<td>Italy</td>
<td></td>
<td>−135.7</td>
<td>−7.9</td>
</tr>
<tr>
<td>Venezuela, Rep. Bol.</td>
<td></td>
<td>−21.2</td>
<td>−19.2</td>
</tr>
<tr>
<td>Nicaragua</td>
<td></td>
<td>−0.9</td>
<td>−19.5</td>
</tr>
<tr>
<td>Dominican Republic</td>
<td></td>
<td>−3.6</td>
<td>−19.8</td>
</tr>
<tr>
<td>Lebanon</td>
<td></td>
<td>−5.9</td>
<td>−27.3</td>
</tr>
<tr>
<td>Zambia</td>
<td></td>
<td>−1.5</td>
<td>−27.6</td>
</tr>
<tr>
<td>Norway</td>
<td></td>
<td>−72.3</td>
<td>−28.4</td>
</tr>
<tr>
<td>Russia</td>
<td></td>
<td>−193.2</td>
<td>−32.7</td>
</tr>
<tr>
<td>Ethiopia</td>
<td></td>
<td>−3.4</td>
<td>−34.9</td>
</tr>
<tr>
<td>Bolivia</td>
<td></td>
<td>−3.4</td>
<td>−39.1</td>
</tr>
<tr>
<td>Mozambique</td>
<td></td>
<td>−2.6</td>
<td>−43.9</td>
</tr>
<tr>
<td>Kuwait</td>
<td></td>
<td>−59.5</td>
<td>−106.8</td>
</tr>
</tbody>
</table>

Note: The table reports the cumulative value of net errors and omissions. A positive value of net errors and omissions can indicate unrecorded net capital inflows or unrecorded net exports, and a negative value of unrecorded capital outflows or net imports. For Russia, the data on net errors and omissions is augmented to include “nonrepatriation of export proceeds” which are classified as other investment outflows but are not used in the calculation of the stock of other investment holdings.

Sources: authors’ calculations based on IMF, Balance of Payments Statistics, and Bank of Russia, Balance of Payments.

position. In Figure 8.11A, we plot the net equity and net debt positions for industrial countries. Ireland and Luxembourg are excluded as extreme outliers—both have very high positive net debt and negative net equity positions. If Figure 8.11 shows that there is no systemic cross-sectional relation between net debt and net equity (the correlation is 0.02). Several industrial countries (such as the United States and the United Kingdom) are long in foreign equity and short in foreign debt, whereas Japan, plus Ireland and Luxembourg, display the opposite pattern.

Figure 8.11B shows that for emerging markets and developing countries there is a typically a positive relation between net debt and net equity (the correlation is 0.35). No country exhibits the “short debt, long equity” profile: 72 developing

19 Financial centers with a large mutual fund industry (like Ireland and Luxembourg) are long in foreign debt and short in foreign equity, because foreign-owned shares in mutual funds are recorded as portfolio equity liabilities, even though some of the assets of the mutual funds are invested in bonds.

20 For countries such as Kuwait, Qatar, and Saudi Arabia, portfolio equity holdings are substantially underestimated: these countries do not report data on equity outflows or holdings, and partner-country data is incomplete (for example, the United States only reports aggregate equity holdings of Middle East oil exporters in the United States). Any reasonable assumption about diversification of external holdings implies that these countries have a positive net equity position.
Figure 8.11 (A) Net equity position versus net debt position: Industrial group, 2004. (B) Net equity and net debt position: Emerging markets and developing countries, 2004. Note: Ireland and Luxembourg excluded from Figure 8.11A because of extreme values (in both cases, very high positive net debt and negative net equity).
countries have net liabilities in both categories. An interesting feature is that 36 of the 44 countries with positive net debt positions have negative net equity liabilities—largely reflecting the large official reserves of the major recipients of FDI and portfolio equity inflows.

8.4.4. The Valuation Channel

Cross-country differences in portfolio structure, and the importance of equity holdings in particular, suggest that changes in the valuation of assets and liabilities can play an important role in driving net foreign assets, in addition to net borrowing or lending. 21 Table 8.4 shows the decline in the correlation between these variables over time, from 0.71 in 1971–81 to 0.33 in 1993–2004 for industrial countries and from 0.7 to 0.46 for a group of emerging markets. The weakening of the correlation is the counterpart to the accumulation of larger gross external holdings—the importance of valuation effects is generally proportional to the scale of international balance sheets. Table 8.5 shows that valuation effects typically imply larger short-term volatility of changes in net foreign assets relative to the current account balance.

However, it is also important to know whether the valuation channel merely raises volatility or also influences the long-term evolution of net foreign assets. There is a strong correlation between the cumulative current account balance and the change in net foreign assets over long time periods for both industrial countries and emerging markets. However, the cumulative divergence over time can be substantial, as shown in Table 8.6, which presents data on changes in net foreign assets and the cumulative current account, capital transfers, and errors and omissions. To understand the link between these variables, it is useful to abstract initially from capital gains and losses. If errors and omissions reflect unrecorded capital flows not captured by stock data, or if they reflect mismeasured trade flows, the sum of current account, capital transfers, and errors and omissions should be close to the change in net foreign assets. If instead errors and omissions reflect unrecorded

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21 As discussed further below, capital transfers (such as debt forgiveness) and errors and omissions can also drive a wedge between the current account and the change in net foreign assets. See also Lane and Milesi-Ferretti (2001a).
capital flows that are captured by stock data (something more likely to occur with unrecorded inflows than unrecorded outflows) then the sum of the current account and capital transfers would be close to the change in net foreign assets.

Within the “industrial” group (Panel A), there are a number of countries where the difference between the change in net foreign assets and the cumulative current account is substantially positive (primarily the United States, but also Canada and the United Kingdom). Although capital transfers explain the divergence for Canada (linked to the move to Canada of wealthy immigrants during the 1990s, as discussed in Lane and Milesi-Ferretti, 2001a), the data suggest substantial cumulative capital gains for the United States and the United Kingdom. In contrast, the difference between changes in net foreign assets and the cumulative current account is substantially negative for Iceland, Finland, New Zealand, and Spain, and does not appear to be explained by capital transfers or errors and omissions.
TABLE 8.6
Cumulative Current Account and Change in Net Foreign Asset Position, 1982–2004

(A) Selected Industrial Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Change in NFA</th>
<th>Cumulative Current Account</th>
<th>Difference</th>
<th>Cumulative Cap. Transfers or Debt Forgiveness</th>
<th>Cumulative Errors and Omissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switzerland</td>
<td>102.7</td>
<td>113.5</td>
<td>−10.9</td>
<td>−2.0</td>
<td>18.7</td>
</tr>
<tr>
<td>Japan</td>
<td>38.5</td>
<td>45.1</td>
<td>−6.6</td>
<td>−1.6</td>
<td>−0.4</td>
</tr>
<tr>
<td>Germany</td>
<td>9.2</td>
<td>8.8</td>
<td>0.4</td>
<td>−0.6</td>
<td>5.2</td>
</tr>
<tr>
<td>France</td>
<td>5.0</td>
<td>9.0</td>
<td>−4.0</td>
<td>−0.4</td>
<td>1.7</td>
</tr>
<tr>
<td>Canada</td>
<td>−1.2</td>
<td>−9.8</td>
<td>8.6</td>
<td>9.1</td>
<td>−1.4</td>
</tr>
<tr>
<td>Finland</td>
<td>−5.8</td>
<td>23.7</td>
<td>−29.5</td>
<td>0.5</td>
<td>−1.3</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>−12.6</td>
<td>−18.8</td>
<td>6.2</td>
<td>1.1</td>
<td>5.6</td>
</tr>
<tr>
<td>Italy</td>
<td>−16.7</td>
<td>−0.5</td>
<td>−16.2</td>
<td>1.5</td>
<td>−7.7</td>
</tr>
<tr>
<td>United States</td>
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<td>−38.4</td>
<td>15.6</td>
<td>−0.3</td>
<td>1.8</td>
</tr>
<tr>
<td>Spain</td>
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<td>8.0</td>
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<td>Australia</td>
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<td>−53.6</td>
<td>−1.1</td>
<td>2.9</td>
<td>−0.6</td>
</tr>
<tr>
<td>Portugal</td>
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<td>−50.7</td>
<td>−11.2</td>
<td>11.5</td>
<td>0.1</td>
</tr>
<tr>
<td>Iceland</td>
<td>−77.1</td>
<td>−43.1</td>
<td>−33.9</td>
<td>0.0</td>
<td>−6.4</td>
</tr>
</tbody>
</table>

(B) Selected Emerging Markets and Developing Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Change in NFA</th>
<th>Cumulative Current Account</th>
<th>Difference</th>
<th>Cumulative Cap. Transfers or Debt Forgiveness</th>
<th>Cumulative Errors and Omissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venezuela</td>
<td>27.9</td>
<td>60.6</td>
<td>−32.8</td>
<td>−3.2</td>
<td>−21.9</td>
</tr>
<tr>
<td>South Africa</td>
<td>6.0</td>
<td>−1.1</td>
<td>7.1</td>
<td>−0.4</td>
<td>2.5</td>
</tr>
<tr>
<td>China</td>
<td>5.2</td>
<td>15.5</td>
<td>−10.3</td>
<td>0.0</td>
<td>−5.0</td>
</tr>
<tr>
<td>Malaysia</td>
<td>−0.8</td>
<td>29.5</td>
<td>−30.3</td>
<td>−0.5</td>
<td>−1.4</td>
</tr>
<tr>
<td>Korea</td>
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<td>14.9</td>
<td>−20.4</td>
<td>−1.6</td>
<td>−2.1</td>
</tr>
<tr>
<td>India</td>
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<td>−11.9</td>
<td>2.4</td>
<td>0.9</td>
<td>0.2</td>
</tr>
<tr>
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<td>−15.7</td>
<td>−31.2</td>
<td>15.5</td>
<td>−5.4</td>
<td>−2.5</td>
</tr>
<tr>
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<td>−54.0</td>
<td>38.2</td>
<td>−9.9</td>
<td>−12.4</td>
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<tr>
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<td>−3.5</td>
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<tr>
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<td>−2.4</td>
<td>−4.4</td>
</tr>
<tr>
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<td>−32.4</td>
<td>−1.7</td>
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<td>−2.2</td>
</tr>
<tr>
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</tr>
<tr>
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<td>0.1</td>
<td>−2.9</td>
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<tr>
<td>Indonesia</td>
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<td>−6.1</td>
<td>−34.5</td>
<td>0.0</td>
<td>−5.0</td>
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</table>

Note: All variables are scaled by 2004 GDP. The cumulative current account balance, capital account transfers, and net errors and omissions are calculated over 1982–2004 (1989–2003 for debt forgiveness), whereas the change in NFA is the change in the net foreign asset position between end-1981 and 2004. Column (3) is the difference between columns (1) and (2). Positive net errors and omissions can indicate unrecorded capital inflows or unrecorded net exports, whereas negative errors and omissions can indicate unrecorded outflows or unrecorded net imports.

Table 8.6 (Panel B) shows that differences between cumulative current account balances and changes in net foreign assets in emerging markets and developing countries can be substantial even over a protracted period of time. As discussed in Lane and Milesi-Ferretti (2005), these differences can often be attributed to negative cumulative valuation effects. These result from a combination of exchange rate depreciation (when debt liabilities are disproportionately in foreign

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22 Table 8.6 (Panel B) also shows the impact of debt-reduction schemes, which can drive a wedge between the cumulative current account and changes in net foreign assets.
currency) or rising domestic asset prices (with equity and FDI liabilities rising in value over time). The table also highlights the large net errors and omissions, likely capturing unrecorded capital outflows, particularly in Argentina, the Philippines, and Venezuela.

Following Lane and Milesi-Ferretti (2007), we can quantify the contributions of the trade balance and returns to the dynamics of NFA by expressing the change in the ratio of NFA to GDP as

\[
b_t - b_{t-1} = bgst_t + \frac{i_t' A_{t-1} - i_t' L_{t-1} + \kappa g c_t A_{t-1} - \kappa g c_t L_{t-1}}{Y_t} - \frac{g_t + \pi_t}{(1 + g_t)(1 + \pi_t)} b_{t-1} + \varepsilon_t
\]

(5)

where \(b\) is the ratio of net foreign assets to GDP, \(bgst\) is the ratio of the balance on goods, services, and transfers to GDP, the second term measures net asset returns (the sum of net investment income and net capital gains, where \(i_t, \kappa g c_t, i_t, \kappa g c_t\) are the yield and capital gain rates on foreign assets and liabilities), \(g_t\) is the growth rate of real GDP, \(\pi_t\) is the inflation rate, and \(\varepsilon\) includes the ratio of capital transfers and errors and omissions to GDP. This expression highlights that the relative importance of net returns depends on the ratios of foreign assets and liabilities to GDP, the returns achieved on both sides of the balance sheet, and the net external position. Returns on assets and liabilities depend on an array of factors, including the equity-debt mix on each side of the balance sheet, currency of denomination and exchange rate fluctuations, and the global and country-specific factors driving asset valuations.

Table 8.7 provides the decomposition given in equation (5) for some industrial and emerging market economies over 1996–2004. At one extreme, in the United

<table>
<thead>
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<th>Net Returns</th>
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<tr>
<td>Initial NFA</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>United States</td>
</tr>
<tr>
<td>Japan</td>
</tr>
<tr>
<td>United Kingdom</td>
</tr>
<tr>
<td>Germany</td>
</tr>
<tr>
<td>Switzerland</td>
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<tr>
<td>Finland</td>
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<td>Norway</td>
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<td>Spain</td>
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<tr>
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<td>Mexico</td>
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<tr>
<td>Korea</td>
</tr>
<tr>
<td>Malaysia</td>
</tr>
</tbody>
</table>

Note: All variables expressed as ratios to GDP. Trade balance is balance on goods, services, and transfers. Net returns are the sum of investment income and capital gains. The term “other factors” is the sum of the growth term, capital account, and errors and omissions.
States significantly positive net returns have partly compensated the large trade deficit. These reflect a combination of low-yield debt liabilities, a long equity position giving the United States net gains from strong global equity returns, and a short dollar position which means that unexpected dollar depreciation generates net capital gains on its external position (see Tille, 2003; Gourinchas and Rey, 2007; and Lane and Milesi-Ferretti 2005, 2007).

In contrast, countries such as Finland and the emerging market economies show the opposite pattern. For Finland, its net capital losses can be attributed to the Nokia-driven boom in the value of its portfolio equity liabilities, underlining that external capital losses are not a welfare indicator and may simply reflect an efficient international risk-sharing mechanism. In related fashion, the net capital losses of emerging economies in Asia are influenced by the skewed composition of their external balance sheet (significant equity liabilities, large reserve assets)—the strong performance of their equity markets because the Asian crisis has raised the value of foreign equity holdings. Finally, the capital gains experienced by Argentina reflect the capital loss on foreign investors imposed by the debt default, as well as the substantial decline in the value of FDI holdings in Argentina resulting from the 2001 financial crisis.

In sum, the past decade has witnessed significant changes in net external positions across the globe. Emerging markets and developing countries—particularly emerging Asia and the Middle East—have substantially improved their aggregate external positions. Other regions, such as emerging Europe, have accumulated large liabilities. In industrial countries, external positions have generally become larger, with debtors (such as Australia, Spain, and the United States) accumulating more liabilities and creditors (such as Japan and Switzerland) more assets. With the increase in gross assets and liabilities, the valuation effects induced by changes in exchange rates and asset prices have become an important source of fluctuations in the value of countries’ external portfolios, often swamping the effects of capital flows.

8.5. CONCLUSION

The stylized facts we described illustrate the usefulness of the EWN II dataset as a comprehensive source of information on gross and net international investment positions, despite severe measurement problems. Relative to the previous state of knowledge, the greatly increased country coverage of the dataset is an important advance that will enable researchers to take a truly global view of developments in international financial trade. This feature is especially important in understanding the dynamics of external imbalances. Furthermore, the extension of the dataset to include 1999–2004 provides important information on the financial globalization process, in view of the ongoing increase in the scale of gross asset trade, accompanied by substantial shifts in the composition of international balance sheets, during this period.

An important contribution of this chapter is to highlight the shift in the structure of the external portfolio for emerging market economies. Taken
collectively, these countries have sharply improved their net foreign positions over the past decade. Moreover, the risk profile of their external balance sheets has been substantially changed by the growth in the share of equity liabilities in total liabilities and the rapid growth in the accumulation of foreign reserves. However, this aggregate performance masks differences in trends, particularly between emerging Europe and emerging Asia plus the Middle East: the former has been rapidly accumulating net liabilities, whereas the latter regions have been running large surpluses.

In terms of financial integration, the developing world has lagged behind the industrial countries in terms of the scale of cross-border asset trade (especially in the debt category). We may expect some catch-up by these countries, in line with further progress in domestic financial development and external capital account liberalization. That said, the increasing prominence of the major emerging market economies as international investors is already reshaping the nature of international asset trade.

There is a rich set of potential applications of this dataset. For instance, in combination with data on investment income and capital flows, it makes it possible to study rates of return on foreign assets and liabilities on a much broader scale than previously feasible. This can shed more light on the role played by the valuation channel in external adjustment.

In terms of the research agenda, there is clearly scope for a two-pronged strategy. In one direction, more work is needed to understand the determinants of gross and net external positions over time and across countries. In the other direction, our estimates of foreign asset and liabilities can be used to investigate a wide range of hypotheses about the impact of international financial integration on macroeconomic performance. We expect the \textit{EWN II} dataset to stimulate research on these questions.

\textbf{APPENDIX I: COUNTRY LIST}

\textit{Industrial countries:} Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

\textit{Other countries:} Albania, Algeria, Angola, Argentina, Armenia, Azerbaijan, Bahrain, Bangladesh, Belarus, Benin, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Cambodia, Cameroon, Chad, Chile, China, Colombia, Dem. Rep. of Congo, Rep. of Congo, Costa Rica, Côte d'Ivoire, Croatia, Cyprus, Czech Republic, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Estonia, Ethiopia, Fiji, Gabon, Georgia, Ghana, Guatemala, Guinea, Haiti, Honduras, Hong Kong SAR, Hungary, India, Indonesia, Iran, Islamic Republic of, Israel, Jamaica, Jordan, Kazakhstan, Kenya, Korea, Kuwait, Kyrgyz Republic, Laos, Latvia, Lebanon, Libya, Lithuania, Macedonia, Madagascar, Malawi, Malaysia, Mali, Malta, Mauritius, Mexico, Moldova, Morocco, Mozambique, Myanmar, Namibia,
Nepal, Nicaragua, Niger, Nigeria, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Qatar, Romania, Russia, Rwanda, Saudi Arabia, Senegal, Serbia and Montenegro, Singapore, Slovak Republic, Slovenia, South Africa, Sri Lanka, Sudan, Swaziland, Syrian Arab Republic, Taiwan Province of China, Tajikistan, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, United Arab Emirates, Uruguay, Uzbekistan, Venezuela, Rep. Bol., Vietnam, Yemen, Zambia, and Zimbabwe.

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International Monetary Fund, various years, Balance of Payments Statistics (Washington: International Monetary Fund).


9.1. INTRODUCTION

Financial globalization—defined as the extent to which countries are linked through cross-border financial holdings, and proxied in this chapter by the sum of countries’ gross external assets and liabilities relative to GDP (Box 9.1)—has made the interaction between international financial flows and domestic financial and macroeconomic stability an increasingly central issue for IMF surveillance. In discharging its mandate, a key issue for the IMF is to advise member countries about how they can reap the benefits of international financial integration while limiting its potentially harmful effects on macroeconomic volatility and crisis propensity. On various occasions—including in the context of discussions of recent Biennial Surveillance Reviews (IMF, 2004) and the Independent Evaluation Office’s report on the IMF’s approach to capital account liberalization (Independent Evaluation Office of the IMF [IEO], 2005)—Executive Directors have called upon staff to undertake further research into the issue of managing the risks associated with international financial integration in a way that maximizes the net benefits. The present chapter focuses on policies and reforms that can be carried out by recipient countries (and especially emerging market and developing countries), with issues related to the role of macroeconomic and prudential policies in source countries being left to later analysis.

Over the past three decades, de facto financial globalization has increased in most member countries, but integration has moved furthest in member countries of the Organisation for Economic Co-operation and Development (OECD), where it has primarily taken the form of two-way (“diversification”) asset trade, with large gross holdings of external assets and liabilities, but relatively small net...
**Measuring Financial Globalization**

A country’s degree of financial globalization/integration/openness (terms used interchangeably in this chapter) is a multifaceted concept, usually referring to the size of gross stocks of external assets and liabilities, the potential for large net flows (that is, differences in saving and investment flows), or the absence of arbitrage opportunities between returns on assets in different countries. Correspondingly, the various measures of this concept can be divided into three broad categories.

**Quantity-based measures.** The most widely applicable, and now generally accepted, measure of international financial integration is the sum of gross external assets and liabilities, relative to GDP (Lane and Milesi-Ferretti, 2010). This chapter relies mainly on this measure, reflecting the need for a broad cross-country coverage over an extended time span. An alternative stock-based measure compares the size and geographic allocation of a country’s external asset holdings with the portfolio predicted by an optimal risk-return frontier. Country coverage of such a measure is, however, limited. Still other quantity-based measures focus on gross financial inflows plus outflows (analogous to measures of trade openness based on imports plus exports). However, stock-based measures—which are less affected by short-term economic fluctuations—are preferable in the context of this chapter in light of its long-term focus.

**Saving-investment correlations.** Although investment can differ from domestic saving for countries with access to international financial markets, investment must equal saving under financial autarky. Saving-investment correlations have thus been used to measure the degree of international financial integration for groups of countries in different historical periods. Measures based on the size of net flows are also closely related, the current account surplus being the difference between saving and investment. A drawback of all such measures is that saving and investment are highly correlated even for groups of countries that seem to be fully open to international flows (the “Feldstein-Horioka puzzle”), and a warranted, or benchmark, correlation against which to compare actual correlations is difficult to identify empirically (but see Ghosh and Ostry, 1995; and Obstfeld and Taylor, 2004).

**Price-based indices.** Under financial integration, there should not be unexploited arbitrage opportunities from trade in similar assets. Comparisons of prospective returns on financial instruments in different countries (for example, covered or uncovered interest parity) thus provide a natural gauge of the extent of international financial integration. Alternative measures focus on real interest rate comparisons across countries. The applicability of these measures to emerging market and developing countries is hampered not only by difficulties in controlling for cross-country differences in risk or liquidity premia but also by the possibility that inefficient arbitrage may reflect domestic rather than international financial frictions.

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**BOX 9.1**

External asset positions. More moderate increases are apparent among middle-income countries, with benign worldwide financial conditions and abundant liquidity having supported the process in recent years. The smallest increases have been experienced by low-income countries.

The analysis presented below suggests that these trends reflect a number of factors. First, country-specific policies—in particular the relative strength of countries’ de jure capital controls—are correlated with relative de facto financial globalization. Controls that are maintained for many years seem to have a significant effect in
slowing integration, even if controls aimed at fine-tuning the timing or composition of financial flows tend to lose their effectiveness beyond the short run. Early external financial liberalization by advanced countries seems, for example, to be a key factor behind their greater degree of de facto integration. Second, beyond financial account policies, the extent of financial integration among emerging market and developing countries—including those with relatively open de jure regimes—has been constrained by other factors, including lower degrees of perceived institutional quality (a factor that also seems to affect the composition of a country’s external liabilities) and lower domestic financial sector development.

Third, although the bilateral pattern of a country’s external portfolio of assets/liabilities is strongly influenced by geographical distance (as in a standard “gravity” trade model), as well as by linkages related to language and colonial history, domestic policies aimed at reducing informational asymmetries—for example, by making local stock markets more transparent—can help to mitigate the role of persistent “gravity” factors. Financial transparency is thus a potentially important vehicle for boosting financial integration in the presence of a variety of persistent constraints.

Regarding the consequences of greater financial integration, economic theory suggests that financial globalization confers a number of potential benefits. Increases in international asset trade may foster economic growth, particularly if assets are used to finance worthwhile projects, or if they facilitate technology transfer (for example, through FDI), thereby underpinning increases in economic efficiency. In addition, such trade may lead to enhanced international risk sharing—indeed, the sizable gross external stock positions of advanced countries seem indicative of large potential risk-sharing gains, whereas an enhanced ability of emerging market and developing countries to borrow abroad in cases of natural disaster or temporary recessions would seem likely to contribute to greater consumption-smoothing. Looking ahead, large potential risk-sharing gains are apparent for emerging market and developing countries in light of their relatively large economic fluctuations while, from the standpoint of advanced-country residents, the ability to invest in emerging market and developing countries would be especially welcome, given the low correlation of these countries’ economic fluctuations with the global economic cycle.

Although there seem to be sizable potential gains from international financial integration, these will need to be set against the possible costs in the form of greater macroeconomic volatility and vulnerability to crisis. Indeed, the emerging market crises of the 1990s have only served to highlight the potential for sudden reversals of capital inflows in financially open economies, and the associated large and abrupt recessions, often with serious social consequences. External financial liberalization has more generally been seen as amplifying vulnerabilities to possible contagion/herd effects, particularly in cases where domestic institutions and policies are not strong enough to steer through bad times.

Against the background of the large potential gains and costs, what can be said of the actual effects of trends in de facto financial globalization? The results presented below suggest that the impact has varied depending on country characteristics:

- With respect to risk sharing, evidence based on data for the past three decades suggests that, while some gains have accrued to advanced economies,
this has not been the case for emerging market and developing countries, perhaps reflecting the more limited increase in financial integration for these countries.

• With respect to volatility, the findings suggest that for countries with sufficiently developed domestic financial systems, relatively open trade systems, good governance, and sound macroeconomic policies (that is, for countries that meet a number of “thresholds,” to use the jargon from the globalization literature), greater integration has not been associated with increased macroeconomic volatility or more frequent crises. Volatility is adversely affected for countries that fail to meet such thresholds, though the broad trend toward improved policies and greater trade openness may point to diminishing policy relevance of volatility concerns over time.

• The relationship between financial globalization and economic growth is more complex—consistent with the difficulties the economic literature has encountered in establishing robust empirical evidence linking growth to economic fundamentals more generally. The results presented below point to the importance of unbundling financial globalization into different components in order to uncover its effects. FDI and other nondebt forms of financial globalization are found to be positively and significantly associated with economic growth for all countries, whereas the impact of debt seems to depend on whether borrowers meet certain policy and institutional thresholds. Although empirical analysis based on macroeconomic data fails to establish a robust relationship between economic growth and all types of financial integration, it does suggest that greater integration is associated with factors that in turn have been found to support economic growth. Examples of such “collateral benefits” are development of the domestic financial sector, macroeconomic policy discipline, faster trade growth, and improvements in economic efficiency. Indeed, recent microeconomic evidence suggests that the efficiency costs of maintaining capital controls are significant.

In determining an appropriate pace of external financial liberalization, an important consideration is the extent to which countries meet the preconditions, or thresholds, for a favorable impact. However, it bears emphasizing that, even for countries that currently fall somewhat short of meeting the thresholds, greater financial integration—if it engenders collateral benefits as discussed above—may itself facilitate over time progress in attaining relevant policy and institutional thresholds. Moreover, two broad developments suggest that the impact of financial globalization may be more beneficial in coming years than in the past: first, FDI and other nondebt forms of international asset trade constitute a higher share of external financing today than in recent decades; and second, steps taken by countries to raise their game in relation to policy and institutional fundamentals are likely to imply greater net benefits from financial integration than would be apparent from empirical analysis of past data. The chapter’s results are broadly supportive of the “integrated” approach, which envisages a gradual and orderly sequencing of external financial liberalization and emphasizes the desirability of complementary
reforms in the macroeconomic framework and the domestic financial system as essential components of a successful liberalization strategy (Ishii and others, 2002).

The remainder of the chapter is structured as follows. Section 9.2 summarizes developments in de facto financial globalization for various groups of countries and types of assets and liabilities, and considers a possible relationship with changes in de jure capital controls. Section 9.3 analyzes the determinants of cross-country differences in de facto financial globalization, including the role of both highly persistent factors (such as institutional quality) and factors that can be substantially affected by policies in the relatively near term (such as capital controls). Section 9.4 estimates the potential gains from international risk sharing for different segments of the IMF’s membership and reports evidence on the extent to which such gains have been realized in practice. Section 9.5 estimates the impact of financial globalization on macroeconomic volatility, the frequency of crises, and long-run economic growth. Section 9.6 concludes.

9.2. SOME FACTS ON FINANCIAL GLOBALIZATION

The global economy has become substantially more financially integrated over the past three decades. Average de facto financial globalization (measured, as discussed in Box 9.1, by gross external assets and liabilities as a share of GDP) has approximately tripled since the mid-1970s. Experience has differed by income group: the worldwide increase in financial globalization has been driven mainly by high-income countries, where financial integration has accelerated since the early 1990s (Figure 9.1). Although low- and middle-income countries have also become more financially integrated, average increases have been more moderate. Regionally, many countries in developing and emerging East Asia as well as in Eastern and Central

![Diagram showing gross external assets and liabilities by income group (in percent of GDP).](image)

Source: Lane and Milesi-Ferretti (2010).

Notes: Based on a sample of 74 countries (see Appendix I) for which data on de facto financial globalization and de jure capital controls are available for the entire sample period. Income groups are according to the World Bank definition. The graph depicts unweighted averages of countries’ ratios of the sum of external assets and liabilities relative to GDP.

Figure 9.1 Gross external assets and liabilities by income group (in percent of GDP).
Europe have displayed relatively large increases in international financial integration—sixfold and threefold, respectively, on average, compared with a twofold increase in the low- and middle-income countries as a whole.

Increasing financial integration among OECD countries has been characterized by two-way, or “diversification,” asset trade—large gross holdings of assets and liabilities that have resulted in a relatively small net external position (Table 9.1). In contrast, for other countries, net liability positions are relatively large. The data also suggest that the composition of external assets and liabilities has shifted away from debt instruments over the past decade, though debt remains—across income groups and regions—the largest component of external liabilities (Figure 9.2). FDI inflows have gained importance in many low- and middle-income countries, whereas portfolio equity finance has increased substantially in several high-income countries.

### 9.2.1. De Jure Financial Openness

Legal (de jure) controls on capital account transactions—a policy variable—are potentially important determinants of de facto financial globalization. Over the

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4 All cross-border financial holdings are included in the data presented in this chapter: debt, bank loans, equity investment, and FDI. Existing data on cross-border holdings of assets and liabilities do not allow a clear-cut distinction between public and private positions. This distinction, even if possible, would in any case be blurred by past conversions of defaulted private obligations into public debt.

5 There is also evidence that the currency composition of emerging market debt is changing: the share of local-currency-denominated debt in marketable sovereign debt rose from 73 percent in 1996 to 82 percent in 2004 (IMF, 2006).

6 For the purposes of this chapter, indices that measure controls on inflows and outflows separately, as well as controls on different categories of assets (equity, debt, and direct investment), have been developed for 91 countries for 1995–2005, drawing on the information in the Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER); see Appendix II and Schindler (2010) for further details. Long-term trends since 1975 draw on the AREAER’s original binary index, which was extended to 2005 for the purposes of this chapter. Shortcomings common to all indices based on the AREAER are that they do not capture differences in enforcement and the economic impact of controls across countries and time periods.
past three decades, most countries have relaxed de jure controls on the capital account, though the process of liberalization has slowed since the mid-1990s. This broad trend is apparent for both the relatively liberalized and the relatively nonliberalized countries, though liberalization efforts took place somewhat earlier in the former group than in the latter group (Figure 9.3, left panel). About one half of the countries in the sample are currently considered fully open to capital flows, up from under one-third in 1975. Although liberalizations were the dominant trend over the period, about 10 percent of the countries in the sample tightened their controls, often in response to crises. The capital controls index developed in this chapter indicates that 17 countries not fully open in 1995 had
Figure 9.3  Capital controls by financial openness and income group.

Sources: IMF, Annual Report on Exchange Arrangement and Exchange Restrictions (AREAER); and IMF staff calculations.

Notes: Based on a sample of 74 countries for which data on de facto globalization and de jure capital controls are available for the entire sample period. The graph depicts unweighted averages of countries’ capital controls, using the IMF’s binary capital controls indicator (based on the AREAER’s pre-1995 methodology). Countries in the left panel are categorized according to the 1975–2005 mean of their capital controls variable: the cutoff for liberalized versus nonliberalized is the sample mean. Countries in the right panel are grouped according to the World Bank definition (see Appendix I).
fully opened their capital accounts by 2005, while only 4 countries opted to fully close their capital accounts between 1995 and 2005.7

Although the level of controls appears to be inversely related to a country’s per capita income, countries in all income groups—on average—have relaxed capital controls over the past three decades (Figure 9.3, right panel). Liberalizations were pervasive among OECD countries—many of which moved from a highly restricted financial account position in 1975 to being fully open by 2005, while among emerging market and developing economies there were regional differences. Many countries in Eastern Europe and Latin America liberalized their financial accounts—owing, in a number of cases, to prospective accession to the European Union (EU) or bilateral or regional trade agreements (IEO, 2005, p. 32; and Árvai, 2005). In contrast, several countries in East Asia and the Middle East tightened capital controls, and most countries in sub-Saharan Africa maintained financial account restrictions. Several high-income oil-exporting countries also introduced new restrictions during the 1990s.

Among countries that retained capital controls, on average outflows were somewhat more restricted than inflows, whereas in low-income countries, restrictions on short-term debt were more common than those on long-term debt (Table 9.2). It is also worth noting that controls on equity, and especially FDI, were brought down considerably between 1995 and 2005 across the IMF’s membership, whereas controls on debt remained essentially unchanged, on average. More generally, in recent years, changes in the structure of capital controls have brought more countries in line with what has come to be referred to as the “integrated approach”

7 Countries with an aggregate capital controls index greater than 0.9 are here defined as fully closed, and those with an index less than 0.1 as fully liberalized. Using instead a definition based on the extreme values of the index (0.0 and 1.0), only 2 countries became fully closed, whereas 14 countries fully opened up.
BOX 9.2

The Integrated Approach to Capital Account Liberalization

As noted in the Independent Evaluation Office’s report (IEO, 2005), the IMF’s “integrated” or “sequencing” approach to capital account liberalization, developed in the late 1990s/early 2000s, appears to be widely accepted among IMF staff and underlies much of the institution’s policy advice in this area. The approach considers capital account liberalization as part of a broader economic reform package encompassing the macroeconomic policy framework, the domestic financial system, and prudential regulation. The approach also emphasizes the importance of following a sequence of measures and reforms.¹

The integrated approach consists of the following 10 general principles: (1) capital account liberalization is best undertaken against a background of sound and sustainable macroeconomic policies; (2) financial sector reforms that support and reinforce macroeconomic stabilization should be given priority in implementation; (3) financial sector reforms that are mutually reinforced and operationally linked should be implemented together; (4) domestic financial reform should be complemented by prudential regulation and supervision and financial restructuring policies; (5) liberalization of capital flows by instruments and/or sectors should be sequenced to take into account concomitant risks—in general, long-term and non-debt-creating flows (especially FDI) should be liberalized before short-term and debt-creating flows; (6) the pace of reform should take into account the conditions in the nonfinancial sector; (7) reforms that take time should be started early; (8) reforms need to take into consideration the effectiveness of controls on capital flows in place at the time of liberalization; (9) the pace, timing, and sequencing of liberalization need to take account of political and regional considerations; and (10) the arrangements for policy transparency and data disclosure should be adapted to support capital account opening.

The evidence reported in this chapter suggests that member countries have increasingly followed the integrated approach to liberalization. Taking a “snapshot” of countries’ capital control structures, the extent to which countries follow the approach should be reflected in the share of countries with more controls on short-term debt than on long-term debt; and with more controls on debt than nondebt flows. As shown in Figure 3.5, the degree to which countries’ practice appears to conform to the approach has increased since the mid-1990s. More generally, as shown in Appendix III, most countries covered in the case studies have also liberalized FDI inflows early on, long-term before short-term flows, and nondebt flows before debt flows, particularly in the more recent period.

¹ Eichengreen and others (1998); and Ishii, Habermeier, and others (2002).

(Box 9.2). According to this approach, countries should liberalize FDI inflows first; this should generally be followed by lifting controls on other long-term and nondebt flows, such as equity and outward FDI, before the liberalization of short-term flows and debt flows.⁸ In fact, as shown in Figure 9.4, both the number of countries with more liberal long-term than short-term flows, and the number of

⁸ The liberalization of some short-term flows into the banking system may be required at an early stage to foster the development of key domestic financial markets, notably the interbank money and foreign exchange markets. Suitable prudential measures in the banking system should be adopted in parallel.
countries with more liberal nondebt flows, increased by 10–15 percent between 1995–97 and 2002–05.9

Countries’ de facto financial integration has been influenced by their de jure financial account openness (Figure 9.5, top panel). First, during 1975–2004, de jure “liberalized” countries (defined as those with a lower-than-average index of capital controls over 1975–2005) had gross external assets and liabilities (relative to GDP) nearly twice as high as the nonliberalized countries (defined as those with a

---

9 This exercise takes a “snapshot” of whether a country’s capital controls structure is broadly in line with the integrated approach, though this is only a rough indication of consistency, because the approach allows for deviations from the broad patterns being considered when warranted by country-specific circumstances. Also, the exercise does not examine whether individual countries have adhered to the sequencing of liberalization implicit in this approach. Árvai (2005), who examines liberalization efforts of eight EU accession countries, reports that sequencing was broadly in line with the integrated approach.
higher-than-average index of capital controls). Second, the “least liberalized” countries (those in the decile with the highest controls)\textsuperscript{10} saw smaller increases in de facto globalization than were experienced by countries with less restrictive regimes, though even the least liberalized countries did not isolate themselves completely from the trend toward greater de facto financial globalization—the ratio of their gross external assets and liabilities to GDP almost doubled over the period. Third, for countries that went from having above-average de jure restrictiveness during the first half of the sample period to below-average restrictiveness during the second

\textsuperscript{10}These results also hold when controlling for per capita income.
half, de facto integration reached levels similar to those in countries that had been open throughout. Conversely, in countries that tightened controls during 1990–2005, financial integration converged to the lower and flatter trend of countries that had been closed throughout (Figure 9.5, bottom panel). These effects, it bears noting, portray the medium-run impact of highly durable characteristics of the capital control regime, rather than the impact of specific measures maintained for a relatively short time. On this latter issue, evidence from case studies suggests that when controls are reimposed in countries that have experienced relatively liberal flows for a number of years, they tend to lose their effectiveness relatively quickly, especially where domestic financial markets are well developed (Obstfeld, 2009).

Beyond the relationship between the de jure regime and the overall level of de facto financial integration, there is also some evidence—for example, Eichengreen and others (1998)—that the structure of capital controls affects the composition of countries’ external assets and liabilities. Indeed, other things equal, the evidence suggests that controls on portfolio equity and FDI are easier to enforce—and therefore more likely to be effective—than controls on debt and bank flows (Edwards, 1999). This evidence would seem to be broadly consistent with the observation that the share of FDI and equity in countries’ external portfolios has increased during the past three decades, over the same period that de jure controls on FDI and equity were reduced compared with other types of controls.¹¹

On the whole, the stylized facts in this section underscore the degree to which countries that have maintained controls in place for many years have experienced smaller increases in de facto globalization than countries that were always open. However, even the countries that maintained the strictest controls in the sample experienced some increase in financial integration, perhaps because trade in financial assets is closely associated with trade in goods, and it would have been too costly for these countries to isolate themselves from globalization in the broader sense. Although durable aspects of the capital account regime seem to have long-term effects on financial integration, controls aimed at fine-tuning the level and composition of flows tend to lose their effectiveness relatively quickly, and may become increasingly difficult to enforce as countries’ financial systems develop.

### 9.3. DETERMINANTS OF FINANCIAL GLOBALIZATION: A CROSS-COUNTRY PERSPECTIVE

What determines cross-country differences in de facto financial globalization (in contrast to the evolution over time in integration discussed in the previous section)? Despite the major increase in de facto financial globalization documented in Section 9.2, countries’ relative success in attracting international investors has been broadly stable over time: comparing countries’ rankings by de facto financial

---

¹¹A more formal approach, based on panel regressions, however, does not find significant evidence linking the shift toward equity and FDI finance to changes in the structure of capital controls (Faria and others, 2007). It is possible that the cross-country variation in lifting controls on equity and FDI compared with other flows has been insufficient for its impact to be captured in regressions.
globalization in different years, the rank correlation is 0.4 between the rankings in 1975 and 2004, and 0.7 between the rankings in 1995 and 2004. Such stability suggests that persistent country characteristics are likely to be key drivers of a country’s de facto international financial integration. This section analyzes the role of such persistent factors, as well as that of capital controls.

Cross-country differences in de facto financial globalization may be related to both foreign investors’ and domestic policy makers’ views on whether foreign financing will be put to productive use. For example, foreign investors are likely to prefer to hold external liabilities of countries where such financing is expected to yield higher returns, whereas policy makers are likely to embrace financial globalization if they believe it will lead to higher growth without engendering excessive volatility. In fact, cross-country evidence drawn from two waves of financial globalization (1870–1913 and 1970s–present) suggests that key determinants of the productivity of foreign capital—including the quality of broad institutions and, to some extent, measures of human capital—are also the main determinants of international investors’ willingness to hold a country’s external liabilities (Faria and others, 2006). Similar factors also seem to affect the composition of a country’s external liabilities: in a cross-section of emerging market and developing countries, equity-like liabilities (FDI and portfolio equity) as a share of countries’ total external liabilities are positively and significantly associated with indicators of educational attainment, natural resource abundance, and especially, institutional quality (Faria and Mauro, 2009).

Controlling for the persistent factors identified above, empirical analysis suggests that domestic policies vis-à-vis the financial account also have an impact on countries’ external liabilities. Table 9.3 presents estimates of the impact of capital controls, institutional quality, trade openness, and level of economic development on total external liabilities as well as their components. The effect of each of these factors is both economically and statistically significant. In particular, a one-standard deviation increase in the index of capital controls—equivalent to moving from the average for the Latin American countries to the average for developing and emerging East Asia–Pacific countries—is associated with a 17 percent reduction in total liabilities per capita, other things equal. Although a one-standard-deviation change in the capital controls index is certainly sizable, it has been undertaken by several countries, within a few years, during the sample period considered.

Empirical analysis also sheds light on how each country allocates foreign assets and liabilities across other countries. Estimating a fixed-effect “gravity model” for bilateral financial holdings of equity, FDI, bank loans, and other debt—similar to such models used to explain trade flows—country pairs characterized by historical links (common language, colonial history, and common legal systems) are found to have larger bilateral holdings (Table 9.4—see also Lane and Milesi-Ferretti, 2008). Moreover, countries that are further apart geographically and that do not share a border have significantly lower bilateral financial integration. The economic magnitude of the coefficient on geographical distance is substantial: for example, the estimates predict that bilateral equity holdings should be about 75 percent larger between France and the United States than between Australia and the United States.
Moreover, geographical distance and historical linkages have a significant impact on financial asset allocation even controlling for the strong correlation between trade and financial patterns. The estimates also confirm that capital controls on inflows in recipient countries and on outflows in source countries (for each type of flow) are negatively correlated with bilateral holdings.

The finding that bilateral gross asset holdings are closely associated with factors such as distance, language, and former colonial links may seem surprising in a globalized world where information appears to flow freely. If distance is instead a proxy for residual informational frictions, it may be expected to matter less for relatively transparent recipient countries and for large markets that are well covered by financial analysts. To investigate this hypothesis, Table 9.4 also considers the impact of the interaction between distance and a survey-based indicator of the recipient country’s financial market transparency, as well as market size. Both greater financial transparency and country size in the recipient country are found to dampen the negative impact of distance on bilateral equity holdings.

Moreover, geographical distance and historical linkages have a significant impact on financial asset allocation even controlling for the strong correlation between trade and financial patterns. The estimates also confirm that capital controls on inflows in recipient countries and on outflows in source countries (for each type of flow) are negatively correlated with bilateral holdings.

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### Table 9.4

<table>
<thead>
<tr>
<th></th>
<th>Total Liabilities (1)</th>
<th>FDI and Portfolio Equity (2)</th>
<th>Debt (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP per capita (log)</td>
<td>0.86*** (0.07)</td>
<td>0.97*** (0.10)</td>
<td>0.80*** (0.08)</td>
</tr>
<tr>
<td>Institutional quality index</td>
<td>0.48*** (0.13)</td>
<td>0.35** (0.17)</td>
<td>0.50*** (0.15)</td>
</tr>
<tr>
<td>Trade openness</td>
<td>0.46*** (0.16)</td>
<td>0.81*** (0.18)</td>
<td>0.29</td>
</tr>
<tr>
<td>Controls on inflows</td>
<td>−0.46*** (0.15)</td>
<td>−0.36** (0.17)</td>
<td>−0.56*** (0.20)</td>
</tr>
<tr>
<td>Constant</td>
<td>−0.10 (0.15)</td>
<td>−1.58*** (0.22)</td>
<td>−0.41*** (0.16)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.94</td>
<td>0.92</td>
<td>0.90</td>
</tr>
</tbody>
</table>

Source: Liabilities and their components are from Lane and Milesi-Ferretti (2010). Debt includes portfolio debt, bank loans, and currency deposits. Total liabilities consist of the sum of debt, FDI, portfolio equity, and financial derivatives. GDP per capita is from the World Bank’s World Development Indicators (WDI). The institutional quality index is the simple average of six indicators from Kaufmann, Kraay, and Mastruzzi (2005): voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption. Trade openness is the sum of imports and exports, divided by GDP, also from WDI. Controls on inflows are averages of all available years between 1995 and 2004 of indices of capital controls on total inflows (1), equity inflows (2), and debt inflows (3). Capital controls index constructed by staff based on the IMF’s Annual Report on Exchange Arrangements and Exchange Restrictions.

Notes: The sample consists of 96 observations. Offshore financial centers are excluded. Estimated by OLS, with robust standard errors in parentheses. The symbols *, **, and *** indicate statistical significance at the 20 percent, 5 percent, and 1 percent level, respectively.

---

12 A regression specification controlling for bilateral trade flows delivered similar results.

13 This result is robust to including an interaction of distance and the recipient’s financial market development, as measured by stock market capitalization relative to GDP, but not to adding the interaction between distance and the recipient’s per capita GDP, which might proxy for other facets of economic development beyond financial market transparency.
### TABLE 9.4
Gravity Estimates for Bilateral Foreign Asset Positions, 2004

<table>
<thead>
<tr>
<th></th>
<th>Equity</th>
<th>Debt</th>
<th>Bank Loans</th>
<th>FDI</th>
<th>Trade</th>
<th>Equity</th>
<th>Debt</th>
<th>Bank Loans</th>
<th>FDI</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
<td>(8)</td>
<td>(9)</td>
</tr>
<tr>
<td><strong>In(distance)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>−0.77***</td>
<td>−0.80***</td>
<td>−1.08***</td>
<td>−1.29***</td>
<td>−1.65***</td>
<td>−4.12***</td>
<td>−1.27</td>
<td>−7.46***</td>
<td>−5.58***</td>
</tr>
<tr>
<td></td>
<td>(0.06)</td>
<td>(0.06)</td>
<td>(0.09)</td>
<td>(0.11)</td>
<td>(0.03)</td>
<td>(0.04)</td>
<td>(0.04)</td>
<td>(0.05)</td>
<td>(0.07)</td>
</tr>
<tr>
<td><strong>Border</strong></td>
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<tr>
<td></td>
<td>0.64***</td>
<td>0.14</td>
<td>−0.10</td>
<td>0.63*</td>
<td>0.75***</td>
<td>0.52**</td>
<td>0.06</td>
<td>0.00</td>
<td>0.67*</td>
</tr>
<tr>
<td></td>
<td>(0.22)</td>
<td>(0.20)</td>
<td>(0.31)</td>
<td>(0.38)</td>
<td>(0.12)</td>
<td>(0.22)</td>
<td>(0.20)</td>
<td>(0.28)</td>
<td>(0.38)</td>
</tr>
<tr>
<td><strong>Common language</strong></td>
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<td></td>
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<tr>
<td></td>
<td>0.49***</td>
<td>0.23</td>
<td>1.14***</td>
<td>0.54**</td>
<td>0.81***</td>
<td>0.62***</td>
<td>0.24*</td>
<td>1.12***</td>
<td>0.28</td>
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<tr>
<td></td>
<td>(0.15)</td>
<td>(0.14)</td>
<td>(0.15)</td>
<td>(0.27)</td>
<td>(0.06)</td>
<td>(0.14)</td>
<td>(0.14)</td>
<td>(0.23)</td>
<td>(0.27)</td>
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<tr>
<td><strong>Common colony</strong></td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>1.08***</td>
<td>2.33***</td>
<td>...</td>
<td>...</td>
<td>1.01***</td>
<td>1.08***</td>
<td>2.24***</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td></td>
<td>(0.39)</td>
<td>(0.47)</td>
<td>(0.09)</td>
<td>(0.32)</td>
<td>(0.63)</td>
<td>(0.09)</td>
<td>(0.12)</td>
<td>(0.17)</td>
<td></td>
</tr>
<tr>
<td><strong>Common legal origin</strong></td>
<td></td>
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<tr>
<td></td>
<td>0.20**</td>
<td>0.12</td>
<td>0.09</td>
<td>0.32*</td>
<td>0.04</td>
<td>0.18**</td>
<td>0.15</td>
<td>0.09</td>
<td>0.43**</td>
</tr>
<tr>
<td></td>
<td>(0.09)</td>
<td>(0.10)</td>
<td>(0.17)</td>
<td>(0.04)</td>
<td>(0.09)</td>
<td>(0.09)</td>
<td>(0.12)</td>
<td>(0.17)</td>
<td></td>
</tr>
<tr>
<td><strong>Capital control—source</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>closed, recipient open</td>
<td>2.52***</td>
<td>−0.06</td>
<td>0.43</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td></td>
<td>(0.96)</td>
<td>(0.51)</td>
<td>(0.72)</td>
<td>(0.72)</td>
<td>(0.46)</td>
<td>(1.70)</td>
<td>(0.83)</td>
<td></td>
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</tr>
<tr>
<td>Capital control—source open, recipient closed</td>
<td>2.66***</td>
<td>0.06</td>
<td>−0.13</td>
<td>0.31</td>
<td>3.63***</td>
<td>0.06</td>
<td>−0.88</td>
<td>0.53</td>
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<tr>
<td></td>
<td>(0.59)</td>
<td>(0.47)</td>
<td>(1.17)</td>
<td>(0.57)</td>
<td>(0.62)</td>
<td>(0.47)</td>
<td>(1.73)</td>
<td>(0.62)</td>
<td></td>
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<tr>
<td>Capital control—both open</td>
<td>5.44***</td>
<td>1.10**</td>
<td>−0.47</td>
<td>1.30*</td>
<td>3.74***</td>
<td>0.41</td>
<td>...</td>
<td>1.20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.91)</td>
<td>(0.54)</td>
<td>(1.13)</td>
<td>(0.68)</td>
<td>(0.78)</td>
<td>(0.47)</td>
<td>...</td>
<td>(0.80)</td>
<td></td>
</tr>
<tr>
<td><strong>Recipient transparency × In(distance)</strong></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
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<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>0.26***</td>
<td>0.32***</td>
</tr>
<tr>
<td></td>
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<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>(0.07)</td>
<td>(0.07)</td>
<td>(0.10)</td>
<td>(0.12)</td>
</tr>
<tr>
<td><strong>Recipient GDP × In(distance)</strong></td>
<td></td>
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<td></td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>0.07**</td>
<td>−0.05</td>
<td>0.22***</td>
<td>0.12*</td>
</tr>
<tr>
<td></td>
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<td>...</td>
<td>...</td>
<td>...</td>
<td>(0.04)</td>
<td>(0.04)</td>
<td>(0.05)</td>
<td>(0.07)</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>1560</td>
<td>1346</td>
<td>1775</td>
<td>793</td>
<td>15,526</td>
<td>1304</td>
<td>1040</td>
<td>915</td>
<td>578</td>
</tr>
<tr>
<td><strong>R²</strong></td>
<td>0.83</td>
<td>0.85</td>
<td>0.80</td>
<td>0.86</td>
<td>0.75</td>
<td>0.85</td>
<td>0.86</td>
<td>0.83</td>
<td>0.89</td>
</tr>
</tbody>
</table>


Notes: All dependent variables in natural logarithms, and measured in end-of-year 2004 U.S. dollars. The capital control variables refer to controls on the specific type of flows, and refer to inflows for the recipients and outflows for the source. Source and recipient country dummies (fixed effects) are included. The estimated capital controls coefficients are relative to the “base” case where both source and recipient countries are closed. Robust standard errors in parentheses. The symbols *, **, and *** indicate statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively. The effects of some variables cannot be estimated for bank loans and FDI (columns 3, 4, 8, and 9), owing to insufficient variation across country-pairs for those cases.

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investors to hold a larger stock of a country’s external liabilities. Moreover, this effect seems to be greater for countries that are relatively isolated from the majority of international investors.

9.4. RISK-SHARING BENEFITS OF FINANCIAL GLOBALIZATION: THEORY AND PRACTICE

One of the key purported benefits of international financial integration relates to greater risk sharing: by making it possible for a country’s residents to hold financial assets whose returns are linked to output performance abroad, financial openness provides opportunities to enjoy relatively stable consumption streams despite fluctuations in domestic output. This section considers both potential gains from risk sharing—by comparing the extent to which the volatility of domestic consumption exceeds that of foreign output—as well as actual gains measured on the basis of observed declines in the correlation between domestic consumption and domestic output. Section 9.5 will then shift the focus to the observed effects of financial globalization on domestic consumption volatility, as well as crisis propensity and long-run economic growth.

9.4.1. International Risk Sharing in Theory

Economic theory suggests that under full financial integration, each country will consume a fixed share of the output produced by the group of countries with which it is integrated. In other words, the growth rate of consumption will be the same for all countries “in the group” and will equal the growth rate of groupwide output. Although this is unlikely to happen in practice, it is a useful benchmark for assessing the potential risk-sharing gains from financial integration. In simple terms, a practical way of measuring potential risk-sharing gains is to compare an individual country’s consumption volatility with the volatility of groupwide output: if a country’s individual consumption volatility is much higher than it would be under full financial integration within the group, then potential risk-sharing gains are relatively large. The main findings, reported in Table 9.5, are as follows:

- The potential risk-sharing benefits (reduction in consumption volatility) from full financial integration with the rest of the world are substantial for every country: the standard deviation of worldwide output growth is

---

14 The precise definition of full international financial integration in this theory involves full sharing of GDP risk, which could in principle be attained via a network of bilateral GDP swaps or the trading of claims on GDP. The analysis assumes that international financial integration does not affect GDP growth correlations across countries: see Obstfeld and Rogoff (1996, Chapter 5).

15 The results are similar using an individual country’s output volatility rather than consumption volatility. Some authors (for example, Lucas, 1987) have argued—based on evidence for advanced countries—that the welfare gains from reducing consumption volatility are small. However, others have shown that the welfare gains are much larger for emerging market and developing countries than for advanced countries (for example, Pallage and Robe, 2003). Potential risk-sharing benefits presented in this chapter suggest sizable welfare gains.
0.8 percentage points, far lower than the median standard deviation of consumption growth for individual countries (4.4 percentage points), and lower even than the standard deviation for the country with the lowest consumption volatility (1.4 percentage points).

- The potential gains from financial globalization are larger for countries whose economies are more volatile because they are subject to more frequent and relatively damaging idiosyncratic shocks (for example, smaller, and therefore less diversified, countries) or because their ability to smooth such shocks through countercyclical policies or domestic financial markets is lower (for example, countries at a lower stage of economic and domestic financial development).
- The potential gains are greater for countries whose international financial integration is relatively low, which to a large degree are countries whose economic cycles are less correlated with worldwide economic developments.

### TABLE 9.5

<table>
<thead>
<tr>
<th>Potential Gains from Risk Pooling Among Countries</th>
<th>Median $\sigma$ Individual Country (Consumption)</th>
<th>$\sigma$ Whole Group (Income)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All countries</td>
<td>4.45</td>
<td>0.81</td>
</tr>
<tr>
<td>Interest in risk sharing,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>by level of development and size of country</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced countries</td>
<td>2.19</td>
<td>1.18</td>
</tr>
<tr>
<td>Emerging market countries</td>
<td>4.01</td>
<td>1.29</td>
</tr>
<tr>
<td>Developing countries</td>
<td>8.24</td>
<td>1.30</td>
</tr>
<tr>
<td>Interest in risk sharing,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>by size of country</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small countries</td>
<td>6.72</td>
<td>1.23</td>
</tr>
<tr>
<td>Large countries</td>
<td>3.48</td>
<td>0.95</td>
</tr>
<tr>
<td>Current degree of international financial integration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-integration countries</td>
<td>2.45</td>
<td>0.85</td>
</tr>
<tr>
<td>Low-integration countries</td>
<td>6.10</td>
<td>1.31</td>
</tr>
<tr>
<td>Cost of weak enforcement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent enforceability countries</td>
<td>2.31</td>
<td>1.07</td>
</tr>
<tr>
<td>Below-excellent enforceability countries</td>
<td>6.11</td>
<td>1.26</td>
</tr>
<tr>
<td>Above-average institutional quality</td>
<td>2.45</td>
<td>1.10</td>
</tr>
<tr>
<td>Below-average institutional quality</td>
<td>6.17</td>
<td>1.32</td>
</tr>
</tbody>
</table>

Sources: Foreign assets are from Lane and Milesi-Ferretti (2010); GDP data in current U.S. dollars are from the IMF’s World Outlook. GDP and consumption data at purchasing power parity are from the World Bank’s World Development Indicators.

Notes: Column (1) reports the median (across countries in the indicated subsample) standard deviation ($\sigma$) of individual country growth in 1975–2004. Column (2) reports the standard deviation of the growth rate of total output for the group of countries as indicated. Small (large) countries are those with a total population of less than (more than) 5.2 million in 1970. High (low) capital integration countries are those in the top (bottom) half of the sample when ranked by total foreign assets to GDP. Above- and below-average institutional quality is measured according to the index by Kaufmann, Kraay, and Mastruzzi (2005). Excellent enforceability is defined as above-average institutional quality and no defaults on international debt in 1970–2004 according to Detragiache and Spilimbergo (2001) and Reinhart, Rogoff, and Savastano (2003).
Against the benchmark of the potential gains from global financial integration, what can be said about “optimal” groupings of countries from a risk-sharing perspective? Empirical analysis (based on Imbs and Mauro, 2007) suggests the following:

- The bulk of the potential risk-sharing benefits available to a country within a given sample of countries (for example, the world, a region, or countries within a given range of per capita income) can be attained in a small pool consisting of a handful of well-chosen partners. For example, consumption volatility can be reduced by more than half for a typical advanced country through full financial integration with an “optimally chosen” pool of five countries. The potential gains are even higher for optimal pools of emerging market and developing countries.

Although regional pools can provide major benefits, risksharing benefits tend to be greater when countries choose partners from the worldwide sample rather than within a region. For example, median volatility of consumption growth for Latin American emerging market countries equals 6.2 percentage points and can be lowered to 1.9 percentage points by pooling with five optimally chosen Latin American emerging market countries, but to 1.3 percentage points by pooling with five optimally chosen emerging market countries in the absence of geographical constraints. Similarly, the median Asian emerging market country can reduce its volatility from 4.1 percentage points to 1.9 percentage points in a pool of five Asian emerging market countries, and to 1.4 percentage points in a pool of five emerging market countries chosen also from outside the region. 16

9.4.2. International Risk Sharing in Practice

Even if the potential benefits of international risk sharing are large, to what extent has international risk sharing actually taken place in practice? In particular, has the increase in international financial integration over the past three decades resulted in improved risk sharing? A possible empirical proxy for high international risk sharing is a low correlation between domestic consumption and domestic output. Based on nine-year rolling window correlations between domestic consumption and domestic output, the empirical evidence suggests that international risk sharing has indeed increased somewhat for advanced countries, especially over the past two decades, but that for emerging market and developing countries there has been relatively little change (Kose, Prasad, and Terrones, 2007). Other studies confirm a favorable effect of financial integration on actual international risk sharing in advanced countries, especially among OECD, EU, and European Monetary Union countries—that is, groups where integration has increased relatively rapidly (Artis and Hoffmann, 2006, 2007). Relatedly, analyses of recent changes in the pattern of countries’ holdings of international financial assets have found that home bias has declined in the advanced countries; and that

16 An approach based on the number of crises common to more than one member of a given pool yields higher costs of geographical constraints, reflecting a regional element in past emerging market country crises.
Reaping the Benefits of Financial Globalization

such decline has indeed been associated with somewhat increased international risk sharing (Sørensen and others, 2007).17

The finding that actual risk-sharing benefits have been larger for advanced countries than for emerging market and developing countries, in contrast to the larger potential gains for these latter groups, may reflect faster and more substantial increases in de facto integration in the first group, as discussed in Section 9.2. It may also result from a dependence of risk-sharing benefits on whether countries have in place certain preconditions—related for example to trade openness or domestic financial sector development (Kose, Prasad, and Terrones, 2007; and Levchenko, 2005). Looking ahead, an implication may be that a large increase in de facto financial integration and/or accompanying progress with regard to domestic fundamentals are required for emerging market and developing countries to reap significant risk-sharing benefits, and it may thus take several years for this segment of the IMF’s membership to attain such benefits, unless present financial integration and reform trends accelerate significantly. This being said, recent increases in the share of equity and FDI—that is, forms of financing that facilitate international risk sharing owing to the procyclical nature of the associated payments—may suggest that actual risk sharing will be higher in the next decades than it has been in the past.

9.5. HOW DOES FINANCIAL GLOBALIZATION AFFECT STABILITY AND GROWTH?

Financial globalization has been argued to affect many aspects of economic performance—including long-run economic growth, the propensity to experience growth upturns or downturns, the sustainability of growth spells, the volatility of economic growth, the frequency of economic crises, and the depth and duration of output drops in the aftermath of crises. This section focuses on financial globalization’s effects on three of these aspects, namely: macroeconomic volatility, crisis propensity, and economic growth.18

A number of underlying mechanisms are likely to be involved in the transmission of financial globalization to economic volatility and growth:

• Financial sector development. Well-developed domestic financial markets may be instrumental in moderating boom-bust cycles that could be triggered by sudden stops in financial flows (Aghion and Banerjee, 2005) and in efficiently allocating foreign financial flows to competing investment projects, thereby promoting economic growth (Aoki, Benigno, and Kiyotaki, 2006). Furthermore, access to international markets is not available to all

17 “Home bias” refers to the observation that investors diversify across countries substantially less than would appear to be warranted based on standard portfolio theories: in other words, by increasing their holding of foreign assets, investors in most countries would be able to reduce the riskiness of their portfolios while maintaining a constant expected rate of return.
18 It should be noted that, for a number of the empirical associations examined in this chapter, causality may run in both directions.
members of society, and underdeveloped domestic financial systems may prevent the pooling of risk across agents (Levchenko, 2005).

- **Institutional quality.** Better institutional quality helps to shift the composition of financial flows toward FDI and portfolio equity, thereby enhancing growth and macroeconomic stability benefits (Becker and others, 2010). Bordo and Meissner (2007) suggest that countries with stronger institutions (in addition to well-developed financial markets and prudent macroeconomic policies) enjoyed greater economic growth benefits from financial integration during the 1870–1913 period.

- **Sound macroeconomic policies.** In the absence of a sound macroeconomic policy framework, international financial integration may lead to excessive borrowing and debt accumulation, thus increasing vulnerability to crisis.

- **Trade integration.** A high degree of trade openness seems to be associated with fewer sudden stops and current account reversals. Trade integration may also facilitate recoveries from financial crises and mitigate their adverse growth effects (Edwards, 2005; and Calvo, Izquierdo, and Mejía, 2004).

### 9.5.1. Volatility and the Frequency of Crises

Following the Asian crisis, a presumption emerged in some policy circles that financial globalization would tend to exacerbate macroeconomic volatility in emerging market and developing countries, and increase vulnerability to sudden stops. The academic literature, however, has found generally inconclusive results on the issue (Kose and others, 2010). Empirical evidence presented below suggests that the relationship between financial integration and macroeconomic volatility (proxied here by consumption volatility) depends on a country’s domestic financial development and the quality of its institutions, consistent with a “thresholds” view of the effects of financial integration.

Indeed, in the panel regression results reported in Table 9.6 and Figure 9.6, the estimated slope coefficient on de facto financial integration is positive and significant for countries with relatively weak perceived institutional quality and a relatively low degree of domestic financial development, whereas the impact is not significantly different from zero for countries with stronger institutions and more developed domestic financial systems. Equivalently, the positive relationship between financial integration and consumption volatility holds for countries with relatively poor institutional quality and low financial sector development; for countries over a certain threshold, the relationship is neutral and may even turn negative (more integration implying less volatility).

Drawing on the regression results, it is possible to estimate thresholds for institutional quality and domestic financial development beyond which financial globalization’s impact is no longer positive or no longer statistically significant.

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19 This result is robust to estimation in a cross-section of long-run averages, changes in country coverage, and sample period.
Although the exact values of the thresholds need to be interpreted with caution, given the considerable uncertainty surrounding the estimates, based on average data over the period 2000–04, virtually all advanced countries and about one-third of emerging market countries meet the thresholds beyond which the estimated effect of financial integration on consumption volatility is insignificant. The developing countries in the sample are currently below the thresholds.

<table>
<thead>
<tr>
<th>TABLE 9.6 Impact of Financial Integration on Consumption Volatility</th>
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<tbody>
<tr>
<td><strong>Private Credit</strong></td>
</tr>
<tr>
<td>(1)</td>
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<tr>
<td>Financial integration</td>
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<tr>
<td>(0.01)</td>
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<tr>
<td>Terms of trade volatility</td>
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<tr>
<td>(0.04)</td>
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<tr>
<td>Trade openness</td>
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<tr>
<td>(0.01)</td>
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<tr>
<td>ln(initial income per capita)</td>
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<tr>
<td>(0.01)</td>
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<tr>
<td>Financial integration* private credit</td>
</tr>
<tr>
<td>(0.01)</td>
</tr>
<tr>
<td>Private credit (percent of GDP)</td>
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<tr>
<td>Financial integration* institutional quality</td>
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<td>(0.02)</td>
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<tr>
<td>Institutional quality (divided by 100)</td>
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<td>R² adjusted</td>
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<tr>
<td>N</td>
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<tr>
<td>Threshold</td>
</tr>
</tbody>
</table>

Sources: IMF, International Financial Statistics; and IMF staff estimates.

Notes: Estimated by panel fixed effects (country and decade dummies) over 1965–2004, subject to data availability. The dependent variable is the standard deviation of the growth rate of consumption per capita over each decade. Financial integration is defined as total liabilities as percent of GDP. Dummy variables are included for each decade, but the estimated coefficients are not reported, for the sake of brevity. Robust standard errors are reported in parentheses. The symbols *, **, and *** indicate statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively.
Empirical studies (surveyed in Kose and others, 2010) do not support the view that greater financial integration increases the likelihood of crisis. On the contrary, a majority of studies find that crises are, if anything, less frequent in financially open countries than in financially closed ones. This could of course be an outcome of self-selection, in which countries less prone to crises will choose to open up, whereas more vulnerable countries might choose to remain closed. However, some studies suggest that, even taking into account the possibility that self-selection could result in estimation bias, the frequency of currency crises is not higher in more financially open countries (Glick, Guo, and Hutchinson, 2006).


Notes: Figure based on regression results reported in Table 9.1, which refer to the estimated impact of an increase in de facto financial globalization on consumption volatility, including an interaction effect for domestic financial development (or institutional quality). The solid line shows the impact (marginal effect) of an increase in total external liabilities on consumption volatility, as a function of the ratio of private credit to GDP (or institutional quality) at the different levels indicated along the horizontal axis. The dashed lines are the standard error bands around the estimated marginal effect. The histogram reports the percentage of countries in the sample at each given level of credit market development (or institutional quality) as of 2004, indicated along the horizontal axis. Institutional quality is the sum of three indices (law and order; bureaucratic quality, and absence of corruption), each of which ranges from 0 to 6.

Figure 9.6 Financial integration and consumption volatility.
Consistent with their role in the transmission of financial openness to macroeconomic volatility, thresholds also appear to influence the impact of financial openness on crisis propensity, with factors such as financial sector development, institutional quality, macroeconomic policy soundness, and trade openness playing key roles. Specifically, within a sample of countries with de facto open financial accounts (that is, above the median with respect to financial integration), countries above the median of the distribution for at least three of the four factors listed above experienced significantly lower crisis frequency between 1970 and 2004 compared with countries that were above the median for no more than two factors (Table 9.7). This suggests that threshold effects—at work in the case of the effects of financial globalization on macroeconomic volatility—also appear to be present in determining the interaction of financial integration and crisis risks.

Evidence based on case studies (summarized in Appendix III) also suggests that, among financially integrated countries, those with sound macroeconomic and fiscal policies and well-developed and regulated financial systems are noticeably less likely to face crisis. For countries that do not meet these preconditions, the case studies suggest that a gradual approach to liberalization—with appropriate sequencing of liberalization of capital controls and improvements in the domestic financial sector and macroeconomic framework—seems to reduce the likelihood of a crisis; external anchors (such as EU membership) are also associated with reduced crisis propensity. Overall, the case studies suggest that the likelihood of currency and debt crises following financial account liberalization is

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**TABLE 9.7**

<table>
<thead>
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<tbody>
<tr>
<td>Above the Median in at Least Three out of Four of the Factors</td>
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<tr>
<td>---</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
</tbody>
</table>

Sources: IMF, *International Financial Statistics (IFS)*, and IMF staff estimates based on the sources and definitions of sudden stops, and banking, currency, and debt crises described in Becker and others (2010, Appendix I). A country has a currency crisis if the following three conditions hold at some point during a calendar year: (1) devaluation/depreciation rate of at least 25 percentage cumulative over a 12-month period; (2) devaluation/depreciation rate by at least 10 percentage points greater than in the preceding 12 months; and (3) a minimum of three years since last crisis; this definition was applied using IFS data. Sudden stops in capital flows are defined as a decline in financial flows by 5 percentage points of GDP. Notes: The factors are financial sector development, institutional quality, macroeconomic policies soundness, and trade openness. Frequency of crises: fraction of countries that had at least one crisis during the sample period. N is the number of countries in each group. One-sided test of equality of means: * significant at the 10 percent level; ** significant at the 5 percent level; *** significant at the 1 percent level.

---

The results are significant for currency crises, debt crises, and sudden stops, though not for banking crises. Results are robust to: splitting the sample on the basis of whether they meet 50 percent (or 100 percent) of the thresholds; excluding the advanced economies from the sample; defining countries as financially open if they are in the top tercile, instead of the top half; and using de jure, instead of de facto, measures of financial openness. Definitions and data sources for the various types of crises are in Becker and others (2010).
noticeably reduced when such liberalization is an element of a broader reform package, macroeconomic policies are sound, and external imbalances are limited.

9.5.2. Economic Growth

The theoretical presumption that financial globalization should raise economic growth is appealing and intuitive, yet a vast empirical literature relying on cross-country regressions has failed to identify robust evidence of such a relationship. This subsection considers first this macroeconomic evidence, and then turns to an emerging literature based on microeconomic evidence, which tends to find more significant effects of (de jure and de facto) financial globalization on economic growth or its proximate causes (such as improvements in economic efficiency or domestic financial development).

A survey of more than 40 empirical studies based on macroeconomic data and cross-country regressions concludes that the evidence of a link between financial integration and economic growth is not robust: although a few studies, mostly focusing on equity market liberalizations, find positive and significant effects, the majority of studies find insignificant effects, or results that do not hold up to changes in specification and country sample (Kose and others, 2010). This is corroborated by cross-country and panel regressions estimated by staff of economic growth on financial integration and a few other standard determinants, where the results appear to be fragile (Table 9.8). The apparent absence of robust evidence of a link between financial globalization and economic growth may not be surprising, in light of the well-known difficulties involved in finding robust determinants of economic growth in cross-country or panel regressions. Nevertheless, it does raise the question of how to reconcile the theoretical promise of financial integration with the mixed/fragile empirical evidence. To address this question, three issues are considered.

- **Composition.** Unbundling financial globalization into different types of financial flow helps to uncover a relationship between financial integration and economic growth. Cross-country and panel regressions reported in Table 9.9 suggest that countries with a higher share of FDI in total liabilities tend to experience more rapid economic growth. The link is statistically and economically significant, and robust to variations in estimation technique. Concretely, keeping constant the stock of foreign liabilities, an increase in FDI by 10 percentage points of GDP (about the average of FDI

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21 Some studies have found positive and significant evidence for limited subsamples of countries, such as Eastern Europe (Abiad, Leigh, and Mody, 2007).

22 In some instances, the distinction between FDI and non-FDI flows may be blurred in the data, in an environment where multinationals can to a large extent choose how to book transactions across branches or subsidiaries in different countries, for example to take advantage of tax or regulatory differentials. In terms of the empirical implementation, such features imply that both FDI and non-FDI flows are likely to be measured with error. It should be emphasized that this type of “measurement error” would tend to make it more difficult to establish a differential impact of FDI and non-FDI flows on growth. Taking this possible “attenuation bias” into consideration, the finding of a statistically significant difference between the impact of FDI and non-FDI flows is thus even more revealing.
### TABLE 9.8

**Financial Integration and Economic Growth**

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<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
<th>(10)</th>
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</thead>
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<td><strong>Initial income per capita (log)</strong></td>
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<td>−1.09***</td>
<td>−1.31***</td>
<td>−1.44***</td>
<td>−1.42</td>
<td>−1.17***</td>
<td>−1.03***</td>
<td>−1.04***</td>
<td>−1.03***</td>
<td>−0.81***</td>
</tr>
<tr>
<td></td>
<td>(0.26)</td>
<td>(0.29)</td>
<td>(0.27)</td>
<td>(0.28)</td>
<td>(0.29)</td>
<td>(0.3)</td>
<td>(0.28)</td>
<td>(0.28)</td>
<td>(0.28)</td>
<td>(0.26)</td>
</tr>
<tr>
<td><strong>Average investment to GDP</strong></td>
<td>9.90***</td>
<td>9.75***</td>
<td>7.71**</td>
<td>7.67**</td>
<td>7.33**</td>
<td>9.89***</td>
<td>9.46**</td>
<td>9.50**</td>
<td>9.43**</td>
<td>12.14***</td>
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<tr>
<td></td>
<td>(2.93)</td>
<td>(3.65)</td>
<td>(3.12)</td>
<td>(3.07)</td>
<td>(3.17)</td>
<td>(3.56)</td>
<td>(3.68)</td>
<td>(3.66)</td>
<td>(3.68)</td>
<td>(3.26)</td>
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<td><strong>Years of schooling</strong></td>
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<td>0.14*</td>
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<td>(0.09)</td>
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<td><strong>Population growth</strong></td>
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<td>−63.89***</td>
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<td>(21.78)</td>
<td>(17.43)</td>
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<td><strong>Gross financial openness to GDP (stock)</strong></td>
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<td><strong>Total inflows to GDP</strong></td>
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<td><strong>Gross flows to GDP</strong></td>
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<td><strong>Total outflows to GDP</strong></td>
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<td><strong>External liabilities to GDP</strong></td>
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<td><strong>FDI plus portfolio equity liabilities to GDP</strong></td>
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<td><strong>De jure financial openness</strong></td>
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<td><strong>Constant</strong></td>
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</tbody>
</table>


Notes: Cross-country regressions, ordinary least squares, 1975–2004. The symbols *, **, and *** indicate statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively.

Outliers, such as financial centers, are excluded from the sample; results are stronger when they are included.

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in the sample) is associated with an increase in average growth of 0.3 percentage point. This evidence is consistent with many studies that have documented a positive impact of FDI on economic growth (e.g., Moran, Graham, and Blomström, 2005).

• **Thresholds.** There is some evidence that the impact of financial integration on growth depends on factors similar to those governing the relationship between financial integration and volatility discussed above.\(^{23}\) Although the results are not particularly robust, financial integration appears to be beneficial for growth in countries that meet certain thresholds with respect to financial development, institutional quality, macroeconomic policy soundness, and trade openness, but has potentially large negative effects in countries that do not.\(^{24}\) Such thresholds seem to be especially relevant for the effects of external

---

**TABLE 9.9**

<table>
<thead>
<tr>
<th>Impact of FDI on GDP Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial income</strong></td>
</tr>
<tr>
<td><strong>Schooling years</strong></td>
</tr>
<tr>
<td><strong>Population growth</strong></td>
</tr>
<tr>
<td><strong>Investment (share of GDP)</strong></td>
</tr>
<tr>
<td><strong>Government balance (share of GDP)</strong></td>
</tr>
<tr>
<td><strong>CPI Inflation</strong></td>
</tr>
<tr>
<td><strong>Trade openness</strong></td>
</tr>
<tr>
<td><strong>Private credit (share of GDP)</strong></td>
</tr>
<tr>
<td><strong>FDI and equity liabilities (share of GDP)</strong></td>
</tr>
<tr>
<td><strong>Total liabilities (share of GDP)</strong></td>
</tr>
</tbody>
</table>


Notes: System of generalized method of moments estimates on a panel of six five-year periods over 1975–2004. The dependent variable is the average growth rate of GDP per capita over each five-year period. The results are based on 410 observations (73 countries). Robust standard errors are reported in parentheses. The symbols *, **, and *** indicate statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively.

---

\(^{23}\) A number of empirical studies (surveyed in Kose and others, 2010) report evidence suggesting that preconditions with respect to domestic financial sector development, institutional quality, and trade openness need to be met for financial integration to have a beneficial impact on economic growth. Reliance on foreign capital (especially non-FDI forms of financing) has not been found to be positively associated with economic growth in a broad cross-section of countries, though it has for a subsample consisting of advanced and transition economies. Prasad, Rajan, and Subramanian (2007) find that greater domestic financial development strengthens the favorable impact of foreign capital on economic growth.

\(^{24}\) In particular, the significance of the results and the estimated thresholds beyond which the impact of financial integration is positive/negative are sensitive to changes in estimation technique and sample composition. Thus, further research is needed to make these findings applicable to policy analysis.
Reaping the Benefits of Financial Globalization

Indirect benefits. A growing body of empirical work suggests that financial liberalization has a positive impact on several variables that are associated with economic growth, even if their effects are difficult to detect in cross-country growth regressions:\(^{25}\)

— Total factor productivity growth. Panel regressions estimated by staff (Table 9.10) suggest that total factor productivity growth (TFP) is positively and significantly associated with de jure financial openness. This result may be surprising, given the lack of robust evidence of a relationship between financial integration and economic growth, and little evidence of threshold effects impinging on the transmission of financial openness to TFP. One possible interpretation of these results is that financial openness enhances economic

---

\(^{25}\) Consistent with this view, although the coefficient on financial globalization is sometimes significant in the regressions reported in Table 9.9, such significance tends to disappear if the list of explanatory variables includes—as is the case in most empirical studies—measures of “collateral benefits,” such as domestic financial sector development, sound macroeconomic policies, and higher external trade. Beyond these effects, financial globalization may also affect the duration of growth spells—an effect that is difficult to capture in growth regressions—and, like trade openness, may improve institutional quality by creating constituencies for economic reform (Berg, Ostry, and Zettelmeyer, 2008; Johnson, Ostry, and Subramanian, 2006; and Rajan 2006).
efficiency but has an unstable and seldom significant effect on factor accumulation, so that the ultimate effect on economic growth is difficult to pinpoint in the data.

— Domestic financial sector development. Financial integration may catalyze domestic financial market development, through greater competitive pressures on financial intermediaries and movement toward international best practices in accounting, financial regulation, and supervision. Foreign ownership of banks may also facilitate transfer of technology and risk-management techniques (Goldberg, 2007; Levine, 2005; and Mishkin, 2006). As reported in Table 9.11, de jure financial openness and domestic financial sector development are significantly correlated, controlling for a range of other determinants. These results, moreover, appear to be robust across sample compositions and econometric specifications.

— Macroeconomic policies. Financial integration may improve policy discipline and signal a country’s commitment to sound policies (Bartolini and Drazen, 1997; and Gourinchas and Jeanne, 2005). Empirical studies suggest that countries with higher levels of financial openness experience lower inflation rates (Tytell and Wei, 2004; and Sen Gupta, 2008), though evidence is more mixed for fiscal policies (Garrett and Mitchell, 2001; and Kim, 2003).

### Table 9.11

<table>
<thead>
<tr>
<th>Financial Integration and Financial Sector Development</th>
<th>Fixed Effects</th>
<th>System-GMM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln private credit to GDP, lagged</td>
<td>–0.53***</td>
<td>–0.26***</td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td>(0.06)</td>
</tr>
<tr>
<td>Ln real GDP per capita PPP</td>
<td>0.38***</td>
<td>0.14**</td>
</tr>
<tr>
<td></td>
<td>(0.1)</td>
<td>(0.06)</td>
</tr>
<tr>
<td>Ln (l + CPI inflation rate)</td>
<td>–0.01</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>(0.06)</td>
<td>(0.06)</td>
</tr>
<tr>
<td>Ln trade openness</td>
<td>0.34**</td>
<td>0.18**</td>
</tr>
<tr>
<td></td>
<td>(0.17)</td>
<td>(0.09)</td>
</tr>
<tr>
<td>Financial account openness index</td>
<td>0.21***</td>
<td>0.19**</td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td>(0.09)</td>
</tr>
<tr>
<td>Constant</td>
<td>–2.05</td>
<td>–0.58</td>
</tr>
<tr>
<td></td>
<td>(1.23)</td>
<td>(0.64)</td>
</tr>
<tr>
<td>R²</td>
<td>0.34</td>
<td></td>
</tr>
<tr>
<td>Sargan test p-value</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>AR1 test p-value</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>AR2 test p-value</td>
<td>0.9</td>
<td></td>
</tr>
</tbody>
</table>

Sources: IMF, *International Financial Statistics*; Financial account openness index (equal to 1 if country is classified as open and 0 if closed) constructed by staff based on the IMF’s *Annual Report on Exchange Arrangements and Exchange Restrictions*; and IMF staff estimates.

Notes: Panel of nonoverlapping five-year averages during 1975–2004. Dependent variable is change in the logarithm of private credit to GDP. Period dummies included but not reported. The results are based on 339 observations (59 countries). Robust standard errors clustered by country in parentheses. The symbols *, **, and *** indicate statistical significance at the 10 percent, 5 percent, and 1 percent level, respectively. In system-GMM estimation, all control variables enter as endogenous.
Turning to the microeconomic, and especially firm-level, evidence, as well as event studies surrounding equity market liberalizations, a clearly beneficial impact of financial globalization on market capitalization, financial development, and the cost of capital is apparent (Bekaert, Harvey, and Lundblad, 2005; and Henry, 2007). Equity market liberalizations have also been found to reduce the cost of capital (Stulz, 1999) and to boost investment growth (Alfaro and Hammel, 2007). Relatedly, microeconomic studies (surveyed in Forbes, 2005a) have found that capital controls may impose significant efficiency costs, including through:

- **Lower international trade.** Wei and Zhang (2007) present evidence suggesting that capital controls increase the cost of engaging in international trade even for those firms that do not intend to evade capital controls. A one-standard-deviation increase in controls on foreign exchange transactions reduces trade by the same amount as a hike in external tariffs by about 11 percentage points, according to their results. More generally, there is ample evidence from case studies that capital controls create incentives for circumvention through misinvoicing.

- **Cost of capital.** Capital controls are estimated to make it more difficult and expensive for small firms to raise capital (Forbes, 2005b). Moreover, multinational affiliates located in countries with capital controls face local borrowing costs that are about 5 percentage points higher than affiliates of the same parent company borrowing locally in countries without capital controls (Desai, Foley, and Hines, 2006).

- **Distortions.** Economic behavior is likely to be distorted by capital controls, and resources and effort are wasted in seeking to circumvent controls. Moreover, a situation in which only some economic agents are able to evade controls may lead to an uneven playing field in which well connected firms—rather than the most efficient—survive. Beyond this, capital controls insulate domestic firms from competitive forces, and in some cases may even create a screen for cronyism and subsidies to politically connected firms (Johnson and Mitton, 2003).

- **Costs for the public administration.** Significant administrative costs result from the need to monitor compliance with capital controls and, in many cases, to continually update the controls to close loopholes and limit evasion (Forbes, 2005a).

To sum up, although policy advice on financial liberalization needs to consider whether countries meet certain thresholds that govern its impact, it also needs to take into account the impact of financial integration on countries’ standing in relation to the thresholds, and the significant microeconomic costs of maintaining capital controls. This leads to a tension: on the one hand, liberalization for countries that do not meet the thresholds may amplify risks; on the other hand, liberalization may itself catalyze improvements in domestic financial development and macroeconomic policies, and reduce the distortionary costs of capital.
controls, perhaps engendering a virtuous circle in which ultimately the country will meet the necessary conditions to reap the full benefits of integration.

9.6. CONCLUSION

International financial integration has increased dramatically in the global economy over the past three decades, though this process has affected advanced countries to a much greater extent than other segments of the IMF’s membership, in particular the developing countries. The differing trends in de facto financial integration reflect in part countries’ different policies with respect to the strength of de jure capital controls—notably the relatively early liberalization of the financial account in advanced countries. In addition, relative institutional quality and domestic financial development have also acted as constraints on the extent of de facto financial integration among emerging market and developing countries. Notwithstanding differences across segments of the IMF’s membership, the global trend toward increased international financial integration has affected all segments of the IMF’s membership, and even—if to a lesser degree—those countries that have sought to lean against the wind through relatively restrictive financial account regimes.

In principle, greater financial openness holds promise: gains may come from greater risk sharing, a more efficient worldwide allocation of capital, and broader technology transfer. Sizable gross external asset and liability positions in advanced countries seem to be reflected in significant risk-sharing gains and, to the extent that international asset trade expands further in emerging market and developing countries in the years ahead, risk-sharing gains should be at least as large, in view of the relatively high current degree of consumption volatility in this segment of the IMF’s membership. Closer integration of emerging market and developing countries into global financial markets may also provide significant benefits to advanced country residents through enhanced opportunities for portfolio diversification.

Empirical evidence on the stability benefits of international financial integration is mixed. The results reported in the chapter suggest that, for countries with relatively strong institutions, well-developed domestic financial systems, and sound macroeconomic policy frameworks, greater integration has not been accompanied by significantly higher macroeconomic volatility, whereas for countries without those conditions in place, volatility has tended to increase with greater openness. Likewise, within a sample of financially open countries, crisis frequency is found to be lower for countries that are relatively open to international trade, and with strong institutions, sound policies, and well-developed financial sectors.

The empirical relationship between international financial integration and long-run economic growth is complex. Evidence presented above stresses the importance of unbundling financial integration into different components: FDI and other nondebt forms of financing are found to be positively and significantly associated with economic growth, whereas the impact of debt seems to
depend on the strength of a country’s institutions and policies. It bears noting, however, that even for countries that do not meet relevant thresholds, policymakers will need to take into account—in framing their strategies in relation to financial liberalization—that greater financial openness is associated with a number of “collateral benefits” that in turn seem to foster economic growth. In other words, when assessing the merits of liberalization, policymakers will need to be cautious, but also consider the costs of caution implied by efficiency losses related to capital controls.

The policy relevance of thresholds for country fundamentals is likely to differ across segments of the IMF’s membership (Table 9.12). For countries that do not yet meet the relevant thresholds, the appropriate focus of policy makers is likely to be on improving fundamentals—such as domestic financial sector development, macroeconomic policy frameworks, and institutions. This said, opening up to inward FDI—a type of flow whose benefits do not seem to hinge on such preconditions—would appear to be desirable at an early stage, given FDI’s favorable impact on growth and no adverse effect on stability; liberalization of other types of flow should be delayed until country fundamentals are raised to be more in line with relevant thresholds, and growth-stability trade-offs are more favorable. For countries that are small or geographically isolated, greater financial

<table>
<thead>
<tr>
<th>Country Characteristics</th>
<th>Estimated Effects of Financial Integration</th>
<th>Recommended Focus of Policies</th>
</tr>
</thead>
</table>
market transparency can be an important vehicle for attracting foreign capital and reaping corresponding benefits.

The need to make early progress with respect to country fundamentals in order to reap net benefits from financial liberalization is highlighted, in particular, by the potentially large costs associated with maintaining a pervasive structure of capital account restrictions. Recent empirical studies based on microeconomic data suggest that controls may increase the difficulty and cost of corporate finance, particularly for small firms. The evidence also suggests that capital controls insulate domestic firms from competitive forces and thereby undercut economic efficiency, induce distortions in the “playing field” for local firms, carry significant administrative costs, and reduce international trade. Indeed, a promising area for future research is to quantify the macroeconomic implications of financial globalization beginning from estimates based on this more illuminating microeconomic evidence.

Looking forward, the net benefits from financial integration are likely to be larger than in the past, in view of a more equity-based structure of international asset and liability positions, as well as policy and institutional reforms that increasingly are bringing emerging market countries up to the thresholds where net benefits associated with liberalization are likely to turn positive. These developments bode well for IMF member countries’ ability to fully reap the benefits of financial globalization in the years ahead.
# APPENDIX I: COUNTRY LISTS

## High-Income Economies

<table>
<thead>
<tr>
<th>OECD</th>
<th>Non-OECD</th>
<th>Middle-Income</th>
<th>Low-Income</th>
<th>Advanced Economies</th>
<th>Emerging Market Countries</th>
<th>Developing Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>[23]</td>
<td>[12]</td>
<td>[42]</td>
<td>[14]</td>
<td>[25]</td>
<td>[26]</td>
<td>[23]</td>
</tr>
</tbody>
</table>

Australia | Bahrain | Angola | Oman | Bangladesh | Australia | Argentina | Algeria  |
Austria | Brunei | Argentina | Panama | Burkina Faso | Austria | Brazil | Bangladesh |
Belgium | Darussalam | Bolivia | Paraguay | Côte d’Ivoire | Belgium | Chili | Benin |
Canada | Cyprus | Brazil | Peru | Ghana | Canada | China | Bolivia |
Denmark | Hong Kong | Bulgaria | Romania | Kenya | SAR | Colombia | Bolivia |
Finland | SAR | China | Russia | Kyrgyz | Denmark | Côte d’Ivoire | Cameroon |
France | Israel | Costa Rica | South Africa | Republic | France | Dominican Republic | Congo, Rep. of |
Germany | Kuwait | Czech | Sri Lanka | Pakistan | Germany | Ecuador | Costa Rica |
Greece | Malta | Republic | Swaziland | Tanzania | Togo | Egypt | Gabon |
Iceland | Qatar | Dominican Republic | Thailand | Republic | Greece | El Salvador | Gambia, |
Ireland | Saudi Arabia | Republic | Tunisia | Uganda | Iceland | Hungary | The |
Italy | Singapore | Ecuador | Turkey | Uzbekistan | Ireland | India | Ghana |
Japan | Slovenia | Egypt | Uruguay | Yemen, United Arab Emirates | Italy | Indonesia | Guatemala |
Korea | United Arab Emirates | El Salvador | República de Venezuela | Rep. of Zambia | Japan | Korea | Kenya |
Netherlands | Emirates | Georgia | Guatemala | Hungary | Luxembourg | Malaysia | Lesotho |
New Zealand | | Indonesia | Malaysia | Indonesia | New Zealand | Mexico | Madagascar |
Norway | | Jamaica | Kazakhstan | Latvia | Portugal | Morocco | Malawi |
Portugal | | Korea | United Kingdom | United States | | Nicaragua | and |
Spain | | Switzerland | United Kingdom | United States | | | Tobago |
Sweden | | United States | United States | United States | | | |
APPENDIX II: CAPITAL CONTROL INDICES

All capital controls indices in this chapter, and essentially all existing cross-country indices in the broader literature, are based on information contained in the IMF’s *Annual Report on Exchange Arrangements and Exchange Restrictions* (AREAER). Until 1995, the AREAER summarized a country’s openness to capital flows using a simple 0/1 dummy variable, where 1 represents a restricted capital account and 0 represents an open capital account. In 1995, the AREAER started providing information on restrictions on capital transactions in 11 categories: shares or other securities of a participating nature; bonds or other debt securities; money market instruments; collective investment securities; derivatives and other instruments; commercial credits; financial credits; guarantees, sureties, and financial backup facilities; direct investment (including liquidation of direct investment); real estate transactions; and personal transactions. For each of these categories, the AREAER’s new methodology distinguishes between restrictions on residents and those on nonresidents.\(^{26}\) For each of these specific types of restrictions, binary indicators were compiled.\(^ {27}\) More aggregate indicators for each country were then calculated as simple averages of the respective subcategories. For example, restrictions on equity inflows are the average of the restriction dummies on “purchase locally by nonresidents” and “sale or issue abroad by residents,” and the equity inflows index can thus take three values, 0, 0.5, or 1. The broadest index for an individual country is the average of 18 dummies. The resulting index and its subcomponents are the most comprehensive and detailed indices of capital controls currently available. Compared with broad binary dummies, the new indices provide a more precise measure of controls, and permit analysis of various types of controls. This said, like all AREAER-based measures, the index cannot reflect differences in enforcement or economic relevance of controls across countries.

\(^{26}\) For the purposes of this chapter, the focus is on a subset of these categories, namely, equity, money market, bond, collective investment, and direct investment. These categories broadly correspond to the standard decomposition of de facto financial flows.

\(^{27}\) Restrictions on capital transactions are coded as a 0 (not restricted) if they consist merely of registration or notification requirements. They are also coded as 0 if a country is generally open but imposes restrictions on investments in a small number of selected industries, for example, for national security purposes, or if it is generally open but excludes a small number of countries, typically for political reasons. Using a binary index at this level facilitates consistency in coding across countries and years, though it requires abstracting from differences in the form of controls (prohibition, limitation, taxation, or registration requirements). Schindler (2010) provides additional detail on the data construction and makes the dataset publicly available.
APPENDIX III: CASE STUDIES ON FINANCIAL ACCOUNT LIBERALIZATION

Using a variety of case studies on countries’ experiences with financial account liberalization, it is possible to illustrate some of the findings reported in Section 9.5. This appendix summarizes a variety of previously published case studies prepared by IMF staff and the IMF’s Independent Evaluation Office. Countries covered include 8 advanced countries, 22 emerging market economies, and 2 developing countries (see Table 9.13). Countries’ experiences are grouped along two dimensions: (1) depending on whether a country experienced a currency or debt crisis after it liberalized the financial account; and (2) whether a country is above the median in at least three of the four factors emphasized in Section 9.5, namely trade openness (imports plus exports, divided by GDP), the soundness of macroeconomic policies (government expenditures divided by revenues), institutional quality (the average index from the *International Country Risk Guide*, Political Risk Services), and domestic financial development (private credit/GDP).

As shown below, the overall picture that emerges is that countries with relatively sound macroeconomic policies and well-developed domestic financial systems are less likely to face crisis than countries without these characteristics. Although the predicted pattern holds on average, a few countries experienced crises despite faring relatively well with respect to sound policies and domestic financial development, and some countries with policy and institutional shortcomings nevertheless avoided crises.

As shown in the case studies, for the sample of countries covered, whether the pace of liberalization is fast, gradual, or slow does not appear to have a significant impact on the likelihood of crisis. On the whole, crisis propensity seems primarily related to whether financial account liberalization is part of a broader package aimed at the development and appropriate regulation of the domestic financial sector and sound macroeconomic policies (including external imbalances that are not excessive).

<table>
<thead>
<tr>
<th>Crisis</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above the median in at least three out of four factors at the time of liberalization</td>
<td>Yes</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>7</td>
</tr>
</tbody>
</table>

Note: The cross-country medians for (1) trade openness, (2) the soundness of macroeconomic policies, (3) institutional quality, and (4) domestic financial development were computed using the averages in the period 1975-2004. Then each country was classified according to whether it was above the median (for three out of four variables) for more than half of the period during which its financial liberalization took place.

28 The country coverage in this appendix differs from that underlying Table 9.7, because the latter covers only de facto integrated countries, and case studies were not available for all countries in Table 9.7. Nevertheless, the broad pattern of results is consistent across the two samples.
### TABLE 9.13

**Evidence from Selected Case Studies, 1979–2004**

<table>
<thead>
<tr>
<th>Country</th>
<th>Pace, Sequencing, and Institutional Anchor of Liberalization</th>
<th>Financial Sector Policies and Context</th>
<th>Macroeconomic Policies and Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chile 1985–98</td>
<td>Gradual and selective. Liberalization of longer-term inflows and outflows, with selective capital controls on inflows that were later broadened because of circumvention. Focused initially on liberalizing inflows, though with strong restrictions on liquidation of FDI and repatriation of profits. Capital outflows gradually liberalized. Introduction of market-based capital controls (URR) on new foreign borrowing (except trade credits) and foreign currency deposits to limit short-term credit inflows.</td>
<td>Restructuring of banking system: the banks achieved low levels of nonperforming loans, comfortable level of provision for bad loans, compliance with BIS capital adequacy ratio. Central bank becomes independent and in charge of stability of financial system. Development of the stock exchange, money and exchange markets, and local security markets.</td>
<td>Fiscal consolidation. Modification of exchange rate regime to allow for greater flexibility of the rate within a crawling band exchange arrangement to ensure orderly real appreciation of the currency. Restrictive monetary policy conducive to a reduction of inflation from more than 25 percent to 4 percent a year. High output growth. Progressive trade liberalization.</td>
</tr>
<tr>
<td>France 1983–90</td>
<td>Gradual. Controls on FDI first to be eased. Last flows to be fully liberalized concerned bank lending in local currency to nonresidents and residents’ ownership of foreign exchange accounts. All controls abolished by January 1, 1990. Liberalization in the context of the transition to the European Monetary System (EMS). Safeguard clauses with respect to European Economic Community (EEC) liberalization obligations were abolished.</td>
<td>Major deregulation of financial sector in stages, with abolition of quantitative credit controls.</td>
<td>Disinflation process. Reduction of current account deficit.</td>
</tr>
<tr>
<td>Lithuania 1994–95</td>
<td>Fast. Real estate and pension funds’ investments last to be liberalized.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Continued*
## TABLE 9.13
Evidence from Selected Case Studies, 1979–2004 (Continued)

<table>
<thead>
<tr>
<th>Country</th>
<th>Pace, Sequencing, and Institutional Anchor of Liberalization</th>
<th>Financial Sector Policies and Context</th>
<th>Macroeconomic Policies and Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slovak Republic</td>
<td>Gradual. Long-term flows liberalized before short-term flows; inflows before outflows; FDI and portfolio before financial credits. Most restrictions eliminated to meet EU requirements. OECD accession was also an important anchor.</td>
<td>Banking sector restructuring (early 1990s), though still fragile. Undeveloped financial markets.</td>
<td>Macroeconomic stability. Prudent macroeconomic policies. Trade gradually liberalized (reduction of quantity restrictions on imports). Adopted full currency convertibility (1993).</td>
</tr>
<tr>
<td>1990–2004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tunisia 1995–</td>
<td>Slow. Step-by-step approach effectively started in 1995. FDI inflows and resident-export-related transactions liberalized first. Many restrictions on inward portfolio investment and outward non-export-related capital transactions remain. In 1995, Tunisia signed an association agreement with the EU that implied the goal of full trade liberalization and capital account convertibility.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indonesia 1989–96</td>
<td>Gradual, partial, and with reversals. Gradual liberalization of FDI, though domestic ownership requirements were kept in place. Portfolio equity investment by foreigners allowed up to 49 percent (1989). Elimination of quantitative limits on bank borrowing from nonresidents, partially reverted later in 1991 to control surging capital inflows. Liberal regime for capital outflows by resident individuals and juridical entities, while prohibiting lending abroad by banks and financial institutions.</td>
<td>Liberalization of interest rates and partial removal of direct credit controls on the banking system. Enhancement of banking supervision, development of money market. Opening up to foreign banks, other financial institutions, and insurance firms. Strengthening of domestic capital markets.</td>
<td>Large current account deficit. Rising inflation. High interest rates. Exchange rate against the U.S. dollar allowed to fluctuate within a narrow band. Partial liberalization of tariff system. Corruption and cronyism during the 1990s.</td>
</tr>
<tr>
<td>1989–96</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysia 1986–97</td>
<td>Gradual, with interruptions in 1994 (controls on portfolio inflows reenacted for one year) and in 1998 (controls on outflows). FDI inflows actively encouraged (although with restrictions in some sectors). Outward FDI unrestricted. Unrestricted portfolio inflows. Borrowing abroad and lending to residents and nonresidents by authorized entities were unrestricted, but subject to prudential limits (de facto limits on foreign currency borrowing by residents).</td>
<td>Structural weaknesses in the banking system led to deterioration in the asset quality of banks, despite improvements in the legal and regulatory framework and supervisory and prudential practices.</td>
<td></td>
</tr>
</tbody>
</table>

Countries above the median in at least three out of four factors at the time of liberalization: Crisis after liberalization (currency or debt crisis or both)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Thailand</td>
<td>1985–96</td>
<td>Rapid opening to inflows with partial reversal at later stage. Gradual liberalization of outflows. In 1995, short-term capital inflows were restricted with the imposition of a 7 percent URR on banks’ nonresident baht accounts to control the growing proportion of short-term inflows. In 1996, these restrictions were extended to cover new foreign borrowing of less than one year.</td>
<td>Oligopolistic structure in banking system and other weaknesses despite improvements on supervision. Banks had inadequate loan provisioning and large exposure to property sector. Development of stock market.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>1991</td>
<td>Slow. Capital controls designed to reduce reliance on short-term and debt-creating flows. FDI inflows first to be progressively liberalized, followed by portfolio equity investment by nonresidents. Strict control of short-term borrowing (except for trade-related purposes). More strict controls for outflows than for inflows, for residents than for nonresidents, for individuals than for corporations.</td>
<td>Steady progress toward more open and market-oriented financial system. Strengthening of prudential regulation and supervision of banking system. Problems remain: large state-controlled banking system, despite increased foreign bank participation. Reform of securities markets.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latvia</td>
<td>1994–95</td>
<td>Fast. Real estate and pension funds' investments last to be liberalized.</td>
<td>Weak regulatory system.</td>
<td>De facto peg to SDR.</td>
<td></td>
</tr>
</tbody>
</table>

*Countries below the median in at least two out of four factors at the time of liberalization: No currency or debt crisis after liberalization*
<table>
<thead>
<tr>
<th>Country</th>
<th>Pace, Sequencing, and Institutional Anchor of Liberalization</th>
<th>Financial Sector Policies and Context</th>
<th>Macroeconomic Policies and Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom</td>
<td>1979 Rapid. All capital controls were abolished in four months, from June to October.</td>
<td>Strong market discipline and prudential policies.</td>
<td>Encompassing policy package aimed at increasing efficiency, and improving the functioning of the labor market. Growth did not improve during the 1980s and inflation fell.</td>
</tr>
<tr>
<td>Argentina</td>
<td>1991 Rapid. Convertibility plan.</td>
<td>Started with good and innovative banking supervision (BASIC), though prudential regulations to discourage use of dollarized debt were not in place. Privatization of 50 percent of state-owned banks and allowed entry of foreign banks (mostly Spanish). To address fiscal problems, government weakened banking regulation to allow banks to hold more government bonds. Low growth after a period of high growth (1991–94). Rigid labor and product markets.</td>
<td>Fiscal imbalances: debt to GDP ratio rose from 29.2 to 41.4 percent, with most of debt denominated in dollars. Currency board.</td>
</tr>
<tr>
<td>Country</td>
<td>Period</td>
<td>Approach</td>
<td>Key Events</td>
</tr>
<tr>
<td>-------------</td>
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<td>-------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Poland</td>
<td>1990–2002</td>
<td>Gradual. Long-term flows liberalized before short-term flows; inflows before outflows; FDI and portfolio before financial credits. Liberalization sped up during OECD accession negotiations (1994–96).</td>
<td>Poor supervision and lack of adequate regulatory standards and accounting practices, together with fixed exchange rate regime encouraged liability dollarization. Lack of competition in banking sector (foreign banks not allowed).</td>
</tr>
<tr>
<td>Paraguay</td>
<td>1989–94</td>
<td>Gradual, on top of a relatively open capital account. Incentives to FDI.</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Descriptions drawn from previously issued IMF staff or IMF Independent Evaluation Office publications. Selection of the case studies was determined by availability.
Countries that liberalized their financial account while suffering from weaknesses in the financial sector, in particular in the banking sector—as was the case for a number of countries affected by the Asian crisis—seem to be more likely to suffer crisis than countries that improved prudential policies before liberalizing the financial account. Countries with increasing current account deficits, rising inflation, and expansionary fiscal policies also seem more likely to suffer a currency or debt crisis when compared with countries with low current account deficits, low inflation, and solid public finances. Countries tied to a credible external anchor appear to be able to liberalize their financial account without suffering currency or debt crisis despite some weaknesses in the financial sector and/or macroeconomic imbalances, as was the case for some of the transition countries in their accession process to the European Union.

REFERENCES


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Financial Globalization: A Reappraisal

M. Ayhan Kose • Eswar Prasad
Kenneth Rogoff • Shang-Jin Wei

10.1. INTRODUCTION

Few issues have stirred such passionate debate among development researchers and policymakers as the merits of financial globalization, including integration of equity, bond, and money markets, as well as direct ownership of foreign capital or foreign direct investment (FDI). On the one hand, many economists see enhanced financial globalization as an important step for middle-income emerging markets that aspire to the levels of income and stability achieved by advanced industrial economies (e.g., Fischer, 1998; Summers, 2000). On the other hand, many influential researchers argue forcefully that financial integration carries huge risks that far outweigh the potential benefits for most middle-income countries (e.g., Rodrik, 1998; Bhagwati, 1998; Stiglitz, 2002). These economists point to the plethora of developing country financial crises that swept across Latin America, Asia, and Africa in the 1980s and particularly in the 1990s as clear evidence of the potentially disastrous consequences of financial globalization.

For policymakers in developing countries, the topic is of enormous practical relevance, not least because countries such as China and India are still very much in the early stages of financial globalization, and face numerous ongoing decisions about the timing and pace of further integration. For researchers, financial globalization is fascinating not only because of its compelling policy relevance, but because of the enormous variation of approaches and experiences across countries. Differences in speed and approach to financial globalization have often been driven as much by philosophy, regional fads, and political circumstances as by economic factors. Hence, cross-country studies of the effects of financial integration can potentially exploit a wide array of natural variation in experiences. A massive empirical literature has evolved over the past

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1 The authors are grateful for helpful comments from numerous colleagues and participants at various seminars where earlier versions of this chapter were presented. Lore Aguilar, Cigdem Akin, Dionysios Kaltis, and Ashley Taylor provided excellent research assistance.

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10 years on the growth and volatility effects of international financial globalization, with literally hundreds of published studies. Most of this work is of relatively recent vintage, as the latest wave of financial globalization got started in earnest only in the mid-1980s.

This survey will attempt to give the reader a synthesis and some perspective on this rapidly evolving literature, including both early contributions and more recent work. Although our overall take is that the literature is still inconclusive, we argue that newer approaches that attempt to focus more on the indirect effects of financial globalization on productivity and GDP growth hold considerable promise. At the same time, we find that there is scant empirical support to underpin the more polemic claims of those who argue that capital account liberalizations (as opposed to, say, inappropriately rigid exchange rate regimes) are the root problem behind most developing country financial crises of the past two decades.

Newer approaches depart from the standard neoclassical framework that largely guided the earlier wave of the financial globalization literature. This literature viewed the key benefit of financial globalization as arising from long-term net flows of capital from industrial to developing economies. Because the former group of countries is capital rich whereas the latter is relatively capital poor, this should generate higher growth in developing economies and welfare gains for both groups. Perhaps not surprisingly, in light of the corresponding literature on growth in closed economies (e.g., Hall and Jones, 1999), this literature often found conflicting results. As we shall see, despite having the advantage of a striking array of policy variation, the earlier literature also suffered from a variety of measurement problems that have since been recognized and at least partially addressed.

The fundamental conceptual point that guides our interpretation of the newer literature is that the main benefits to successful financial globalization are probably catalytic and indirect. The benefits are not simply, or even primarily, the result of enhanced access to financing for domestic investment. When viewed from this perspective, we will see that there is modest but increasing evidence that financial openness can in many circumstances promote development of the domestic financial sector, impose discipline on macroeconomic policies, generate efficiency gains among domestic firms by exposing them to competition from foreign entrants, and unleash forces that result in better public and corporate

2 The working paper version of this chapter provides a comprehensive list of references (see Kose and others, 2006). In this article, we limit ourselves to mentioning some key papers and do not aim to be exhaustive in our citations.

3 Eichengreen (2001), who focuses on the relationship between growth and measure of restrictions on capital account transactions, argues that the evidence is quite mixed. A subsequent survey by us on the broader dimensions of financial globalization deepens the puzzle (Prasad and others, 2003). We conclude that the vast empirical literature provides little robust evidence of a causal relationship between financial integration and growth. Moreover, we find that, among developing countries, the volatility of consumption growth relative to income growth appears to be positively associated with financial integration, the opposite of what canonical theoretical models would predict.
governance. That is, it can generate significant indirect or “collateral” benefits which, in quantitative terms, are likely to be the most important sources of enhanced growth and stability for a country engaged in financial globalization. True, the research we survey does not contain any simple formulas a country could follow to avoid the pitfalls of financial globalization. However, simply understanding that the main benefits are likely to be catalytic rather than direct is already useful guidance to policymakers.

The notion that financial globalization mainly influences growth through indirect channels has important implications for empirical analysis of its benefits. For one thing, building institutions, enhancing market discipline, and deepening the financial sector takes time, and so does the realization of growth benefits from such channels. This may explain why, over relatively short periods, it may be much easier to detect the costs of financial globalization than it is to see the benefits. Indeed, even at long horizons, detecting the benefits may be tricky, because they are indirect and work through improvements in structural, institutional, and macroeconomic policy variables. If these variables are included separately in long-run cross-country regressions, the catalytic effects of financial globalization may be hidden.

The approach we emphasize helps to link together a number of other pieces of the literature. For instance, most papers looking at the effects of financial integration have relied on de jure measures of capital account openness, which reflect legal restrictions (or lack thereof) on capital movements. But the collateral benefits are likely to be realized at least as much through de facto integration, which, as we show, can be quite different. In practice, the distinction between de jure and de facto openness can be very important. Many countries have capital controls that are quite strict on paper but toothless in practice so their de facto level of integration—as measured by capital flows or stocks of foreign assets and liabilities—is quite high; this in itself could act as a disciplining device on the government and firms.4

Focusing on collateral instead of direct benefits to financial globalization can also help explain why recent research that examines the growth effects of equity market liberalizations finds such strong positive effects even though portfolio equity inflows are typically small relative to other types of flows. Equity market liberalizations typically take place in tandem with various other domestic reforms, and when national governments have confidence in their ability to adequately supervise domestic financial markets. Thus, equity inflows are precisely the ones that, along with FDI, are most likely to confer the collateral benefits discussed above. Our analysis may also help explain why there is much stronger evidence based on microeconomic (firm- or industry-level) data on the distortionary effects of capital controls and the benefits of capital account liberalization.

4 We emphasize up front that our analysis focuses largely on private capital flows and does not encompass the effects of official flows, including foreign aid, and other flows such as remittances (which should, strictly speaking, appear in the current account of the balance of payments).
Financial Globalization: A Reappraisal

We will begin by providing a brief overview of theory and then turn to measurement issues. We then survey the empirical literature looking at the direct growth impact of financial globalization, before turning to newer approaches that focus more on potential collateral benefits. In the concluding section, we summarize implications for future research.

10.2. A BRIEF OVERVIEW OF THEORY

We begin with a brief introduction to the basic theoretical arguments about how financial globalization should affect growth and volatility; we will continue to introduce further theoretical channels through which financial globalization has an impact on growth as we discuss relevant issues in the empirical literature.

10.2.1. Growth

The simplest—one might say even naïve—benchmark one-sector neoclassical growth model suggests that financial globalization should lead to flows of capital from capital-rich economies to capital-poor economies as, in the latter, the returns to capital should be higher. We call the model naïve because, in fact, the actual volumes of such flows do not come anywhere near what the baseline models predict, as famously emphasized by Lucas (1990). In theory, these financial flows should complement limited domestic saving in capital-poor economies and, by reducing the cost of capital, allow for increased investment. Certain types of financial flows could also generate technology spillovers and serve as a conduit for imbibing managerial and other forms of organizational expertise from more advanced economies.

Newer analyses emphasize more subtle and indirect channels. For example, when domestic residents are able to hold foreign assets, they can insure themselves against country-specific shocks to their income. This naturally allows for greater diversification of income risk which can, in turn, encourage higher productivity and economic growth through greater specialization. In addition, financial flows

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5 Indeed, from 2004–06, developing countries and emerging markets collectively averaged a large current account surplus, rather than a deficit. Lucas himself offered a new growth model based on increasing returns to human capital to explain what was then a low volume of net flows to developing countries, though recent work has tended to focus more on the financial channel emphasized contemporaneously by Gertler and Rogoff (1990). Mendoza, Quadrini, and Ríos-Rull (2007) and Alfaro, Kalemli-Ozcan, and Volosovych (2007) argue that institutional failures more generally may lead to capital flow reversals. Reinhart and Rogoff (2004) suggest that recurrent defaults and financial crises in developing countries may depress investment there. Gordon and Bovenberg (1996) focus on the role played by information asymmetries.

6 Henry (2007) argues that, even in the context of the basic neoclassical model, the financing channel should imply only a temporary, rather than permanent, pickup in growth from financial integration. It is not clear, however, how important this nuance is likely to be empirically in studies that look at growth experiences over periods of just two to three decades.

7 Among developed countries and across regions within developed countries, better risk sharing is associated with greater specialization (Obstfeld, 1994; Acemoglu and Zilibotti, 1997; and Kalemli-Ozcan, Sorensen, and Yoshia, 2003).
could foster development of the domestic financial sector and, by imposing discipline on macroeconomic policies, lead to more stable policies. We discuss the mechanisms and evidence for these channels later in the chapter.

10.2.2. Volatility

In theory, the effects of financial integration on output volatility are ambiguous. Financial integration allows capital-poor countries to diversify away from their narrow production bases that are often agricultural or natural resource dependent, thereby reducing macroeconomic volatility. At a more advanced stage of development, however, trade and financial integration could together allow for enhanced specialization, as we have already noted. This could make middle-income developing countries more vulnerable to industry-specific shocks and thereby lead to higher output volatility. If financial integration takes the form of heavy reliance on external debt, it could expose these countries to world interest rate shocks and, thus, to higher output volatility.

Theory does have a strong prediction, however, about the relationship between financial integration and consumption volatility. Because consumers and, by extension, economies are risk-averse, consumption theory tells us that they should desire to use financial markets to insure against income risk, thereby smoothing the effects of temporary idiosyncratic fluctuations in income growth on consumption growth. Although the benefits of international risk sharing could be quite large in theoretical models, the magnitudes of these benefits depend on various model-specific features. Recent research convincingly shows that the higher volatility that developing countries experience implies that they can potentially reap large benefits from international risk-sharing arrangements (see Pallage and Robe, 2003).

10.2.3. Theoretical Caveats to the Benefits of Financial Globalization

We could continue at considerable length about how financial globalization matters in theory, and will indeed keep introducing further ideas throughout the chapter. However, what makes the debate on financial globalization fascinating is that several prominent economists question whether, in practice, the effects are positive at all. Most of these economists base their arguments on the theory of the second best and the potential presence of other distortions stemming from the trade policy regime, macroeconomic policies, labor markets, and information asymmetries. For example, if certain industries are protected by trade barriers, international capital could flow into these sectors to exploit the

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8 See Kose, Prasad, and Terrones (2004) for a more detailed exposition.
9 In particular, the welfare gains depend on the volatility of output shocks, the rate of relative risk aversion, the risk-adjusted growth rate, and the risk-free interest rate in these models (see the discussion in Obstfeld and Rogoff, 2004, Chapter 5; Lewis, 1999; and van Wincoop, 1999). Lucas’s (1987) claim that macroeconomic stabilization policies that reduce consumption volatility can have only minimal welfare benefits continues to be influential in the literature (see Barlevy, 2004).
benefits of protection in domestic markets and result in welfare losses and sub-optimality growth (Eichengreen, 2001). Information asymmetries stemming from a lack of transparency in financial institutions could lead to inefficient allocation of financial flows, generate maturity mismatches, and result in costly crises (Stiglitz, 2004).

The concern that financial globalization can sometimes spin off negative side effects in highly-distorted developing economies is a legitimate one, though not necessarily debilitating. Indeed, as we shall see, in light of the ambiguity of theoretical findings, the critical question in this entire literature is whether empirical evidence can guide us on why financial globalization seems to have clearly positive effects in some cases, whereas it appears to be counterproductive in others.

10.3. MEASURING FINANCIAL OPENNESS

The traditional approach to measuring financial openness is to use measures of legal restrictions on cross-border capital flows. Such capital controls come in many varieties—controls on inflows versus those on outflows, quantity versus price controls, restrictions on foreign equity holdings, etc. Indeed, the IMF’s Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) measures over 60 different types of controls. The early literature on capital account liberalization employed a 0/1 measure of capital account openness based on information from these reports. Some researchers have used a “share” measure, reflecting the fraction of years in the sample in which a country’s capital account was open. Other authors have taken the detailed information in the AREAER publications to construct finer measures of capital account restrictiveness.10

All of these measures, despite their increasing sophistication and fineness, suffer from a variety of similar shortcomings. For example, they do not capture the degree of enforcement of capital controls (or the effectiveness of that enforcement), which can change over time even if the legal restrictions themselves remain unchanged. Moreover, these measures do not always reflect the actual degree of integration of an economy into international capital markets. Another complication is that, despite the extensive coverage of the AREAER, there could be other regulations that effectively act as capital controls but are not counted as controls. For instance, prudential regulations that limit the foreign exchange exposure of domestic banks could, in some circumstances, have the same effect as capital controls.

This discussion suggests that the distinction between de jure and de facto financial integration is a crucial one. After all, what matters in analyzing the

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10 Share measures have been created by Grilli and Milesi-Ferretti (1995), Rodrik (1998), and Klein and Olivei (2006). Finer measures of openness based on the AREAER have been developed by Quinn (1997, 2003), Miniane (2004), Chinn and Ito (2006), Mody and Murshid (2005), and Edwards (2007). Edison and Warnock (2003) construct measures of capital account restrictions related to just equity flows. Bekaert and Harvey (2000) and Henry (2000a) compile dates of equity market liberalizations for developing countries. We briefly discuss some of these narrower measures in more detail later.
effects of financial globalization is not how integrated economies seem on paper but how integrated they are in practice. Many Latin American economies have experienced massive capital flight at times during the last two decades despite having controls on outflows. And China, despite its extensive regime of capital controls, has not been able to stop inflows of speculative capital in recent years (Prasad and Wei, 2007).

But how does one go about measuring de facto integration? One approach has been to look at price-based measures of asset market integration. The logic is that integration of capital markets should be reflected in common prices across national borders of similar financial instruments (Karolyi and Stulz, 2003). There are, however, serious practical problems in using such measures for emerging markets and low-income developing economies. Returns on financial instruments in these economies may incorporate a multitude of risk and liquidity premia that are difficult to quantify. Also, domestic financial markets may simply not be deep or liquid enough to allow for efficient arbitrage of price differentials.\(^\text{11}\)

Quantity-based measures of integration based on actual flows provide, in our view, the best available measure of a country’s de facto integration with global financial markets. Should one measure integration using gross flows (the sum of total inflows and total outflows) or net flows (the difference between inflows and outflows)? Although the choice depends on the precise question one is interested in, gross flows in general provide a less volatile and more sensible picture of integration. Indeed, this measure has the advantage of capturing two-way flows which one would expect to see if economies were sharing risk efficiently in a world with multiple financial instruments and agents with different risk profiles.

However, annual gross flows tend to be volatile and prone to measurement error. To mitigate these problems, it is preferable to use the sum of gross stocks of foreign assets and liabilities as a ratio to GDP. This preserves the spirit of measuring de facto integration and obviates many of the problems associated with flow data. Moreover, for some purposes—particularly risk sharing—stock measures are more appropriate. For instance, if countries have large stocks of foreign assets and liabilities, small exchange rate changes can have large valuation effects and serve as a mechanism for risk sharing even if net asset positions are small.

The measures of financial integration that we use in the next section draw upon the pioneering work of Lane and Milesi-Ferretti (2010), who have constructed an extensive dataset of gross liabilities and assets for 145 countries covering the period 1970–2004.\(^\text{12}\) Their dataset contains information about the composition of

\(^{11}\) Other measures of integration include saving-investment correlations and, related to the price-based approach discussed above, various interest parity conditions (see Frankel, 1992; and Edison and others, 2002). However, these measures are also difficult to operationalize and interpret for an extended period of time and for a large group of countries.

\(^{12}\) These authors substantially extend their External Wealth of Nations database (Lane and Milesi-Ferretti, 2001) using a revised methodology and a larger set of sources. Although their benchmark series are based on the official estimates from the International Investment Position, they compute the stock positions for earlier years using data on capital flows and account for capital gains and losses.
international financial positions, including FDI, portfolio equity investment, external debt, and official reserves. In addition, the dataset accounts for valuation effects and other problems that typically plague raw country-level data, and also corrects for some differences across countries in data definitions and variable construction.

We do not claim that our preferred de facto measure of financial integration is flawless. Collins (2006) has argued that, notwithstanding their other merits, de facto indicators are likely to be endogenous in growth regressions, making it difficult to pin down causal effects. As we discuss later, de jure measures also have a strong element of endogeneity to them, in addition to their various other deficiencies. Our bottom line is that there is important information in both the de jure and de facto measures of financial integration, but de facto measures provide a better picture of the extent of a country’s integration into global financial markets and, for many empirical applications, this measure is more suitable.

### 10.3.1. Patterns of Financial Globalization

Measures of de facto integration based on the Lane-Milesi-Ferretti data show a surge in financial globalization since the mid-1980s. Figure 10.1 compares the evolution of de jure integration based on the IMF’s binary capital account restrictiveness measure, averaged across all countries in each group, and corresponding group averages of the de facto financial openness measure (stock of international financial assets and liabilities expressed as a ratio to GDP). By both measures, advanced economies have become substantially integrated into global financial markets. For emerging market economies, average de jure openness has not changed much based on the IMF measure, but de facto integration has increased sharply over the last two decades. For other developing economies, de jure openness on average rose sharply over the last decade, to a level higher than that for emerging market economies, but the de facto measure has stayed flat over this period. This figure highlights the different informational content in the two types of integration measures and the importance of taking these differences into account in analyses of the effects of financial globalization.

FDI and portfolio equity flows have become the dominant form of new flows into developing economies, although debt still accounts for more than half of the stock of all external liabilities. The share of debt in gross stocks of foreign assets and liabilities declined from 75 percent in 1980–84 to 59 percent in 2000–04.

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13 FDI refers to direct investment in a domestic company, giving the foreign investor an ownership share. Portfolio equity inflows refers to foreign investors’ purchases of domestically issued equity in a company. Debt inflows include foreign investors’ purchases of debt issued by corporates or the government, and also foreign borrowing undertaken by domestic banks.

14 An earlier wave of financial globalization (1880–1914) has been analyzed by Bordo, Taylor, and Williamson (2003), Obstfeld and Taylor (2004), and Mauro, Sussman, and Yafeh (2006).

15 The sample of countries used in our analysis is listed in the Data Appendix.

16 Certain measures of de jure integration do track the de facto measures better. For instance, the Edison-Warnock measure of restrictions on equity inflows does change more in line with de facto integration in emerging markets, but this measure is available for only a limited number of countries and for a short time interval. Moreover, equity inflows constitute only a small portion of total inflows.
Note: This figure shows unweighted cross-country averages, within each group, of two measures of capital account openness. The de jure measure is based on the IMF 0-1 capital account restrictiveness classification, with 1 representing countries that have open capital accounts. The de facto measure is based on the ratio of gross stocks of foreign assets and liabilities to GDP, with the raw data taken from Lane and Milesi-Ferretti (2010). See the Data Appendix for a listing of countries in each group.

**Figure 10.1**  Evolution of international financial integration, 1970–2004.
### TABLE 10.1
International Financial Integration

<table>
<thead>
<tr>
<th></th>
<th>Gross Stocks of Foreign Assets and Liabilities</th>
<th>Gross Inflows</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Countries (billions of dollars)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share of FDI</td>
<td>15.6</td>
<td>17.9</td>
</tr>
<tr>
<td>Share of equity</td>
<td>4.9</td>
<td>9.5</td>
</tr>
<tr>
<td>Share of debt</td>
<td>75.1</td>
<td>69.4</td>
</tr>
<tr>
<td>Share of other</td>
<td>4.4</td>
<td>3.3</td>
</tr>
<tr>
<td>Advanced Economies (billions of dollars)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share of FDI</td>
<td>16.1</td>
<td>17.9</td>
</tr>
<tr>
<td>Share of equity</td>
<td>5.5</td>
<td>9.9</td>
</tr>
<tr>
<td>Share of debt</td>
<td>74.8</td>
<td>69.7</td>
</tr>
<tr>
<td>Share of other</td>
<td>3.6</td>
<td>2.5</td>
</tr>
<tr>
<td>Emerging Markets (billions of dollars)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share of FDI</td>
<td>12.0</td>
<td>17.6</td>
</tr>
<tr>
<td>Share of equity</td>
<td>1.3</td>
<td>6.1</td>
</tr>
<tr>
<td>Share of debt</td>
<td>77.9</td>
<td>64.6</td>
</tr>
<tr>
<td>Share of other</td>
<td>8.8</td>
<td>11.7</td>
</tr>
<tr>
<td>Other Developing Economies (billions of dollars)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share of FDI</td>
<td>16.0</td>
<td>14.4</td>
</tr>
<tr>
<td>Share of equity</td>
<td>0.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Share of debt</td>
<td>73.8</td>
<td>78.5</td>
</tr>
<tr>
<td>Share of other</td>
<td>6.7</td>
<td>5.6</td>
</tr>
</tbody>
</table>

Note: Data shown in this table are based on cross-country averages of annual data over the relevant five-year period for each group of countries. The sample comprises 21 industrial, 20 emerging market, and 30 other developing countries. See the Data Appendix for a listing of countries in each group. The category “Other” includes financial derivatives and total reserves minus gold. Shares are in percentage of total. The raw data are based on a dataset constructed by Lane and Milesi-Ferretti (2010).

Among advanced economies, the biggest increase has been in the share of portfolio equity. For emerging markets, the share of FDI and portfolio equity rose from 13 percent in 1980–84 to 37 percent in 2000–04, reflecting the wave of mergers and acquisitions, privatizations of state firms, and stock market liberalizations that spurred flows to these economies in the early- to mid-1990s. In recent years, accumulation of official international reserves has accounted for a significant portion of the increase in gross foreign assets of emerging and other developing economies; consequently, the share of the “other” category has jumped over the last decade.

Some of these patterns are stronger when one looks at gross private inflows (Table 10.1). Although debt financing remains the most important source of inflows for advanced economies, FDI now accounts for almost half of total inflows into developing economies. Equity flows have become quite important for emerging markets, accounting for almost 12 percent of inflows, whereas this category still remains virtually nonexistent for other developing economies, reflecting their underdeveloped stock markets.
10.4. MACROECONOMIC EVIDENCE ON THE EFFECTS OF FINANCIAL GLOBALIZATION

In this section, we review macroeconomic evidence on the effects of financial globalization in terms of both growth and volatility. The main conclusion is that the evidence based on cross-country regression frameworks has been inconclusive in some respects and, as we discuss below, has a number of conceptual limitations that cannot easily be overcome just by using better cross-country datasets or more sophisticated econometric techniques.

10.4.1. Effects on Growth

A large swath of the literature on the benefits of financial globalization has been based on cross-country growth regressions. This literature suffers from many of the drawbacks of other related growth literatures that use the same empirical approach. Nevertheless, there is some hope that this approach may work better for detecting the growth effects of financial integration. After all, in addition to cross-country variation in levels of financial integration, these levels have varied enormously over time for most countries and the approaches taken by different countries to opening up to financial flows have also varied widely.

Common perceptions about the growth benefits of financial integration owe much to the fact that emerging market economies have, as a group, experienced far higher cumulative growth since 1970 than other developing countries or even industrial countries (Figure 10.2). Excluding China and India from the list of emerging markets makes the performance of this group look less spectacular, although it is still better than that of the group of other developing countries.

To obtain an intuitive impression of the relationship between financial openness and growth, Table 10.2 presents a list of the fastest-growing economies during 1980–2005 and a list of the slowest-growing (or fastest-declining) economies during the same period. One can tell from this table that financial globalization is not a necessary condition for achieving a high growth rate. For example, Mauritius managed to achieve high growth despite not being very open to financial flows. The fastest growing economy in the world during this period was China, which was open to FDI but not to other types of flows.

It is obvious that financial integration is also not a sufficient condition for rapid economic growth. For example, both Bolivia and Venezuela were partially open to foreign capital flows during this period; yet, their economies on average registered negative growth. The table does suggest, however, that declining economies are in general more likely to be financially closed, though the direction of causality is not clear.

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17 Some countries underwent financial integration during this period, especially in the latter half of the 1990s. Therefore any result based on the average growth over this period should be interpreted with caution. The list of countries in our sample is listed in the Data Appendix.
Note: This figure shows cumulative changes in indexes of per capita GDP for each group of countries, computed using growth rates of real GDP for each country and weighting these by a purchasing power parity (PPP) adjustment factor. The indexes are set to 100 in the base period. See the Data Appendix for a listing of countries in each group.

**Figure 10.2** GDP per capita, PPP-weighted.
To further illustrate the relationship between economic growth and financial openness, Figure 10.3A (left panel) presents a scatter plot of the average growth rate of real per capita GDP against the average level of de facto financial openness over the past two decades. There is no systematic relationship between these variables. There is a weak positive association between average GDP growth and the change in the financial openness measure (Figure 10.3B, left panel), consistent with the notion that economies that integrated into global financial markets grew faster. But once other growth determinants are controlled for, even this relationship vanishes (Figure 10.3B, right panel).

In Table 10.3, we provide an overview of the empirical literature that aims to establish a causal relationship between financial openness and growth. Although some of these studies conclude that there are growth benefits associated with international financial integration, the majority of them tend to find no effect or a mixed effect (results that are not robust across alternative specifications) for developing countries. This confirms our claim that, if financial integration has a positive effect on growth, it is apparently not robust, especially once the usual determinants of growth are controlled for.

18 We excluded from these plots a few countries that were outliers, mostly those with very high levels of financial openness relative to GDP (see the Data Appendix). Using the full sample of countries made little difference to the correlations shown here. We do not systematically examine the effects of outliers as these plots are meant to be descriptive and do not constitute formal empirical evidence.
Financial Globalization: A Reappraisal

Figure 10.3

Unconditional Relationship

Conditional Relationship

(A)

(B)

Note: Growth refers to average real per capita GDP growth. Financial openness is defined as the ratio of gross stocks of foreign assets and liabilities to GDP and is based on a dataset constructed by Lane and Milesi-Ferretti (2010). The second panel in each figure uses residuals from a cross-section regression of growth on initial income, population growth, human capital, and the investment rate.

<table>
<thead>
<tr>
<th>Study</th>
<th>Number of Countries/ Time Period</th>
<th>Dependent Variable/ Regression Methodology</th>
<th>Financial Openness Measure</th>
<th>Main Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alesina, Grilli, Milesi-Ferretti (1994)</td>
<td>20</td>
<td>$\Delta Y$ and $\Delta Yc$</td>
<td>Binary</td>
<td>NO EFFECT: No clear impact of capital controls on growth in the OECD countries.</td>
</tr>
<tr>
<td>Grilli and Milesi-Ferretti (1995)</td>
<td>61</td>
<td>$\Delta Yc$</td>
<td>Share</td>
<td>NO EFFECT: No evidence of a robust correlation of capital account with growth.</td>
</tr>
<tr>
<td>Quinn (1997)</td>
<td>64</td>
<td>$\Delta Yc$</td>
<td>$\Delta Quinn$</td>
<td>POSITIVE: There is a robust positive association between capital account liberalization and growth.</td>
</tr>
<tr>
<td>Kraay (1998)</td>
<td>117</td>
<td>$\Delta Yc$</td>
<td>Share, Quinn, Volume</td>
<td>MIXED: Change in financial openness is not significantly related to growth (coefficient on Volume significantly positive but result not robust).</td>
</tr>
<tr>
<td>Rodrik (1998)</td>
<td>95</td>
<td>$\Delta Yc$</td>
<td>Share</td>
<td>NO EFFECT: No evidence of a significant effect of financial openness on growth.</td>
</tr>
<tr>
<td>Bosworth and Collins (1999)</td>
<td>58</td>
<td>$I/Y, S/Y$</td>
<td>Volume</td>
<td>MIXED: FDI is highly beneficial for domestic investment whereas portfolio flows have no discernible effect and loans lie in between. Insignificant impact of international flows on saving.</td>
</tr>
<tr>
<td>Bailliu (2000)</td>
<td>40</td>
<td>$\Delta Yc$</td>
<td>Volume</td>
<td>MIXED: Capital inflows foster higher economic growth but only for economies where the banking sector has reached a certain level of development.</td>
</tr>
<tr>
<td>Arteta, Eichengreen, and Wyplosz (2003)</td>
<td>61</td>
<td>$\Delta Yc$</td>
<td>Quinn, $\Delta Quinn$</td>
<td>MIXED: Evidence on positive association between capital account liberalization and growth fragile but stronger correlation with growth when openness measures are interacted with trade openness and rule of law.</td>
</tr>
<tr>
<td>Edwards (2001)</td>
<td>62</td>
<td>$\Delta Yc, \Delta TFP$</td>
<td>Share, Quinn, $\Delta Quinn$</td>
<td>MIXED: Capital account openness positively affects growth only after a country has achieved a certain degree of economic development and financial development.</td>
</tr>
</tbody>
</table>

(continued)
### Summary of Key Empirical Studies on Financial Integration and Growth (Continued)

<table>
<thead>
<tr>
<th>Study</th>
<th>Number of Countries / Time Period</th>
<th>Dependent Variable / Regression Methodology</th>
<th>Financial Openness Measure</th>
<th>Main Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quinn, Inclan, and Toyoda (2001)</td>
<td>76 1960–98</td>
<td>$\Delta Y_c$ Five-yearly panel FE</td>
<td>Quinn, $\Delta$Quinn</td>
<td>POSITIVE/MIXED: Capital account liberalization has a robust positive impact on growth in most countries.</td>
</tr>
<tr>
<td>Quinn and Toyoda (2008)</td>
<td>85 1955–2004</td>
<td>$\Delta Y_c$ Cross-section and five-yearly panel. FE, dynamic system GMM</td>
<td>Quinn, $\Delta$Quinn, Share, SMLD</td>
<td>POSITIVE: Capital account openness (and international equity market liberalizations) associated with subsequent economic growth. Little evidence of effects being because of contingency on other factors.</td>
</tr>
<tr>
<td>Reisen and de Soto (2001)</td>
<td>44 1986–97</td>
<td>$\Delta$GNP; Annual panel dynamic GMM</td>
<td>Volume</td>
<td>MIXED: Both FDI and portfolio equity flows have a significant positive impact on growth, but bank lending contributes to growth only if banking system is well capitalized.</td>
</tr>
<tr>
<td>Edison and others (2010)</td>
<td>57 1980–2000</td>
<td>$\Delta Y_c$ Cross-section OLS, IV; five-yearly panel dynamic GMM</td>
<td>Share, Volume</td>
<td>NO EFFECT/MIXED: With isolated exceptions, unable to reject the null hypothesis that international financial integration does not accelerate growth even when controlling for particular economic, financial, institutional, and policy characteristics.</td>
</tr>
<tr>
<td>Bonfiglioli and Mendicino (2004)</td>
<td>90 1975–99</td>
<td>$\Delta Y_c$ Five-yearly panel dynamic system GMM</td>
<td>Binary</td>
<td>MIXED: Capital liberalization has positive effect on growth but mainly via indirect channels, e.g., mitigating effects of banking crises (whereas equity market liberalization has direct effect but no interaction with banking crises).</td>
</tr>
<tr>
<td>Author(s) (Year)</td>
<td>Period</td>
<td>Dep. Var.</td>
<td>Methodology</td>
<td>Measure</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------</td>
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<td>---------</td>
</tr>
<tr>
<td>Edison and others (2004)</td>
<td>1976–95</td>
<td>$\Delta Y_c$</td>
<td>Cross-section OLS</td>
<td>Share, Quinn</td>
</tr>
<tr>
<td>Vanassche (2004)</td>
<td>1980–97</td>
<td>$\Delta Y_c$</td>
<td>Cross-section OLS, IV</td>
<td>Share, Quinn</td>
</tr>
<tr>
<td>Chanda (2005)</td>
<td>1976–95</td>
<td>$\Delta Y_c$</td>
<td>Cross-section OLS</td>
<td>Share</td>
</tr>
<tr>
<td>Klein (2005)</td>
<td>1976–95</td>
<td>$\Delta Y_c$</td>
<td>Cross-section OLS, IV, NLLS</td>
<td>Share</td>
</tr>
<tr>
<td>Mody and Murshid (2005)</td>
<td>1979–99</td>
<td>Annual and three-yearly panels FE, IV</td>
<td>Volume, A Sum</td>
<td>MIXED: FDI had strongest positive impact on domestic investment. Positive relationship between capital flows and investment growth is more emphasized with stronger policies.</td>
</tr>
<tr>
<td>Vlachos and Waldenström (2005)</td>
<td>1980–90</td>
<td>$\Delta Y_c$</td>
<td>Cross-section with FE, OLS, and IV</td>
<td>Volume, Binary</td>
</tr>
<tr>
<td>Klein and Olivei (2006)</td>
<td>1976–95</td>
<td>$\Delta Y_c$</td>
<td>Cross-section OLS, IV</td>
<td>Share</td>
</tr>
</tbody>
</table>

Dependent variable: EBITDA: earnings before interest, taxes, depreciation, and amortization; $\Delta$GNP: growth rate of real per-capita GNP; I: investment; I/Y: investment over GDP; $\Delta$I: growth rate in investment per capita; $\Delta$IND: growth rate of industry-level measures (e.g., real value added, output, or number of firms); $\Delta$In: growth rate of real private investment; $\Delta$S/Y: saving over GDP; $\Delta$TFP: growth rate of total factor productivity; $\Delta$Y: growth rate of real GDP per capita; $\Delta$Y: growth rate of real GDP. Regression methodology: Cross-section: single observation for each country over entire period; FE: country and/or industry fixed effects; GMM: generalized method of moments; IV: instrumental variables; NLLS: non-linear least squares; OLS: ordinary least squares; Panel: repeated observations on countries (or country industries) observed over multiple periods (which may be, for example, annual, five years, or a decade); Pooled: assumes no country-specific fixed effects; RE: country random effects; SUR: seemingly unrelated regressions; WLS: weighted least squares. Financial openness measure: A Sum: sum of four binary AREAEER liberalization indicators across the following categories: capital account; current account; export proceeds; and multiple exchange rates. Binary: 0/1 dummy variable from AREAEER taking the value of one when capital controls in place; KS: measure based on Kaminsky and Schmukler (2003); Quinn: measure based on Quinn (1997); $\Delta$Quinn: change in Quinn measure; Share: the proportion of years in which countries had liberalized capital accounts based on the binary variable from AREAEER; SMLD: official date of stock market liberalization; Volume: variable based on actual flows/stocks of financial flows. Main findings: NO EFFECT: no evidence of a significant effect of greater financial integration on growth; MIXED: evidence of positive effect of financial integration on growth is conditional upon other economic characteristics (for example, financial development or human capital) or otherwise nonrobust (for example, conditional on different country samples); POSITIVE: significant positive effect of greater financial integration on growth.
Why do different studies reach such diverse conclusions about the importance of financial integration in affecting long-run economic performance? Empirical studies using finer de jure measures of capital account openness appear to reach more positive results about the impact of financial integration on economic growth. In a much-cited study, Rodrik (1998) finds that capital account liberalization has no significant effect on economic growth. His analysis is based on a binary measure of capital controls, which is obviously a very coarse measure of international financial integration. Employing a finer and more informative version of the same de jure openness measure, Quinn and Toyoda (2008) document a positive association between capital account liberalization and economic growth. In studies that use both de jure and de facto measures, specifications where capital account openness is measured using de facto measures tend to lend more support for the potential growth-enhancing effects of financial integration than those employing de jure measures (see Kraay, 1998; O’Donnell, 2001; and Edison and others, 2002).

There are other reasons why the results differ markedly across studies—the sample period, country coverage, and choice of empirical methodology all make a big difference. For example, Rodrik’s analysis covers the period 1975–89 whereas Quinn and Toyoda’s sample covers a longer period, 1955–2004. Thus, the impact of the debt crises of the 1980s receives a higher weight in Rodrik’s study. Longer time spans are presumably more suitable for studying the impact of international financial integration on economic growth. At the same time, one must keep in mind that capital flows to developing countries have really taken off only in the last two decades. Some authors find that capital account liberalization tends to have a positive impact in all groups of countries—advanced, emerging market, and other developing economies; others have found that the impact is limited for the last group.19

At any rate, our reading of this large literature based on aggregate data is that it remains difficult to find robust evidence that financial integration systematically increases growth, once other determinants of growth are controlled for. Nevertheless, the weight of the evidence seems to be gradually shifting toward finding positive marginal effects on growth, especially when financial integration is measured using de facto or finer de jure measures, when data over longer time periods are used, and when interaction terms accounting for supportive conditions (such as good policies and institutions) are properly included in cross-country regression frameworks. We will expand on these themes later in the chapter.

We should note again, however, that endogeneity between financial integration and growth remains a potentially problematic issue in studies that find a positive association between these variables. Some authors have attempted to deal with this problem by using lagged measures of financial integration and generalized method

of moments techniques in panel regressions. This problem may ultimately be intractable in macroeconomic data; looking at more disaggregated data may be one way out. Another possibility, as we will discuss later, is that it is difficult, even at a conceptual level, to make strong causal statements about the direct effects of financial globalization on GDP growth, independent of whether macro or micro data are used.

10.4.2. Effects on Volatility

Capital account liberalization is believed to have played an important role in fomenting financial crises and has been indicted by some observers as the proximate cause for the crises experienced by emerging markets in recent decades. But there is little empirical evidence to support the view that capital account liberalization by itself increases vulnerability to crises. Indeed, the literature on the effects of financial integration on volatility (and crises) is much sparser than the literature on its growth effects. Further research is warranted in this area.

10.4.2.1. Crises

Some papers that have analyzed the effects of capital controls on susceptibility to financial crises have found that countries with capital controls are in fact more subject to crises. But this could simply be because of a “selection effect”—often it is countries with poor macroeconomic fundamentals that put controls in place to try and insulate themselves from crises. Glick, Guo, and Hutchison (2006) address this issue—they find that capital account openness reduces the probability of currency crises, even after controlling for selection bias in terms of how macroeconomic policies influence the existence of capital controls. The relationship between capital controls and crises could also reflect the fact that some of the countries are actually more integrated in terms of de facto measures of integration (capital flight) and that capital controls therefore do not insulate them from crises.

Edwards (2007) examines this issue using a new measure of de jure financial openness that attempts to capture the intensity of capital account restrictiveness. He looks at two manifestations of external crises—sudden stops of inflows and current account reversals—and finds no evidence that countries with higher capital mobility tend to have a higher incidence of crises. In subsequent work, Edwards (2008) concludes that there is no evidence that the output costs of currency crises are smaller in countries that restrict capital mobility.

Although currency crises have been emphasized in the literature on the risks of capital account liberalization, it is worth noting that banking crises account for about one-third of financial crises over the last three decades and that their

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20 These authors use a binary capital account openness indicator based on the IMF’s AREAER. Whether this relationship holds up with de facto measures remains to be seen.
frequency increased in the 1980s and 1990s. Banking crises tend to be more disruptive and generally have larger adverse effects on output growth than currency crises. Glick and Hutchison (2001) find little evidence that capital account liberalization by itself affects vulnerability to banking crises; moreover, the adverse effects of banking crises seem to be weaker for countries with open capital accounts. 21

In sum, there is little formal empirical evidence to support the oft-cited claims that financial globalization in and of itself is responsible for the spate of financial crises that the world has seen over the last three decades. 22 Of course, as we will discuss in more detail below, the interaction between capital account liberalization and other policy choices (e.g., fixed exchange rate regimes that are not well supported by other macroeconomic policies) could, under certain circumstances, spell trouble for a developing economy.

10.4.2.2. Volatility

Although crisis episodes receive most of the attention, however, they are just particularly sharp manifestations of the more general phenomenon of macroeconomic volatility. Here the results are less favorable—there is no evidence that financial globalization has delivered on the promised benefit of improved international risk sharing and reduced volatility of consumption growth.

There has been a well-documented trend decline in macroeconomic volatility in most of the major industrial economies since the mid-1980s, although the reasons for this decline are still a matter of debate. Output volatility seems to have been on a declining trend in emerging market and developing economies as well. However, the existing evidence based on papers using a variety of regression models, different country samples, and time periods leads to the conclusion that there is no systematic empirical relationship between financial openness and output volatility, which is, in a sense, consistent with the predictions of theory (see Razin and Rose, 1994; Easterly, Islam, and Stiglitz, 2001; and Buch, Döpke, and Pierdzioch, 2005).

Kose, Prasad, and Terrones (2003) note that, during the 1990s, average declines in output growth volatility were smaller for emerging markets than for either industrial or low-income developing economies. More importantly, they find that the ratio of consumption growth volatility to income growth volatility increased during the recent period of globalization for emerging market economies (and remained flat for the other two groups). What is surprising is not just that the volatility of consumption rose (perhaps because of crises experienced by some of these economies) but that it increased by more than income volatility. This is a striking result in that it runs exactly counter to a presumed theoretical

21 On the output costs of banking crises, see Hutchison and Noy (2005) and Bonfiglioli and Mendicino (2004).

22 The evidence cited on this point by some prominent critics of globalization in fact turns out to be about how domestic financial sector liberalization, rather than financial integration, has in some cases precipitated financial crises (see footnote 5 in Stiglitz, 2004).
benefit of financial integration—that it allows countries to share income risk and
smooth consumption.23

These authors also find that the relative volatility of consumption growth (rela-
tive to income) increases with the degree of financial openness, but only up to a
certain threshold level of integration. At higher levels of financial integration, coun-
tries do seem to accrue the benefits of financial integration in terms of improved
risk sharing and better consumption smoothing relative to autarky. Most emerging
market economies are, however, below this threshold level of integration whereas
most industrial economies are above it. We will have more to say later on about the
importance of various thresholds in attaining the benefits of financial globalization.

To summarize, the macroeconomic evidence on the growth and volatility
effects of financial integration remains sobering although there are some grounds
for optimism in more recent work. But most of the evidence so far is based on
cross-country regressions that lump together different types of capital flows. Is
there a different way to approach the issue?

10.5. HOW DOES THE COMPOSITION OF CAPITAL
FLOWS MATTER?

An alternative line of inquiry into the effects of financial globalization is based on the
notion that not all types of capital flows are created equal. As we have documented
earlier, there have been substantial changes in the composition of financial flows over
time. What does the evidence show about the macroeconomic effects of different
types of flows? The empirical literature is fairly decisive about debt flows worsening
the benefit-risk trade-off related to inflows. Flows that have equity-like features—
that is, FDI and portfolio equity flows—are not only presumed to be more stable
and less prone to reversals, but are also believed to bring with them many of the
indirect benefits of financial globalization such as transfers of managerial and tech-
nological expertise. Because a number of recent papers have focused on attempting
to uncover the benefits of FDI and equity flows, we examine their effects first.

10.5.1. Foreign Direct Investment

There is a strong presumption in theory that FDI should yield more benefits than
other types of financial flows because, in addition to augmenting the domestic capi-
tal stock, it has a positive impact on productivity through transfers of technology and

23 A number of recent theoretical papers have attempted to explain the hump-shaped relationship
between financial integration and the relative volatility of consumption growth. Levchenko (2005)
and Leblebicioglu (2006) consider dynamic general equilibrium models where only some agents
have access to international financial markets. In both models, financial integration leads to an
increase in the volatility of aggregate consumption because agents with access to international finan-
cial markets stop participating in risk-sharing arrangements with those who lack such access.
Bekaert, Harvey, and Lundblad (2005) find that consumption volatility declines following equity
market liberalizations. Kose, Prasad, and Terrones (2008) show that emerging market economies,
which have experienced large increases in cross-border capital flows, have seen little change in their
ability to share risk during the globalization period.
managerial expertise. It has also been argued that FDI is less volatile than other inflows, making countries less vulnerable to sudden stops or reversals of these flows. Studies using aggregate data have, however, been unable to provide conclusive evidence about the positive impact of FDI on economic growth. Table 10.4 provides a summary of the key studies in this literature.  

Carkovic and Levine (2005) provide a comprehensive analysis of the growth effects of FDI; they conclude that FDI has no robust causal effect on economic growth. Interestingly, their baseline results suggest a positive association between FDI and economic growth; this association disappears when they introduce controls for trade and domestic financial credit. Thus, the Carkovic-Levine results could be taken to imply that an expansion of FDI flows accompanied by an increase in trade could indeed enhance growth. 

There may be other reasons why the beneficial effects of FDI are difficult to detect in macroeconomic data. Pooling of data from developed and developing countries could dampen the estimated growth effects because FDI is more likely to crowd in domestic investment in developing countries. The growth benefits also depend on the sectoral composition of FDI and its interactions with domestic investment. Flows into the primary sector may have limited beneficial spillovers, because they often involve megaprojects that scarcely employ domestically produced intermediate goods. FDI in the manufacturing sector, on the other hand, tends to have a significant effect on GDP growth because of stronger linkages between this sector and the rest of the economy. Some studies note that FDI boosts growth only in economies that have the right initial conditions, including high levels of human capital, financial sector development, and policies fostering free trade. 

Direct evidence on the role of horizontal spillovers—productivity spillovers from foreign firms to domestic firms in the same sector—in transmitting the productivity benefits of FDI remains inconclusive. Apart from causality issues (foreign firms may tend to locate in high-productivity sectors), studies looking for horizontal spillovers do not account for the possibility that foreign firms may try to minimize technological spillovers to domestic firms in the same sector in order to protect their firm-specific advantages. However, foreign firms have incentives to transfer knowledge to their local suppliers and customers, implying that productivity spillovers from FDI may occur through “vertical” linkages. This is a promising line of research that has picked up steam in recent years. For instance, Javorcik (2004) uses enterprise-level

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24 Recent surveys of this literature include Lipsey (2004) and Moran, Graham, and Blomström (2005).  
25 Along similar lines, it should be noted that Morocco and Venezuela were relatively closed to trade during the periods covered by the country-specific panel datasets used in the influential studies by Haddad and Harrison (1993) and Aitken and Harrison (1999), respectively, both of which concluded that FDI has minimal growth benefits (see Moran, Graham, and Blomström, 2005).  
26 Blonigen and Wang (2005) discuss the pooling issue whereas Aykut and Sayek (2005) analyze the effects of sectoral composition of FDI inflows. The importance of the three initial conditions is shown by Borensztein, De Gregorio, and Lee (1998); Hermes and Lensink (2003) and Alfaro and others (2006); and Balasubramanyan, Salisu, and Sapsford (1996), respectively. On the last point, also see Melitz (2005).
## TABLE 10.4
Summary of Key Empirical Studies on Foreign Direct Investment and Growth

<table>
<thead>
<tr>
<th>Study</th>
<th>Number of Countries/Time Period</th>
<th>Dependent Variable/Regression Methodology</th>
<th>Financial Openness Measure</th>
<th>Main Findings</th>
</tr>
</thead>
</table>
Cross-section OLS, IV                  | FDI/Y                                  | MIXED: FDI has a positive impact on economic growth in countries which have export-oriented rather than import-substituting trade policies. |
Cross-section IV; 
decade panel pooled SUR, IV | FDI/Y                                  | MIXED: FDI contributes to growth in countries with a higher level of human capital. |
VARs, cointegration; 
annual panel FE IV, pooled group | FDI/      | MIXED: Growth effects of FDI depend on the degree of complementarity and substitution between FDI and domestic investment. |
| Haveman, Lei, and Netz (2001)     | 74 1970–89                     | $\Delta Y_c$  
Five-yearly panel FE                  | FDI/Y                                  | POSITIVE: FDI leads to increased growth. |
Cross-section OLS,  
decade panel FE, IV                  | FDI/Y                                  | MIXED: FDI has a positive impact on growth, but evidence is weak in developing countries. FDI volatility has a negative growth effect. |
| Hermes and Lensink (2003)         | 67 1970–95                     | $\Delta Y_c$  
Cross-section OLS, 
five-yearly panel FE, RE               | FDI/Y                                  | MIXED: FDI has a positive growth impact if financial system sufficiently developed. |
| Choe (2003)                       | 80 1971–95                     | $\Delta Y_c$  
Five-yearly panel VAR                  | FDI/Y                                  | MIXED: FDI Granger-causes economic growth, and vice versa, but effects are more emphasized from growth to FDI than from FDI to growth. |
| Alfaro and others (2004)          | 71 1975–95                     | $\Delta Y_c$  
Cross-section OLS, IV                  | FDI/Y                                  | MIXED: FDI has a significantly positive effect on growth in countries with well-developed financial markets. |
| Carkovic and Levine (2005)        | 72 1960–95                     | $\Delta Y_c$  
Cross-section OLS, 
five-yearly panel dynamic system GMM | FDI/Y                                  | MIXED: FDI inflows do not exert an independent influence on economic growth. |

(continued)
TABLE 10.4

Summary of Key Empirical Studies on Foreign Direct Investment and Growth (Continued)

<table>
<thead>
<tr>
<th>Study</th>
<th>Time Period</th>
<th>Number of Countries/ Time Period</th>
<th>Dependent Variable/Regression Methodology</th>
<th>Financial Openness Measure</th>
<th>Main Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blonigen and Wang (2005)</td>
<td>1970–89</td>
<td>69</td>
<td>$\Delta Y_c$, Ten-yearly panel RE, pooled SUR</td>
<td>FDI/Y</td>
<td>MIXED: FDI has a positive impact on growth in less developed countries provided education levels are high enough, but not in developed countries.</td>
</tr>
<tr>
<td>Aykut and Sayek (2005)</td>
<td>1990–2002</td>
<td>37</td>
<td>$\Delta Y_c$, Cross-section OLS IV</td>
<td>FDI/Y</td>
<td>MIXED: Although manufacturing sector FDI has a positive impact on growth, primary or service sector FDI has no significant impact.</td>
</tr>
</tbody>
</table>

Dependent variable: EBITDA: earnings before interest, taxes, depreciation, and amortization; $\Delta$GNP, $\Delta$IND: growth rate of real per capita GDP; $\Delta$I, $\Delta$I/Y: growth rate in investment per capita; $\Delta$I c: growth rate in investment per capita; $\Delta$INL: growth rate of industry-level measures (e.g., real value added, output, or number of firms); $\Delta$lnI: growth rate of real private investment; $\Delta$N: saving over GDP; $\Delta$TFP: growth rate of total factor productivity; $\Delta$Y c: growth rate of real per capita GDP; $\Delta$Y: growth rate of real GDP.

Regression methodology: Cross-section: single observation for each country over entire period; FE: country and/or industry fixed effects; GMM: generalized method of moments; IV: instrumental variables; NLLS: nonlinear least squares; OLS: ordinary least squares; Panel: repeated observations on countries (or country industries) observed over multiple periods (which may be, for example, annual, five years, or a decade); Pooled: assumes no country-specific fixed effects; RE: country random effects; SUR: seemingly unrelated regressions; WLS: weighted least squares.

Financial openness measure: A Sum: sum of four binary AREAER liberalization indicators across the following categories: capital account; current account; export proceeds; and multiple exchange rates. Binary: 0/1 dummy variable from AREAER taking the value of one when capital controls in place; KS: measure based on Kaminsky and Schmukler (2003); Quinn: measure based on Quinn (1997); $\Delta$Quinn: change in Quinn measure; Share: the proportion of years in which countries had liberalized capital accounts based on the binary variable from AREAER; SMLD: official date of stock market liberalization; Volume: variable based on actual flows/stocks of financial flows.

Main findings: NO EFFECT: no evidence of a significant effect of greater financial integration on growth; MIXED: evidence of positive effect of greater financial integration on growth is conditional upon other economic characteristics (for example, financial development or human capital) or otherwise nonrobust (for example, conditional on different country samples); POSITIVE: significant positive effect of greater financial integration on growth.

Data from Lithuania and employs semiparametric estimation methods to account for simultaneity and sample selection problems affecting ordinary least squares estimates. Her results suggest that, although there are positive spillovers from FDI through vertical linkages, there are few spillovers through horizontal channels.27

In short, empirical research that takes a more nuanced approach, especially by accounting for the role of various initial conditions (human capital, trade openness),

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27 Lipsey and Sjölhom (2005) provide a survey of the evidence on FDI spillovers. Also see Gög and Greenaway (2004). For more evidence on FDI spillovers through backward linkages, see Lopez-Cordova (2003), Alfaro and Rodriguez-Clare (2004), and Blalock and Gertler (2005).
has been more successful at showing the potential links between FDI and growth. Similarly, at the micro level, a reassessment of the channels through which technological spillovers from FDI inflows should take place has begun to turn up more positive evidence of such spillovers.

### 10.5.2. Portfolio Equity Flows

The rising importance of portfolio equity flows to emerging markets has spurred a rapidly expanding literature that examines the growth effects of equity market liberalizations, with most papers finding significant positive effects. Whether these estimated growth effects (in macroeconomic data) could be picking up the effects of other factors—especially other reforms that tend to accompany these liberalizations—remains, in our view, an open question. On the other hand, there is now a growing body of micro evidence (using industry- and firm-level data) supporting the macro evidence on the benefits of equity liberalizations. Table 10.5 provides a summary of the key papers in this literature.

In an influential paper, Bekaert, Harvey, and Lundblad (2005; henceforth BHL) conclude that equity market liberalizations increase long-term GDP growth by about 1 percentage point, a remarkably strong effect. 28 Henry (2007) argues that it is not possible to explain such a strong effect on long-term growth using standard growth accounting techniques as this would require an elasticity of output with respect to capital of about 1. He notes that equity market liberalizations are often part of a larger reform program and that these reforms could have a positive impact on productivity, leading to a longer-term increase in output growth that is compatible with the predictions of standard production theory. When BHL attempt to control for other determinants of growth, including broader capital account and trade liberalizations, the magnitude of the growth effects of equity market liberalizations is dampened. But the growth impact remains statistically significant and in the range of 0.7 to 0.9 percentage points, still a large effect. It is unclear, however, whether their attempts to control for broader liberalization are really adequate to account for all the legal and institutional reforms required for stock market deepening, or for the massive privatizations that accompanied many stock market liberalizations. Therefore, it is still debatable whether the large remaining growth effect may be fully attributed to equity market liberalizations or other supporting reforms. 29

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28 Also see Li (2003). Equity market liberalizations are defined as events that make shares of common stock of local firms available to foreign investors. Commonly used dates, drawn from Henry (2000a) and Bekaert and Harvey (2000), include official liberalization dates and dates of “first sign” of liberalization based on events such as the launching of a country fund or American Depository Receipt (ADR) announcement. ADRs are securities that are traded in the United States but represent underlying stocks listed in a foreign country.

29 Recent research also provides some cross-country evidence about the empirical relevance of various channels linking equity market liberalization to economic growth. There is evidence, consistent with the predictions of international asset pricing models, that stock market liberalizations reduce the cost of capital and boost investment growth. For evidence on the first point, see Stulz (1999a, 1999b), Bekaert and Harvey (2000), Henry (2000a), and Kim and Singal (2000). On the latter, see Henry (2000b) and Alfaro and Hammel (2006).
## TABLE 10.5
Summary of Key Empirical Studies on Equity Market Liberalization and Growth

<table>
<thead>
<tr>
<th>Study</th>
<th>Number of Countries/ Time Period</th>
<th>Dependent Variable/Regression Methodology</th>
<th>Financial Openness Measure</th>
<th>Main Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bekaert, Harvey, and Lundblad (2001)</td>
<td>30 1980–97</td>
<td>ΔYc</td>
<td>SMLD POSITIVE: Positive effect on growth following equity market liberalization which is greater for countries with above median education levels.</td>
<td></td>
</tr>
<tr>
<td>Li (2003)</td>
<td>95 1975–2000</td>
<td>ΔYc, I/Y, ΔYc/Ic</td>
<td>SMLD POSITIVE: Positive growth impact of opening equity markets due mainly to productivity channel (ΔYc/Ic) in middle- and high-income countries and to capital accumulation (I/Y) in low-income.</td>
<td></td>
</tr>
<tr>
<td>Bekaert, Harvey, and Lundblad (2005)</td>
<td>95 1980–97</td>
<td>ΔYc</td>
<td>SMLD POSITIVE: Equity liberalizations increased growth (controlling for policy endogeneity) with stronger effects in better legal and investment environment and financial development.</td>
<td></td>
</tr>
<tr>
<td>Gupta and Yuan (2005)</td>
<td>31 1981–98</td>
<td>ΔIND</td>
<td>SMLD POSITIVE/MIXED: Stock market liberalization leads to higher real value added growth in sectors more dependent on external finance (but, controlling for liberalization endogeneity, not in those with higher growth opportunities).</td>
<td></td>
</tr>
<tr>
<td>Mitton (2006)</td>
<td>28 1980–2000</td>
<td>Firm-level indicators, (e.g. Δlog(sales), EBITDA/total assets, log(sales/employees)). Annual panel FE</td>
<td>SMLD POSITIVE: Significant improvement in sales performance associated with liberalization of a firm’s equity to foreign investors (controlling for growth opportunities).</td>
<td></td>
</tr>
</tbody>
</table>
Because it is so difficult to disentangle the effects of the bundled reforms that typically accompany equity liberalizations, we view research using industry and firm-level data as important for obtaining a deeper understanding of their effects. This line of empirical research has indeed turned up encouraging results. For example, Gupta and Yuan (2005) find that, following such liberalizations, industries that are technologically more dependent on external finance (the difference between investments and cash generated from operations) experience higher growth. They also find that liberalizations have a larger impact on the growth of industries facing better growth opportunities (based on industry-level global demand indicators). When the liberalization decision is assumed to be endogenous, however, only the former result survives, suggesting that countries may time the liberalization decision to coincide with high growth in certain industries.

TABLE 10.5
Summary of Key Empirical Studies on Equity Market Liberalization and Growth (Continued)

<table>
<thead>
<tr>
<th>Study</th>
<th>Number of Countries/Time Period</th>
<th>Dependent Variable/Regression Methodology</th>
<th>Financial Openness Measure</th>
<th>Main Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hammel (2006)</td>
<td>13 1982–95</td>
<td>ΔIND Three-yearly panel FE</td>
<td>SMLD</td>
<td>MIXED: Real value added in sectors more dependent on external finance grows faster following equity liberalization in countries with larger stock market capitalization to GDP.</td>
</tr>
</tbody>
</table>

Dependent variable: EBITDA: earnings before interest, taxes, depreciation, and amortization; ΔGDP: growth rate of real per capita GNP; ΔI: investment; ΔY: investment over GDP; Δi: growth rate in investment per capita; ΔIND: growth rate of industry-level measures (e.g., real value added, output, or number of firms); ΔlnI: growth rate of real private investment; ΔS: saving over GDP; ΔTP: growth rate of total factor productivity; ΔY: growth rate of real per capita GDP; ΔY: growth rate of real GDP.

Regression methodology: Cross section: single observation for each country over entire period; FE: country and/or industry fixed effects; GMM: generalized method of moments; IV: instrumental variables; NLLS: nonlinear least squares; OLS: ordinary least squares; Panel: repeated observations on countries (or country industries) observed over multiple periods (which may be, for example, annual, five years, or a decade); Pooled: assumes no country-specific fixed effects; RE: country random effects; SUR: seemingly unrelated regressions; WLS: weighted least squares.

Financial openness measure: A Sum: sum of four binary AREAER liberalization indicators across the following categories: capital account; current account; export proceeds; and multiple exchange rates. Binary: 0/1 dummy variable from AREAER taking the value of one when capital controls in place; KS: measure based on Kaminsky and Schmukler (2003); Quinn: change in Quinn measure; Share: the proportion of years in which countries had liberalized capital accounts based on the binary variable from AREAER; SMLD: official date of stock market liberalization; Volume: variable based on actual flows/stocks of financial flows.

Main findings: NO EFFECT: no evidence of a significant effect of greater financial integration on growth; MIXED: evidence of positive effect of financial integration on growth is conditional upon other economic characteristics (for example, financial development or human capital) or otherwise nonrobust (for example, conditional on different country samples); POSITIVE: significant positive effect of greater financial integration on growth.
Evidence based on firm-level data confirms that equity market liberalizations give firms in emerging markets access to a new financing channel, thereby lowering the cost of capital and increasing opportunities for investment (Chari and Henry, 2004, 2005). Moreover, foreign investors tend to demand higher governance standards, which could have a positive impact on profitability, efficiency, and other measures of operating performance. Mitton (2006) finds that firms with stocks that are open to foreign investors register higher levels of sales growth, investment, and efficiency, and lower leverage ratios.

Although evidence of the positive effects of equity market liberalizations looks promising, it raises an interesting question. Why is it that, using similar de jure measures, the growth effects of broader capital account liberalization appear much weaker? As noted above, one possibility is that equity market reforms take place only when governments feel they have supportive conditions in place. Then again, analyses based on micro data uniformly indicate that the productivity-enhancing effects of equity market liberalizations are greater than those of full capital account liberalizations. Our conclusion is that equity market liberalizations do have an independent impact on growth, but we are skeptical that by themselves they can generate as large growth effects as has been reported by authors such as BHL.

10.5.3. Debt Flows

Debt flows, which include portfolio debt flows and bank loans, remain the dominant form of flows to developing economies, although their relative importance has declined over time. The procyclical and highly volatile nature of these flows, especially short-term bank loans, can magnify the adverse impact of negative shocks on economic growth.

Even at a conceptual level, debt flows lack the positive attributes of equity-like flows. They do not solve certain agency problems, can lead to inefficient capital allocation if domestic banks are poorly supervised, and generate moral hazard as debt is implicitly guaranteed by the government (in the case of corporate debt) and/or international financial institutions (both corporate and sovereign debt). Open capital accounts exacerbate the adverse effects of poor financial sector supervision by allowing banks to expose their balance sheets to currency risk and also by permitting them to take speculative open positions in foreign exchange.

The empirical literature on financial globalization is decisive that debt flows generate the greatest risks from financial openness. In particular, there is a systematic empirical link between exposure to short-term debt and the likelihood (and severity) of financial crises. One reason could be that countries with unfavorable conditions are forced to rely more on short-term external debt denominated in foreign currencies as their main source of foreign capital (Eichengreen, Hausmann, and Panizza, 2006). However, even if debt flows are more likely to be associated with less desirable outcomes, one cannot automatically infer that a ban on debt flows would be beneficial in all cases. A capital-poor country that has no access to equity or FDI inflows might still be able to benefit from debt inflows to finance
illiquid investments, even though it could potentially face more risks. Similarly, short-term debt could serve as a useful commitment device to foster good macroeconomic policies, although debt would of course increase vulnerability to external shocks.\(^{30}\)

### 10.5.4. Other Evidence on the Effects of Different Types of Flows and of Capital Controls

The literature that we have summarized thus far suggests that only equity market liberalizations clearly boost short- and medium-term growth. The evidence that FDI increases growth is less conclusive although recent work has begun to come up with more positive evidence. There are two related strands of literature that help round out the picture. The first looks jointly at the effects of different flows in a common framework. The second analyzes the costs of capital controls—this constitutes another approach to examining the costs/benefits of financial integration.

A number of authors have attempted to disentangle the effects of different types of flows by looking at them in a unified empirical framework. The results are largely consistent with those from papers looking at each of these types of flows individually. For instance, Reisen and Soto (2001) conclude that FDI and portfolio equity flows increase growth whereas portfolio bond flows and official flows do not. By contrast, Durham (2004) finds that both FDI and total portfolio flows (bond and equity) could have growth-enhancing effects, depending on the level of a country’s financial and institutional development, as well as openness to trade.

Another theme that emerges from the evidence we have reviewed thus far is that many of the benefits of financial openness are masked in cross-country analysis using macroeconomic data but are more apparent in disaggregated analyses using micro data. The latter approach has the advantage of being able to better capture the channels through which capital flows affect the allocation of capital and overall efficiency. However, even using micro data it is difficult to separate the effects of capital account liberalization from those of other reforms. And, by construction, these studies tend to be partial equilibrium in nature.

A related strand of literature using micro data has tried to estimate the costs of capital controls, an enterprise that is complicated in aggregate data because of endogeneity, timing, and other problems. Forbes’ (2005a) survey concludes that capital controls can cause distortions in the behavior of firms (and individuals) as they adjust their behavior to evade capital controls. By insulating an economy from competitive forces, they may also reduce market discipline. In short, the existence of capital controls appears to result in significant efficiency costs at the

\(^{30}\)See Diamond and Rajan (2001) and Jeanne (2003), respectively, on these two points about the potential benefits of debt flows. For a survey of the empirical literature on the risks associated with short-term debt, see Berg, Borenstein, and Pattillo (2004).
level of individual firms or sectors. We find this evidence plausible although the
fact that this strand of the literature largely uses de jure measures of integration
gives one pause. A mitigating circumstance is that many of these papers are based
on data from individual countries or small groups of countries where one has
reason to believe that the capital controls really bite, although this might generate
subtle sample selection problems.

10.6. ORGANIZING PRINCIPLES

To put together the disparate strands of evidence that we have assembled thus far,
we now introduce a framework that could help reconcile some of the apparently
inconsistent results in the literature and also shed light on why empirical evidence
at different levels of disaggregation reaches different conclusions. This framework
may provide some guidance on fruitful directions for future research on the mac-
roeconomic effects of financial globalization.

10.6.1. Collateral Benefits

A key component of our argument is that it is not just the capital inflows them-
theselves, but what comes along with the capital inflows, that drives the benefits of
financial globalization for developing countries (Figure 10.4). There is accumulat-
ing—although not yet definitive—evidence that financial integration serves as an
important catalyst for a number of indirect benefits, which we term potential
“collateral benefits.” These collateral benefits could include development of the
domestic financial sector, improvements in institutions (defined broadly to
include governance, the rule of law, etc.), better macroeconomic policies, etc.
These collateral benefits then result in higher growth, usually through gains in
allocative efficiency.

The empirical implications of this perspective are potentially far reaching. It
suggests that the beneficial impact of financial integration on growth may take
years to show up as policies and institutions adapt. Even after the effects take
hold, they may be difficult to document. Standard growth regressions nowadays
already include measures of institutional quality, financial sector development,
quality of macroeconomic policies, etc. Yet, these may be the very channels
through which financial integration generates growth benefits, making it difficult
to disentangle the effects of financial integration.

31 Johnson and Mitton (2002) argue that capital controls reduced market discipline among Malaysian
firms and fostered cronyism. Desai, Foley, and Hines (2006) use firm-level data to argue that the cost
of capital is higher for multinationals when capital controls are in place. Based on the cross-country
investment patterns of multinationals, they conclude that the level of FDI inflows into a country is
adversely affected by capital controls. Forbes (2005b) concurs that the costs of capital controls include
not just efficiency losses and lower market discipline but also reduced inflows. Magud and Reinhart
(2007) discuss the difficulty of using macro data to measure the costs of capital controls.

32 A number of papers have explicitly taken the tack that the costs of financial globalization—including
crises—are in the nature of growing pains that will recede once globalizing economies achieve fuller
integration (Krugman, 2002; Martinez, Tornell, and Westermann, 2004).
A corollary of our argument is that the collateral benefits mainly affect growth through total factor productivity (TFP). Ultimately, if financial integration is to have a lasting effect on growth, it must be by moving economies closer to their production possibility frontiers by eliminating various distortions and creating efficiency gains, including in financial intermediation, technological adoption, etc. But there is as yet little empirical work looking at whether financial integration boosts TFP growth. This seems to us an important dimension of the future research program on the macroeconomic effects of financial integration. 33

Recent literature has emphasized the importance of TFP growth as the main driver of long-term GDP growth (see, e.g., Hall and Jones, 1999; Jones and Olken, 2005; Gourinchas and Jeanne, 2006). Edwards (2001), Bonfiglioli (2007), and Kose, Prasad, and Terrones (2009) have assembled some preliminary evidence suggesting that financial integration raises TFP growth. Kose, Prasad, and Terrones (2008) provide a detailed analysis of various threshold factors that help promote the growth benefits of financial integration.
Financial globalization leads to better macroeconomic outcomes when certain threshold conditions are met. This generates a deep tension as many of the threshold conditions are also on the list of collateral benefits.

**Figure 10.5** Threshold conditions: A complication.
10.6.2. Thresholds

A large related literature has tried to tackle the question of what initial conditions are needed to prepare the ground for financial openness to generate growth benefits and lower the risks (Figure 10.5). There is plenty of evidence that opening of the capital account without having in place well-developed and well-supervised financial sectors, good institutions, and sound macro policies can hurt a country by making the structure of inflows unfavorable and by making the country vulnerable to sudden stops or reversals of flows. Furthermore, the process of globalization seems to proceed more smoothly when trade liberalization precedes financial integration. Thus, it is the interaction between financial globalization and this set of initial conditions that determines growth and volatility outcomes. This literature could be important for understanding why the macroeconomic evidence on the growth effects of financial integration is rather mixed, whereas the microeconomic evidence finds more positive effects.

Comparing Figures 10.4 and 10.5 highlights a deep tension between the potential risks and benefits of financial globalization. Financial globalization can catalyze a number of important collateral benefits but can also greatly elevate the risks-to-benefits ratio if the initial conditions in these dimensions are inadequate. This is not to say that the risks are entirely eliminated beyond the thresholds or that financial integration is doomed to failure before the thresholds are reached. But the process of financial integration clearly needs to be managed more carefully if the threshold conditions are not met. Unfortunately, existing papers have identified only the importance of threshold effects in specific dimensions. There is as yet little work on the relative importance of different thresholds and the trade-offs among them.

Does this mean that there is no alternative for a country desirous of benefiting from the collateral benefits of financial globalization but to expose itself to substantial risks of crises if it has not already attained the threshold conditions? Our view is that, although the risks can never be totally avoided, there are ways to improve the benefit-risk calculus. There is, however, unlikely to be a uniform approach to opening the capital account that will work well for all countries. Indeed, the collateral benefits perspective may provide a way for moving forward on capital account liberalization that takes into account individual country circumstances (initial conditions) as well as the relative priorities of different collateral benefits for that country.

We now turn to examining the evidence that financial globalization indeed has significant collateral benefits. Although the majority of studies are largely theoretical, a small but growing empirical literature has already obtained some early results that are encouraging.

10.7. COLLATERAL BENEFITS OF FINANCIAL GLOBALIZATION

We review the evidence for three key areas in which the indirect benefits ought to be important—financial sector development, institutional quality, and macroeconomic policies.
Figure 10.6 presents some simple unconditional correlations. During the recent period of financial globalization (1985–2004), financial openness is positively correlated with measures of financial development and institutional quality, and negatively correlated with log inflation. Its correlation with the government budget deficit is, however, essentially zero.\textsuperscript{34}

\subsection*{10.7.1. Financial Sector Development}

International financial flows seem to serve as an important catalyst for domestic financial market development, as reflected in both straightforward measures of the size of the banking sector and equity markets as well as broader concepts of financial market development, including supervision and regulation. There is also a large body of theory suggesting that foreign ownership of banks can, in principle, generate a variety of benefits (e.g., Levine, 2005; Mishkin, 2008). First, foreign bank participation can make a country’s access to international financial markets easier. Second, it can help improve domestic regulatory and supervisory frameworks. Third, foreign banks may introduce new financial instruments and technologies which can increase competition and improve the quality of financial services.

What does the empirical evidence show? Work based on a variety of techniques, including country case studies, supports the notion that increased foreign bank presence raises competition and leads to a decline in both bank overhead costs and profits (see Claessens, Demirgüç-Kunt, and Huizinga, 2001; Levine, 2001; Claessens and Laeven, 2004; Clarke and others, 2003; and Schmukler, 2004). As for equity markets, the overwhelming theoretical presumption is that foreign entry increases efficiency and the evidence seems to support this channel. For example, applying an event study approach to data from 16 emerging markets, Levine and Zervos (1998) report that stock markets become larger and more liquid after equity market liberalizations.\textsuperscript{35}

A number of studies also find that financial integration helps overall financial sector development. For instance, Klein and Olivei (2006) find that, in financially integrated economies, the degree of domestic financial sector development is higher than in countries that maintain capital controls. Financial-sector FDI from well-regulated and well-supervised source countries can support institutional development and governance that are essential for financial market deepening in emerging markets (Goldberg, 2007).

\subsection*{10.7.2. Institutional Quality and Governance}

Again, in theory, there are a number of potential channels through which financial globalization improves corporate governance and thereby reduces the cost of capital (Stulz, 2005). Foreign investors may have skills and information technologies

\textsuperscript{34} As with Figure 10.3, we excluded a few countries that were outliers. Inclusion of all the countries in our sample strengthened the unconditional cross-sectional correlations shown here.

\textsuperscript{35} In a cross-county regression framework, Chinn and Ito (2006), however, identify one possible caveat. Financial openness contributes to equity market development only once at least a moderate level of legal and institutional development has been attained (a hurdle cleared by most emerging markets); less developed countries do not necessarily gain this benefit.
Figure 10.6 Potential indirect benefits of financial globalization.
that allow them to monitor management better than local investors. Globalization also weakens certain agency problems by reducing the cost of outside finance, thereby creating incentives for firms that use more external finance to improve their governance.

The empirical evidence on financial globalization and corporate governance, while still sparse, does seem to indicate that financial globalization has induced some countries to adjust their corporate governance structures in response to demands from international investors (Cornelius and Kogut, 2003). Morck, Wolfenzen, and Yeung (2004) note that corporate governance problems associated with concentration of ownership can be mitigated by financial globalization, in part by raising expectations and demands among local investors through exposure to better standards of governance.

More recent work has started to examine the implications of financial globalization for broader public governance (see Wei, 2001; Gelos and Wei, 2005; and Doidge, Karolyi, and Stulz, 2005). There is evidence that poor public governance (as measured by severity of bureaucratic corruption or lack of government transparency) discourages inward FDI and portfolio equity inflows. But whether the prospect of more inflows has actually led to improvements in public governance remains an open question. There is some evidence that firms in countries with weak governance undertake listing on stock exchanges in countries with a substantially better court system, less corruption, and stricter disclosure requirements as one approach to “renting” good public governance in order to improve corporate governance. This form of financial integration may also have spillover effects on domestic firms that see the benefits of better corporate governance.

Political economy considerations enter into the picture as well, with financial integration helping to shake loose power structures that allow certain groups to thwart reforms. Rajan and Zingales (2003), for instance, propose an interest group theory wherein cross-border trade and financial flows weaken incumbents’ opposition to reforms and facilitate financial sector development. These authors find some support in the cross-sectional and time-series dimensions of historical data to support this theory.

10.7.3. Macroeconomic Policies

We have already discussed how capital account liberalization might impose discipline on macroeconomic policies because it increases the potential costs associated with weak policies and enhances the benefits of good ones. Precisely because capital account liberalization makes a country more vulnerable to sudden shifts in global investor sentiment, it can serve as a signal of commitment to better macroeconomic policies (see Bartolini and Drazen, 1997; and Gourinchas and Jeanne, 2006). Indeed, even skeptics of the benefits of financial integration such as Stiglitz (2000) have accepted that this is likely to be one of the most important potential benefits of capital account liberalization. Unfortunately, although the empirical evidence is suggestive, it remains limited.

Tytell and Wei (2004) review the existing evidence and also systematically examine the disciplining effect of capital flows on monetary and fiscal policies in

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They note that previous studies have not tackled the potential problem of endogeneity—countries with better policies may receive more flows. Tytell and Wei adopt an instrumental variables strategy wherein they instrument capital flows to each country using a measure of flows to neighboring countries that rely on similar source countries but whose capital inflows are independent from the macro policies of the country in question. They conclude that countries with higher levels of financial openness are more likely to generate better monetary policy outcomes in terms of lower inflation. Interestingly, they find no evidence of a corresponding disciplining effect of financial globalization on fiscal policy.

10.7.4. Implications

Although we can hardly argue that the evidence that we have surveyed in this section is decisive, it consistently points to a role for international financial integration as a catalyst for financial and institutional development, in line with our schematic view about the channels through which financial globalization affects growth. Given the difficulties that we have noted in interpreting the cross-country growth evidence, it is useful to see that financial integration does seem to be operating through some of the indirect channels, especially given that we are only about two decades into the most recent wave of financial globalization. Before turning to the implications of this line of reasoning, we review the literature on a closely-related matter: Is there a threshold level of institutional and financial development beyond which the various benefits we have been cataloging start to definitively outweigh the risks?

10.8. THRESHOLD EFFECTS IN THE OUTCOMES OF FINANCIAL GLOBALIZATION

There are four factors that interact with financial globalization in important ways to determine the eventual macroeconomic outcomes and also influence the short-run trade-offs. Each of these has in its own right been shown to influence growth, but our interest here is in the narrower question of how they affect the outcomes (in terms of growth and volatility) of financial integration.36


Financial sector development not only enhances the growth benefits associated with financial globalization but also reduces vulnerability to crises. Well-developed domestic financial markets are instrumental in efficiently allocating

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36 Another threshold effect, on which the literature is still rather limited, is related to human capital. Borensztein, De Gregorio, and Lee (1998) and Blonigen and Wang (2005) find that countries that have more human capital get larger growth benefits from FDI.
foreign financial flows to competing investment projects. Recent empirical research supports the view that financial sector development amplifies the growth benefits associated with FDI flows, with some authors finding that a threshold level of financial sector development is necessary for a country to realize any growth benefits from FDI (see Hermes and Lensink, 2003; Alfaro and others, 2004; and Durham, 2004). In a similar vein, BHL find that deep financial markets enhance the growth benefits of equity market liberalizations.

Financial development also has a positive impact on macroeconomic stability. Sudden changes in the direction of capital flows tend to induce or exacerbate boom-bust cycles in developing countries that lack deep and well-functioning financial sectors (Caballero and Krishnamurthy, 2001; Aghion and Banerjee, 2005). Moreover, inadequate or mismanaged domestic financial sector liberalizations have been a major contributor to crises that may be associated with financial integration (Mishkin, 2008). After capital account liberalization, excessive risk taking by poorly supervised domestic banks played a major role in triggering the financial crises in Mexico in 1994 and many East Asian countries in 1997.

Institutional quality affects not just the outcomes of financial integration but also the level of de facto integration itself. Better institutions enhance the responsiveness of growth to capital account liberalization (Klein, 2005). Furthermore, better institutional quality increases the level of inflows and also helps tilt the structure of inflows toward FDI and portfolio equity which, as noted earlier, are more stable and tend to bring more of the collateral benefits of financial integration (see Hines, 1995; Wei, 2001; Wei and Wu, 2002; Faria and Mauro, 2005; and Alfaro and others, 2006). This has important consequences for volatility as the composition of inflows has strong predictive power for currency crashes. In particular, the share of FDI in a country’s capital inflows is negatively associated with the probability of a currency crisis.

### 10.8.2. Why Do Macroeconomic Policies Affect the Outcomes of Financial Integration?

Capital account liberalization is more likely to be successful if it is supported by sound fiscal, monetary, and exchange rate policies. Arteta, Eichengreen, and Wyplosz (2003) report evidence of such threshold effects in generating positive growth effects of financial openness. Ishii and others’ (2002) case study analysis underscores the importance of stable macro policies for averting crises in countries with open capital accounts.37

There is a compelling case to be made that rigid exchange rate regimes can make a country more vulnerable to crises when it opens its capital markets. It can be argued that, in the absence of fixed rates (de facto or de jure), most of the

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37 Austria and Hungary, for example, were able to avoid crises after they liberalized their capital accounts because they had relatively stable macroeconomic policies. Mexico and Turkey ran into difficulties in the mid-1990s after liberalizing their capital accounts because they had tightly managed exchange rates for a prolonged period, along with uncertain policy settings and growing imbalances.
crises of the 1990s—including Mexico, East Asia, Russia, and Brazil—might have been less virulent, or might even have been avoided entirely. However, the literature does not imply that fixed exchange rates are necessarily a problem for countries that are at early stages of financial development or that they are inappropriate prior to capital account liberalization (see Husain, Mody, and Rogoff, 2004). What is clear is that an open capital account puts a greater burden on other policies and structural features of the economy (e.g., product and labor market flexibility) to support a fixed exchange rate.

10.8.3. Does the Level of Trade Openness Matter for the Effects of Financial Openness?

Trade integration reduces the probability of crises associated with sudden stops and current account reversals. Economies that are less open to trade have to undergo larger real exchange rate depreciations for a given current account adjustment, face more severe balance sheet effects stemming from depreciations, and, as a result, are more likely to default on their debt. This creates a link between the probability of sudden stops and the likelihood of default, implying that more open economies are less vulnerable to financial crises (see Calvo, Izquierdo, and Mejia, 2004; and Frankel and Cavallo, 2004).

Trade integration should also mitigate the adverse growth effects of financial crises and facilitate recoveries from crises. It could help an economy to continue servicing its debt and export its way out of a recession because a given exchange rate depreciation would have a larger impact on its export revenues than in a less open economy. Recent research confirms that, among countries that have experienced sudden stops and current account reversals, those that are more open to trade suffer smaller growth declines (see Edwards, 2004, 2007; Desai and Mitra, 2004; and Guidotti, Sturzenegger, and Villar, 2004). Trade integration in general has a better cost-benefit trade-off than financial integration (Martin and Rey, 2006). Thus, the recent literature has a clear implication—consistent with the received wisdom—that developing countries should liberalize trade in goods before trade in financial assets.

10.8.4. Does the Degree of Financial Integration Matter?

A different threshold is related to the level of financial integration itself, because many of the presumed benefits start to become apparent only when economies achieve a high level of integration. In particular, industrial economies, which are far more integrated into global financial markets, are able to use international capital flows to generate TFP gains and share income risk. Does this mean that the only hope for developing countries to realize these benefits is to attain similar

38 For a discussion of how fixed exchange rate regimes and open capital accounts can together spell disaster, see Obstfeld and Rogoff (1995) and Wyplosz (2004).
39 Calvo and Talvi (2005) claim that this is why the collapse of capital flows to Argentina and Chile in the 1990s had a smaller impact on Chile. Kose, Meredith, and Towe (2005) argue that trade integration has made the Mexican economy more resilient to shocks and contributed to its faster recovery from the 1994–95 peso crisis than from the 1982 debt crisis.
levels of financial integration and that the risks en route are unavoidable? After all, if the short-term costs take the form of crises, they could have persistent negative effects that detract from the long-term growth benefits.

Some comfort may still be provided by a newly developing literature on how globalization affects the relationship between growth and volatility. Although macroeconomic volatility does have a negative effect on growth, this relationship is attenuated for more open economies (Kose, Prasad, and Terrones, 2005, 2006). That is, economies that are more open to trade and financial flows are able to tolerate higher levels of volatility—other things being equal—than less open economies, without this volatility having an adverse effect on growth. Furthermore, some of the collateral benefits generated by financial integration, including macroeconomic discipline and financial market development, could also reduce volatility.

10.9. CONCLUSION

Our synthesis of the literature on financial globalization, while offering a guardedly positive overall assessment, points to some major complications during the transition from low to high levels of financial integration. For developing countries, financial globalization can play a catalytic role in generating an array of collateral benefits that boost long-run growth and welfare.

But the picture is complicated by the existence of threshold conditions. Full-fledged opening of the capital account in the absence of essential supporting conditions can vitiate the realization of any benefits, whereas making a country more vulnerable to sudden stops of capital flows. These supporting conditions include stable macroeconomic policies as well as sufficiently strong financial and other institutions, regulation, and governance. Thus, it is not surprising that evidence on the effects of financial globalization is so mixed.

Nevertheless, it is also wrong to conclude that the literature offers no guidance for developing countries that aspire to accrue greater benefits from financial globalization. Countries across all parts of the spectrum of institutional quality can be successful in maintaining sound fiscal policy and low inflation, as the experience of the current decade has shown. A more flexible exchange rate system also greatly reduces the risks. At the same time, the relatively positive experiences that many countries have had with stock market liberalizations suggest that efforts to enhance financial globalization are more likely to be successful when accompanied by supporting reforms in other areas.

Where can research help sharpen such policy conclusions? First, it is imperative to extend the research program on measuring financial openness. Although it is clear that different countries have adopted widely differing approaches to financial globalization, existing measures of cross-country differences are so crude as to be highly misleading in many cases, often leading to incorrect conclusions. Thus, additional work on constructing measures that line up better with theoretical notions of integration would be extremely useful. In addition, understanding the specific channels through which different types of inflows affect growth dynamics would also be an important step in evaluating their relative benefits.
We have emphasized that future research should focus on the indirect benefits of financial globalization that ultimately express themselves in TFP growth and macroeconomic stability. Early research that emphasized how financial globalization can help enhance physical capital accumulation in developing countries was clearly misplaced. Thus, more work needs to be done on how countries can best exploit the “potential collateral benefits” of globalization.

Research on these potential collateral benefits is still in its infancy, but is growing rapidly. The links between certain aspects of open capital accounts (e.g., unrestricted foreign bank entry) and domestic financial sector development have been analyzed extensively, but evidence on other indirect benefits is limited. In particular, despite the existence of a theoretical literature positing a link between financial globalization, on the one hand, and governance (both public and corporate) and macroeconomic policies on the other, the empirical literature remains sparse.

It is clear from the discussion here that the benefits of financial openness should be more apparent in terms of the effects on TFP growth rather than per capita income growth, because the latter depends also on physical and human capital accumulation. Empirical evidence on how different types of flows affect productivity growth should be an integral part of the research agenda on financial openness. It is highly misleading to lump together equity market liberalization, direct foreign investment, and short-term capital flows, as each of these can have very different effects on productivity. Another promising research avenue is a more detailed analysis of threshold effects—especially the relative importance of different threshold conditions and the trade-offs among them for a country that wishes to open up its capital account.

We caution, however, that existing macro-level approaches to testing the effects of financial globalization do not, and perhaps cannot, offer definitive answers. In particular, it is very difficult to make strong statements about casual links between financial integration and growth using macroeconomic data. Further research based on industry- and firm-level data as well as event and case studies may provide useful corroborative evidence and, possibly, more informative insights about the channels through which these effects operate.

In the meantime, we should recognize that some of the more extreme polemic claims made about the effects of financial globalization on developing countries, both pro and con, are far less easy to substantiate than either side generally cares to admit.

**DATA APPENDIX**

This appendix lists the countries included in the analysis and also indicates the acronyms used for each country. The full sample of 71 countries is divided into three groups.  

40 For presentational reasons, in Figures 10.3 and 10.4 we excluded the following countries that were outliers: United Kingdom (GBR), Netherlands (NLD), Belgium (BEL), Singapore (SGP), Switzerland (CHE), Ireland (IRL), Zambia (ZMB), and China (CHN). Inclusion of outliers did not change our qualitative findings.
Advanced Economies

The 21 advanced industrial economies in our sample are Australia (AUS), Austria (AUT), Belgium (BEL), Canada (CAN), Denmark (DNK), Finland (FIN), France (FRA), Germany (DEU), Greece (GRC), Ireland (IRL), Italy (ITA), Japan (JPN), Netherlands (NLD), New Zealand (NZL), Norway (NOR), Portugal (PRT), Spain (ESP), Sweden (SWE), Switzerland (CHE), United Kingdom (GBR), and United States (USA).

Emerging Market Economies

This group includes 20 countries: Argentina (ARG), Brazil (BRA), Chile (CHL), China (CHN), Colombia (COL), Egypt (EGY), India (IND), Indonesia (IDN), Israel (ISR), Korea (KOR), Malaysia (MYS), Mexico (MEX), Pakistan (PAK), Peru (PER), Philippines (PHL), Singapore (SGP), South Africa (ZAF), Thailand (THA), Turkey (TUR), and Venezuela (VEN).

Other Developing Economies

This group has 30 countries: Algeria (DZA), Bangladesh (BDG), Bolivia (BOL), Cameroon (CMR), Costa Rica (CRI), Dominican Republic (DOM), Ecuador (ECU), El Salvador (SLV), Fiji (FJI), Ghana (GHA), Guatemala (GTM), Honduras (HND), Iran (IRN), Jamaica (JAM), Kenya (KEN), Malawi (MWI), Mauritius (MUS), Nepal (NPL), Niger (NER), Papua New Guinea (PNG), Paraguay (PRY), Senegal (SEN), Sri Lanka (LKA), Tanzania (TZA), Togo (TOG), Trinidad and Tobago (TTO), Tunisia (TUN), Uruguay (URY), Zambia (ZMB), and Zimbabwe (ZWE).

REFERENCES


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11.1. INTRODUCTION

Theory provides conflicting predictions about the growth effects of international financial integration (IFI) (i.e., the degree to which an economy does not restrict cross-border transactions). According to some theories, IFI facilitates risk sharing and thereby enhances production specialization, capital allocation, and economic growth (Obstfeld, 1994; and Acemoglu and Zilibotti, 1997). Further, in the standard neoclassical growth model, IFI eases the flow of capital to capital-scarce countries with positive output effects. Also, IFI may enhance the functioning of domestic financial systems, through the intensification of competition and the importation of financial services, with positive growth effects (Klein and Olivei, 2008; and Levine, 2001). On the other hand, IFI in the presence of preexisting distortions can actually retard growth. Boyd and Smith (1992), for instance, show that IFI in countries with weak institutions and policies (e.g., weak financial and legal systems) may actually induce a capital outflow from capital-scarce countries to capital-abundant countries with better institutions. Thus, some theories predict that international financial integration will promote growth only in countries with sound institutions and good policies.

Although theoretical disputes and the concomitant policy debate over the growth effects of IFI have produced a burgeoning empirical literature, resolving
this issue is complicated by the difficulty in measuring IFI. Countries impose a complex array of price and quantity controls on a broad assortment of financial transactions. Thus, researchers face enormous hurdles in measuring cross-country differences in the nature, intensity, and effectiveness of barriers to international capital flows (Eichengreen, 2001).

In practice, empirical analyses use either (1) proxies for government restrictions on capital flows or (2) measures of actual international capital flows. The IMF-Restriction measure is the most commonly used proxy of government restrictions on international financial transactions. It classifies countries on an annual basis by the presence or absence of restrictions (i.e., it is a zero-one dummy variable). Quinn (1997) attempts to improve upon the IMF-Restriction measure by reading through the IMF’s narrative descriptions of capital account restrictions and assigning scores of the intensity of capital restrictions. Unfortunately, the Quinn (1997) measure is only available for intermittent years for most countries (1958, 1973, 1982, and 1988). The advantage of the IMF-Restriction and Quinn (1997) measures is that they proxy directly for government impediments. The disadvantage of both measures, as noted above, stems from the difficulty in accurately gauging the magnitude and effectiveness of government restrictions.

Empirical studies also use measures of actual international capital flows to proxy for international financial openness. The assumption is that more capital flows as a share of GDP are a signal of greater IFI. The advantage of these measures is that they are widely available and they are not subjective measures of capital restrictions. A disadvantage is that many factors influence capital flows. Indeed, growth may influence capital flows and policy changes may influence both growth and capital flows, producing a spurious, positive relationship between growth and capital flows, and growth may affect capital flows. This highlights the need to account for possible endogeneity in assessing the growth IFI-relationship.

Empirical evidence yields conflicting conclusions about the growth effects of IFI. Grilli and Milesi-Ferretti (1995), Rodrik (2008), and Kraay (1998) find no link between economic growth and the IMF-Restriction measure. In contrast, Edwards (2001) finds that the IMF-Restriction measure is negatively associated with growth in rich countries but positively associated with growth in poor countries. He thus argues that good institutions are necessary to enjoy the positive growth effects of IFI. Arteta, Eichengreen, and Wyplosz (2001), however, argue that Edwards’s results are not robust to small changes in the econometric specification. Although Quinn (1997) finds that his measure of capital account openness is positively linked with growth, Arteta, Eichengreen, and Wyplosz (2001) and Kraay (1998) find these results are not robust. Finally, although some studies find that foreign direct investment (FDI) inflows are positively associated with economic growth when countries are sufficiently rich (Blomström, Lipsey, and Zejan, 1994), educated (Borenzstein, De Gregorio, and Lee, 1998), or financially developed (Alfaro and others, 2004). Carkovic
and Levine (2005) find that these results are not robust to controlling for simultaneity bias.\footnote{For more detailed literature reviews of cross-country studies of the causes and effects of IFI, see Eichengreen (2001) and Edison, Klein, Ricci, and Sløk (2004). For a review of country-specific experiences with IFI, see Cooper (1999).}

In light of the current state of the literature on the growth effects of IFI, we contribute to existing empirical analyses in four ways.

First, we examine an extensive array of IFI indicators. We examine the IMF-Restriction measure and the Quinn measure of capital account restrictions. Furthermore, we examine various measures of capital flows: FDI, portfolio, and total capital flows. Moreover, we consider measures of just capital inflows as well as measures of total capital flows (inflows plus outflows) to proxy for IFI because openness is defined both in terms of receiving foreign capital and in terms of domestic residents having the ability to diversify their investments abroad. We examine a wide array of IFI proxies because each indicator has advantages and disadvantages.

Second, we examine two new measures of IFI. Lane and Milesi-Ferretti (2001) carefully compute the accumulated stock of foreign assets and liabilities for an extensive sample of countries. Because we want to measure the average level of openness over an extended period of time, these stock measures provide a useful additional indicator. Furthermore, these stock measures are less sensitive to short-run fluctuations in capital flows associated with factors that are unrelated to IFI, and may therefore provide a more accurate indicator of IFI than capital flow measures. As proxies for IFI, we examine both the accumulated stock of liabilities (as a share of GDP) and the accumulated stock of liabilities and assets (as a share of GDP). Also, we break down the accumulated stocks of financial assets and liabilities into FDI, portfolio, and total financial claims in assessing the links between economic growth and a wide assortment of IFI indicators. Thus, we add these additional IFI indicators to the empirical examination of growth and international financial integration.

Third, because theory and some past empirical evidence suggest that IFI will only have positive growth effects under particular institutional and policy regimes, we examine an extensive array of interaction terms. Specifically, we examine whether IFI is positively associated with growth when countries have well-developed banks, well-developed stock markets, well-functioning legal systems that protect the rule of law, low levels of government corruption, sufficiently high levels of real per capita GDP, high levels of educational attainment, prudent fiscal balances, and low inflation rates. Thus, we search for economic, financial, institutional, and policy conditions under which IFI boosts growth.

Fourth, we use newly developed panel techniques that control for (1) simultaneity bias, (2) the bias induced by the standard practice of including lagged dependent variables in growth regressions, and (3) the bias created by the omission of country-specific effects in empirical studies of the IFI-growth relationship. Because each of these econometric biases is a serious concern in assessing the growth-IFI
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nexus, applying panel techniques enhances the confidence we can have in the empirical results. Furthermore, the panel approach allows us to exploit the time-series dimension of the data instead of using purely cross-sectional estimators.

Before beginning the analyses, it is important to mention a related strand of the literature on IFI. We examine the relationship between broad measures of IFI and growth. Other researchers focus instead on a much narrower issue: restrictions on foreign participation in domestic equity markets. Levine and Zervos (1998b) construct indicators of restrictions on equity transactions by foreigners. They show that liberalizing restrictions boosts equity market liquidity. Henry (2000a,b) extends these data and shows that liberalizing restrictions on foreign equity flows boosts domestic stock prices and domestic investment. Bekaert, Harvey, and Lundblad (2005) go further and show that easing restrictions on foreign participation in domestic stock exchanges accelerates economic growth. Although it is valuable to examine the impact of liberalizing restrictions on foreign activity in domestic stock markets, it is also valuable to study whether IFI in general has an impact on economic growth under particular economic, financial, institutional, and policy environments. This chapter examines the relationship between economic growth and broad measures of IFI for a large cross-section of countries, while recognizing the value of studies that focus on specific barriers to particular categories of international financial transactions.

The remainder of the chapter is organized as follows. Section 11.2 discusses the data and presents summary statistics. Section 11.3 describes the econometric methodology and Section 11.4 gives the results. Section 11.5 concludes.

11.2. DATA AND SUMMARY STATISTICS

This chapter uses new data to examine the growth effects of IFI and to assess whether the growth-IFI relationship depends on the level of economic development, financial development, institutional development, or macroeconomic policies. Given existing barriers to measuring IFI confidently for a broad cross section of countries, this chapter seeks to improve the analysis of IFI and growth by (1) assessing a broader array of IFI indicators than any previous study and (2) using a new type of financial openness indicator. The new indicators are based on the Lane and Milesi-Ferretti (2001) measures of the accumulated stock of foreign assets and liabilities.

11.2.1. Data on International Financial Integration

IMF-Restriction: The IMF-Restriction measure equals one in years where there are restrictions on capital account transactions and zero in years where there are no restrictions on these external transactions. The data are from the IMF’s Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) (line E.2). When conducting regressions averaged over, for example, the 1980–2000 period,
we follow the literature and average the IMF-Restriction measure over the entire period and use this to measure the average level of openness during the period (e.g., see Grilli and Milesi-Ferretti, 1995; Rodrik, 2008; and Klein and Olivei, 2008). As emphasized above, the IMF-Restriction measure may not accurately capture the magnitude and effectiveness of restrictions on capital flows.

Quinn measure: Based on descriptive information in the AREAER, Quinn (1997) assigns scores associated with the intensity of official restrictions on both capital inflows and outflows. This measure attempts to improve upon the IMF-Restriction measure by providing information about the magnitude of restrictions, rather than simply designating countries as closed or open. The Quinn measure, however, is a particularly subjective measure. Also, it is highly correlated (0.9) with the IMF-Restriction measure (Edison and others, 2004). Moreover, for non-OECD countries, it is only available for two years (1982, 1988) over the sample period that we examine. Thus, we cannot use the Quinn measure in our panel estimates. Because the use of panel estimates to reduce statistical biases is an important contribution of this chapter, we confirm our pure cross-country, ordinary least squares (OLS) results using the Quinn measure but do not report these results in the tables.

Stock of Capital Flows accumulates FDI and portfolio inflows and outflows as a share of GDP. Thus, it is the stock of a nation’s foreign assets plus liabilities as a share of GDP (Lane and Milesi-Ferretti, 2001). We examine assets plus liabilities because theoretical concepts of openness include both (1) the ability of foreigners to invest in a country and (2) the ability of residents to invest abroad. We have also examined the components of the Stock of Capital Flows measures (i.e., the accumulated stock of FDI and portfolio flows, respectively). Because we obtain the same results with these components, we focus on the stock of total capital inflows and outflows. This is the first time these stock measures of IFI have been used to study economic growth. The advantage of the stock measure is that it accumulates flows over a long period. Thus, unlike standard capital flow measures, the stock measure does not vary very much with short-run changes in the political and policy climate.

Flow of Capital equals FDI and portfolio inflows and outflows as a share of GDP. Thus, it is total capital inflows plus outflows divided by GDP. Kraay (1998) used this indicator to measure capital account openness. As noted, it is important to measure both inflows and outflows in creating an IFI proxy. As with the Stock of Capital Flows measure, we have examined the individual components of the Flow of Capital indicator. Specifically, we examined FDI and portfolio flows individually. Again, we obtain similar results with the subcomponents, so we simply report the results with total capital flows. Although we recognize the

5 In 1997, however, there was a structural break in the AREAER documentation of capital controls. No longer are countries categorized as having open or restricted capital accounts. Since 1997, information is provided on 13 separate categories of capital flows, including a distinction between restrictions on inflows and outflows. Because of the structural break, we only use information on IMF-Restriction through 1996.
problems associated with using the Flow of Capital indicator, we include it to provide as comprehensive an empirical assessment of IFI and growth as possible.

*Stock of Capital Inflows* accumulates FDI and portfolio inflows as a share of GDP. Thus, it is the stock of a nation’s foreign liabilities as a share of GDP (Lane and Milesi-Ferretti, 2001). Unlike the Stock of Capital Flows variable defined above, the Stock of Capital Inflows indicator excludes capital outflows. We use the Stock of Capital Inflows measure as some consider capital inflows to be particularly important for economic growth in developing countries. We have also examined the components of the Stock of Capital Inflows measures (i.e., the stock of FDI and portfolio liabilities, respectively), but only report the results on the stock of total capital inflows because we get similar results on the components. Thus, we add this new measure of capital account openness to the study of growth and IFI.

*Inflows of Capital* equals FDI and portfolio inflows as a share of GDP. Unlike Flows of Capital, Inflows of Capital excludes capital outflows. Again, we include this variable as some discussions emphasize the growth effects of capital inflows. Although none of these indicators may fully capture the concept of IFI, we use a collection of indicators with different pros and cons to assess the relationship between economic growth and financial openness.

### 11.2.2. Data on Other Variables

To assess the relationship between economic growth and IFI we control for other potential growth determinants and also examine whether IFI influences growth only under particular economic, financial, institutional, and policy environments (Levine and Renelt, 1992). *Growth* equals real per capita GDP growth, which is computed over the period of analysis. Thus, in the pure cross-country regressions and in the Table 11.1 summary statistics Growth is computed over the 1980–2000 period. As is common in cross-country growth regressions, we control for initial conditions. *Initial Income* equals the logarithm of real per capita GDP in the initial year of the period under consideration, and *Initial Schooling* equals the logarithm of the average years of secondary schooling in the initial year of the period under consideration. We examine both financial intermediary development and the liquidity of the domestic stock market. *Private Credit* equals the logarithm of credit to the private sector by deposit money banks and other financial institutions as a share of GDP, whereas *Stock Activity* equals the logarithm of the total value of domestic stock transactions on domestic exchanges as a share of GDP. We use logarithms to reduce the influence of large outliers of the finance variables. Including the finance variables in levels still produces a positive relationship between financial development and growth (Levine and Zervos, 1998a). We also control for macroeconomic policies. *Inflation* equals the growth rate of the consumer price index and *Government Balance* equals the government’s fiscal balance divided by GDP, with positive values signifying a surplus and negative values a fiscal deficit. Finally, we examine the level of institutional development, as measured by the law and order tradition (*Law and Order Tradition*) of the country and the level of government corruption (*Corruption in Government*), where larger values signify better institutions (i.e., a better law and order tradition and less corruption).
11.2.3. Summary Statistics

Table 11.1 provides summary statistics. Four key points are worth emphasizing before we undertake a systematic examination of the IFI-growth relationship.

First, rich countries tend to be more open. As shown in Table 11.1, Panel B, there is a significant positive correlation between Initial Income and Stock of Flows, Stock of Inflows, Flows of Capital, and Inflows of Capital. Similarly, these measures of IFI are also positively associated with Initial Schooling in 1980. The IMF-Restriction measure, however, is not significantly correlated with income or schooling. Rich, well-educated countries tend to be more open to international financial transactions, as measured by the stock and flow of capital flows, than poorer countries and countries with less well-educated workers.

Second, countries with well-developed financial intermediaries, stock markets, legal systems, and low levels of government corruption tend to have greater capital account openness. Specifically, Private Credit, Stock Activity, Law and Order, and Corruption are all positively associated with the measures of Stock of Capital Flows, Stock of Capital Inflows, Flows of Capital, and Inflows of Capital and negatively associated with the IMF-Restriction measure. Thus, although measures of IFI are generally unrelated to macroeconomic policies, as proxied by Inflation and the Government Balance, IFI is strongly correlated with measures of institutional and financial development.

Third, the IMF-Restriction measure is significantly, negatively correlated with the stock and flow measures of capital account openness. Specifically, countries that have had a large number of years over the post-1980 period with capital account restrictions (high values of the IMF-Restriction measure) have, on average, lower values of Stock of Capital Flows, Stock of Capital Inflows, Flows of Capital, and Inflows of Capital. Thus, measures of government restrictions on capital account transactions are negatively linked with international capital flows and the accumulated stock of those flows.

Fourth, the correlations between economic growth and the indicators of IFI are mixed. The IMF-Restriction measure, Stock of Capital Flows, and Flows of Capital are not significantly correlated with economic growth at the 0.05 level. However, growth is significantly positively associated with Stock of Capital Inflows and Inflows of Capital. This suggests the value of examining a range of indicators and studying IFI indicators that focus on capital inflows.

11.3. METHODOLOGY

This section describes three econometric methods that we use to assess the relationship between IFI and economic growth. We first use simple ordinary least squares (OLS) regressions with one observation per country over the 1980–2000 period. Second, we use a two-stage least squares instrumental variable estimator within the purely cross-country context (i.e., while using one observation per country over the 1980–2000 period). Third, we use a generalized method of moments (GMM), dynamic panel procedure to control for potential biases associated with the purely cross-sectional estimators.
### TABLE 11.1

**Data Description**

**PANEL A. SUMMARY STATISTICS**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min. Value</th>
<th>Max. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth¹</td>
<td>0.02</td>
<td>0.02</td>
<td>−0.03</td>
<td>0.08</td>
</tr>
<tr>
<td>Initial Income²</td>
<td>7.96</td>
<td>0.99</td>
<td>5.97</td>
<td>9.47</td>
</tr>
<tr>
<td>Initial Schooling³</td>
<td>3.81</td>
<td>0.65</td>
<td>2.04</td>
<td>4.65</td>
</tr>
<tr>
<td>Government Balance⁴</td>
<td>−0.03</td>
<td>0.03</td>
<td>−0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>Inflation Rate⁵</td>
<td>0.15</td>
<td>0.22</td>
<td>0.02</td>
<td>1.29</td>
</tr>
<tr>
<td>Private Credit⁶</td>
<td>−1.00</td>
<td>0.82</td>
<td>−3.21</td>
<td>0.57</td>
</tr>
<tr>
<td>Stock Activity⁷</td>
<td>−3.50</td>
<td>1.81</td>
<td>−8.09</td>
<td>−0.02</td>
</tr>
<tr>
<td>Law and Order⁸</td>
<td>4.05</td>
<td>1.36</td>
<td>1.70</td>
<td>6.00</td>
</tr>
<tr>
<td>Corruption⁹</td>
<td>4.84</td>
<td>1.20</td>
<td>2.48</td>
<td>6.89</td>
</tr>
<tr>
<td>IMF Restriction¹⁰</td>
<td>0.74</td>
<td>0.37</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Stock of Capital Flows¹¹</td>
<td>0.53</td>
<td>0.60</td>
<td>0.01</td>
<td>2.77</td>
</tr>
<tr>
<td>Flow of Capital¹²</td>
<td>0.05</td>
<td>0.05</td>
<td>−0.01</td>
<td>0.22</td>
</tr>
<tr>
<td>Stock of Capital Inflows¹³</td>
<td>0.35</td>
<td>0.30</td>
<td>0.01</td>
<td>1.13</td>
</tr>
<tr>
<td>Inflow of Capital¹⁴</td>
<td>0.03</td>
<td>0.02</td>
<td>−0.00</td>
<td>0.12</td>
</tr>
</tbody>
</table>

**Notes:**

1. Real per capita GDP growth rate (calculated in logarithmic terms).
2. Logarithm of Initial real per capita GDP in 1980.
3. Logarithm of average years of schooling in 1980.
4. Fiscal Balance (Revenues – Expenditures) as a ratio of GDP.
5. Inflation using consumer price index (calculated in logarithmic first difference terms).
6. Logarithm of private credit by deposit money banks and other financial institutions as a ratio to GDP.
7. Logarithm of stock market total value traded as a ratio to GDP.
8. ICRG – Law and Order.
9. ICRG – Corruption in Government.
### PANEL B. CORRELATION MATRIX

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
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<td>Growth</td>
<td>1.00</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial Income</td>
<td>−0.10</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Schooling</td>
<td>0.24</td>
<td>0.76*</td>
<td>1.00</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Government Balance</td>
<td>0.22</td>
<td>0.05</td>
<td>−0.02</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Inflation</td>
<td>−0.26*</td>
<td>−0.00</td>
<td>−0.07</td>
<td>−0.16</td>
<td>1.00</td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>IMF Restriction</td>
<td>−0.03</td>
<td>−0.55</td>
<td>−0.42</td>
<td>−0.22</td>
<td>0.14</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Stock of Capital Flows</td>
<td>0.07</td>
<td>0.60*</td>
<td>0.48*</td>
<td>0.22</td>
<td>−0.25*</td>
<td>−0.62*</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Flow of Capital</td>
<td>0.04</td>
<td>0.54*</td>
<td>0.41*</td>
<td>0.21</td>
<td>−0.22</td>
<td>−0.53*</td>
<td>0.93*</td>
<td>1.00</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Stock of Capital Inflows</td>
<td>0.25*</td>
<td>0.55*</td>
<td>0.42*</td>
<td>0.24</td>
<td>−0.23</td>
<td>−0.47*</td>
<td>0.77*</td>
<td>0.72*</td>
<td>1.00</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Inflows of Capital</td>
<td>0.29*</td>
<td>0.42*</td>
<td>0.32*</td>
<td>0.29*</td>
<td>−0.17</td>
<td>−0.36*</td>
<td>0.62*</td>
<td>0.69*</td>
<td>0.92*</td>
<td>1.00</td>
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<td></td>
</tr>
<tr>
<td>Private Credit</td>
<td>0.26*</td>
<td>0.66*</td>
<td>0.64*</td>
<td>−0.00</td>
<td>−0.37*</td>
<td>−0.48*</td>
<td>0.60*</td>
<td>0.49*</td>
<td>0.54*</td>
<td>0.40*</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stock Activity</td>
<td>0.21</td>
<td>0.46*</td>
<td>0.46*</td>
<td>0.23</td>
<td>−0.18</td>
<td>−0.41*</td>
<td>0.56*</td>
<td>0.49*</td>
<td>0.57*</td>
<td>0.51*</td>
<td>0.71*</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Law and Order</td>
<td>0.26*</td>
<td>0.76*</td>
<td>0.59*</td>
<td>0.22</td>
<td>−0.25</td>
<td>−0.56*</td>
<td>0.69*</td>
<td>0.72*</td>
<td>0.66*</td>
<td>0.59*</td>
<td>0.67*</td>
<td>0.54*</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Corruption</td>
<td>0.10</td>
<td>0.82*</td>
<td>0.67*</td>
<td>0.06</td>
<td>−0.19</td>
<td>−0.48*</td>
<td>0.69*</td>
<td>0.70*</td>
<td>0.65*</td>
<td>0.54*</td>
<td>0.68*</td>
<td>0.49*</td>
<td>0.87*</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*Significant coefficients (at 5 percent significance level).
11.3.1. OLS Framework

The pure cross-sectional, OLS analysis uses data averaged over 1980–2000, such that there is one observation per country, and heteroskedasticity-consistent standard errors. The basic regression takes the form:

\[ \text{GROWTH} = \alpha + \beta \text{IFI} + \gamma X + \varepsilon_i \] (1)

where the dependent variable, GROWTH, equals real per capita GDP growth, IFI is one of the five measures of IFI discussed above, and \( X \) represents a matrix of control variables. We focus on the 1980–2000 period because we have complete data for the 57 countries over this period. When using data in the 1960s and 1970s, some countries are missing data over certain periods. Twenty years of data allow us to abstract from business-cycle fluctuations and short-run political and financial shocks and focus on long-run growth. Thus, as discussed in the Introduction, some theories suggest that greater IFI will be positively associated with economic growth (i.e., these theories predict that \( \beta \) will be significantly greater than zero).

We also use a slight variant of equation (1) to examine whether IFI influences growth only under certain economic, institutional, and policy conditions. Specifically, we also examine the following regression equation with interaction terms.

\[ \text{GROWTH} = \alpha + \beta \text{IFI} + \gamma(\text{IFI} \times x) + \varepsilon_i \] (1')

where \( x \) is a variable included in the matrix of control variables \( X \). For example, if \( x \) is the Rule of Law, equation (1') permits us to assess whether international financial integration has a different influence on growth in countries with high values of the Rule of Law than in countries with low values of the Rule of Law. Specifically, differentiate equation (1') with respect to IFI to obtain,

\[ \frac{\partial \text{GROWTH}}{\partial \text{IFI}} = \beta + \delta \times x \] (1'')

If \( \delta > 0 \), this would imply that greater international financial integration has a bigger, positive growth effect in countries with high levels of \( x \). Thus, for example, the theoretical model developed by Boyd and Smith (1992) predicts that IFI will positively influence economic performance only in countries with high levels of the Rule of Law and well-developed financial systems. This model, therefore, predicts that when \( x \) is the Rule of Law or a measure of financial development that \( \delta \) will be greater than zero. We examine many “\( x \)”s (i.e., we examine many possible economic, institutional, and policy conditions that may influence the IFI-growth relationship).

11.3.2. Two-Stage Least Squares

We also use a two-stage least squares instrumental variable estimator to control for simultaneity bias while allowing for heteroskedasticity-consistent errors. It uses the same countries, estimation period, and equation specification as the OLS estimator. With the two-stage least squares estimator, we also examine whether IFI's
influence on growth depends on other economic, institutional, and policy conditions. That is, we use also interaction terms in the instrumental variable regressions.

We use two sets of instrumental variables. First, we use exogenous indicators that past studies have shown are good predictors of “policy openness” (broadly defined). Specifically, La Porta and others (1999) show that legal traditions differ in terms of the priority they attach to private property rights relative to the power of the state and that legal systems that emphasize the power of the state tend to be less open to competition. According to this view, the English common law evolved to protect private property owners against the crown. This facilitated the ability of private property owners to transact confidently, with positive repercussions on free, competitive markets. In contrast the French and German civil codes in the nineteenth century were constructed to solidify state power. Over time, state dominance produced legal traditions that focus more on the power of the state and less on the rights of individual investors. Countries with a socialist legal tradition further reflect these differences. As documented by La Porta and others (1999), socialist legal origin countries tend to restrict open, competitive markets. According to the La Porta and others (1999) theory, these legal traditions spread throughout the world through conquest, colonization, and imitation, so differences in legal origin can be treated as relatively exogenous. There are five possible legal origins: English Common Law, French Civil Law, German Civil Law, Scandinavian Civil Code, and Socialist/Communist Law. Thus, we include dummy variables for each country’s legal origin (except the Scandinavian Law countries) as instrumental variables. Second, leading economists, historians, and biogeographers emphasize the impact of geography on economic institutions and policies (e.g., Engerman and Sokoloff, 1997). Lands with high rates of disease and poor agricultural yields—such as the tropics—tend to create political institutions that are closed to competition and free markets so that the elite can exploit the rest of the population (see, Acemoglu, Johnson, and Robinson, 2001; and Easterly and Levine, 2003). In contrast, countries with better geographical endowments tend to create political institutions that place greater emphasis on private property rights and competitive markets in part because the elite benefit more from free markets than from limiting competition and exploiting domestic labor. We use the absolute value of latitudinal distance from the equator as an additional instrument in the two-stage least squares regressions.

11.3.3. Motivation for the Dynamic Panel Model

The dynamic panel approach offers advantages to OLS and also improves on previous efforts to examine the IFI-growth link using panel procedures. First, estimation using panel data—that is pooled cross-section and time-series data—allows us to exploit the time-series nature of the relationship between IFI and growth. Second, in a pure cross-country instrumental variable regression, any unobserved country-specific effect becomes part of the error term, which may bias the coefficient estimates as we explain in detail below. Our panel procedures control for country-specific effects. Third, unlike existing cross-country studies, our panel estimator (1) controls for the potential endogeneity of all explanatory
variables and (2) accounts explicitly for the biases induced by including initial real per capita GDP in the growth regression. Thus, the dynamic panel estimator is free from some of the biases plaguing past studies of IFI and growth.

11.3.4. Detailed Presentation of the Econometric Methodology

We use the GMM estimators developed for dynamic panel data that were introduced by Holtz-Eakin, Newey, and Rosen (1990), Arellano and Bond (1991), and Arellano and Bover (1995). Our panel consists of data for a maximum of 57 countries over the period 1976–2000. We average data over nonoverlapping, five-year periods, so that data permitting there are five observations per country (1976–80, 1981–85, ..., 1996–2000). The subscript \( i \) designates one of these five-year averages. Consider the following regression equation,

\[
y_{i,t} = \alpha y_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t}
\]

where \( y \) is the logarithm of real per capita GDP, \( X \) represents the set of explanatory variables (other than lagged per capita GDP), \( \eta \) is an unobserved country-specific effect, \( \varepsilon \) is the error term, and the subscripts \( i \) and \( t \) represent country and time period, respectively. Specifically, \( X \) includes an IFI indicator as well as other possible growth determinants. We also use time dummies to account for period-specific effects, though these are omitted from the equations in the text. We can rewrite equation (2).

\[
y_{i,t} = \alpha y_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t}
\]

To eliminate the country-specific effect, take first-differences of equation (3).

\[
y_{i,t} - y_{i,t-1} = \alpha(y_{i,t-1} - y_{i,t-2}) + \beta'(X_{i,t} - X_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1})
\]

The use of instruments is required to deal with (1) the endogeneity of the explanatory variables, and (2) the problem that by construction the new error term \( \varepsilon_{i,t} - \varepsilon_{i,t-1} \) is correlated with the lagged dependent variable, \( y_{i,t-1} - y_{i,t-2} \). Under the assumptions that (1) the error term is not serially correlated, and (2) the explanatory variables are weakly exogenous (i.e., the explanatory variables are uncorrelated with future realizations of the error term), the GMM dynamic panel estimator uses the following moment conditions:

\[
E[y_{i,t-s} \cdot (\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \quad \text{for } s \geq 2; \ t = 3, \ldots, T
\]

\[
E[X_{i,t-s} \cdot (\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \quad \text{for } s \geq 2; \ t = 3, \ldots, T
\]

We refer to the GMM estimator based on these conditions as the difference estimator.

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There are, however, conceptual and statistical shortcomings with this difference estimator. Conceptually, we would also like to study the cross-country relationship between financial development and per capita GDP growth, which is eliminated in the difference estimator. Statistically, Alonso-Borrego and Arellano (2002) and Blundell and Bond (1998) show that when the explanatory variables are persistent over time, lagged levels make weak instruments for the regression equation in differences. Instrument weakness influences the asymptotic and small-sample performance of the difference estimator. Asymptotically, the variance of the coefficients rises. In small samples, weak instruments can bias the coefficients.

To reduce the potential biases and imprecision associated with the usual estimator, we use a new estimator that combines in a system the regression in differences with the regression in levels (see Arellano and Bond, 1995; and Blundell and Bond, 1998). The instruments for the regression in differences are the same as above. The instruments for the regression in levels are the lagged differences of the corresponding variables. These are appropriate instruments under the following additional assumption: although there may be correlation between the levels of the right-hand side variables and the country-specific effect in equation (3), there is no correlation between the differences of these variables and the country-specific effect, in other words,

$$E[y_{i,t+p} \cdot \eta_i] = E[y_{i,t+q} \cdot \eta_i] \text{ and } E[X_{i,t+p} \cdot \eta_i] = E[X_{i,t+q} \cdot \eta_i] \text{ for all } p \text{ and } q$$ (6)

The additional moment conditions for the second part of the system (the regression in levels) are:

$$E[(y_{i,t-s} - y_{i,t-s-1}) \cdot (\eta_i + \varepsilon_{i,t})] = 0 \text{ for } s = 1 \tag{7}$$
$$E[(X_{i,t-s} - X_{i,t-s-1}) \cdot (\eta_i + \varepsilon_{i,t})] = 0 \text{ for } s = 1 \tag{8}$$

Thus, we use the moment conditions presented in equations (4), (5), (7), and (8), use instruments lagged two periods (t–2), and employ a GMM procedure to generate consistent and efficient parameter estimates.\(^7\)\(^8\)

\(^7\) We use a variant of the standard two-step system estimator that controls for heteroskedasticity. Typically, the system estimator treats the moment conditions as applying to a particular time period. This provides for a more flexible variance-covariance structure of the moment conditions because the variance for a given moment condition is not assumed to be the same across time. This approach has the drawback that the number of overidentifying conditions increases dramatically as the number of time periods increases. Consequently, this typical two-step estimator tends to induce overfitting and potentially biased standard errors, which is particularly important for this chapter because of data limitations. To limit the number of overidentifying conditions, we follow Calderon, Chong, and Loayza (2002) and apply each moment condition to all available periods. This reduces the overfitting bias of the two-step estimator. However, applying this modified estimator reduces the number of periods by one. Although in the standard estimator time dummies and the constant are used as instruments for the second period, this modified estimator does not allow the use of the first and second period. We confirm the results using the standard system estimator.

\(^8\) Recall that we assume that the explanatory variables are “weakly exogenous.” This means they can be affected by current and past realizations of the growth rate but not future realizations of the error term. Weak exogeneity does not mean that agents do not take into account expected future growth in their decision to undertake IFI; it just means that unanticipated shocks to future growth do not influence current IFI. We statistically assess the validity of this assumption.
Consistency of the GMM estimator depends on the validity of the instruments. To address this issue we consider two specification tests suggested by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1997). The first is a Sargan test of overidentifying restrictions, which tests the overall validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation process. The second test examines the hypothesis that the error term $e_{it}$ is not serially correlated. In both the difference regression and the system difference-level regression we test whether the differenced error term is second-order serially correlated (by construction, the differenced error term is probably first-order serially correlated even if the original error term is not).

11.4. RESULTS

11.4.1. International Financial Integration and Economic Growth

Using the econometric methods outlined above, this section presents regression results concerning the relationship between economic growth and various measures of IFI and also assesses whether the growth-IFI relationship depends on economic, financial, institutional, and policy factors as suggested by some theories.

Table 11.2 presents the benchmark regression without any IFI proxies. Specifically, the regressions simply include the logarithm of initial real per capita GDP, the logarithm of initial schooling, the average government fiscal balance over the period, and the average inflation rate over the period. We present the OLS, instrumental variables (one observation per country), and the GMM system panel estimator (five observations per country) regressions.

The Table 11.2 OLS results are consistent with previous cross-country growth regressions. The logarithm of initial income enters significantly and negatively, which is evidence of conditional convergence. We also find that the logarithm of initial schooling is significant and positive, suggesting a positive relationship between educational attainment of the workforce and future economic growth. The macroeconomic policy indicators, the government balance, and inflation enter with the expected signs. Although fiscal surplus and inflation enter the growth equation jointly significantly, neither enters individually significantly in the OLS regression; it is difficult to identify the independent impact of the fiscal surplus and the rate of inflation on economic growth.

The benchmark regression results are broadly consistent across the three econometric methodologies. The two-stage least squares regression results produce the same sign as the OLS regressions. Although the logarithm of initial income and the logarithm of initial schooling do not enter with t-statistics greater than two, inflation is negatively and significantly related to growth in the two-stage least squares regression.

The system panel estimates further confirm the OLS regressions. The logarithm of initial income and schooling enter significantly and with the same sign
as the OLS regressions. The panel estimates also suggest a significant, negative relationship between inflation and economic growth. Unfortunately, when we move to the panel estimator, we lose country observations because some of the countries do not have sufficient data continuously over the entire 1976–2000 period. We have 40 countries in the Table 11.2 regression. Importantly, however, the panel estimates pass the specifications tests defined above. The Sargan test has a p-value of 0.17, which means we do not reject the econometric specification and the validity of the instruments. Similarly, the serial correlation test has a p-value of 0.56, which means we do not reject the econometric model because of serial correlation.

Table 11.3 examines the relationship between economic growth and IFI controlling for the same benchmark regressors presented in Table 11.2. We present results on five measures: IMF-Restriction, the Stock of Capital Flows, Flow of Capital, Stock of Capital Inflows, and Inflow of Capital. As discussed above, we examined the components of these indicators and obtained similar results. Thus, Table 11.3 summarizes the results of 14 regressions, 5 regressions each for the OLS and two-stage least squares specifications and 4 regressions for the panel methodology. The reasons

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International Financial Integration and Economic Growth

there is one less regression for the panel is that we are unable to use the system panel estimator for the IMF-Restriction measure because there is too little temporal variation in this variable, on average, across the countries and because the IMF-Restriction variable (as discussed above) is not available in the last five-year period, 1996–2000.

The regressions in Table 11.3 do not suggest a strong relationship between IFI and economic growth. The IMF-Restriction measure, the Stock of Capital Flows, and the Stock of Capital Inflows are not significantly related to economic growth in any of the regressions. In the OLS regression, the Flow of Capital and Inflow of Capital measures are positively associated with growth. In the two-stage least squares regression that controls for the endogeneity of capital flows, however, none of the IFI measures are significantly associated with growth. This suggests that OLS results may be driven by reverse causality. Importantly, the instrumental variables do a good job of explaining cross-country variation in the IFI measures. We reject the null hypothesis that the instruments do not explain the IFI measures at the 0.01 level in all of the two-stage least squares regressions in Table 11.3.

TABLE 11.3
Economic Growth and International Financial Integration1,2 (Dependent Variable: Real Per Capita GDP Growth)

<table>
<thead>
<tr>
<th>International Financial Integration Measure</th>
<th>Ordinary Least Squares3,4</th>
<th>Instrumental Variables4,5</th>
<th>Panel4,6</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMF Restriction7</td>
<td>0.002 (0.29)</td>
<td>−0.011 (0.91)</td>
<td>NA</td>
</tr>
<tr>
<td>Stock of Capital Flows8</td>
<td>0.003 (0.72)</td>
<td>0.008 (0.85)</td>
<td>0.002 (0.35)</td>
</tr>
<tr>
<td>Flow of Capital9</td>
<td>0.101 (2.46)*</td>
<td>0.056 (0.79)</td>
<td>0.077 (2.08)</td>
</tr>
<tr>
<td>Stock of Capital Inflows10</td>
<td>0.002 (0.25)</td>
<td>−0.007 (0.63)</td>
<td>0.001 (0.033)</td>
</tr>
<tr>
<td>Inflow of Capital11</td>
<td>0.183 (2.24)*</td>
<td>0.078 (0.62)</td>
<td>0.132 (1.23)</td>
</tr>
</tbody>
</table>

*Significant at the 5 percent level.

Notes:
1. Numbers in parentheses are t-statistics.
2. The regressions also include Initial Income, Initial Schooling, the Government Balance, and Inflation.
3. Column 2 presents OLS regression results using heteroskedasticity-consistent standard errors.
4. The Ordinary Least Squares and Instrumental Variables regressions use one observation per country with data over the 1980–2000 period, so that Initial Income and Initial Schooling are computed in 1980 and the Government Balance and Inflation are averaged over the 1980–2000 period. The Panel regressions use data averaged over a five-year period from 1976–2000, so data permitting there are five observations per country (1976–80, 1981–85, 1986–90, 1991–95, 1996–2000). For the Panel regression, Initial Income and Initial Schooling are computed in the initial year of each five-year period and the Government Balance and Inflation are averaged over each period. The table summarizes the findings from 15 separate regressions.
5. Column 3 presents Two-Stage Least Squares results, with heteroskedasticity-consistent standard errors, where the instruments are the latitudinal distance from the equator, and a dummy variable for the legal origin of the country (Common, French Civil, German Civil, Scandinavian, Socialist).
6. Column 4 presents dynamic system panel regression results with robust standard errors. Note, we are unable to use the system panel estimator for the IMF-Restriction measure because there is too little cross-time variation in this variable, on average, across the countries and because the IMF-Restriction variable is not available in the last five-year period, 1996–2000, as discussed in the text.
7. IMF Restriction: Capital Account Restrictions from the IMF.
9. Flow of Capital: FDI plus Portfolio inflows and outflows divided by GDP.
10. Stock of Capital Inflows: Capital Liabilities (FDI and Portfolio) divided by GDP.
11. Inflow of Capital: FDI and Portfolio inflows divided by GDP.

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The panel estimates in Table 11.3 suggest that there is not a robust relationship between IFI and economic growth.\(^9\) There is only one case in which the IFI indicator is significantly associated with growth (i.e., for the indicator of total capital inflows and outflows as a share of GDP). For those that have particularly strong priors that the Flows of Capital indicator is better than the other IFI indicators, these results suggest the IFI exerts a positive influence on economic growth. However, because the IFI-growth relationship is consistent neither across IFI indicators nor across the different estimation procedures, we interpret the econometric results as not strongly rejecting the null hypothesis of no statistical relationship between IFI and economic growth.

### 11.4.2. IFI Under Different Economic, Financial, Institutional, and Policy Environments

Next, we examine interaction terms to assess whether IFI exerts a positive influence on growth under certain economic, financial, institutional, and policy environments. Specifically, we first examine whether the growth effects of IFI depend on the level of GDP per capita or the level of educational attainment. Second, we examine whether the growth-IFI relationship depends on the level of financial development, as proxied by banking sector development and stock market development respectively. Third, we test whether IFI’s growth impact varies with the level of institutional development, as measured by the law and order tradition of the country and the degree of government corruption. Finally, we study the growth-IFI link under different macroeconomic policies, as proxied by inflation and the government fiscal surplus. Thus, as discussed above, we examine the following specification,

\[
GROWTH = \alpha + \beta IFI + \delta [IFI \times x] + \gamma x + \text{[the benchmark control variables]} + \epsilon_i \tag{9}
\]

where \(x\) is a variable included in the matrix of control variables \(X\), and is either income per capita, educational attainment, bank development, stock market development, the Rule of Law, government corruption, inflation, or the fiscal balance. In Tables 11.4 to 11.7, we report the estimated coefficients on IFI, the interaction term, and \(x\) (i.e., we report statistics on \(\beta\), \(\delta\), and \(\gamma\)). For brevity, we simply present the OLS result because the two-stage least squares and panel regression results are very similar.

Contrary to some theories and past empirical evidence, Table 11.4 indicates that IFI does not exert a positive influence on growth in countries with suitably high levels of GDP per capita or sufficiently high levels of educational attainment. Out of the 10 regressions in Table 11.4, only in the regression where we interact Initial Income with the Stock of Capital Flows do we find that IFI and the interaction term enter significantly. However, the results run counter to theory and past findings. In that regression, the results suggest that IFI only promotes growth

---

\(^9\) The four panel regressions in Table 11.3 pass the standard specifications tests. Specifically, none reject the Sargan test (i.e., they do not reject the econometric specification and the validity of the instruments). Also, the regressions do not exhibit significant serial correlation (i.e., they do not reject the null hypothesis of no serial correlation as discussed in the methodology section).
in sufficiently poor countries (i.e. the growth effect becomes negative as countries become sufficiently rich). In sum, we interpret the Table 11.4 findings as not rejecting the view that IFI is unrelated to economic growth even when allowing this relationship to vary under different economic conditions, as measured by GDP per capita and educational attainment.

Similarly, Table 11.5 shows that international financial integration does not exert a positive influence on growth in countries with high levels of bank or stock market development. Although banking sector development enters all of the growth regressions positively and significantly (Levine, Loayza, and Beck, 2000), the IFI indicator and the interaction terms between IFI and the financial development indicators never enter significantly. Again, these findings do not show that IFI is unimportant for growth. Rather, the results do not reject the null hypothesis that IFI is unrelated to economic growth even when allowing this relationship to vary with financial development.

TABLE 11.4
Economic Growth and International Financial Integration: Initial Economic Conditions¹–³

<table>
<thead>
<tr>
<th>International Financial Measure</th>
<th>IFI</th>
<th>IFI*(Initial Income)</th>
<th>Initial Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMF Restriction⁵</td>
<td>−0.002 (0.05)</td>
<td>0.000 (0.09)</td>
<td>−0.01 (2.15)*</td>
</tr>
<tr>
<td>Stock of Capital Flows⁶</td>
<td>0.410 (2.56)*</td>
<td>−0.040 (2.46)*</td>
<td>−0.01 (2.04)*</td>
</tr>
<tr>
<td>Flow of Capital⁷</td>
<td>0.079 (0.16)</td>
<td>0.002 (0.04)</td>
<td>−0.01 (3.02)*</td>
</tr>
<tr>
<td>Stock of Capital Inflows⁸</td>
<td>0.011 (0.27)</td>
<td>−0.001 (0.24)</td>
<td>−0.01 (2.18)*</td>
</tr>
<tr>
<td>Inflow of Capital⁹</td>
<td>−0.340 (0.55)</td>
<td>0.066 (0.88)</td>
<td>−0.01 (3.34)*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>International Financial Measure</th>
<th>IFI</th>
<th>IFI*(Initial Schooling)</th>
<th>Initial Schooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMF Restriction⁵</td>
<td>−0.010 (0.25)</td>
<td>0.003 (0.30)</td>
<td>0.013 (1.16)</td>
</tr>
<tr>
<td>Stock of Capital Flows⁶</td>
<td>0.030 (0.75)</td>
<td>−0.006 (0.71)</td>
<td>0.017 (2.26)*</td>
</tr>
<tr>
<td>Flow of Capital⁷</td>
<td>0.008 (0.04)</td>
<td>0.023 (0.43)</td>
<td>0.014 (1.89)</td>
</tr>
<tr>
<td>Stock of Capital Inflows⁸</td>
<td>0.013 (0.38)</td>
<td>−0.003 (0.34)</td>
<td>0.016 (2.14)*</td>
</tr>
<tr>
<td>Inflow of Capital⁹</td>
<td>−0.140 (0.46)</td>
<td>0.087 (1.13)</td>
<td>0.013 (1.77)</td>
</tr>
</tbody>
</table>

*Significant at the 5 percent level.
Notes:
1. Numbers in parentheses are t-statistics.
3. The table presents OLS regression results using heteroskedasticity-consistent errors.
5. IMF Restriction: Capital Account Restrictions from the IMF.
7. Flow of Capital: FDI plus Portfolio inflows and outflows divided by GDP.
8. Stock of Capital Inflows: Capital Liabilities (FDI and Portfolio) divided by GDP.
9. Inflow of Capital: FDI and Portfolio inflows divided by GDP.
We do not find statistical support for the view that the growth effects of international financial integration increase with greater institutional development (Table 11.6). We examine the Rule of Law and Corruption, where higher values imply greater adherence to the rule of law and less government corruption. In 3 out of the 10 regressions, we find that IFI is positively related to growth when controlling for institutional development and including interaction terms. However, in those regressions the interaction term enters with a sign that runs counter to theoretical predictions. Specifically, the regressions suggest that whereas IFI is positively related with growth, the positive growth-effects diminish as adherence to the rule of law and the integrity of the government increase. Given the infrequency with which the IFI terms enter significantly and the counterintuitive results on the interaction terms in those three regressions, we interpret the results as not rejecting the view that IFI is unrelated to economic growth even when allowing this relationship to vary with institutional development.
Finally, we examine whether the growth-IFI relationship varies with macroeconomic policies. We use inflation and the government fiscal surplus as measures of macroeconomic policies. Again, we do not find strong evidence for the view that IFI has a positive growth effect only in countries with sound macroeconomic policies. IFI enters significantly and positively in only 3 out of the 10 regressions in Table 11.7 and in these three regressions, the interaction term does not enter significantly. Because we control for macroeconomic policies in the Table 11.3 regressions (which do not include interaction terms), the Table 11.7 results do not support the view that IFI boosts growth in general. Turning to the interaction term, the IFI-fiscal balance interaction term does not enter significantly in any of the equations (Table 11.7).

In the inflation regressions, the IFI-inflation term enters significantly in two out of the five regressions. For these equations, the results suggest that IFI in high-inflation regimes has a negative growth effect (i.e., IFI is particularly conducive to growth in low-inflation countries). Although these regressions offer some support to the view

<table>
<thead>
<tr>
<th>Panel A. RULE OF LAW⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Financial Integration Measure</td>
</tr>
<tr>
<td>IMF Restriction⁵</td>
</tr>
<tr>
<td>Stock of Capital Flows⁶</td>
</tr>
<tr>
<td>Flow of Capital⁷</td>
</tr>
<tr>
<td>Stock of Capital Inflows⁸</td>
</tr>
<tr>
<td>Inflow of Capital⁹</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B. CORRUPTION¹⁰</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Financial Integration Measure</td>
</tr>
<tr>
<td>IMF Restriction⁵</td>
</tr>
<tr>
<td>Stock of Capital Flows⁶</td>
</tr>
<tr>
<td>Flow of Capital⁷</td>
</tr>
<tr>
<td>Stock of Capital Inflows⁸</td>
</tr>
<tr>
<td>Inflow of Capital⁹</td>
</tr>
</tbody>
</table>

*Significant at the 5 percent level.
Notes:
1. Numbers in parentheses are t-statistics.
3. The table presents OLS regression results using heteroskedasticity-consistent errors.
4. Law and Order: ICRG – Law and Order. Larger values imply more of a law and order tradition.
5. IMF Restriction: Capital Account Restrictions from the IMF.
7. Flow of Capital: FDI plus Portfolio inflows and outflows divided by GDP.
8. Stock of Capital Inflows: Capital Liabilities (FDI and Portfolio) divided by GDP.
9. Inflow of Capital: FDI and Portfolio inflows divided by GDP.
that the positive growth effects of IFI depend on macroeconomic stability, these findings are not robust across the different measures of IFI.

### 11.5. CONCLUSION

This chapter uses new data and new econometric techniques to investigate the impact of international financial integration on economic growth and to assess whether the IFI-growth relationship depends on the level of economic development, educational attainment, financial development, legal system development, government corruption, and macroeconomic policies. We contribute to the existing literature by (1) using new measures of international financial integration, (2) examining an extensive array of IFI indicators, (3) employing econometric methods that cope with statistical biases plaguing past studies of the IFI-growth relationship, and (4) investigating, as suggested by some theories, whether IFI only has positive growth

### Table 11.7

#### PANEL A. FISCAL POLICY


<table>
<thead>
<tr>
<th>International Financial Integration Measure</th>
<th>IFI</th>
<th>IFI*(Government Balance)</th>
<th>Government Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMF Restriction5</td>
<td>0.001 (0.14)</td>
<td>−0.034 (0.21)</td>
<td>0.150 (1.11)</td>
</tr>
<tr>
<td>Stock of Capital Flows6</td>
<td>0.004 (0.93)</td>
<td>0.058 (0.91)</td>
<td>0.090 (0.93)</td>
</tr>
<tr>
<td>Flow of Capital7</td>
<td>0.108 (2.51)*</td>
<td>0.373 (0.64)</td>
<td>0.078 (0.80)</td>
</tr>
<tr>
<td>Stock of Capital Inflows8</td>
<td>0.004 (0.49)</td>
<td>0.110 (0.63)</td>
<td>0.092 (0.88)</td>
</tr>
<tr>
<td>Inflow of Capital9</td>
<td>0.202 (2.47)*</td>
<td>0.940 (0.97)</td>
<td>0.054 (0.55)</td>
</tr>
</tbody>
</table>

#### PANEL B. MONETARY POLICY


<table>
<thead>
<tr>
<th>International Financial Integration Measure</th>
<th>IFI</th>
<th>IFI*(Inflation)</th>
<th>Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMF Restriction5</td>
<td>−0.007 (1.37)</td>
<td>0.081 (3.06)*</td>
<td>−0.080 (3.61)*</td>
</tr>
<tr>
<td>Stock of Capital Flows6</td>
<td>0.008 (1.48)</td>
<td>−0.100 (1.36)</td>
<td>0.009 (0.47)</td>
</tr>
<tr>
<td>Flow of Capital7</td>
<td>0.090 (1.80)</td>
<td>0.110 (0.17)</td>
<td>−0.014 (0.64)</td>
</tr>
<tr>
<td>Stock of Capital Inflows8</td>
<td>0.016 (1.75)</td>
<td>−0.180 (2.56)*</td>
<td>0.025 (1.33)</td>
</tr>
<tr>
<td>Inflow of Capital9</td>
<td>0.210 (2.28)*</td>
<td>−0.350 (0.43)</td>
<td>−0.004 (0.17)</td>
</tr>
</tbody>
</table>

*Significant at the 5 percent level.

Notes:
1. Numbers in parentheses are t-statistics.
3. The table presents OLS regression results using heteroskedasticity-consistent errors.
4. Fiscal Policy: Fiscal Balance (Revenues − Expenditures) as a ratio of GDP.
5. IMF Restriction: Capital Account Restrictions from the IMF.
7. Flow of Capital: FDI plus Portfolio inflows and outflows divided by GDP.
8. Stock of Capital Inflows: Capital Liabilities (FDI and Portfolio) divided by GDP.
9. Inflow of Capital: FDI and Portfolio inflows divided by GDP.
effects under particular economic, financial, institutional, and policy regimes. In studying the IFI-growth relationship, the chapter examines up to 57 countries over the last 20–25 years using an assortment of statistical methodologies.

The data do not support the view that IFI per se accelerates economic growth even when controlling for particular economic, financial, institutional, and policy characteristics. Note, however, these results do not imply that openness is unassociated with economic success. Indeed, IFI is positively associated with real per capita GDP, educational attainment, banking sector development, stock market development, the law and order tradition of the country, and government integrity (low levels of government corruption). Thus, successful countries are generally open economies. Rather, this chapter finds that IFI is not robustly linked with economic growth when using a variety of IFI measures and an assortment of econometric approaches. Similarly, although there are isolated exceptions, we do not reject the null hypothesis that IFI is unrelated to economic growth even when allowing this relationship to vary with economic, financial, institutional, and macroeconomic characteristics.

This chapter’s findings must be interpreted cautiously. As emphasized in Section 11.1, there are extreme barriers to measuring openness to international financial transactions. There are many different types of financial transactions, countries impose a complex array of barriers, and the effectiveness of these barriers varies across countries, time, and type of financial transaction. Although we use new measures of IFI that improve upon past measures and although we use a more extensive list of IFI measures than past studies, each of these measures may be criticized for not fully distinguishing international differences in barriers to financial transactions. Given these qualifications, this chapter finds that although IFI is associated with economic success (high levels of GDP per capita and strong institutions), the data do not lend much support to the view that IFI stimulates economic growth.

**APPENDIX I**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td>Real per capita GDP growth</td>
<td><em>International Financial Statistics</em> (IFS), line 99b.r</td>
</tr>
<tr>
<td>Initial Income</td>
<td>Logarithm of real per capita GDP for initial year of period</td>
<td>Penn World Tables</td>
</tr>
<tr>
<td>Initial Schooling</td>
<td>Logarithm of average years of secondary schooling in the population over the age of 15 for the initial year of the period</td>
<td>Barro and Lee (1996)</td>
</tr>
<tr>
<td>Government Balance</td>
<td>Fiscal Balance (Revenues − Expenditures) divided by GDP</td>
<td>IFS, line 80</td>
</tr>
<tr>
<td>Inflation</td>
<td>Logarithmic difference of Consumer Price Index</td>
<td>IFS, line 64</td>
</tr>
<tr>
<td>Private Credit</td>
<td>Credit by banks and other financial intermediaries to private enterprises as a share of GDP</td>
<td>Beck and Levine (2004)</td>
</tr>
<tr>
<td>Stock Activity</td>
<td>Total Value of Trades of Domestic Stock on Domestic Exchanges as a share of GDP</td>
<td>Beck and Levine (2004)</td>
</tr>
<tr>
<td>Law and Order Tradition</td>
<td>Measure of Law and order tradition of a country, ranging from 10 for strong law and order tradition to 1 for weak law and order tradition</td>
<td><em>International Country Risk Guide</em> (ICRG)</td>
</tr>
<tr>
<td>Variable</td>
<td>Definition</td>
<td>Source</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Corruption in Government</td>
<td>Measure of Corruption, with 0 meaning high level of corruption to 10 low level</td>
<td>ICRG</td>
</tr>
<tr>
<td>IMF Restriction</td>
<td>Capital Account Restriction measure (0 = no restriction, 1 = restrictions)</td>
<td>IMF Annual Report on Exchange Arrangements and Exchange Restrictions</td>
</tr>
<tr>
<td>Stock of Capital Flows</td>
<td>Stock of accumulated capital flows (sum of asset and liabilities of FDI and portfolio flows) divided by GDP</td>
<td>Lane and Milesi-Ferretti (2001), CFDIAH + CFDILH + CEQAR + CEQLR + IPPDA + IPPDL</td>
</tr>
<tr>
<td>Flows of Capital</td>
<td>Capital inflows and outflows (FDI and portfolio flows) divided by GDP</td>
<td>IFS, lines 78bdd + 78bed + 78bdf + 78bgd</td>
</tr>
<tr>
<td>Stock of Capital Inflows</td>
<td>Stock of accumulated capital inflows (sum of liabilities of FDI and portfolio flows) divided by GDP</td>
<td>Lane and Milesi-Ferretti (2001), CFDILH + CEQAR + IPPDL</td>
</tr>
<tr>
<td>Inflows of Capital</td>
<td>Capital inflows (sum of FDI and portfolio inflows) divided by GDP</td>
<td>IFS, lines 78bed + 78bgd</td>
</tr>
</tbody>
</table>

REFERENCES


12.1. INTRODUCTION

Is financial liberalization associated with improved capital allocation? This chapter finds robust evidence of a “quality effect” of financial liberalization, using a newly developed measure of efficiency in allocating capital across firms. The measure is essentially the variation in expected returns to investment. If financial liberalization is efficiency enhancing, this variation should be lower when markets—rather than governments—determine the allocation of credit. The hypothesis is that when government controls are reduced or removed, credit is reallocated from firms with low expected returns to firms with higher expected returns, raising expected returns for the former and reducing them for the latter.

We measure the variation in expected returns by the dispersion in Tobin’s Q, after controlling for industry, age, and leverage effects. We calculate this “Q-dispersion” for firms in five emerging-market economies—India, Jordan, Korea, Malaysia, and Thailand—from 1980 to 1994. Simple descriptive statistics show that Q-dispersion decreased in all five countries following financial liberalization. In panel regressions of Q-dispersion, we find that the coefficient on liberalization is negative.

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1 We would like to thank Anusha Chari, Raymond Fisman, Xavier Gine, Nobu Kiyotaki, Aart Kraay, Inessa Love, Ashoka Mody, Jeremy Stein, Rene Stulz, Robert Townsend, and participants at the Annual Meeting of European Economic Association at the University of Amsterdam, the Sixth Jacques Polak Annual Research Conference at the IMF, and the Conference on Globalization and Financial Services in Emerging Economies at the World Bank, as well as the seminar participants at the IMF and the World Bank for helpful comments and suggestions; and Tom Walter for excellent editorial comments. The usual caveats apply.

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The regression results are robust, even when we include financial deepening as a control. Indeed, financial liberalization is strongly associated with improved allocative efficiency but financial deepening is associated with lower allocative efficiency. Note that this distinction between financial liberalization and financial deepening is not often made in the literature. Financial liberalization, on the one hand, refers to a reduction in the role of government, and an increase in the role of the market. We measure this using the financial liberalization index of Abiad and Mody (2005), which summarizes de jure changes in credit controls, interest rate controls, entry barriers for banks, regulations, privatization, and restrictions on international financial transactions. Financial deepening, on the other hand, refers to an increase in the volume of financial activity and is typically measured by indicators such as M2, credit to the private sector, or stock market capitalization relative to GDP. Although the two will tend to be related, they are not equivalent.²

Unlike this chapter, much of the literature on financial liberalization has focused on whether it has a positive “quantity effect,” as manifested in higher levels of savings and investment. Theoretically, however, financial liberalization can improve the functioning of the financial sector without necessarily increasing savings and investment. It is not surprising, then, that the empirical evidence of a quantity effect is mixed.

A positive theoretical prediction, going back to McKinnon (1973) and Shaw (1973), is that higher interest rates, following the removal of interest rate ceilings, will generate greater savings. Higher rates of return may also result from better insurance against risk, which, as Obstfeld (1994) argues, may induce a shift toward higher-risk, higher-return projects. Finally, a positive quantity effect on investment may be expected because increased competition among banks can lead firms to internalize production externalities when making investment decisions (Ueda, 2006).

However, there are also reasons to expect a negative, or at least an ambiguous, effect on savings and investment. First, even if rates of return increase with improved risk sharing or the removal of interest rate ceilings, the effect on savings will depend on whether income or substitution effects prevail. Second, if liberalized financial sectors provide for better insurance against risk, this may lower the need for precautionary savings (Devereux and Smith, 1994).

The theoretical ambiguity of the quantity effect is reflected in empirical studies. Using both a cointegration and an augmented Euler equation approach, Bandiera and others (2000) show that, in a sample of eight developing countries, financial liberalization is not associated with an increase in savings. In fact, certain aspects of liberalization—those that reduce liquidity constraints for household consumption—are associated with a fall in savings. Jayaratne and Strahan (1996)

² For example, during the 1970s and up into the early 1980s, Japan and France had financially deep markets that were highly repressed. Conversely, several Latin American countries in the 1990s (e.g., Peru, Argentina, and Brazil) had liberalized financial markets that were relatively shallow.
find that the deregulation of bank branches in the United States in the 1970s did not increase the volume of bank lending.

Thus far, only a few studies have attempted to estimate quality effects, and they have generally found positive results. In an early study, Cho (1988) finds that financial liberalization in Korea led to a decrease in the variation in borrowing costs, which he interprets as an improvement in allocative efficiency. Galindo, Schiantarelli, and Weiss (2007) also report a positive and significant effect of liberalization on a measure of allocative efficiency, using firm-level data for 12 developing countries. In a somewhat different context, Chari and Henry (2003) find that capital account liberalization improves the allocation of capital across countries, just as financial liberalization would improve the allocation of capital within countries.

In our view, the main problem with existing studies on quality effects has been their definition of allocative efficiency. For example, Cho’s (1988) definition of allocative efficiency as a reduction in the variation in borrowing costs is almost tautological, as this variation naturally decreases when governments eliminate directed credit and interest rate controls. More importantly, even if all firms faced identical borrowing costs, the allocation of capital would still not be efficient if access to credit were determined by noneconomic factors. Galindo, Schiantarelli, and Weiss (2007) use a more sophisticated definition and argue that, if capital is allocated more efficiently after financial liberalization, more capital should flow to firms with a higher marginal product of capital. They test this hypothesis by assessing whether an investment-weighted average of ex post marginal returns increases relative to a naïve size-weighted average of ex post marginal returns. However, a problem with this definition is that, as they themselves note, “the marginal product of capital of a perfectly efficient economy would be the same in all firms. Consequently, random allocations of capital would do as well as any other allocation” (p. 12). In other words, in a perfectly efficient economy, the investment-weighted average should be equal to the size-weighted average. But this implies that the ratio of investment-weighted to size-weighted average ex post marginal returns should converge to one, not diverge away from one, which is the case for several countries in their sample. Moreover, although it is correct that ex ante (expected) marginal returns should be equal across firms in equilibrium, the effect of financial liberalization on the ex post (realized) marginal returns is uncertain. As Obstfeld (1994) suggests, the improved availability of risk insurance may

---

3 Bekaert and Harvey (2000) find that the average firm-level cost of capital declines in many emerging market economies after the opening of equity markets for foreign investors.
4 Wurgler (2000) finds that in countries with deeper financial sectors (but perhaps without liberalization), capital is better allocated in the sense that it tends to flow to growing industries. However, this is not necessarily evidence of a quality effect, because governments can artificially stimulate growth in certain industries using directed credit and differential interest rates.
5 They proxy ex post marginal returns by the sales-to-capital ratio and the operating-profits-to-capital ratio, under the assumption of a constant-returns-to-scale technology.
lead firms to adopt higher-risk, higher-return projects, thus creating a larger dispersion of ex post returns.\(^6\)

The rest of the chapter is organized as follows. Section 12.2 presents a simple model that explains our rationale for using Q-dispersion as our measure of variation in expected marginal returns. Section 12.3 discusses data sources and a simple bivariate analysis. Section 12.4 presents regression results and robustness checks and Section 12.5 concludes.

### 12.2. Financial Liberalization and Q-Dispersion: Theory and Measurement

We incorporate the classical Marshallian view that each firm has an optimal, industry-specific operating size. We thus write the profit function for a firm at time \(t\) as follows:

\[
\pi(K_t, L_t) = f(K_t, L_t) - wL_t - \phi(I_t) - RK_t,
\]

with a standard law of motion for capital:

\[
K_t = (1 - \delta)K_{t-1} + I_t,
\]

where \(K\) denotes capital, \(L\) denotes labor, \(w\) is the real market wage, \(I\) is investment, and \(R\) is the gross interest rate. The function \(f\) is a constant-returns-to-scale (CRS) production function with partial derivatives \(f_1 > 0, f_2 > 0, f_{11} < 0, f_{22} < 0, \text{ and } f_{12} > 0\). The function \(\phi(I)\) measures the adjustment cost of investment, and satisfies \(\phi' > 0\) and \(\phi'' > 0\).\(^7\)

Profit maximization gives the unique steady state optimal policy \((K^*, I^*, L^*)\) by

\[
f_1 (K^*, L^*) - \phi'(I^*) = R, \quad (3)
\]

\[
f_2 (K^*, L^*) = w, \quad \text{ and } \quad (4)
\]

\[
\delta K^* = I^*. \quad (5)
\]

Also, the transition path of \((K, L)\) to the steady state is uniquely determined.\(^8\)

In a fully liberalized financial sector, each firm faces the market interest rate, \(R\), implying that the marginal returns to capital, given by (3), are equal across

---

\(^6\) A related strand of the literature has analyzed the effect of financial liberalization on firm-level credit constraints (e.g., Laeven, 2003, Love, 2003, and Sancak, 2002). However, from a general equilibrium perspective, Gomes (2001) argues that investment regressions on cash flows may not provide meaningful measures of credit constraints both with and without Tobin’s Q as a control variable for potential growth opportunities. Tobin’s Q itself is affected by the presence of credit constraints so that it should not be used as a control variable; however, without controlling for Tobin’s Q, there will be an omitted variable bias, as unobserved productivity shocks (e.g., growth opportunities) affect both cash flow and investment. Our approach is based on a general equilibrium framework and is not subject to Gomes’s critique. Moreover, our approach, by looking at Q-dispersion, accounts for the effects of liberalization not just on credit-constrained firms but also on overinvesting (e.g., privileged) firms.

\(^7\) Allowing for the presence of low fixed-adjustment costs would not change the results.

\(^8\) We assume, for now, that these adjustments are quick (i.e., can be completed within a year) so that the steady state values can be approximated with annual data. We relax this assumption in Section 12.4.
firms. However, in a repressed financial sector, governments may impose price controls (e.g., interest rate floors or ceilings) or quantity controls (e.g., directed credit) and both controls generate a variation in marginal returns across firms. Consider the case where a government controls interest rates and applies different rates to different firms. As is clear from (3), the variation in interest rates faced by firms generates variation in returns across firms. Alternatively, consider the case where interest rates are equal, but the investment amount $I$ is determined by the government—either directly, via control of firms’ investment plans, or indirectly, via credit allocation. Let us denote this amount by $\hat{I}$. In this case, firms maximize their profit function (1) subject to (2) and the additional constraint $I = \hat{I}$. Letting $\lambda$ denote the Lagrange multiplier associated with this constraint, the capital market condition (3) can then be rewritten as

$$f_1(K^{**}, L^{**}) - \phi'(\hat{I}) = R + \lambda. \quad (3')$$

If firms are constrained with respect to the amount they can invest ($\hat{I} < I^*$), $\lambda$ is positive. Conversely, if firms overinvest ($\hat{I} > I^*$), as may happen, for example, when a government identifies specific industries for development or employment objectives, $\lambda$ becomes negative.

Elimination of government controls leads to smaller variation of marginal returns, as the market reallocates credit from the overinvesting firms to underinvesting firms. This analysis can be generalized to a stochastic case, where the real wage, the interest rate, and productivity are allowed to vary over time. In this case, our predictions apply to the ex ante, expected marginal returns to capital, rather than the ex post, realized marginal returns. As previously noted, the dispersion in ex post marginal returns may actually increase after liberalization, if a better financial system leads firms to select higher-risk, higher-return projects (Obstfeld, 1994).

An imperfect but nevertheless frequently used measure of expected marginal returns to capital is Tobin’s Q, which measures the discounted sum of expected future profits per asset. More precisely, the numerator of Tobin’s Q is the market value of its equity and debt, whereas the denominator is the replacement costs of tangible and intangible assets. It should equal unity in perfectly functioning markets and in the absence of measurement errors. We construct our measure of Tobin’s Q by making four approximations that are common in the literature. First, even though marginal Q (the ratio of the increment of market valuation to the cost of the associated investment) provides the best estimate of the expected marginal return to capital (Hayashi, 1982), data constraints require us to proxy

---

9 For a more thorough discussion of this case, see Appendix I of Abiad, Oomes, and Ueda (2007). The prediction would also follow from more complicated models with informational problems. That is, even with informational problems, the variation in marginal returns before financial liberalization would still reflect an inefficient allocation of capital, to the extent that governments allocate capital based on considerations beyond marginal productivity.

10 If the market valuation per unit of capital is different from the replacement cost of a unit of capital, firms have an incentive to adjust capital stock instantly. This discrepancy may also be quickly arbitraged away by investment firms looking for mergers or acquisitions (Jovanovic and Rousseau, 2002).
marginal Q by average Q. Second, because data on nontangible assets are not available, we follow the convention of using only tangible assets in the denominator (e.g., Blanchard, Rhee, and Summers, 1993; Bond and Cummins, 2001; and Chari and Henry, 2003). Third, data constraints require the use of book value rather than market value of debt. Fourth, in the absence of data on the replacement cost of tangible assets, we approximate replacement costs by adjusting book values for cumulative inflation.

We attempt to correct for measurement errors (i.e., proxying marginal Q with average Q) and other factors that may affect the Q-dispersion by adjusting our estimates of Q for industry, age, and leverage effects. We adjust for industry effects to correct for the disparity between marginal and average Q that can arise from industry-specific production or adjustment cost functions—we thus focus on intra-industry allocation of capital. In addition, controlling for industry effects allows us to correct for differences in Tobin’s Q because of differences in wages across industries. We also adjust for differences in the age of firms to correct for the fact that firms of different ages have different vintages of machines and factories. Controlling for age also allows us to correct for the possibility that younger firms may not yet be correctly valued in the stock market, as well as any measurement errors in estimating capital stock resulting from accumulated differences in consumer-goods and investment-goods prices. Finally, there may be measurement error stemming from underinvestment as a result of debt overhang (Hennessy, 2004). Specifically, if high leverage increases default probability, a firm’s managers (who are assumed to represent equity holders) will invest less than is optimal because the firm may be taken over by creditors in the event of default. This creates an additional discrepancy between the observed average Q and the true marginal Q. Because the default probability may also be affected by liberalization, unlike the other sources of measurement error, the debt overhang problem may change the variance of the measurement errors systematically before and after the liberalization.

11 Although there is a standard approach to convert book values of debt to market values (Blanchard, Rhee, and Summers, 1993), this cannot be applied in our case because data on corporate bond rates are not available for the relevant time period. According to Chari and Henry (2003), estimating the market value of debt would require further assumptions about unobservable corporate bond rates, which may be a cure worse than the ailment.

12 Specifically, if $K_t$ is the reported value of tangible assets in year $t$, the inflation-adjusted value of tangible assets is given by $K_t + (1 - \delta) \cdot K_{t-1} \cdot (1 + \pi_t)$, where $\delta = 0.05$ is an assumed depreciation rate and $\pi_t$ is the inflation rate. Here, we eliminate any additional measurement errors arising from inflation rate through different investment levels each year among firms, though we cannot correct the measurement errors in valuation at the initial year. As long as we look at changes in Q-dispersion, the initial measurement errors will not create any problem in panel regressions. All our empirical results hold when we do not adjust for inflation.

13 We ignore possible differences arising from patent holdings, because our focus is on developing countries, whereas most blueprints are produced by firms in industrial countries. Also, we ignore often observed, potentially bigger distortion of government interventions at industry level.

14 Although it is common to also control for firm size, this is not appropriate in our case because, according to our model, the firm size distribution depends directly on the extent to which financial sectors are liberalized.

15 We thank a referee for pointing this out.
In order to control for industry, age, and debt overhang effects, we run the following regression for each country and year:

\[ q_h = \sum_{j=1}^{J} \xi_j \cdot Industry_{bj} + \varphi_1 \cdot Age_h + \varphi_2 \cdot \frac{\text{Liability}_h}{\text{Asset}_h} + \varphi_3 \left( \frac{\text{Liability}_h}{\text{Asset}_h} \right)^2 + e_h, \]  

(6)

where \( q_h \) is the logarithm of Q for firm \( h = 1, \ldots, H \), \( Age_h \) is the difference between the current year and the year of establishment\(^{17} \) of firm \( h \), and \( Industry_{bj} \) is the binary variable, taking a value of 1 if firm \( h \) belongs to industry \( j \), and a value of 0 otherwise.\(^{18} \) Both the linear and squared terms of the liability-asset ratio are included to allow for the possibility that the default probability increases non-linearly with the leverage ratio.

Running this regression gives us a residual, \( e_h \), which captures the component of \( q_h \) that is unexplained by the age, industry, and leverage effects,\(^{19} \) and we construct an adjusted measure of Q for each firm:

\[ \hat{q}_h = \text{mean}(q_h) + e_h = \left( \frac{1}{H} \sum_{h=1}^{H} q_h \right) + e_h. \]  

(7)

Although it is unlikely that all the measurement errors of Tobin’s Q are eliminated, a change in our measured Q-dispersion will reflect a change in dispersion of true marginal product of capital so long as the distribution of any remaining measurement error is uncorrelated with financial liberalization.

Finally, we calculate the dispersion in \( \hat{q}_h \) by using four inequality measures: the Gini coefficient, mean logarithm of deviations, Theil index, and the coefficient of variation. A comparison of these is useful because each index has different sensitivities to different ranges of the distribution. In particular, the Gini coefficient is most sensitive to changes in \( \hat{q}_h \) around the mean; the mean log deviation is most sensitive to changes in \( \hat{q}_h \) at the bottom of the distribution; the coefficient of variation is most sensitive to changes at the top end of the distribution; and the Theil index has constant sensitivity across the range of the distribution. The precise definitions of the four inequality indices are given in Appendix II of Abiad, Oomes, and Ueda (2007).

12.3. DATA DESCRIPTION AND BIVARIATE ANALYSIS

Our measure of financial liberalization, described in detail in Abiad and Mody (2005), captures the various facets and gradations of financial reform. Specifically,

---

\(^{16}\) We use the logarithm rather than the level of Q, because given a concave production function, the distribution of log(Q) better reflects the underlying distribution of capital than the distribution of Q itself. Indeed, in our data set, the distribution of Q itself is skewed to the right, whereas the distribution of the logarithm of Q is close to normal.

\(^{17}\) In the absence of data on the year of establishment for Thai firms, we measure their age as the difference between the current year and the year in which the firm was first listed at the Thai stock exchange.

\(^{18}\) We use 2-digit ISIC (rev. 2) classifications.

\(^{19}\) As the first-stage regressions are run for each country and each year, we do not report the results here.
The financial liberalization index takes as inputs the following six policy dimensions: credit controls, including directed credit toward favored sectors or industries, ceilings on credit toward other sectors, and excessively high reserve requirements; interest rate controls, including cases where the government directly controls interest rates or where floors, ceilings, or interest rate bands exist; entry barriers, including licensing requirements, limits to the participation of foreign banks, and restrictions relating to bank specialization or the establishment of universal banks; regulations, including operational restrictions (e.g., on staffing, branching, and advertising) which are considered repression, as well as prudential regulations, which are considered reforms; state ownership in the financial sector; and restrictions on international financial transactions, including restrictions on capital and current account convertibility, and the use of multiple exchange rates. 20

To compute Tobin’s Q, we use firm-level data from the International Finance Corporation’s (IFC) Corporate Finance Database, which is unique in that it covers emerging markets for most of the 1980s, during which much of the financial liberalization took place. From the original set of countries in the database, we eliminated countries that experienced hyperinflation, as this introduces large errors in balance sheet data. We also eliminated countries with insufficient time coverage, particularly around the period of financial liberalization. Third, we dropped countries that lacked the data required to compute Tobin’s Q or our control variables. Finally, we dropped country-years with fewer than 10 firms. This left us with five countries: India, Jordan, Korea, Malaysia, and Thailand—the same five countries used by Chari and Henry (2003) for evaluating the impact of capital market liberalization. The data coverage for each country is summarized in Table 12.1. 21

The fact that the IFC database only includes large publicly listed firms, creates a bias against detecting a positive effect of liberalization on allocative efficiency and, therefore, would strengthen any finding of such a positive effect. Large firms are more likely to be well connected and less likely to be financially constrained, even under financial repression. Hence, if we observe a decrease in Q-dispersion even among these large firms, then the efficiency gains are likely to be even larger if one could measure Q-dispersion across firms of all sizes. Another advantage of focusing on publicly listed firms is that information on the activities of these firms is easy for investors to obtain, and therefore informational problems should be smaller.

20 In the theoretical analysis, we considered only the cases of credit control and interest control. However, the analysis can be easily extended to other areas of financial liberalization listed here. State ownership can be viewed as a more direct method of price and quantity control. Restrictions on international transactions can be viewed as intended to preserve effectiveness of the state control over the domestic financial system. Entry barriers may protect the monopolistic power of existing banks, possibly resulting in price and quantity distortions. Operational regulations can be viewed as a way to protect the existing system of allocating capital.

21 We used slightly fewer observations than mentioned in Table 12.1 because of the need to remove some outliers. We eliminated outliers by first taking the logarithm of Q, the distribution of which is close to normal, and then removing all observations further than three standard deviations from the mean. Our results were robust to using different procedures for removing outliers (e.g., excluding all observations with Q > 50 before calculating the standard deviations).
The unbalanced sample also biases us against finding a decrease in Q-dispersion. A balanced sample contains only those firms that survived throughout the sample period; hence, biasing the sample toward firms that did not face financing constraints over sample periods. Using an unbalanced sample should eliminate this bias. And although financial liberalization may allow more marginal firms with severe credit constraints to enter the market, a better functioning financial system should decrease Q-dispersion even in the presence of new entrants. 22

Let us now compare Q-dispersion before and after financial liberalization, using the liberalization dates specified by Demirgüç-Kunt and Detragiache (2001), which are based solely on interest rate liberalization. The liberalization dates are 1991 for India, 1988 for Jordan, 1984 for Korea, 1987 for Malaysia, 23 and 1989 for Thailand. The results are supportive of a quality effect: in all cases, Q-dispersion declined following financial liberalization, although the degree of decline varied across countries. As Figure 12.1 shows, efficiency increased most strongly in Jordan and India. The Gini coefficient for Jordan, for example, dropped by 41 percent, whereas in India it decreased by 19 percent. Interestingly, the East Asian countries in our sample showed smaller gains following financial liberalization, with the Gini coefficient decreasing by 11 percent in Malaysia, 7 percent in Thailand, and by only 2 percent in Korea. The other dispersion measures show the same tendency.

TABLE 12.1
International Finance Corporation (IFC) Corporate Financial Database Coverage (Number of firms per year)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
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<td>64</td>
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<td>79</td>
<td>85</td>
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<td>83</td>
<td>78</td>
</tr>
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<td>24</td>
<td>30</td>
<td>32</td>
<td>33</td>
<td>33</td>
<td>35</td>
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<tr>
<td>Korea</td>
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<td>89</td>
<td>90</td>
<td>87</td>
<td>90</td>
<td>89</td>
<td>88</td>
<td>89</td>
</tr>
<tr>
<td>Malaysia</td>
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<td>90</td>
<td>93</td>
<td>94</td>
<td>94</td>
<td>94</td>
<td>96</td>
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<tr>
<td>Thailand</td>
<td>33</td>
<td>36</td>
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<td>47</td>
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<td>196</td>
<td>283</td>
<td>331</td>
<td>336</td>
<td>338</td>
<td>343</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
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<td>79</td>
<td>84</td>
<td>79</td>
<td>75</td>
<td>75</td>
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<tr>
<td>Jordan</td>
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<td>33</td>
<td>31</td>
<td>33</td>
<td>32</td>
<td>31</td>
<td>31</td>
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<tr>
<td>Korea</td>
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<td>87</td>
<td>84</td>
<td>84</td>
<td>73</td>
<td>74</td>
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<tr>
<td>Malaysia</td>
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<td>87</td>
<td>94</td>
<td>87</td>
<td>89</td>
<td>91</td>
<td>88</td>
</tr>
<tr>
<td>Thailand</td>
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<td>62</td>
<td>61</td>
<td>60</td>
<td>57</td>
<td>58</td>
</tr>
<tr>
<td>Total</td>
<td>329</td>
<td>348</td>
<td>358</td>
<td>344</td>
<td>340</td>
<td>252</td>
<td>251</td>
</tr>
</tbody>
</table>

22 When more heterogeneous firms in production and cost functions enter after the liberalization, a possible increase in Q-dispersion could happen only if the technology is linear and heterogeneous across firms (e.g., $y_i = A_k k_i$). However, as we assume, with more standard production function with decreasing marginal product of capital, the dispersion in marginal product of capital must decline by more flexible adjustment of the size of capital, even with potentially more heterogeneous firms in total factor productivity (e.g., $y_i = A_k k_i f_i^{-1}$). Heterogeneity in the cost side can be similarly analyzed.

23 Interest rate decontrol in Malaysia occurred in October 1978, which predates both Demirgüç-Kunt and Detragiache’s sample and ours. However, Malaysia reimposed controls in 1985 before liberalizing them again in 1987.
The Quality Effect: Does Financial Liberalization Improve the Allocation of Capital?

Source: Authors’ calculations.

**Figure 12.1** Dispersion measures, pre- and postliberalization.
12.4. PANEL REGRESSIONS

12.4.1. Fixed Effects Regressions

In this section we employ both time and cross-country dimensions of the data on Q-dispersion and financial liberalization, and control for other factors that can influence the variation in expected returns. Our benchmark equation is as follows:

\[ D_{it} = \alpha_i + \beta FLI_{it-1} + \gamma X_{it} + \varepsilon_{it}, \]  

where \( i \) denotes country and \( t \) denotes time; \( D_{it} \) denotes Q-dispersion, \( FLI_{it-1} \) the financial liberalization index with one year lag, \( X_{it} \) the vector of control variables, and \( \varepsilon_{it} \) the error term. Our hypothesis is that \( \beta \) is negative.

There are two obvious candidates that should be included in the set of control variables. The first is the ratio of stock market turnover to market capitalization, a measure of stock market liquidity. Although we have thus far assumed that markets are pricing stocks efficiently, it is not uncommon for stock prices to deviate from fundamentals, especially in thin markets typically observed in developing countries and emerging markets. At any point in time, this deviation creates an additional source of Q-dispersion across firms that does not reflect the underlying capital allocation. Hence, we need to distinguish this source of dispersion from the dispersion caused by improved efficiency in capital allocation for each country and each year.

The second one is trade openness, the ratio of the sum of exports and imports to GDP. Exports and imports are directly affected by product market reforms that involve price or quantity restrictions on goods and services. As such, trade openness acts as a proxy for other reforms that may affect Q-dispersion through effects on firms’ profitability.

Table 12.2 reports the fixed-effect panel regression results, which shows that the coefficient on financial liberalization is negative and highly significant. This result is robust to using different measures of dispersion. Note that the effect of stock market liquidity is negative as predicted and is generally significant. In addition, the effect of trade openness is negative and is almost always significant.

Now we try to separate the effects of financial liberalization and financial deepening, by including two different measures of financial deepening (FD) typically used in the literature. The first is bank credit to the private sector relative to GDP, an indicator of the depth of the banking sector, and the second is stock market capitalization relative to GDP, an indicator of stock market development. Data for these indicators (as well as for stock market turnover) were taken from Beck, Demirgüç-Kunt, and Levine (2000). The regression is now expressed as

\[ D_{it} = \alpha_i + \beta FLI_{it-1} + \gamma X_{it} + \delta FD_{it} + \varepsilon_{it}. \]

Table 12.3 presents these regression results, with one panel for each inequality measure. When the financial liberalization index and the two financial deepening indicators are included separately in the regressions (columns 1 through 3), financial liberalization is always correctly signed (negative) and strongly significant.

---

24 We use the lagged index of financial liberalization, because of timing—some balance sheet information at the end of the firm-specific fiscal year may be dated before a regulatory change within a calendar year. We obtained similar results using the contemporaneous financial liberalization index.
### TABLE 12.2

Fixed Effects Regressions

<table>
<thead>
<tr>
<th></th>
<th>Fixed Effects</th>
<th></th>
<th></th>
<th></th>
<th>Memo: Random Effects</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Liberalization (t−1)</td>
<td>−0.199</td>
<td>−0.419</td>
<td>−0.911</td>
<td>−0.398</td>
<td>−0.059</td>
<td>−0.1432</td>
<td>−0.5354</td>
<td>−0.1259</td>
</tr>
<tr>
<td></td>
<td>[4.98]***</td>
<td>[5.02]***</td>
<td>[4.78]***</td>
<td>[5.03]***</td>
<td>[1.48]</td>
<td>[1.77]*</td>
<td>[3.40]***</td>
<td>[1.58]</td>
</tr>
<tr>
<td>Stock Market Turnover</td>
<td>−0.084</td>
<td>−0.177</td>
<td>−0.272</td>
<td>−0.154</td>
<td>−0.1041</td>
<td>−0.218</td>
<td>−0.3576</td>
<td>−0.2072</td>
</tr>
<tr>
<td>Trade Openness</td>
<td>−0.403</td>
<td>−0.755</td>
<td>−0.816</td>
<td>−0.876</td>
<td>−0.0219</td>
<td>−0.0487</td>
<td>0.0424</td>
<td>−0.0511</td>
</tr>
<tr>
<td></td>
<td>[3.35]***</td>
<td>[2.99]***</td>
<td>[1.42]</td>
<td>[3.67]***</td>
<td>[0.46]</td>
<td>[0.50]</td>
<td>[0.22]</td>
<td>[0.54]</td>
</tr>
<tr>
<td>Observations</td>
<td>65</td>
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<td>65</td>
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<td>65</td>
<td>65</td>
</tr>
<tr>
<td>Number of countries</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.57</td>
<td>0.56</td>
<td>0.43</td>
<td>0.58</td>
<td>0.31</td>
<td>0.35</td>
<td>0.43</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Absolute value of t statistics in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

In the Hausman Test of FE vs. RE, the null hypothesis is that the Random Effects model is valid.
TABLE 12.3  
Fixed Effects Regressions With Financial Deepening Indicators

<table>
<thead>
<tr>
<th></th>
<th>Gini Coefficient</th>
<th>Theil Index</th>
<th>Mean Log Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variable:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial Liberalization</td>
<td>$-0.199^{***}$</td>
<td>$-0.419^{***}$</td>
<td>$-0.911^{***}$</td>
</tr>
<tr>
<td></td>
<td>[4.98]</td>
<td>[5.02]</td>
<td>[4.78]</td>
</tr>
<tr>
<td>Private Credit</td>
<td>0.103</td>
<td>0.214</td>
<td>0.765</td>
</tr>
<tr>
<td></td>
<td>[0.91]</td>
<td>[0.90]</td>
<td>[1.44]</td>
</tr>
<tr>
<td>Stock Market Capitalization</td>
<td>$-0.011$</td>
<td>$-0.032$</td>
<td>$-0.119$</td>
</tr>
<tr>
<td></td>
<td>[0.33]</td>
<td>[0.47]</td>
<td>[0.78]</td>
</tr>
<tr>
<td>Stock Market Turnover</td>
<td>$-0.084^{***}$</td>
<td>$-0.177^{***}$</td>
<td>$-0.272^{*}$</td>
</tr>
<tr>
<td></td>
<td>[2.79]</td>
<td>[2.81]</td>
<td>[1.89]</td>
</tr>
<tr>
<td>Trade Openness</td>
<td>$-0.403^{***}$</td>
<td>$-0.755^{***}$</td>
<td>$-0.816^{*}$</td>
</tr>
<tr>
<td></td>
<td>[3.35]</td>
<td>[2.99]</td>
<td>[1.42]</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>65</td>
<td>65</td>
<td>65</td>
</tr>
<tr>
<td><strong>Number of countries</strong></td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>R-squared</strong></td>
<td>0.57</td>
<td>0.56</td>
<td>0.43</td>
</tr>
</tbody>
</table>

Absolute value of t statistics in brackets.  
* significant at 10%; ** significant at 5%; *** significant at 1%.
The valuation effect, measured by stock market turnover, is also correctly signed (negative) and significant in almost all cases. However, the two financial deepening indicators are insignificant. When liberalization is combined with the two financial deepening indicators (columns 4 through 6), financial liberalization remains strongly significant and correctly signed. Surprisingly, private credit now becomes significant, but with a positive sign, implying that private credit expansion without financial liberalization worsens the efficiency of capital allocation. Although stock market capitalization alone with financial liberalization also shows a positive sign, it is not significant when private credit is also added as a regressor (column 6). This is consistent with our view that capital allocation through credit is distorted under financial repression, and that credit booms without sufficient liberalization may harm an economy.

12.4.2. Allowing for Adjustment Lags

So far, we have assumed that the adjustment is quick and the capital level is adjusted to the optimal level within one year after the policy change. If adjustment is slower, however, Q-dispersion may improve gradually over a few years. In this case, the current Q-dispersion should also be explained partially by the lagged values of Q-dispersion. To take this slow adjustment into account, the test equation needs to be revised to

\[
D_t = \alpha_i + \beta FLI_{t-1} + \gamma X_i + \delta FD_t + \phi D_{t-1} + \varepsilon_t
\]  

To estimate this revised test equation, we conduct a GMM dynamic panel estimation following Arellano and Bond (1991). Our main results are unchanged for this specification. Table 12.4 shows that the coefficient on

\[\text{TABLE 12.3} \]

Fixed Effects Regressions With Financial Deepening Indicators (Continued)

<table>
<thead>
<tr>
<th>Dependent Variable: Squared Coefficient of Variation</th>
<th>Financial Liberalization (t−1)</th>
<th>Private Credit</th>
<th>Stock Market Capitalization</th>
<th>Stock Market Turnover</th>
<th>Trade Openness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>−0.398 (5.03)***</td>
<td>0.182 (0.80)</td>
<td>−0.030 (0.46)</td>
<td>−0.154 (2.58)**</td>
<td>−0.876 (3.67)***</td>
</tr>
<tr>
<td></td>
<td>−0.506 (6.48)***</td>
<td>0.674 (3.58)***</td>
<td>0.163 (2.71)***</td>
<td>−0.202 (2.41)**</td>
<td>−1.194 (4.34)***</td>
</tr>
<tr>
<td></td>
<td>−0.522 (5.94)***</td>
<td>0.544 (2.52)**</td>
<td>0.080 (1.21)</td>
<td>−0.225 (3.90)***</td>
<td>−1.153 (3.84)***</td>
</tr>
<tr>
<td></td>
<td>−0.546 (6.46)***</td>
<td>0.544 (2.52)**</td>
<td>−0.224 (3.12)***</td>
<td>−0.179 (3.89)**</td>
<td>−0.733 (4.51)***</td>
</tr>
</tbody>
</table>

Observations 65 66 66 65 65 65
Number of countries 5 5 5 5 5 5
R-squared 0.58 0.40 0.39 0.66 0.63 0.67

Absolute value of t statistics in brackets.
* significant at 10%; ** significant at 5%; *** significant at 1%.

The valuation effect, measured by stock market turnover, is also correctly signed (negative) and significant in almost all cases. However, the two financial deepening indicators are insignificant.

When liberalization is combined with the two financial deepening indicators (columns 4 through 6), financial liberalization remains strongly significant and correctly signed. Surprisingly, private credit now becomes significant, but with a positive sign, implying that private credit expansion without financial liberalization worsens the efficiency of capital allocation. Although stock market capitalization alone with financial liberalization also shows a positive sign, it is not significant when private credit is also added as a regressor (column 6). This is consistent with our view that capital allocation through credit is distorted under financial repression, and that credit booms without sufficient liberalization may harm an economy.

25This estimation takes the first difference of the test equation and then applies GMM using instrumental variables, which are based on lagged dependent and independent variables. Specification tests reject the null hypothesis of second-order serial correlation, and the Sargan test does not reject the validity of the overidentifying restrictions. As such, the Arellano-Bond estimation of equation (10) is valid.
### TABLE 12.4

#### Arellano-Bond Dynamic Panel Regressions

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Financial Liberalization (t – 1)</th>
<th>Private Credit</th>
<th>Stock Market Capitalization</th>
<th>Stock Market Turnover</th>
<th>Trade Openness</th>
<th>Lagged Dependent Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.189 (3.15)**</td>
<td>0.255 (1.84)*</td>
<td>0.102 (1.74)*</td>
<td>-0.077 (2.35)**</td>
<td>-0.243 (1.93)*</td>
<td>0.498 (11.23)**</td>
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<tr>
<td></td>
<td>0.199 (3.35)**</td>
<td>0.284 (1.95)*</td>
<td>0.092 (1.70)*</td>
<td>-0.076 (2.32)**</td>
<td>-0.158 (1.78)*</td>
<td>0.506 (11.86)**</td>
</tr>
<tr>
<td></td>
<td>0.178 (3.23)**</td>
<td>0.215 (1.97)**</td>
<td></td>
<td>-0.054 (1.91)**</td>
<td>-0.327 (3.61)*</td>
<td>0.511 (6.91)**</td>
</tr>
<tr>
<td></td>
<td>0.188 (3.75)**</td>
<td></td>
<td></td>
<td>-0.094 (3.00)**</td>
<td>-0.161 (1.84)*</td>
<td>0.448 (7.83)**</td>
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<td></td>
<td>-0.070 (2.64)**</td>
<td>-0.328 (5.83)*</td>
<td>0.467 (5.37)**</td>
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<td>-0.084 (3.39)**</td>
<td></td>
<td>0.436 (4.84)**</td>
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<td>0.42</td>
<td>0.36</td>
<td>0.46</td>
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<td>0.44</td>
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<tr>
<td>Sargan test statistic (p-value):</td>
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<td>0.99</td>
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</tbody>
</table>

Robust t statistics in brackets.

* significant at 10%; ** significant at 5%; *** significant at 1%.

### Dependent Variable: Theil Index

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Financial Liberalization (t – 1)</th>
<th>Private Credit</th>
<th>Stock Market Capitalization</th>
<th>Stock Market Turnover</th>
<th>Trade Openness</th>
<th>Lagged Dependent Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-0.389 (3.33)**</td>
<td>0.565 (2.21)**</td>
<td>0.210 (1.75)*</td>
<td>-0.167 (2.52)**</td>
<td>-0.481 (1.76)*</td>
<td>0.454 (7.62)**</td>
</tr>
<tr>
<td></td>
<td>-0.412 (3.61)**</td>
<td>0.632 (2.27)**</td>
<td>0.191 (1.71)*</td>
<td>-0.120 (2.10)**</td>
<td>-0.294 (1.63)*</td>
<td>0.458 (11.08)**</td>
</tr>
<tr>
<td></td>
<td>-0.367 (3.35)**</td>
<td></td>
<td></td>
<td>-0.205 (2.33)**</td>
<td>-0.650 (3.78)**</td>
<td>0.471 (5.50)**</td>
</tr>
<tr>
<td></td>
<td>-0.390 (4.02)**</td>
<td></td>
<td></td>
<td>-0.152 (2.87)**</td>
<td>-0.656 (1.64)**</td>
<td>0.394 (5.92)**</td>
</tr>
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<td>0.94</td>
<td>0.97</td>
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<td>0.53</td>
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</tbody>
</table>

Robust t statistics in brackets.

* significant at 10%; ** significant at 5%; *** significant at 1%.

### Dependent Variable: Mean Log Deviations

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Financial Liberalization (t – 1)</th>
<th>Private Credit</th>
<th>Stock Market Capitalization</th>
<th>Stock Market Turnover</th>
<th>Trade Openness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-0.766 (4.14)**</td>
<td>2.481 (4.22)**</td>
<td>0.480 (2.25)**</td>
<td>-0.287 (1.67)*</td>
<td>-0.871 (0.96)</td>
</tr>
<tr>
<td></td>
<td>-0.886 (6.84)**</td>
<td>2.670 (4.11)**</td>
<td>0.439 (2.02)**</td>
<td>-0.365 (2.03)**</td>
<td>-0.201 (0.48)</td>
</tr>
<tr>
<td></td>
<td>-0.708 (3.18)**</td>
<td></td>
<td></td>
<td>-0.188 (1.19)</td>
<td>-1.245 (4.20)**</td>
</tr>
<tr>
<td></td>
<td>-0.851 (6.43)**</td>
<td></td>
<td></td>
<td>-0.446 (2.95)**</td>
<td>-1.197 (3.60)**</td>
</tr>
<tr>
<td>Observations</td>
<td>56</td>
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<td>56</td>
<td>56</td>
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<td>Number of countries</td>
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<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Second-order serial correlation (p-value):</td>
<td>0.76</td>
<td>0.94</td>
<td>0.97</td>
<td>0.52</td>
<td>0.69</td>
</tr>
</tbody>
</table>

Robust t statistics in brackets.

* significant at 10%; ** significant at 5%; *** significant at 1%.

(continued)
TABLE 12.4
Arelano-Bond Dynamic Panel Regressions (Concluded)

<table>
<thead>
<tr>
<th>Lagged Dependent Variable</th>
<th>Mean Log Deviations</th>
<th>Squared Coefficient of Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.069</td>
<td>−0.044</td>
</tr>
<tr>
<td></td>
<td>[0.55]</td>
<td>[0.41]</td>
</tr>
<tr>
<td></td>
<td>0.092</td>
<td>−0.114</td>
</tr>
<tr>
<td></td>
<td>[0.65]</td>
<td>[1.14]</td>
</tr>
<tr>
<td></td>
<td>0.049</td>
<td>−0.108</td>
</tr>
<tr>
<td></td>
<td>[0.37]</td>
<td>[0.98]</td>
</tr>
<tr>
<td>Observations</td>
<td>56</td>
<td>56</td>
</tr>
<tr>
<td>Number of countries</td>
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<td>5</td>
</tr>
<tr>
<td>Second-order serial correlation (p-value)</td>
<td>0.54</td>
<td>0.66</td>
</tr>
<tr>
<td>Sargan test statistic (p-value):</td>
<td>0.99</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Robust t statistics in brackets.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Dependent Variable: Mean Log Deviations

Financial Liberalization (t−1) | −0.385 | −0.403 | −0.363 | −0.382 |
|                              | [3.11]** | [3.33]** | [3.14]** | [3.60]** |
Private Credit                | 0.487   | 0.545   | 0.409   |
|                              | [2.00]** | [2.10]** |       |
Stock Market Capitalization   | 0.199   | 0.180   | 0.138   |
|                              | [1.77]*  | [1.75]*  | [1.42]  |
Stock Market Turnover         | −0.150  | −0.146  | −0.104  | −0.135  | −0.162  |
|                              | [2.42]** | [2.40]** | [1.99]** | [3.18]** | [2.80]** |
|                              | [1.77]** | [1.75]** |       |
Trade Openness                | −0.533  | −0.362  | −0.690  | −0.376  | −0.699  | −0.542  |
|                              | [2.40]** | [2.17]** |       |
Lagged Dependent Variable     | 0.494   | 0.511   | 0.514   | 0.449   | 0.466   | 0.439   |
|                              | [14.41]** | [14.12]** | [8.65]** | [10.01]** | [6.96]** |
|                              | [14.41]** | [14.12]** |       |
Observations                  | 56      | 56      | 56      | 56      | 56      | 56      |
Number of countries           | 5       | 5       | 5       | 5       | 5       | 5       |
Second-order serial correlation (p-value): | 0.18 | 0.22 | 0.18 | 0.20 | 0.17 | 0.19 |
Sargan test statistic (p-value): | 0.98 | 0.99 | 1.00 | 1.00 | 1.00 | 1.00 |

financial liberalization remains correctly signed in all the regressions and is statistically significant. Stock market turnover is also correctly signed and significant. Private credit is wrongly signed and often significant. As before, stock market capitalization is significant on its own but is not significant when also controlling for private credit.

We also explored interactions between financial liberalization and financial deepening to allow for the possibility of nonlinear effects. In particular, we tested whether both financial liberalization and financial deepening are required to realize a significant improvement in allocative efficiency. Including these interactions, however, produced no interesting results.

12.4.3. Different Aspects of Financial Liberalization

Different components of financial liberalization may have different effects on Q-dispersion. To find out whether the results are driven by a specific type of financial liberalization, we ran the regressions with each of the six subcompo-
ponents of the financial liberalization index. High correlations precluded the inclusion of all six at once, so the subcomponents are tried one at a time, with the other five components aggregated into a separate control (to avoid omitted variable bias).

Table 12.5 shows that each component is always correctly signed and often significant, even when controlling for the aggregate of the five other components, implying that all of the components seem to be associated with improved allocative efficiency. Specifically, interest rate liberalization and changes in regulations (both operational and prudential) are always significant, whereas removal of credit controls and liberalization of the capital account are significant for three of the four dispersion measures. Bank privatization and entry barriers seem to matter least for allocative efficiency, being significant for only two out of the four dispersion measures. Moreover, the package of reforms also appears important, as the coefficient on the aggregate of five other components is always correctly signed and statistically significant in most cases.

12.4.4. Other Robustness Checks

We conducted five robustness checks based on the Arellano-Bond regression specification.26 The first robustness check we conducted was to drop one country at a time, in order to investigate whether a single country was driving the results. This could have been the case because the sample contains only five countries, and Figure 12.1 seems to indicate that effects of financial liberalization were stronger in some countries than in others. We found, however, that our results held up in all cases.

As a second robustness check, we included a crisis dummy variable in our regressions to control for potential temporary effects on Q-dispersion. The crisis dummy was set equal to one if the country had experienced a currency crisis or banking crisis, based on the crisis database of Bordo and others (2001). Theoretically, the effect of a currency or banking crisis on allocative efficiency is unclear. The coefficient on the crisis dummy was found to be positive, suggesting that crises widen the variation in returns. However, the signs are almost always insignificant, and including the crisis dummy does not change any of our main results.

Third, we tried interacting the financial liberalization index with country dummies, i.e., allowing the coefficient on financial liberalization to vary across countries; however, this did not generate any interesting patterns either. The financial liberalization coefficient for India (which we used as the uninteracted coefficient) was negative but insignificant; the coefficient for Jordan was significantly more negative than for India; the coefficients for Korea and Malaysia were insignificantly more negative than for India; and the coefficient for Thailand was significantly more positive than for India.

26 These robustness results are not reported but are available from the authors.
<table>
<thead>
<tr>
<th>FLI Component (t−1)</th>
<th>Credit</th>
<th>Interest</th>
<th>Entry</th>
<th>Reg.</th>
<th>Priv.</th>
<th>Intl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.135</td>
<td>−0.338</td>
<td>−0.055</td>
<td>−0.109</td>
<td>−0.057</td>
<td>−0.085</td>
<td></td>
</tr>
<tr>
<td>[0.81]**</td>
<td></td>
<td>[2.08]**</td>
<td>[1.18]</td>
<td>[3.83]**</td>
<td>[0.89]</td>
<td></td>
</tr>
<tr>
<td>Remainder of FLI (t−1)</td>
<td>0.219</td>
<td>0.099</td>
<td>−0.398</td>
<td>−0.315</td>
<td>−0.466</td>
<td>−0.306</td>
</tr>
<tr>
<td>[1.25]</td>
<td></td>
<td>[5.31]**</td>
<td>[7.07]**</td>
<td>[6.03]**</td>
<td>[3.46]**</td>
<td>[1.31]</td>
</tr>
<tr>
<td>Trade Openness</td>
<td>0.327</td>
<td>0.266</td>
<td>−0.313</td>
<td>−0.289</td>
<td>−0.316</td>
<td>−0.331</td>
</tr>
<tr>
<td>Stock Market Turnover</td>
<td>−0.044</td>
<td>−0.064</td>
<td>−0.057</td>
<td>−0.063</td>
<td>−0.04</td>
<td></td>
</tr>
<tr>
<td>[2.27]**</td>
<td></td>
<td>[2.10]**</td>
<td>[3.06]**</td>
<td>[2.47]**</td>
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<td>0.394</td>
<td>0.429</td>
<td>0.39</td>
<td>0.434</td>
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<td>[5.52]**</td>
<td></td>
<td>[15.91]**</td>
<td>[3.82]**</td>
<td>[8.02]**</td>
<td>[36.18]**</td>
<td>[10.90]**</td>
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<td>4</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Robust t statistics in brackets.  
* significant at 10%; ** significant at 5%; *** significant at 1%.

### Dependent Variable: Mean Log Deviation

<table>
<thead>
<tr>
<th>FLI Component (t−1)</th>
<th>Credit</th>
<th>Interest</th>
<th>Entry</th>
<th>Reg.</th>
<th>Priv.</th>
<th>Intl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.28</td>
<td>−0.217</td>
<td>−0.134</td>
<td>−0.205</td>
<td>−0.141</td>
<td>−0.668</td>
<td></td>
</tr>
<tr>
<td>[0.68]**</td>
<td></td>
<td>[2.29]**</td>
<td>[7.82]**</td>
<td>[4.58]**</td>
<td>[1.00]</td>
<td></td>
</tr>
<tr>
<td>Remainder of FLI (t−1)</td>
<td>−0.504</td>
<td>−0.731</td>
<td>−0.84</td>
<td>−0.708</td>
<td>−0.951</td>
<td>−0.18</td>
</tr>
<tr>
<td>[1.39]</td>
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<td>[6.49]**</td>
<td>[1.46]</td>
<td>[5.83]**</td>
<td>[3.40]**</td>
<td>[1.34]</td>
</tr>
<tr>
<td>Trade Openness</td>
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<td>−0.543</td>
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<td>−0.661</td>
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<td>[4.74]**</td>
<td>[3.61]**</td>
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<td>Stock Market Turnover</td>
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</tbody>
</table>

Robust t statistics in brackets.  
* significant at 10%; ** significant at 5%; *** significant at 1%.

### Dependent Variable: Squared Coeff. of Variation

<table>
<thead>
<tr>
<th>FLI Component (t−1)</th>
<th>Credit</th>
<th>Interest</th>
<th>Entry</th>
<th>Reg.</th>
<th>Priv.</th>
<th>Intl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.273</td>
<td>−0.678</td>
<td>−0.789</td>
<td>−0.652</td>
<td>−0.92</td>
<td>−0.184</td>
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<td>[1.33]</td>
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<td>[4.75]**</td>
<td>[1.60]</td>
<td>[3.69]**</td>
<td>[3.29]**</td>
<td>[1.41]</td>
</tr>
<tr>
<td>Remainder of FLI (t−1)</td>
<td>−0.468</td>
<td>−0.207</td>
<td>−0.133</td>
<td>−0.212</td>
<td>−0.131</td>
<td>−0.623</td>
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<td></td>
<td>[2.10]**</td>
<td>[6.11]**</td>
<td>[5.55]**</td>
<td>[1.16]</td>
<td>[6.46]**</td>
</tr>
<tr>
<td>Trade Openness</td>
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<td>−0.571</td>
<td>−0.66</td>
<td>−0.616</td>
<td>−0.67</td>
<td>−0.699</td>
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<td>[3.51]**</td>
<td>[3.94]**</td>
<td>[3.81]**</td>
<td>[6.46]**</td>
<td>[4.01]**</td>
</tr>
<tr>
<td>Stock Market Turnover</td>
<td>−0.075</td>
<td>−0.112</td>
<td>−0.118</td>
<td>−0.101</td>
<td>−0.11</td>
<td>−0.067</td>
</tr>
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<td>0.355</td>
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<td>0.353</td>
<td>0.388</td>
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<td>[12.21]**</td>
<td>[10.90]**</td>
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<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Robust t statistics in brackets.  
* significant at 10%; ** significant at 5%; *** significant at 1%.
Fourth, when liberalizing the financial sector, a country might also improve closely related institutions such as law enforcement. Specifically, increased recovery of nonperforming loans implies a reduction of ex ante, equilibrium borrowing constraints (e.g., Albuquerque and Hopenhayn, 2004). Our regressions might pick up the effects of this potential omitted variable, so we added law enforcement measures from the International Country Risk Guide\(^\text{27}\) to our set of controls. None of these measures were significant, and their inclusion did not change the financial liberalization effect found previously.

Lastly, we repeated all regressions while controlling for three- or five-year cumulative inflation to eliminate any measurement errors in Tobin’s Q, possibly remaining even after adjusting for inflation when constructing capital stock estimates. There are two possible offsetting effects: on the one hand, across-the-board inflation “lifts all boats” and reduces inequality when measured in a log scale, though on the other hand, dispersion increases with heterogeneous inflation variation (in location and equipments), which in turn is likely correlated with across-the-board inflation. When we included inflation (the GDP deflator) in the regressions, we found that the coefficient on inflation was negative and occasionally significant, indicating that the first effect is stronger than the second. However, all key results remained the same.

12.5. CONCLUSION

Although recent studies have found little or no effect of liberalization on the level of savings and investment, we found robust evidence that liberalization is associated with improved efficiency in allocating capital. With a simple general equilibrium model, we predicted that financial liberalization, by equalizing access to credit, reduces the variation in expected returns across firms, which we measured by the dispersion in Tobin’s Q. In testing this prediction, we found that financial liberalization was negatively associated with Q-dispersion, and hence, positively associated with allocative efficiency. In other words, the benefits of liberalization appear to be realized mainly through its effect on the quality, not the quantity, of investment. In addition, we found that financial liberalization, rather than financial deepening, mattered the most for allocative efficiency. In fact, increasing private credit typically worsened efficiency, suggesting that credit growth without liberalization may lead to a misallocation of credit.

\(^{27}\) Specifically, we use “Law and Order,” “Investment Profile,” and “Repudiation (Risk) of Contracts by Government.” Measures of creditor rights from Djankov, McLiesh, and Shleifer (2007) were also considered, but show no variation for our countries over the sample period and hence get absorbed in the country fixed effect.
REFERENCES


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SECTION III

Policy Issues
13.1. INTRODUCTION

The link between monetary policy and asset price movements has been of perennial interest to policymakers. The 1920s stock market boom and 1929 crash and the 1980s Japanese asset bubble are two salient examples where asset price reversals were followed by protracted recessions and deflation. The key questions that arise from these episodes is whether the monetary authorities could have been more successful in preventing the consequences of an asset market bust or whether it was appropriate for the authorities to react to these events only ex post. This question is of keen interest today in the United States, as more and more observers wonder about the extent of the decline in the stock market, and as the only bright spot in the economy seems to be a still-ebullient housing market.

Should central banks respond only to inflation in the price of goods, or should they also respond to inflation in the price of assets? The main theme of this chapter is that this question should be thought of in terms of insurance. Restricting monetary policy in an asset market boom can be thought of as an insurance against the risk of real and financial disruption induced by a later bust. This insurance obviously does not come free: restricting monetary policy implies a sacrifice in terms of immediate macroeconomic objectives. However, letting the boom go unchecked entails the risk of even larger costs down the road. It is the task of the monetary authorities to assess the relative costs and benefits of a preemptive monetary restriction in an asset price boom.

This chapter is a slightly revised version of an article that appeared in International Finance, Vol. 5, No. 2 (2002): 139–64.

1 This chapter benefited from comments by conference participants (most notably Olivier Blanchard, our discussant) as well as an anonymous referee. It also benefited from comments by Ben Bernanke, Mark Gertler, Charles Goodhart, Allan Melzer, and Anna Schwartz on our companion paper, Bordo and Jeanne (2002). For valuable research assistance, we thank Priya Joshi.

2 Other recent episodes of asset price booms and collapses include experiences in the 1980s and 1990s in the Nordic Countries, Spain, Latin America, and East Asia (see e.g., Schinasi and Hargreaves, 1993; Drees and Pazarbasioglu, 1998; IMF, 2000; and Collyns and Senhadji, 2002).
Assessing the likelihood that an asset market boom will end up in a bust is a difficult task. Should this difficulty deter the monetary authorities from restricting monetary policy preemptively? The essence of the question becomes much clearer, we think, once it is cast in terms of insurance. In a boom the authorities’ problem is to make the best possible assessment of the probability of a bust, and of the extent of the disruption it would produce. Obviously this assessment must be probabilistic—one cannot demand from the authorities that they exhibit a considerably higher degree of prescience than the market. But it is clear, from an insurance perspective, that uncertainty as to the sustainability of the boom is not per se a reason for inaction—no more than a homeowner needs to be certain that his house will burn to take some fire insurance.

Another theme that we develop in this chapter is that the optimal monetary stance in an asset market boom depends on economic conditions in a complex, nonlinear way. We do not argue that the monetary authorities should routinely target the price of assets in normal times. Rather, we argue that exceptional developments in asset markets may occasionally require deviations from the rules that should prevail in normal times. Moreover, we do not find that the optimal policy can be described in terms of a simple rule. The circumstances in which a preemptive monetary restriction is warranted cannot be reduced to the macroeconomic indicators that guide monetary policy in normal times. They involve imbalances in the balance sheets of the private sector, as well as market expectations.

This chapter is related to a growing debate on the links between monetary policy, asset prices, and financial stability. The dominant view among central bankers can be characterized as one of “benign neglect.” According to this view, the monetary authorities should deal with the financial instability that may result from a crash in asset prices if and when the latter occurs, but they should not adjust monetary policy preemptively in the boom phase.

 [...] the general view nowadays is that central banks should not try to use interest rate policy to control asset price trends by seeking to burst any bubbles that may form. The normal strategy is rather to seek, firmly and with the help of a great variety of instruments, to restore stability on the few occasions when asset markets collapse. (Ms Hessius, Deputy Governor of the Sveriges Risksbank, BIS Review 128/1999). 3

This benign neglect is sometimes justified by the claim that although a liquidity injection may be required in the event of financial instability, it is short-lived and need not interfere with the macroeconomic objectives of monetary policy. The problems posed by lending-in-last-resort, in other words, are orthogonal to monetary policy.

On the face of it, the central bankers’ doctrine of benign neglect is difficult to understand. First, the idea that financial stability can be ensured, in the event of

3 See also Bullard and Schaling (2002), Reinhart (2002), and Goodfriend (2002). Note that what we describe as the “central bankers’ view” is not shared by the official sector as a whole. Economists at the Bank for International Settlements (BIS), for example, have expressed concerns that are rather close to those developed in this paper (Borio and Crockett, 2000; and Borio and Lowe, 2002).
a crash, without sacrifice in terms of the objectives of monetary policy, is true only under a very special condition, namely that the crisis is a self-fulfilling panic. If the crisis is triggered by a permanent revision of expectations about future returns, lending-in-last-resort is not the solution. The bust in asset prices may provoke financial instability, a credit crunch, and an economic depression. Curing these problems may require maintaining for some time a higher rate of inflation than would otherwise be desirable. In this case, both the real dislocation induced by the financial crisis and the response of monetary policy involve some sacrifice in terms of the macroeconomic objectives of monetary policy.

If dealing with the crisis requires a sacrifice in terms of monetary objectives ex post, then it is difficult to understand why the monetary authorities should not take precautionary actions ex ante. There is an important difference between exogenous shocks and financial crises. Financial crises, unlike earthquakes, are endogenous in part to monetary policy. Their severity is determined by the imbalances that have built up in the boom phase, which, in turn, depends on the more or less accommodating stance of monetary policy. It is quite unlikely that it is optimal for the monetary authorities to ignore the endogeneity of these risks to their own actions.

In this chapter, we consider the potential cases for proactive versus reactive monetary policy based on the situation where asset price reversals can have serious effects on real output.

Our analysis is based on a stylized model of the dilemma with which the monetary authorities are faced in asset price booms. On the one hand, letting the boom go unchecked entails the risk that it will be followed by a bust, accompanied by a collateral-induced credit crunch. Restricting monetary policy can be thought of as an insurance against the risk of a credit crunch. On the other hand, this insurance is costly: restricting monetary policy implies immediate costs in terms of lower output and inflation. The optimal monetary policy depends on the relative cost and benefits of the insurance.

Although the model is quite stylized, we find that the optimal monetary policy depends on the economic conditions—including the private sector’s beliefs—in a rather complex way. Broadly speaking, a proactive monetary restriction is the optimal policy when the risk of a bust is significant and the monetary authorities can defuse it at a relatively low cost. One source of difficulty is that in general, there is a tension between these two conditions. As investors become more exuberant, the risks associated with a reversal in market sentiment increase. At the same time, leaning against the wind of investors’ optimism requires more radical and costly monetary actions. To be optimal, a proactive monetary policy must come into play at a time when the risk is perceived as sufficiently large but the authorities’ ability to act is not too diminished.

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4 The buildup in risks can also be mitigated by regulatory and other policies but there is no reason to believe that only these other policies, and not monetary policy, should bear all the burden of adjustment.

5 Alan Greenspan (2002) emphasized in a recent speech that the increase in the interest rate that may be required to prick a bubble may be quite sizable and disruptive for the real economy.
Another, more difficult question is whether (and when) the conditions for a proactive monetary policy are met in the real world. We view this question as very much open and deserving further empirical research. In the meantime, we present in this chapter some stylized facts on asset booms and busts that have some bearing on the issue. We find that historically, there have been many booms and busts in asset prices, but that they have different features depending on the countries and whether one looks at stock or property prices. Boom-bust episodes seem to be more frequent in real property prices than in stock prices, and in small countries than in large countries. However, two dramatic episodes (the United States in the Great Depression and Japan in the 1990s) have involved large countries and the stock market. We also present evidence that busts are associated with disruption in financial and real activity (banking crises, slowdown in output, and decreasing inflation).

This chapter contributes to a growing academic literature on monetary policy and asset prices. The benign neglect view is vindicated, on the academic side, by the recent work of Bernanke and Gertler (2000, 2001) and Gilchrist and Leahy (2002). These authors argue that a central bank dedicated to price stability should pay no attention to asset prices per se, except insofar as they signal changes in future inflation. These results stem from the simulation of different variants of the Taylor rule in the context of a new Keynesian model with sticky wages and a financial accelerator. Bernanke and Gertler also argue that trying to stabilize asset prices per se is problematic because it is nearly impossible to know for sure whether a given change in asset values results from fundamental factors, non-fundamental factors, or both.

In another study, Cecchetti and others (2000) have argued in favor of a more proactive response of monetary policy to asset prices. They agree with Bernanke and Gertler that the monetary authorities would have to make an assessment of the bubble component in asset prices, but take a more optimistic view of the feasibility of this task. They also argue, on the basis of simulations of the Bernanke-Gertler model, that including an asset price variable (e.g., stock prices) in the Taylor rule would be desirable. Bernanke and Gertler (2001) attribute the latter findings to the use of a misleading metric in the comparison between policy rules.

Our approach differs from these in several respects. First, we view the emphasis on bubbles in this debate as excessive. In our model the monetary authority needs to ascertain the risk of an asset price reversal but it is not essential whether the reversal reflects a bursting bubble or a change in the fundamentals. Nonfundamental influences may exacerbate the volatility of asset prices and thus complicate the monetary authorities’ task, but they are not of the essence of the question. Even if asset markets were completely efficient, abrupt price reversals could occur, and pose the same problem for monetary authorities as bursting bubbles.

Assessing the bubble component in asset prices should not be qualitatively more difficult, they argue, than measuring the output gap, an unobservable variable which many central banks use as an input into policy making.
Second, we find that the optimal policy rule is unlikely to be closely approximated by a Taylor rule, even if the latter is augmented by a linear term in asset prices. If there is scope for proactive monetary policy, it is highly contingent on a number of factors for which output, inflation, and the current level of asset prices do not provide appropriate summary statistics. It depends on the risks in the balance sheets of private agents assessed by reference to the risks in asset markets. The balance of these risks cannot be summarized in two or three macroeconomic variables.

More generally, our analysis points to the risks of using simple monetary policy rules as the guide for monetary policy. These rules are blind to the fact that financial instability is endogenous—to some extent, and in a complex way—to monetary policy. The linkages between asset prices, financial instability, and monetary policy are complex because they are inherently nonlinear, and involve extreme (tail probability) events. The complexity of these linkages does not imply, however, that they can be safely ignored. Whether they like it or not, the monetary authorities need to take a stance that involves some judgment over the probability of extreme events. As our model illustrates, the optimal stance cannot be characterized by a simple rule. If anything, our analysis emphasizes the need for some discretionary judgment with respect to financial stability.

This chapter is based on an analysis that is presented in more detail in Bordo and Jeanne (2002). The latter study describes and motivates the analysis by reference to two dramatic boom-bust episodes: the U.S. Great Depression and Japan in the 1990s. Our companion study also shows how the stylized model used here can be grounded in rigorous microfoundations.

The chapter is structured as follows. As background to the analysis, Section 13.2 presents stylized facts on boom and bust cycles in asset prices in the post-1970 experience of 15 OECD countries. Section 13.3 presents the model and discusses policy implications. Section 13.4 concludes.

13.2. IDENTIFYING BOOMS AND BUSTS IN ASSET PRICES: THE POSTWAR OECD

Many countries have experienced asset price booms and busts since 1973, often associated with serious recessions. In this section we present a simple criterion to delineate boom and bust cycles in asset prices. We apply this criterion to real annual stock and residential property price indexes for 15 countries: Australia, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, Norway, Spain, Sweden, the United Kingdom, and the United States over the period 1970–2001 for stocks and 1970–98 for property prices.7

7 Some data points are missing for some countries. The source for the stock price data is IFS, for property prices is BIS.
13.2.1. Methodology

This section presents a criterion to ascertain whether movements in an asset price represents a boom or bust. A good criterion should be simple, objective, and yield plausible results. In particular, it should select the notorious boom-bust episodes, such as the Great Depression in the United States or Japan 1986–95, without producing (too many) spurious episodes. We found that the following criterion broadly satisfied these conditions.

Our criterion compares a moving average of the growth rate in asset prices with the long-run historical average. Let $g_{i,t} = \left(\frac{100}{3}\right) \log \left(\frac{P_{i,t}}{P_{i,t-3}}\right)$ be the growth rate in the real price of the asset (stock prices or property prices) between year $t-3$ and year $t$ and in country $i$, expressed in annual percentage points. Let $\bar{g}$ be the average growth rate over all countries. Let $v$ be the arithmetic average of the volatility (standard deviation) in the growth rate $g$ over all countries.

Then if the average growth rate between year $t-3$ and year $t$ is larger than a threshold:

$$g_{i,t} > \bar{g} + xv$$

we identify a boom in years $t-2$, $t-1$, and $t$.

Conversely we identify a bust in years $t-2$, $t-1$, and $t$ if

$$g_{i,t} < \bar{g} - xv$$

Our method detects a boom or a bust when the three-year moving average of the growth rate in the asset price falls outside a confidence interval defined by reference to the historical first and second moments of the series. Variable $x$ is a parameter that we calibrate so as to select the notorious boom-bust episodes without selecting (too many) spurious events. (We implement some sensitivity analysis with respect to this parameter.) We use the three-year moving average so as to eliminate the high-frequency variations in the series. (This is particularly a problem with stock prices, which are more volatile than property prices.)

For real property prices the average growth rate across the 15 countries is 1.0 percent with an average volatility of 5.8 percent. For real stock prices the growth rate and the volatility are both higher, 3.8 percent and 13.4 percent respectively. For both prices we take $x = 1.3$.


Figures 13.1 and 13.2 show the log of the real prices of residential property and stocks, with the boom and bust periods marked with shaded and clear bars.

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8 We experimented with different values of $x$ in order to see how the number of boom-bust episodes declines as $x$ increases. Thus for property prices at $x = 1.0$, there are 14 boom-bust and for stock prices there are 8. We settled on $x = 1.3$ because lowering the threshold below that level produces an excessively large number of booms and busts.

9 Nominal prices were deflated using the GDP deflator, and a constant was added to the logs in order to show only positive values.
Sources: Bank of International Settlements; International Financial Statistics and World Economic Outlook, International Monetary Fund.


Booms and busts are calculated by a three-year moving average. The data starts in 1971 for Germany and in 1975 for Spain due to limited availability.

The variable on the y-axis is 1 plus the log of the real property price index. The real property price index is derived by deflating the BIS nominal property price index by the GDP deflator. It is normalized to 1995 = 1.

Figure 13.1 Boom-bust in residential property prices, 1970–98.
Monetary Policy and Asset Prices: Does “Benign Neglect” Make Sense?

Sources: International Financial Statistics, World Economic Outlook, and country desks, International Monetary Fund.

Booms and busts are calculated by a three-year moving average. The data ends in 2000 for Denmark due to limited availability.
The variable on the y-axis is 2 plus the log of the real share price index. The real share price index is derived by deflating the IFS share price index by the GDP deflator. It is normalized to 1995 = 1.

Figure 13.2 Boom-bust in industrial share prices, 1970–2001.
respectively. We define a boom-bust episode as a boom followed by a bust that starts no later than one year after the end of the boom. For example, Sweden (1987–94) exhibits a boom-bust in real property prices but Ireland (1977–84) does not, because the boom and the bust are separated by a two-year interval (see Figure 13.1). We also show banking crises marked by an asterisk country by country. A few facts stand out.

First, boom-bust episodes are much more prevalent in property prices than in stock prices. Out of 24 boom episodes in stock prices only four are followed by busts: Finland (1989), Italy (1982), Japan (1990), and Spain (1990). (We give the first year of the bust in parentheses.) Hence the sample probability of a boom ending up in a bust is 16.7 percent. Of course Japan is a very significant boom-bust episode. Also there might be more boom-bust episodes in the making because it is too early to tell whether the recent slides in stock markets in all countries are busts according to our criterion.

Out of 20 booms in property prices, 11 were followed by busts: Denmark (1987), Finland (1990), Germany (1974), Italy (1982), Japan (1974, 1991), the Netherlands (1978), Norway (1988), Sweden (1991), and the United Kingdom (1974, 1990). The probability of a boom in property prices ending up in a bust is 55 percent. That is, more than one in two property booms end up in a bust, against one in six for stock market booms. Only three countries had boom-busts in both stock prices and property prices, Finland, Italy, and Japan. In all three cases the peaks virtually coincided.

One explanation for the larger number of boom-bust episodes in property prices than in stock prices may be that property price episodes are often local phenomena occurring in the capital or major cities of a country. This would explain their high incidence in small countries like Finland or even in countries with relatively large populations like the United Kingdom, where the episode occurred in London and environs. The fact that no such episodes are found in the United States may reflect the fact that boom-busts in property prices that occurred in New York, California, and New England in the 1990s washed out in a national average index.

Second, in a number of cases, banking crises occurred either at the peak of the boom or after the bust. This is most prominent in the cases of Japan and the Nordic countries.

Finally, to provide historical perspective to our methodology, we do the same calculations for two U.S. stock price indexes for the last century: the S&P 500 from 1874 to 1999 and the Dow Jones Industrial Average from 1900 to 1999. As can be seen in Figures 13.3 and 13.4, there are very few boom-bust episodes. The

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10 The data on banking crises come from Eichengreen and Bordo (2002).
11 If we were to take a lower threshold such as $x = 1.0$, then, two more countries would be listed as having boom-busts: Australia and Sweden.
12 Note that the incidence of a boom-bust episode by our criterion is very different from what is usually referred to as a stock market crash. For the United States, for example, Mishkin and White (2002) document 15 crashes 1900–2000 and 4 from 1970–2000. They define a crash as a 20 percent decline in stock prices in a 12-month window.
13 Again, a lower threshold of $x = 1.0$ would add in two countries: Ireland and Spain.
14 This fact has an interesting implication for the theory of Optimum Currency Areas and the euro zone. One important source of asymmetric shocks could be boom-busts in real estate prices.
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Figure 13.3 U.S. stock prices: S&P 500, 1874–1999.

*Banking crisis. See Eichengreen and Bordo (2002) Appendix A. Booms and busts are calculated by a three-year moving average.
Figure 13.4  U.S. stock prices: Dow Jones Industrial Average, 1899–1999.

*Banking crisis. See Eichengreen and Bordo (2002) Appendix A. Booms and busts are calculated by a three-year moving average.
crash of 1929 stands out in both figures. In the S and P we also identify a boom-bust in 1884, the year of a famous Wall Street crash associated with speculation in railroad stocks and political corruption, and one in 1937, the start of the third most serious recession of the 20th century. As is well known the bust of 1929 was followed by banking crises in each of the years from 1930–33.

13.2.3. Ancillary Variables

Associated with the boom-bust episodes for property and stock prices that we have isolated above, we display figures for three macro variables directly related to the asset price reversals: CPI inflation, the real output gap, and domestic private credit. The figures are averages of each variable across all the boom-bust episodes demarcated above. The seven-year time window shown is centered on the first year of the bust.

In Figure 13.5A for property price boom-busts, we observe inflation rising until the first year of the bust and then falling, whereas the output gap plateaus the year before the bust starts and then declines with the bust. Domestic private credit rises in the boom and then plateaus in the bust. This pattern is remarkably consistent with the scenario relating asset price reversals to the incidence of collateral, to the credit available to liquidity-constrained firms, and to economic activity that we develop in Section 13.3 subsequently.

Figure 13.5B shows the behavior of inflation, the output gap, and domestic private credit averaged across the four boom-bust episodes in stock prices demarcated in Figure 13.2. Inflation rises to a peak in the year preceding the bust and then declines, although not as precipitously as with the property price episodes. The output gap plateaus the year the bust starts and then declines. Domestic credit plateaus the year after the bust starts. Although the pattern displayed for the three ancillary variables for stock price boom-busts is quite similar to that seen in Figure 13.5A, we attach more weight to the property price pattern because it is based on a much larger number of episodes (11 versus 4).

With this descriptive evidence as background, in Section 13.3 we develop a model to help us understand the relationship between boom-busts, the real economy, and monetary policy.

13.3. A STYLIZED MODEL

A regular feature of boom-bust episodes is that the fall in asset prices is associated with a slowdown in economic activity (sometimes negative growth), as well as

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15 Using a lower threshold of $x = 1.0$ does not change the outcome.

16 Private Credit, line 22d of IFS is defined as “claims on the private sector of Deposit Money Banks (which comprise commercial banks and other financial institutions that accept transferable deposits, such as demand deposits).”

17 The figure shows the nominal level of private domestic credit. Real private domestic credit declines in the bust.
Figure 13.5 Ancillary variables: (A) boom-bust in property prices; (B) boom-bust in stock prices.

Sources: *International Financial Statistics* and *World Economic Outlook*, International Monetary Fund.
financial and banking problems. There may be a number of explanations for this pattern, and they do not all give a causal role to asset prices. However, there is evidence that the bust in asset prices contributes to the fall in output by generating a credit crunch. The domestic private sector accumulates a high level of debt in the boom period; when asset prices fall, the collateral base shrinks, and so do firms’ ability to finance their operations.18

This section addresses the following question. Assuming that asset market booms involve the risk of a reversal in which the economy falls prey to a collateral-induced credit crunch, what is the consequence of this risk for the design of monetary policy?

This section presents a stylized model in which the optimal policy can be derived analytically. Unlike a number of related studies (Bernanke and Gertler, 2000; Batini and Nelson, 2000; and Cecchetti and others, 2000), the aim is not to compare the performance of different monetary policy rules in the context of a realistic, calibrated model of the economy. Rather, it is to highlight the difference between a proactive monetary policy and a reactive monetary policy in the context of a simple and transparent framework. It turns out that although the model is quite simple, the optimal monetary policy is not trivial, and depends on the exogenous economic conditions in a nonlinear way. Although this nonlinearity complicates the analysis, we think it is an essential feature of the question we study in this chapter because financial crises are inherently nonlinear events.

Our analysis is based on a reduced-form model that is very close to the standard undergraduate textbook macroeconomic model. In Bordo and Jeanne (2002), we provide micro-foundations in the spirit of the “Dynamic New Keynesian” literature. Private agents have utility functions and optimize intertemporally. The government prints and distributes money, which is used because of a cash-in-advance constraint. Nominal wages are predetermined, giving rise to a short-run Phillips Curve. Monetary policy has a credit channel, based on collateral. The collateral is productive capital; its price is driven by the expected level of productivity in the long run. However, the essence of our results can be conveyed with the reduced-form model that we present in this chapter.

The reduced-form model has two periods \( t = 1, 2 \). Period 1 is the period in which the problem “builds up” (debt is accumulated). In period 2, the long-run level of productivity is revealed. An asset market crash may or not occur, depending on the nature of the news. If the long-run level of productivity is lower than expected, the price of the asset falls, reducing the collateral basis for new borrowing. If the price of collateral is excessively low relative to firms’ debt burden, the asset market crash provokes a credit crunch and a fall in real activity.

Note that these market dynamics are completely driven by the arrival of news on long-run productivity, which comes as a surprise to both central bank and the market. The asset market boom is not caused by a monetary expansion or a bubble. Nor is the crash caused by a monetary restriction, or a self-fulfilling liquidity crisis. Irrational

18 This meaning of a collateral-induced credit crunch differs from an earlier meaning which viewed a credit crunch as a restriction on bank lending induced by tightening monetary policy.
expectations or multiple equilibria can be introduced into the model, but keeping in line with our desire to stay close to the textbook framework, we prefer to abstract from these considerations in the benchmark model. At the end of this section we briefly discuss a variant of the model in which investors are “irrationally exuberant.”

13.3.1. The Model

The equations of the reduced-form model are as follows.

\[
\begin{align*}
    y_t &= m_t - p_t \quad (1) \\
    y_t &= \alpha p_t + \varepsilon_t \quad (2) \\
    y_1 &= -\sigma (r - \bar{r}) \quad (3)
\end{align*}
\]

where \(y_t\) is the output gap at time \(t = 1, 2\), \(m_t\) is money supply, \(p_t\) is the price level, \(r\) is the real interest rate between period 1 and period 2, and \(\bar{r}\) is the natural interest rate (the level consistent with a zero output gap in period 1). All variables, except the real interest rate, are in logs.

The first two equations characterize aggregate demand and aggregate supply. Aggregate supply is increasing with the nominal price level because the nominal wage is sticky. The third equation says that the first-period output is decreasing with the real interest rate. It is based, in the micro-founded model, on the Euler equation for consumption.

The key difference between our model and the standard macro model is the “supply shock,” \(\varepsilon\). In the standard model the supply shock is an exogenous technological shock or more generally, any exogenous event which affects the productivity of firms. Here the supply shock is instead a “financial” shock and it is not entirely exogenous, because its distribution depends on firms’ debt and the price of assets, two variables that monetary policy may influence. That monetary policy can influence debt accumulation ex ante (in period 1) plays a central role in our analysis of proactive monetary policy.

The supply shock \(\varepsilon\) results from credit constraints in the corporate sector. Firms issue debt in period 1 and inherit a real debt burden \(D\) in period 2 (debt is in real terms). They also own some collateral, whose real value in the second period is denoted by \(Q\). Because of a credit constraint, the firms’ access to new credit in period 2 is increasing with their net worth \(Q - D\). In Bordo and Jeanne (2002), the credit constraint results from a debt renegotiation problem à la Hart and Moore (1994). Some firms must obtain new credit in period 2 to finance working capital. The firms that need but do not obtain this intraperiod credit simply do not produce, which reduces aggregate supply. If \(Q - D\) goes down, more and more firms are credit constrained and must reduce their supply. As a result, the supply term \(\varepsilon_2\) is an increasing function of \(Q - D\):

\[
\varepsilon_2 = f(Q - D), \quad f' > 0
\]

In Bordo and Jeanne (2002), the function \(f(\cdot)\) is derived from more primitive assumptions about firms’ behavior, but for the purpose of our present discussion, we can restrict our attention to the following properties of \(f(\cdot)\). First, \(f(\cdot)\) takes
negative values: although the credit constraint can reduce supply below its potential level, it cannot increase it above potential.\footnote{That $f(\cdot)$ is always negative implies of course that $\varepsilon_2$ is not centered on zero. The expected value of $\varepsilon_2$ is negative.} This implies an asymmetry and a nonlinearity in the response of supply to asset prices: although a fall in asset prices can depress supply, an equivalent rise in asset prices does not raise it by the same amount. Second, it is plausible to assume that a threshold in the price of collateral occurs below which the credit constraint becomes widespread (i.e., there is a credit crunch). As a result, we would expect function $f(\cdot)$ to have a shape like the one shown in Figure 13.6.

There are several ways in which monetary policy can deal with a credit crunch. For the purpose of our discussion it is useful to distinguish the ex post and the ex ante channels of monetary policy.

- Ex post, monetary policy has three channels. The first channel is the standard one: inflation stimulates supply by reducing the real wage. Second, a monetary expansion increases the real price of collateral and thus reduces the number of collateral-constrained firms. Third, if firms’ debt is set in nominal terms, inflation also relaxes the credit constraint by reducing the real burden of debt.

- Ex ante (in period 1), a monetary restriction could reduce the risk of a credit crunch, by reducing the accumulation of debt.

In this chapter we are more interested in the ex ante channel because we want to focus the analysis on preemptive monetary restrictions. For the sake of simplicity, we completely abstract from the ex post credit channel by assuming first, that debt is in real terms, and second, that $Q$, the real price of collateral in period 2, is stochastic and exogenous to monetary policy. Hence, monetary policy does not affect $\varepsilon_2$. Period 2 monetary policy affects output solely through the standard channel based on nominal wage stickiness.
The relevant channel of monetary policy, hence, is the ex ante channel. The real interest rate \( r \) influences the stochastic distribution of \( \varepsilon_2 \), and so the probability of a credit crunch. In general, an increase in the real interest rate \( r \) could increase or decrease the debt burden \( D \), depending on whether the price effect does or does not dominate the demand effect. If the elasticity of firms’ demand for loans is large enough, the burden of debt is decreasing with the real interest rate, that is:

\[
D = D(r), \quad D' < 0
\]  

(5)

It then follows that

\[
\frac{\partial \varepsilon_2}{\partial r} \geq 0
\]  

(6)

Other things equal, raising the interest rate in period 1 reduces the number of firms that are credit-constrained in period 2. Restricting monetary policy, in other words, reduces the risk of a credit crunch in the future.

As noted earlier, the difference between our model and the standard textbook model is that the supply shock at period 2 is endogenous to monetary policy at period 1. The optimal monetary policy involves a trade-off between the macroeconomic objectives of monetary policy in the first period and the risk of a credit crunch in the second period. In order to investigate this trade-off one has to endow the monetary authorities with an intertemporal objective function. We assume that the government minimizes the following quadratic loss function:

\[
L = L_1 + L_2
\]

where

\[
L_t = p_t^2 + \omega y_t^2.
\]  

(7)

In period 1 the authorities set the interest rate so as to minimize the expected intertemporal loss \( E_1(L) \). In period 2 they set monetary policy so as to minimize their loss \( L_2 \), given the realization of \( Q \).

After solving for the endogenous policy reaction, the second-period loss can be written in reduced form as a function of the supply shock \( \varepsilon_2 \).

\[
L_2 = L_2(\varepsilon_2)
\]

The loss \( L_2 \) is positive, and equal to zero for \( \varepsilon_2 = 0 \).

Setting the first period supply shock \( (\varepsilon_1) \) to zero for the sake of simplicity, the first period loss is a function of the real interest rate \( r \), because \( y_1 = -\sigma(r - \bar{r}) \) and \( p_1 = -\sigma(r - \bar{r})/\alpha \). The government’s problem at time 1 can be written as a function of the policy instrument \( r \).

\[
\min_r E_1(L) = L_1(r) + E_1[L_2(f(Q - D(r))]]
\]  

(8)

20 There is no time consistency issue in this model because by assumption the nominal wage is taken as given in both periods.
where $Q$ is stochastic and exogenous. This expression captures the trade-off with which the monetary authorities are faced in period 1. On the one hand, given the absence of supply shock in period 1, the authorities would like to set the interest rate at its natural level $\bar{r}$, in order to minimize the period 1 loss $L_1(r)$. On the other hand, the authorities may also want to increase the real interest rate above $\bar{r}$ in order to reduce the risk of a credit crunch in period 2. That is, a proactive monetary restriction involves a trade-off between the macroeconomic objectives of monetary policy in period 1 and the risk of a credit crunch in period 2. How this trade-off is solved in general is not trivial, because (8) is a nonlinear problem. The only way we can derive properties of the solution is by specifying the model further.

13.3.2. A Nonconventional, Nonlinear Taylor Rule

We now illustrate the optimal monetary policy with a specification of the model that draws on the recent debates on the “New Economy” and the stock market. Assume that in the second period, the price of collateral can take two values, a high level, $Q_H$, corresponding to the “New Economy” scenario, and a low level, $Q_L$, corresponding to the “Old Economy” scenario. Viewed from period 1, the probability of the “New Economy” scenario is a measure of the optimism of economic agents. We denote it by $\pi$. We also assume that as firms become more optimistic, they borrow more (i.e., $D$ is an increasing function of $\pi$):

$$D = D(\pi, r)$$

Let us assume that there is no credit crunch if the expectation of the “New Economy” is fulfilled, but that there might be a credit crunch otherwise. Then the government’s expected period 2 loss is the probability of the Old Economy scenario, times the loss conditional on this scenario. The government’s problem becomes

$$\min_{r} L_1(r) + (1 - \pi)L_2(f(Q_L - D(\pi, r)))$$

(9)

How does the optimal monetary policy depend on $\pi$, the optimism of the private sector? The answer is given in Figure 13.7, which shows the generic shape of the optimal policy. For low levels of optimism, the monetary authorities optimally set the interest rate at the natural level $\bar{r}$. Then the authorities respond to rising levels of optimism by raising the interest rate. For very high levels of optimism, the authorities revert to the low interest rate policy.

Let us give the intuition behind Figure 13.7 step by step. First, if $\pi$ is small, firms do not borrow a great deal, implying that a low realization of $Q$ does not trigger a credit crunch. In this case the authorities’ loss function is minimized by setting $r = \bar{r}$. The government has no reason to distort its policy in period 1 because there is no risk of a credit crunch in period 2.

The optimal interest rate is also low for a high level of optimism, but for a very different reason. Increasing optimism tilts the balance of benefits and costs toward low interest rates for two reasons. First, if the private sector becomes...
Figure 13.7 The optimal monetary policy.
more optimistic, it takes a higher interest rate to induce firms not to increase their debt level. Second, increasing optimism, if it is rational, is associated with an objectively lower probability of a credit crunch, and so reduces the benefit of a proactive policy. As (9) shows, in the limit, if \( \pi = 1 \) the government minimizes its loss function by setting set \( r = \bar{r} \), the same policy as if \( \pi = 0 \).

Taken together, these considerations explain the shape of the optimal policy depicted in Figure 13.7. A proactive policy dominates for intermediate levels of optimism, when a risk exists but it is not too costly to defuse. In this range, the monetary authorities respond to increasing optimism by restricting monetary policy. Beyond some level, however, leaning against the private sector’s optimism becomes too costly, and the authorities are better off accepting the risk of a credit crunch.

The model highlights both the potential benefits and the limits of a proactive monetary policy. It may be optimal, in some circumstances, to sacrifice some output in order to reduce the risk of a collateral-induced credit crunch. However, there are also circumstances in which the domestic authorities are better off accepting the risk of a credit crunch (i.e., a reactive policy). Whether the authorities should in practice engage in a proactive policy at a particular time is contingent on many factors, and is a matter of judgment. In our model, the optimal monetary policy depends on the observable macroeconomic variables, and on the private sector’s expectations, in a highly nonlinear way.

### 13.3.3. Discussion

#### 13.3.3.1. Taylor Rules

Note the difference in our analysis with standard rules, such as the Taylor rule. Standard rules make the monetary authorities respond to the current or expected levels of macroeconomic variables such as the output gap or the inflation rate. The rule above suggests that the monetary policy maker should also respond to prospective developments in asset markets, for which macroeconomic aggregates do not provide appropriate summary statistics.

Admittedly, the standard Taylor rule could happen to be always close to the optimal policy by accident. However, there are reasons not to take this Panglossian view for granted. It is not very difficult to imagine circumstances in which a standard Taylor rule induces the monetary authorities to take the wrong policy stance in an asset price boom.

For example, let us consider a situation in which the perceived risk of a bust increases from a low level to an intermediate level where it is optimal to restrict monetary policy proactively. Let us further assume that consistently with the evidence presented in Section 13.2, an asset price bust is deflationary.\(^{21}\) Then, other things equal, the increase in the probability of a bust reduces the expected output gap, which is deflationary.

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\(^{21}\) In our model, a credit crunch is inflationary because it reduces supply without changing demand. For a credit crunch to be deflationary, it would have to affect demand as well as supply—a possible extension of our model.
level of inflation. According to a forward-looking specification of the Taylor rule, the decrease in the inflation forecast would call for a monetary relaxation, which is the exact opposite of the required policy adjustment. The monetary relaxation will only fuel the boom and exacerbate the macroeconomic dislocation in the bust, if it occurs.

This is only one example. One could also construct examples where the Taylor rule happens to coincide with the optimal policy. Our more general point, however, is that there is no reason to expect a Taylor rule to characterize the optimal policy in general, because this rule does not take as arguments the variables that are the most relevant in assessing the likelihood and implications of an asset market boom turning into a bust.

13.3.3.2. Irrational Exuberance

As noted in Section 13.1, a common objection against proactive monetary policies is that it requires the authorities to perform better than market participants in assessing the fundamental values of asset prices (Bernanke and Gertler, 2000). In this regard, it is important to note that our analysis of proactive monetary policy is not premised on the assumption that asset prices deviate from their fundamental values. The essential variable, from the point of view of policymaking is the risk of a credit crunch induced by an asset market reversal. This assessment can be made based on the historical record (as illustrated in Section 13.2), as well as information specific to each episode. In particular, the suspicion that an asset market boom is a bubble which will have to burst at some point is an important input in this assessment. However, bubbles are not the essence of the question because, as our model shows, the question would arise even in a world without bubbles. Hence, the debate about proactive versus reactive monetary policies should not be reduced to a debate over the central bank’s ability to assess deviations in asset prices from fundamental values.

Going back to our model, the notion of irrational expectations can be captured by assuming that private agents base their decisions, in period 1, on an excessively optimistic assessment of the probability of the New Economy scenario. In Bordo and Jeanne (2002), we consider the case where firms borrow in period 1 on the basis of a probability \( \pi' \) which is larger than the probability \( \pi \) assessed by the authorities. We find that this tilts the balance toward proactive policies. Hence irrational exuberance broadens the scope for proactive monetary policy.\(^\text{22}\)

13.3.3.3. Policy-Induced Booms

To conclude this section, let us also emphasize that we have not analyzed the question of whether booms in asset prices are induced by an excessively expansionary monetary policy. In our model, monetary policy affects the growth in credit but the dynamics of asset prices are exogenous. This assumption was made mainly for the sake of simplicity. Disentangling monetary policy from other

\(^{22}\) See Dupor (2002) for a model in which asset price targeting is justified by irrational expectations in the private sector.
sources of asset price booms is an important issue—which we do not attempt to tackle in this chapter. In the event monetary policy induces an asset price boom—which in turn may be a warning sign of impending inflation—the case for a monetary restriction seems straightforward.23

13.4. CONCLUSION

A senior official of the Federal Reserve System recently disputed the view that monetary policy should pay special attention to booms in asset prices in the following terms.

...macro policy should be focused on macro outcomes. Tightening monetary policy beyond that required to achieve desired macroeconomic outcomes in response to high and rising equity prices or other asset values would seem to involve trading off among goals. The central bank would be tolerating some straying from the fundamental goal of the stability of the prices of goods and services, at least in the near term, in order to lessen the risks of future systemic problems or severe macroeconomic dislocation down the road. It is by no means obvious that the mandates of most central banks in industrial countries admit accepting such a tradeoff (Reinhart, 2002).24

We find this statement interesting (and somewhat atypical) in that it acknowledges the risk of an asset price boom resulting in “severe macroeconomic dislocation” (which presumably cannot be painlessly averted by lending-in-last-resort). Hence the trade-off between current and future macroeconomic objectives is not exactly the same in an asset price boom as in normal times: it is between the cost of deviating from short-run macroeconomic objectives and the risk of severe economic dislocation in the future. This is indeed the trade-off that our stylized model focuses on. However, we have difficulty understanding why the monetary authorities, having acknowledged this trade-off, should always choose not to insure against the risk of severe economic dislocation.

We have made this point in the context of a very stylized illustrative model. Our analysis in this chapter should be interpreted as being mainly suggestive because we do not provide empirical estimates of the magnitude of the output losses under the alternative policy strategies. To do this would require simulating the effects of alternative policy rules in calibrated or estimated structural models. We would argue that it would be important for these models to involve the kind of nonlinearity and tail-probability events that we have emphasized in this chapter, an aspect that is generally ignored in the literature.25 Although introducing

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23 Also, we have not addressed the question of whether asset price movements act as predictors of future inflation. The evidence on this issue is mixed (see Filardo, 2000).

24 Vincent Reinhart is the director of the Division of Monetary Affairs at the Board of Governors of the Federal Reserve System.

25 For example, Bernanke and Gertler (2000) or Cechetti and others (2000) run policy simulations in a model that is linearized around steady state. The financial friction introduces a financial accelerator but there are no financial crises.
nonlinearities is technically challenging, nonlinearity seems difficult to abstract from in an analysis of the relationship between monetary policy and financial stability. We suspect that in such models it may be optimal for the monetary authorities to deviate from the policy rule of normal times in some circumstances, in particular when there is an exceptional boom in asset prices.

Let us conclude by taking a broader perspective on the issues discussed in this chapter. The recent literature on monetary policy may give the impression of having reached an "end of history" based on a consensus on the desirability of simple rules, with the main remaining object of debate being the precise form of the golden policy rule. Like all "ends of history," this one must have its Achilles heel, and we would surmise that it has to do with the relationship between monetary policy and financial stability. Systemic financial crises are tail-probability events with huge consequences, and the rule paradigm has not developed a well-articulated doctrine with regard to these risks—rather, it has generally eschewed the question by arguing that monetary policy and financial stability should be thought of as separate issues. Indeed we do not think that this omission occurred by accident. Financial stability presents a direct challenge to the rule paradigm because it may require occasional deviations from simple rules (i.e., policies that are sometimes based in a complex way on discretionary judgment). Furthermore, these deviations may rely on information that may be difficult to communicate to the public. There might be such a thing, after all, as an “art of central banking.”

REFERENCES


14.1. INTRODUCTION

Corporate governance reform has ranked high on policy makers’ agendas in many countries around the world since the late 1990s. New laws and regulations aimed at improving corporate governance have been introduced in many countries, and particularly in several Asian countries in the aftermath of the East Asian financial crisis of 1997–98.²

Yet, have governance practices actually improved? And, do improvements in corporate governance contribute to higher output, investment, and productivity growth in the corporate sector? To date, these key questions have not been addressed in the literature. This chapter addresses these questions. We first construct a composite corporate governance quality (CGQ) index and document its evolution for major emerging markets and developed economies during the period 1994–2003. Then, we assess the impact of measured improvements in corporate governance quality on output growth, productivity growth, and investment at a country level, and on industry growth.

Our CGQ index is constructed at a country level using accounting and market data of samples of nonfinancial firms listed in the relevant domestic stock markets. Hence, it captures corporate governance quality specific to a universe of firms which are likely to be comparatively more exposed to market discipline. For this reason, the finding of no improvement in governance for these firms would likely signal the lack of improvements for the corporate sector as a whole. On the other hand, the finding of improvements for these firms could signal either that improvements have occurred in the corporate sector as a whole, or that improvements are
likely to be found especially among firms subject to market discipline. In either case, the evolution of the index is informative about changes in governance in the corporate sector.

The CGQ index is a simple average of three proxy measures of outcomes of corporate governance in the dimensions of accounting disclosure and transparency. Disclosure and transparency are necessary, albeit not sufficient, conditions of good corporate governance, as the extent of information asymmetries among managers and stakeholders pointed out by the corporate governance literature are likely to be less severe with enhanced transparency and disclosure. By focusing on indicators capturing necessary conditions for good corporate governance, we aim at capturing in a parsimonious, yet informative way, the dynamics of dimensions of corporate governance quality that are likely to be correlated with other determinants of efficient governance arrangements. As detailed below, these indicators are derived from selected studies in the finance and accounting literature.

Considering outcome-based measures of corporate governance, as opposed to de jure measures, is advantageous and informative for at least two reasons. First, tracking changes in corporate governance with de jure measures is difficult, because improvements may not necessarily occur because of lags in implementation and/or enforcement, as stressed by Berglöf and Claessens (2006), who more generally point out that it is hard to measure enforcement of corporate governance rules. Second, firms may indeed choose to improve their corporate governance prior to or independently of the enactment of new rules whenever the benefits of good corporate governance, especially in terms of easier and less costly access to finance, are critical for their growth prospects. In other words, firms can choose to improve corporate governance beyond the minimum standards set by the country.

In essence, corporate governance quality may be viewed partly as an “endogenous” firm’s choice, as pointed out by Himmelberg, Hubbard, and Palia (1999) and Coles, Lemmon, and Meschke (2006). Ultimately, shareholders’ or stakeholders’ values will be maximized when managerial incentives are set in a right direction, and a good corporate governance helps it happen (e.g., Jensen, 1986; and Tirole, 2001). Thus, it is a broad set of underlying rules and practices that determine corporate governance and influence managerial incentives. Our aim is not to identify and quantify each of these underlying factors and the specific channels through which they operate to affect corporate governance and managerial incentives. Our contribution is to develop outcome-based corporate-governance measures based on accounting and market data, as those data measure the outcomes of managerial decisions.

We investigate the relationship between corporate governance quality and economic performance at the country-level, although most of the literature relates measures of corporate governance to firm-level performance (see, for example, Gompers, Ishii, and Metrick, 2003). Our choice is supported by empirical evidence in Doidge, Karolyi, and Stulz (2007) who show that most of the variation in firm-level governance can be explained by country-level characteristics.

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Furthermore, Core, Guay, and Rusticus (2006) show that investors discount values of weakly governed firms and that weak governance does not cause poor stock market returns at the firm level. Our work is further motivated by Bushman and Smith (2001), who review the literature on the role of publicly reported financial accounting information in the governance processes of corporations and propose areas for future research. They argue that “the use of financial accounting information in corporate governance mechanisms is one channel by which financial accounting information potentially enhances the investment decisions and productivity of firms” and “propose cross-country research to investigate more directly the effects of financial accounting information on economic performance through its role in governance.”

Our investigation yields three main findings. First, the CGQ index exhibits improvements in corporate governance quality in most countries considered since 1994, with the exception of a few countries, where either no significant changes have occurred, or a worsening is recorded. Although improvements in accounting disclosure have been more limited, corporate governance quality has improved especially in the dimension of transparency, that is in terms of the reliability of accounting and market information.

Second, the data exhibit cross-country convergence in corporate governance quality with countries that score poorly initially catching up with countries with high corporate governance scores.

Third, improvements in corporate governance quality affect aggregate economic activity positively and significantly, as shown in regression analysis of per capita GDP growth, total factor productivity (TFP) growth, and the ratio of investment to GDP on the CGQ index. Moreover, when we gauge the impact of changes in corporate governance quality on sales growth and growth opportunities of firms grouped by industry, we find a positive effect of improvements in corporate governance on the growth of financially dependent industries. This result is consistent with the idea that improvements in corporate governance quality benefit most those industries whose growth crucially depends on external finance.

Overall, the answers to the two questions we wished to address are both positive. Actual improvements in corporate governance, as captured by our indicators, have indeed occurred in most countries, although in varying degrees and with some notable exceptions. More importantly, improvements in corporate governance quality yield tangible benefits in terms of enhanced growth, productivity, and investment, and these benefits are large for those industries which rely most on external finance. Thus, effective implementation of corporate governance reform appears to be an important contributing factor to countries’ well-being.

The remainder of this chapter is composed of three sections. Section 14.2 details the construction of the CGQ index and its components. Section 14.3 depicts the evolution of our measures of corporate governance quality within and across countries and regions. Section 14.4 presents country and industry regressions relating the CGQ index and its components to measures of growth, productivity growth, and investment for the economy and the corporate sector. Section 14.5 concludes.
14.2. THE CGQ INDEX

The CGQ index is a simple average of three indicators, called Accounting Standards (AS), Earning Smoothing (ES), and Stock Price Synchronicity (SPS). These indicators are constructed from accounting and market data for samples of nonfinancial companies listed in stock markets taken from the Worldscope and Datastream databases.

14.2.1. Accounting Standards

The first indicator is a simple measure of the amount of accounting information firms disclose and is constructed similarly to the index reported by the Center for International Financial Analysis and Research (CIFAR) until 1993. This indicator captures the degree of accounting disclosure of firms in the country. CIFAR uses information based on the top 8 to 40 companies (depending on data availability) and on 90 items selected by professional accountants (CIFAR, 1993). Our indicator is given by the number of reported accounting items as a fraction of 40 accounting items selected from CIFAR’s 90 items based on availability in the Worldscope database. We use information for the top 10 manufacturing companies in terms of total assets for each year and in each country.4

14.2.2. Earning Smoothing

The second indicator is a measure of “earnings opacity” proposed by Leuz, Nanda, and Wysocki (2003) and Bhattacharya, Daouk, andWelker (2003). It tracks the extent to which managers may conceal the true performance of firms using accruals to smooth fluctuations of annual profits. Specifically, it is the rank correlation between cash flows (before any accounting adjustments) and profits (after accounting adjustments) across a set of firms at each point in time. This indicator is an important complement to the first indicator, because a large number of reported accounting items may be meaningless if accounts are seriously manipulated or misrepresented.

4 We checked the robustness of the AS indicator by constructing variants in several ways. For example, eliminating the accounting items that are reported by 95 percent of all firms in 1995, we construct the index using only those 16 items that are reported by less than 95 percent of all firms. This index has more variation, compared to the original index that is based on 40 accounting items, but the correlation with the original index is very high, more than 0.95. We also constructed an alternative index using the percentage of the 10 largest firms in each country (in terms of market capitalization) that reports all of the 24 items that are reported by 95 percent or more of all firms, but there is very little variation. We calculate these two variants using a threshold of 85 percent instead of 95 percent, but this does not alter our findings. Finally, we constructed an index based on the 100 largest firms (or fewer when 100 are not available) instead of the 10 largest firms, but sample selection bias appears severe, as the number of firms covered by Worldscope typically grows over time in emerging market economies. However, using this alternative measure of accounting standards based on the largest 100 firms does not alter our main findings.
Unlike these authors, who use a pooled cross-section data for each country, our measures are calculated for each year and each country. Accruals (AS) are estimated as

$$AS_{ikt} = (\Delta CA_{ikt} - \Delta Cash_{ikt}) - (\Delta CL_{ikt} - \Delta STD_{ikt} - \Delta TP_{ikt}) - Dep_{ikt}$$

where $CA$ denotes current assets, $Cash$ is cash and cash equivalents, $CL$ are current liabilities, $STD$ is short-term debt and the current portion of long-term debt, $TP$ is income tax payable, and $Dep$ denotes depreciation and amortization.

Because cash-flow statements are not widely reported in many developing countries, cash flow from operations ($ECF$) are estimated by subtracting accruals ($AS$) from operating income ($OI$): $ECF_{ikt} = OI_{ikt} - AS_{ikt}$. Cross-sectional earnings smoothing is then measured by a Spearman rank order correlation between changes in accruals and changes in estimated cash flow (both normalized by total assets). It is defined for each year and each country as

$$EarningSmoothing = 1 - \frac{6 \sum_{t=1}^{N} \left( \frac{Rank\left( \frac{\Delta AS_{ikt}}{TA_{ikt}} \right) - Rank\left( \frac{\Delta ECF_{ikt}}{TA_{ikt}} \right) }{N} \right)^2}{N(N^2 - 1)}$$

The ES indicator is standardized so that its values fall in the unit interval and increases as earning smoothness declines (i.e., firm performance is less opaque). Thus, an increase of this indicator signals an improvement in transparency.

### 14.2.3. Stock Price Synchronicity

The third indicator is a measure of stock price synchronicity proposed by Morck, Yeung, and Yu (2000), given by the average goodness-of-fit ($R^2$) of regressions of each company’s stock return on country-average return in each year. These authors show that after controlling for other drivers of comovements in stock prices not necessarily related to corporate governance, more synchronous stock prices are found in countries in which corporate governance is poor and financial systems are less developed. More recently, Jin and Meyers (2006) analyze a larger data set and find a positive relationship between stock price synchronicity and lack of transparency. Intuitively, if the accounting information is opaque, investors find it difficult to distinguish good performers from bad performers. Ceteris paribus, in the event of a shock to the market or the arrival of new information, the inability of investors to discriminate among firms would induce them to trade most stocks, prompting movements in stock prices to become more synchronous. We use this measure of stock price synchronicity as a proxy for the degree of accounting transparency in the country.

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5 Morck, Yeung, and Yu (2000) report a second measure, given by the share of stocks whose prices move in the same direction (either up or down). Our results are invariant to the use of this measure.

6 Synchronicity may be observed if a country specializes in specific industries. In this case, industry-specific shocks would drive overall movements of stock prices, in contrast with the case of a highly diversified country. In addition, if aggregate shocks are large (e.g., overall boom and bust, oil shocks, or currency crisis), then stock prices may move more in those countries which are most sensitive to aggregate shocks.

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We should note that synchronicity can also occur if there is cross-subsidization among firms belonging to the same group. Cross-subsidization may stem from optimal allocation of funds in internal capital markets. Yet, in a poor governance environment, cross-subsidization is likely to be associated with inefficient connected lending: this governance-specific feature is likely captured by the SPS indicator, but it is not by the AS and ES indicators. In this sense, the SPS indicator complements the two indicators previously described.

For each year, the SPS indicator is computed in five steps. First, we calculate the weekly return $r_{ikt}$ for each firm ($t = \text{week}$), dropping firms with less than 30 weeks’ observations, and dropping an observation if the absolute value of $r_{ikt}$ is greater than 0.25. Second, we calculate market capitalization-weighted weekly returns for each country $k$, $\rho_{kt}$, using weekly stock price indices from Datastream, and weekly net exchange rate appreciation rates for each country, $e_{kt}$. Third, for each firm we run the regressions: $r_{ikt} = \alpha_i + \beta_i \rho_{kt} + \gamma_i (\rho_{US} + e_{kt}) + \varepsilon_{it}$, and retrieve the relevant goodness of fit $R_{ik}^2$.

Fourth, we calculate the total variation for each firm, given by

$$SST_{ik} = \sum_{t=1}^{T} \left(r_{ikt} - \frac{1}{T} \sum_{t=1}^{T} r_{ikt}\right)^2$$

and compute the country-level common variation, given by

$$R_k^2 = \frac{\sum_i (R_{ik}^2 \times SST_{ik})}{\sum_i SST_{ik}}$$

To avoid sample selection bias, $R_i^2$ is computed for the same sample size over years (but possibly for different companies) based on the rank order of market capitalization. Finally, the SPS indicator is standardized so that its range is the unit interval, it increases as synchronicity declines (i.e., transparency improves), and is computed based on an equal number of (but different) firms selected by their market capitalization at each date.7

Three measurement issues deserve further discussion. First, although our measures of corporate governance are widely accepted proxies for various aspects of corporate governance, we cannot rule out that they also capture other aspects of firm performance. For example, stock price synchronicity may be affected by abrupt declines in capital inflows, also known as sudden-stops. We try to mitigate this in our empirical work by investigating various subsamples of our data, such as dropping countries that experienced a crisis or that do not have well-developed stock markets.

Second, by construction, our CGQ index does not capture all aspects of corporate governance but focuses on two important aspects of corporate governance: disclosure and transparency. The choice of our variables has been determined by

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7 This selection criterion takes into account changes in stock price synchronicity because of changes in the number of firms that are listed in the stock exchange at each point in time. This is important especially in the case of countries that experienced a crisis. By construction, a balanced sample would not reflect exits of bankrupt firms (possibly characterized by poor corporate governance) and entry of new firms (possibly characterized by good corporate governance).
three criteria: (1) they are based on widely accepted methodologies developed in the finance literature; (2) they are based on widely available financial data and can easily be replicated and updated; and (3) they can be computed annually so we can track changes over time. We have considered a number of other variables considered by the corporate governance literature but these were not included because they did not meet any of the above criteria. These variables include ownership structures, American Depository Receipts (ADR) premiums, and the value of cash holdings.

Finally, as already mentioned, we focus on de facto measures of corporate governance and do not include de jure measures such as shareholder rights and those based on securities laws (see La Porta and others, 1998; and La Porta, Lopez-de-Silanes, and Shleifer, 2006). The reason is that we want to capture changes in corporate governance at the firm level rather than changes in laws that are generally made at the country level, and most importantly, we aim to capture real rather than legal changes in corporate governance quality. Changes in laws, because they are often not effectively enforced, may not be reflected in real changes that affect firm performance.

14.3. TRENDS IN CORPORATE GOVERNANCE QUALITY

The time series of the CGQ index and its components for 10 Asian countries (China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Singapore, and Thailand), 7 Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela), 22 developed countries and 2 other emerging markets (South Africa and Turkey) are reported in Tables A14.1 to A14.4 in the Appendix of the working paper on which this chapter is based (De Nicolò, Laeven, and Ueda, 2006).

As shown in Figure 14.1, improvements in corporate governance quality have been recorded in most emerging market economies and developed economies, although with varying intensity. With regard to emerging market economies, it is

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8 Although there exists a large literature on the relationship between ownership and firm performance (see, for example, Shleifer and Vishny, 1997; Claessens, Djankov, and Lang, 2000; and Gompers, Ishii, and Metrick, 2003), we do not consider ownership structures of firms because data on ownership structures is not widely available and because ownership structures do not change much over time, except when dramatic events such as mergers and acquisitions occur.

9 We do not consider ADR premiums because this measure does not exhibit a consistent pattern across countries. In theory, ADR premiums (i.e., the stock price premium of ADRs over domestically listed shares) for foreign firms cross-listed in the United States should be higher for firms with worse corporate governance (see, for example, Doidge, Karolyi, and Stulz, 2004). However, of all the countries included in our study we find that U.K. and Canadian firms display the highest premiums, and that premiums of firms in these countries are significantly higher than for firms in countries that one would expect to have poor corporate governance.

10 The value of cash holdings measure proposed by Pinkowitz, Stulz, and Williamson (2005) is based on the premise that one dollar in the corporate balance sheet is valued less than one dollar by the stock market in countries where corporate governance is weak. This measure appears highly volatile when estimated over time and therefore does not seem to capture well changes in corporate governance over time.

11 The developed countries are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States.
Figure 14.1  CGQ index, subperiod averages. This figure shows the average of the CGQ index for each country for the two periods 1995 to 1996 and 2000 to 2003. The countries are grouped by region.
worth noting that improvements in the CGQ index in Asian countries have been larger on average than those witnessed by Latin American countries, which also exhibit levels of the index generally lower than in Asia. Yet, in both emerging market regions, as well as in some developed economies, the level of the index remains about 15 to 20 percent below that of the first quartile of developed economies.

The case of Asia is of interest with regard to the information content of our CGQ index relative to changes in *de jure* measures. As shown in Figure 14.2, the CGQ index exhibits an upward trend in all Asian countries except China, where the index exhibits a decline. However, notable improvements have been recorded in Hong Kong SAR, Malaysia, Philippines, Singapore, and Thailand, although improvements in India, Indonesia, Korea, and Pakistan have been more muted.

These patterns contrast with those exhibited by measures of shareholder and creditor rights during a similar period.12 As shown in Table 14.1, minority shareholder rights appear to have been strengthened in some countries, but not in others. By contrast, measures of creditor rights do not appear to have improved, and they have even worsened in some countries. On average, minority shareholder rights have improved somewhat and creditor rights have deteriorated somewhat for our sample of countries. In general, these *de jure* indexes of shareholder rights and creditor rights are very stable over the sample period for our sample of countries, with little or no changes in most cases. Yet, there appears to be no relationship between the direction of change recorded by *de jure* type measures and that recorded by our outcome-based measure. Panel A of Table 14.2 shows that the correlation between the CGQ index and the *de jure* measures is low (−0.17 in the case of creditor rights and −0.01 in the case of shareholder rights) and statistically insignificant. This difference between *de jure* and *de facto* measures suggests the importance of taking into account the endogeneity of firms’ governance choices in evaluating trends in corporate governance quality.

In which dimension has corporate governance quality changed most? As noted, each component of the CGQ index captures different, albeit complementary, aspects of corporate governance quality, as witnessed by the fact that their cross-correlation is relatively low, ranging from 0.16 to 0.28 (Panel B of Table 14.2). Thus, it is informative to look at the evolution of each component separately.

As shown in Figure 14.3, improvements in the ES indicator have occurred in Asia, and they have been substantial in developed economies, although progress has been either slow, or nonexistent, in the Latin American countries. Thus, in the dimension of transparency captured by the ES indicator, progress has been slower on average in emerging markets. Observe that the value of the ES indicator for the median Asian and Latin American countries remains about one-third lower than the median of the developed country group as of 2003. By contrast, progress in the transparency dimension captured by the SPS indicator has been more pronounced in emerging markets than in developed economies.

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Figure 14.2  CGQ index in Asia. This figure shows the evolution of the CGQ index over the period 1995 to 2003 for a select number of countries in Asia.
### TABLE 14.1
Changes in Creditor Rights and Shareholder Protection

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<tbody>
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<td>0</td>
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<tr>
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<td>Chile</td>
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<td>China</td>
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<td>n.a.</td>
</tr>
<tr>
<td>Denmark</td>
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<td>Germany</td>
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<td>Greece</td>
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</tr>
<tr>
<td>Hong Kong SAR</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>India</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Indonesia</td>
<td>−1</td>
<td>n.a.</td>
</tr>
<tr>
<td>Ireland</td>
<td>0</td>
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</tr>
<tr>
<td>Israel</td>
<td>−1</td>
<td>1</td>
</tr>
<tr>
<td>Italy</td>
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<td>1</td>
</tr>
<tr>
<td>Japan</td>
<td>−2</td>
<td>0</td>
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<tr>
<td>Korea, Rep.</td>
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<td>1</td>
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<tr>
<td>Mexico</td>
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<tr>
<td>Netherlands</td>
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<td>Norway</td>
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<td>Pakistan</td>
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<td>Philippines</td>
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<tr>
<td>Portugal</td>
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<td>0</td>
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<tr>
<td>Singapore</td>
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<td>South Africa</td>
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<tr>
<td>Spain</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Sweden</td>
<td>−1</td>
<td>0</td>
</tr>
<tr>
<td>Switzerland</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Taiwan, Province of China</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Thailand</td>
<td>−1</td>
<td>0</td>
</tr>
<tr>
<td>Turkey</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>United States</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Average change</strong></td>
<td>−0.16</td>
<td>0.19</td>
</tr>
</tbody>
</table>

n.a., data not available.

This table lists the changes over the period 1995 to 2002 in the index of creditor rights from Djankov and others (2007) and the changes over the period 1997 to 2005 in the index of anti-directors’ rights (shareholder protection) from Spamann (2006) for the sample of countries included in our study.

(Figure 14.4). Indeed, Asian countries exhibit levels closer to those exhibited by other developed countries, whereas for Latin American countries SPS levels remain significantly lower than those of developed countries, despite recent improvements. Lastly, the AS indicator exhibits some improvement, albeit small, in most Asian countries, though the indicator exhibits virtually no change in both Latin American and developed economies (Figure 14.5).
### TABLE 14.2
Correlation Matrix of Creditor Rights, Shareholder Protection, and CGQ Index

#### PANEL A. CORRELATION AMONG CHANGES IN CREDITOR RIGHTS, SHAREHOLDER PROTECTION, AND CGQ INDEX

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in Shareholder Protection, 1997–2005</td>
<td>−0.005</td>
<td>−0.006</td>
</tr>
<tr>
<td>(36)</td>
<td>(38)</td>
<td></td>
</tr>
<tr>
<td>Change in CGQ Index, 1995–2003</td>
<td>−0.172</td>
<td></td>
</tr>
<tr>
<td>(38)</td>
<td>(36)</td>
<td></td>
</tr>
</tbody>
</table>

#### PANEL B. CORRELATION BETWEEN CREDITOR RIGHTS, SHAREHOLDER PROTECTION, CGQ INDEX, AND ITS COMPONENTS

<table>
<thead>
<tr>
<th></th>
<th>Creditor Rights</th>
<th>Shareholder Protection</th>
<th>CGQ Index</th>
<th>Accounting Standards</th>
<th>Earnings Smoothing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shareholder protection</td>
<td>0.124</td>
<td>0.005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(40)</td>
<td>(36)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CGQ Index</td>
<td>0.024</td>
<td>−0.057</td>
<td>0.538**</td>
<td>0.267**</td>
<td>0.157**</td>
</tr>
<tr>
<td>(320)</td>
<td>(36)</td>
<td>(361)</td>
<td>(361)</td>
<td>(395)</td>
<td>(378)</td>
</tr>
<tr>
<td>Accounting standards</td>
<td>0.170**</td>
<td>0.106</td>
<td>0.747**</td>
<td>0.276**</td>
<td>0.157**</td>
</tr>
<tr>
<td>(354)</td>
<td>(36)</td>
<td>(361)</td>
<td>(361)</td>
<td>(395)</td>
<td>(378)</td>
</tr>
<tr>
<td>Earnings smoothing</td>
<td>−0.130**</td>
<td>−0.107</td>
<td>0.747**</td>
<td>0.276**</td>
<td></td>
</tr>
<tr>
<td>(336)</td>
<td>(36)</td>
<td>(361)</td>
<td>(361)</td>
<td>(395)</td>
<td></td>
</tr>
<tr>
<td>Price synchronicity</td>
<td>0.022</td>
<td>0.164</td>
<td>0.754**</td>
<td>0.276**</td>
<td>0.157**</td>
</tr>
<tr>
<td>(378)</td>
<td>(40)</td>
<td>(361)</td>
<td>(395)</td>
<td>(378)</td>
<td></td>
</tr>
</tbody>
</table>

CGQ, corporate governance quality

Panel A reports correlations between changes over the period 1995 to 2002 in the index of creditor rights from Djankov and others (2007), changes over the period 1997 to 2005 in the index of anti-directors’ rights (shareholder protection) from Spamann (2006), and changes over the period 1995 to 2003 in the CGQ index. Panel B reports correlations over the sample period (when data are available) between the levels of the index of creditor rights from Djankov and others (2005), the index of anti-directors’ rights (shareholder protection) from Spamann (2006), and the CGQ index and its components.

Number of observations between parentheses.

**Significant at 5 percent.

Despite the noted regional and country differences in the evolution of the index, convergence toward higher values of the CGQ index has occurred, as indicated by the negative and relatively large cross-country correlation (−0.53) between the average growth rate of the CGQ index during the 1994–2003 period and the 1995 level. On average, countries with the fastest average rate of increase of the index were indeed those witnessing the lowest levels of the index in 1995. For example, the gap between the CGQ index in Asian countries and that recorded for the United States, which is the highest among all countries in all years, has narrowed since 1994. Notably, convergence has occurred at a relatively faster rate in the transparency dimension, as the correlations between initial levels of the ES and SPS indicators and their average growth rates, equal to −0.74 and −0.67, respectively, are substantially higher in absolute value than the relevant correlation for the CGQ index.

In sum, corporate governance quality of nonfinancial firms listed in domestic stock markets has improved overall in almost every country considered during the
Figure 14.3  Earning smoothing indicator, subperiod averages. This figure shows the average of the earnings smoothing indicator for each country for the two periods 1995 to 1996 and 2000 to 2003. The countries are grouped by region.
Figure 14.4  Stock price synchronicity indicator, subperiod averages. This figure shows the average of the Stock Price Synchronicity indicator for each country for the two periods 1995 to 1996 and 2000 to 2003. The countries are grouped by region.
Figure 14.5  Accounting standards indicator, subperiod averages. This figure shows the average of the accounting standards indicator for each country for the two periods 1995 to 1996 and 2000 to 2003. The countries are grouped by region.
1994–2003 period, and improvements have been witnessed primarily in the transparency dimension captured by the ES and SPS indicators. Remarkably, convergence in corporate governance quality has indeed occurred within the set of countries considered.

A critical question is whether improvements in corporate governance quality have “real” effects. We address such questions next by measuring the impact of our indicators on real economic outcomes.

14.4. THE REAL EFFECTS OF CORPORATE GOVERNANCE QUALITY

Corporate governance quality may affect aggregate economic activity through several channels. For example, improvements in corporate governance quality may impact positively on growth by lowering firms’ cost of funds and possibly increasing the supply of credit, thereby encouraging investment. Moreover, better governed firms may align managers’ and claimholders’ interests more closely, providing stronger incentives for managers to achieve high firm productivity growth by the adoption of frontier technologies. As a result, capital in the corporate sector may be allocated more efficiently, and economy-wide productivity growth may increase.

More generally, corporate governance arrangements can be viewed as technologies that firms may adopt subject to the constraints of the institutional environment in which they operate. Comin and Mulani (2005) formulate an endogenous growth model which embeds firms’ choices of “general innovations,” defined as innovations that are available and applicable to several firms and sectors, and whose “rents” or “benefits” are not privately appropriable, as in the case of patentable research and development. Their model rationalizes several empirical facts concerning the dynamics of productivity growth at the aggregate level, as well as at an industry and firm level. Managerial and organizational innovations are prominent examples of general innovations. If corporate governance arrangements are viewed as general innovations in the sense of Comin and Mulani, then they may have a significant impact on macroeconomic activity and productivity growth.

To assess the link between corporate governance quality and macroeconomic activity, we estimate two complementary statistical models that can be viewed as generic empirical counterparts of models of endogenous growth partly driven by general innovations such as corporate governance arrangements. The first model is a simple dynamic panel model that exploits both the time and cross-sectional dimensions of the data. We use this setup to explore the impact of our measures of corporate governance quality on GDP growth, on estimates of TFP growth, and on the ratio of investment to GDP. The second model exploits only the cross-sectional dimensions of the data, but expands such dimensions by including industry-level data. We use it to explore the impact of changes in our corporate governance indicators on the growth of industries most dependent on external finance.
14.4.1. Impact on Growth, Productivity, and Investment

Our benchmark statistical setup is given by the following standard autoregressive dynamic panel model:

\[
Y_{it} = \alpha_i + CGQ_{it-1}\beta + \ln(X_{it})\gamma + \delta_1Y_{it-1} + \delta_2Y_{it-2} + \varepsilon_{it},
\]

\[t \in [1,\ldots,T], i \in \{1,\ldots,N\}\] (1)

The dependent variable, \(Y_{it}\), denotes either GDP growth, TFP growth, and the investment-to-GDP ratio for country \(i \in \{1,\ldots,N\}\) (\(N\) denotes the number of countries) in year \(t \in [1,\ldots,T]\) (\(T\) denotes the terminal date of the sample). The constants \(\alpha_i\) capture time-invariant, unobserved country-specific effects. \(CGQ_{it-1}\) denotes the CGQ index or the vector of its components, and it is lagged because we assume it takes time to translate the effects of a change in corporate governance in a given year into macroeconomic outcomes. Of course, such a change will affect values of the dependent variable beyond the subsequent year via its autoregressive term. \(X_{it}\) denotes a vector that includes all other variables that affect \(Y_{it}\), and are log-transformed for the reasons detailed below. We include two lags of the dependent variable to deal with potential serial correlation of the residuals. The errors \(\varepsilon_{it}\) are assumed to be identically, independently distributed and uncorrelated over time and across countries. Our focus is on estimates of the parameter vector \(\beta\).

We accomplish this estimation following two steps. First, using the difference operator \(\Delta x_t = x_t - x_{t-1}\), equation (1) can be expressed as:

\[
\Delta Y_{it} = \Delta CGQ_{it-1}\beta + \Delta \ln(X_{it})\gamma + \delta_1\Delta Y_{it-1} + \delta_2\Delta Y_{it-2} + \Delta \varepsilon_{it}
\]

(2)

Note that if we could control exhaustively for each relevant country component of the vector \(X_{it}\), we would be able to obtain precise unbiased estimates of \(\beta\) using equation (2). However, controlling for all relevant variables is likely to be a daunting task. Even if this could be done, we would rapidly exhaust our degrees of freedom.

Alternatively, we can approximate, and control for, the effects of these variables by making assumptions on the data-generating process of \(X_{it}\). Specifically, we assume that the vector \(X_{it}\) satisfies \(\Delta \ln(X_{it}) = G_{it} + v_{it}\), where \(v_{it}\) are identically, independently distributed, and uncorrelated over time and across countries. This

---

13 We estimate TFP growth based on the standard method used by Klenow and Rodriguez-Clare (2005) without correcting for changes in educational attainments, as they vary little in the sample period for our sample countries. The underlying data are from Penn World Table 6.1 and the IMF’s World Economic Outlook database.

14 When including only one lag of the dependent variable, we obtain similar results but the Arellano and Bond (1991) test for second-order serial correlation rejects the null hypothesis of zero autocorrelation in several specifications of our basic model.

15 As stressed by Bond (2002), one advantage of this type of autoregressive-distributed lag model is that it does not require modeling the series on the right-hand side of the equation to estimate the relevant coefficients.

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amounts to assuming that the continuously compounded growth rates of the variables in $X_i$ are random. Next, define $A_i = G_i \gamma$ and $\eta_i = \nu_i \gamma + \Delta \varepsilon_i$. We make the further assumption that all $\nu_i$ are uncorrelated with $CGQ_{i,t-1}$ and $\Delta \varepsilon_i$. Under this set of assumptions, we obtain the following fixed (country) effect dynamic panel regression model in differenced variables:

$$\Delta Y_{it} = A_i + \Delta CGQ_{i,t-1} \beta + \delta_1 \Delta Y_{i,t-1} + \delta_2 \Delta Y_{i,t-2} + \eta_i. \tag{3}$$

Using equation (3), we effectively control for time-invariant country characteristics by including country-fixed effects.\(^{16}\) Furthermore, to the extent that any time-varying country characteristic that we have not controlled for is not correlated with changes in our corporate governance index, our inference remains valid.\(^{17}\)

We estimate $\beta$ by applying the difference GMM estimation procedure developed by Arellano and Bond (1991) to equation (3). Because such estimation is carried out on differenced variables, it is actually implemented through differencing of equation (3), which is equivalent to “double” differencing equation (1). In this way, we are able to introduce an additional layer of country-specific effects that are used to control for the deterministic component of all variables $X_i$. Only in the regressions of the ratio of investment to GDP as the dependent variable, we have added the lagged value of GDP growth to control for business-cycle effects.

Estimations are carried out using an unbalanced panel composed of annual data of country-year observations for all countries listed previously for which data could be constructed or were available (about 40 countries) during the period 1993–2004. In all estimations, we treat both the lagged dependent variables and all independent variables as endogenous and instrument these variables using their lags at time $t-3$, $t-4$, and so on, up to a maximum of nine lags. We report results for the one-step Arellano-Bond (1991) estimator, though Sargan specification tests are based on the relevant two-step estimator.\(^{18}\) We first present the results for the benchmark model, and subsequently we assess whether, and in what way, these results change under some modifications of the benchmark model. In all the benchmark estimates, as well as in virtually all subsequent ones, the autocorrelation and specification tests indicate that coefficient estimates are unbiased and the specification of the model is satisfactory.

\(^{16}\) When including time-fixed effects, all specification tests remain valid. Moreover, the sign of the coefficients is unchanged, but there is a loss of precision in the estimates, as significance levels drop. This is not surprising, because these variables in part capture the synchronicity of changes in corporate governance arrangements across several countries.

\(^{17}\) Standard control variables used in the growth literature, such as schooling and population growth, tend not to vary much over short periods of time, and are unlikely to be highly correlated with our corporate governance index. However, a large aggregate shock, for example one resulting in a currency crisis, may be correlated with the CGQ index, and below we conduct robustness checks to account for this possibility.

\(^{18}\) One assumption underlying the Arellano and Bond (1991) model is the stationarity of the dependent and independent variables. Standard Dickey-Fuller unit root tests indeed confirm that the variables of interest are stationary.
14.4.1.1. Benchmark Results

As shown in Table 14.3, estimates of the benchmark model yield three main results. First, GDP growth, TFP growth, and the ratio of investment to GDP vary positively and significantly with lagged values of the CGQ index. Second, changes in corporate governance quality have a significant economic impact on GDP, TFP growth, and the ratio of investment to GDP. Namely, a one-standard deviation increase in the CGQ index in the current year results in an increase in GDP growth of about 2 percentage points \((0.02 = 0.21 \times 0.09)\), an increase in TFP growth of about 2 percentage points \((0.02 = 0.24 \times 0.09)\), and an increase in the ratio of investment to GDP of about 1 percentage point \((0.93 = 10.30 \times 0.09)\), in the following year. These are substantial effects compared to the averages for these variables (see Table 14.9 for the summary statistics of the main regression variables).

Third, the positive dynamic relationship between all measures of macroeconomic outcomes and corporate governance quality appears to be driven by improvements in transparency, because the coefficients associated with the SPS indicator are positive and significant in all regressions. In this specification, the SPS indicator appears to be the main component driving the significance of the overall CGQ index. Given the lack of significance of the AS indicator, this suggests that what matters for firm performance is the transparency of the accounting information.

### TABLE 14.3

| Aggregate Economic Activity and Corporate Governance: Benchmark Model |
|----------------------------------|--------|--------|--------|
|                                  | (1)    | (2)    | (3)    |
| **DEPENDENT VARIABLES**          | (4)    | (5)    | (6)    |
| GDP Growth\(_{t-1}\)             | 0.209* | 0.238**| 10.306**|
| TFP Growth\(_{t-1}\)             |        |        |        |
| INV to GDP\(_{t-1}\)             |        |        |        |
| CGQ index\(_{t-1}\)              | (1.88) | (2.10) | (2.06) |
| Earnings smoothing\(_{t-1}\)     | 0.029  | 0.005  | 0.352  |
| Price synchronicity\(_{t-1}\)    | 0.082**| 0.101***| 5.639**|
| Accounting standards\(_{t-1}\)   | 0.081  | 0.0417 | 5.987  |
| GDP growth\(_{t-1}\)             | (0.42) | (1.25) | (0.97) |
| Dependent variable\(_{t-1}\)     | −0.496*** | −0.513*** | −0.494*** |
|                          | (−6.41) | (−6.63) | (−7.40) |
| Dependent variable\(_{t-2}\)     | −0.322*** | −0.317*** | −0.355*** |
|                          | (−6.01) | (−5.93) | (−9.01) |
| Number of countries/obs          | 40/271 | 40/271 | 40/234 |
| M1 (p-value)                     | 0.00   | 0.00   | 0.00   |
| M2 (p-value)                     | 0.33   | 0.34   | 0.33   |
| Sargan test (p-value)            | 1.00   | 1.00   | 1.00   |

CGQ, corporate governance quality; INV, investment; TFP, total factor productivity.

Estimates are obtained by the (difference) GMM one-step estimator of Arellano and Bond (1991) applied to equation (3), where both the lagged dependent and independent variables are treated as endogenous and are instrumented with all their lags at \(t-3, t-4\), and so on, up to a maximum of nine lags. Robust t-statistics are reported in brackets; * denotes significant at 10%; ** significant at 5%; *** significant at 1%; M1 and M2 is the p-value of the Arellano Bond statistics for second-order correlation of residuals; Sargan test is the p-value obtained by estimates of the two-step version of the model.
disclosed (as captured by the SPS indicator) rather than the amount of information disclosed (as captured by the AS indicator).\textsuperscript{19} The Sargan test for overidentifying restrictions and the Arellano and Bond (1991) $m_2$ test for second-order serial correlation of the error term both support the benchmark model specification and do not detect any problems.\textsuperscript{20}

14.4.1.2. Accounting for Financial Crises

We wish to establish whether the benchmark results are primarily driven by observations sampled during “crisis” years, defined as years characterized by either output drops, sharp currency devaluations, stock market crashes, systemic bank failures, or combinations of all these occurrences. If this were the case, the impact of corporate governance quality on macroeconomic outcomes (parameter $\beta$) would likely be estimated imprecisely, since even shocks that are “temporary” relative to a long time span would necessarily appear as “long-lasting” in the short time dimension of our data. Moreover, and related to some of the components of our CGQ index, our estimates could capture effects not necessarily related to corporate governance. For example, the high synchronicity of individual stock returns occurring during stock market crashes may coincide with sharp declines in GDP per capita, generating a temporarily high comovement between GDP growth and synchronicity in stock returns.\textsuperscript{21} In addition, during crisis periods firms may try even harder not to disclose information and overstate firm performance, resulting in an unusually high reporting of accounting accruals. Again, this could generate a temporarily high comovement between ES and macroeconomic outcomes, which would be reflected as a relatively “long-lasting” shock in our estimation.

To cope with this issue, we first defined “crises” country-years if there was either a negative value of GDP growth (an output drop), or a negative change in stock market capitalization (a stock market drop), or a banking crisis, identified as the initial year and the year subsequent to a banking crisis date as classified by Laeven and Honohan (2005). Then, we estimated the benchmark model on a sample where all crisis country-years were dropped, that is, on a sample of “non-crisis” country-years.

\textsuperscript{19}Note, however, that greater synchronicity may also be related to factors other than accounting transparency (as mentioned earlier), such as the degree of industry specialization or the degree of uncertainty about monetary policy in the country, and should thus be interpreted with this caveat in mind.

\textsuperscript{20}We should note that the test of second-order serial correlation indicates the absence of second-order serial correlation. If the errors in the model in levels [equation (1)] are serially uncorrelated, then the double-differenced model [equation (3)] may exhibit second-order serial correlation. This not being the case, our results suggest that the errors in the model in levels are close to a random walk, which may generate only first-order serial correlation in the double-differenced model.

\textsuperscript{21}The data on stock price synchronicity and GDP growth for the East Asian crisis countries during the crisis years 1998–99 are consistent with this: the stock market crash in late 1998 coincided with high synchronicity in stock returns, and a sharp decline in GDP was recorded with one-year lag in 1999, generating an exceptionally high comovement between stock price synchronicity and GDP per capita growth during the crisis period.
As shown in Table 14.4, all our parameter estimates remain virtually unchanged, although the significance of the results of TFP growth is somewhat reduced. Thus, our results do not appear to be driven by crisis periods.

14.4.1.3. Accounting for Complex Dynamics

In the benchmark model a change in corporate governance quality affects macroeconomic outcomes with a one-year lag, and impacts on their future values through the persistence parameters $\delta_1$ and $\delta_2$. In reality, changes in corporate governance may take a longer time to exert their effects on macroeconomic outcomes and could be highly persistent. In addition, crisis and recovery from crisis may well create complicated dynamic paths which might not be effectively captured by the simple lag structure of the benchmark model. For example, if improving governance is costly to the firm, but its cost varies according to whether or not a crisis is unfolding, then a firm dynamic decision to improve governance could create a complex interaction with the level of macroeconomic activity. Statistically, in these cases the assumption of independent distribution of the errors over time in equation (3) may be too strong.
To assess whether the benchmark model is a reasonable approximation of the data-generating process in this dimension, we augmented the lag structure of the model subject to the constraints imposed by the time span of our data. Specifically, we estimated equation (1) with two additional lagged values of the corporate governance indicator, and one additional autoregressive term (at time $t-3$), both for the whole sample and the “noncrisis” sample defined previously.

As shown in Table 14.5, the qualitative results obtained previously remain unchanged. In addition, these estimates provide some useful insights. First, higher-lagged values of the CGQ index do not enter significantly, indicating that the benchmark specification of the lagged structure for this variable is not off the mark. Second, all three lags of the dependent variable are statistically significant, indicating a high persistence of the impact of improvements in corporate governance. Third, the coefficients for the “noncrisis” sample are comparable in size to those of the whole sample, suggesting that during crisis periods the effects of improvements in corporate governance may not be all that different from during “noncrisis” periods.22

Note that in Tables 14.4 and 14.5, there is evidence of second-order serial correlation for some specifications, consistent with the assumptions of lack of serial correlation of the disturbances in the model in levels (see footnote 20).

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14.4.1.4. Accounting for Financial Development

Identifying the impact of corporate governance quality per se on aggregate economic activity is complicated because other interrelated factors may be at play. Among these, financial development is of particular importance, because such development may be both a function, and a potentially important determinant, of corporate governance quality. For example, if firms cannot achieve the potential reduction in borrowing costs arising from improvements in corporate governance because the capacity of the financial sector to price risk is underdeveloped, then their incentives to improve corporate governance may be limited. There is also a growing literature on how transparency improves the operation of banks and other financial intermediaries (e.g., Barth, Caprio, and Levine, 2004, 2006; Demirgüç-Kunt, Laeven, and Levine, 2004; and Beck, Demirgüç-Kunt, and Levine, 2007). Given that banks as creditors and equity holders play an important role in governing firms, an improvement in the transparency and governance of banks may also increase the likelihood that banks exert sound governance over the firms they fund. In addition, financial development per se may be an important determinant of macroeconomic outcomes. In terms of the benchmark model, variables related to financial development may be dynamically correlated with our corporate governance indicators, making it necessary to take them explicitly into account to mitigate the potential biases in the estimates.

To account for financial development and its potential interaction with corporate governance, we consider the following extension of the benchmark model:

\[
Y_{it} = \alpha_i + \beta_1 CGQ_{it-1} + \beta_2 FD_{it-1} + \beta_3 CGQ_{it-1} FD_{it-1} + \ln(X_{j}) \gamma +
\delta_1 Y_{it-1} + \delta_2 Y_{it-2} + \varepsilon_{it},
\]

where \( FD_{it-1} \) is the lagged value of a proxy measure of financial development, given by the sum of private credit and stock market capitalization to GDP. As before, we estimate parameters \( \beta_1, \beta_2, \) and \( \beta_3 \) by applying the difference GMM estimator to the regression:

\[
\Delta Y_{it} = A_i + \beta_1 \Delta CGQ_{it-1} + \beta_2 \Delta FD_{it-1} + \beta_3 \Delta(CGQ_{it-1} FD_{it-1}) +
\delta_1 \Delta Y_{it-1} + \delta_2 \Delta Y_{it-2} + \eta_{it}.
\]

As shown in Table 14.6, although the qualitative results are essentially the same as those obtained with the benchmark model, they provide evidence of the complementarities between corporate governance and financial development we have emphasized. In fact, the interaction terms between these variables are positive and significant in all regressions except the ones with the ratio of investment to GDP as the dependent variable. That is, the economic impact of improvements in corporate governance on macroeconomic outcomes is greater the more developed is the financial sector. Furthermore, although the “autonomous” impact of the SPS indicator continues to be positive and significant in all regressions, now the ES measure too exhibits a positive and significant effect on GDP growth and TFP growth when interacted with the financial development proxy. This result is consistent with the role of a developed financial sector in enhancing
the impact of improvements in corporate governance. The SPS measure exhibits a positive and significant effect only on TFP growth when interacted with the financial development proxy. The AS measure enters positively and significantly in the investment to GDP regression at low levels of financial development and turns negative or insignificant at high levels of financial development. However, the AS variables turn insignificant when not controlling for the ES and SPS variables and interaction terms, suggesting that this result is because of collinearity between the three governance measures.

### 14.4.1.5. Long-Run Effects

The “long-run” effects of corporate governance quality on macroeconomic outcomes are given by estimates of the parameter $\beta/(1 - \delta_1 - \delta_2)$. Although we have
established that this parameter is positive and significant, the time span of our
data is too short to allow us to measure these long-run effects with precision.
Moreover, pinning down such effects with cross-country regressions would be
difficult, because one would need to identify through theory, and control explicit-
ly for, a host of country-specific, possibly endogenous, variables. Besides, with
only about 40 observations in the sample and the potential need to consider
many control variables, our degrees of freedom would be rapidly exhausted and
the precision of our estimates would likely be unsatisfactory. Rather than pursu-
ing this avenue, we complement the foregoing analysis by expanding the cross-
sectional dimension of the data in order to focus on the differential effect of
improvements of corporate governance on long-run industry growth.

14.4.2. Impact on Growth of Financial Dependent Industries

As noted, the returns of good corporate governance are likely to be the largest
when firms are able to attain easier and less costly access to finance, and such
access is critical for their growth prospects. Therefore, we would expect that the
benefits of improvements in corporate governance quality would be the largest for
financially dependent industries.

To assess this conjecture, consider the following industry-level counterpart of
model (1):

\[
Y_{ijt} = \hat{\alpha}_i + \hat{\alpha}_j + X_{it-1}\beta_1 + Z_{jt-1}\beta_2 + W_{ijt-1}\beta_3 + \delta_1 Y_{ijt-1} + \delta_2 Y_{ijt-2} + \eta_{ijt},
\]  

(6)

with \( t \in \{1, ..., T\} \), \( i \in \{1, ..., N\} \), \( j \in \{1, ..., M\} \), where \( M \) is the number of industries,
\( Y_{ijt} \) is the continuously compounded real growth rate of industry \( j \) in country \( i \),
\( \hat{\alpha}_i \) and \( \hat{\alpha}_j \) are fixed country and industry effects respectively,
\( X_{it} \) are firm-specific variables,
\( Z_{jt} \) are country-specific variables,
\( W_{ijt} \) are firm-country-specific variables,
and \( \eta_{ijt} \) is the error term.

Under the assumption that all right-hand side variables grow at a constant
deterministic rate during the period \([1, ..., T]\), in a steady state we obtain the fol-
loowing regression model:

\[
Y_{ij} = \alpha_i + \alpha_j + W_{ij}\hat{\beta} + \varepsilon_{ij},
\]

(7)

where \( \alpha_i = (1 - \delta)^{-1}(\hat{\alpha}_i + X_i\beta_1) \), \( \alpha_j = (1 - \delta)^{-1}(\hat{\alpha}_j + Z_j\beta_1) \), \( \hat{\beta} = (1 - \delta)^{-1}\beta_3 \) and
\( \varepsilon_{ij} = T^{-1}\sum_{t=1}^{T} \eta_{ijt} \)
and all variables without time subscript denote their relevant constant growth rates.

As noted previously, precise and unbiased estimates of \( \hat{\beta} \) would be obtained if
we could control exhaustively for each relevant component of the vector \( W_{ij} \). Yet,
this is a task even more difficult than that we faced before, because it would
require identification of a host of country- and industry-specific variables. For
these reasons, we employ an approach similar to the one developed by Rajan and
Zingales (1998), and estimate the following benchmark industry-level regression:

\[
Growth_{ij} = \alpha_i + \alpha_j + \gamma^* Share_{ij} + \beta^* CGQ_i^* ED_j + \delta^* FD_i^* ED_j + \varepsilon_{ij},
\]

(8)
where $Growth_{ij}$ is real sales growth over the period 1995 to 2003 of industry $j$ in country $i$, calculated at the ISIC industry level and weighted by the lagged value of market capitalization of individual firms, $Share_{ij}$ is the share of the industry in total real sales of the country in 1995, $CGQ_i$ is the level of corporate governance of country $i$ in 1995, $FD_i$ is the level of financial development of country $i$ in 1995, and $ED_j$ is the Rajan and Zingales (1998) measure of external financial dependence, calculated at the two- or three-digit ISIC industry level over the period 1980 to 1989. The sample consists of the 36 manufacturing industries covered by Rajan and Zingales (1998) in a total of 34 countries. We include the industry share in total sales to capture a potential convergence effect, because industries that are large relative to other industries in the country are expected to grow at lower rates. Rajan and Zingales (1998) show that the growth of financially dependent industries is disproportionally higher in countries with more financial development.

By augmenting the specification in Rajan and Zingales (1998) with the interaction between the level of corporate governance quality and external financial dependence, we can disentangle the effect of corporate governance from the effect of financial development on growth and assess the differential effect of corporate governance quality on growth net of the impact of financial development. Following Rajan and Zingales (1998) we use the sum of private credit and stock market capitalization to GDP as the measure of financial development.23

This specification has the advantage over a pure cross-country regression in that it controls for country- and industry-fixed effects. However, it rests on the assumption that the vector $W_{ij}$ is only composed of three elements, the variable $Share_{ij}$ and the interaction terms $CGQ_i^*ED_j$ and $FD_i^*ED_j$, that is, $W_{ij} \hat{\beta} = \gamma Share_{ij} + \beta CGQ_i^*ED_j + \delta FD_i^*ED_j$. In what follows, we also consider a richer specification of the vector $W_{ij}$ which includes a triple interaction between financial dependence, corporate governance, and financial development.

It is worth stressing that this specification only allows us to measure the differential effect of corporate governance (controlling for financial development) on outcome measures of economic performance, but not level effects. That is, we can measure whether improvements in corporate governance disproportionately affect the growth of industries that are most likely to benefit from such improvements, but we cannot measure whether improvements in corporate governance directly affect the growth of all industries.

The industry characteristic of interest is the degree of external financial dependence, measured as the share of investment not financed by operating cash-flow (see Rajan and Zingales, 1998), because we expect industries that rely more on outside finance to benefit most from improvements in corporate governance because it should help them to attract external financing for investment.

Table 14.7 reports the regression results of our basic specification in model (8). In addition to using our overall index of corporate governance, we also run regressions for each component of the governance index. We include the level of

23 We obtain similar results when using private credit to GDP as a measure of financial development.
We find a strong and positive effect of corporate governance on the growth of financially dependent industries. The effect is statistically significant at the 5 percent level (column 1 of Table 14.7). We also find a disproportionate positive and significant effect on the growth of financial dependent industries for the indices of earnings smoothing and stock price synchronicity. For the index of accounting standards, the effect, though positive, is not measured precisely and is not statistically significant from zero. The interaction between financial development and financial dependence also does not enter significantly. In column 5, we include all three subcomponents of the corporate governance index and find similar results.

The economic effect of the result on stock price synchronicity is also significant. Take the regression in column 1 of Table 14.7. The coefficient of this regression suggests that an industry at the 75th percentile of financial dependence in a country at the 75th percentile of the corporate governance index has a growth rate that is 0.10 (= 0.409*(0.625*0.452 − 0.571*0.070)) higher than an industry at the 25th percentile of financial dependence in a country at the 25th percentile of corporate governance (see Table 14.10 for the summary statistics of the main

### TABLE 14.7

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<td>R-squared</td>
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**CGQ**, corporate governance quality. The dependent variable is real sales growth over the period 1995 to 2003, calculated at the ISIC industry level. Share in industry sales is the share of the industry in total real sales of the country in 1995. Financial dependence is the Rajan and Zingales (1998) measure of external financial dependence, calculated at the 2- or 3-digit ISIC industry level. **CGQ** index is our country-level index of corporate governance, and is the average of the Earnings smoothing, Price synchronicity, and Accounting standards indicators. We include the value of these corporate governance scores in 1995 in the regressions. Financial development is private credit plus stock market capitalization to GDP in 1995. We lose two countries because of missing data on financial development: we do not have data on private credit for China and we do not have data on stock market capitalization for Ireland. All regressions include country- and industry-fixed effects. We report White's heteroskedasticity-consistent standard errors between brackets. Standard errors are corrected for clustering at the industry level. * denotes significant at 10%; ** significant at 5%; and *** significant at 1%.
regression variables). This is a substantial effect compared to the average growth rate of 0.10 (i.e., about one time average growth).

In Table 14.8, we wish to assess whether the effect depends on whether countries were affected by a banking crisis or not, as we did in the panel regressions in Table 14.4. As noted, we wish to check that the results are not driven by the crisis countries. In fact, Kroszner, Laeven, and Klingebiel (2007) show that the positive effect of financial development on the growth of financially dependent industries identified by Rajan and Zingales (1998) disappears during crises, and the same may be true for the effect of corporate governance on the growth of financially dependent industries. We use data from Laeven and Honohan (2005) to identify banking crises. In columns 1 to 5, we rerun the regressions for the subset of countries without banking crises during the sample period 1995–2003. We confirm our previous result on the overall corporate governance index (although the size of the effect decreases somewhat), suggesting that the effect we find is not driven by crisis countries. The interaction between earnings smoothing and financial dependence now enters positively and significantly at the 5 percent level (column 2), though the interaction between stock price synchronicity and financial dependence no longer enters significantly at the 10 percent level.

### TABLE 14.8

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<tr>
<td>R-squared</td>
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CGQ, corporate governance quality.
The dependent variable is real sales growth over the period 1995 to 2003, calculated at the ISIC industry level. Share in industry sales is the share of the industry in total real sales of the country in 1995. Financial dependence is the Rajan and Zingales (1998) measure of external financial dependence, calculated at the 2- or 3-digit ISIC industry level. CGQ index is our country-level index of corporate governance, and is the average of the Earnings smoothing, Price synchronicity, and Accounting standards indicators. We include the value of these corporate governance scores in 1995 in the regressions. Financial development is private credit plus stock market capitalization to GDP in 1995. We lose two countries because of missing data on financial development: we do not have data on private credit for China and we do not have data on stock market capitalization for Ireland. All regressions include country- and industry-fixed effects. We report White’s heteroskedasticity-consistent standard errors between brackets. Standard errors are corrected for clustering at the industry level. * denotes significant at 10%; ** significant at 5%; and *** significant at 1%.

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Thus far, we have tested whether the governance effect we identify is independent of the financial development effect identified by Rajan and Zingales (1998). In Table 14.9, we further corroborate the results in Rajan and Zingales (1998) by including a triple interaction term between financial dependence, corporate governance quality, and financial development to test whether the effect we find for corporate governance is conditional on the level of financial development of the country. This is indeed what we find. The sign of the coefficient on the triple interaction term is positive, suggesting that the effect we found previously on the interaction between financial dependence and the CGQ index is more pronounced in more financially developed countries, although the effect is not

| TABLE 14.9 |
| Controlling for Financial Development |

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<td>0.48</td>
<td>0.48</td>
</tr>
</tbody>
</table>

CGQ, corporate governance quality.
The dependent variable is real sales growth over the period 1995 to 2003, calculated at the ISIC industry level.
Share in industry sales is the share of the industry in total real sales of the country in 1995. Financial dependence is the Rajan and Zingales (1998) measure of external financial dependence, calculated at the 2- or 3-digit ISIC industry level. CGQ index is our country-level index of corporate governance, and is the average of the Earnings smoothing, Price synchronicity, and Accounting standards indicators. We include the value of these corporate governance scores in 1995 in the regressions. Financial development is private credit plus stock market capitalization to GDP in 1995. We lose two countries because of missing data on financial development: we do not have data on private credit for China and we do not have data on stock market capitalization for Ireland. In regressions (4) to (6), we report results for the subset of countries that did not experience a banking crisis during the period 1995–2003. We use data from Laeven and Honohan (2005) to identify banking crises. All regressions include country- and industry-fixed effects. We report White’s heteroskedasticity-consistent standard errors between brackets. Standard errors are corrected for clustering at the industry level. * denotes significant at 10%; ** significant at 5%; and *** significant at 1%.
statistically significant in all cases. The estimates indicate that this effect operates only at high levels of financial development.

14.5. CONCLUSION

The chapter has constructed new measures of corporate governance quality for a broad set of developed and emerging market countries based on recent advances in the finance literature. Contrary to existing indicators of corporate governance based on tracking changes in de jure governance laws and regulations, our index reflects the actual outcome of governance in the marketplace. This is important, because legal changes may not necessarily reflect actual outcomes owing to implementation lags, and because corporate governance quality may be an important firm decision, which can change relatively independently of the institutional environment in which firms operate. For a large set of countries during the period 1994 to 2003, our measures indicate that corporate governance quality has improved in almost all countries, and there is evidence of convergence.

We have gauged the “real” effects of corporate governance quality through estimation of a set of dynamic panel regression models for GDP growth, TFP growth, and the ratio of investment to GDP, and cross-sectional regressions of growth at the industry level.

Overall, our evidence suggests that improvements in corporate governance quality have a positive and significant effect on all measures of macroeconomic outcomes considered. This is true especially in the transparency dimension, as shown by the positive and significant impact of the SPS indicator, although all dimensions of corporate governance captured by our measures show a similar impact in countries with more developed financial sectors. In addition, at the industry level, we find that improvements in corporate governance appear to positively affect the performance of industries that depend on external finance.

These results are consistent with the notion that well-governed firms incorporate better managerial incentives that are likely to spur corporate sector growth and improve its productivity independently of the level of financial development. However, we also find that a higher level of financial development boosts the positive effects of improvements of corporate governance on macroeconomic outcomes, consistent with the notion that well-governed firms are better able to attract outside financing.

In sum, these findings suggest that it is actual, not necessarily legal, changes in corporate governance that really matter. Thus, our findings call for additional work to collect new data and compare a broad set of de jure and outcome-based measures of corporate governance rules and practices. We believe that such comparisons would enhance our understanding of the drivers of improvements in the quality of corporate governance and their real effects.

We have also analyzed whether the effect is different for the subset of East Asian countries in our sample. The reason for focusing on the East Asian countries is that growth and changes in corporate governance quality may have followed different paths in these countries in response to governance problems arising from the East Asian financial crisis in 1997 to 1998. However, we do not find a significant difference in the results for East Asian countries compared to the rest of the world.
### APPENDIX I

**TABLE 14.10**

Summary Statistics of Main Variables in Country Panel Regressions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs.</th>
<th>Mean</th>
<th>Median</th>
<th>Std. Dev.</th>
<th>25th Percentile</th>
<th>75th Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP growth</td>
<td>328</td>
<td>0.021</td>
<td>0.021</td>
<td>0.035</td>
<td>0.007</td>
<td>0.038</td>
</tr>
<tr>
<td>TFP growth</td>
<td>287</td>
<td>0.009</td>
<td>0.012</td>
<td>0.032</td>
<td>−0.000</td>
<td>0.023</td>
</tr>
<tr>
<td>INV to GDP</td>
<td>328</td>
<td>21.493</td>
<td>20.713</td>
<td>4.694</td>
<td>18.769</td>
<td>23.504</td>
</tr>
<tr>
<td>CGQ index</td>
<td>328</td>
<td>0.553</td>
<td>0.564</td>
<td>0.095</td>
<td>0.493</td>
<td>0.618</td>
</tr>
</tbody>
</table>

CGQ, corporate governance quality; INV, investment; TFP, total factor productivity.

**TABLE 14.11**

Summary Statistics of Main Variables in Industry Panel Regressions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs.</th>
<th>Mean</th>
<th>Median</th>
<th>Std. Dev.</th>
<th>25th Percentile</th>
<th>75th Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real sales growth</td>
<td>601</td>
<td>0.093</td>
<td>0.086</td>
<td>0.093</td>
<td>0.033</td>
<td>0.141</td>
</tr>
<tr>
<td>CGQ index</td>
<td>36</td>
<td>0.596</td>
<td>0.595</td>
<td>0.049</td>
<td>0.571</td>
<td>0.625</td>
</tr>
<tr>
<td>Earnings smoothing</td>
<td>36</td>
<td>0.146</td>
<td>0.121</td>
<td>0.108</td>
<td>0.080</td>
<td>0.187</td>
</tr>
<tr>
<td>Price synchronicity</td>
<td>36</td>
<td>0.810</td>
<td>0.824</td>
<td>0.115</td>
<td>0.782</td>
<td>0.902</td>
</tr>
<tr>
<td>Accounting standards</td>
<td>36</td>
<td>0.834</td>
<td>0.839</td>
<td>0.041</td>
<td>0.810</td>
<td>0.860</td>
</tr>
<tr>
<td>Financial development</td>
<td>34</td>
<td>1.418</td>
<td>1.136</td>
<td>0.905</td>
<td>0.744</td>
<td>2.074</td>
</tr>
<tr>
<td>Financial dependence</td>
<td>36</td>
<td>0.319</td>
<td>0.231</td>
<td>0.406</td>
<td>0.070</td>
<td>0.452</td>
</tr>
</tbody>
</table>

CGQ, corporate governance quality.

**REFERENCES**


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15.1 INTRODUCTION

Member countries are routinely faced with a range of shocks that can contribute to higher volatility in aggregate output and, in extreme cases, to economic crises. The presence of such risks underlies a potential demand for mechanisms to soften the blow from adverse economic shocks. Such a protective infrastructure—which may, of course, have ancillary benefits that are not related to offering protection against the impact of adverse shocks—will be referred to in this chapter as “country insurance.” Protective measures that countries can take themselves (“self-insurance”) include sound economic policies, robust financial structures, and adequate reserve coverage. Beyond self-insurance, countries have also established regional arrangements that pool risks whereas, at the multilateral level, the IMF has a central role in making its resources temporarily available to ease the costs of economic adjustment when shocks create balance of payments difficulties for a member country. In addition, the IMF, through the policy advice it provides under surveillance, has a key role in helping countries improve their own crisis-proofing armor.

This chapter analyzes a number of mechanisms through which countries can self-insure, with particular focus on national balance sheets—including the roles of countries’ external liability structures and self-insurance through reserves accumulation. As foreshadowed in the IMF Managing Director’s medium-term strategy (see IMF, 2005a), separate staff papers are expected to address collective insurance arrangements—regional reserve pooling arrangements, and global arrangements using a possible new lending instrument to provide high-access contingent financing for countries that have strong macroeconomic policies, sustainable debt, and transparent reporting, but nevertheless remain vulnerable to shocks.2

This chapter is a slightly revised version of IMF Occasional Paper No. 254 (2007).

1 Other contributors were Andre Levchenko (Appendix II) and Marcos Chamon and Cheng-Hoon Lim (Box 3.2). The authors are grateful to Raghuram Rajan for suggesting the topic and for his support and helpful suggestions throughout the project, and to Martín Minnon and Aleksander Zaklon for excellent research assistance.

The nature of the shocks that countries face—and for which they may seek insurance—is worthy of examination in its own right, because having a clear notion of which shocks are relatively frequent and costly—and for which members—is an essential step toward tailoring insurance solutions appropriately. For example, if terms of trade shocks or natural disasters are important for one group of countries, but sudden stops in financial flows are important for another, then appropriate insurance arrangements for them may well differ. Information on the structure of shocks (and their costs) for different countries is key in both tailoring policy advice on country insurance matters and drawing on regional or multilateral facilities to meet the diverse needs of member countries. Likewise, decisions about the appropriate or warranted level of official reserves for a country are likely to depend on the probability of facing different disturbances and the consequences of such shocks.

Against this background, our study begins with an analysis of the frequency and economic costs of the most important shocks faced by different groups of member countries (mainly emerging market and developing countries). Output drops are found to be associated primarily with real shocks (notably terms of trade declines) in developing countries, whereas financial shocks (such as sudden stops) appear to play a lead role in emerging market countries. Although wars and episodes of political turmoil are relatively infrequent over the entire sample, they are extremely costly, particularly for developing countries, when they do occur.

Following the analysis of shocks, the study considers some of the actions that member countries can take to self-insure. The major and long-lasting damage inflicted by currency, debt, and banking crises reemphasizes the role of sound macroeconomic policies and supporting institutions as a first line of defense. Beyond this, evidence outlined in the study shows that sound policies may facilitate the issuance of long-term, domestic currency debt, with commensurately lower rollover and foreign exchange risk, and that longer-run reforms aimed at improving broad institutional quality may also foster increases in the share of equity-like liabilities (such as foreign direct investment [FDI]) in countries’ external liability structures, thereby strengthening links between external payments and countries’ ability to pay.

Underutilized private sector arrangements or financial instruments may also have a role to play in providing country insurance. Relevant examples include catastrophe bonds and insurance against natural disasters for smaller, disaster-prone countries; commodity price futures or other instruments aimed at hedging against commodity price fluctuations for countries with heavily concentrated production structures; and GDP growth-indexed bonds for a broader segment of the IMF membership. As with many types of financial innovation, issuance of new types of instruments would have a greater chance of success when undertaken by larger economies, which are more likely to provide the necessary critical mass for a deep and liquid secondary market, and by countries with transparent institutions and statistics—these are especially relevant to overcoming measurement challenges posed by growth-indexed bonds.

On the asset side, the main form of self-insurance is, of course, reserve holdings—a flexible and reliable form of insurance against a wide variety of shocks. Relatively high stocks of reserves are especially desirable for emerging market...
countries that are exposed to sudden stops in financial flows and, more generally, for
countries facing large shocks that cannot be hedged using alternative instruments. In
determining a desired level of reserves, countries need to trade off the financial costs
of holding reserves against the consumption-smoothing benefits of having a ready
stock of reserve assets. To help guide judgments about the desirable level of self-
insurance through reserves, this chapter develops an analytical framework that takes
into account the costs of reserve holdings, their consumption-smoothing benefits,
and the role of country fundamentals in determining the likelihood of crisis.

The framework yields a number of insights about the degree to which reserve
accumulation in different regions is warranted by the fundamentals captured by
the model. For example, although reserve buildups observed in Asian emerging
markets since the early 1990s are assessed to have been initially commensurate
with these countries’ insurance needs, they appear more recently to have exceeded
what could be justified on the basis of plausible changes in fundamentals. Further,
although Latin American emerging markets seem to have been underinsured in
the early 1990s, their reserves are now assessed as providing a broadly appropriate
degree of self-insurance, given the fundamentals faced by these countries.

The remainder of this chapter is organized as follows. Section 15.2 examines
the nature and economic costs of various types of shock across different segments
of the IMF’s membership. Section 15.3 analyzes the roles of sound fundamentals
and liability structures, especially in relation to the external capital structures of
countries and their public debt management. Section 15.4 turns to the asset side
of countries’ balance sheets and develops an analytical framework to help guide
judgments about the desirable level of self-insurance to be obtained through
accumulation of official reserves. Section 15.5 summarizes and concludes.

15.2. INSURANCE AGAINST WHAT?

15.2.1. Shocks and Their Costs

In analyzing the types of events that countries may wish to insure against, this
section will focus on drops in per capita GDP as a practical and widely available
proxy for the economic costs that countries incur when adverse disturbances
occur. This approach requires a number of simplifications, such as abstracting
from distributional effects. Nevertheless, drops in per capita GDP would seem to
capture many empirically relevant features of welfare declines, as well as being a
highly visible measure that the public and country authorities are worried about
when they consider the costs of economic crises.

3 The main results—including on the relative importance of various shocks—hold using drops in
either income or consumption per capita as the proxy for the economic costs of shocks (Becker and
Mauro, 2006). Consumption drops and output events are closely associated in most countries,
though the association is somewhat weaker for countries that are highly integrated into interna-
tional financial markets. Closer proxies for income (such as GNP rather than GDP) might also be
used but present greater difficulties with respect to data availability; in most cases, however, the
differences are small.
15.2.2. Definitions

The events analyzed are defined as starting in the first year of a decline in per capita GDP and ending when per capita GDP returns to its pre-event level. Yearly losses are measured relative to pre-event GDP per capita and are cumulated over the duration of the event (see the shaded area in Figure 15.1). Two further conditions are imposed to filter out events that might result from measurement error or temporary growth spurts: (1) the duration of the event must be at least two years; and (2) the total output loss must be at least 5 percent of pre-event per capita GDP. If an event is completely observed within the sample period, it is called a concluded event (Figure 15.1). This seems to correspond to the notion of a temporary, though costly, crisis. The analysis also, however, includes ongoing events where per capita GDP has failed to recover to pre-event levels by the end of the sample period. Many ongoing events in the sample are extremely long-lasting and associated with severe output losses and prolonged growth slowdowns. (Several of these started in the 1970s and 1980s and relate to emerging and developing countries that experienced major domestic crises in the wake of civil wars, oil price increases, interest rate hikes, or adverse terms of trade developments from which they had not fully recovered by the end of the sample period.) Finally, a subevent is defined as a new event starting before the end of a previous event.

15.2.3. Empirical Features of Output Drops

Output events are more frequent, long-lasting, and costly for emerging market and developing countries than for advanced economies (Table 15.1). On average, both emerging market and developing countries have output events starting

---

4 On the one hand, a potential concern is that this approach may produce a conservative measure of the cost of output events by abstracting from trend growth during the events. On the other hand, defining the start of events and associated costs with respect to pre-event GDP might lead to an overstatement of event cost if boom-bust cycles are prevalent. Conceivably, these two biases might offset one another. As a robustness check, an alternative approach is to define the start of an event as output falling relative to a (Hodrick-Prescott filtered) trend, and to assess the end of the event and the associated loss relative to this trend: the main results are similar.

5 To compute the duration and output loss associated with ongoing events (for which the end date is unknown), it is assumed that the event ends in the first year after the end of the sample period. This produces a lower bound on the durations and costs associated with these events.

6 Throughout this chapter, advanced countries are defined as in the IMF’s World Economic Outlook (WEO) database, except for the Republic of Korea, which for the purpose of the empirical analysis is classified as emerging, rather than advanced, to capture the experience of its 1997–98 crisis; emerging market countries are countries included in either the (stock market-based) International Finance Corporation’s Major Index (2005) or JPMorgan’s EMBI Global Index (2005) (which consists of countries that issue bonds on international markets), excluding countries classified as advanced by the WEO; remaining countries are classified as developing. The exact sample varies depending on data availability for each exercise. Real GDP is measured in purchasing power parity (PPP)-adjusted dollars. The end of the sample period (2001) is determined by the availability of comparable data. All results are similar using an alternative classification of countries according to their level of financial development (high, intermediate, or low). Data sources and definitions are reported in Appendix I.
about every 16 years (or approximately twice during the three decades considered in the sample period); the events last for six years in emerging markets and twice as long in developing countries. The median cumulative output loss over the event (for concluded events) is equivalent to 15 and 38 percentage points of GDP for emerging markets and developing countries, respectively. (To illustrate, a total cumulative output loss of 15 percentage points of GDP per capita would correspond to the hypothetical case of a country whose output per capita fell by 5 percentage points, remained stable for three years, and then jumped back up to

**TABLE 15.1**


<table>
<thead>
<tr>
<th></th>
<th>Advanced Economies</th>
<th>Emerging Markets</th>
<th>Developing Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample frequency</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>1.9</td>
<td>6.5</td>
<td>6.7</td>
</tr>
<tr>
<td>Concluded</td>
<td>1.5</td>
<td>3.0</td>
<td>2.3</td>
</tr>
<tr>
<td><strong>Median duration</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>4</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Concluded</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>Median cumulative loss</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>15</td>
<td>41</td>
<td>89</td>
</tr>
<tr>
<td>Concluded</td>
<td>13</td>
<td>15</td>
<td>38</td>
</tr>
</tbody>
</table>

Sources: Maddison (2003) and IMF staff calculations.
Notes: “All” events include concluded, ongoing, and subevents. Concluded events are fully observed within the sample period, whereas ongoing events had not ended by 2001 and the duration and loss for these events are calculated assuming that the events ended in 2002. Subevents are new events that start before the previous event has ended.
its initial level.) For both emerging markets and developing countries, the frequency, duration, and especially median loss of concluded output events is significantly lower than for all events. Output losses are two to three times larger (for any type of event) in developing countries than they are in emerging markets.⁷

### 15.2.4. Taxonomy of Shocks and Their Cost

A systematic analysis of the types of shock that are associated with output drops may help countries prioritize among different forms of country insurance. The shocks analyzed here include the following.⁸

- **Financial and macroeconomic**—currency crises, banking crises, debt crises, and sudden stops in financial flows;⁹
- **Country-specific external**—terms of trade shocks and disasters;
- **Sociopolitical**—wars and political turbulence;
- **Global**—large increases in international interest rates and oil prices; and
- **Boom-bust cycles**—the end of lending booms and growth booms.¹⁰

Two simplifying assumptions bear highlighting. First, the analysis does not address the causes of shocks; in particular, it does not ask whether shocks cause declines in output rather than the other way around. (Inspection of WEO forecasts for 1990–2001, however, suggests that output events have been largely unexpected.) Second, the analysis does not seek to separate the effects of individual shocks for those events that are associated with more than one shock. (One-third of output events are associated with more than one shock; for example, various types of financial crises—currency, debt, or

---

⁷ Furthermore, the relative impact on consumption is exacerbated by the degree of economic and financial development: for a given output decline, consumption falls more in developing countries than in emerging markets. This may reflect either liquidity constraints or the events’ more pronounced impact on permanent income in developing countries.

⁸ Volatility owing to abrupt changes in aid flows, an important issue for developing countries, is not considered; but see Bulíř and Hamann (2003) and Gelb and Eifert (2005). For data sources and definitions of shocks, see Appendix I.

⁹ The present study defines a sudden stop as a worsening in the financial account balance by more than 5 percentage points of GDP compared with the previous year, though the main results hold using alternative numerical thresholds. Should sudden stops be attributed to volatile supply of international flows to emerging markets, or are they caused by worsening expectations regarding a country’s economic performance? Although this question cannot be answered definitively, the list of sudden stops seems to include few, if any, instances in which the stop was clearly triggered by worsening growth expectations. For the 1990s, this was confirmed by analyzing quarterly data on financial flows, identifying the first quarter when the sudden stop began, and checking that the immediately preceding World Economic Outlook did not forecast a slowdown in economic growth for the country in question.

¹⁰ The end of a lending or growth boom may fail to fit the usual definition of a shock; nevertheless, this type of episode is included in the analysis to capture output declines that might be part of a boom-bust cycle.
banking crises, or sudden stops—often occur in combination.) Moreover, the frequency and nature of the shocks may result from underlying factors—including domestic policies and institutions. Nevertheless, the associations between shocks and output drops may provide a useful gauge of the relative importance of the various types of shock for different country groups, which may help countries to find strategies for mitigating output costs through country insurance.

The importance of a given type of shock may be summarized by the expected cost of the shock or, equivalently (for cases where insurance arrangements might be conceivable), the ex ante value of insurance (analogous to the value a risk-neutral homeowner would attach to fire insurance). Three inputs are needed, and are estimated on the basis of observed frequencies in 1970–2001 (Table 15.2): (1) the probability of the shock (how often a fire starts), (2) the conditional probability that the shock will lead to a loss in output (the likelihood the house will burn down if a fire starts), and (3) the output cost associated with the event (the cost of rebuilding the house).

Combining these three components (Table 15.2), the expected cost seems to be substantial for several types of shock (Figure 15.2). For emerging markets, the largest expected cost is for financial and macroeconomic shocks—especially sudden stops (¾ of 1 percent of GDP per capita annually based on concluded events) and currency crises. For developing countries, terms of trade shocks are the most costly (amounting to 2½ percent of per capita GDP annually when concluded and ongoing events are considered), followed by debt crises and global interest rate hikes. The expected cost refers to the impact of one type of shock (regardless of whether it occurs in combination with other shocks). Thus, for example, for emerging markets, the expected cost is 1 percentage point of GDP for currency crises and 0.8 percentage points of GDP for debt crises, but the expected cost of both shocks would be less than 1.8 percentage points of GDP, because some part of the cost is double counted when currency and debt crises occur simultaneously.

15.3. SOUND FUNDAMENTALS AND LIABILITY STRUCTURES

It is generally recognized that countries can self-insure significantly against shocks through their own policies and institutions. Beyond prudent macroeconomic policies, resilience to shocks can be fostered through measures and reforms aimed

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11 The expected cost will be substantially lower than the ex post cost of observed output events, because the relevant probabilities are much lower than one.
12 Figure 15.2 is based on contemporaneous correlations between shocks and output events. Similar results are obtained using lagged shocks. The figure omits advanced countries, because the value of insurance for this segment appears to be very low. This may be because of a better diversified production structure or more resilient financial systems and institutions. An additional factor, however, may be the focus on types of shock that seem to be more relevant for emerging and developing countries.
## TABLE 15.2
Frequencies and Cost of Shocks (Based on Concluded Output Events, 1970–2001)

<table>
<thead>
<tr>
<th>Financial and macroeconomic shocks</th>
<th>Unconditional Frequency of Shocks</th>
<th>Frequency of Output Event Conditional on Shocks</th>
<th>Cumulative Output Loss Conditional on Shocks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Advanced Economies</td>
<td>Emerging Markets</td>
<td>Developing Countries</td>
</tr>
<tr>
<td>Currency crisis</td>
<td>2.6 (in percent of country-years)</td>
<td>9.1</td>
<td>6.5</td>
</tr>
<tr>
<td>Banking crisis</td>
<td>12.5</td>
<td>5.7</td>
<td>4.6</td>
</tr>
<tr>
<td>Debt crisis</td>
<td>0.0</td>
<td>3.8</td>
<td>1.6</td>
</tr>
<tr>
<td>Sudden stop in capital flows</td>
<td>5.5</td>
<td>11.5</td>
<td>15.1</td>
</tr>
<tr>
<td>Country-specific external shocks</td>
<td>Terms of trade shock</td>
<td>5.7</td>
<td>14.3</td>
</tr>
<tr>
<td>Disaster</td>
<td>0.6</td>
<td>2.1</td>
<td>3.2</td>
</tr>
<tr>
<td>Sociopolitical</td>
<td>War</td>
<td>2.1</td>
<td>3.2</td>
</tr>
<tr>
<td>Political shock</td>
<td>0.4</td>
<td>3.0</td>
<td>3.4</td>
</tr>
<tr>
<td>Global shocks</td>
<td>Global interest rate hike</td>
<td>12.5</td>
<td>12.5</td>
</tr>
<tr>
<td>Oil price hike</td>
<td>12.5</td>
<td>12.5</td>
<td>12.5</td>
</tr>
<tr>
<td>End of booms</td>
<td>End of lending boom</td>
<td>2.1</td>
<td>3.6</td>
</tr>
<tr>
<td>End of growth boom</td>
<td>0.4</td>
<td>1.1</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Source: IMF staff calculations based on GDP data from Maddison (2003).

Notes: The dates for currency, banking, and debt crises, as well as lending booms, are based on existing studies (see Appendix I). Sudden stops in financial flows are defined as a 5 percentage point of GDP decline in financial flows, drawn from the IMF’s International Financial Statistics database. Terms of trade shocks are defined as a 10 percent worsening in the terms of trade of goods, drawn from the IMF’s World Economic Outlook (WEO) database. The dates of disasters, wars, and political shocks are from the Center for Research on the Epidemiology of Disasters (CRED) (http://www.em-dot.net), Correlates of War (http://www.correlatesofwar.com), and Marshall and Jaggers (2002), respectively. The global interest rate shock is defined as an increase in the U.S. federal funds rate by more than 150 basis points in one year. The dates of the oil shocks are from IMF (2003). The three columns report how often the various types of shock occur, how often the occurrence of a given type of shock leads to an output decline, and the median output losses for output events associated with each type of shock. Median (rather than average) output losses are used to reduce sensitivity to outliers. Missing values indicate that the frequency of output events is based on fewer than five occurrences of the relevant type of shock, or that the median loss is based on fewer than five concluded output events (associated with the given type of shock for the relevant group of countries).
at increasing flexibility in the exchange rate regime (Mussa and others, 2000; Rogoff and others, 2004), openness in the financial account (which may help cushion consumption and investment from the impact of output shocks, though it may also bring volatilities of its own, at least in the short run [see Prasad and others, 2003]), and goods and labor market flexibility. Reducing constraints on the ability of entrepreneurs to shift resources across sectors might also foster resilience by enhancing sectoral diversification, though there are, of course, trade-offs between the gains from specialization and the benefits from greater
output stability. This section, however, will focus on a specific aspect of sound fundamentals, namely the role of countries’ external liability structures in fostering international risk sharing of the costs of adverse shocks, and the role of sound policies and institutions in promoting structures that can better meet countries’ insurance needs.

15.3.1. External Capital Structure of Countries

The composition of a country’s external liabilities (that is, the shares of FDI, portfolio equity, and external debt in its external finance) is often held to be an important determinant of the risk of crisis and the economic costs countries incur when they experience a crisis. Two types of argument are put forward to support this view.

First, the payments associated with some types of external liabilities have desirable cyclical properties. For example, with equity-like forms of finance such as portfolio equity or FDI, payments are lower when economic performance is worse. Equity finance thus makes it possible for domestic producers to share risk with foreign investors, which helps to stabilize domestic consumption and improves domestic producers’ ability to undertake projects with higher risk and expected return. Indeed, it has been argued that emerging market countries should adopt a less debt-intensive structure of external finance (Rogoff, 1999).

Second, some forms of flows behave in a more desirable manner during a crisis than others. For example, liquidity crises have often been triggered by sudden stops in debt flows, rather than flows of equity-like forms of finance. More generally, FDI has traditionally been viewed as more stable than portfolio financial flows.

The analysis in this section offers broad support for the conventional wisdom about the external capital structures of countries during sudden stops:

- An analysis of 33 sudden-stop episodes using annual data over the period since 1980 suggests that FDI has played essentially no role in financial flow reversals (Figure 15.3). This result is robust to alternative thresholds for defining sudden stops and also holds using quarterly data for all emerging market countries in a specific analysis of reversals during the Russia/Long-Term Capital Management (LTCM) crisis.
- Portfolio equity also seems to play a limited role in sudden stops. Portfolio debt plays a more prominent role, though it recovers relatively quickly.
- Bank lending flows and official flows experience severe drops and remain depressed for several years after sudden stops.

Although the results mentioned previously underscore a protective role of FDI and equity flows during sudden stops, the relative stability of FDI also appears to hold more generally over the entire sample (including during noncrisis times). For

13 Some benefits of real sector diversification might be achievable through the financial system—for example, by holding foreign equities or engaging in total return swaps between governments or private entities of countries with different production structures—a proposal associated with Nobel laureate Robert C. Merton.

Notes: The behavior of different types of flows is illustrated in sudden-stop time, with $t=1$ being the year the sudden stop occurred. The solid line represents the average across episodes for each type of financial flow. The dotted lines are one-standard-error bands. Sudden stops are reversals in the financial account by more than 5 percentage points of GDP. The sample is restricted to instances in which all six subcomponents of the financial account are available for at least a five-year period around the sudden-stop year. The sample consists of 33 episodes: Argentina (2001); Barbados (1992, 2002); Brazil (1983); Chile (1991); Côte d’Ivoire (1983, 1996); Croatia (1998); the Czech Republic (1996); Estonia (1998); the Republic of Korea (1997); Latvia (2000); Lithuania (1999); Mauritius (2001); Mexico (1995); Namibia (1991, 1999); Panama (2000); Peru (1998); the Philippines (1997); the Russian Federation (1998); Senegal (1982); Slovenia (1998); Swaziland (1993); Thailand (1982, 1997); Togo (1992); Turkey (1994, 2001); Ukraine (1998); and República Bolivariana de Venezuela (1980, 1989, 2002). For each type of financial flow, the entire available sample of countries and years is first regressed on a full set of country and year fixed effects to remove country-specific means and global trends from the data.

**Figure 15.3** Composition of financial flows around all sudden stops, 1980–2004.
emerging and developing countries, Table 15.7 (in Appendix II) suggests a clear ranking in volatility measures (taking into account the size of flows) from FDI and portfolio equity flows (low), to portfolio debt and official flows (medium), to bank flows (high). Moving beyond volatility measures, and perhaps in contrast with conventional wisdom, co-movement across countries does not seem to be more pronounced for portfolio flows or bank flows (often viewed as a channel of contagion) than for FDI. Differences across financial flows with respect to other features—such as persistence, procyclicality, or responsiveness to Group of Seven (G-7) growth or U.S. interest rates—are also not particularly striking. Against this background, a key issue is what factors help to explain the external liability structures observed in particular countries. Although the empirical evidence is not extensive, results based on a cross-section of emerging market and developing countries suggest that equity-like liabilities (FDI and, especially, portfolio equity) as a share of total external liabilities (or GDP) are positively and significantly associated with indicators of educational attainment and, especially, institutional quality (Faria and Mauro, 2004). Thus, by improving institutional quality, countries may be able to secure a beneficial impact on their national external liability structures, though the effect is likely to be gradual owing to the persistence of institutional quality through time (IMF, 2005b; and Johnson, Ostry, and Subramanian, 2006).

15.3.2. Public Debt Management and Debt Structure

In spite of the desirability of equity-like instruments, debt will undoubtedly remain an important component of the capital structures of emerging market countries. The insurance perspective suggests that—for a given cost of borrowing—debt managers should seek to induce as high a correlation as possible between debt-service costs and the borrower’s ability to repay. A previous study (Borensztein and others, 2004) suggested that this objective could be pursued by (1) developing domestic debt markets so as to allow borrowers to extend maturities and to issue debt denominated in domestic currencies; and (2) denominating international debt in the domestic currency or indexing it to real variables, such as economic growth. More specifically,

- Credibility of fiscal and monetary policies is a key prerequisite for investors’ willingness to hold long-term local currency bonds. Credibility, in turn, depends on both the quality of institutions and a reputation for sound policymaking. This is reflected in the differences in debt structures among emerging markets. For example, the share of foreign currency–denominated or indexed debt is far higher in Latin America than in Asia, and this may reflect, at least in part, the regions’ different inflation histories (Figure 15.4). Building credibility in this area can take years, but a combination of

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14 The Institutional Quality Index used in the estimation is the simple average of the Kaufmann, Kraay, and Mastruzzi (2003) indicators of voice and accountability; political stability and absence of violence; government effectiveness; regulatory quality; rule of law; and control of corruption. The results are robust to variations in how the index is computed. A firm-level analysis of corporate balance sheets in a panel of countries has also found an important effect of institutional quality on domestic financial structures, including debt-equity ratios and the ratio of short-term debt in total debt (Fan, Titman, and Twite, 2003).
Becker, Jeanne, Mauro, Ostry, and Rancière

Source: Guscina and Jeanne (2006).

Notes: Short-term debt has a maturity of less than one year; medium-term debt has a maturity of between one and five years; and long-term debt has a maturity of more than five years. The data are simple averages across countries for 1980–2004. Asian economies include China, India, Indonesia, the Republic of Korea, Malaysia, the Philippines, and Thailand. Latin American economies include Argentina, Brazil, Chile, Colombia, Mexico, and República Bolivariana de Venezuela. Indexed debt involves indexation to consumer prices (or, rarely, commodity prices) and may apply to principal or coupon payments. Floating-interest-rate debt involves indexation to short-term or foreign interest rates.

Figure 15.4 Emerging market economies: Central government domestic debt composition, 1980–2004 (in percent of total central government domestic debt).
macroeconomic stabilization and institutional reforms has, in practice, helped to accelerate this process. Countries that curbed inflation and committed themselves to macroeconomic stability through reforms, such as the establishment of central bank independence or inflation-targeting regimes; adopted pension reforms that widened the domestic investor base; and used inflation-indexed bonds in the transition toward a lengthened maturity structure of the debt have seen a payoff in their debt structures. 15

• Debt instruments with equity-like features, which provide for lower payments in the event of adverse shocks and weak economic performance, could help sovereigns to improve debt sustainability and international risk sharing. In particular, growth-indexed bonds would likely provide substantial insurance benefits to a broad range of countries, though they present a number of implementation challenges (Borensztein and Mauro, 2004; and Borensztein and others, 2004). 16

These considerations may have underpinned a number of developments in emerging market country debt structures in recent years, including the following:

• Greater reliance on long-term, domestic currency debt by a number of emerging market issuers. Domestic currency bonds have become more attractive for nonresidents, owing in part to the development of local emerging market

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15 These results are corroborated in a dataset on the structure of government debt in emerging market countries (Guscina and Jeanne, 2006).
16 Chamon and Mauro (2006) provide a simple framework to price growth-indexed bonds.
indices (IMF, 2005c, Chapter 2). In addition, a number of emerging market sovereigns have issued domestic currency debt on international markets. The share of long-term, domestic currency debt issued on domestic markets has recently increased somewhat, though with considerable variation across regions (Figure 15.5).

- **Asian Bond Market Initiative.** The establishment of a set of Asian Bond Funds has sought to foster the development of government bond markets in the domestic currencies of a number of East Asian countries (Box 15.1).

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**Box 15.1**

**Asian Bond Funds**

A number of bond funds have been recently set up by the Executives’ Meeting of East Asia and Pacific Central Banks (EMEAP) group of 11 central banks (Australia, China, Hong Kong SAR, Indonesia, Japan, the Republic of Korea, Malaysia, New Zealand, the Philippines, Singapore, and Thailand). The main objectives are to invest Asian reserves in Asian bonds, rather than European or U.S. bonds; to provide a new regional channel of financial intermediation at lower costs than intermediation through nonregional banks; and to provide a catalyst for private investors—notably institutional investors from the region—to consider investment in Asian securities.

Ultimately, the Asian Bond Funds (ABFs) are intended to promote the development of regional bond markets and facilitate issuance of domestic currency bonds by the countries involved. The role of the ABFs is to create a demand for local instruments and—in the process of setting up ABFs—to identify and remove market impediments including capital controls and other legal constraints, withholding taxes, and deficient clearing and settlement infrastructures. Initiatives by other regional bodies, such as the Association of Southeast Asian Nations (ASEAN) and Asia-Pacific Economic Cooperation (APEC), are also aimed at removing regulatory and infrastructure obstacles and increasing the supply of local instruments through such measures as allowing multinationals to issue domestic currency bonds in local markets.

Thus far, two sets of bond funds have been launched under the ABF initiative. Their mandate is to invest in bonds issued by sovereigns and quasi-sovereigns from eight EMEAP countries (excluding Australia, New Zealand, and Japan). The ABF1 was set up in 2003, with US$1 billion supplied by the EMEAP central banks to be invested in U.S. dollar-denominated bonds; the ABF1 is managed by the Bank for International Settlements (BIS). The ABF2, launched in 2005, consists of nine separate funds (one pan-Asian fund, the Pan-Asia Bond Index Fund (PAIF), and eight local market funds) for a total of US$2 billion to be invested in local currency–denominated debt. These open-ended, exchange-traded funds are managed by private sector institutions and will gradually be opened up to institutional and retail investors.

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1 For further information on the Asian Bond Funds, see IMF (2005c, 2005d); and Ma and Remolona (2005).

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17 Examples include Uruguay in 2003 and 2004, Colombia in 2004, and Brazil in 2005. In addition, private entities have issued global bonds denominated in or indexed to the local currencies in Mexico and Brazil.
This is aimed in part at reducing countries’ exposures to maturity and exchange rate risks as well as sudden stops.

- **Use of GDP warrants in Argentine debt exchange of early 2005.** This is by far the largest issue of growth-indexed instruments to date, for a total market capitalization estimated at US$5.8 billion in mid-April 2006 (Box 15.2).

On the whole, these developments may be viewed as representing a gradual move toward greater reliance on long-term domestic currency debt and greater use of innovative forms of financing, such as growth-indexed instruments.

**Argentina’s GDP-Linked Securities**

In Argentina’s recent global debt restructuring, GDP-linked securities were included in the package of new bonds issued to creditors participating in the exchange. The warrants were intended to add value to the exchange offer by providing creditors with the potential to benefit from Argentina’s future economic growth while ensuring that the additional payments could be met by available resources. In settling its exchange on June 10, 2005, Argentina issued 11 new bonds, each with a detachable GDP-linked security. For each US$1 of defaulted debt tendered and accepted in the exchange, creditors received new restructured bonds and one unit of a GDP-linked security.

This was the largest operation to date involving the issuance of financial instruments indexed to economic growth. Following the conclusion of the exchange, a forward market for trading GDP-linked securities in isolation emerged, with market participants placing a higher value on the securities, partly reflecting a more favorable forecast of medium-term growth. The forward market was thin, however. Market activity picked up considerably after the GDP-linked securities were detached and began trading independently on November 30, 2005. At that time, total market capitalization amounted to US$2.9 billion. Subsequent upward revisions to growth expectations have led prices approximately to double—to 9.3 cents per dollar of notional value in mid-April 2006—with total market capitalization reaching US$5.8 billion.

Payments on the GDP-linked securities are contingent on Argentina’s economic performance. The securities will pay holders only if both the level and growth of GDP exceed a specified threshold in the relevant reference year, beginning in 2005 and ending in 2034. In addition, the sum of payments that can be received during the life of the security cannot be higher than 48 percent of its notional value. Payments will be made on December 15 of each year following the relevant reference year. The first payment, of about 0.2 percent of GDP, was expected to be made on December 15, 2006.

As the GDP-linked securities were attached to their underlying bonds at the time of the debt exchange, it was difficult to separate the valuation of each item. The value of the restructuring offer was priced by market participants in the range of 34–35 cents per dollar of principal claims. Market analysts at that time estimated the theoretical value of the GDP-linked securities to be about 4 points (cents per dollar of notional value) but recommended adopting a conservative approach and valuing the GDP-linked securities at half the estimated theoretical value. The conservative approach reflected a host of factors that are hard to quantify, including the novelty of the instrument and other possible obstacles; these are analyzed in Borensztein and others (2004).
Although this is encouraging, countries’ liability structures are unlikely to have evolved sufficiently rapidly to obviate the need for other forms of self-insurance against sudden stops and other shocks.

15.4. SELF-INSURANCE THROUGH INTERNATIONAL RESERVES

On the asset side of countries’ external balance sheets, international reserves constitute the main form of self-insurance against damaging crises, partly because of the speed and ease with which they can be used in a period of balance of payments pressure and partly because of their role in underpinning the credibility of the monetary and exchange regime, such as to help ward off external pressures and currency crises. Reserves are costly to hold, however, because they yield a return that is generally lower than the interest rate that the authorities must offer on their debt. The authorities must therefore strike a balance between the cost of reserves in noncrisis times and their benefits in crisis times.

15.4.1. Trends in Reserve Accumulation, and Benefits and Costs of Reserve Holdings

Total international reserves in the world economy have more than tripled since 1990, partly reflecting the rapid deepening in trade and financial integration (IMF, 2003; and Flood and Marion, 2002). The increase has been particularly pronounced in Asian emerging economies, whose share of global reserves increased by more than 20 percentage points between 1990 and 2005 (Figures 15.6 and 15.7). 18

The causes of rapid reserve accumulation have been the subject of fervent debate—for example, regarding whether accumulation in Asia reflects a desire to keep exchange rate stability in the face of significant current and financial account inflows, rather than crisis-prevention efforts (Dooley, Folkerts-Landau, and Garber, 2004; Goldstein, 2004; and Genberg and others, 2005). An analytical framework to gauge the benefits and costs of international reserves would thus seem helpful for shedding light on recent developments as well as giving policy guidance. This subsection reports results based on a calibrated model for emerging market countries (Jeanne and Rancière, 2006). The model focuses on an open economy that is hit by financial flow reversals, which, in turn, lead to falls in output. The optimal level of reserves in the model equates the opportunity cost of holding foreign reserves with the marginal benefit from being able to smooth domestic consumption in the event of a sudden stop.

18 Considering the ratio of reserves to M2 (a measure of the country’s ability to withstand a sudden shift in demand from local currency to foreign currency), Latin America displays the highest ratio, as might be expected in light of widespread de facto dollarization in several countries, but the smallest increase. Of the 34 emerging economies in the sample, 7 are defined as highly dollarized by Honohan and Shi (2002); of these, 5 are located in Latin America.
Figure 15.6  International reserves by country group, 1990–2005.
Reserves as Share of GDP
(In percent)

Reserves as Share of M2
(In percent)

Reserves as Share of Imports
(In percent)

Ratio of Reserves to Short-Term Debt

Sources: IMF, International Financial Statistics (IFS) and World Economic Outlook (WEO) databases; and World Bank, World Development Indicators database.

Notes: Data for 2005 refer to the end of the second quarter for the stocks of reserves and M2, and to WEO projections for GDP and imports. “Emerging others” includes emerging market economies in Eastern Europe, the Middle East, and Africa. For each country group, the data refer to unweighted cross-country averages. For the developing countries, reserves as a share of M2 and reserves as a share of short-term debt are medians to avoid undue influence of outliers.

Figure 15.7 International reserve ratios by country group, 1990–2005.
15.4.2. Benefits

From an insurance perspective, countries hold reserves to achieve a range of objectives, whose relative importance depends on several factors, such as the exchange rate regime and the degree of integration into international financial markets. Such objectives include limiting volatility in the exchange rate; providing liquidity to the foreign exchange market, thus making a floating exchange rate regime more efficient; buffering the domestic economy against shocks to the balance of payments; and providing liquidity to the domestic financial markets and the banking sector, especially if there is significant dollarization (Jeanne and Wyplosz, 2003).

With countries’ increasing international financial integration, considerations regarding reserve adequacy have shifted from an emphasis on trade (traditionally associated with the “three-months-of-imports” rule) to the financial account and balance-sheet fragilities (associated with the Greenspan-Guidotti rule, according to which reserves should cover short-term debt). Indeed, if one considers a sample of 33 middle-income countries during 1980–2003, 31 out of 40 episodes in which reserves decreased by more than 10 percentage points of GDP are associated with a sudden stop, a currency crisis, or a banking crisis. With countries’ increasing international financial integration, considerations regarding reserve adequacy have shifted from an emphasis on trade (traditionally associated with the “three-months-of-imports” rule) to the financial account and balance-sheet fragilities (associated with the Greenspan-Guidotti rule, according to which reserves should cover short-term debt).

Reserves have played an important role in cushioning domestic absorption (that is, consumption and investment) during financial account reversals. The typical sudden stop—which sees average net inflows of 5 percent of GDP (in the year prior to the stop) turn to net outflows of 4 percent of GDP (in the year of the stop)—is accompanied by a large drop in reserves (by 4 percentage points of GDP). This drop helps to hold the observed fall in domestic absorption to 2 percentage points of GDP, which is much smaller than the counterfactual fall in domestic absorption (6½ percentage points of GDP) that would have been observed if reserves had been held constant during each episode.

It has also been argued that reserves help reduce the likelihood of crises, including by discouraging speculation against the domestic currency; making it easier for the public and private sectors to roll over their foreign currency debt; and instilling confidence in the domestic financial sector. Empirical evidence on these benefits is mixed, owing in part to methodological difficulties. An increase in the ratio of reserves to short-term debt has been found to be associated with a lower probability of a currency crisis or sudden stop (Bussière and Mulder, 1999; and Garcia and Soto, 2006). However, the robustness of this finding has been questioned out of sample (Berg, Borensztein, and Pattillo, 2004) and because of reverse causality (Detragiache and Spilmbergo, 2001).

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19 The operational implications of this greater emphasis on balance-sheet considerations are further analyzed in Mulder (2000) and IMF (2000 and 2001).
20 Banking and currency crises are drawn from Caprio and Klingebiel (2003) and Ghosh, Gulde, and Wolf (2002), respectively.
21 A higher level of reserves has also been found to reduce the portion of exchange rate volatility that is unrelated to macroeconomic fundamentals (Hviding, Nowak, and Ricci, 2004).
15.4.3. Costs

The cost of holding reserves is usually measured as the difference between the return on short-term foreign currency assets and the return on more profitable alternative investment opportunities. The simplicity of this approach, however, masks thorny questions regarding the appropriate definition of alternative investment opportunities, which have traditionally been interpreted as the repayment of foreign debt (Frenkel and Jovanovic, 1981; and Flood and Marion, 2002) or higher-yielding investment opportunities in the domestic business sector or public infrastructure (Ben-Bassat and Gottlieb, 1992; and Hauner, 2005).

Even following the traditional approach based on the opportunity cost of repaying long-term foreign debt, plausible arguments can be made both in favor of and against using only some subcomponents of the yield on bonds issued by an emerging market country. The full yield can be thought of as the sum of four components: (1) the short-term rate on U.S. treasury bonds, (2) the term premium—the difference between long-term and short-term U.S. interest rates, (3) the default premium, and (4) the risk premium owing to a possible correlation between the tendency for defaults and the global cycle or global asset prices. Although in practice the default premium and the risk premium cannot be observed separately, they are conceptually distinct and may need to be treated differently. There is some evidence to suggest that the risk premium is small, because there is essentially no relationship between emerging market defaults and the “world market portfolio” held by international investors (Borensztein and Mauro, 2004). However, to the extent that investor classes are segmented, and investors specialize in emerging market bonds and other assets that comove strongly with them, the risk premium could be significant. Regarding the default premium, one could argue that it should be excluded on the grounds that, on average, it is a fair reflection of the probability of nonrepayment. At the same time, country authorities that have no intention of defaulting will likely include the default premium when computing the cost of holding reserves. Given the size and variation of the default premium across countries and over time, the choice of whether or not to include it has important implications for the results, as is discussed later on. The opportunity cost of holding reserves is thus estimated using two variants: (1) the U.S. term premium—that is, the difference between long and short rates excluding the default and risk premiums—which is the baseline in this section; and (2) the full difference between emerging market yields and U.S. short-term treasury bonds.\(^{22}\)

On average, the total cost of holding reserves was substantially lower in Latin America than in Asia in 2001–05 (ranging between 0.2 and 0.4 percentage points of GDP in the former and 0.3–0.8 percentage points of GDP in the latter) using the term premium (Table 15.3). The cost was, however, relatively similar in the

\(^{22}\)The analysis considers the ex ante cost of holding foreign reserves and thus, in light of the unpredictability of exchange rates, abstracts from exchange rate gains or losses, even though these can turn out, ex post, to have been substantial (Hauner, 2005).
two regions using the term premium plus the spread (ranging between 1.0–1.6 percentage points of GDP in Latin America and 0.7–1.2 percentage points of GDP in Asia). This is explained by the fact that although, on average, the reserves/GDP ratio is twice as high for Asian countries as for Latin American countries, the sovereign spread is substantially higher in Latin America than in Asia. The cost of holding reserves has increased moderately for emerging market countries over the past few years, as the impact of reserve accumulation has been partly offset by a reduction in sovereign spreads.

Although the previous analysis assumes that reserves are held in liquid assets such as short-term, fixed-income instruments issued by the major advanced countries, the cost of holding reserves might be reduced by investing in longer-term, higher-yielding foreign assets (Genberg and others, 2005). For the specific case of economies experiencing large financial inflows and accumulating substantial reserve stocks, a related idea is to use these favorable external circumstances to make gradual progress toward financial account liberalization, with a portion of financial inflows being securitized through closed-end mutual funds that issue shares in domestic currency and use the proceeds to purchase foreign exchange from the central bank and then invest abroad (Prasad and Rajan, 2005). This would eliminate the fiscal costs of sterilizing inflows, give domestic investors opportunities for international diversification, stimulate the development of domestic financial markets, and allow central banks to control both the timing and quantity of outflows.

Another way of reducing the cost of self-insurance through reserves may be to hold assets that provide liquidity at the time when countries most need it, thus obviating the need to hoard large amounts of reserves in noncrisis times. For example, a commodity exporter might hold instruments whose return is inversely

<table>
<thead>
<tr>
<th>TABLE 15.3</th>
<th>Cost of Reserves in Emerging Market Countries, 2001–05</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2001</td>
</tr>
<tr>
<td>Reserves/GDP (in percent)</td>
<td></td>
</tr>
<tr>
<td>Latin America</td>
<td>12.1</td>
</tr>
<tr>
<td>Asia</td>
<td>21.2</td>
</tr>
<tr>
<td>Others</td>
<td>17.5</td>
</tr>
<tr>
<td>Cost of reserves (in percent of GDP)</td>
<td></td>
</tr>
<tr>
<td>based on term premium</td>
<td></td>
</tr>
<tr>
<td>Latin America</td>
<td>0.2</td>
</tr>
<tr>
<td>Asia</td>
<td>0.3</td>
</tr>
<tr>
<td>Others</td>
<td>0.3</td>
</tr>
<tr>
<td>Cost of reserves (in percent of GDP)</td>
<td></td>
</tr>
<tr>
<td>based on term premium + sovereign spread</td>
<td></td>
</tr>
<tr>
<td>Latin America</td>
<td>1.0</td>
</tr>
<tr>
<td>Asia</td>
<td>0.9</td>
</tr>
<tr>
<td>Others</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Sources: IMF, International Financial Statistics and World Economic Outlook databases; and JPMorgan.
Notes: The cost of reserves is computed as the stock of reserves times either the term premium (the differential between the yields on 10-year and 3-month U.S. treasuries) or the term premium plus the EMBIG spread. All regional averages are unweighted.
related to the price of its main exports; or an emerging market country could hold instruments that provide liquidity when international liquidity conditions are tight. One possibility would be for the central bank's portfolio to include instruments whose payoff is positively related to the implied volatility index on the S&P 500—the so-called VIX, which has displayed an empirical association with recent sudden-stop episodes. Such a proposal—advanced by Caballero and Panageas (2004 and 2005)—is summarized in Box 15.3.

15.4.4. Framework for Assessing Optimal Level of Reserves

Although it has been recognized that the benefits of reserves are multifaceted, reserve adequacy has traditionally been assessed using rules of thumb based on ratios of reserves to imports or, reflecting greater international financial integration, to short-term debt. Although these provide useful guidance, they lack...
fully developed analytical foundations. The remainder of this section seeks to fill this gap by developing an analytical framework that may be useful for making judgments about the level of reserves that is warranted by a country’s particular fundamentals. The analysis focuses on the role of reserves as self-insurance against vulnerabilities resulting from changes in the financial account balance and may thus be especially relevant for emerging markets facing a risk of sudden stops.  

The main benefit of reserves in the context of the model is that they help to smooth domestic consumption in response to decreases in financial inflows and output. Based on a calibration of the model, the warranted level of reserves can be derived as an explicit function of factors that include the probability of a sudden stop, the size of a sudden stop, the output cost of a crisis, the opportunity cost of reserves, and the authorities’ risk aversion regarding crisis episodes. The probability of a sudden stop is based upon panel probit regressions that relate sudden stops to country fundamentals (including the exchange rate regime, financial openness, the level of public debt, de facto dollarization, output growth, and exchange rate overvaluation).

15.4.5. Warranted Reserves as Function of Macroeconomic Fundamentals

The model can be used to compute the impact of a change in fundamentals (for example, a change in the debt/GDP ratio) on the warranted level of reserves. A change in fundamentals will affect the probability of a sudden stop (to an extent estimated by the probit model), and the calibration will determine the implications for the optimal level of reserves. Plausible changes in fundamentals have a substantial impact on the optimal level of reserves (Table 15.4). The (comparative statics) results may be summarized as follows:

- Moving from no real exchange rate overvaluation to an overvaluation of 20 percent increases the estimated annual probability of a sudden stop by approximately 4.3 percentage points and generates an increase in the optimal level of reserves of 2.7 percentage points of GDP.

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23 For further details, see Jeanne and Rancière (2006). Other related studies include Aizenman, Lee, and Rhee, 2004; Lee, 2004; Aizenman and Lee, 2005; and Caballero and Panageas, 2005.

24 More specifically, in the version of the model presented in Appendix III, the probability of a sudden stop is estimated for each country and each year by applying the regression coefficients to the observed country fundamentals. The size of the sudden stop and the output cost of a crisis are assumed constant (and identical across countries) and are estimated as the observed averages for the 33 countries in the sample over 1980–2003. Risk aversion is also assumed constant, across countries and over time, at a level that is well within the range of plausible estimates available from existing studies. The opportunity cost of holding reserves is the term premium and therefore varies over time but not across countries.

25 The exercise is based on a benchmark economy characterized by the calibration parameters presented in Appendix III (Table 15.8), with the cost of holding reserves based on the term premium only. The effect of a change in each fundamental on the optimal level of reserves is analyzed by comparison with the optimal level of reserves in the benchmark economy.
## TABLE 15.4
Changes in Fundamentals and Optimal Reserves: Simulations for Emerging Markets (In percentage points unless otherwise noted)

<table>
<thead>
<tr>
<th>Fundamentals</th>
<th>Sample Mean</th>
<th>Parameter Change (in percent)</th>
<th>Estimated Change in Sudden Stop Probability</th>
<th>Change in Optimal Ratio of Reserves to GDP</th>
<th>Change in Optimal Level of Reserves (in months of imports)</th>
<th>Change in Optimal Ratio of Reserves to Short-Term Debt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange rate overvaluation</td>
<td>0</td>
<td>0 → 20</td>
<td>4.3</td>
<td>2.7</td>
<td>1.3</td>
<td>34.6</td>
</tr>
<tr>
<td>Public debt/GDP</td>
<td>40</td>
<td>40 → 60</td>
<td>2.2</td>
<td>1.7</td>
<td>0.8</td>
<td>21.8</td>
</tr>
<tr>
<td>Foreign liabilities/money</td>
<td>46</td>
<td>45 (Thailand, 1990)</td>
<td>7.0</td>
<td>3.7</td>
<td>1.8</td>
<td>47.4</td>
</tr>
<tr>
<td>Financial openness as (</td>
<td>gross inflows</td>
<td>5.5 → 10.4</td>
<td>5.4</td>
<td>3.2</td>
<td>1.5</td>
<td>41.0</td>
</tr>
<tr>
<td>Exchange rate regime</td>
<td>—</td>
<td>Floating → Fixed</td>
<td>5.3</td>
<td>3.4</td>
<td>1.6</td>
<td>43.5</td>
</tr>
</tbody>
</table>

Source: See Appendix I.

Notes: The initial optimal level of reserves is equivalent to 8.2 percent of GDP (about three months of imports, or 105 percent of short-term debt). The results are based on regression (1) in Table 15.9 (in Appendix III)—except for the exchange rate regime, which is based on regression (2). All fundamentals are averages of the first and second lags.
A rise in the ratio of public debt to GDP from 40 percent to 60 percent implies an increase in the optimal reserve ratio by 1.7 percentage points of GDP.

A large buildup of the ratio of foreign liabilities to money, calibrated on the experience of Thailand between 1990 (45 percent) and 1997 (262 percent), raises the optimal level of reserves by 3.7 percentage points of GDP.

An increase of one standard deviation in the degree of financial openness (measured by the absolute value of gross inflows, divided by GDP) leads optimal reserves to increase by 3.2 percentage points of GDP.

A change from a floating to a fixed exchange rate regime induces an increase in the optimal level of reserves of 3.4 percentage points of GDP.

The changes in fundamentals analyzed previously are sizable but have certainly been observed in the sample considered. Interestingly, such assumed changes in one fundamental variable lead to large changes in optimal reserves, in some cases by one-third to one-half of the initial optimal level of reserves. The next subsection considers the impact on optimal reserves of the observed combination of changes in all fundamentals simultaneously.

15.4.6. Trends in Optimal Reserves for Country Groups

The optimal level of reserves—based on the calibrated model—is computed for each country and year for the 33 middle-income countries used in the probit estimation over 1980–2003. To trace the implications of the model for trends in optimal reserves, results are then summed up to obtain regional averages for Latin American and Asian emerging markets.26 For each country and year, the probability of a sudden stop is computed on the basis of the probit estimates. The size of the sudden stop is set to its realized mean value in each region and each decade. The only unobservable parameter, risk aversion, is set equal to six—a value selected to match the actual mean level of reserves to GDP in Asia in the middle of the sample period (1991).27 Using this approach, it is possible to compare changes over time in the optimal level of reserves, actual reserves, and the three-months-of-imports and Greenspan-Guidotti rules of thumb (Figure 15.8).

For the group of Asian emerging markets, the model suggests that reserves should have declined somewhat between the early and the late 1980s: in the aftermath of the debt crisis of the early 1980s, a slowdown in financial flows to emerging markets contributed to reducing the probability of sudden stops. Beginning in the early 1990s, the model envisages a rapid increase in optimal reserves, owing to rising international financial integration.28 The slight decline

26 The remaining emerging markets in the sample form a limited and heterogeneous group—the related average is therefore not reported.

27 Ogaki, Ostry, and Reinhart (1996) provide estimates by region of this parameter.

28 A further factor contributing to the increase in optimal reserves in the mid-1990s and the postcrisis decline is the buildup and subsequent unwinding of foreign currency liabilities, particularly in Thailand.
Figure 15.8  Asia and Latin America: Reserves as shares of GDP, 1980–2003 (in percentage points of GDP).

Sources: IMF staff calculations using data from IMF, International Financial Statistics database; and World Bank, Global Development Finance database.

in optimal reserves following the Asian crisis is primarily accounted for by the reduction in public debt and financial flows. Although the model is intended to be normative, it is interesting to note that it outperforms the rules of thumb in predicting the actual level of reserves for most of the period under consideration. In particular, the upward trend in reserves in Asia during the 12 years prior to the Asian crisis (1985–96) is matched more closely by the model than by the alternative rules depicted in Figure 15.8.

For the Asian emerging market countries following 1997–98, however, the model suggests that the buildup in reserves may have been excessive—a finding consistent with previous analyses (IMF, 2003). A possible caveat is that the Asian crisis may have led to an upward revision of the size of sudden stops or of the associated output loss, though the revision would need to be very large for actual accumulation to be consistent with the increase in optimal reserves predicted by the model. For example, in order for the model to explain the increase in the average level of reserves held by emerging Asian countries between 1997 and 2003, the expected size of either the sudden stop or the output cost would have had to more than double relative to its average level observed in the 1990s.

Another possible caveat is that the crisis may have led some countries to revise their views on the availability of other sources of insurance—such as financial support by the international financial institutions. A further note of caution on the result of excessive reserve accumulation is that some countries may envisage measures to increase their degree of integration in international financial markets and may thus be preparing for greater exposure to international financial flows.

In Latin America, warranted reserves appear to have been well in excess of actual reserves in the 1980s, a turbulent period for the region. Predicted reserves are lower in the early 1990s, partly on account of improved fundamentals (public debt and economic growth), but the rise over the course of the past decade seems to be in line with heightened international financial integration and increasing de facto dollarization. The close match between the model and the data for 1991–2003 is notable, considering that no individual-year level of reserves for Latin America has been used in the calibration. The model might be interpreted to suggest that the current level of reserves is, on average, adequate in Latin America. It is important to recall, however, that although the model includes de facto dollarization among the determinants of the likelihood of sudden stops, it does not take into account the possibility that output losses may be greater for dollarized economies in the event of a crisis.

Increasing the risk aversion parameter from 6 to 10 (the maximum value considered in existing studies on growth and business cycles) would lead the warranted level of reserves to increase by less than 3 percentage points of GDP, much less than is needed to explain the postcrisis buildup in emerging Asia’s reserves.

Extensions of the model might help explain a portion of the difference in reserve holdings between Asia and Latin America: this would be the case, for example, if one were to consider the opportunity cost based on the sum of the term and the individual country sovereign spreads, because spreads are lower in Asia than in Latin America.
15.5. CONCLUSION

The stylized facts presented in this study suggest that countries are subject to a wide variety of shocks that often have major, enduring consequences for levels of aggregate output, and thus for economic well-being. Against this background, mechanisms aimed at preventing such shocks from causing excessive economic disruption have the potential to provide sizable benefits for the affected countries and the global economy as a whole. This chapter has examined various types of insurance mechanisms that countries can pursue to soften the blow from adverse shocks and their relevance for different segments of the IMF’s membership (Table 15.5).

Although all countries are subject to a range of financial and real shocks, the types of shock differ considerably across country groups. For developing countries, real shocks, such as changes in the terms of trade, tend to rank among the most costly, though the debt crises of the early 1980s also inflicted considerable economic damage. For emerging market countries, in contrast, greater integration in global financial markets has been associated with higher exposure to financial shocks, which are by far the most significant for this segment of the IMF’s membership.

For all countries, the first line of defense against adverse shocks is the pursuit of sound policies. In light of the large costs experienced by emerging markets and developing countries as a result of past debt crises, fiscal policies should seek to improve sustainability, taking into account that sustainable debt levels seem to be lower in emerging and developing countries than in advanced countries. Appropriate debt management aimed at increasing the share of long-term, domestic currency debt in total debt would also be beneficial. Efforts to improve the structure of the liability side of national balance sheets more generally, by increasing the share of equity-like liabilities, such as FDI, would also be well rewarded. The evidence presented in this chapter suggests that macroeconomic stability and supporting institutional reforms may facilitate the move toward safer liability structures.

A range of financial instruments may also have a role to play in providing country insurance. Relevant examples include catastrophe bonds and insurance against natural disasters for smaller, disaster-prone countries; commodity price futures or other instruments aimed at hedging against commodity price fluctuations for countries with heavily concentrated production structures; and GDP growth–indexed bonds for a broader segment of the IMF’s membership. New instruments would have a greater chance to succeed with large issuers, which are more able to provide the critical mass necessary for a deep and liquid secondary market.

Maintaining appropriate cushions of official reserves is also clearly an essential part of countries’ self-insurance toolkits. The analytical framework developed in this chapter may be useful in clarifying judgments about the trade-off between the costs of holding reserves and the benefits they provide in smoothing the impact of external shocks. When applied to data for the past two and a half
<table>
<thead>
<tr>
<th>Measure/Type of Insurance</th>
<th>Especially Relevant for Which Countries?</th>
<th>Time Frame/Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound macroeconomic and financial policies</td>
<td><em>All countries.</em> Evidence suggests this should help increase the share of equity-like liabilities (e.g., FDI and portfolio equity) in countries' total external liabilities.</td>
<td>Impact to be observed in short term.</td>
</tr>
<tr>
<td>Improving institutional quality</td>
<td><em>All countries.</em> Evidence suggests sound policies (macroeconomic stability and supporting institutional reforms) may facilitate an increase in the share of long-term domestic currency debt.</td>
<td>Medium term.</td>
</tr>
<tr>
<td>Appropriate debt management</td>
<td><em>Emerging market countries.</em> Evidence suggests sound policies (macroeconomic stability and supporting institutional reforms) may facilitate an increase in the share of long-term domestic currency debt.</td>
<td>Impact to be observed in short term.</td>
</tr>
<tr>
<td>Innovative financial instruments</td>
<td><em>Emerging markets and developing countries.</em> Instruments with equity-like features (e.g., growth-indexed bonds) could help improve debt sustainability and international risk sharing. Larger economies are more likely to attain the requisite critical mass to ensure sufficient liquidity of the instruments. Financial instruments aimed at hedging against commodity price fluctuations may be relevant for countries with heavily concentrated production structures. For disaster-prone developing countries, disaster insurance may be appropriate.</td>
<td>Immediate in principle, but obstacles in practice. May require some international coordination.</td>
</tr>
<tr>
<td>Appropriate reserve holdings</td>
<td><em>Emerging markets and developing countries.</em> Strong reserve positions are especially important for dollarized economies and financially integrated economies.</td>
<td>Impact to be observed in short term.</td>
</tr>
<tr>
<td>Collective arrangements, including high-access contingent financing instrument proposal and IMF support for regional pooling arrangements</td>
<td><em>Emerging market countries.</em></td>
<td>To be analyzed in separate studies.</td>
</tr>
</tbody>
</table>
decades for a sample of more than 30 middle-income countries, the framework suggests that the rapid reserve accumulation observed in Asian emerging markets since the early 1990s may now have resulted in a degree of self-insurance that exceeds what can be justified on the basis of plausible changes in fundamentals. More specifically, although increased international financial integration and the related potential for financial flow reversals seem consistent with the rapid increase in reserves observed in earlier years, for the period since the late 1990s reserve accumulation seems to be excessive compared with what the model would estimate as appropriate self-insurance. For Latin America, the model suggests a substantial degree of underinsurance, at least until the early 1990s, though, on average, reserves may have reached broadly adequate levels in recent years; an open issue that might alter this judgment is that the model may not fully account for larger output losses in the presence of de facto dollarization.

Although much can be accomplished by individual countries through sound policies, risk management, and self-insurance through reserves, collective insurance arrangements are likely to continue playing a key role in cushioning countries from the impact of shocks. Collective insurance arrangements—insurance provided through regional or other pooling arrangements such as the Chiang Mai initiative, or global insurance provided through international financial institutions—hold promise because of their ability to pool risks, which makes them potentially more cost effective than self-insurance. These issues are to be taken up in separate studies.

APPENDIX I: DATA SOURCES AND DEFINITIONS

Data on per capita GDP are purchasing powerparity-adjusted (1990 international Geary-Khamis dollars), drawn from Maddison (2003). For the purposes of the present study, the sample period is limited to 1970–2001, yielding 4882 country-year observations. At the end of the sample period, the data cover 167 countries. The shock dates or the criteria for identifying shock dates are mainly based on existing studies. Because different studies analyze different types of shock, samples vary and, in general, do not cover the same extensive set of country-years available for the output data.

Financial and Macroeconomic Shocks

Currency crises are identified using the following three conditions (as in Frankel and Rose, 1996): (1) cumulative devaluation/depreciation of at least 25 percent over a 12-month period; (2) devaluation/depreciation rate at least 10 percentage points greater than in the preceding 12 months; and (3) a minimum of three years since the last crisis. Given the relatively large depreciation/devaluation required, the definition of a currency crisis seems geared toward emerging and developing countries; nevertheless, to ensure consistency, the same definition was applied to all countries, using the IMF’s International Financial Statistics (IFS) data. The banking crisis dummy takes the value 1 if at least one of the following studies...
identifies the country-year as an outbreak of a banking crisis: Kaminsky and
(2003), and Demirgüç-Kunt and Detragiache (2005). The use of several studies
produces a large sample, though the definition of a banking crisis is not identical
across studies. Using banking crisis dates drawn from only one study does not
change the main results. The debt crisis dummy records a 1 if at least one of the
following studies identifies the country-year as the beginning of a debt crisis:
Detragiache and Spilimbergo (2001); Manasse and Roubini (2005); and
Reinhart, Rogoff, and Savastano (2003). As was mentioned in the text, sudden
stops in financial flows are defined as a worsening in the financial account balance
by more than 5 percentage points of GDP.

Country-Specific External Shocks

Terms of trade shocks are defined as a 10 percent worsening in the terms of trade
for goods, based on the IMF’s World Economic Outlook (WEO) data. The
dummy variable for disasters takes the value 1 if the number of persons injured
times 0.3 plus the number of persons killed is greater than 0.01 percent of the
country’s total population; the data are drawn from the World Health
Organization’s Emergency Events Database (EM-DAT) and published by the
Center for Research on the Epidemiology of Disasters (CRED) (available on the
Internet at http://www.em-dat.net).

Sociopolitical Shocks

Data from the Correlates of War project were used to construct a war dummy,
which records a 1 in the first year of a war. Shocks to the political system are
defined as a deterioration by 3 points or more in the Polity index published by
the Polity IV project (see Marshall and Jaggers, 2002, for a definition of the
variable). The data are drawn from http://www.cidcm.umd.edu/inscr/polity
(Center for International Development and Conflict Management, University of
Maryland; and Center for Global Policy, George Mason University).

Global Shocks

The global interest rate shock takes the value 1 when the U.S. federal funds rate
increases by more than 150 basis points in one year. Oil price shocks refer to the
first year of these episodes (i.e., 1973, 1978, 1989, 1999).

Boom-Bust Cycles

Lending boom dates are drawn from Gourinchas, Valdés, and Landerretche
(2001, Table A1). The dummy variable takes the value 1 in the year after a lend-
ing boom ends. A growth boom is defined as a three-year period with average
growth exceeding by two standard deviations the country’s average growth rate
estimated over the entire sample period. The dummy variable takes the value 1 in
the first year after such an episode.
APPENDIX II: BEHAVIOR OF DIFFERENT TYPES OF FINANCIAL FLOW

Data Description

This appendix analyzes data on the financial account and six of its components—FDI; portfolio debt investment (PDI); portfolio equity investment (PEI); official flows (which include flows by government and monetary authorities); bank flows; and other investment—for 1970–2003. All flows are net, taken from IMF’s Balance of Payments Statistics (BOPS) database, and reported in current U.S. dollars. Throughout the analysis that follows, the flows are normalized by GDP in current U.S. dollars (taken primarily from the World Bank’s World Development Indicators database and supplemented with data from the IMF’s World Economic Outlook database). All data were checked for quality, with outliers and unusable observations dropped. The full sample includes 153 countries (Table 15.6), though only a subset of countries have reliable data for a sufficiently long time series.

Summary Statistics

Average Net Flows

Considering the average financial account balance for each country during 1970–2003, and taking the cross-country median within each country group over the period, it is perhaps not surprising that developing countries had the largest net inflows, followed by emerging markets and then advanced countries (Table 15.7). This pattern is even more pronounced for FDI, which has not been a net source of finance for advanced countries. By contrast, emerging markets received net FDI inflows averaging about 1.3 percentage points of GDP yearly, and developing countries received inflows averaging about 2.3 percentage points. The results (not reported here for the sake of brevity) are similar when considering 1990–2003 only, suggesting that the relative importance of FDI as a source of net inflows for emerging and developing countries has not diminished over the last decade. All the main results highlighted in this appendix hold for the subperiod 1990–2003.

Volatility

Using the standard deviation of net flows as a measure of volatility, financial flows are found to be substantially more volatile in emerging and developing countries. The cross-country median of the standard deviation of the financial account is about 2.9 percentage points of GDP for advanced countries, and about 4.5 percentage points for emerging markets and developing countries, during 1970–2003. This corroborates findings by previous studies (Broner and Rigobon, 2006; Prasad and others, 2003). The ranking by standard deviation is the same for FDI and official flows. However, PDI and PEI are, respectively, two and five times more volatile in advanced countries than in developing countries, with emerging market countries somewhere in between. Comparing across flows, in advanced
<table>
<thead>
<tr>
<th>Advanced</th>
<th>Emerging</th>
<th>Developing</th>
</tr>
</thead>
<tbody>
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<td>Albania</td>
</tr>
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</table>

Notes: Advanced countries are defined as in the IMF’s World Economic Outlook database, except for the Republic of Korea, which for the purpose of the empirical analysis is classified as emerging rather than advanced to capture the experience of its 1997–98 crisis; the remaining countries are considered emerging if they are included in either the (stock market-based) International Finance Corporation’s Major Index (2005) or JP Morgan’s EMBI Global Index (2005) (which includes countries that issue bonds on international markets); the remaining countries are classified as developing.
TABLE 15.7

<table>
<thead>
<tr>
<th>Financial Account</th>
<th>FDI</th>
<th>PDI</th>
<th>PEI</th>
<th>Official Flows</th>
<th>Bank Flows</th>
<th>Other Investment</th>
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</thead>
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<td>Average of capital flows</td>
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<td>Correlation with domestic growth</td>
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<td>Correlation with G-7 growth</td>
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<td>-0.1</td>
<td>-0.1</td>
<td>0.1</td>
<td>-0.0</td>
<td>-0.1</td>
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<tr>
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<td>0.0</td>
<td>0.2</td>
<td>0.0</td>
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</tr>
<tr>
<td>Correlation with U.S. one-year treasury bill</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
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<td>-0.1</td>
<td>0.1</td>
<td>0.3</td>
<td>0.0</td>
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<tr>
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<td>-0.2</td>
<td>0.0</td>
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<td>First principal component</td>
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<tr>
<td>Advanced</td>
<td>0.3</td>
<td>0.4</td>
<td>0.2</td>
<td>0.4</td>
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<td>0.3</td>
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<tr>
<td>Emerging</td>
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<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>Developing</td>
<td>0.3</td>
<td>0.3</td>
<td>0.4</td>
<td>0.4</td>
<td>0.3</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Sources: IMF, Balance of Payments Statistics database (all financial flows) and World Economic Outlook database, and World Bank, World Development Indicators database (GDP). See the text for details.

Notes: FDI denotes foreign direct investment; PDI denotes portfolio direct investment; PEI denotes portfolio equity investment; and G-7 denotes the Group of Seven industrial countries. The data reported are medians across countries within each group. All flows are net and normalized by total GDP for each year. The coefficient of variation of a series is the standard deviation divided by the mean: it is computed for each country separately, and this table reports the median across countries. The measure of persistence is the slope coefficient in a regression of a variable on its lagged value. The first principal component is a measure of co-movement across countries within each group: it is the share of total variance in a set of series that can be explained by a common component.

countries, FDI is the least volatile type of flow, with the exception of official flows. For emerging markets, in contrast, FDI is more volatile than PDI or PEI. For developing countries, official flows are the most volatile, followed closely by FDI. Comparing across flows, it is important to take into account the size of the various types of flow by using the coefficient of variation. On that basis, FDI is the most stable of all flows to emerging and developing countries, with a coefficient of
variation near 1, compared with 2–3 for PDI and PEI, or 5–7 for official flows, bank flows, and other investment (see also Wei, 2001).

**Persistence**

Regarding the persistence properties of financial flows, autoregressive coefficients were calculated on pooled data for each relevant country group, using a fixed-effects regression with the first lag on the right-hand side. The financial account exhibits similar autoregressive properties for emerging markets and developing countries, with the AR(1) coefficient estimated at around 0.5. The financial account is more persistent in advanced countries, with an autoregressive coefficient of 0.7. Interestingly, for advanced countries, the AR(1) coefficient is also quite similar across flows, ranging between 0.3 and 0.4. For emerging market countries, the most persistent type of flow is FDI, with an AR(1) coefficient of 0.5, and the least persistent is PDI, with a coefficient of virtually zero. For developing countries, FDI has an AR(1) coefficient of 0.35, with the coefficients for PDI, PEI, and other flows lying between 0.2 and 0.5. These estimates are close to those in Obstfeld and Taylor (2004) and Broner and Rigobon (2006), though the latter argue that total financial flows are more persistent in emerging and developing countries.

**Correlations**

Table 15.7 also reports correlations of financial flows with domestic GDP growth, G-7 growth, and the U.S. interest rate (the one-year treasury bill rate). Correlations between financial flows and these variables turn out to be quite low, except as noted herein. Financial flows are mildly procyclical in emerging market and developing countries. In developing countries, FDI is the financial flow most correlated with growth, though the correlation is still low at 0.2. For emerging markets, official flows and other investments are the most procyclical. A positive correlation between financial flows and growth has also been reported by Albuquerque, Loayza, and Servén (2005). The only type of flow that exhibits significant correlation with G-7 growth is PEI for emerging markets (0.1) and developing countries (0.2). The U.S. interest rate is correlated with the inflows into advanced countries, with a coefficient of 0.2, and is virtually uncorrelated with the financial accounts of emerging and developing countries. FDI is negatively correlated with the U.S. interest rate in both emerging markets (correlation of −0.3) and developing countries (correlation of −0.16). Other studies, such as Fernandez-Arias (1996), find, using higher-frequency data for shorter time periods, that foreign interest rates do matter for financial flows. The present exercise shows that at a yearly frequency, foreign interest rates matter less, a result also

---

\[31\] One possible problem with calculating the coefficient of variation is that average net inflows are often quite close to zero. To check robustness, two alternative measures of relative volatility were calculated. First, the coefficient of variation was calculated for gross financial inflows. Second, the standard deviation of net flows was normalized by average gross flows. The conclusions reached were virtually the same.

\[32\] Alternatively, AR(1) regressions were estimated for each country separately. The disadvantage of the pooled approach is that it constrains the AR(1) coefficient to be the same for each country group. The advantage is that it allows for inclusion of countries for which only a short time series is available. Results were similar to those reported here.
found in Broner and Rigobon (2006). Different kinds of financial flow are also either uncorrelated or weakly negatively correlated with each other, a pattern that holds for all country groups—this finding is consistent with Claessens, Dooley, and Warner (1995). This may suggest that different types of flows may be substitutes rather than complements or that reclassifications are frequent.

**Principal Components Analysis**

The interrelationships of financial flows across regions and income groups were analyzed using principal components analysis, focusing on the share of variation explained by the first principal component for each country group or region. For total financial flows, the patterns across developed and developing countries are quite similar, with the first principal component accounting for 25–30 percent of the variation in financial flows. Comparing across flows, FDI and PEI display the largest common component for advanced countries; for emerging markets, FDI has the largest common component; for developing countries, FDI, PDI, and PEI are roughly similar in this respect. Overall, however, there are no pronounced differences across types of flows in the relative importance of the common component. Although Calvo, Leiderman, and Reinhart (1993) find that the first principal component can account for 60–80 percent of variation in financial flows, their use of monthly data for a shorter time span (four years) on a Latin American sample may explain the difference in results.

**APPENDIX III: A MODEL OF OPTIMAL RESERVES**

This appendix presents background information on the Jeanne and Rancière (2006) model of a growing open economy where reserves are accumulated, at a cost, in order to reduce the frequency of sudden stops in financial flows and smooth their impact on domestic consumption. The simple version of the model presented in this study considers only the smoothing role of reserves. At the time of a sudden stop, the country’s authorities lend reserves to domestic agents whose lines of credit have been cut off by private lenders, thereby mitigating the drop in domestic consumption. The cost of holding reserves (the difference between the return on reserves and the long-term interest rate) translates into lower domestic consumption during noncrisis times. The optimal level of reserves equates the marginal costs and benefits of holding reserves. The parameters of the benchmark calibration (Table 15.8) are based on information drawn from a panel of 33 middle-income countries during 1980–2003. Defining a sudden stop as a worsening in the financial account balance by more than 5 percent of GDP, 77 sudden stops are observed during the sample period. This yields an unconditional probability of a sudden stop of 10 percent per year. The magnitude of a sudden stop is the mean size of sudden stops in the sample (11 percentage points of GDP). The output cost of a sudden stop is set equal to 6 percent of GDP (the difference in average real GDP growth between the year of the sudden stop, on the one hand, the following year and, on the other hand, the remaining years for all countries).
The cost of holding reserves is the difference between the opportunity cost of borrowing long term and the return on reserves invested in safe, short-term liquid assets. In the benchmark calibration, this premium consists only of the term premium, set at 1.5 percent—that is, the mean difference between the yield on 10-year U.S. treasury bonds and the federal funds rate during 1987–2005. Variants of the model consider the case where the opportunity cost of holding reserves also includes the sovereign spread. The coefficient of risk aversion is allowed to vary in the 1–10 range, as is customary in existing studies on growth and business cycles. It is assumed that the authorities are benevolent and maximize the welfare of the representative domestic consumer. The risk-free rate is set at 5 percent. The potential output growth rate is set at 3.3 percent, the mean real GDP growth rate in middle-income countries during 1980–2003 excluding sudden-stop years.

To analyze the role of the parameters in determining the optimal level of reserves, the model is repeatedly simulated by letting each key parameter vary (one at a time) over a plausible range while keeping the other parameters fixed at their baseline values as in Table 15.8. For the sake of comparison, in each plot (Figure 15.9) the optimal level of reserves is presented alongside the level of reserves predicted by the Greenspan-Guidotti rule.

When the size or probability of a sudden stop is sufficiently low, the optimal ratio of reserves is zero. (The costs of reserves exceed their benefits.) Optimal reserves rise near-linearly as the size of the sudden stop increases (beyond 2.5 percent of GDP), and nonlinearly as the probability of a sudden stop increases. For some starting values of the sudden-stop probability, a relatively modest rise can imply a substantial adjustment in the optimal ratio of reserves to GDP: for example, an increase in the annual probability from 5 to 10 percent leads optimal reserves to rise from 4 to 10 percentage points of GDP. Changes in the opportunity cost of holding reserves (regardless of whether they stem from a change in the term premium or, when included, the sovereign spread) have a substantial impact on optimal reserve levels. For example, an increase in the opportunity cost by 1.5 percentage points above its baseline value reduces the optimal reserve ratio by more than 6 percentage points of GDP. Finally, the impact of changes in the degree of risk aversion on the optimal level of reserves is major when starting from relatively low values of the coefficient, but limited when starting from higher values.

### TABLE 15.8
Calibration Parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Baseline</th>
<th>Range of Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of sudden stop</td>
<td>( \lambda = 0.11 )</td>
<td>[0, 0.3]</td>
</tr>
<tr>
<td>Probability of sudden stop</td>
<td>( \pi = 0.10 )</td>
<td>[0, 0.25]</td>
</tr>
<tr>
<td>Output loss</td>
<td>( \gamma = 0.06 )</td>
<td>[0, 0.2]</td>
</tr>
<tr>
<td>Potential output growth</td>
<td>( g = 0.033 )</td>
<td>[0, 0.025]</td>
</tr>
<tr>
<td>Term premium</td>
<td>( \delta = 0.015 )</td>
<td>[0.0025, 0.05]</td>
</tr>
<tr>
<td>Risk-free rate</td>
<td>( r^* = 0.05 )</td>
<td>[1, 10]</td>
</tr>
<tr>
<td>Risk aversion</td>
<td>( \sigma = 2 )</td>
<td></td>
</tr>
</tbody>
</table>

Sources: IMF staff calculations. The parameters were chosen based on data from the U.S. Board of Governors of the Federal Reserve System and the IMF’s International Financial Statistics database.
Figure 15.9  Optimal level of reserves as function of various factors.

The probability of a sudden stop can be estimated as a function of a country’s economic fundamentals by running a probit estimation of the probability of sudden stops in a sample of 33 middle-income countries over 1980–2003. The explanatory variables are selected using a general-to-specific approach—that is, by initially considering a large set of potential explanatory variables and iteratively eliminating those that are statistically less significant to arrive at the preferred specification reported in Table 15.9. The complete set of variables considered is listed in Jeanne and Rancière (2006). All explanatory variables are averages of the first and second lags, and are thus predetermined with respect to the sudden stop. The results are robust to the inclusion of time effects and fixed effects.

The probability of a sudden stop decreases with the precrisis growth performance and increases with the currency’s real appreciation, the ratio of public debt to GDP, openness to financial flows, and the ratio of foreign liabilities to money in the banking sector. The last two determinants suggest that the vulnerability to sudden stops rises with the degree of international financial integration.

Determinants of Vulnerability to Sudden Stops

The probability of a sudden stop can be estimated as a function of a country’s economic fundamentals by running a probit estimation of the probability of sudden stops in a sample of 33 middle-income countries over 1980–2003. The explanatory variables are selected using a general-to-specific approach—that is, by initially considering a large set of potential explanatory variables and iteratively eliminating those that are statistically less significant to arrive at the preferred specification reported in Table 15.9. The complete set of variables considered is listed in Jeanne and Rancière (2006). All explanatory variables are averages of the first and second lags, and are thus predetermined with respect to the sudden stop. The results are robust to the inclusion of time effects and fixed effects.

The probability of a sudden stop decreases with the precrisis growth performance and increases with the currency’s real appreciation, the ratio of public debt to GDP, openness to financial flows, and the ratio of foreign liabilities to money in the banking sector. The last two determinants suggest that the vulnerability to sudden stops rises with the degree of international financial integration.

**TABLE 15.9**

<table>
<thead>
<tr>
<th>Probit Estimation of Probability of Sudden Stop</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
</tr>
<tr>
<td>Real effective exchange rate deviation from HP trend</td>
</tr>
<tr>
<td>(3.1)***</td>
</tr>
<tr>
<td>GDP growth</td>
</tr>
<tr>
<td>(1.6)*</td>
</tr>
<tr>
<td>Public debt/GDP</td>
</tr>
<tr>
<td>(3.3)***</td>
</tr>
<tr>
<td>Ratio of foreign liabilities to money in banking sector</td>
</tr>
<tr>
<td>(3.0)***</td>
</tr>
<tr>
<td>Financial openness as (</td>
</tr>
<tr>
<td>(5.7)***</td>
</tr>
<tr>
<td>Dummy for fixed exchange rate regime</td>
</tr>
<tr>
<td>(1.8)*</td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>(12.6)***</td>
</tr>
<tr>
<td>Observations</td>
</tr>
<tr>
<td>Pseudo R²</td>
</tr>
<tr>
<td>Time effects</td>
</tr>
<tr>
<td>Fixed effects</td>
</tr>
</tbody>
</table>

Sources: IMF, International Financial Statistics database; World Bank, Global Development Finance database; and IMF staff calculations.

Note: One asterisk (*) denotes significance at 10 percent; two asterisks (**) denote significance at 5 percent; and three asterisks (****) denote significance at 1 percent. Absolute values of $z$ statistics are in parentheses. All explanatory variables are taken as averages of first and second lags. The fixed exchange rate regime is a “fix” or “peg” in the Reinhart and Rogoff (2004) classification.

33 The ratio of foreign liabilities of the financial sector to money in the banking sector (International Financial Statistics (IFS) line 26C/line 34) is a reasonable proxy for, though not a direct measure of, the extent of mismatch in the currency denomination of assets and liabilities in countries’ balance sheets. It is available for almost all countries from 1970 onward.

34 We find that trade openness does not significantly affect the probability of a sudden stop when financial openness is included as an explanatory variable.
A fixed exchange rate regime is associated with a higher probability of a sudden stop, though only if financial openness and exchange rate overvaluation are omitted from the regression.

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———, 2005b, World Economic Outlook, Chapter 3, September (Washington: International Monetary Fund).


CHAPTER 16

International Reserves in Emerging Market Countries: Too Much of a Good Thing?

OLIVIER JEANNE

16.1. INTRODUCTION

With international reserves four times as large, in terms of their GDP, as in the early 1990s, emerging market countries seem more protected than ever against shocks to their current and capital accounts. Some have argued that this buildup in reserves might be warranted as insurance against the increased volatility of capital flows associated with financial globalization. Others view this development as the unintended consequence of large current account surpluses and suggest that the level of international reserves has become excessive in many of these countries (see, for example, Summers, 2006). Do emerging market countries hold too much international reserves, and are there better ways to use those funds?

Answering these questions requires a normative benchmark for the optimal level of reserves. I present in this chapter a simple welfare-based model of the optimal level of reserves to deal with the risk of capital account crises or of “sudden stops” in capital flows. On the basis of this model, I derive some formulas for the optimal level of reserves and compare them with conventional rules of thumb, such as the Greenspan-Guidotti rule of full coverage of short-term debt. I then


1 I thank Ioannis Tokatlidas for superb research assistance. I also thank Joshua Aizenman and Lawrence Summers, as well as Eduardo Borensztein, Stijn Claessens, Fernando Goncalves, Pierre-Oliver Gourinchas, Nancy Marion, Jonathan D. Ostry, Brad Setser, and Shang-Jin Wei for comments on earlier drafts. This chapter benefited from discussions with Romain Rancière (who also generously shared data) and Christian Mulder.

2 See, for example, Aizenman and Marion (2003) and Stiglitz (2006). According to a survey of central bankers of developing and emerging market countries, the main reason for the recent buildup in reserves was to “secure protection from volatile capital flows” (Pringle and Carver, 2005). In the words of Stiglitz (2006, p. 248) “The East Asian countries that constitute the class of ’97—the countries that learned the lessons of instability the hard way in the crises that began in that year: have boosted their reserves in part because they want to make sure that they won’t need to borrow from the IMF again. Others, who saw their neighbors suffer, came to the same conclusion—it is imperative to have enough reserves to withstand the worst of the world’s economic vicissitudes.”
calibrate the model for emerging market countries and compare its predictions with the actual data.

One lesson from this exercise is that the optimal level of reserves is subject to considerable uncertainty, because it is sensitive to certain parameters that are difficult to measure. The model nevertheless produces ranges of plausible estimates against which the data can be compared. I find that it is not difficult for the model to explain a reserves-to-GDP ratio on the order of 10 percent for the typical emerging market country (close to the long-run historical average), and that even higher ratios can be justified if one assumes that reserves have a significant role in crisis prevention. The levels of reserves observed in many countries in the recent period, in particular in Latin America, are within the range of the model’s predictions.

Ultimately, however, the insurance model fails to account for the recent pattern of reserves accumulation in emerging market countries. The reason is that most of the reserves accumulation has taken place in Asian emerging market countries, where the risk of a capital account crisis seems much too small to justify such levels of self-insurance. The insurance model can account for the reserves accumulation observed in the Asian emerging market countries only if one assumes that the expected cost of a capital account crisis is unrealistically large (more than 60 percent of GDP for one of the two major types of crisis examined).

The conclusion that most of the current buildup of reserves is not justified by precautionary reasons has some implications for reserves management. There is little reason for countries to invest these funds in the liquid but low-yielding foreign assets in which central banks tend to invest. Rather, reserves should be viewed as a component of domestic external wealth that is managed by the public sector on behalf of the domestic citizenry, taking full advantage of the portfolio diversification opportunities available abroad. Indeed, an increasing number of emerging market countries are transferring a fraction of their reserves to “sovereign wealth funds,” mandated to invest in a more diversified way and at a longer horizon than central banks normally do. This is a trend that might take on considerable importance looking forward.

The last part of the chapter discusses some policy challenges and opportunities implied by the buildup in emerging market countries’ “sovereign wealth.” I discuss, first, the impact of sovereign wealth diversification on global financial markets, and second, some ways in which this wealth could be used in collective international arrangements—to insure against future crises or to promote financial development.

16.2. THE BUILDUP IN INTERNATIONAL RESERVES

The growth in the international reserves of emerging market countries is striking when compared with the contemporaneous trends in reserves in industrial countries (Figure 16.1).3 Whereas reserves in a group of industrial countries have remained

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3 My sample of emerging market countries is based on JP Morgan’s Emerging Markets Bond Index Global (EMBIG); my sample of industrial countries includes all countries that were members of the Organisation for Economic Co-operation and Development (OECD) in 1990. Appendix I lists the countries in both samples. Neither sample includes three large reserves holders in Asia: Hong Kong SAR, Singapore, and Taiwan Province of China.
stable below 5 percent of GDP, reserves in the emerging market countries have grown more than fourfold in terms of GDP since 1990. Much of this accumulation—more than half of the dollar amount—has taken place in Asia since the 1997–98 Asian crisis. China now has the largest stock of international reserves in the world, having overtaken Japan at the end of 2005, and it accounts for an important share of the buildup in emerging market reserves. However, China is not very different from the other Asian emerging market countries in terms of its ratio of reserves to GDP. This development is an important dimension of what Lawrence Summers calls the “capital flows paradox” in the current world financial system (see Summers, 2006), namely, that capital is flowing upstream from developing and emerging market countries toward the industrialized world and principally the United States.
The reserves accumulated in my sample of emerging market countries between 2000 and 2005 are equal to a significant fraction (about 40 percent) of the U.S. current account deficit in the same period and may thus have contributed to keeping global interest rates low.

Table 16.1 provides some insights on whether the reserves buildup has tended to be financed by current account surpluses or through capital inflows. The first line of the table reports cumulative net capital inflows as a percent of the increase in reserves over 2000–05 for the sample of emerging market countries, with a breakdown for Asia and Latin America. About 40 percent of the reserves buildup has been financed by capital inflows on average. Whereas Asia has relied more than the average on net exports to accumulate reserves, Latin America has run current account deficits, so that its (relatively smaller) increase in reserves has had to be financed more than one for one by capital inflows.

Another way to look at reserves is in the broader context of the country’s external balance sheet. The bottom two panels of Table 16.1 show the composition of the increase in both external assets and external liabilities that were traded in the financial accounts of emerging market countries between 2000 and 2005. More than 60 percent of their foreign asset accumulation consisted of reserves (more than 70 percent in Asia). By contrast, foreign direct investment (FDI) accounted for almost 70 percent of the new liabilities accumulated by these countries.

That emerging market countries tend to have external assets that are more liquid than their external liabilities is confirmed by looking at stocks rather than flows. Figure 16.2 compares the external balance sheets of emerging market and industrial countries (taking the average over 2000–05), using the IMF data on international investment positions. The share of reserves in gross foreign assets is

<table>
<thead>
<tr>
<th>TABLE 16.1</th>
<th>Reserves Accumulation and the Financial Account in Emerging Market Countries, 2000–05*</th>
</tr>
</thead>
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<tr>
<td>Item</td>
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<td>Net capital inflows as percent of change in reserves</td>
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<td>Composition of the Increase in Gross Foreign Assets (Percent)</td>
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<td>Direct investment</td>
<td>8.8</td>
</tr>
<tr>
<td>Portfolio investment</td>
<td>8.7</td>
</tr>
<tr>
<td>Other investment</td>
<td>22.3</td>
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<tr>
<td>Reserve assets</td>
<td>60.2</td>
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<tr>
<td>Composition of the Increase in Gross Foreign Liabilities (Percent)</td>
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</tr>
<tr>
<td>Direct investment</td>
<td>67.9</td>
</tr>
<tr>
<td>Portfolio investment</td>
<td>20.9</td>
</tr>
<tr>
<td>Other investment</td>
<td>11.2</td>
</tr>
</tbody>
</table>

*The data come from the standard presentation of the Balance of Payments Statistics. Net capital inflows are computed as the sum of the financial account over the period 2000–05. Reserve assets include foreign exchange reserves, monetary gold, special drawing rights, and the reserve position in the International Monetary Fund.

Figure 16.2 Composition of stock and foreign assets and liabilities in emerging market and industrial countries, 2000–05 averages.

almost nine times as large in the emerging market countries as in the industrial countries, whereas the share of FDI in their liabilities is almost twice as large.

The level of reserves in emerging market countries has thus increased since the early 1990s, but so has their trade and financial integration—and with it the associated risks. How much of the increase in reserves can be explained as self-insurance in response to an increase in the hazards of globalization?

As numerous studies have pointed out, the recent accumulation of reserves by emerging market countries seems difficult to explain using the conventional rules of thumb for reserves adequacy. Figure 16.3 tracks three conventional reserves

![Reserves to imports](image1)

![Reserves to short-term debt](image2)

![Reserves to M2](image3)

**Figure 16.3** Reserve adequacy in emerging market countries, 1980–2005. The conventional range of the reserves-M2 ratio is 5 to 20 percent. (Sources: IMF, *International Financial Statistics*; World Bank, *Global Development Finance*.)
adequacy ratios in emerging market countries since 1980: the ratios of reserves to imports, to short-term external debt, and to broad money (M2). Although imports and M2 have increased over time in these countries, international reserves have increased by much more. All three reserves adequacy ratios have increased markedly and are now much higher than any of the conventional rules of thumb would prescribe. In 2005, reserves in emerging market countries were close to seven months of imports and five times the level of short-term debt. That reserves deviate even more from the Greenspan-Guidotti rule than from the three-months-of-imports rule is surprising, since the latter was developed to better capture the risks stemming from the capital account after the crises of the 1990s.

The reserves buildup is also difficult to explain using regression-based empirical models for precautionary reserves. A large empirical literature explains the cross-country and time variation in reserves by a few key variables: economic size of the country, current and capital account vulnerability, and exchange rate flexibility. Recent studies find that although such regressions do a good job of predicting reserve holdings over a long period, they significantly underpredict the reserves accumulation of emerging market countries after the Asian crisis, especially in Asia (see IMF, 2003; Aizenman and Marion, 2003; and Aizenman, Lee, and Rhee, 2007).

It could be, however, that such regressions fail to capture the impact that the severe capital account crises of the 1990s had on how these countries perceived the risks associated with their international financial integration. It has been argued that the Asian crisis marked a watershed, in that emerging market countries became painfully aware that even sound macroeconomic policies did not insulate them from contagion and sharp reversals in capital flows. The buildup in reserves could be a rational adaptation to this new, more volatile world.

The concept that came to epitomize the capital account instability of the 1990s is that of “sudden stop” in capital inflows. Figure 16.4 shows that although sudden stops were not a total novelty for emerging market countries as a whole, they were a relatively new phenomenon in Asia. For the five Asian countries most affected by the 1997–98 crisis, furthermore, the size of the shock to the capital account and the loss of reserves were unprecedented, in recent decades at least, as Figure 16.5 shows. It may not be a coincidence, from this point of view, that most of the recent buildup in international reserves has taken place in Asia.

In sum, the recent buildup in emerging market countries’ international reserves cannot be explained by conventional adequacy ratios or by simple linear regressions. But it may be that neither approach fully captures how the instability of the 1990s changed the perception of risks and the desire for insurance on the part of

---

4 The ratio of reserves to imports should equal 0.25 according to the three-months-of-imports rule. The ratio of reserves to short-term external debt should equal 1 according to the Greenspan-Guidotti rule, the idea being that reserves should allow a country to live without foreign borrowing for up to one year. A conventional range for the ratio of reserves to broad money is 5 to 20 percent. The rationale for this ratio is that broad money reflects a country’s exposure to the withdrawal of assets (Calvo, 1996; De Beaufort-Wijnholds and Kapteyn, 2001).
Figure 16.4 Sudden stops in emerging market countries, 1980–2000, using the SS2 definition of a sudden stop. (See Table 16.11 in Appendix I for crisis definitions.)
Figure 16.5  Yearly changes in reserves-to-GDP ratios in five Asian countries (Indonesia, Korea, Malaysia, the Philippines, and Thailand), 1980–2000. Data include crisis loans received from the IMF.

the countries most affected. For this reason, looking at the implications of a cost-benefit analysis of the optimal level of reserves might be more informative than historical regressions. This is the approach that I take in the rest of the chapter.

16.3. AN INSURANCE MODEL OF OPTIMAL RESERVES

I present in this section a simple framework for a cost-benefit analysis of the optimal level of reserves to deal with capital account crises. The model features a small, open economy that is subject to being hit by a capital account crisis. Reserves are useful both in terms of crisis prevention (reducing the probability of a crisis) and in terms of crisis mitigation (reducing the welfare cost of a crisis, once it has occurred). I start with a brief review of the literature on cost-benefit analyses of international reserves, before presenting the model.

16.3.1. Cost-Benefit Analyses of the Optimal Level of Reserves

The idea of a cost-benefit approach to the optimal level of reserves has inspired a long line of literature that goes back to a seminal contribution published by Robert Heller in 1966. In Heller’s analysis the optimal level of reserves was determined in the context of a trade-off between their opportunity cost and the risk of an external disequilibrium leading to a costly adjustment—a contraction in domestic absorption. Heller simply posited that the optimal level of reserves should minimize the sum of the expected cost of adjustment plus the opportunity cost of reserves.

One problem with traditional models of optimal reserves is that the objective function maximized by the authorities is only loosely related to domestic welfare. This leaves room for ambiguity in the definition and in the measurement of key variables of the model. First, it is not very clear how the cost of an external disequilibrium should be measured. Second, the lack of a rigorous welfare criterion also leads to some ambiguity in the definition of the opportunity cost of reserves, as I will show later.

I will therefore rely on a model of the optimal level of reserves that is welfare-based but preserves some of the simplicity of the earlier literature. This section concludes with a brief summary of the main features of my analytical framework. After reading this summary, those primarily interested in my predictions on the optimal level of reserves can skip the remainder of this section, which presents the model in more detail, and proceed directly to the discussion of the numerical findings.

5 See Heller (1966). The dynamic aspect of the authorities’ optimization problem was treated more rigorously in the buffer stock models of international reserves of Hamada and Ueda (1977) and Frenkel and Jovanovic (1981).

6 Whereas Heller (1966) interpreted the adjustment cost as a transitory fall in domestic absorption, Ben-Bassat and Gottlieb (1992) and Garcia and Soto (2004) define it as a fall in domestic output. The two are not equivalent for domestic welfare.
The model features a small, open economy that is vulnerable to crisis, defined as a loss of access to external credit associated with a fall in output. The economy is populated by a representative consumer who holds a certain amount of foreign assets, or “sovereign wealth.” This wealth can be invested in liquid international reserves or an illiquid asset. Reserves yield benefits in terms of crisis prevention and crisis mitigation but entail an opportunity cost relative to the more profitable illiquid investment. The optimal level of reserves will depend on the following parameters of the model:

- $L$ and $\Delta Y$, the size of the capital flight and of output loss in a crisis, respectively, expressed in terms of potential output;
- $\delta$, the opportunity cost of accumulating reserves;
- $\sigma$, the relative risk aversion of the domestic consumer; and
- $\pi$, the probability of a crisis (which is endogenous to the level of reserves if there is crisis prevention).

### 16.3.2. Assumptions

The model assumes a small open economy and three periods of time $t = 0, 1, 2$. The last period (period 2) represents the long term. The intermediate period (period 1) is the time during which a crisis could occur. During the initial period (period 0) the country adjusts its reserves to the risk of a crisis in period 1. This simple time structure makes it possible to preserve the simplicity of Heller’s original approach but does not preclude a more dynamic interpretation of the model, as I will show shortly.8

At the end of period 0, a representative consumer in the small open economy structures his or her external assets and liabilities to deal with the risk of a crisis in period 1. To keep the problem simple, I assume that the consumer allocates wealth $W_0$ between two assets: liquid bonds (or reserves, $R_0$) and an illiquid asset $I$. This asset can be defined as a negative variable, in which case the consumer issues a long-term external liability $D = -I$. The welfare of the representative consumer is given by

$$U_t = E_t\left[u(C_t) + \frac{W_2}{1 + r}\right]$$

(1)

where $u(\cdot)$ is an increasing and concave function of consumption, and $W_2$ is the consumer’s net foreign wealth at the beginning of period 2. Foreign wealth can be

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7 The representative-consumer assumption implies that one must look at the optimal level of reserves from the point of view of the country as a whole, without distinguishing between the private sector and the public sector. See, for example, Caballero and Krishnamurthy (2004) for a model of international reserves that includes a meaningful distinction between the private sector and the government.

8 Aizenman and Marion (2003) and Miller and Zhang (2006) present two-period precautionary savings models of reserves. Caballero and Panageas (2005) and Durdu, Mendoza, and Terrones (2007) present more dynamic precautionary savings models of international reserves. These models do not yield closed-form solutions for the optimal level of reserves but can be solved numerically.
traded between periods at interest rate $r$. The consumer thus desires a level of consumption $C^*$ in period 1 that satisfies the first-order condition,

$$u'(C^*) = 1$$  \hspace{1cm} (2)$$

The reserves are more liquid than the asset in the sense that they are the only form of wealth that can be sold in period 1. The illiquid asset cannot be sold in period 1 but brings a higher return in the long run (period 2). The difference between the return on the illiquid asset and the return on reserves is the opportunity cost of reserves, the price that the consumer must pay in order to keep wealth in liquid form.

The sequence of events and actions is as follows.

Period 0. The consumer allocates wealth between reserves and the illiquid asset,

$$W_0 = R_0 + I$$  \hspace{1cm} (3)$$

Period 1. An external liability $L$ comes due. The consumer repays $L$ and consumes $C_1$ under the budget constraint,

$$Y_1 + L + R = C_1 + L + R'$$  \hspace{1cm} (4)$$

where $Y_1$ is domestic output, $L'$ is new debt issued in period 1, $R = (1+r)R_0$ is the stock of reserves at the beginning of the period, and $R'$ is the stock of reserves at the end of the period.

Period 2. The consumer’s net foreign wealth is equal to output in period 2 plus the net return on net foreign assets,

$$W_2 = Y_2 + (1 + r)^2 (1 + \delta) I + (1 + r) (R' - L')$$  \hspace{1cm} (5)$$

where $r$ is the interest rate between period 1 and period 2, and $\delta$ is the excess return on the illiquid asset (or “illiquidity premium”).

In period 1, the economy can be in either of two states that differ by the level of output and the consumer’s access to external credit:

- The no-crisis state: output is at its potential, $Y_1 = Y$, and the representative consumer has complete access to external credit (there is no restriction on $L'$), or
- The crisis state: output is below potential, $Y_1 = Y - \Delta Y$, and the representative consumer has no access to external credit in period 1 ($L'$ is equal to zero).

The crisis state thus consists of both an output drop and a sudden stop in capital flows. As equation (4) shows, the negative impact of the fall in output and capital inflows on domestic consumption can be mitigated by running down reserves ($R' = 0$).\(^9\) I shall assume, as a matter of normalization, that $Y = 1$, so

\(^9\) Note that the consumer always repays the short-term debt that is not rolled over; that is, default is ruled out by assumption as a way of smoothing domestic consumption.
that the output cost of a crisis $\Delta Y$ and the size of the sudden stop $L$ are expressed in terms of potential output. I also assume that the desired level of consumption is equal to potential output ($C^* = Y$) so that there is no predictable trade deficit in period 1.

The ex ante probability of a crisis is denoted by $\pi$. To capture the idea that reserves might provide a benefit in terms of prevention, I assume that the probability of crisis is a decreasing function of the ratio of reserves to short-term debt,

$$\pi(R) = F\left(\nu - a \frac{R}{L}\right)$$

(6)

where $F(\cdot)$ is an increasing function, and $\nu$ is a measure of vulnerability to a crisis, summarizing the fundamentals other than reserves. (I will at times refer to the coefficient $a$ as the prevention benefit parameter.) In calibrating the model I will use a probit specification, implying that $F(\cdot)$ is the cumulative distribution of a normal function.

The interesting question is how the optimal level of reserves $R$ depends on the relevant determinants: the country’s vulnerability to a crisis, measured by $\nu$; the magnitude of the crisis, measured by the size of the shock to the capital account $L$ and of the output loss $\Delta Y$, and the opportunity cost of reserves, $\delta$.

16.3.3. The Optimal Level of Reserves

As shown in Appendix II, the optimal level of reserves minimizes a loss function that equals the opportunity cost of reserves plus the expected welfare cost of a crisis:

$$\text{Loss} = \delta R + \pi(R) f(R)$$

(7)

where $f(R)$, the welfare cost of a crisis, is increasing with the size of the crisis ($L$ and $\Delta Y$) and decreasing with the level of reserves $R$.

Equation (7) is reminiscent of the loss function postulated in some earlier cost-benefit analyses of optimal reserves (see, for example, Heller, 1966; Ben-Bassat and Gottlieb, 1992; and Garcia and Soto, 2004). It captures in a simple way the trade-off between the opportunity cost of reserves $\delta R$ and their benefits in terms of crisis prevention $\pi(R)$ and crisis mitigation $f(R)$. It can be interpreted, in a more dynamic context, as the average intertemporal loss of a country maintaining a constant level of reserves $R$. The consumer bears the opportunity cost $\delta R$ in every period but pays the welfare cost of a crisis with a frequency $\pi(R)$. Equation (7) thus sums up the average cost of crises and the average cost of insurance against those crises. As shown in Figure 16.6, for low levels of reserves the gains from increasing reserves, in terms of crisis prevention and crisis mitigation, dominate the opportunity cost, whereas the opposite holds for high levels of reserves.

Closed-form expressions for the optimal level of reserves can be obtained if one assumes that reserves have no benefits in terms of prevention—that is, if $\pi$ is exogenous. The first-order condition for the minimization of the loss function in equation (7) can then be written as

$$u'[C^* - (\bar{R} - R)] = 1 + \frac{\delta}{\pi}$$

(8)
Figure 16.6  Total loss and the optimal level of reserves.
where $\bar{R} = L + \Delta Y$ is the “full insurance” level of reserves (i.e., the minimum level of reserves sufficient to maintain consumption at the desired level in a crisis). This condition implies that the optimal level of reserves is increasing with the probability of a crisis and decreasing with the opportunity cost of holding reserves—as one would expect.

If the consumer has constant relative risk aversion $\sigma$, then the optimal level of reserves is given by the formula

$$R = L + \Delta Y - \left[ 1 - \left( 1 + \frac{\delta}{\pi} \right)^{-1/\sigma} \right]$$  \hspace{1cm} (9)

In words, the optimal level of reserves is equal to short-term external debt plus the output cost of a crisis minus a term reflecting the opportunity cost of holding reserves.

Note that in this model the optimal level of reserves could be higher than under the Greenspan-Guidotti rule ($R = L$), because reserves smooth the impact on consumption of the fall in output, and not only the impact of the debt rollover crisis. The optimal level of reserves could also be lower than short-term debt because of the opportunity cost of holding reserves, which the Greenspan-Guidotti rule ignores.

The optimal level of reserves does not have a closed-form expression in the general case where the probability of a crisis is endogenous to the level of reserves. Then the optimal level of reserves minimizes

$$\text{Loss} = \delta R + F\left( v - a \frac{R}{L} \right)f(R)$$  \hspace{1cm} (10)

Taking into account the benefits of crisis prevention leads to an increase in the optimal level of reserves, other things equal. In fact—and this is an important difference from the case where the probability of a crisis is exogenous—the optimal level of reserves may now exceed the “full insurance” level $\bar{R} = L + \Delta Y$. Crisis prevention could make it optimal for a country to hold more reserves than it is willing to spend in a crisis.

16.4. THE BENEFITS OF INTERNATIONAL RESERVES

I now turn to the calibration of the model, starting with the benefits of reserves. In my model reserves yield benefits in terms of crisis prevention $\pi(R)$ and crisis mitigation $f(R)$. To calibrate the model I thus try to identify each type of benefit in the data.\footnote{In line with the model, my discussion will focus on crisis management and will not deal with some benefits that reserves may have in noncrisis times, such as limiting exchange rate volatility (Hviding, Nowak, and Ricci, 2004) or providing liquidity to the foreign exchange market. Reserves can also yield benefits if the government is able to invest them more wisely than the average citizen, or if they promote capital market integration and domestic financial development.}

16.4.1. Crisis Prevention

The international financial crises of the 1990s triggered a search for reserves adequacy ratios that would capture the vulnerability of emerging market countries’ balance
sheets and capital accounts in a world with highly mobile capital flows. The staff of the IMF concluded that the ratio of reserves to short-term external debt was the “single most important indicator of reserves adequacy in countries with significant but uncertain access to capital markets” (IMF, 2000, p. 6), although this ratio should be taken as only a starting point for an analysis that should also look at other reserves adequacy ratios in light of each country’s specific conditions.\(^{11}\)

This view was supported by a vast body of empirical research showing that the ratio of reserves to short-term external debt tended to perform well as an early indicator of currency crises. By contrast, the (relatively smaller) empirical literature on sudden stops in capital flows has been less conclusive, generally failing to detect a significant preventive role for reserves.\(^{12}\)

In order to take a broad view of the preventive role of reserves with respect to both currency crises and sudden stops, I ran a number of univariate probit regressions using various crisis definitions and reserves adequacy ratios. The regression results are based on four different definitions of a currency crisis (denoted by CC1 to CC4) and four different definitions of a sudden stop (denoted by SS1 to SS4). Table 16.11 gives these definitions, and Table 16.12 lists the years when each type of crisis occurred in each country. For the first of the currency crisis definitions (CC1), I use Frankel and Rose’s criterion of a nominal depreciation of the currency of at least 25 percent relative to the previous year that is also at least a 10-percentage-point increase in the rate of depreciation (Frankel and Rose, 1996). The other three definitions (CC2 to CC4) are based on a crisis pressure index that adds the percentage nominal depreciation of the currency to the percentage loss in foreign reserves (Frankel and Wei, 2005).

I first identify sudden stops as those years in which net capital inflows fell by more than 5 percent of GDP (SS1). This simple criterion has been criticized for various reasons, in particular because it captures some episodes in which capital net inflows slowed down but remained positive (such as Malaysia in 1994, following the imposition of controls on capital inflows). For robustness, I also consider three sudden-stop measures that are more stringent (SS2 to SS4).\(^{13}\)

\(^{11}\) Those conclusions were presented in two documents: “Debt- and Reserve-Related Indicators of External Vulnerability” (IMF, 2000) and “Issues in Reserves Adequacy and Management” (IMF, 2001). One study that contributed to crystallizing the official sector’s conventional wisdom about the importance of this ratio was Bussière and Mulder (1999). See also Mulder (2000).

\(^{12}\) The literature on early warning signals and the empirical determinants of crisis in probit/logit regressions is too large to be reviewed here—the reader is referred to the reviews by Kaminsky, Lizondo, and Reinhart (1998); Berg, Borensztein, and Patillo (2005); and Frankel and Wei (2005). Another way in which reserves might stabilize the domestic economy is by lowering the interest rate on foreign debt (Levy-Yeyati, 2006). Evidence that larger reserves decrease the sovereign spread is provided in Hauner (2005); Duffie, Pedersen, and Singleton (2003); and Eichengreen and Mody (2000). By contrast with currency crises, Calvo, Izquierdo, and Mejía (2004) and Frankel and Cavallo (2008) did not find that reserves had a statistically significant effect of reducing the probability of sudden stops.

\(^{13}\) The precise definitions are given in Table 16.11 in Appendix I. The crisis dates for SS2 to SS4 are taken from Frankel and Cavallo (2008), who apply the criteria of Calvo, Izquierdo, and Mejía (2004) to a larger sample of countries and a longer time period.
Table 16.2 summarizes the results of 160 univariate regressions using various reserves adequacy ratios, crisis definitions, and probit specifications. For each crisis definition and reserves adequacy ratio, I ran four probit regressions of the crisis dummy variable on the lagged reserves ratio and a constant: without fixed effects, with country fixed effects, with time fixed effects, and with both country and time fixed effects. Since currency crises and sudden stops each have four different definitions, each cell in the table is based on 16 probit regressions. The table reports the number of regressions in which the coefficient on reserves was both negative and significant at the 10 percent level or better.

Several facts stand out. First, the denominator of the reserves adequacy ratio that “works” best to predict a currency crisis is short-term debt. The benefit of increasing reserves in terms of crisis prevention, furthermore, is economically significant. To illustrate, Figure 16.7 shows how the probability of a crisis varies with the Greenspan-Guidotti ratio $R/L$ for values of $a$ in the range of estimation of the probit. As the figure shows, if $a = 0.3$, doubling the ratio of reserves to short-term debt from 1 to 2 reduces the probability of a crisis by almost 4 percent. However, there are diminishing returns to further increasing reserves: increasing $R/L$ from 5 to 6 reduces the probability of crisis by less than 1 percent.

Second, the reserves adequacy ratios do not perform as well at predicting sudden stops as they do at predicting currency crises. The ratio that works best is that

TABLE 16.2
Regressions of Crisis Variables on Alternative Measures of Reserves, 1980–2000

<table>
<thead>
<tr>
<th>Measure of Reserves Adequacy</th>
<th>Currency Crisis</th>
<th>Sudden Stop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio of reserves to imports</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Ratio of reserves to short-term debt (World Bank measure)</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>Ratio of reserves to short-term debt (BIS measure)</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Ratio of reserves to M2</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Ratio of reserves to GDP</td>
<td>12</td>
<td>1</td>
</tr>
</tbody>
</table>

*For each pair of reserves adequacy measure and type of crisis, regressions were performed combining each of four crisis definitions with one of four fixed-effects specifications (no fixed effects, country fixed effects only, time fixed effects only, and both country and time fixed effects), for a total of 16 regressions. Each cell of the table reports the number of regressions out of the 16 in which the coefficient on the indicated reserve adequacy ratio was negative and significant at the 10 percent level or better.

Source: Author’s calculations.

More precisely, the measure of short-term debt that works best is that from the World Bank Global Development Finance database rather than that in the Bank for International Settlements (BIS) data. This result is surprising because the BIS data should be a better measure of the denominator in the Greenspan-Guidotti ratio (the BIS reports debt maturing in the following year, whereas the World Bank data are based on maturity at issuance). However, the BIS debt measure might be less significant because it is available for fewer of the countries in the regressions.
Figure 16.7  Reserves and crisis prevention. The variable $\alpha$ is the prevention benefit parameter, the coefficient on the Greenspan-Guidotti ratio in the crisis probability (equation 6 in the text). It is assumed that the probability of crisis is 10 percent for $R = L$. 

Source: Author’s calculations.

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based on M2, but even this ratio is significant in only one-fourth of the regressions. This result also seems consistent with the empirical literature, which is ambiguous with regard to the benefits of reserves in preventing sudden stops rather than currency crises.

One important caveat is necessary before one accepts the conclusion that reserves help to prevent crises. The existing empirical studies do not really distinguish between two possibilities: whether high levels of reserves allow countries to prevent crises, or whether spending the reserves merely postpones the crises.\(^\text{15}\) This identification problem does not affect the rationale for using reserves as an early warning indicator of crisis, but it may lead to an exaggeration of the benefits of reserves in terms of crisis prevention. In many cases, countries might actually have hastened the crisis, and not reduced its probability, by trying to maintain a high level of reserves in the face of a loss of confidence in domestic policies.

### 16.4.2. Crisis Mitigation

There are two ways in which reserves can help to mitigate the impact of a balance of payments crisis on domestic welfare. First, the reserves can be used to mitigate the fall in domestic output. Second, the reserves can be used to buffer the impact of the balance of payments shock on domestic absorption.

The authorities can reduce the output cost of a crisis by using international reserves through various channels. Foreign exchange interventions can mitigate the depreciation of the domestic currency, and thus the disruption induced by currency mismatches in balance sheets. Reserves help the monetary authorities in providing liquidity to the domestic financial markets, the banking sector, and even exporters; this is especially valuable if there is significant dollarization of bank deposits and other domestic liabilities.\(^\text{16}\)

As for the second benefit, I present a simple accounting exercise that shows the extent to which international reserves help smooth domestic absorption in the face of balance of payments shocks. In a small, open economy, domestic absorption can be written as the sum of domestic output, capital inflows, and reserves

\(^\text{15}\) This ambiguity is certainly present in the theoretical literature on crises and reserves. In some models, a large volume of reserves effectively reduces the probability of crisis by making the economy more resilient to adverse shocks (Chang and Velasco, 2000; Aizenman and Lee, 2005) or to self-fulfilling changes in market sentiment (Morris and Shin, 1998). By contrast, in the Krugman-Flood-Garber framework, a speculative attack made unavoidable by excessive money growth is merely delayed by a larger stock of reserves (Krugman, 1979; Flood and Garber, 1984). In addition, countries often shorten the maturity of their debt before a crisis, further reducing the Greenspan-Guidotti ratio (Detragiache and Spillimbergo, 2001).

\(^\text{16}\) Jeanne and Wyplosz (2003) and Calvo (2006) emphasize that lending the reserves to domestic agents is a more effective tool than foreign exchange intervention in preventing and mitigating crises. Calvo (2006) points to an interesting example of a nonstandard way of disposing of international reserves: in August 2002 the central bank of Brazil employed some of its international reserves to make loans to the export sector through commercial banks.
decumulation (net income from abroad is omitted because it typically varies little in a crisis):\cite{Jeanne2006}

\[ A_t = Y_t + KA_t - \Delta R_t \quad (11) \]

There is an exact correspondence between this decomposition and equation (4) of the model, which can be written

\[ C_1 = Y_1 + \frac{(L' - L)}{K} - \frac{(R' - R)}{\Delta R} \]

Thus information about the behavior of the components of equation (11) can help in calibrating the model. I now look at how the components of equation (11) behave in observed sudden stop episodes. Sudden stops will be identified, in my sample of emerging market countries, as a year in which net capital inflows fall by more than 5 percent of GDP (definition SS1).

Figure 16.8 shows the average behavior of domestic absorption and the contribution of the various components on the right-hand side of equation (11) in a five-year event window centered around a sudden stop. Real output is normalized to 100 in the year before the sudden stop. All the variables are converted from current dollars into constant local currency units so that the changes in output and domestic absorption can be tracked in volume terms.\cite{IMF2023}

A large fall in net capital inflows is observed in the year of the sudden stop, amounting to almost 10 percent of the previous year’s output on average. This is not surprising, since a large fall in those inflows is the criterion used to identify sudden stops. More interestingly, most of the negative impact of the capital account reversal on domestic absorption is offset by a fall in reserves accumulation. Thus domestic absorption falls by only 3 percent of GDP on average in the year of the sudden stop—much less than the capital inflows. Figure 16.8 also shows that the contribution of output is relatively small: real growth merely falls to zero at the time of the sudden stop.

This evidence is consistent with the view that emerging market countries accumulate reserves in good times so as to be able to decumulate them, thereby smoothing domestic absorption, in response to sudden stops. This smoothing effect is potentially large. To illustrate, if reserves accumulation were equal to zero in the year of the sudden stop, domestic absorption would fall by 9 percent of output on average instead of 3 percent, other things equal. This counterfactual

\cite{Jeanne2006} See Jeanne and Rancière (2006). This decomposition of domestic absorption results from two national accounting identities. First, domestic absorption (the sum of domestic private and public consumption and investment) is the difference between real output and the trade balance, \( A_t = Y_t - TB_t \). Second, the balance of payments equation \( CA_t + KA_t = \Delta R_t \), where \( CA_t = TB_t + IT_t \), is the current account balance (the sum of the trade balance and income and transfer from abroad), can be used to substitute out the trade balance from the first identity.

\cite{IMF2023} The dollar value of output and domestic absorption falls by a larger amount than indicated in Figure 16.8 because of the real depreciation of the domestic currency. The variables are converted from current dollars to constant local currency units using the nominal dollar exchange rate and the local GDP deflator. IMF loans are counted as reserves rather than capital inflows.
experiment should be interpreted with caution, because the magnitude of capital flight could in part be endogenous to the fall in reserves. It does suggest, however, that foreign exchange reserves may well make a sizable contribution to the smoothing of domestic absorption in response to sudden stops.

The case of Uruguay in 2002 provides a striking illustration of the role of reserves in a very severe sudden stop episode. Following the Argentine crisis, net capital inflows decreased significantly, leading to a sharp decrease in reserves. The data shows a clear pattern where reserves decline before the stop, indicating that reserves may have been used to smooth the impact of the sudden stop. The figure also illustrates the subsequent recovery of reserves and domestic absorption, suggesting that reserves play a crucial role in stabilizing the economy during such episodes.

(Figure 16.8) Domestic absorption and output, net capital inflows, and reserves in sudden stops (percent of GDP in year of sudden stop). A sudden stop is defined as a fall in the financial account of more than 5 percent of GDP (SS1). Events that occurred before 1980 or within the five-year window of a previous sudden stop are excluded from the calculation. The solid line is the sample mean; the dotted lines indicate the mean plus and minus one standard deviation. (Source: Author’s calculations using data from the IMF, International Financial Statistics and the World Bank, World Development Indicators.)
capital inflows to Uruguay fell by 26 percentage points of precrisis GDP. The Uruguayan government used a large amount of foreign exchange reserves (a significant part of which was made available in the context of an IMF arrangement) to cover the withdrawal of dollar-denominated deposits from the domestic banking system. As a result, the decline in domestic absorption, although quite substantial (14 percent of GDP), was much smaller than the shock to the capital account.

16.5. THE COSTS OF INTERNATIONAL RESERVES

The cost of holding reserves is measured in the literature—as in the model—as the difference between the return on the reserves and the return on more profitable alternative investment opportunities. One term of the comparison, the return on the reserves, is generally proxied as the return on short-term foreign currency assets. The appropriate definition of alternative investment opportunities, on the other hand, raises several thorny questions.

One approach is to consider higher-yielding investment opportunities in the domestic business sector or in the building of public infrastructure. However, the marginal product of capital is difficult to measure in a way that is comparable across a large number of countries. Caselli and Feyrer’s recent estimates can be used to compute an average annual real return to capital of 7.8 percent in 17 emerging market countries in my sample. This, together with an estimate for the short-term real interest rate of 2 percent a year—roughly the average U.S. real short-term rate over 1980–2005—would lead to an opportunity cost of around 6 percent a year.

Given the difficulties involved in measuring the returns to physical investment, most measures in the literature assume that the alternative to holding international reserves is to invest in other financial assets or to repay existing financial liabilities. One approach defines the opportunity cost of reserves as the quasi-fiscal cost of sterilization by the central bank, that is, the difference between the return on the central bank’s domestic currency assets and the return on international reserves (see, for example, Frenkel and Jovanovic, 1981; Flood and Marion, 2002; and Mohanty and Turner, 2006). This differential is generally positive, but in countries where domestic interest rates are very low—such as China recently—this approach leads to a negative opportunity cost of reserves.

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19 My discussion focuses on the opportunity cost of carrying the reserves and does not deal with the challenges to monetary and financial stability posed by large-scale sterilization (see Mohanty and Turner, 2006, and European Central Bank, 2006, for a discussion of those costs). Another cost that I do not discuss is the false sense of confidence that reserves may instill in foreign investors, allowing the domestic authorities to postpone necessary adjustments. Finally, large-scale purchases and sales of reserves could induce exchange rate changes that cause valuation losses on the reserves.

20 Caselli and Feyrer (2007) compute the return to capital using production functions calibrated as in the development accounting literature. They find that the return to capital is not higher in developing countries than in industrial countries once one adjusts for nonreproducible capital (land).
There are two serious issues with measuring the opportunity cost of reserves in this way. First, this measure is not adjusted for the expected appreciation or depreciation of the domestic currency. For example, the fiscal cost of reserves could be found to be negative because the domestic currency is expected to appreciate relative to the dollar—and interest rate parity applies—but this measure fails to take into account the expected valuation loss on the reserves. Second, the central bank’s profit is not a measure of domestic welfare. Selling high-yielding domestic bonds for reserves may reduce the central bank’s flow of profit but increases the income of the domestic investors who purchase the bonds. The opportunity cost of reserves should therefore be measured by looking at the budget of the country as a whole rather than that of the central bank. This might be a reason to measure the opportunity cost of reserves by reference to external—rather than domestic—assets and liabilities.

Reserves can be accumulated by issuing—or can be used to repay—external debt. Given this observation, some authors measure the opportunity cost as the spread between the interest rate on external debt and the return on reserves.\(^\text{21}\) By this measure the opportunity cost of reserves was 8.4 percent a year in emerging market countries on average in 2000–05, but this figure masks important disparities between Asia, where the spreads were low, and Latin America, where they were much higher (Figure 16.9).

One might argue that these spreads overstate the true opportunity cost of holding reserves, because they include the default risk premium on foreign debt. As shown more formally in Appendix II, the welfare-based approach suggests that the default risk premium should not be included, because it is, on average, a fair reflection of the probability of less than full repayment. Pushed to its logical extreme, this approach suggests that the true opportunity cost of reserves is the U.S. term premium, that is, the opportunity cost of financing a stock of liquid dollar assets with default-free long-term dollar debt. This would lead to a much lower measure of the opportunity cost of reserves of at most 2 percent.\(^\text{22}\)

Table 16.3 presents some measures of the average opportunity cost of reserves in terms of domestic GDP in my sample of emerging market countries over the period 2000–05. The measures are based on a uniform opportunity cost of 6 percent as well as the term premium, with and without a spread. With an opportunity cost of 6 percent a year, the average cost of reserves amounts to 1 percent of GDP.\(^\text{23}\) The estimated cost of reserves is significantly lower if one considers the term premium, but larger if one includes the emerging market spread. On average, the total cost of holding reserves was substantially lower in Latin America than in Asia if one uses the same opportunity cost per unit of reserves for both regions, but it was relatively

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21 This measure was initially proposed by Edwards (1985). It is used by Garcia and Soto (2004) and Rodrik (2006).

22 The differential between 10-year U.S. Treasury bonds and three-month U.S. Treasury bills was almost 2.5 percentage points on average over 2000–05. Expectation-adjusted measures lead to even lower estimates of less than 1 percentage point (Rudebusch, Sack, and Swanson, 2007).

23 This is consistent with the estimates obtained by Rodrik (2006) and Bird and Rajan (2003).
Figure 16.9  Alternative measures of the opportunity cost of reserves, 2000–05. The term premium is the difference between the return on long-term dollar assets and liquid dollar assets. The spread is the difference between the interest rate on external debt and the return on reserves.
similar in the two regions when one uses the term premium plus the spread. This is explained by the fact that, whereas on average the reserves-to-GDP ratio is more than twice as high for Asian countries as for Latin American countries, the sovereign spread is substantially higher in Latin America than in Asia.

16.6. MODEL PREDICTIONS

The model presented above is used here to predict the optimal level of reserves in emerging market countries. This is done in two steps. First, I calibrate the model by reference to an average emerging market country, as a way of getting a broad sense of the quantitative implications of the model and their sensitivity to the parameters chosen. Second, I calibrate the model by reference to country-specific data, to study how far the model can go in explaining the reserves buildup in emerging market countries.

16.6.1. Benchmark Calibration and Sensitivity Analysis

The benchmark calibration is based on the parameter values given in Table 16.4. I assume that reserves provide no benefits in terms of prevention, so that the formula in equation (9) applies. The probability of crisis was set to the unconditional

<table>
<thead>
<tr>
<th>TABLE 16.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunity Cost of Reserves, 2000–05*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PERCENT OF GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Emerging Markets</td>
</tr>
<tr>
<td>Opportunity cost of reserves is 6 percent a year</td>
</tr>
<tr>
<td>Opportunity cost of reserves is the term premium (2 percent a year)</td>
</tr>
<tr>
<td>Opportunity cost of reserves is the term premium plus the spread on external debt</td>
</tr>
</tbody>
</table>

*The sample includes all the emerging market countries listed in Table 16.10, except Korea and India. Data are unweighted averages for the countries in each group. The term premium is the difference between the return on long-term dollar assets and liquid dollar assets. The spread is the difference between the interest rate on external debt and the return on reserves.

Sources: Author’s calculations using data from Bloomberg; World Bank, *World Development Indicators*; and IMF, *International Financial Statistics*.

<table>
<thead>
<tr>
<th>TABLE 16.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchmark Calibration Parameters</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Baseline</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of sudden stop</td>
<td>( L = 0.10 )</td>
<td>([0, 0.3])</td>
</tr>
<tr>
<td>Probability of sudden stop</td>
<td>( \pi = 0.10 )</td>
<td>([0, 0.25])</td>
</tr>
<tr>
<td>Output loss</td>
<td>( \Delta Y = 0.10 )</td>
<td>([0, 0.2])</td>
</tr>
<tr>
<td>Opportunity cost</td>
<td>( \delta = 0.03 )</td>
<td>([0.01, 0.06])</td>
</tr>
<tr>
<td>Risk aversion</td>
<td>( \sigma = 2 )</td>
<td>([1, 10])</td>
</tr>
<tr>
<td>Prevention benefit parameter</td>
<td>( a = 0 )</td>
<td>([0, 0.3])</td>
</tr>
</tbody>
</table>

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frequency of sudden stops (SS1) in my sample of emerging market countries, which is close to 10 percent a year. The value for the opportunity cost of reserves, \( \delta = 3 \) percent, is close to the middle of the range of estimates discussed earlier. The chosen values for risk aversion and its range of variation are standard in the growth and real business cycle literature.

Capital flight \( (L) \) and the output loss \( (\Delta Y) \) are both set to 10 percent of GDP. These figures are in line with the behavior of capital flows and of output during the sudden stops documented in Figure 16.8.\(^{24}\) The output cost figure was obtained by cumulating the average output gap in the year of a sudden stop and the following year, under the assumption that output would have grown at the same rate as before the crisis in the absence of a sudden stop. An output loss of 10 percent of GDP is in the ballpark of the estimates reported in the literature on currency crises and sudden stops.\(^{25}\)

The benchmark calibration implies an optimal level of reserves of 7.7 percent of GDP, or 77 percent of short-term external debt. This is close to the ratio of reserves to GDP observed in the data on average over 1980–2000, but significantly below the level observed in the most recent period, especially in Asia. It would be interesting to know what changes in the parameters are required to increase the optimal level of reserves to something approaching the recently observed level.

Figure 16.10 shows the sensitivity of the optimal level of reserves to the probability of crisis, the opportunity cost of reserves, the degree of risk aversion, and the elasticity of the crisis probability to the level of reserves. In each case the level of reserves computed using the sudden stop model is contrasted with that implied by the Greenspan-Guidotti rule. Several interesting results emerge.

The optimal level of reserves is quite sensitive to the probability of crisis, the opportunity cost of reserves, and the risk aversion parameter. This offers an interesting contrast with the Greenspan-Guidotti rule, which does not depend at all on these parameters. The optimal level of reserves is zero if the probability of crisis falls below 5 percent, but it almost doubles, from 7.7 percent to 13.3 percent of GDP, if the probability of crisis increases from 10 percent to 20 percent. Risk aversion also has a first-order impact on the optimal level of reserves. A shift in the risk aversion parameter from 2 to 8 increases the optimal level of reserves from 7.7 percent to 16.8 percent of GDP.

\(^{24}\) Using instead the ratio of short-term external debt to GDP would give similar values for \( L \). For my sample this ratio is 8.2 percent on average over the period 1980–2000 according to the World Bank’s Global Development Finance (GDF) data set, and 11.7 percent according to the BIS database.

\(^{25}\) Hutchison and Noy (2006) find that the cumulative output loss of a sudden stop is around 13 to 15 percent of GDP over a three-year period. Becker and Mauro (2006) find an expected output cost of 10.2 percent of GDP for currency crises and 16.5 percent of GDP for sudden stops. On the one hand, the estimated output cost of a crisis can be significantly larger if the output gap is cumulated until output has returned to potential, which typically takes longer than two or three years. On the other hand, using the precrisis growth rate to estimate postcrisis potential output may exaggerate the size of the output gap if the crisis was preceded by an unsustainable economic boom.
Figure 16.10  Sensitivity analysis of the optimal level of reserves (percent of GDP). Dashed line indicates the optimal level of reserves using the Greenspan-Guidotti rule, assuming that short-term debt is 10 percent of GDP. (Source: Author’s calculations.)

Figure 16.10 also shows that the optimal level of reserves can be significantly larger if one assumes that reserves have benefits in terms of crisis prevention (parameter $a$). If, in line with my univariate probit results for currency crises, $a$ is set between 0.2 and 0.3, then the optimal level of reserves can reach 23 percent of GDP, about three times the optimal level if reserves have no effectiveness at crisis prevention.

To summarize, there are two ways in which the model can potentially explain a level of reserves of the order of magnitude currently observed in Asia. The first
is to assume very large numbers for capital flight or for the output cost of a crisis. To illustrate, if the size of the sudden stop or the output cost amounted to 40 percent of GDP, instead of 10 percent in the benchmark calibration, the model would predict an optimal level of reserves in excess of 35 percent of GDP. Such an assumption, however, seems out of line with the historical record on currency crises and sudden stops. The second and perhaps more plausible way in which the model can predict a higher level of reserves is if reserves offer substantial benefits in terms of crisis prevention.

16.6.2. Country Estimates

I now bring the model closer to the data by estimating the optimal level of reserves for each emerging market country in my sample in 2000. For each country I estimate the level of reserves that minimizes the loss function in

<table>
<thead>
<tr>
<th>Table 16.5</th>
<th>Probit Regressions of the Probability of Crisis on Macroeconomic Fundamentals, 1980–2000*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Crisis and Independent Variable</strong></td>
<td><strong>Regression Specification</strong></td>
</tr>
<tr>
<td>Crisis is Sudden Stop SS1†</td>
<td></td>
</tr>
<tr>
<td>Real exchange rate deviation from Hodrick-Prescott trend‡</td>
<td></td>
</tr>
<tr>
<td>GDP growth§</td>
<td></td>
</tr>
<tr>
<td>Ratio of foreign liabilities to money††</td>
<td></td>
</tr>
<tr>
<td>Ratio of current account to GDP††</td>
<td></td>
</tr>
<tr>
<td>Ratio of total public debt to GDP††</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td></td>
</tr>
<tr>
<td>Number of observations</td>
<td>511</td>
</tr>
<tr>
<td>Pseudo-(R^2)</td>
<td>0.12</td>
</tr>
<tr>
<td>Crisis is Currency Crisis CC1†</td>
<td></td>
</tr>
<tr>
<td>Ratio of reserves to short-term debt††</td>
<td></td>
</tr>
<tr>
<td>Real exchange rate deviation from Hodrick-Prescott trend‡</td>
<td></td>
</tr>
<tr>
<td>Consumer price inflation††</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td></td>
</tr>
<tr>
<td>No. of observations</td>
<td>560</td>
</tr>
<tr>
<td>Pseudo-(R^2)</td>
<td>0.07</td>
</tr>
</tbody>
</table>

*Numbers in parentheses are robust standard errors. Asterisks indicate statistical significance at the **1 percent, **5 percent, and *10 percent level.
†Sudden stops and currency crises are defined in Table 16.11.
‡Average of one-year and two-year lags.
§One-year lag.
Source: Author’s regressions.
equation (10), that is, the sum of the opportunity cost of reserves and of the expected welfare cost of a crisis,

\[
\text{Loss}_i = \delta R_i + F\left(\nu_i - a \frac{R_i}{L_i}\right)f(R_i)
\]

where \( i \) is the country index. This loss function is calibrated based on a probit estimation of the crisis probability for each country. The model indicates excess or insufficient reserves, depending on how the optimal level of reserves, \( R^*_i \), compares with the observed level, \( R_i \).

The first step is to estimate the probability of a crisis for each country. This is done by running a probit regression of the probability of crisis on the countries’ economic fundamentals in my sample of emerging market countries over 1980–2000. The preferred specifications are reported in the top panel of Table 16.5 for sudden stops (defined as SS1) and in the bottom panel for currency crises (CC1). The explanatory variables have been selected using a general-to-specific approach, starting from a set of 18 potential regressors, which are listed in Table 16.13 in Appendix I. All explanatory variables are lagged at least one year and are thus predetermined with respect to the crisis. The results are robust to the inclusion of time and country fixed effects.

I find that the main explanatory variable is the real exchange rate (or, more precisely, its deviation from a trend), which appears with the expected sign in both probit regressions. Consistent with the univariate evidence presented earlier, the ratio of reserves to short-term debt is significant for currency crises but not for sudden stops. The GDP growth rate, the ratio of foreign liabilities to money (a measure of dollarization in the banking sector), the current account, and total public debt are also significant in the regressions for sudden stops. Finally, the probit estimation for currency crises finds a role for inflation.

Figure 16.11 tracks the estimated probability of crisis over time in my sample of emerging market countries (the averages are GDP-weighted and based on the regressions without fixed effects). The probability of crisis is significantly lower in Asia than in the other emerging market countries, especially at the end of the 1990s because of the weak real exchange rates, large current account surpluses, and strong economic growth that prevailed in that region. To illustrate, the probability of a sudden stop is estimated at 2.7 percent in China in 2000, and that of a currency crisis is less than 0.2 percent.

In the second step, I compute the optimal level of reserves \( R^*_i \) for each country in 2000. Parameter \( \nu_i \), which captures the country’s intrinsic vulnerability to a crisis, is calibrated using the probit regression for sudden stops reported in Table 16.5. Capital flight, the output cost of the crisis, and the values for the opportunity cost of reserves and for the risk aversion parameter remain the same as in the benchmark calibration (see Table 16.4).

The results of this exercise are reported in Table 16.6. At $234 billion, the total predicted level of reserves for all countries in the sample is significantly below the actual level observed in 2000 (just over $650 billion). However, the discrepancy comes mainly from the Asian countries, where the predicted level of reserves is extremely low. The estimated optimal level of reserves is zero in several important
Asian countries (China, Korea, and Malaysia), because the probability of a sudden stop was below the 5 percent threshold (see Figure 16.10). By contrast, the model works well for Latin America, where the observed level of reserves is actually slightly below the model prediction.

The last two columns of Table 16.6 give the “implied” values for the risk aversion parameter σ and the expected output loss in a crisis ΔY, that is, the values that one must assign to these parameters for the model to explain the observed level of reserves. In Latin America the implied values are very close to those in the benchmark calibration (reflecting the fact that the model fits the observations well in that region). By contrast, in Asia the implied values are implausibly high—
almost 12 percent of GDP for risk aversion and more than 30 percent of GDP for the output cost of a crisis.

The results in Table 16.6 assume that reserves have no benefits in terms of crisis prevention. As mentioned before, the optimal level of reserves may be significantly higher if reserves have preventive benefits. Might this explain the reserves buildup in Asia? I look into this question by estimating the benefits of the reserves accumulation between 2000 and 2005 in terms of crisis prevention. For simplicity, I assume that the welfare cost of a crisis is equal to the output cost. Then increasing the level of reserves from \( R \) to \( R' \) is optimal if

\[
(\pi(R') - \pi(R))\Delta Y \geq \delta (R' - R)
\]

that is, if the decrease in the expected output cost of a crisis exceeds the opportunity cost of increasing reserves. To calibrate this condition, I compute for each country in my sample the decrease in the crisis probability induced by the reserves accumulation observed between 2000 and 2005, \( \Delta \pi = \pi_{2000} - \pi_{2005} \). The probabilities are estimated using the probit regression for currency crises reported in the bottom panel of Table 16.5. The benefits and costs of the observed reserve accumulation are computed under the assumption that a crisis costs 10 percent of potential output and that the opportunity cost of reserves is 3 percent.

Table 16.7 reports the results of this exercise for emerging market countries as a whole as well as for Asia and Latin America separately (country averages weighted by GDP). It appears that, on average, the cost of reserves accumulation exceeded the benefits in terms of crisis prevention by a factor of about 3. But again the average masks an important difference between Asia, where the cost was more than five times larger than the benefit, and Latin America, where the benefit of reserves accumulation in terms of crisis prevention actually exceeded the cost.

The reason for this difference is that the probability of a currency crisis was much lower in Asia than in Latin America in 2000 (see Figure 16.11), implying that the marginal returns to reserves accumulation in terms of crisis prevention were much higher in Latin America than in Asia. To illustrate, in 2000 Mexico could have reduced its estimated crisis probability from 9.6 percent to 5.6 percent by doubling its reserves. By contrast, in China the estimated probability of crisis was 0.2 percent in 2000 and so could not have been reduced much further. It is nevertheless in emerging market Asia that most of the recent reserves accumulation has taken place.

<table>
<thead>
<tr>
<th>Country Group</th>
<th>Actual, 2000 (billions of dollars)</th>
<th>Predicted Benchmark* (billions of dollars)</th>
<th>Implied Risk Aversion (( \pi )) percent of GDP</th>
<th>Implied Output Cost of a Crisis (( \Delta Y )), percent of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>All emerging market countries</td>
<td>651</td>
<td>234</td>
<td>5.2</td>
<td>20.8</td>
</tr>
<tr>
<td>Asia</td>
<td>406</td>
<td>24</td>
<td>11.7</td>
<td>30.6</td>
</tr>
<tr>
<td>Latin America</td>
<td>145</td>
<td>153</td>
<td>1.9</td>
<td>9.6</td>
</tr>
</tbody>
</table>

*Level that minimizes the loss function in equation (10), calibrated using the probit estimation for sudden stops (SS1) reported in Table 16.5. Excludes Russia and Ukraine.

Source: Author’s calculations.
Finally, the last line of Table 16.7 reports the “implied” output loss for each country, that is, the minimum output cost that one must assume for the observed accumulation of reserves between 2000 and 2005 to be worth the cost. To rationalize the reserves buildup in Asian emerging market countries, one needs to assume that the output cost of a crisis amounts to more than 60 percent of GDP; the implied output cost is one-tenth that size in Latin America.

The conclusion is that the model cannot reasonably account for the increase in reserves in Asian emerging market countries as self-insurance against capital account crises. It can only do so by assuming that a capital account crisis costs more than 60 percent of one year’s output, which is out of line with the historical experience.26

16.7. DISCUSSION

To summarize, one justification for emerging market countries holding liquid international reserves is as a means of dealing with capital flow volatility and the risk of capital account crises, but the evidence suggests that most countries (especially in Asia) hold more international reserves than can be justified by this objective. This raises several questions. Why have Asian emerging market countries accumulated such large reserves? How should those reserves be managed? And looking forward, what are the implications of this buildup in emerging market countries’ foreign assets for the international financial system?

16.7.1. Trade Surpluses and Sovereign Wealth

Having rejected the view that the recent reserves accumulation can be justified on a precautionary basis, one has to consider as the main alternative explanation that

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26 However, this may not be an implausible order of magnitude for the cost of a severe banking crisis or of social unrest.
these reserves are the unintended consequence of large current account surpluses.\footnote{Another alternative is the view that the high-growth developing countries are exporting their savings abroad because of a shortage of domestic assets for their residents to invest in (Caballero, 2006). These capital outflows must take the form of reserves accumulation if residents’ holdings of foreign assets are restricted by capital controls.} The “mercantilist” variant of this view holds that the central banks of these countries are accumulating reserves in order to resist the appreciation of the domestic currency.\footnote{The nonmercantilist variant would hold that these countries’ competitiveness results from natural factors (for example, that wages are kept low in the export sector by a reserve army of labor migrating from the traditional sectors) rather than policy-induced distortions. Mercantilism is at the core of the “Breton Woods II” view (Dooley, Folkerts-Landau, and Garber, 2004) of the international financial system. Although many commentators find this view quite plausible, it is not obvious how to confirm or reject it empirically. For example, Aizenman and Lee (2005) find that variables associated with the mercantilist motive (lagged export growth and deviations from predicted purchasing power parity) explain very little of the cross-country difference in reserves accumulation.} For this effort not to be defeated by domestic inflation, it must be augmented by policies that repress domestic demand—for example, capital controls or domestic financial repression.

Table 16.8 shows, for the same sample of emerging market countries, the cross-country correlations between the increase in the reserves-to-GDP ratio between 2000 and 2005 and some key macroeconomic variables. It appears that reserves accumulation is strongly correlated with the current account surplus and not correlated at all with the change in gross external liabilities. This suggests that, to a first approximation, the accumulation of reserves reflects net export flows rather than balance sheet operations.

\begin{table}[h]
\centering
\small
\begin{tabular}{|c|c|c|c|c|}
\hline
 & Change in Reserves to GDP & Average Current Account to GDP & Change in Gross External Liabilities to GDP & Capital Account Restrictions Index & Average Real GDP Growth Rate \\
\hline
Change in Reserves to GDP & 1 & & & & \\
Average Current Account to GDP & 0.585*** & 1 & & & \\
Change in Gross External Liabilities to GDP & 0.072 & 0.014 & 1 & & \\
Capital Account Restrictions Index & 0.337* & 0.184 & -0.281 & 1 & \\
Average Real GDP Growth Rate & 0.460*** & 0.223 & 0.422** & 0.288 & 1 \\
\hline
\end{tabular}
\caption{Correlation Between the Change in Reserves-to-GDP Ratio and Selected Macroeconomic Variables, 2000–05}
\end{table}

Sources: IMF, Balance of Payments Statistics; World Bank, World Development Indicators; and Chinn and Ito, 2005.

Note: The table presents the simple cross-country correlations for the emerging market countries reported in Table 16.10. The change in reserves is the difference in the reserves-to-GDP ratio between 2000 and 2005. The average of the current-account-to-GDP ratio is over the period 2001–05. The change in gross external liabilities is the difference in the ratio of gross external liabilities to GDP between 2000 and 2005. The capital account restrictions index is defined as one minus the average Chinn-Ito measure of capital account openness over the period 2000–04 (Chinn and Ito, 2005). The average real growth rate is over the period 2000–05. Asterisks denote statistical significance at the ***1 percent, **5 percent, and *10 percent levels.
The change in the reserves-to-GDP ratio is also positively correlated with capital account restrictions and with the real GDP growth rate. The correlation with capital account restrictions is the opposite of what one would expect based on the precautionary view of reserves accumulation, which predicts that countries with a more open capital account should hold more precautionary reserves because they are more vulnerable to the volatility of capital flows. The positive correlation with the growth rate is also puzzling if one thinks that high-growth developing countries should be importing foreign capital to finance their development.

One could develop a cost-benefit welfare analysis of a mercantilist development strategy in the same way as I have done for the precautionary view, but the trade-offs involved would be very different. On the cost side, one would have to count the various distortions that are necessary to repress domestic demand, as well as the valuation loss on the foreign assets accumulated by the authorities when the inevitable real appreciation eventually takes place. The benefit side would include the gains in terms of productivity and growth from stimulating the export sector.

It is important to understand that what such a cost-benefit analysis would endogenize is not the level of reserves $R$, but rather the level of total publicly held foreign assets, which was denoted by $W_0$ and taken as exogenous in my model of reserves. Endogenizing $W_0$ would not affect my conclusion that most emerging market countries in Asia have excess reserves from the point of view of crisis insurance. Those excess reserves are costly, first in terms of forgone returns and portfolio diversification, and second because they generate difficulties for domestic monetary control that can be mitigated only by introducing or maintaining costly distortions in the domestic banking and financial system.

The governments of emerging market countries have started to mitigate these costs by transferring a fraction of foreign exchange reserves from the central bank to “sovereign wealth funds.” These funds are mandated to invest in a more diversified portfolio and at a longer horizon than central banks—not unlike the natural resource-based stabilization funds set up by a number of commodity exporters. For example, since July 2005 a fraction of Korea’s reserves have been managed by an independent entity, the Korean Investment Corporation, with the aim of seeking higher yields. China recently established the State Foreign Exchange Investment Corporation to manage reserves outside of the central bank.

According to some estimates, the holdings of sovereign wealth funds already amount to more than $2 trillion, mostly consisting of funds derived from oil and natural gas exports.

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29 The correlation is less significant for capital account restrictions than for the current account balance or the growth rate, and it seems less robust—it is no longer significant if one uses Edwards’ (2001) measure of capital mobility rather than Chinn and Ito’s (2006).

30 As Gourinchas and Jeanne (2006) have shown, high-growth developing countries tend to export capital, a puzzle that is explained in part by reserves accumulation.

31 See Rozanov (2005) and Johnson-Calari and Rietveld (2007). Another approach would be to give the private sector more direct control over the allocation of the country’s foreign assets, as in Prasad and Rajan’s (2005) proposal to set up closed-end mutual funds that purchase reserves from the central bank and invest the proceeds abroad.
gas exports, but their size could increase to $12 trillion by 2015, surpassing official reserves within five years (see Jen, 2007). If those estimates are correct, sovereign wealth funds are set to become a major force in the international financial system.

**16.7.2. Portfolio Diversification**

Although, as just described, central banks in emerging market countries have recently been diversifying their allocation of reserves, this trend has been slow, and central banks continue to allocate their portfolios in a significantly different manner than private investors do.\(^3^2\) To illustrate, Figure 16.12 compares the allocation of U.S. assets held by the foreign official sector with that of foreign private investors. The foreign official sector invests much more in U.S. government debt and much less in equity or corporate debt than do private investors. Clearly there remains significant scope for diversification, a trend that should be facilitated by the transfer of emerging market countries’ reserves to sovereign wealth funds.

Some have expressed concern that the diversification of emerging market countries’ reserves could lead to disruptions in exchange rates and the relative prices of financial assets. To shed light on this question, consider, for the sake of argument, the following experiment. The total stock of foreign exchange reserves in my sample of emerging market countries amounted to approximately $2 trillion dollars in 2005. Assume that $1.2 trillion of this (60 percent of the total) was invested in dollar assets, of which $900 billion was invested in the asset classes represented in Figure 16.11.\(^3^3\) Assume further that the emerging market countries in my sample reinvest half of the assets currently invested in the official sector’s portfolio shown in Figure 16.11 ($450 billion) in the global financial portfolio. What would be the impact on the net supply of financial assets for the rest of the global investor community?

Table 16.9 details the current structure of the global portfolio of financial assets. The table was constructed by aggregating World Bank cross-country data on stock and bond market capitalizations in the industrial countries. The table also shows, for each asset class, the net demand from emerging market central banks that would be induced by the assumed portfolio reallocation, as a percentage of the outstanding stock. For example, the demand for U.S. bonds would decrease by 1.34 percent of the outstanding stock, though the demand for Japanese equity would increase by 0.66 percent of the outstanding stock.

As one would expect, the selling pressure would play against the dollar, especially fixed-income dollar assets (net demand for U.S. equity would actually increase with the diversification). Net demand for U.S. assets would decrease by

\(^3^2\) On recent trends in reserves diversification see Knight (2006), Woolridge (2006), and Truman and Wong (2006).

\(^3^3\) Figure 16.11, which is based on data from the Treasury International Capital (TIC) database, does not report foreign official investment in onshore or offshore dollar deposits and repurchase agreements, which amount to about one-fourth of the total (Knight, 2006, Table 2).
0.5 percent of the outstanding stock, while that for non-U.S. assets would increase by 0.66 percent.

Overall, this back-of-the-envelope calculation shows that the changes in net demand would amount to relatively small fractions of the outstanding stocks. This suggests that moderate price and exchange rate changes would suffice to restore equilibrium. This conclusion, however, comes with several caveats. First, the net supply exceeds 7 percent of the outstanding stock if one restricts one’s attention to marketable U.S. Treasury debt. This results from the fact that the foreign official sector holds a significant fraction—about one-third—of outstanding


**Figure 16.12** Composition of foreign official and nonofficial holdings of U.S. assets, 2005.
Jeanne

The U.S. government debt (see Parisi-Capone and Setser, 2006). The impact on the interest rate that the U.S. government pays on its debt might thus be nonnegligible, depending on its substitutability with other forms of dollar debt in the portfolios of global investors.34

Second, the short-run price effects of portfolio diversification will depend on the pace of the diversification and on the reaction of private investors. Whereas the literature on sterilized foreign exchange intervention suggests that such interventions have moderate and transitory effects on exchange rates, the microstructure literature shows that their impact might be large (at least in the short run), especially in markets that lack depth and in which information is fragmented. Furthermore, private speculation may not be stabilizing—private investors might want to get out in front of any government moves rather than offset them as they occur. So, although it is unlikely that large price and exchange rate adjustments must result, in the long run, from increased diversification of emerging market countries’ foreign assets, there certainly is a need for the international community to assess and monitor the risks in the transition.

16.7.3. Collective Arrangements

The abundance of reserves held by emerging market countries reduces the need for collective insurance—such as that provided by the IMF at the global level, or by the Chiang Mai Initiative or the Latin American Reserve Fund at the regional level. Indeed, the resources of collective insurance arrangements have become relatively small compared with the reserves that emerging market countries have

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TABLE 16.9

<table>
<thead>
<tr>
<th>Item</th>
<th>United States</th>
<th>Euro Area</th>
<th>Japan</th>
<th>United Kingdom</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current stock (billions of dollars)</td>
<td>16,800</td>
<td>6000</td>
<td>4200</td>
<td>3000</td>
</tr>
<tr>
<td>Expected change in demand* (percent)</td>
<td>(+0.40)</td>
<td>(+0.66)</td>
<td>(+0.66)</td>
<td>(+0.66)</td>
</tr>
<tr>
<td><strong>Bonds</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current stock (billions of dollars)</td>
<td>19,800</td>
<td>8400</td>
<td>8700</td>
<td>1000</td>
</tr>
<tr>
<td>Expected change in demand (percent)</td>
<td>(-1.34)</td>
<td>(+0.66)</td>
<td>(+0.66)</td>
<td>(+0.66)</td>
</tr>
<tr>
<td>Of Which: U.S. Treasury Marketable Debt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current stock (billions of dollars)</td>
<td>4000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected change in demand (percent)</td>
<td>(-7.1)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Under the assumption that emerging market countries reallocate $450 billion of reserves from the official sector’s portfolio given in Figure 16.12 to the global financial portfolio given in the table in 2005.

Source: Beck, Demirgüç-Kunt, and Levine (1999) and author’s calculations.

34 Warnock and Warnock (2009) find that foreign demand for Treasury securities has a significant impact on Treasury yields. A study by the European Central Bank (2006) finds that the interventions conducted by Asian central banks cannot be shown to be responsible for the low yields in the United States, although they have certainly played a role.

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recently accumulated. For example, the increase in reserves in the Asian emerging market countries over 2000–05 amounts to more than 4 times the IMF’s usable resources at the end of 2005, and more than 20 times the bilateral swap agreements under the Chiang Mai Initiative signed over 2001–05. The buildup in reserves explains in part the recent decline in IMF credit outstanding, which is likely to persist for some time.35

Looking forward, one question is whether the large accumulated stocks of sovereign wealth could be used to collectively insure risks other than capital account crises. Emerging market countries face other risks that are now largely uninsured, such as natural disasters, epidemics, terms of trade shocks, and severe output drops (see Becker and others, 2010). Although some of these risks may be uninsurable because of the potential for moral hazard, there might be scope for expanding insurance through appropriate collective intervention at the regional or global level.

Finally, sovereign wealth can be used to induce the development of regional financial markets. An example of this is the Asian Bond Fund, created in 2003 to diversify the investment of Asian central banks’ reserves away from U.S. and European securities into Asian bonds. Since 2005 the Asian Bond Fund has also invested in domestic currency bonds issued by regional sovereign issuers, as a catalyst for private investment in Asian issues.36 Such initiatives might enable emerging market countries to develop debt instruments (with long maturities and domestic currency denomination) that are safer for borrowers.

16.8. CONCLUSION

This chapter has argued that reserves accumulation in Asian emerging market countries is difficult to justify—at least since 2000—in terms of self-insurance against capital flow volatility and capital account crises. The main piece of evidence behind this claim is the failure of a simple cost-benefit model of optimal reserves to account for the reserve buildup in these countries since 2000: their vulnerability to a capital account crisis was too low in that year to justify the cost of the accumulated reserves. That reserves were excessive from the point of view of crisis insurance is also suggested by recent moves to reallocate reserves from central banks to sovereign wealth funds investing in less liquid, higher-yielding assets.

Even if the rate of accumulation of reserves were to abate—and notwithstanding the good reasons that it should—the public sectors of a number of emerging market countries, especially in Asia, will have to manage stocks of foreign

35 Using various models of the demand for IMF loans, Ghosh and others (2007) project that IMF credit outstanding will decline from an average of SDR 50 billion over 2000–05 to SDR 8 billion over 2006–10, in part because of the increase in the reserves-to-short-term-debt ratio in emerging market countries.

36 Eichengreen (2006) recommends that the Latin American Reserve Fund follow a similar course of action.
Jeanne

financial assets of unprecedented size for some time to come. This generates both policy challenges and opportunities for the international community. One challenge is to ensure that the diversification of those assets is conducted in an orderly manner, to avoid large or abrupt changes in the relative prices of financial assets or in exchange rates. An opportunity lies in the fact that this increase in sovereign wealth could provide the basis for cross-country insurance arrangements against risks other than capital account crises, or could catalyze regional financial development.

**APPENDIX I**

**Data and Definitions**

**TABLE 16.10**

<table>
<thead>
<tr>
<th>Countries in the Sample</th>
<th>Industrial Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emerging Market Countries*</td>
<td></td>
</tr>
<tr>
<td>Argentina</td>
<td>Mexico</td>
</tr>
<tr>
<td>Brazil</td>
<td>Morocco</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>Nigeria</td>
</tr>
<tr>
<td>Chile</td>
<td>Pakistan</td>
</tr>
<tr>
<td>China</td>
<td>Panama</td>
</tr>
<tr>
<td>Colombia</td>
<td>Peru</td>
</tr>
<tr>
<td>Coté d’Ivoire</td>
<td>Philippines</td>
</tr>
<tr>
<td>Dominican Republic</td>
<td>Poland</td>
</tr>
<tr>
<td>Ecuador</td>
<td>Russia</td>
</tr>
<tr>
<td>Egypt</td>
<td>South Africa</td>
</tr>
<tr>
<td>El Salvador</td>
<td>Thailand</td>
</tr>
<tr>
<td>Hungary</td>
<td>Tunisia</td>
</tr>
<tr>
<td>India</td>
<td>Turkey</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Ukraine</td>
</tr>
<tr>
<td>Korea</td>
<td>Uruguay</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Venezuela</td>
</tr>
</tbody>
</table>

*All countries in the JP Morgan Emerging Market Bond Index Global (EMBIG) as of August 31, 2005, excluding Serbia and Montenegro and Lebanon because of data availability, and adding India and Korea.

†Countries that were members of the Organisation for Economic Co-operation and Development in 1990 and are not on the list of emerging market countries.
# Table 16.11

## Crisis Definitions

<table>
<thead>
<tr>
<th>Crisis Type</th>
<th>Source</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Currency Crises</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CC1</td>
<td>Frankel and Rose (1996)</td>
<td>A nominal depreciation of the currency of at least 25 percent relative to the previous year that is also at least a 10 percent acceleration, year over year, in the rate of depreciation.</td>
</tr>
<tr>
<td>CC2</td>
<td>Frankel and Wei (2005)</td>
<td>A year is identified as a crisis year if, in at least one month, the sum of the monthly percentage nominal depreciation and the percentage loss in foreign reserves exceeds 15. The index of the nominal depreciation and loss in reserves must also accelerate by 10 percent over the previous month. In cases where successive years may satisfy the crisis criterion, only the first year of crisis is counted within any three-year window.</td>
</tr>
<tr>
<td>CC3</td>
<td>Frankel and Wei (2005)</td>
<td>Same as CC2 except that the sum of the index of nominal depreciation and the loss of foreign reserves must exceed 25 percent.</td>
</tr>
<tr>
<td>CC4</td>
<td>Frankel and Wei (2005)</td>
<td>Same as CC2 except that the sum of the index of nominal depreciation and the loss of foreign reserves must exceed 35 percent.</td>
</tr>
<tr>
<td><strong>Sudden Stops</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SS1</td>
<td>Jeanne and Rancière (2006)</td>
<td>The ratio of net capital inflows* to GDP falls by more than 5 percent relative to the previous year.</td>
</tr>
<tr>
<td>SS2</td>
<td>Frankel and Cavallo (2004), “sudden stop 1”</td>
<td>A reduction in the financial account from a surplus position with respect to the previous year that is two standard deviations above the mean standard deviation (the average of standard deviations of the financial account over the entire sample). A fall in GDP per capita and in the current account deficit must accompany the financial account reduction, either during the same year or the next year.</td>
</tr>
<tr>
<td>SS3</td>
<td>Frankel and Cavallo (2004), “sudden stop 2”</td>
<td>Same as SS2 except that the mean standard deviation of the financial account is that over the corresponding decade only.</td>
</tr>
<tr>
<td>SS4</td>
<td>Frankel and Cavallo (2004), “sudden stop 3”</td>
<td>Same as SS2 except that the mean standard deviation is computed for the year-to-year change in the financial account rather than the level.</td>
</tr>
</tbody>
</table>

*Net capital inflows are measured as the sum of the capital and financial account plus net errors and omission minus reserve assets and use of fund credit (source: IMF Balance of Payments Statistics).
**TABLE 16.12**
Currency Crises and Sudden Stops in Emerging Market Countries, 1980–2000

<table>
<thead>
<tr>
<th>Country</th>
<th>CC1</th>
<th>CC2</th>
<th>CC3</th>
<th>CC4</th>
<th>SS1</th>
<th>SS2</th>
<th>SS3</th>
<th>SS4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>1990</td>
<td>1993</td>
<td>1996</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chile</td>
<td>1982</td>
<td>1985</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>1984</td>
<td>1994</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colombia</td>
<td>1985</td>
<td>1997</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Côte d'Ivoire</td>
<td>1994</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ecuador</td>
<td>1982</td>
<td>1985</td>
<td>1988</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egypt</td>
<td>1989</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>El Salvador</td>
<td>1986</td>
<td>1990</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hungary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>1991</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>1983</td>
<td>1986</td>
<td>1997</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Korea</td>
<td>1997</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>1997</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>Country</th>
<th>CC1</th>
<th>CC2</th>
<th>CC3</th>
<th>CC4</th>
<th>SS1</th>
<th>SS2</th>
<th>SS3</th>
<th>SS4</th>
</tr>
</thead>
</table>

Frequency (%)* 11.2 4.5 2.7 2.5 10.3 20.1 15.7 12.2

*Percent of all available observations for the sample period.
Sources: Author’s computations, Frankel and Cavallo (2004), and Frankel and Wei (2005).
<table>
<thead>
<tr>
<th>Variable*</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual growth in GDP</td>
<td>WDI</td>
</tr>
<tr>
<td>Current account balance</td>
<td>IFS</td>
</tr>
<tr>
<td>Reserves</td>
<td>IFS</td>
</tr>
<tr>
<td>M2</td>
<td>IFS</td>
</tr>
<tr>
<td>Debt</td>
<td></td>
</tr>
<tr>
<td>Ratio of lagged real public debt to real GDP</td>
<td>GDF, WDI</td>
</tr>
<tr>
<td>Ratio of lagged short-term debt to real GDP</td>
<td>GDF, WDI</td>
</tr>
<tr>
<td>Exchange Rate</td>
<td></td>
</tr>
<tr>
<td>Second lag of exchange rate regime dummies</td>
<td>Reinhart and Rogoff (2004)</td>
</tr>
<tr>
<td>Lagged real effective exchange rate deviation from Hodrick-Prescott trend</td>
<td>IFS</td>
</tr>
<tr>
<td>Trade</td>
<td></td>
</tr>
<tr>
<td>Ratio of lagged sum of exports and imports to GDP</td>
<td>WDI</td>
</tr>
<tr>
<td>Lagged growth in terms of trade (percent)</td>
<td>IFS</td>
</tr>
<tr>
<td>Index of current account openness</td>
<td>Quinn (2000)</td>
</tr>
<tr>
<td>U.S. Interest Rates</td>
<td></td>
</tr>
<tr>
<td>Interest rate on Treasury bills (percent a year)</td>
<td>IFS</td>
</tr>
<tr>
<td>Change in the interest rate on Treasury bills (basis points)</td>
<td>IFS</td>
</tr>
<tr>
<td>Business Cycle Indicators</td>
<td></td>
</tr>
<tr>
<td>Average of first and second lags of real GDP growth</td>
<td>WDI</td>
</tr>
<tr>
<td>Financial Account Openness</td>
<td></td>
</tr>
<tr>
<td>Ratio of lagged absolute gross inflows to GDP</td>
<td>IFS</td>
</tr>
<tr>
<td>Ratio of lagged sum of absolute gross inflows and absolute gross outflows to GDP</td>
<td>IFS</td>
</tr>
<tr>
<td>Stocks of Foreign Assets and Foreign Liabilities</td>
<td></td>
</tr>
<tr>
<td>Ratio of lagged net foreign assets to GDP</td>
<td>Lane and Milesi-Ferretti (2010)</td>
</tr>
<tr>
<td>Ratio of lagged stock of foreign liabilities to GDP</td>
<td>Lane and Milesi-Ferretti (2010)</td>
</tr>
<tr>
<td>Ratio of stock of debt liabilities to stock of total liabilities</td>
<td>Lane and Milesi-Ferretti (2010)</td>
</tr>
<tr>
<td>Ratio of lagged stock of FDI to stock of total liabilities</td>
<td>Lane and Milesi-Ferretti (2010)</td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Ratio of foreign liabilities to money in the financial sector</td>
<td>IFS</td>
</tr>
<tr>
<td>Consumer price inflation (percent a year)</td>
<td>IFS</td>
</tr>
</tbody>
</table>

*Lags are one-year lags except where stated otherwise.

GDF, Global Development Finance (World Bank); IFS, International Financial Statistics (IMF); WDI, World Development Indicators (World Bank).
APPENDIX II
Solving for the Optimal Level of Reserves

Reserves Management in a Crisis. How does the country in the model use its reserves in period 1? If there is no crisis, the consumer achieves the desired level of consumption $C^*$ and saves any residual wealth (which could be positive or negative) as net reserves. But if there is a crisis, the consumer may be unable to consume $C^*$. Then, using equation (4), $Y_1 = Y - \Delta Y$, and $L' = 0$, period-1 consumption is given by

$$C_1 = Y - \Delta Y - L + R - R'$$

The question is whether the consumer can achieve the desired level of consumption $C_1 = C^* = Y$ by running down reserves ($R' = 0$). This is the case if reserves $R$ exceed the following threshold:

$$\bar{R} = L + \Delta Y + (C^* - Y)$$

$\bar{R}$ is the “full insurance” level of reserves, that is, the amount that allows the consumer to maintain consumption as if there were no crisis. It is also the maximum amount of reserves that the consumer is ready to spend in a crisis. The “full insurance” level of reserves is equal to the sum of the capital outflow and output fall in a crisis, plus the period-1 trade deficit. The last term is equal to zero because of the assumption that $C^* = Y$.

The Loss Function [Equation (7)]. Period-0 welfare is given by

$$U_0 = (1 - \pi)U_1^* + \pi U_1^c = U_1^* - \pi f(R)$$

where $U_1^*$ is the welfare level conditional on no crisis, $U_1^c$ is that conditional on a crisis, and $f(R) = U_1^* - U_1^c$ is the welfare cost of a crisis. Using equations (3) and (4) to substitute out $I$ and $R' - L'$ from equation (5), we can write period-1 welfare as

$$U_1 = u(C_i) + \frac{W_2}{1 + r}$$

$$= u(C_i) + Y_1 + (1 + r)(1 + \delta)W_0 - L - C_i - \delta R$$

(I set $Y_2 = 0$ to reduce the amount of algebra.) If there is no crisis, $C_1 = Y_1 = C^* = Y$, so that welfare is given by

$$U_1^* = u(C^*) + (1 + r)(1 + \delta)W_0 - L - \delta R$$

$$= \bar{U} - \delta R$$

where $\bar{U}$ is the consumer’s ex ante welfare if there is no crisis risk and $W_0$ is invested in the illiquid asset. By contrast, if there is a crisis, $Y_1 = Y - \Delta Y$ and $R' = 0$ (assuming $R \leq \bar{R}$), so that $C_1 = Y - \Delta Y - L + R = C^* - (\bar{R} - R)$, implying a welfare level of

$$U_1^c = u(C^* - (\bar{R} - R)) + (1 + r)(1 + \delta)W_0 - L - \Delta Y + (\bar{R} - R) - \delta R$$

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Taking the difference, one obtains $U^r_i - U^r_i = f(R)$, with

$$f(R) = \frac{\Delta Y^r + u(C^r) - u(C^r - (\bar{R} - R))}{\text{output cost}} - (\bar{R} - R)$$

(if $R \leq \bar{R}$). The welfare cost of a crisis is the sum of two components: the output cost of the crisis and the cost of distorting the path of domestic consumption away from the unconstrained equilibrium. The second component, which is decreasing with $R$ and equal to zero if $R = \bar{R}$, captures the benefit of reserves in terms of crisis mitigation in my model. Finally, period-0 welfare can be written

$$U_0 = \bar{U} - (\delta R + \pi f(R))$$

An Extension with Debt and Default

Assume that reserves are financed by long-term debt $D = -I$, and assume $W_0 = 0$, so that $R = D$. There is no need to assume that debt is illiquid in the same sense as the physical investment—the debt could be traded in a liquid market. What is important for my results is that $I$ cannot be decreased (or, equivalently, $D$ cannot be increased) in a crisis. For debt this is an implication of the credit constraint to which the consumer is subject during a crisis.

Let us assume that the consumer fails to repay long-term debt $D$ with probability $\mu$ and therefore pays a risk premium $[1/(1 - \mu)] - 1$. Then the expression for final wealth [equation (5)] is

$$W_2 = Y_2 - \eta \frac{(1 + r)^2(1 + \delta)}{1 - \mu} D + (1 + r)(R' - L')$$

where $\eta$ takes the value of 1 if the consumer repays the debt and 0 if not. The expression for the expected wealth $E_1(W_2)$, and thus the expressions for $U^r_i$ and $U^c_i$, are the same as before. Hence the default probability $\mu$ has no impact on the optimal level of reserves; only $\delta$ should be counted in the opportunity cost of reserves.

However, the risk of default could be relevant if there are default costs. Assume that $Y_2$ is stochastic and default occurs only if the debt repayment exceeds the cost of default $\gamma Y_2$. Then, given $D = R$, the probability of default $\mu$ is endogenous and is solved by

$$\mu = \Pr \left( \gamma Y_2 < \frac{(1 + r)^2(1 + \delta)}{1 - \mu} R \right)$$

This equation implicitly defines a default threshold $\bar{Y}(R)$ that is increasing with $R$. The ex-ante loss becomes

$$\text{Loss} = \delta R + \gamma \int_{0}^{\bar{Y}(R)} Y_2 g(Y_2) dY_2 + \pi f(R)$$

The opportunity cost of reserves includes a term for the deadweight cost of default, which is increasing with reserves. This term is not the same as the default risk premium, $1/(1 - \mu) - 1$. 

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REFERENCES


CHAPTER 17

Policy Responses to Systemic Banking Crises

LUC LAEVEN AND FABIAN VALENCIA

17.1. INTRODUCTION

Financial crises can be damaging and contagious, prompting calls for swift policy responses. The financial crises of the past have led affected economies into deep recessions and sharp current account reversals. Some crises turned out to be contagious, rapidly spreading to countries with no apparent vulnerabilities. Among the many causes of financial crises are a combination of unsustainable macroeconomic policies (including large current account deficits and unsustainable public debt), excessive credit booms, large capital inflows, and balance sheet fragilities, combined with policy paralysis arising from a variety of political and economic constraints. In many financial crises, currency and maturity mismatches were a salient feature, whereas in others off-balance sheet operations of the banking sector were prominent (for a review of the literature on macro origins of banking crisis, see Lindgren, Garcia, and Saal, 1996; Dooley and Frankel, 2003; and Collyns and Kincaid, 2003).

At the writing of this chapter, the current global financial crisis is evolving with breakneck speed. The debate about why it happened and how it will unfold is still very much ongoing. Although it may be too early to write about the lessons learned, authorities do not have the luxury to wait and have already embarked on large-scale interventions in the financial sector and beyond.

Choosing the best way of resolving a financial crisis and accelerating economic recovery is far from unproblematic. There has been little agreement on what constitutes best practice or even good practice. Policy responses will need to depend on the nature of the crisis.

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This chapter is a slightly revised version of IMF Working Paper 08/224 (2008).

1 The authors thank Olivier Blanchard, Eduardo Borensztein, Martin Cihak, Stijn Claessens, Luis Cortazar-Checkley, Giovanni Dell’Ariccia, David Hoelscher, Simon Johnson, Ashoka Mody, Jonathan Ostry, and Bob Traa for comments and discussions, and Ming Ai, Chuling Chen, and Mattia Landoni for excellent research assistance.
Many divergent approaches have been proposed and tried to resolve systemic crises more efficiently. These differences in approach reflect in part different policy objectives. Some have focused on reducing the fiscal costs of financial crises, others on limiting the economic costs in terms of lost output and on accelerating restructuring, whereas again others have focused on achieving long-term, structural reforms. Trade-offs are likely to arise between these objectives (for an overview of existing literature on how crisis resolution policies have been used and the trade-offs involved, see Claessens, Klingebiel, and Laeven, 2003; Hoelscher and Quintyn, 2003; and Honohan and Laeven, 2005). Governments may, for example, consciously incur large fiscal outlays in resolving a banking crisis through certain policies, with the objective of accelerating recovery. Alternatively, structural reforms may only be politically feasible in the context of a severe crisis with large output losses and high fiscal costs.

This chapter introduces and describes a new dataset on banking crises, with detailed information about the type of policy responses employed to resolve crises in different countries. The emphasis is on policy responses to restore the banking system to health. The database covers all systemically important banking crises for the period 1970 to 2007, and has detailed information on crisis management strategies for 42 systemic banking crises from 37 countries.

Governments have employed a broad range of policies to deal with financial crises. Central to identifying sound policy approaches to financial crises is the recognition that policy responses that reallocate wealth toward banks and debtors and away from taxpayers face a key trade-off. Such reallocations of wealth can help to restart productive investment, but they have large costs. These costs include taxpayers’ wealth that is spent on financial assistance and indirect costs from misallocations of capital and distortions to incentives that may result from encouraging banks and firms to abuse government protections. Those distortions may worsen capital allocation and risk management after the resolution of the crisis.

Institutional weaknesses typically aggravate the crisis and complicate crisis resolution. Bankruptcy and restructuring frameworks are often deficient. Disclosure and accounting rules for financial institutions and corporations may be weak. Equity and creditor rights may be poorly defined or weakly enforced. In addition, the judiciary system is often inefficient.

Many financial crises, especially those in countries with fixed exchange rates, turn out to be twin crises with currency depreciation exacerbating banking sector problems through foreign currency exposures of borrowers or banks themselves. In such cases, another complicating factor is the conflict of objectives: between the desire to maintain currency pegs on the one hand and the need to provide liquidity support to the banking system on the other.

Existing empirical research has shown that providing assistance to banks and their borrowers can be counterproductive, resulting in increased losses to banks, which often abuse forbearance to take unproductive risks at government expense. The typical result of forbearance is a deeper hole in the net worth of banks, crippling tax burdens to finance bank bailouts, and even more severe
credit supply contraction and economic decline than would have occurred in the absence of forbearance (for empirical evidence on this, see Demirgüç-Kunt and Detragiache, 2002; Honohan and Klingebiel, 2003; and Claessens, Klingebiel, and Laeven, 2003).

Cross-country analysis to date also shows that accommodative policy measures (such as substantial liquidity support, explicit government guarantee on financial institutions’ liabilities, and forbearance from prudential regulations) tend to be fiscally costly and that these particular policies do not necessarily accelerate the speed of economic recovery (see the analyses in Honohan and Klingebiel, 2003; Claessens, Klingebiel, and Laeven, 2005; and Laeven and Valencia, 2008). The caveat to these findings is that a counterfactual to the crisis resolution cannot be observed and therefore it is difficult to speculate how a crisis would unfold in absence of such policies. Better institutions are, however, uniformly positively associated with faster recovery.

The remainder of the chapter is organized as follows. Section 17.2 presents new data on the timing of banking crises, currency crises, and sovereign debt crises. Section 17.3 presents variable definitions of the data collected on crisis management techniques for a subset of systemic banking crises. Section 17.4 presents descriptive statistics of data on containment and resolution policies, fiscal costs, and output losses. Section 17.5 discusses the ongoing global liquidity crisis that originated with the U.S. subprime crisis. Section 17.6 concludes.

17.2. CRISIS DATES

17.2.1. Banking Crises

We start with a definition of a systemic banking crisis. Under our definition, in a systemic banking crisis, a country’s corporate and financial sectors experience a large number of defaults and financial institutions and corporations face great difficulties repaying contracts on time. As a result, nonperforming loans increase sharply and all or most of the aggregate banking system capital is exhausted. This situation may be accompanied by sharp falls in asset prices (such as equity and real estate prices) following runups before the crisis, sharp increases in real interest rates, and a slowdown or reversal in capital flows. In some cases, the crisis is triggered by depositor runs on banks, though in most cases it is a general realization that systemically important financial institutions are in distress.

Using this broad definition of a systemic banking crisis that combines quantitative data with some subjective assessment of the situation, we identify the starting year of systemic banking crises around the world since the year 1970. Unlike prior work (Caprio and Klingebiel, 1996; and Caprio and others, 2005), we exclude banking system distress events that affected isolated banks but were not systemic in nature. As a cross-check on the timing of each crisis, we examine whether the crisis year coincides with deposit runs, the
introduction of a deposit freeze or blanket guarantee, or extensive liquidity support or bank interventions, using data from the IMF’s International Financial Statistics (IFS) database. This way, we are able to confirm about two-thirds of the crisis dates. Alternatively, we require that it becomes apparent that the banking system has a large proportion of nonperforming loans and that most of its capital has been exhausted. This additional requirement applies to the remainder of crisis dates.

In sum, we identify 124 systemic banking crises over the period 1970 to 2007. This list is an updated, corrected, and expanded version of the Caprio and Klingebiel (1996) and Caprio and others (2005) banking crisis databases. Table 17.1 lists the starting year of each banking crisis, as well as some background information on each crisis, including peak nonperforming loans (percent of total loans), gross fiscal costs (percent of GDP), output loss (percent of GDP), and minimum real GDP growth rate (in percent). Peak nonperforming loans is the highest level of nonperforming loans as percentage of total loans during the first five years of the crisis. Gross fiscal costs are computed over the first five years following the start of the crisis using data from Hoelscher and Quintyn (2003), Honohan and Laeven (2005), IMF Staff reports, and publications from national authorities and institutions. Output losses are computed by extrapolating trend real GDP, based on the trend in real GDP growth up to the year preceding the crisis, and taking the sum of the differences between actual real GDP and trend real GDP expressed as a percentage of trend real GDP for the first four years of the crisis (including the crisis year). Minimum real GDP growth rate is the lowest real GDP growth rate during the first three years of the crisis.

17.2.2. Currency and Sovereign Debt Crises

Building on the approach in Frankel and Rose (1996), we define a “currency crisis” as a nominal depreciation of the currency of at least 30 percent that is

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2 We define bank runs as a monthly percentage decline in deposits in excess of 5 percent. We add up demand deposits (IFS line 24) and time, savings, and foreign currency deposits (IFS line 25) for total deposits in national currencies (except for the United Kingdom, Sweden, and Vietnam, where we use IFS 25L for total deposits). We define extensive liquidity support as claims from monetary authorities on deposit money banks (IFS line 12E) to total deposits of at least 5 percent and at least double the ratio compared to the previous year.

3 In some cases, nonperforming loans are built up slowly over time and financial sector problems arise gradually rather than suddenly. Japan in the 1990s is a case in point. Although nonperforming loans had been increasing since the early 1990s, they reached crisis proportions only in 1997. Also, initial shocks to the financial sector are often followed by additional shocks, further aggravating the crisis. In such cases, these additional shocks can sometimes be considered as being part of the same crisis. Latvia is a case in point. Latvia experienced a systemic banking crisis in 1995, which was followed by another stress episode in 1998 related to the Russian financial crisis.

4 Note that estimates of output losses are highly dependent on the method chosen and the time period considered. In particular, our measure tends to overstate output losses when there has been a growth boom before the banking crisis. Also, if the banking crisis reflects unsustainable economic developments, output losses need not be attributed to the banking crisis per se.
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<th>Country</th>
<th>Systemic Banking Crisis (starting date)</th>
<th>Share of NPLs at Peak (%)</th>
<th>Gross Fiscal Cost (% of GDP)</th>
<th>Output Loss (% of GDP)</th>
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(continued)
TABLE 17.1  
Timing of Systemic Banking Crises (Continued)

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NPL: nonperforming loan.


also at least a 10 percent increase in the rate of depreciation compared to the year before. In terms of measurement of the exchange rate depreciation, we use the percent change of the end-of-period official nominal bilateral dollar exchange rate from the World Economic Outlook (WEO) database of the IMF. For countries that meet the criteria for several continuous years, we use the first year of each five-year window to identify the crisis. This definition yields 208 currency crises during the period 1970 to 2007. It should be noted that this list also includes large devaluations by countries that adopt fixed exchange rate regimes.

We identify and date episodes of sovereign debt default and restructuring by relying on information from Beim and Calomiris (2001), World Bank (2002), Sturzenegger and Zettelmeyer (2006), and IMF staff reports. The information compiled includes year of sovereign defaults to private lending and year of debt rescheduling. Using this approach, we identify 63 episodes of sovereign debt defaults and restructurings since 1970. Table 17.2 provides the complete list of starting years of systemic banking crises, currency crises, and sovereign debt crises.
# TABLE 17.2
Timing of Financial Crises

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**17.2.3. Frequency of Crises and Occurrence of Twin Crises**

Table 17.3 reports the frequency of different types of crises (banking, currency, and sovereign debt), as well as the occurrence of twin (banking and currency) crises or triple (banking, currency, and debt) crises. We define a twin crisis in year $t$ as a banking crisis in year $t$ combined with a currency crisis during the period $[t-1, t+1]$; we define a triple crisis in year $t$ as a banking crisis in year $t$ combined with a currency crisis during the period $[t-1, t+1]$ and a sovereign debt crisis during the period $[t-1, t+1]$.

We find that banking crises were most frequent during the early 1990s, with a maximum of 13 systemic banking crises starting in the year 1995. Currency crises were also common during the first half of the 1990s, but the early 1980s also represented a high mark for currency crises, with a peak in 1981 of 45 episodes. Sovereign debt crises were also relatively common during the early 1980s, with a peak of 10 debt crises in 1983. In total, we count 124 banking crises, 208 currency crises, and 63 sovereign debt crises over the period 1970 to 2007. Note that several countries experienced multiple crises. Of these 124 banking crises, 42 are considered twin crises and 10 can be classified as triple crises, using our definition.

**17.3. CRISIS CONTAINMENT AND RESOLUTION**

In reviewing crisis policy responses, it is useful to differentiate between the containment and resolution phases of systemic restructuring (see Honohan and Laeven, 2005; and Hoelscher and Quintyn, 2003, for further details). During the containment phase, the financial crisis is still unfolding. Governments tend to implement policies aimed at restoring public confidence to minimize the
repercussions on the real sector of the loss of confidence by depositors and other investors in the financial system. The resolution phase involves the actual financial, and to a lesser extent operational, restructuring of financial institutions and corporations. Whereas policy responses to crises naturally divide into immediate reactions during the containment phase of the crisis, and long-term responses towards resolution of the crisis, immediate responses often remain part of the long-run policy response. Poorly chosen containment policies undermine

TABLE 17.3

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<th>Year</th>
<th>Banking Crisis (number)</th>
<th>Currency Crisis (number)</th>
<th>Sovereign Debt Crisis (number)</th>
<th>Twin Crisis (number)</th>
<th>Triple Crisis (number)</th>
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<td>Total</td>
<td>124</td>
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*Twin crisis indicates banking crisis in year $t$ and currency crisis during $[t-1, t+1]$. Double crisis indicates banking crisis in year $t$ and currency crisis during $[t-1, t+1]$ and debt crisis during $[t-1, t+1]$.
the potential for successful long-term resolution. It is thus useful to recognize the context in which policy responses to financial crises occur.

For a subset of 42 systemic banking crises episodes (in 37 countries) that are well documented, we have collected detailed data on crisis containment and resolution policies using a variety of sources, including IMF staff reports, World Bank documents, and working papers from central bank staff and academics. This section explains in detail the type of data collected and defines variables in the process, organized by the following categories: initial conditions, containment policies, resolution policies, macroeconomic policies, and outcome variables.

17.3.1. Overview and Initial Conditions

We start with information on initial conditions of the crisis, including whether or not banking distress coincided with exchange rate pressures and sovereign debt repayment problems, initial macroeconomic conditions, the state of the banking system, and institutional development of the country.

Crisis date is the starting date of the banking crisis, including year and month, when available. The timing of the banking crisis follows the approach described in Section 17.2.

Currency crisis indicates whether or not a currency crisis occurred during the period \([t-1, t+1]\), where \(t\) denotes the starting year of the banking crisis. The timing of a currency crisis follows the approach described in Section 17.2, except that we do not impose the restriction that we only keep the first year of each five-year window for observations that meet the criteria for several continuous years. For example, if the currency experiences a nominal depreciation of at least 30 percent that is also at least a 10 percent increase in the rate of depreciation in both years \(t-2\) and \(t-1\), with \(t\) the starting year of the banking crisis, we treat year \(t-1\) as the year of the currency crisis for the purposes of creating this variable. We also list the year of the currency crisis, denoted as year of currency crisis.

Sovereign debt crisis indicates whether or not a sovereign debt crisis occurred during the period \([t-1, t+1]\), where \(t\) denotes the starting year of the banking crisis. The timing of a sovereign debt crisis follows the approach described in Section 17.2. We also list the year of the sovereign debt crisis, denoted as year of sovereign debt crisis.

In terms of initial macroeconomic conditions, we have collected information on the following variables. Each of these variables are computed at time \(t-1\), where \(t\) denotes the starting year of the banking crisis, using data from the IMF’s IFS and WEO databases. Fiscal balance/GDP is the ratio of the general government balance to GDP. Public debt/GDP is the ratio of the general government gross debt to GDP. Inflation is the percentage increase in the consumer price index. Net foreign assets (Central Bank) is the net foreign assets of

\[\text{Net foreign assets (Central Bank)}\]

5 Whenever general government data were not available, central government data were used.
the central bank in millions of U.S. dollars. Net foreign assets/M2 is the ratio of net foreign assets (central bank) to M2. Deposits/GDP is the ratio of total deposits at deposit-taking institutions to GDP. GDP growth is real growth in GDP. Finally, current account/GDP is the ratio of current account to GDP.

We have collected the following information on the state of the banking system. Peak NPL is the peak ratio of nonperforming loans to total loans (in percent) during the years \([t, t+5]\), where \(t\) is the starting year of the crisis. This is an estimate using data from Honohan and Laeven (2005) and IMF staff reports. In all cases, we use the country’s definition of nonperforming loans. Government-owned is the share of banking system assets that is government owned (in percent) in year \(t\). Data are from La Porta, Lopez-De-Silanes, and Shleifer (2002) and refer to the year 1980 or 1995, whichever is closer to the starting date of the crisis, \(t\). When more recent data is available from IMF staff reports, such data are used instead. Significant bank runs indicates whether or not the country’s banking system experiences a depositors’ run, defined as a one-month percentage drop in total outstanding deposits in excess of 5 percent during the period \([t, t+1]\). This variable is constructed using data from IFS. Credit boom indicates whether or not the country has experienced a credit boom leading up to the crisis, defined as three-year precrisis average growth in private credit to GDP in excess of 10 percent per annum, computed over the period \([t-3, t-1]\). This variable is constructed using data from IFS.

As proxy for institutional development, we collect data on the degree of protection of credit rights in the country. Creditor rights is an index of protection of creditors’ rights from Djankov, McLiesh, and Shleifer (2007). The index ranges from 0 to 4, and higher scores denote better protection of creditor rights. We use the score in the year \(t\), where \(t\) denotes the starting year of the banking crisis.

### 17.3.2. Crisis Containment Policies

Initially, the government’s policy options are limited to those policies that do not rely on the formation of new institutions or complex new mechanisms. Immediate policy responses include (1) suspension of convertibility of deposits, which prevents bank depositors from seeking repayment from banks; (2) regulatory capital forbearance, which allows banks to avoid the cost of regulatory compliance (for example, by allowing banks to overstate their equity capital in order to avoid the costs of contractions in loan supply); (3) emergency liquidity support to banks; or (4) a government guarantee of depositors. Each of these immediate policy actions are motivated by adverse changes in the condition of banks.

Banks suffering severe losses tend not only to see rising costs but also to experience liability rationing, either because they must contract deposits to satisfy their regulatory equity capital requirement, or because depositors at risk of loss prefer to place funds in more stable intermediaries. Banks, in turn, will transmit

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6 Regulatory forbearance often continues into the resolution phase, though it is generally viewed as a crisis containment policy.
those difficulties to their borrowers in the form of a contraction of credit supply (Valencia, 2008). Credit will become more costly and financial distress of borrowers and banks more likely.

The appropriate policy response will depend on whether the trigger for the crisis is a loss of depositor confidence (triggering a deposit run), regulatory recognition of bank insolvency, or the knock-on effects of financial asset market disturbances outside the banking system, including exchange rate and wider macroeconomic pressures.

Deposit withdrawals can be addressed by emergency liquidity loans, usually from the central bank when market sources are insufficient, by an extension of government guarantees of depositors and other bank creditors, or by a temporary suspension of depositor rights in what is often called a “bank holiday.” Each of these techniques is designed to buy time, and in the case of the first two, that depositor confidence can soon be restored. The success of each technique will crucially depend on the credibility and creditworthiness of the government.

Preventing looting of an insolvent or near-insolvent bank requires a different set of containment tools, which may include administrative intervention including the temporary assumption of management powers by a regulatory official, or closure, which may for example include the subsidized compulsory sale of a bank’s good assets to a sound bank, together with the assumption by that bank of all or most of the failed entity’s banking liabilities; or more simply an assisted merger. Here the prior availability of the necessary legal powers is critical, given the incentive for bank insiders to hang on, as well as the customary cognitive gaps causing insiders to deny the failure of their bank.

Most complex of all are the cases where disruption of banking is only one part of a wider problem of financial and macroeconomic turbulence. In this case, the bankers may be innocent victims of external circumstances, and it is now that special care is needed to ensure that regulations do not become part of the problem.

Adopting the correct approach to an emerging financial crisis calls for a clear understanding of what the underlying cause of the crisis is, as well as a quick judgment as to the likely effectiveness of the alternative tools that are available. The actions taken at this time will have a possibly irreversible impact on the ultimate allocation of losses in the system. In addition, the longer-term implications (e.g., creation of future moral hazard) also need to be taken into account.

All too often, central banks privilege stability over cost in the heat of the containment phase: if so, they may too liberally extend loans to an illiquid bank which is almost certain to prove insolvent anyway. Also, closure of a nonviable bank is often delayed for too long, even when there are clear signs of insolvency (Lindgren, 2003). Because bank closures face many obstacles, there is a tendency to rely instead on blanket government guarantees which, if the government’s fiscal and political position makes them credible, can work albeit at the cost of placing the burden on the budget, typically squeezing future provision of needed public services.

We collect information on the following crisis containment policies. First, we collect information on whether the authorities impose deposit freezes, bank holidays, or blanket guarantees to halt or prevent bank runs. *Deposit freeze*
indicates whether or not the authorities imposed a freeze on deposits. If a freeze on deposits is implemented, we collect information on the duration of the deposit freeze (in months), and the type of deposits affected. Bank holiday indicates whether or not the authorities initiated a bank holiday. In case a bank holiday is introduced, we collect information on the duration of the bank holiday (in days). Blanket guarantee indicates whether or not the authorities introduced a blanket guarantee on deposits (and possibly other liabilities). In case a blanket guarantee is introduced, we collect information on the date of introduction and the date of removal of the blanket guarantee and compute the duration that the guarantee is in place (in months). We also collect information on whether or not a previous explicit deposit insurance arrangement was in place at the time of the introduction of the blanket guarantee.

Next, we collect information on the timing and scope of emergency liquidity support to financial institutions. Liquidity support indicates whether or not emergency liquidity support, measured as claims from monetary authorities on deposit money banks (IFS line 12E) to total deposits, is at least 5 percent and at least doubled with respect to the previous year during the period \([t, t+3]\), where \(t\) is the starting year of the banking crisis. We also collect information on whether or not liquidity support was different across banks, and whether or not emergency lending was remunerated. If liquidity support was remunerated, we collect information on whether or not interest was at market rates. We also collect information on the peak of liquidity support (in percent of deposits), computed as the maximum value (in percent) of the ratio of claims from monetary authorities on deposit money banks (IFS line 12E) to total deposits during the period \([t, t+3]\). Lowering of reserve requirements denotes whether or not authorities lowered reserve requirements in response to the crisis.

17.3.3. Crisis Resolution Policies

Once emergency measures have been put in place to contain the crisis, the government faces the long-run challenge of crisis resolution, which entails the resumption of a normally functioning credit system and legal system, and the rebuilding of banks’ and borrowers’ balance sheets. At this point, the crisis has left banks and nonfinancial firms insolvent and many are in government ownership or under court or regulatory administration. Economic growth is unlikely to resume on a secure basis until productive assets and banking franchises are back in the hands of solvent private entities.

The financial and organizational restructuring of financial and nonfinancial firms during the crisis resolution phase is thus a large task, typically entailing much detailed implementation work in the bankruptcy courts, as well as the use of informal or ad hoc work-out procedures. There are also important trade-offs such as that between speed and durability of the subsequent economic recovery on the one hand and the fiscal costs on the other.

Crisis resolution involves inherently complicated coordination problems between debtors and creditors. The fate of an individual corporation or financial institution
and the best course of action for its owners and managers will depend on the actions of many others and the general economic outlook. Because of these coordination problems, as well as a lack of capital and the importance of the financial system to economic growth, governments often take the lead in systemic restructuring, especially of the banking system. In the process, governments often incur large fiscal costs, presumably with the objective of accelerating the recovery from the crisis.

The most recurrent question arising at this time is should an overindebted corporate entity be somehow subsidized or forgiven some of its debt, or should its assets be transferred to a new corporate structure and new management? This question applies to both undercapitalized banks and to overindebted nonbank corporations. The feasibility of making such decisions on a case-by-case basis becomes problematic during a systemic crisis resulting in thousands of insolvencies, and it becomes necessary to establish a systematic approach. General principles have proved elusive and, as well as depending on the scale of the crisis and the quality of existing legal and other governance institutions, to an extent the best answer is likely to depend on the source of the crisis.

Where the problem results from an economy-wide crash, the best prospect for future performance of banks and their borrowing customers may be with their existing owners and managers, given the information and other intangible forms of firm or relationship-specific capital they possess. On the other hand, where bank insolvency has been the result of incompetent, reckless, or corrupt banking or the use of government-controlled banks as quasi-fiscal vehicles or for political purposes, the relevant stock of information and relationship capital is unlikely to be of much social value. Therefore, separating the good assets from their current managers and owners offers better prospects in such circumstances—as well as establishing a better precedent for avoiding moral hazard. Information capital is also likely to be relatively unimportant for real estate ventures, which have been central to many recent banking crises.

The main policy approaches employed in the resolution phase of recent crises include: (1) government-subsidized work-outs of distressed loans; (2) debt forgiveness; (3) the establishment of a government-owned asset management company (AMC) to buy and resolve distressed loans; (4) government-assisted sales of financial institutions to new owners, typically foreign; and (5) government-assisted recapitalization of financial institutions through injection of funds. We focus on the latter three that deal with bank insolvency.

In an attempt to let the market determine which firms are capable of surviving given some modest assistance, some official schemes have offered loan subsidies to distressed borrowers conditional on the borrower’s shareholders injecting some new capital. Likewise, there have been schemes offering injection of government capital funds for insolvent banks whose shareholders were willing to provide matching funds. To the extent that they are discretionary, schemes of debt relief for bank borrowers carry the risk of moral hazard as debtors stop trying to repay in the hope of being added to the list of scheme beneficiaries.

Debt forgiveness, such as is effectively provided by inflation and currency depreciation, is a more generalized approach to providing debt relief to borrowers.
Inflation is also a solution that reduces the budgetary burden. After all, if the crisis is big enough, the government’s choices may be limited by what it can afford. Its capacity to subsidize borrowers or inject capital into banks are constrained by its ability over time to raise taxes or cut expenditures. It is for these reasons that inflationary solutions or currency devaluation have been a feature of the resolution of many crises in the past. Debt forgiveness amounts to generalized debt relief and a transfer of the costs of the crisis to money holders and other nominal creditors. In this case, the banks as well as the nonbank debtors receive relief, without a climate of debtor delinquency being created.

The key advantage of debt forgiveness is its simplicity and speed—it recognizes loan losses up front, thus providing immediate relief to borrowers. At the same time, however, debt forgiveness does not impose losses on borrowers and bank shareholders, thus posing incentive problems. It can also undermine trust in monetary institutions and the rule of law, as it can violate monetary standards and interfere in private contracting. Moreover, its possible implementation needs to be considered in the light of the need to preserve an environment of macroeconomic stability into the future. Whether it works will ultimately depend on the frequency of use and specific circumstances of financial distress. As it creates moral hazard, however, debt forgiveness should only be considered as a last-resort policy.

In contrast, the carving-out of an insolvent bank’s bad loan portfolio, and its organizational restructuring under new management and ownership, represents the alternative pole, appropriate where large parts of the bank’s information capital was dysfunctional. The bad loan portfolio may be sold back into the market, or disposed of by a government-owned AMC. The effectiveness of government-run AMCs has been quite mixed: better where the assets to be disposed have been primarily real estate, less good where loans to large politically connected firms dominated (Klingebiel, 2000).

Government itself often retains control and ownership of troubled banks for much of the duration of the resolution phase. Whether or not control of the bank passes into public hands, it should eventually emerge, and at this point it must be adequately capitalized. Depending on how earlier loss allocation decisions have been taken, the sums of money that are involved in the recapitalization of the bank so that it can safely be sold into private hands may be huge. Many governments have felt constrained by fiscal and monetary policy considerations from doing the financial restructuring properly. Putting the bank on a sound financial footing should be the priority. Without this, banks will be undercapitalized, whatever the accounts state, and will have an incentive to resume reckless behavior.

Countries typically apply a combination of resolution strategies, including both government-managed programs and market-based mechanisms (Calomiris, Klingebiel, and Laeven, 2003). Both prove to depend for their success on efficient and effective legal, regulatory, supervisory, and political institutions. Further, a lack of attention to incentive problems when designing specific rules governing financial assistance can aggravate moral hazard problems, especially in environments where these institutions are weak, unnecessarily raising the costs of resolution. Policymakers in economies with weak institutions should, accordingly, not
expect to achieve the same level of success in financial restructuring as in more developed countries, and they should design resolution mechanisms accordingly.

We collect information on the following crisis resolution policies.

*Forbearance* indicates whether or not there is regulatory forbearance during the years $[t, t+3]$, where $t$ denotes the starting year of the crisis. This variable is based on a qualitative assessment of information contained in IMF staff reports. We consider two forms of regulatory forbearance: banks are permitted to continue functioning despite being technically insolvent or prudential regulations (such as for loan classification and loan loss provisioning) are suspended or not fully applied.

In terms of actual bank restructuring, we collect information on nationalizations, closures, mergers, sales, and recapitalizations.

*Large-scale government intervention* indicates whether or not there was large-scale government intervention in banks, such as nationalizations, closures, mergers, sales, and recapitalizations of large banks, during the years $[t, t+3]$. *Institutions closed* indicates the share of bank assets (in percent) liquidated or closed during the years $[t, t+3]$. We also collect information on the number of banks in year $t$ and the number of banks in $t+3$, where $t$ is the starting year of the crisis. *Bank closures* indicate whether or not banks were closed during the period $t$ to $t+3$. We also collect information on the number of banks closed or liquidated during the period $t$ to $t+3$. We separately collect information on whether or not financial institutions other than banks were closed (*other FI closures*), and on whether or not shareholders of closed institutions were made whole (*shareholder protection*).

We also collect information on whether or not banks were nationalized (*nationalizations*), merged (*mergers*), or sold to foreigners (*sales to foreigners*) during the period $t$ to $t+5$. For mergers, we also collect information on whether or not private shareholders/owners of banks injected capital, and for sales to foreigners we collect information on the number of banks sold to foreigners during period $t$ to $t+5$.

Next, we collect information on whether or not a bank restructuring agency (*bank restructuring agency*) was set up to deal with bank restructuring, and whether or not an AMC (*asset management company*) was set up to take over and manage distressed assets. In case an AMC was set up, we collect information on whether it was centralized or decentralized.

As part of crisis resolution, systemically important (or government-owned) banks are often recapitalized by the government. *Recapitalization* denotes whether or not banks were recapitalized by the government during the period $t$ to $t+3$. We also compute an estimate of the gross recapitalization cost (as a percentage of GDP) to the government during the period $t$ to $t+5$. The latter variable is denoted as *recap cost* (*gross*). Next, we collect information on the recovery of recapitalization costs. *Recovery* denotes whether or not the government was able to recover part of the recapitalization cost. *Recovery proceeds* denotes the recovery proceeds (as a percentage of GDP) during the period $t$ to $t+5$. *Recap cost* (*net*) denotes the net recapitalization cost to the government, expressed as a percentage of GDP, computed as the difference between the gross recapitalization cost and recovery proceeds.
On deposit insurance and depositor compensation, we collect the following information from Demirgüç-Kunt, Kane, and Laeven (2008) and IMF staff reports. *Deposit insurance* indicates whether or not an explicit deposit insurance scheme is in place at the start of the banking crisis. Note that we ignore deposit insurance arrangements put in place after the first year of the crisis. *Coverage limit* denotes the coverage limit (in local currency) of insured deposits at the start of the banking crisis. This variable is set to zero if there is no explicit deposit insurance. *Coverage ratio* is the ratio of the coverage limit to per capita GDP at the start of the banking crisis. This variable is set to zero if there is no explicit deposit insurance. Finally, we collect information on whether or not losses were imposed on depositors of failed banks.

### 17.3.4. Macroeconomic Policies

Governments also tend to change macroeconomic policy to manage banking crises and reduce their negative impact on the real sector. In addition to crisis containment and resolution policies, we therefore also collect information on monetary and fiscal policies during the first three years of the crisis. Although these measures are somewhat crude, they serve the purpose of providing some sense about the policy stance.

*Monetary policy index* is an index of monetary policy stance during the years \([t, t+3]\), where \(t\) denotes the starting year of the crisis. The index indicates whether monetary policy is (1) expansive (+1), if the average percentage change in reserve money during the years \([t, t+3]\) is between 1 to 5 percent higher than during the years \([t-4, t-1]\); (2) contractive (−1), if the average percentage change in reserve money during the years \([t, t+3]\) is between 1 to 5 percent lower than during the years \([t-4, t-1]\); or (3) neither (0). We also report the average change in reserve money (in percent) during the years \([t, t+3]\).

*Fiscal policy index* is an index of fiscal policy stance during the years \([t, t+3]\), where \(t\) denotes the starting year of the crisis. The index indicates whether fiscal policy is (1) expansive (+1), if the average fiscal balance during the years \([t, t+3]\) is less than \(-1.5\) percent of GDP; (2) contractive (−1), if the average fiscal balance during the years \([t, t+3]\) is greater than \(1.5\) percent of GDP; or (3) neither (0). We also report the average fiscal balance (in percent of GDP) during the years \([t, t+3]\).

Finally, we report whether or not an IMF program was put in place around the time of the banking crisis (*IMF program*), including the year the program was put in place.

### 17.3.5. Outcome Variables

In terms of outcome variables, we collect information on fiscal costs and output losses.

*Fiscal cost (net)* denotes the net fiscal cost, expressed as a percentage of GDP, over the period \([t, t+5]\), where \(t\) denotes the starting year of the crisis. We also report the gross fiscal costs, and the recovery proceeds over the period \([t, t+5]\),
which is the difference between the two. Fiscal cost estimates are from Hoelscher and Quintyn (2003), Honohan and Laeven (2003), IMF staff reports, and publications from national authorities and institutions.

Output loss is computed by extrapolating trend real GDP, based on the trend in real GDP growth up to the year preceding the crisis, and taking the sum of the differences between actual real GDP and trend real GDP expressed as a percentage of trend real GDP for the period \([t, t+3]\). We require a minimum of three precrisis real GDP growth observations to compute the trend real GDP numbers.\(^7\)

### 17.4. DESCRIPTIVE STATISTICS

Tables 17.4 and 17.5 summarize the data collected on crisis containment and resolution policies for a subset of 42 systemic banking crises. The list of crisis countries consists of Argentina (four times), Bolivia, Brazil (two times), Bulgaria, Chile, Colombia (two times), Côte d’Ivoire, Croatia, Czech Republic, Dominican Republic, Ecuador, Estonia, Finland, Ghana, Indonesia, Jamaica, Japan, Korea, Latvia, Lithuania, Malaysia, Mexico, Nicaragua, Norway, Paraguay, Philippines, Russia, Sri Lanka, Sweden, Thailand, Turkey, Ukraine, United Kingdom, United States, Uruguay, Venezuela, and Vietnam. Note that the financial crisis in the United Kingdom and the United States is still ongoing at the time of writing of this chapter, so the analysis of crisis containment and resolution policies for these two countries is preliminary and incomplete.

The selection of crisis episodes is determined by the availability of detailed information on such policies. We rely on a variety of sources, including IMF staff reports and working papers, World Bank documents, and central bank and academic publications. We refer to the electronic version of the database for the exact sources of the data.\(^8\) The electronic version of the database also contains a slightly larger set of variables than that reported here, including a brief description of each crisis, the name of the administering agency of the blanket guarantee (if introduced) and the coverage of the guarantee, and the name of the entity in charge of the AMC (if set up), its funding, and the type of assets transferred to it.

#### 17.4.1. Initial Conditions

Table 17.4 reports summary statistics for the initial conditions variables. We find that the banking crises selected tend to coincide with currency crises, but they rarely coincide with sovereign debt crises. In 55 percent of cases, the banking crisis coincides with a currency crisis, but in only 11 percent of cases does the banking crisis coincide with a debt crisis.

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\(^7\) As a result, we do not have output loss estimates for many transition economies that experienced crises in the early 1990s.

Macroeconomic conditions are often weak prior to a banking crisis. Fiscal balances tend to be negative (−2.1 percent on average), current accounts tend to be in deficit (−3.9 percent), and inflation often runs high (137 percent on average) at the onset of the crisis. However, the role of macroeconomic fundamentals has evolved across generations of crisis. Whereas crises such as Russia in 1998, Argentina in 2001, and most crises of the 1980s were precipitated by large macroeconomic imbalances, and in particular unsustainable fiscal policies, the nature of the east Asian crises had more to do with the maturity composition of debt and foreign exchange risk exposures rather than the level of public debt and fiscal deficit.

Nonperforming loans tend to be high during the onset of a banking crisis, running as high as 75 percent of total loans and averaging about 25 percent of loans. However, it is not always clear to what extent the sharp rise of nonperforming loans was caused by the crisis itself or whether it reflects the effects of tightening of prudential requirements during the aftermath of the crisis. In the case of Chile, for instance, nonperforming loans peaked at 36 percent of total loans only in 1986, several years after the start of the crisis. However, part of the unsound banking practices that led to the Chilean banking crisis was the existence of substantial connected loans, which ranged across banks from 12 to 45 percent of the total loan portfolio (Sanhueza, 2001).

Government ownership of banks is common in crisis countries, with the government owning about 31 percent of banking assets on average. In many

### TABLE 17.4
Descriptive Statistics of Initial Conditions of Selected Banking Crises

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Crises</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currency crisis (Y/N)</td>
<td>42</td>
<td>0.548</td>
<td>0.504</td>
<td>0.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Sovereign debt crisis (Y/N)</td>
<td>42</td>
<td>0.119</td>
<td>0.328</td>
<td>0.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Fiscal balance/GDP</td>
<td>42</td>
<td>−0.021</td>
<td>0.045</td>
<td>−0.170</td>
<td>0.056</td>
</tr>
<tr>
<td>Debt/GDP</td>
<td>33</td>
<td>0.464</td>
<td>0.395</td>
<td>0.080</td>
<td>1.913</td>
</tr>
<tr>
<td>Inflation</td>
<td>41</td>
<td>1.371</td>
<td>4.862</td>
<td>−0.007</td>
<td>24.772</td>
</tr>
<tr>
<td>Net foreign assets/M2</td>
<td>42</td>
<td>0.174</td>
<td>0.189</td>
<td>−0.351</td>
<td>0.576</td>
</tr>
<tr>
<td>Deposits/GDP</td>
<td>42</td>
<td>0.491</td>
<td>0.454</td>
<td>0.062</td>
<td>2.524</td>
</tr>
<tr>
<td>GDP growth</td>
<td>42</td>
<td>0.024</td>
<td>0.045</td>
<td>−0.098</td>
<td>0.100</td>
</tr>
<tr>
<td>Current account/GDP</td>
<td>41</td>
<td>−0.039</td>
<td>0.049</td>
<td>−0.249</td>
<td>0.025</td>
</tr>
<tr>
<td>Peak NPLs (fraction of total loans)</td>
<td>40</td>
<td>0.252</td>
<td>0.155</td>
<td>0.040</td>
<td>0.750</td>
</tr>
<tr>
<td>Government-owned banks (fraction of total assets)</td>
<td>42</td>
<td>0.309</td>
<td>0.245</td>
<td>0.000</td>
<td>0.920</td>
</tr>
<tr>
<td>Bank runs (Y/N)</td>
<td>42</td>
<td>0.619</td>
<td>0.491</td>
<td>0.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Largest one-month drop in deposits-to-GDP</td>
<td>26</td>
<td>0.112</td>
<td>0.058</td>
<td>0.056</td>
<td>0.267</td>
</tr>
<tr>
<td>Credit boom (Y/N)</td>
<td>33</td>
<td>0.303</td>
<td>0.467</td>
<td>0.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Annual growth in private credit to GDP prior to crisis</td>
<td>33</td>
<td>0.083</td>
<td>0.098</td>
<td>−0.199</td>
<td>0.341</td>
</tr>
<tr>
<td>Creditor rights</td>
<td>41</td>
<td>1.780</td>
<td>1.129</td>
<td>0.000</td>
<td>4.000</td>
</tr>
</tbody>
</table>

NPL: nonperforming loan; Std. Dev.: standard deviation.

cases, government ownership may have become a vulnerability as problems at state-owned banks have been major contributors to the crisis, with many exhibiting low asset quality prior to the onset. In Uruguay, for instance, state-owned banks Republica and Hipotecario—accounting for 40 percent of the system’s assets—exhibited nonperforming loans of 39 percent of total loans as of 2001, compared to 5.6 percent at private banks (IMF, 2003). In Turkey, duty losses at state-owned banks were estimated at 12 percent of GNP as early as in 1999 (IMF, 2000), and state-owned bank Bapindo in Indonesia had experienced important losses as early as in 1994, three years prior to the onset of the crisis (Enoch and others, 2001).

Bank runs are a common feature of banking crises, with 62 percent of crises experiencing momentary sharp reductions in total deposits. The largest one-month drop in the ratio of deposits to GDP averages is about 11.2 percent for countries experiencing bank runs, and is as high as 26.7 percent in one case. Severe runs are often system-wide, but it is also common to observe a flight to quality effect within the system from unsound banks to sound banks that implies no or moderate systemic outflows. During the Indonesian crisis in 1997, for instance, private national banks lost 35 trillion rupiah in deposits between October and December 2007, while state-owned banks and foreign and joint-venture banks gained 12 and 2 trillion, respectively. A similar situation occurred in Paraguay following the intervention of the third and fourth largest banks and the uncovering of unrecorded deposits. Depositors migrated from these banks to those perceived as more solid.

Banking crises are also often preceded by credit booms, with precrisis rapid credit growth in about 30 percent of crises. Average annual growth in private credit to GDP prior to the crisis is about 8.3 percent across crisis countries, and is as high as 34.1 percent in the case of Chile. Credit booms have often been preceded by processes of financial liberalization, such as the one that led to the crisis in the Scandinavian countries in the 1990s (see Drees and Pazarbasioglu, 1998).

Crisis-affected countries often suffer from weak legal institutions, rendering a speedy resolution of distressed assets hard to accomplish. Creditor rights in the selected crisis countries averages about 1.8, ranging from a low of 0 to a high of 4 (the maximum possible score).

In summary, initial conditions are important because they may shape the market’s and policymakers’ response during the containment phase. If macroeconomic conditions are weak, then policymakers have limited buffers to cushion the impact of the crisis and the burden falls on the shoulders of containment and resolution policies. Moreover, sudden changes in market expectations may gather strength rapidly depending on how weak initial conditions of the country are, in particular the macroeconomic setting, the institutional environment, and the banking sector. Take, for instance, the case of Turkey in 2000. The trigger of the crisis was the collapse of interbank loans from large banks to a few small banks on November 20, in particular to DemirBank, which depended greatly on overnight funding. Turkey was widely known to exhibit macroeconomic vulnerabilities, with inflation hovering around 80 percent per annum during the 1990s, high fiscal deficits, large public debt, high current account deficits, and a
weak financial system. Banks had high exposure to the government through large holdings of public securities and sizable maturities and exchange rate risk mismatches, making them highly vulnerable to market risk. When credit lines to DemirBank were cut, several small banks were forced to sell their government securities. This caused a sharp drop in the price of government securities and triggered panic among foreign investors, a reversal in capital flows, sharp increases in interest rates, and declines in the value of the Turkish lira. Within a few weeks of these developments, the Turkish government announced a blanket guarantee. An opposite example is Argentina in 1995, where the contagion from the “Tequila crisis” was weathered successfully with a substantial consolidation of the banking sector and small fiscal costs, in large part because of the robust macroeconomic performance during the preceding years.

17.4.2. Crisis Containment

Table 17.5 reports summary statistics for the crisis containment and resolution policies of the 42 selected banking crisis episodes.

The data show that emergency liquidity support and blanket guarantees are two commonly used containment measures. Extensive liquidity support is used in 71 percent of crises considered and blanket guarantees are used in 29 percent of crisis episodes. Deposit freezes and bank holidays to deal with bank runs are less frequently used. In our sample, only five cases (or 12 percent of episodes) used deposit freezes: Argentina in 1989 and 2001, Brazil in 1990, Ecuador in 1999, and Uruguay in 2002. In all but one case (Brazil in 1990), the deposit freeze was preceded by a bank holiday. Bank holidays were used in only 10 percent of crises and only in the cases mentioned above. In all episodes where holidays and deposit freezes were used, bank runs occurred. Bank holidays typically do not last long: about five days on average. However, deposit freezes can be in existence for a much longer period, up to 10 years in one case, and about 41 months on average. The longest freeze recorded corresponded to the Bonex plan implemented in Argentina in 1989.9 After the conversion, the bonds traded with a discount of almost two-thirds and recovered to about 50 percent within a few months. Similarly, in the case of Ecuador, depositors received certificates of reprogrammed deposits, which traded at significant discounts depending on the perceived solvency of the issuing bank. Moreover, bank runs resumed as soon as the unfreezing began (Jácome, 2004). It seems that at least in these cases, deposit freezes were highly disruptive, imposing severe losses to depositors, and therefore should be considered only in extreme circumstances. Bank holidays, on the other hand, may be used to buy time until a clear strategy is laid out; they were also used in the United States during the Great Depression in the 1930s.

9 The freeze converted time deposits—except for the first US$500 and special accounts such as charitable foundations and funds that could be proven were meant to be used in tax or salary payments—into dollar-denominated bonds at the exchange rate prevailing on December 28, 1989. The measure was announced on January 1, 1990, after the exchange rate dropped from 1800 australis per dollar to over 3000 between December 28 and 31, 1989.
### Table 17.5

Descriptive Statistics of Crisis Policies of Selected Banking Crisis Episodes

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Crises</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deposit freeze (Y/N)</td>
<td>42</td>
<td>0.119</td>
<td>0.328</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Duration of deposit freeze (in months)</td>
<td>5</td>
<td>40.600</td>
<td>46.030</td>
<td>6</td>
<td>120</td>
</tr>
<tr>
<td>Coverage of deposit freeze: time deposits only? (Y/N)</td>
<td>5</td>
<td>0.400</td>
<td>0.548</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Bank holiday (Y/N)</td>
<td>42</td>
<td>0.095</td>
<td>0.297</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Duration of bank holiday (in days)</td>
<td>4</td>
<td>4.750</td>
<td>0.500</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Blanket guarantee (Y/N)</td>
<td>42</td>
<td>0.286</td>
<td>0.457</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Duration of guarantee (in months)</td>
<td>14</td>
<td>53.071</td>
<td>33.992</td>
<td>11</td>
<td>109</td>
</tr>
<tr>
<td>Previous explicit deposit insurance arrangement (Y/N)</td>
<td>42</td>
<td>0.524</td>
<td>0.505</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Liquidity support/emergency lending (Y/N)</td>
<td>42</td>
<td>0.714</td>
<td>0.457</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Liquidity support different across banks? (Y/N)</td>
<td>18</td>
<td>0.500</td>
<td>0.514</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Collateral required for liquidity provision</td>
<td>15</td>
<td>0.467</td>
<td>0.516</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Collateral provided is remunerated (Y/N)</td>
<td>13</td>
<td>0.846</td>
<td>0.376</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>If remunerated, interest at market rates (Y/N)</td>
<td>11</td>
<td>0.636</td>
<td>0.505</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Peak liquidity support (fraction of deposits)</td>
<td>41</td>
<td>0.277</td>
<td>0.497</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Lowering of reserve requirements (Y/N)</td>
<td>41</td>
<td>0.366</td>
<td>0.488</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Forbearance (Y/N)</td>
<td>42</td>
<td>0.667</td>
<td>0.477</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Banks not intervened despite being technically insolvent</td>
<td>37</td>
<td>0.351</td>
<td>0.484</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Prudential regulations suspended or not fully applied</td>
<td>37</td>
<td>0.730</td>
<td>0.450</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Large-scale government intervention in banks (Y/N)</td>
<td>42</td>
<td>0.857</td>
<td>0.354</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Fraction of financial institutions closed</td>
<td>39</td>
<td>0.083</td>
<td>0.117</td>
<td>0</td>
<td>0.500</td>
</tr>
<tr>
<td>Bank closures (Y/N)</td>
<td>42</td>
<td>0.667</td>
<td>0.477</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Other financial institutions closures (Y/N)</td>
<td>34</td>
<td>0.500</td>
<td>0.508</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Were shareholders made whole? (Y/N)</td>
<td>30</td>
<td>0.067</td>
<td>0.254</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Nationalizations (Y/N)</td>
<td>42</td>
<td>0.571</td>
<td>0.501</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Mergers (Y/N)</td>
<td>41</td>
<td>0.610</td>
<td>0.494</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Did private bank shareholders inject fresh capital? (Y/N)</td>
<td>24</td>
<td>0.667</td>
<td>0.482</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Sales to foreigners (Y/N)</td>
<td>37</td>
<td>0.514</td>
<td>0.507</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Bank restructuring agency (Y/N)</td>
<td>40</td>
<td>0.475</td>
<td>0.506</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Asset management company (Y/N)</td>
<td>42</td>
<td>0.595</td>
<td>0.497</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Centralized asset management company (Y/N)</td>
<td>25</td>
<td>0.840</td>
<td>0.374</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Recapitalization (Y/N) of banks</td>
<td>42</td>
<td>0.762</td>
<td>0.431</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Recap level (%)</td>
<td>13</td>
<td>0.078</td>
<td>0.020</td>
<td>0.040</td>
<td>0.100</td>
</tr>
<tr>
<td>Recap cost to government (gross) (fraction of GDP)</td>
<td>32</td>
<td>0.078</td>
<td>0.096</td>
<td>0.002</td>
<td>0.373</td>
</tr>
</tbody>
</table>

(continued)
Unlike the Bonex plan in Argentina in 1989 and the deposit freeze in Uruguay in 2002 (which covered dollar-denominated time deposits at public banks), deposit freezes have generally also covered deposits other than time deposits. The 2001 freeze in Argentina, for example, began with the Corralito, which limited withdrawals up to US$250 a week, prohibited transfers abroad unless trade-related, introduced marginal reserve requirements, and limited transactions that could reduce deposits. However, soon after the Corralito, the Corralon was implemented which reprogrammed time deposits over a five-year horizon. Similarly, in Brazil in 1990, the freeze included M2 plus federal securities in the hands of the public, except balances below NCZ$50,000 for checking accounts and NCZ$25,000 for savings accounts or 20 percent of the balance (whichever was larger) for deposits in the overnight domestic debt market, and 20 percent of the balance for mutual funds. The broadest freeze recorded in our sample was implemented by Ecuador, and included savings deposits above US$500, half of checking account balances, repurchase agreements, and all time deposits.

Blanket guarantees tend to be in place for a long period as well, about 53 months on average. Blanket guarantees are another policy tool that—if successful—may buy some time for policymakers to implement a credible policy package. The use of a blanket guarantee is usually justified on the grounds that if not put in place, the payments system could collapse. Using the dataset presented in this chapter, Laeven and Valencia (2008) examined the effectiveness of blanket guarantees in restoring depositor confidence and found that blanket guarantees are often successful in that sense. However, they also found that outflows by foreign

### TABLE 17.5

Descriptive Statistics of Crisis Policies of Selected Banking Crisis Episodes (Continued)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Crises</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recovery of recap expense (Y/N)</td>
<td>31</td>
<td>0.516</td>
<td>0.508</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Recap cost to government (net) (fraction of GDP)</td>
<td>32</td>
<td>0.060</td>
<td>0.079</td>
<td>0</td>
<td>0.373</td>
</tr>
<tr>
<td>Deposit insurance (Y/N)</td>
<td>42</td>
<td>0.524</td>
<td>0.505</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Coverage limit to per capita GDP</td>
<td>35</td>
<td>1.142</td>
<td>1.730</td>
<td>0</td>
<td>7.180</td>
</tr>
<tr>
<td>Were losses imposed on depositors? (Y/N)</td>
<td>42</td>
<td>0.310</td>
<td>0.468</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Monetary policy index</td>
<td>40</td>
<td>−0.050</td>
<td>0.815</td>
<td>−1</td>
<td>1</td>
</tr>
<tr>
<td>Change in reserve money (rate)</td>
<td>35</td>
<td>1.681</td>
<td>4.562</td>
<td>−0.070</td>
<td>20.47</td>
</tr>
<tr>
<td>Fiscal index</td>
<td>40</td>
<td>0.600</td>
<td>0.709</td>
<td>−1</td>
<td>1</td>
</tr>
<tr>
<td>Fiscal balance (share of GDP)</td>
<td>40</td>
<td>−0.036</td>
<td>0.030</td>
<td>−0.127</td>
<td>0.008</td>
</tr>
<tr>
<td>IMF program put in place (Y/N)</td>
<td>42</td>
<td>0.524</td>
<td>0.505</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Fiscal cost net (share of GDP)</td>
<td>40</td>
<td>0.130</td>
<td>0.133</td>
<td>0</td>
<td>0.551</td>
</tr>
<tr>
<td>Gross fiscal cost (share of GDP)</td>
<td>40</td>
<td>0.157</td>
<td>0.150</td>
<td>0</td>
<td>0.568</td>
</tr>
<tr>
<td>Output loss (share of GDP)</td>
<td>40</td>
<td>0.201</td>
<td>0.260</td>
<td>0</td>
<td>0.977</td>
</tr>
</tbody>
</table>

Std. Dev.: standard deviation.

creditors were virtually unresponsive to the announcement of such guarantees, despite being covered in most cases. Regarding the fiscal cost of using guarantees, they found that such guarantees tend to be costly, confirming earlier results by Honohan and Klingebiel (2003), but argue that this result is driven mainly by the fact that guarantees are usually adopted in conjunction with extensive liquidity support and when crises are severe.

Blanket guarantees not only imply fiscal contingencies, but also potential moral hazard problems. Moral hazard arises because banks no longer feel disciplined by depositors to avoid excessive risk taking. With the backing of a blanket guarantee, it is often attractive for banks to engage in risky activities or, in case the bank is distressed, to “gamble for resurrection” while the guarantee is in place. Another consequence of guarantees is that depositors no longer feel the need to screen banks. For instance, following the announcement of a blanket guarantee by the Irish authorities on September 29, 2008, there was a large migration of deposits from the United Kingdom, where a limited guarantee was in place, to banks in Ireland. In light of these moral hazard considerations, blanket guarantees should only be used as a temporary measure.

Peak liquidity support tends to be sizable and averages about 28 percent of total deposits across the 42 crisis episodes considered. Liquidity support is clearly the most common first line of response in systemic crisis episodes, even in the case of Argentina in 1995 when a currency board was in place. This was possible through an amendment of the charter of the Central Bank of Argentina in February 1995, allowing it to lengthen the maturities of its swap and rediscount facilities, with the possibility of monthly renewal, and in amounts exceeding the net worth of the borrowing bank.

In severe crises, there has been a positive correlation of about 30 percent between the provision of extensive liquidity support and the use of blanket guarantees. Blanket guarantees are often introduced to restore confidence even when previous explicit deposit insurance arrangements are already in place (this is the case in about 52 percent of crises where blanket guarantees are introduced). It is worth noting that in some cases, partial guarantees have been introduced to cover only a segment of the market, not all banks.

17.4.3. Crisis Resolution

Table 17.5 reports summary statistics for the crisis resolution policies of the 42 selected banking crisis episodes. Regulatory forbearance is a common feature of crisis management. The policy objective is to achieve a gradual recovery of the banking system over time, or a gradual transitioning toward stricter prudential requirements. The latter is a common outcome whenever modifications to the regulatory framework are introduced. In Ecuador for instance, banks were given two years to fully comply with new loan classification rules, among other requirements. In the 2001 crisis episode in Argentina, the authorities granted regulatory forbearance which included a new valuation mechanism for government bonds and loans, allowing for a gradual convergence to market value. Banks were also allowed to temporarily decrease their capital charge on interest.
rate risk, and losses stemming from court injunctions<sup>10</sup> could be booked as assets to be amortized over a period of 60 months. Prolonged forbearance occurs in about 67 percent of crisis episodes. In 35 percent of cases, forbearance takes the form of banks not being subject to intervention despite being technically insolvent, and in 73 percent of cases prudential regulations are suspended or not fully applied.

Forbearance, however, does not really solve the problems and therefore a key component of almost every systemic banking crisis is a bank restructuring plan. In 86 percent of cases, large-scale government intervention in banks takes place in the form of bank closures, nationalizations, or assisted mergers. In only a handful of episodes, the system survived a crisis without having at least significant bank closures. For instance, in the case of Latvia, banks holding 40 percent of assets were closed, but no further intervention of the government was implemented. In Argentina, in the 1995 episode, 15 institutions ran into problems: 5 of them were liquidated (with 0.6 percent of the system’s assets), 6 were resolved under a purchase and assumption scheme (with 1.9 percent of the system’s assets), and 4 were absorbed by healthier institutions. However, in addition to that, a significant consolidation process took place through 14 mergers, involving 47 financial institutions. Regarding the treatment of shareholders, they often lose money when banks are closed and are often forced to inject new capital into the banks they own.

Closures have not been limited to banks and have also included nonbank financial institutions. In Thailand, for instance, the problem started with liquidity problems at finance companies as early as March 1997, and 56 of them (accounting for 11 percent of the financial system’s assets) were closed. In Jamaica, a large component of the financial problems was in the insurance sector, whose restructuring cost reached 11 percent of GDP.

Sales to foreigners are often seen as a last resort, though they have become quite common in recent crises. On average, 51 percent of crisis episodes have seen sales of banks to foreigners.

Bank closures seem to be associated with larger fiscal costs (there is a positive correlation between those two variables of 22 percent). However, closures are negatively associated with the issuance of a blanket guarantee, with a correlation of −22 percent. Because the guarantee entails a sizable fiscal contingency, once in place governments may try to avoid closing banks so as to avoid materializing the guarantee. Bank closures seem also positively associated with peak nonperforming loans, with a correlation of about 25 percent. One potential contributing factor to this correlation is that once a bank is closed, its asset quality may deteriorate because in the process any value attached to bank relationships with customers may be destroyed. Borrowers may delay payments or the collection of

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<sup>10</sup>In 2002, the Argentinean government introduced an asymmetric pesofication of assets and liabilities of banks. However, the exchange rate used for deposits—ARG$1.4 per US$1—was substantially below market rates. Depositors initiated legal processes and some obtained additional compensation through court injunctions.
loans becomes less effective than before, which may also contribute to higher fiscal costs.

Special bank restructuring agencies are often set up to restructure distressed banks (in 48 percent of crises) and AMCs have been set up in 60 percent of crises to manage distressed assets. AMCs tend to be centralized rather than decentralized. The main objective of government-owned AMCs is to accelerate financial restructuring by taking over nonperforming assets from banks. Two examples of successful AMCs are Securum and Retrieve in Sweden, created in 1992 to manage the problem loans of two major Swedish banks, Nordbanken and Gota Bank. Both companies managed to recover substantial amounts of their initial investment by selling off their assets. Factors that contributed to their success include an efficient judicial system, which allowed them to force insolvent debtors into bankruptcy; the real estate-related nature of their assets, which made it easier to restructure; and the strong governance mechanisms and skilled management teams of the companies. However, other countries have found it harder to realize these advantages, in part owing to weak legal, regulatory, and political institutions—often banks’ assets were transferred to the AMC at above-market-value prices, resulting in backdoor bank recapitalization and creating moral hazard. Examining the cases where AMCs were used, we find that the use of AMCs is positively correlated with peak nonperforming loans and fiscal costs, with correlation coefficients of about 15 percent in both cases. These correlations may suggest some degree of ineffectiveness in AMCs, at least in those episodes where such companies were established. Consistent with our findings, Klingebiel (2000) studied seven crises where AMCs were used and concluded that they were largely ineffective.

Another important policy used in the resolution phase of banking crises is recapitalization of banks. Measures aimed at quickly improving the capital bases of financial institutions do not directly improve debtor capacity, but make it easier for banks to recognize losses and thereby facilitate corporate restructuring. Government-assisted recapitalizations can, however, create moral hazard for shareholders, especially if government intervention is small relative to the negative net worth of recipient institutions. Comparing the preferred bank stock programs adopted in the United States (starting in 1933) and Japan (1998) helps to illustrate some of the key issues with recapitalization. Although in both cases policymakers used preferred stock purchases to enhance bank capital, this approach appeared to work better in the United States, where appropriate screening and incentives for participants ensured that only banks worth saving and those that managed their risk and capital structure more prudently received taxpayer funds.11 Moreover, banks receiving assistance were monitored to ensure that they made proper use of public aid. In Japan, by contrast, virtually every bank of significant size received assistance, though the amounts involved were relatively small. The recapitalization program thus pro-

11This is not to say that other aspects of Japan’s bank restructuring program were not successful. The example merely illustrates that one aspect of this program was less successful. A subsequent preferred stock program in 1999, that was much larger in size, was successful in recapitalizing banks.
vided a boost to bank capital but did less to foster corporate restructuring or to restart bank lending.  

In 33 out of the 42 selected crisis episodes, banks were recapitalized by the government. Recapitalization costs constitute the largest fraction of fiscal costs of banking crises and take many forms. In 12 crises, recapitalization took place in the form of cash; in 14 crises, in the form of government bonds; in 11 episodes, subordinated debt was used; in 6 crises, preferred shares were used; in 7 crises, it took place through the purchase of bad loans; in 2 crises, a government credit line was extended to banks; in 3 crises, the government assumed bank liabilities; and in 4 crises, the government purchased ordinary shares of banks. In some cases, a combination of these methods was used. Recapitalization usually entails writing off losses against shareholders’ equity and injecting either Tier 1 or Tier 2 capital or both. Recapitalization programs are usually accompanied with some conditionality. For instance, in the case of Chile, a nonperforming loans purchase program was implemented, and during this period banks could not distribute dividends and all profits and recoveries had to be used to repurchase the loans. In Mexico, PROCAPTE (a temporary recapitalization program) would have FOBAPROA (deposit insurance fund) purchase subordinated debt from qualifying banks, but the resources had to be deposited at the central bank, bearing the same interest rate as the subordinated bonds. Banks could redeem the bonds if their capital adequacy ratio went above 9 percent, but FOBAPROA had the option to convert the bonds into stocks after five years or if banks’ Tier 1 capital ratio fell below 2 percent.

Similar conditionalities were applied to recapitalization programs in Turkey in 2000 and Thailand in 1997. In the former, SDIF (the Turkish deposit insurance fund) would match owners’ contribution to bring banks’ Tier 1 capital to 5 percent, but only for banks with a market share of at least 1 percent. SDIF could also contribute to Tier 2 capital through subordinated debt, to all banks with Tier 1 capital greater than or equal to 5 percent. Similar to the case of Mexico, if Tier 1 capital fell below 4 percent, the subordinated debt would convert into stocks. In the case of Thailand, the recapitalization plan involved Tier 1 capital injections, with the government matching private contributions and the requirement that the financial institution make full provisions upfront, in line with new regulations. Additionally, the government and the new investors had the right to change the board of directors and management of each participating financial institution. The government also had the right to appoint at least one board member to each financial institution. The program also included Tier 2 capital injections equal to a minimum of (1) the total write-down exceeding previous provisioning or (2) 20 percent of the net increase in lending to the private sector, among other criteria.

Bank recapitalization approaches are often influenced by a country’s insolvency regime for financial institutions, which in many countries today still does not allow for speedy resolution, but rather leads to a prolongation of problems. Another lesson for successful bank recapitalization is that bank capital regulations and rules need to be enforced rigorously, including if necessary by limitations on dividends.
On average, the net recapitalization cost to the government (after deducting recovery proceeds from the sale of assets) amounts to 6 percent of GDP across crisis countries in the sample, though in the case of Indonesia, it reached as high as 37.3 percent of GDP.

About half the countries experiencing a systemic banking crisis had an explicit deposit insurance scheme in place at the outbreak of the crisis (and several countries adopted deposit insurance throughout the crisis). Losses are imposed on depositors in a minority of cases. Simple correlations show that episodes where losses were imposed on depositors faced higher output losses, with a correlation of about 8 percent.

Regarding monetary and fiscal policies, monetary policy tends to be fairly neutral during crisis episodes, whereas the fiscal stance tends to be expansive, arguably to support the financial and real sectors, and to accommodate bank-restructuring and debt-restructuring programs. On average, the fiscal balance is about −3.6 percent of GDP during the initial years of a banking crisis. The IMF has participated through programs in about 52 percent of the episodes considered.

Fiscal costs, net of recoveries, associated with crisis management can be substantial, averaging about 13.3 percent of GDP on average, and can be as high as 55.1 percent of GDP. Recoveries of fiscal outlays vary widely as well, with the average recovery rate reaching 18.2 percent of gross fiscal costs. Although countries that used AMCs seem to achieve slightly higher recovery rates, the correlation is very small, at about 10 percent.

Finally, output losses (measured as cumulative deviations from trend GDP) of systemic banking crises can be large, averaging about 20 percent of GDP on average during the first four years of the crisis, and ranging from a low of 0 percent to a high of 98 percent of GDP.

17.5. GLOBAL LIQUIDITY CRISIS OF 2007–08

During the course of 2007, U.S. subprime mortgage markets went into meltdown and global money markets came under intense pressure. The U.S. subprime mortgage crisis manifested itself first through liquidity issues in the banking system owing to a sharp decline in demand for asset-backed securities. Hard-to-value structured products and other instruments created during a boom of financial innovation had to be severely marked down because of newly implemented fair-value accounting rules and credit-rating downgrades. Credit losses and asset write-downs got worse with declining housing prices and accelerating mortgage foreclosures, which increased in late 2006 and worsened further in 2007 and 2008. Profits at U.S. banks declined from $35.2 to $5.8 billion (83.5 percent) during the fourth quarter of 2007 versus the prior year, arising from provisions for loan losses. As of March 2009, estimates of subprime-related and other credit losses or write-downs by global financial institutions stand at over $4 trillion.

We now briefly compare the ongoing global liquidity crisis and its policy responses to the other crises included in our database. Given that the global liquidity crisis is still very much unfolding at the time of writing, this analysis is obviously preliminary and incomplete.
17.5.1. Initial Conditions

At the time of writing this chapter, the underlying causes of the global 2007–08 financial crisis are still being debated, and most likely can be attributed to a combination of factors. However, from the perspective of describing its initial conditions, it is useful to classify the underlying factors in two groups: macroeconomic and microeconomic factors.

The macroeconomic context is characterized by a prolonged period of excess global liquidity induced in part by relatively low interest rates set by the Federal Reserve and other central banks following the 2001 recession in the United States. The excess liquidity fueled domestic demand and in particular residential investment, triggering a significant rise in housing prices which more than doubled in nominal terms between the year 2000 and mid-2006.\(^{13}\) During this period, the economy faced high current account deficits, reaching 7 percent of GDP in the last quarter of 2005, induced primarily by household expenditure but also by sizable fiscal deficits.

However, microeconomic factors related to financial regulation (and lack thereof) and industry practices by financial institutions also appear to have played a crucial role in the buildup of the bubble. The originate-and-distribute lending model (see Bhatia, 2007, for a description) adopted by many financial institutions during this period seems to have exacerbated the problem. Under this approach, banks made loans primarily to sell them to other financial institutions that in turn would pool them to issue asset-backed securities. The underlying rationale for these loan sales was a transfer of risk to the ultimate buyer of the security, backed by the underlying mortgage loans. These securities could then be pooled again and new instruments would be created and so forth. A mispricing of risk of mortgage-backed securities (MBSs) linked to subprime loans led the market to believe that there was an arbitrage opportunity. Such market perceptions fueled demand for these instruments and contributed to a deterioration in underwriting standards by banks in an attempt to increase the supply of loans to meet the demand for securitized instruments. Regulatory oversight missed the buildup of vulnerabilities induced by this process as risks were expected to be transferred to the unregulated segment of the market. The premise was that heavily regulated banks would only be originators and the ultimate holders of securities were beyond the scope of regulation. In this process, however, spillover effects and systemic risks seem to have been neglected by regulators, and the regulated segment ended up being significantly affected. The crisis reached a global dimension as it became apparent that foreign banks, mainly European, had also played a significant role in the demand for mortgage-related (and in particular subprime mortgages-linked) securities. For U.K. banks, this shock coincided with a homegrown housing bubble.

\(^{13}\) Measured as the percent change in the Case-Shiller 20-city composite index between January 2000 and its peak in July 2006.
In addition to a move toward the originate-and-distribute lending model, many banks, particularly in the United Kingdom, increasingly relied on wholesale funding. As the crisis unfolded, banks that relied heavily on wholesale markets for their funding, such as Northern Rock in the United Kingdom, were hit particularly hard, causing stress in global money markets. Given ongoing concerns with counterparty risk, notably regarding adequacy of banks’ capital, money market strains have continued.

At first glance, the buildup of this crisis episode in the United States and the United Kingdom does not seem to differ significantly from the traditional boom-bust cycles observed in the other crisis countries in our database. Many of these historical crisis episodes experienced buildups of asset price bubbles, and in particular of real estate bubbles, often originating from financial liberalization. In many cases, deregulation of financial systems led to rapid expansion of credit, but with deficiencies in risk management and pricing as the financial system was evolving and prone to abuse. In the case of the United States, it was not financial liberalization in the conventional sense, but financial innovation of financial instruments which the market and regulators did not fully understand. Supported by these new financial products and asset securitization, mortgage credit markets expanded rapidly only to virtually collapse in some segments as the financial crisis unfolded. In 30 percent of the episodes included in our database, the crisis was preceded by a credit boom. In the cases of the United States and the United Kingdom, however, although credit rose rapidly—mortgage lending in particular—the pace of expansion did not satisfy our criteria to be labeled as a credit boom.

What is different from many previous financial crises, especially in developing countries, is that the United States and the United Kingdom have thus far not suffered from a sudden stop of capital flows, which has caused major economic stress in other countries. The dollar did depreciate against the euro in the years preceding the 2007 turmoil, but demand for U.S. assets did not contract sharply, possibly because of the dollar’s use as a reserve currency. Also, the speed and breadth with which stress in U.S. mortgage markets has spread to other continents, financial institutions (notably securities firms), and financial markets (notably money markets) seems to have been fueled by uncertainty about the unfolding of the subprime crisis, as it became more clear that risk had been mis-priced and exposures had not been transparent.

17.5.2. Containment

Average house prices in the United States reached a peak around mid-2006 and began to decline after the initial signs that a financial crisis might be around the corner. Losses at financial institutions began to appear as early as February 2007 with HSBC Finance, the U.S. mortgage unit of HSBC, reporting over $10 billion in losses from its U.S. mortgage lending business. The bad news continued in April 2007 with the bankruptcy filing of New Century Financial, one of the biggest subprime lenders in the United States, followed by the rescue of two Bear Stearns hedge funds in June 2007. Problems further intensified when on August 16, 2007,
Countrywide Financial, the largest mortgage lender in the United States, ran into liquidity problems because of a decline in value of securitized mortgage obligations, triggering a deposit run on the bank. The Federal Reserve “intervened” by lowering the discount rate by 0.5 percent and by accepting $17.2 billion in repurchase agreements for MBSs to aid liquidity. On January 11, 2008, Bank of America bought Countrywide for $4 billion. Up to this point, containment policy in the United States was limited to alleviating liquidity pressures through the use of existing tools.

During this time, the United Kingdom experienced its own banking sector problems in light of tight conditions in money markets. On September 14, 2007, Northern Rock, a midsized U.K. mortgage lender, received a liquidity support facility from the Bank of England, following funding problems related to turmoil in the credit markets caused by the U.S. subprime mortgage financial crisis. Starting on September 14, 2007, Northern Rock experienced a bank run, until a government blanket guarantee—covering only Northern Rock—was issued on September 17, 2007. The run on Northern Rock highlighted weaknesses in the U.K. financial sector framework, including the maintenance of adequate capital by financial institutions, bank resolution procedures, and deposit insurance (IMF, 2008). Commercial banks in the United States did not seem to have experienced runs among retail customers, but as mentioned earlier, many institutions faced significant stress in wholesale markets. The blanket guarantee issued on Northern Rock was perhaps the first significant step away from the usual tools employed to resolve liquidity problems. However, unlike in other episodes where a blanket guarantee was used, this time it was introduced at an early stage. In our sample, 29 percent of episodes used a blanket guarantee. However, in the majority of them, they were put in place in the midst of a financial meltdown. In the Asian countries for instance, blanket guarantees were announced when markets were under significant stress and the crisis was already of systemic proportions with widespread runs throughout the financial system.

The next significant policy measure adopted by authorities in both countries was an increase in the range of tools available to provide liquidity. The Federal Reserve introduced the Term Securities Lending facility in March 2008 by which it could lend up to $200 billion of Treasury securities to primary dealers secured for a term of 28 days (rather than overnight, as in the program in place) by a pledge of other securities, including federal agency debt, federal agency residential MBSs, and nonagency AAA-/Aaa-rated private-label residential MBSs. Similarly, it increased its currency swap lines with other central banks in an attempt to reestablish calm in money markets. The Bank of England took similar steps on April 21, 2008, when it announced it would accept a broad range of MBSs under the new Special Liquidity Scheme and swap those for government paper for a period of one year to aid banks experiencing liquidity problems. The scheme enabled banks to temporarily swap high-quality but illiquid mortgage-backed

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14 Mexico is one example in which an implicit blanket guarantee was already in place before the crisis, namely since end-1993. However, the guarantee was reaffirmed in end-1994, during the burst of the Tequila crisis.
assets and other securities. These steps are common measures in other episodes documented, where central banks usually increase the tools to provide the system with additional liquidity at both longer and more flexible terms.

Following the Federal Reserve’s announcement of the expansion of liquidity facilities, a major event took place: the collapse of Bear Stearns, the fifth largest investment bank at the time. Mounting losses arising from its mortgage exposure triggered a run on the bank requiring an emergency financial assistance from the government and purchase by JP Morgan Chase—with federal guarantees on its liabilities—in March 2008. It was a rather controversial measure because Bear Stearns was not subject to regulation by the Federal Reserve, yet the Federal Reserve’s guarantee on its liabilities was crucial to avoid the firm’s bankruptcy.15 Because of large counterparty risk, it was believed that an intervention was justified. Although there was no explicit blanket guarantee announced on Bear Stearns, there was a de facto protection of all its creditors. Shareholders of Bear Stearns, however, did suffer significant losses.

The containment measures employed thus far by the U.S. and U.K. authorities to deal with the ongoing financial turmoil are not that different from those employed in previous crisis episodes. Almost all crises have used generous liquidity support to deal with illiquid banks. What is different in the current episode is that such liquidity support is extended not only to commercial banks but also to investment banks. Blanket guarantees are also not uncommon, though thus far they have mainly been used in developing countries to deal with systemic financial crises where depositors have lost confidence in banks’ ability to repay them.

17.5.3. Resolution

It is too early to assess how the crisis will be resolved because it is still ongoing and its adverse implications have not been fully materialized. However, some insights can be extracted from events thus far.

Between January 2008 and February 2009, 41 commercial banks failed in the United States, and each of these bank failures was handled through traditional purchase and assumption schemes with a de facto protection of all depositors. This is no different from what has been done in the case of bank failures in the past. A large fraction of failures included in our database was handled in such a way, with only 31 percent of episodes imposing losses on depositors. Failures are likely to rise as the Federal Deposit Insurance Corporation (FDIC)’s watch list of troubled banks grew to 252 banks by the end of 2008. The largest commercial bank failure thus far is that of IndiMac, a bank with $19 billion in deposits that was taken over by the FDIC in July 2008.

15 The case is to some extent similar to the failures of Sanyo Securities and Yamaichi Securities in the Japanese crises (see Nakaso, 2001). Both did not fall under the scope of the deposit insurance system but were supervised by the Ministry of Finance. However, the collapse of Sanyo caused the first default ever in the Japanese interbank market, resulting in a sharp deterioration in market sentiment. Yamaichi, on the other hand, was unwound gradually.
The most notable failures so far, however, have been those of three major U.S. investment banks: Bear Stearns, Lehman Brothers, and Merrill Lynch. Bear Stearns collapsed on March 16, 2008, after facing major liquidity problems—its sale to JP Morgan went through after the Federal Reserve Bank of New York agreed to take over Bear Stearns’ $30 billion portfolio of MBSs. Lehman Brothers filed for Chapter 11 bankruptcy protection on September 14, 2008, after failed attempts to sell the bank to private parties. Merrill Lynch was acquired by Bank of America on September 15, 2008. Equally important has been the nationalization of the insurance giant AIG, whose interconnectedness with the banking system through counterparty risk could have caused a major wave of failures. As of early 2009, the government has injected more than $100 billion into the insurance firm.

Another significant event has been the placement under conservatorship of Fannie Mae and Freddie Mac, the two largest U.S. housing government-sponsored entities (GSEs). As part of the plan announced on September 7, 2008, the Federal Housing Finance Authority was granted direct oversight of the GSEs, the U.S. Treasury was given authority to inject capital into the GSEs in the form of senior preferred shares and warrants (whereas dividends on existing common and preferred stock have been suspended), and senior management and the boards of directors at both enterprises were dismissed. Effectively, this entailed a nationalization of the two entities. The U.S. Treasury was also granted temporary authority to purchase agency-backed MBSs, and a short-term credit facility was established for the housing GSEs. The rescue of Fannie Mae and Freddie Mac came shortly after legislation approved late July 2008 that gave the U.S. Treasury the power to use public funds to recapitalize them. The bill also contained a tax break of as much as $7500 for first-time homebuyers, created a new regulator to oversee Fannie Mae and Freddie Mac, and allowed the Federal government to insure up to $300 billion in refinanced mortgages. These measures came after severe declines of stock prices of Fannie Mae and Freddie Mac following market perceptions of a significant capital shortfall.

In October 2008, after a first round of hesitation, the U.S. House of Representatives voted in favor of the Stabilization act to bail out the U.S. financial sector in the amount of US$700 billion. Though the act was initially sold as a government program to purchase distressed financial assets, it has since been recast as a program to recapitalize financial institutions by directly injecting capital. Recapitalization measures have been widely used, with 76 percent of episodes covered implementing them, but in most cases such measures were implemented only after major insolvency problems at banks. It is too early to tell what will be the amount of U.S. taxpayer money involved in the rescue of Fannie Mae and Freddie Mac. In the United Kingdom, recapitalization costs of the banking system have escalated substantially since the initial 0.2 percent of GDP used to capitalize Northern Rock, with the government acquiring large stakes in some of the country’s major banks. For example, by end-2008, the U.K. government owned 95 percent of the capital of Royal Bank of Scotland, the largest bank in the country.

The crisis at Northern Rock, which was triggered by illiquidity but where solvency concerns led to a loss of depositor confidence, was contained at first
through a government guarantee on deposits, but when a private-sector solution on acceptable terms was not identified by the government, the bank was nationalized on February 22, 2008. Nationalizations are last-resort measures commonly used in previous crises, with 57 percent of episodes in the sample using them. However, they have been more common in developing countries where it may be hard to find new owners for failed banks. Other U.K. banks that have reported major losses have sought private-sector solutions to restore bank capital, mostly by attracting new capital from existing shareholders through rights issues, but also through asset sales and a reduction in dividends. Another mortgage lender experiencing stress, Alliance & Leicester, was bought in July 2008 by the Spanish bank Banco Santander.

A noteworthy difference with previous crisis episodes is the role that sovereign wealth funds have played in this crisis in terms of providing new capital to restore banks’ capital positions to health. Globalization in conjunction with asset securitization has provided an international dimension to this crisis, by allowing many investors around the world to take a piece of the U.S. mortgage pie. Sovereign wealth funds have injected capital in major banks in both the United States and the United Kingdom as part of their recapitalization efforts.

The final costs of this crisis will not be known for some time. The United States has thus far assigned $700 billion, or about 4.9 percent of U.S. GDP, for bank restructuring and recapitalization. This is not an outlier when compared to fiscal costs associated with government action to resolve financial crises of the past. Our data on previous financial crisis episodes puts the fiscal costs associated with resolving financial crises in the average country at 16 percent of GDP. Although this average includes some small and emerging economies, the fiscal cost is equally high among advanced economies, about 15 percent of GDP on average. About half (or 8 percent of GDP) of these fiscal outlays relate to costs associated with government-assisted recapitalization of banks. The remainder relate mainly to costs associated with government asset purchase and debtor relief programs. There is much variation in this number, though, as the severity and management of crises have varied a great deal. The crisis management packages in countries as diverse as Finland, Japan, Korea, Mexico, and Turkey all cost the taxpayer a multiple of the current U.S. bailout plan, ranging from 13 percent of GDP in Finland to as high as 32 percent in Turkey. Countries like Norway and Sweden fared much better with costs to the taxpayer of 3 and 4 percent of GDP, respectively.

Of course, the current U.S. financial crisis is still ongoing and the ultimate fiscal costs could be much higher. Recent bailouts of individual financial institutions and extensions of government guarantees for deposits and money market funds have already added significant contingent fiscal liabilities. As the crisis has spread around the globe, other countries, particularly in Europe, have followed suit with policy actions that add to fiscal costs, varying from the announcement of a blanket guarantee on bank liabilities in Ireland to a comprehensive bailout package for major financial institutions in the United Kingdom.

A key driver of this variation in ultimate fiscal costs is the speed with which governments act to resolve the crisis. Speed is of the essence and is often accomplished
through a comprehensive package of simple assistance measures to borrowers and banks that is politically acceptable.

Also, although the upfront cost of interventions is high, if done right, the government would not be left empty-handed. If the government purchases bad assets, these assets may recover in value, and if the government takes equity stakes in banks, the value of these stakes may increase in the years to come. The ultimate cost to the taxpayer is likely to be smaller.

Surely, any bailout plan involves a transfer of wealth from creditors to debtors, from those that behaved prudently to those that took excessive risks. However, the consequence of no action is likely to be worse. What starts as a crisis of confidence in the financial system often spreads quickly to the real economy, negatively affecting household wealth. Declines in banks’ net worth, which may result in bank failures, reduce their ability to supply loans to households and firms, and at a minimum increase the cost of borrowing. At the same time, initial declines in economic activity that begin as a normal recession become larger as declines in borrowers’ income and net worth destroy bank net worth, creating a vicious cycle of wealth destruction that in the past has often led affected economies into deep recession. It is for this reason that financial crises call for swift policy responses. Sound policies today can avoid even larger fiscal and economic costs tomorrow.

In summary, there is much similarity in the handling of today’s crisis compared to that of previous experiences with crisis management. Authorities have, with some delay, embarked on large-scale interventions, ranging from providing generous liquidity support to bank recapitalizations and asset purchases. Banking systems are being restored to health through a combination of bank recapitalizations, mergers and acquisitions, asset purchases, and guarantees. As in earlier episodes, government interventions have not been limited to the financial sector, but include a wide range of measures aimed at boosting consumption and investment, including measures to support the housing market and lending to the corporate sector. The sheer scale of intervention, including the (partial) nationalization of financial institutions, may be unprecedented, with the possible exceptions of the Japanese crisis of the 1990s and the U.S. Great Depression, though it is too early to draw up a complete comparison.

17.6. CONCLUSION

How can policymakers respond to financial stress, including the current global financial turmoil, in a way that ensures that the financial system is restored to health, while containing the fallout on the economy, and avoiding the creation of long-term moral hazard problems? Well-timed interventions aimed at financial institutions and borrowers can help restore balance sheets and incentives, mitigate the negative shock of a financial system under stress on the economy, and help to restart productive investment. But in applying these interventions, governments frequently face trade-offs. The key challenge is to restore financial intermediation while keeping assistance costs down, avoiding misallocations of capital, and maintaining proper incentives going forward.
This chapter presents a new database on the timing and resolution of banking crises. It demonstrates that governments have employed a broad range of policies to deal with financial crises. They typically start with regulatory forbearance and generous liquidity support to banks. Forbearance, however, does not really solve the underlying problems of too little bank capital, and therefore, a key component of almost every systemic banking crisis is a bank restructuring plan. All too often, government intervention in financial institutions is delayed because regulatory capital forbearance and liquidity support are used for too long to deal with insolvent financial institutions in the hope that they will recover, ultimately increasing the stress on the financial system and the real economy.

Central to identifying sound policy approaches to financial crises is the recognition that policy responses that reallocate wealth toward banks and debtors and away from taxpayers face a key trade-off. Such reallocations of wealth can help to restart productive investment, but they have large costs. These costs include taxpayers’ wealth that is spent on financial assistance and indirect costs from misallocations of capital and distortions to incentives that may result from encouraging banks and firms to abuse government protections. Those distortions may worsen capital allocation and risk management after the resolution of the crisis. For example, government recapitalizations of insolvent banks may lead shareholders of the bank to “gamble for resurrection” at the expense of the bank’s other stakeholders. More generally, government bailouts generate moral hazard as they increase the perception that bailouts will occur next time around. Although policymakers should take these trade-offs into account when crafting their bailout plans, they do not have the luxury of waiting for the perfect solution. The economic cost of no action can be enormous, lending support to large-scale fiscal outlays to encourage investment and restore financial markets to health.

The data show that fiscal costs associated with banking crises can be substantial and that output losses are large. Although countries have adopted a variety of crisis management strategies, we observe that emergency liquidity support and blanket guarantees have frequently been used to contain crises and restore confidence, though not always with success. Our review of past experiences of financial system distress and the current episode of financial turmoil suggests that the effectiveness and cost of policy responses depend on four key dimensions.

First, having a sound framework for assuring financial sector stability helps prevent and contain financial stress. Key elements of this framework include precrisis sanctions on undercapitalized financial institutions that pose systemic risks; legal and institutional mechanisms to deal quickly with weak financial institutions, such as bank-specific bankruptcy regimes; tools and processes for closing and rapidly reopening a bank; and an effective deposit insurance scheme.

Second, a swift response may help minimize the impact on the real economy. All too often, regulatory capital forbearance and liquidity support have been used to help insolvent financial institutions recover, only to realize that the delay in intervention increases the stress on the financial system and the real economy. To avoid this, policymakers should force recognition of losses at an early stage and take steps to ensure that financial institutions are adequately capitalized.
Third, the adverse impact of financial system distress on the real economy may have to be contained through measures that directly support firms and households—for example, through targeted debt relief programs to distressed borrowers and corporate restructuring programs.

Fourth, steps should be taken to limit costs and moral hazard implications of these policy responses. It is key that shareholders first absorb the losses by writing down their equity capital. In case of large losses, creditors should contribute too by reducing and restructuring their claims. Borrowers will also have to absorb some of the costs, especially if they have engaged in reckless borrowing. Mechanisms that link government support (such as preferred stock purchases) to privately raised capital could also help identify those banks that are truly worth saving and limit distortions for the future arising from moral hazard.

Policy responses to financial crises normally depend on the nature of the crises, and some unsettled issues remain. First, fiscal tightening may be needed when unsustainable fiscal policies are the trigger of the crises, though crises are typically attacked with expansionary fiscal policies. Second, tight monetary policy could help contain financial market pressures. However, in crises characterized by liquidity and solvency problems, the central bank should stand ready to provide liquidity support to illiquid banks. In the event of systemic bank runs, liquidity support may need to be complemented with depositor protection (including through a blanket government guarantee) to restore depositor confidence, although such accommodative policies tend to be very costly and need not necessarily speed up economic recovery.

Our preliminary analysis based on partial correlations indicates that some resolution measures are more effective than others in restoring the banking system to health and containing the fallout on the real economy. Above all, speed is of the essence. As soon as a large part of the financial system is deemed insolvent and has reached systemic crisis proportions, bank losses should be recognized, the scale of the problem should be established, and steps should be taken to ensure that financial institutions are adequately capitalized. A successful recapitalization program tends to be selective in its financial assistance to banks, specifies clear quantifiable rules that limit access to preferred stock assistance, and enacts capital regulation that establishes meaningful standards for risk-based capital. Government-owned AMCs appear largely ineffective in resolving distressed assets, largely because of political and legal constraints. Next, the adverse impact of the stress on the real economy needs to be contained. To relieve indebted corporates and households from financial stress and restore their balance sheets to health, intervention in the form of targeted debt relief programs to distressed borrowers and corporate restructuring programs appear most successful. Such programs will typically require public funds, and tend to be most successful when they are well-targeted with adequate safeguards attached.

Future research based on this dataset needs to investigate in more detail how policymakers should respond to financial system stress in a way that ensures that the financial system is restored to health while containing the fallout on the economy. Such research should establish to what extent fiscal costs incurred by accommodative policy measures (such as substantial liquidity support, explicit government guarantees, and forbearance from prudential regulations)
help to reduce output losses and to accelerate the speed of economic recovery, and identify crisis resolution policies that mitigate moral hazard problems going forward.

Future research should also review and draw lessons from policy responses to the current global financial turmoil. Our preliminary assessment is that policy responses to today’s crisis have much in common with those employed in previous crisis episodes, though it is too early to draw any conclusions on the effectiveness of these responses.

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