

MARKET INTERVENTIONS DURING THE FINANCIAL CRISIS: HOW EFFECTIVE AND HOW TO DISENGAGE?

This chapter assesses the short-term effectiveness of the unprecedented market interventions announced and undertaken by the authorities of major advanced economies during the current financial crisis toward achieving the twin objectives of calming stressed markets and regaining financial stability. An initial, preliminary examination of the longer-term impact of these interventions on their intended target markets is also presented. The chapter lastly discusses disengagement from these crisis interventions by touching upon issues of timing, sequencing, and market distortion.

I ncreasing pressures on the financial system have prompted wide-ranging central bank and government interventions. While the ultimate goal of these interventions has been to help normalize credit conditions and thereby the resumption of sustainable economic growth, their immediate aim was to restore confidence in the financial system by focusing on three broad objectives: (1) contain and reverse the stress in financial markets through liquidity provision and funding guarantees; (2) cleanse banks' balance sheets of impaired assets; and (3) recapitalize and restructure viable but undercapitalized financial institutions and resolve nonviable ones.

To reach these objectives, the authorities have explored a multiplicity of policy measures. These include (1) unprecedented amounts of liquidity injections, accessible to a broadened set of counterparties; (2) credit easing through purchases of credit instruments (such as commercial paper and corporate bonds) or taking them as collateral for nonrecourse liquidity provision;

(3) guaranteeing bank liabilities; (4) injecting capital into financial institutions; and (5) in some cases, introducing schemes to relieve banks of their impaired assets.

Given the fiscal costs that these market interventions entail and the distortions they potentially create in financial intermediation, it is important to assess their effectiveness in achieving their short-term goal of calming financial markets. Although policymakers are now focused on the effectiveness of their interventions over the longer term, it is clearly too early to assess this impact concretely, as more time and observations are needed for a comprehensive analysis. However, given the multiplicity of issues to be considered in assessing the effectiveness of crisis resolution, there are several aspects one can usefully evaluate in the interim.

This chapter first assesses effectiveness in terms of its impact on normalizing market conditions in the short term. This assessment is performed by conducting a number of event studies that measure the effect of the announcements of market interventions by the authorities on different financial stress indicators. The study is limited to 13 advanced economies over a two-year period (June 2007 to June 2009), but covers 153 identifiable events.

The conclusions from the empirical work are only indicative of short-term responses, given

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the nature of event studies. The results indicate that in an environment of high market uncertainty and counterparty risks, such as that in the early phase of the crisis when solvency concerns were still nebulous, liquidity support announcements were the most promising. Announcements of recapitalization and, to a lesser extent, asset purchases were most effective in the later stages of the crisis as these measures helped alleviate credit risk.

The chapter also examines longer-term effectiveness by looking at volumes of issuance and general price movements of the financial instruments that the authorities have attempted to influence. While tying the specific policy interventions to longer-term effectiveness is very difficult due to intervening events and other confounding factors, the initial conclusions are that some market prices appear to be stabilizing and issuance is picking up. The chapter then summarizes Japan's experience during the latter part of its "lost decade" and draws parallels to the current crisis.

Knowing what was effective when crisis policies were introduced may not necessarily provide guidance about unwinding these policies. In principle, however, if a measure is ineffective (in the short or long term) one might want to exit sooner than if it has worked upon entry. Other factors in assessing the effectiveness and cost of interventions are the ease with which they can be reversed or removed and the degree of distortion their ongoing use creates.

The chapter concludes with a summary of the key results and policy takeaways.

Interventions during the Crisis—Market Reaction to Announcements

In response to the severe disruption in financial markets, the authorities introduced a host of policy measures to unfreeze markets and restore confidence in the financial system. Figure 3.1 shows the cumulative set of interventions for the two years spanning the duration of the crisis for a sample of major advanced economies, indicating the acceleration of announced measures

immediately following the Lehman Brothers collapse on September 14, 2008. Given the importance at the height of the turmoil to urgently restore market confidence and prevent the collapse of the financial system in the near future, this section examines the short-term effectiveness of intervention announcements during the crisis. Specifically, this section analyzes the effectiveness of central bank and government intervention announcements on institutions and markets in stabilizing the market by utilizing a set of event studies drawing in part on Aït-Sahalia and others (2009).¹

The event study analysis concentrates on the immediate reaction of financial markets to crisis policy announcements. This methodology is well established, especially in the finance literature,² and is well suited to the statistical examination of a repeated set of actions. It focuses on announcement effects for a short period around an event, thus providing reliable and relevant evidence for understanding the impact of different policy interventions on financial market indicators. In this context, a policy is effective if, following the announcement, we observe a short-term positive market response

¹Regarding similar research on the assessment of crisis measures and specific effects of central bank interventions on interbank and derivatives markets, see Artuç and Demiralp (forthcoming); Baba and Packer (2009); Cihák, Harjes, and Stavrev (forthcoming); Deutsche Bank (2009); Meier (2009); Panetta and others (2009); and Taylor and Williams (2009).

²See Campbell, Lo, and McKinlay (1997) for a discussion of event studies. Kothari and Warner (2007) report that more than 500 event studies have been published since the 1970s. The event study is particularly suitable for the current setting, which allows us to define abnormal response as any permanent deviation from the recent past. Since all interventions in a particular country are tested on one country-specific market indicator at a time before the results are aggregated, we avoid common correlation problems if similar events are tested across different market indicators simultaneously. Any contamination effects of overlapping time windows are eliminated by the exclusion of clustered policy announcements (which, however, does not remove possible dependence of market responses to repeated policy measures). In addition, some events are excluded if they are too close to another large event that dominates in terms of economic magnitude.

that constitutes a break point in a downward spiral of declining financial stability and investor confidence.

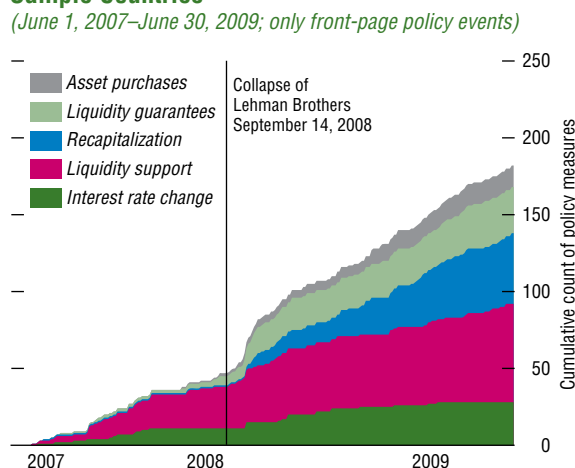
The study covers the period from the inception of the financial crisis in the summer of 2007 to the end of June 2009 and is separated into three subsamples: (1) the *pre-Lehman period* from June 1, 2007 to September 14, 2008, which is characterized by a series of predominantly central bank measures with a relatively narrow focus on arresting the downward spiral of counterparty confidence and unfreezing interbank markets; (2) *global crisis 1* from September 15, 2008 to December 31, 2008, which witnessed the most frequent and diverse types of policy intervention announcements by both central banks and governments in an environment of heightened urgency, when a clearer link was made between the financial crisis and a severe economic downturn; and (3) *global crisis 2* from January 1, 2009 to June 30, 2009, which continued with diverse but lower-frequency interventions, while witnessing the first signs of bottoming out.

The splitting of the period helps establish a consistent identification of effectiveness at different points in time, given the differential volatility of markets across the periods.³ Since the market response presumably hinges on the perceived timeliness and adequacy of announced measures contingent on the credibility of their sponsor, the examination of effectiveness is complicated by time-varying market perception of the underlying problem and the ability of public intervention to address it.

Event Database Construction

For the purpose of our analysis we classify policy events into five broad categories. Central bank actions are divided into (1) interest rate changes and (2) liquidity support, while government actions are divided into (1) recapitalization, (2) liability guarantees, including decisions

Figure 3.1. Time Pattern of Crisis Measures in Sample Countries
(June 1, 2007–June 30, 2009; only front-page policy events)



Sources: National sources; and IMF staff estimates.
Note: Euro area sample countries, Japan, Sweden, Switzerland, United Kingdom, and United States. This figure adds up the total number of policy measures introduced over time; it disregards the scale of each intervention, in both relative and absolute terms.

³Moreover, the tests for differences of means of the indicators of financial stress used in this study indicate significant differences between the subperiods.

Table 3.1. Classification of Events

Central Bank—Monetary Policy and Liquidity Support	
Interest rate change	Reduction of interest rates
Liquidity support	Reserve requirements, longer funding terms, more auctions and/or higher credit lines
	Domestic system lender of last resort: broader set of eligible institutions, wider collateral rules, and/or eligible collateral
	Other liquidity support (e.g., support of money market funds)
	Foreign exchange lender of last resort: forex swap lines (with other central banks) and forex repos
Government—Financial Sector Stabilization Measures	
Recapitalization	Capital injection (common stock/preferred equity)
	Capital injection (subordinated debt)
Liability guarantees ¹	Enhancement of depositor protection
	Debt guarantee (all liabilities)
	Debt guarantee (new liabilities)
	Government lending to an individual institution
Asset purchases ²	Asset purchases (individual assets, bank by bank)
	Asset purchases (individual “bad bank”)
	Provisions of liquidity in context of bad asset purchases/removal
	On-balance-sheet “ring-fencing” with toxic assets kept in the bank
	Off-balance-sheet “ring-fencing” with toxic assets moved to a “bad bank”
	Asset guarantees

Source: IMF staff estimates.

¹Includes the Federal Reserve’s liquidity support to AIG for toxic asset removal to a special-purpose vehicle, coupled with government’s loss sharing.

²Includes business loan guarantees as part of financial sector stabilization measures (e.g., the United Kingdom, Germany); for some countries, asset purchases were not conducted by the government, but (also) by the central bank (or a central bank-sponsored) agent, such as in the case of the United States and Switzerland.

to expand depositor protection schemes, and (3) asset purchases and guarantees. (Table 3.1 classifies the interventions in greater detail.)⁴

The database contains the official announcement of significant crisis-related policy measures by the following 13 countries: Austria, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, Spain, Switzerland, Sweden, the United Kingdom, and the United States. The measures that are recorded as events include central bank interventions and government actions. In contrast to other compilations of crisis policies, our event study dataset exclusively contains actual

announcements, dated as of their publication in official press releases, major newspapers, and news search engines.⁵

Since the analysis is predicated on the determination of the immediate market impact of significant policy decisions, announcements are screened as to the prominence of their media coverage and concentrate on the “front page” news events during the past two years.⁶ It is

⁵See also IMF (2009a). The degree of financial stress experienced during the crisis varies considerably across countries. In particular, stress in Japan has been less acute than in other sample countries primarily due to a lower exposure to subprime-related assets. In this analysis, however, the same analytical framework is used for all 13 countries for the sake of cross-country comparison and to be able to identify statistical significance.

⁶In the United Kingdom and the United States these are defined as events that appeared on the front page of the *Financial Times* or the *Wall Street Journal* during a window of four working days around the date of the

⁴Quantitative and credit easing were included in the interventions examined in an early version of the study. These have been dropped due to the very limited number of observations in the sample and because these measures do not directly address the stability of the financial sector.

assumed that events that contain multiple types of measures, the largest and most significant measure, representing a “driving force” for financial markets, would receive prominent news coverage. Table 3.2 reports the number of crisis interventions included in the study by country and by crisis subperiod.

In the event study, we test whether the announcements about a given type of intervention have a statistically significant impact on the following financial indicators: two index measures of stress—the Financial Stress Index (FSI) and the Economic Stress Index (ESI), constructed to broadly measure these stresses—the three-month LIBOR-OIS spread,⁷ and a composite index of the credit default swap (CDS) spread of the respective national banks. The event study is performed in two stages. The first stage tests the effectiveness of various interventions on measures that proxy policy objectives, as described below.

The impact of monetary easing via interest rate cuts is measured by its effect on the ESI. This index tracks the broad economic stress by integrating (1) forward-looking measures of business activity, approximated by the consumer and business confidence indices; and (2) forward-looking indicators of nonfinancial firms’ health, approximated by equity prices of nonfinancial companies and corporate credit spreads. (Annex 3.1 provides details on the construction of the ESI and the FSI.)

The impact of liquidity provisions is measured by its effect on the respective three-month LIBOR-OIS spread in the country of

Table 3.2. Number of Interventions

Country	Pre-Lehman	Global Crisis 1	Global Crisis 2
Euro area	13	19	17
Japan	0	4	3
Sweden	1	11	10
Switzerland	1	5	2
United Kingdom	7	6	5
United States	18	18	13
Total	40	63	50

Sources: National sources; and IMF staff estimates.

Note: Only announcements of crisis policy measures that passed the “front page criterion” of sufficient news coverage have been considered. Any announcements of subsequent changes or revisions to policy measure are not included.

interest, which is used as a proxy for the liquidity risk premium.⁸

The impact of financial sector policies, which include recapitalization, liability guarantees, and asset purchases and guarantees, is measured by their effect on the CDS spread of the respective national banks, which is used as a proxy for the credit risk premium.

In the second stage, the more general impact of policy events on the financial stress index is tested. The financial stress index is a composite measure of the relative stress in the domestic banking and credit sector that integrates the cumulative effect of (1) liquidity and credit risk (approximated by the LIBOR-OIS spread and the CDS spread); (2) expected profits/losses (approximated by banks’ equity prices); (3) the level of bank capital; and (4) lending condi-

official announcement. Thus, we also acknowledge that the intensity of news reporting may contribute to market perception as much as policy measures eliciting strong market movements that became front page news. For continental Europe and Japan, we broaden our screen of news sources to include all major national newspapers and test the robustness of our selection criterion by testing the consistency of eliminated observations for each sample subperiod and type of policy measure.

⁷LIBOR is the London Interbank Offered Rate; OIS is the overnight index swap rate.

⁸The LIBOR contains at least four identifiable components: the expected overnight risk-free interest rate, the term premium, the credit risk premium, and the liquidity risk premium (McAndrews, Sarkar, and Wang, 2008; IMF, 2008b). As the OIS contains little counterparty risk (McAndrews, Sarkar, and Wang, 2008), the LIBOR-OIS spread measures mainly the credit and liquidity risk premia in the interbank market, as confirmed in IMF (2008b), except for the pound sterling LIBOR-OIS spread, where the forex swap spread is also an important component. Further, McCormick (2007) interprets the LIBOR-OIS spread as the best way to measure the effectiveness of the coordinated action by international central banks to increase the willingness among banks to lend.

tions measured by the credit standards applied by banks.⁹

To measure the impact of each type of intervention announcement, we examine the *abnormal changes* of the selected stress indicator over a short period of time before and after each policy announcement—the *event window*. In this study, the event window covers one day prior to the announcement, the day of the announcement, and three days after the announcement. The abnormal changes are computed as a difference between the expected daily change of the market indicator and its actual daily change,¹⁰ under an assumption that no other factors moved the stress indicators in the short run. We then aggregate these day-to-day changes through time to construct cumulative abnormal differences for the event window. These differences are averaged across the same type of policy measure to calculate *average cumulative abnormal differences* for each country during each of the three identified crisis periods.¹¹ This allows us to statistically test whether the given

type of intervention announcement has a systematic, significant effect on the stress indicator under consideration. The tests employed in this chapter are parametric and nonparametric tests of means before and after the announcements. Tables 3.3 and 3.4 report the results for the two sets of tests. These results need to be interpreted with caution given the limitations of an event study, as discussed at the end of this section.

Summary of Findings of the Event Study

Table 3.3 summarizes the effectiveness of interventions on the different stress indicators as noted above.

Interest Rate Cuts—Effect on the Economic Stress Index

Most central banks reduced policy rates in all three subperiods of the crisis. However, only on a few occasions did this lead to a statistically significant reduction in the ESI. This is not surprising, since the effect of these cuts on the economic outlook, which has a longer horizon, is likely to be overshadowed by the more immediate negative effect of the financial crisis. In addition, these actions were to a large extent anticipated by market participants, implying that their effect was already taken into account before the actual cut took place. In general, however, lower policy rates contributed to lowering the funding cost to financial institutions of attracting additional liquidity.

Liquidity Support—Effect on the LIBOR-OIS Swap Spread

The results show the importance of liquidity support in the first period of the crisis (pre-Lehman). Even though most countries announced liquidity support measures during all three sample subperiods, the announcement of such measures is statistically significant primarily during the first subperiod. This response showed the need for additional liquidity when concern

⁹A caveat applies to event study results based on the stress indices. The indices consist of daily and monthly data series, in which the lower frequency monthly series are converted into daily/weekly series by interpolating between the available data points. Including interpolated monthly data could be viewed as expanding the event window. In late 2008, with a series of large shocks as well as policy announcements from various major countries clustered, estimation with a larger implied window is likely to be contaminated by other events.

¹⁰We refer to the daily change of the LIBOR-OIS spread during the crisis period as abnormal, since the average precrisis change in this spread was close to zero, leading to a noncrisis expectation of positive and negative spread changes cancelling each other out (i.e., level stationarity of mean-reverting spreads). This definition of abnormality implies a random walk process of the LIBOR-OIS spread with a diffusion commensurate to the length of the crisis time period under consideration. For the CDS spreads and the stress indices, the assumption of a random walk since the onset of the financial crisis in the summer of 2007 does not apply, so the expected daily change of the market indicator is subtracted from the actual daily change on each day of the event window in order to obtain abnormal differences (see Annex 3.2).

¹¹For the euro area, CDS spreads, the ESI, and the FSI are country-specific. Country-specific variables are used alongside the euro LIBOR-OIS spread to test the impact of domestic interventions as well as the European Central

Bank's interventions. We then average the results over all euro area countries.

Table 3.3. Effectiveness of Crisis Interventions

Index/Indicator	Monetary Policy		Financial Sector Policy		
	Interest rate cuts	Liquidity support	Recapitalization	Liability guarantees	Asset purchases
	Economic Stress Index	LIBOR-OIS spread	Bank credit default swap spread		
Country	Event window (–1/+3 days)				
Period 1: Pre-Lehman (06/01/07 to 09/14/08)					
Euro area	–	X	X	X	X
Japan	–	–	–	–	–
Sweden	–	X	X	X	–
Switzerland	–	X	–	–	–
United Kingdom	X	X	–	X	–
United States	X	X	–	X	X
Period 2: Global Crisis 1 (09/15/08 to 12/31/08)					
Euro area	X	X	X	X	X
Japan	X	X	X	–	–
Sweden	–	X	–	X	–
Switzerland	X	X	X	X	X
United Kingdom	X	X	X	–	–
United States	X	X	X	X	X
Period 3: Global Crisis 2 (01/01/09 to 06/30/09)					
Euro area	X	X	X	X	X
Japan	–	X	X	–	–
Sweden	–	X	–	–	–
Switzerland	X	X	–	–	X
United Kingdom	X	–	X	–	X
United States	X	X	X	X	X

Source: IMF staff estimates.

Note: Shading denotes a statistically significant intervention at the 10 percent level. The statistical significance of the short-term impact of intervention announcements is tested as follows: (1) interest rate cuts on the economic stress index; (2) liquidity support on the three-month LIBOR-overnight index swap (OIS) spread; and (3-5) financial sector interventions on credit default swap spreads of local banks, weighted by the size of total assets. Only the front page policy announcements have been considered. An unshaded “x” denotes statistically insignificant interventions and a “–” denotes that there were fewer than two front page policy events during the given subperiod. Statistical significance is attributed to policy measures only if both the parametric and the nonparametric tests concur (see Annex 3.2).

about counterparty credit risk meant banks were unwilling to lend in the interbank market.

As the crisis worsened, the announcement of liquidity support measures no longer had a direct impact on interest rate spreads. The knowledge by the markets that central banks would step in to provide the needed liquidity translated into a nonsignificant announcement value. This does not necessarily mean that liquidity measures were less effective, but rather that they may have been anticipated.¹² More-

over, by this time, solvency concerns had come to the fore. The event study results indicate that the effectiveness of liquidity injections diminished in the later stages of the crisis consistent with the notion that credit risk, rather than liquidity risk, became the main concern.

¹²One can test for the difference in effectiveness between surprises and anticipated events in those

announcements of monetary interventions for which market expectations are publicly available. Ait-Sahalia and others (2009) find that policy surprises during the crisis have some positive yet statistically insignificant impact on the market perception of counterparty risk.

Table 3.4. Effectiveness of Crisis Interventions on the Financial Stress Index

Country	Monetary Policy		Financial Sector Policy		
	Interest rate cuts	Liquidity support	Recapitalization	Liability guarantees	Asset purchases
Event window (–1/+3 days)					
<i>Period 1: Pre-Lehman (06/01/07 to 09/14/08)</i>					
Euro area	–	x	x	x	x
Japan	–	–	–	–	–
Sweden	–	x	x	x	–
Switzerland	–	x	–	–	–
United Kingdom	x	x	–	x	–
United States	x	x	–	x	x
<i>Period 2: Global Crisis 1 (09/15/08 to 12/31/08)</i>					
Euro area	x	x	x	x	x
Japan	x	x	x	–	–
Sweden	–	x	–	x	–
Switzerland	x	x	x	x	x
United Kingdom	x	x	x	–	–
United States	x	x	x	x	x
<i>Period 3: Global Crisis 2 (01/01/09 to 06/30/09)</i>					
Euro area	x	x	x	x	x
Sweden	–	x	–	–	–
Switzerland	x	x	–	–	x
Japan	–	x	x	–	–
United Kingdom	x	–	x	–	x
United States	x	x	x	x	x

Source: IMF staff estimates.

Note: Shading denotes a statistically significant intervention at the 10 percent level. The statistical significance of the short-term impact of intervention announcements is tested on the financial stress index. Only the front page policy announcements have been considered. An unshaded “x” denotes statistically insignificant interventions and a “–” denotes that there were fewer than two front page policy events during the given subperiod. Statistical significance is attributed to policy measures only if both the parametric and the nonparametric tests concur (see Annex 3.2).

Financial Sector Policy—Effect on the Composite Credit Default Swap Spread

In almost all cases, where there were enough events, announcements of capital injections have a significant impact on the average composite CDS spread, indicating that they were effective in reducing credit risk, although most of these events occurred during the second and third stage of the crisis. Announcements of liability guarantees reduced credit risk significantly in some cases (euro area and the United Kingdom), but not in the United States, perhaps because liability guarantees secure only a subset of creditors and not the bank as a whole. Wholesale funding guarantees are primarily aimed at restoring long-term funding markets, thereby targeting credit risk only indirectly.

Regarding the increase in retail deposit protection schemes, the effectiveness of this measure is related to bank runs, which is hard to measure with an indicator of credit risk.

Table 3.3 shows that announcements of asset purchases or guarantees led to a statistically significant reduction in a country’s average bank CDS spread in three cases, the euro area, Switzerland, and the United Kingdom. This confirms the initial success of the U.K.’s asset protection scheme (announced in January 2009) in reducing credit risk. The significant result for Switzerland is due to the government’s purchase of UBS assets. Given the large size of this bank in the domestic banking sector, the purchase of assets has led to a reduction in the average credit risk. Announcements of asset purchase

schemes in Germany and the United States were less successful, according to the event study results. The Dutch government's asset guarantee of ING had a small impact on the average credit risk premium for the sample of Dutch banks.

Effect on the Financial Stress Index

Table 3.4 summarizes the effectiveness of the same crisis policy announcements, in this case using the FSI as a composite indicator for overall financial stress (see Annex 3.1 for more details).¹³

An important difference with the results discussed above is that this test, in most cases, shows recapitalization announcements not having a significant effect on the FSI. This result could be explained by the lower sensitivity of this index to credit risk compared with CDS spreads, but also possibly because recapitalizations dilute future profits, which has a downward effect on equity prices. The other key difference compared to our earlier results is that announcements of monetary easing are more effective in reducing financial stress than economic stress. This might reflect the upward effect on equity prices, partly resulting from the positive income effect of lower interest rates for banks. During a financial crisis, bank profits might be more sensitive to funding costs given the limited extension of new credit compared to periods of normal market conditions.

Spillovers from Global and U.S. Crisis Interventions—Effect on the Financial Stress Index

Figure 3.2 illustrates the impact of global and U.S. crisis policy announcements on the FSIs of the euro area, Switzerland, and the United Kingdom, where “global” is defined as the policies of all foreign countries in the event study sample. The results suggest that global spillovers matter and are mostly driven by crisis interventions in

the United States. In general, during the phase preceding the Lehman Brothers collapse, spillovers were relatively small and primarily negative, increasing the FSI, except to the United Kingdom, which was influenced positively by U.S. interventions (first column of panels in Figure 3.2). Spillovers became much larger and adverse across all countries in the sample in the immediate post-Lehman period, as indicated by a large rise in the FSI (second column of panels). Once financial conditions began to stabilize alongside the introduction of sizable interventions in most affected countries and the economic outlook started to show signs of improvement in 2009, cross-border spillovers of policy announcements were favorably received, as measured by a fall in the FSI (third column of panels).

Assessing the Relative Efficiency of Interventions

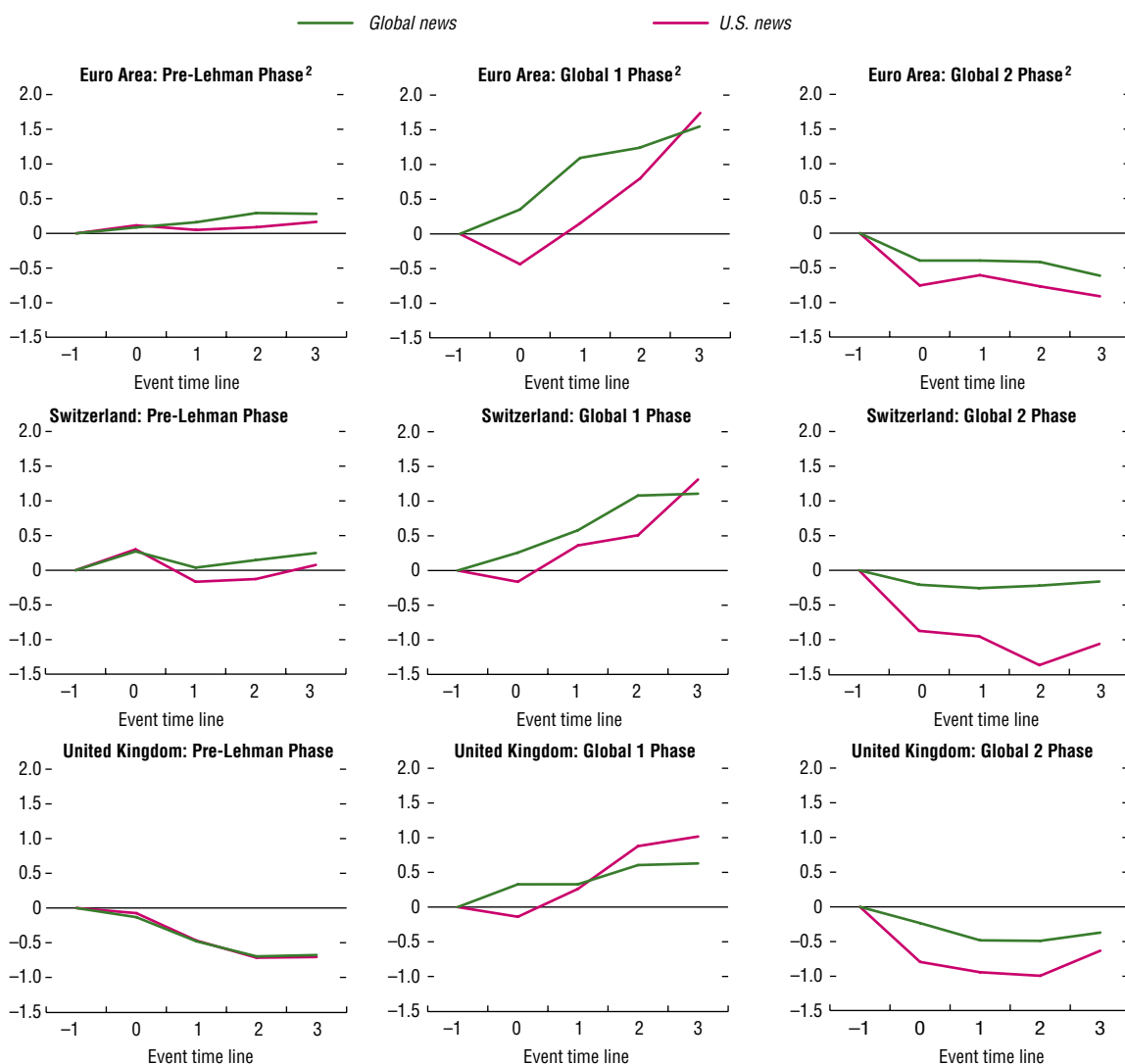
Table 3.5 illustrates the impact of a number of financial sector interventions (using only those that were statistically significant results of the event study) and compares it to the size of the intervention measured in percent of GDP. It indicates that liability guarantees were relatively efficient (biggest “bang for the buck”) early on in the United Kingdom, and their efficiency (measured by their impact relative to the scale of the intervention) declined in later phases of the crisis as shown by the effects in the euro area. Capital injections were efficient, especially once major stresses had abated, but their efficiency (although not shown) was highest if they were combined with other measures (e.g., after adoption of guarantees in the United Kingdom) or if they were repeated (e.g., second round of capital injections in the euro area).

Addressing the Shortcomings of the Event Study as an Analytical Tool

The results presented in the previous section should be interpreted in the context of a number of challenges that are associated with event studies along both the conceptual and the analytical fronts. This subsection proposes ways of addressing some of them.

¹³By combining indicators of both risk and performance, the FSI aims to provide a broad measure of conditions in the financial sector. One should be aware, however, that interventions can affect the individual underlying indicators differently and in opposite directions. For example, a bank recapitalization reduces risk but can have a downward effect on equity prices through the dilution of future profits.

Figure 3.2. Spillovers from Global and U.S. Crisis Interventions Reflected on the Financial Stress Index¹
(Average cumulative abnormal differences in index units)



Source: IMF staff estimates.

¹The Financial Stress Index is scaled between 0 and 100 over the sample period, with 100 denoting the most stressful episode.

²Sample euro area countries covered by the event study.

First on the conceptual front is the challenge of *identification*. Specifically, markets can react negatively because they perceive a policy measure as being introduced too late, or as inappropriate, insufficient, or not credible. Separating the information content of a measure from the

measure itself is difficult, too. During the early stages of the crisis, interventions may have been interpreted negatively by market participants, who may have seen the intervention as a signal that the condition of certain financial markets or institutions was worse than they had previ-

Table 3.5 Efficiency of Financial Sector Policy Measures

Country	Scale of Intervention				Impact ¹		
	Liability guarantees	Recapitalizations	Asset purchases	Total	Liability guarantees	Recapitalizations	Asset purchases
	<i>(In percent of GDP)</i>				<i>(In percent of periodic amplitude of credit default swap composite)</i>		
Euro area ²	15.79	1.82	1.08	18.7	Global crisis 1 -25.0	Pre-Lehman/Global crisis 1 -1.5/-12.0	Global crisis 2 -13.4
Japan	–	0.02	0.00	0.0	–	Global crisis 2 -5.9	–
Sweden	44.65	1.95	0.00	46.6	Global crisis 1 2.1	Global crisis 2 0.2	–
Switzerland	–	1.06	7.86	8.9	–	Global crisis 1 -2.6	Global crisis 1 -2.6
United Kingdom	10.94	2.19	38.89	52.0	Pre-Lehman -55.4	Global crisis 1/Global crisis 2 -21.7/-6.1	Global crisis 2 -5.4
United States	2.18	3.19	3.62	9.0	Pre-Lehman 16.6	Global crisis 1 -13.5	Pre-Lehman 16.6

Source: IMF staff estimates.

¹Pre-Lehman period: 06/01/07 to 09/14/08; global crisis 1: 09/15/08 to 12/31/08, and global crisis 2: 01/01/09 to 6/30/09. The number below the crisis subperiod label shows the ratio between the average market response of the respective type of financial sector policy and the amplitude of the LIBOR-overnight index swap (OIS) spread over the subperiod. A green number highlights a positive response due to a short-term reduction of the credit default swap spread, whereas a red number flags a negative market response.

²GDP-weighted composite of Austria, France, Germany, Greece, Ireland, Italy, Netherlands, and Spain.

ously thought. This could bias the event study results negatively. There is little we can do to distinguish among these possibilities to attain more precise identification.

A second conceptual challenge is *endogeneity*, as policymakers respond to market pressures and markets respond to policy announcements. Our approach addresses endogeneity effectively by looking for post-announcement effects that are large relative to the pre-announcement period and by focusing on a narrow event window, such as five days, a period in which policymakers are unlikely to be able to respond to markets.¹⁴

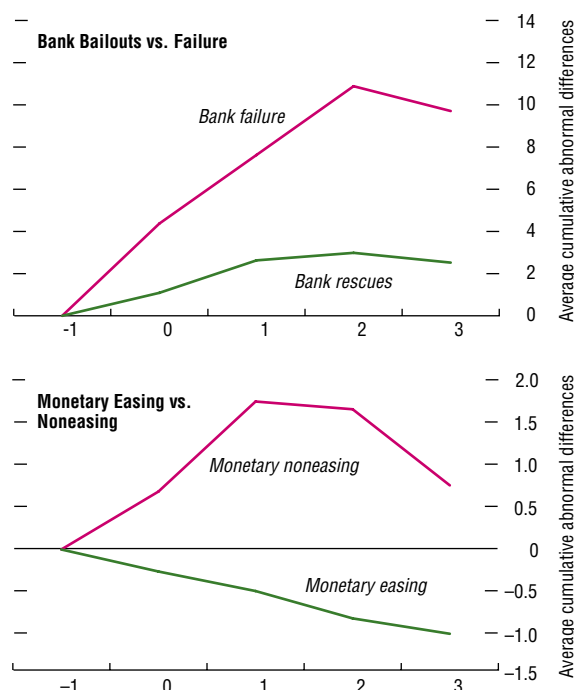
¹⁴The current choice of the event window attempts to control for different market conditions by keeping the time horizon short. A long time horizon before the event date would condition the magnitude of market response on the potential anticipation of interventions (as the realization of greater systemic risk manifests itself in higher perceived chances of policy action). Similarly, allowing a longer response time after the announcement of policies would acknowledge the sometimes very complex nature of some policy measure, whose impact is a result of a drawn-out information absorption by market participants. That said, an overly generous time horizon runs the risk of generating overlap in the timing and impact of a multitude of announcements within and across sample

Finally, *interpretation* is another conceptual challenge as we address the question of whether to assess effectiveness of policy in terms of a short-term market response or a sustained response. In addition, there is no clear guidance from the literature on how to address the difficulty of disentangling effects of different policies ex post, and we also have no formal counterfactual with which to compare.

That said, as a general way of examining a potential counterfactual, we have compared the relative short-term effectiveness of actions taken by the authorities to their *counterproductive actions*, defined as policy events that would be expected ex ante to increase market stress. Specifically, we examine the response of the FSI to no change in the policy rate and outright bank failures versus monetary easing and bank interventions. The results for the United States, for which we have a set of counterproductive interventions as defined above, indicate that

countries, including the chances of repeated policy announcements of the same type of intervention occurring within the same window.

Figure 3.3. United States: Impact of Counterproductive Interventions on the Financial Stress Index



Source: IMF staff estimates.
Note: The Financial Stress Index is scaled between 0 and 100 over the sample period, with 100 denoting the most stressful episode.

although policy interventions were not always highly successful in lowering financial market stress, the counterproductive interventions yielded a much worse response (Figure 3.3).

Follow-Up to Initial Market Reaction—Longer-Term Effects of Intervention

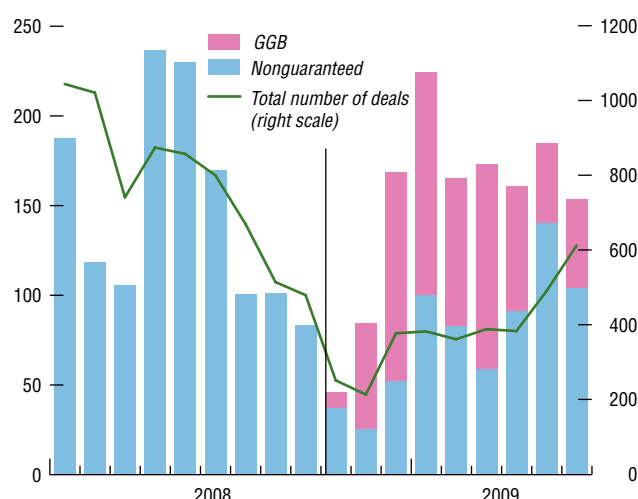
It is intrinsically difficult to discern trends of longer-term effectiveness, especially because as more time elapses from the time of the intervention, the more other events or general market developments influence the results. Despite such difficulties, this section discusses the effectiveness of crisis policies, with the understanding that such analysis will be, by definition, incomplete and heuristic.

The Impact of Crisis Interventions on Issuance

Bank liability guarantees. The financial crisis that began in the summer of 2007 brought about an abrupt decline in bonds issued by banks, with a particularly severe drop in investment-grade paper after April 2008 (Figure 3.4). Bank bond issuance rebounded in late 2008 but primarily under the protection of government guarantees. As noted in Figure 3.5, the guarantee schemes put in place by governments helped revive the bank bond market. Issuance increased in 2009 in all regions examined, with the largest portion of the increase coming from issuance of government-guaranteed bonds, except for Japan, which has not introduced a bond guarantee scheme. The effect of guarantees on bank liabilities was strongest in the United Kingdom, where the issuance of guaranteed paper replaced nonguaranteed issuance almost completely.

U.S. commercial paper. The Federal Reserve's Commercial Paper Funding Facility (CPFF), which was introduced in October 2008, helped to briefly revive issuance by financial institutions, but the declining trend returned in early 2009 (Figure 3.6). The CPFF did not appear to appreciably support the issuance of asset-backed commercial paper (ABCP), whose downward trend accelerated in 2009. This trend may have more to do

Figure 3.4. Government-Guaranteed Bonds (GGB) and Nonguaranteed Investment-Grade Bank Bonds
(In billions of U.S. dollars; left scale)



Source: DCM Analytics.
Note: The vertical line refers to the introduction of the bank liquidity guarantee scheme.

with the high proportion of ABCP that had been used as funding for structured credit product entities, which have themselves closed or obtained other funding sources. The issuance of commercial paper by nonfinancial corporations has been fairly stable throughout, although it declined somewhat in 2009, which might reflect the worsened economic outlook and unemployment, therefore the diminished demand for working capital often associated with commercial paper.

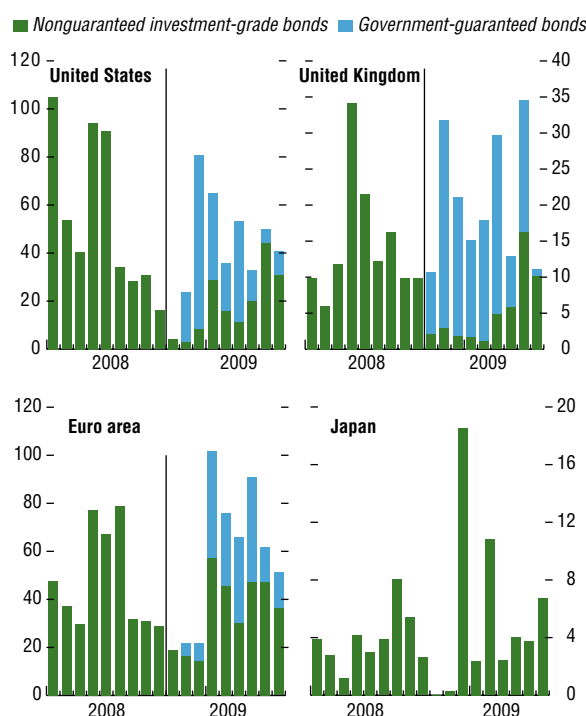
Securitization. The issuance of mortgage-backed securities (MBS) increased in the United States, most notably beginning in March 2009, when the Term Asset-Backed Securities Loan Facility (TALF) was announced and the Federal Reserve's agency MBS purchase program was expanded (Figure 3.7) (see also Chapter 2).¹⁵ The November 2008 original announcement of the MBS purchase program had been associated with only a small increase in MBS issuance. In Europe, higher securitization issuance in late 2008 was due to banks' strong increase in demand for liquidity, as nearly all issuance was pledged as collateral for central bank funding.

As regards covered bonds, the May 2009 announcement by the European Central Bank (ECB) that it would purchase €60 billion has been successful in reviving the euro area covered bond market, ending a two-quarter drought of jumbo issuance. The higher issuance has been accompanied by a decline in spreads.

Credit to the nonfinancial private sector. Bank credit growth to the nonfinancial sector has declined, although with a considerable lag. The abrupt drops exhibited in the United States, the United Kingdom, and the euro area did not come about until the second half of 2008. Although throughout the crisis both demand and supply factors have contributed to the decline in credit growth, the sharp drop after the Lehman collapse signals that supply was the dominant factor at that time (Figure 3.8). This is also reflected

Figure 3.5. Impact of Liability Guarantees on Bond Issuance

(Issuance in billions of U.S. dollars)

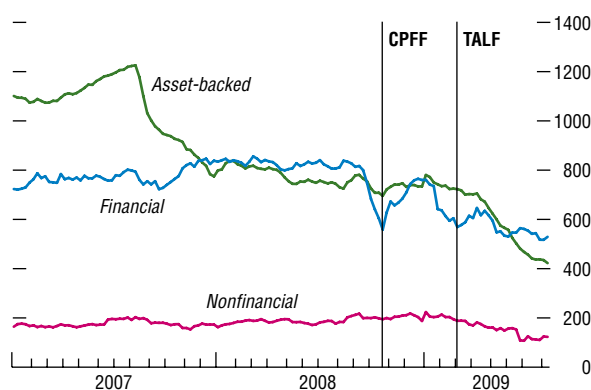


Sources: DCM Analytics; and national sources.

Note: Data include preferred shares. The vertical line refers to the introduction of the bank liquidity guarantee scheme in each country.

Figure 3.6. United States: Outstanding Amount of Commercial Paper

(In billions of U.S. dollars; seasonally adjusted)

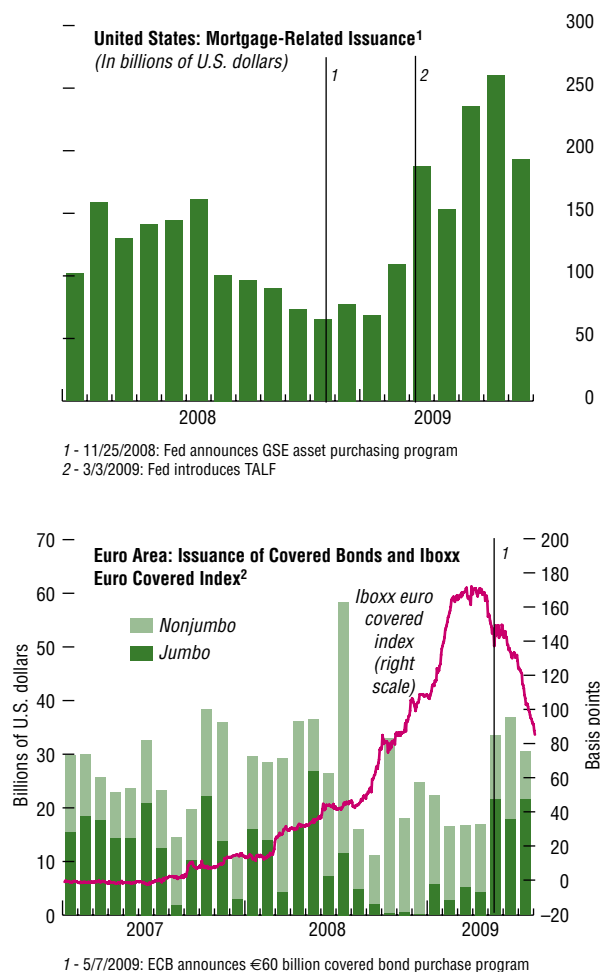


Source: U.S. Federal Reserve.

Note: CPFF = Commercial Paper Funding Facility; TALF = Term Asset-Backed Securities Loan Facility.

¹⁵The TALF includes loans for the purchase of commercial MBS but not residential MBS, so its direct effect is only on a portion of the mortgage-related issuance.

Figure 3.7. Securitization in the United States and Europe



Sources: Datastream; DCM Analytics; SIFMA; and European Securitization Forum.

¹Includes GNMA, FNMA, FHLMC mortgage-backed securities, CMOs, and private-label MBS/CMOs.

²Iboxx euro covered index is an indicator of the difference in the yield on a basket of euro-denominated covered bonds and interest rate swaps with a similar maturity; 7–10 year maturity of covered bonds and 10-year euro vs. LIBOR interest rate swaps are used for this figure.

in the tightening of credit standards by banks.¹⁶ Since the beginning of 2009 credit growth has returned to some extent in the United States and the United Kingdom, while it has continued to decline in both the euro area and Japan.

The Impact of Crisis Interventions on Liquidity and Credit Risk Indicators

LIBOR-OIS spreads. The longer-term effects of the various interventions on the LIBOR-OIS spread show improvement, according to the statistics in Table 3.6. As of end-June 2009, spread levels of all sample countries have declined between 53 and 90 percent from their respective crisis peaks. Based on standardized LIBOR-OIS spreads, however, we find that in some countries with large declines in absolute terms, spreads remain unusually high relative to their historical levels and compared to spread changes in other countries.

Another way of assessing the longer-term impact of interventions is by tracing their usage over time and plotting it against the LIBOR-OIS. In the United States, the immediate positive market response to liquidity support schemes, such as the Term Auction Facility (TAF) and CPFF, appears to be associated with a persistent decline of LIBOR-OIS spreads as these facilities gained popularity starting in late 2008 (Figure 3.9).

The extent of the usage of various unconventional central bank and government crisis policies should also be taken into account when contemplating the timing and modalities regarding their unwinding. Box 3.1 provides information on usage, while the section below on disengagement discusses the general principles of unwinding.

CDS spreads. The interventions that policymakers claimed targeted a reduction in credit risk were effective to some degree in reducing the average credit risk premium for banks, although the relative effectiveness differs across mea-

¹⁶See Chapter 1 for a more complete analysis of credit developments.

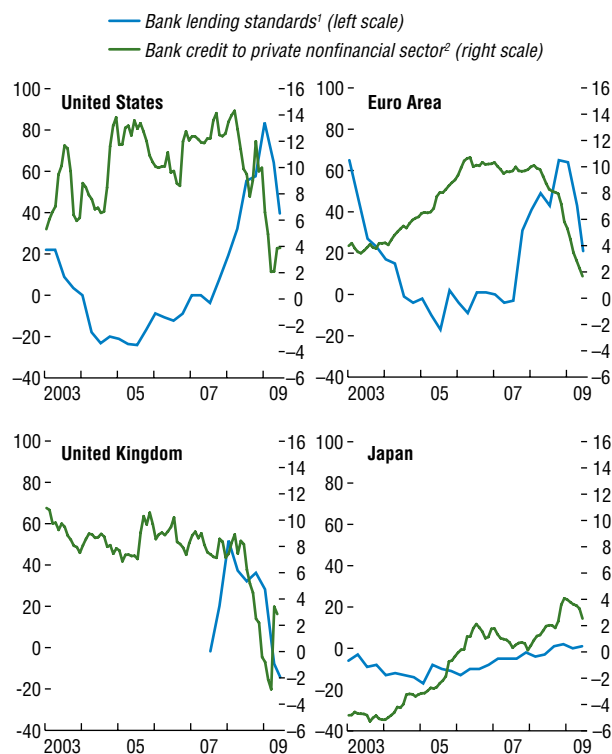
tures and countries (Figure 3.10). The rescue of Bear Stearns in March 2008 reduced credit risk premia not only in the United States but also in other countries, reflecting the degree of systemic interconnectedness and the importance of this rescue. This action contrasts with the rescues of other financial institutions, such as IKB in Germany, Northern Rock in the United Kingdom, and Anglo Irish Bank in Ireland, where the effect on perceived credit risk was smaller and primarily local. The collapse of Lehman Brothers marked a watershed in the financial crisis, as can be seen from the large jump in the risk premia in all countries shown.

The panel for the United Kingdom and to a lesser extent those for Germany and Ireland show a reduction in credit risk after the coordinated European Union (EU) measures in response to the financial crisis were announced on October 7, 2008. Ireland had already imposed wide-ranging guarantees, which were also effective in reducing credit risk. The panels of the two EU countries also show the effect of the recapitalization of domestic banks, which had a positive but limited effect compared to the internationally coordinated measures.

In all four countries examined, sovereign credit risk started to rise after October 2008, although less so for the United States, pointing to the negative effect of the crisis on public finances as financial risks were transferred to the public sector. Despite the numerous government measures, bank spreads continued to rise through March 2009. Since then, risk premia show a descending trend, perhaps reflecting that concerted fiscal measures have begun to stabilize the economic outlook.

Mortgage rates have been on a downward trend since October 2008. In addition, the U.S. authorities aimed to reduce mortgage rates through the agency MBS purchase program. As shown in Figure 3.11, there was some downward movement after both announcements, while the rates returned to an increasing trend in recent months. In the United Kingdom, where a guarantee scheme for ABS was announced in January 2009, mortgage rates continued their downward

Figure 3.8. Credit Growth and Bank Lending Standards

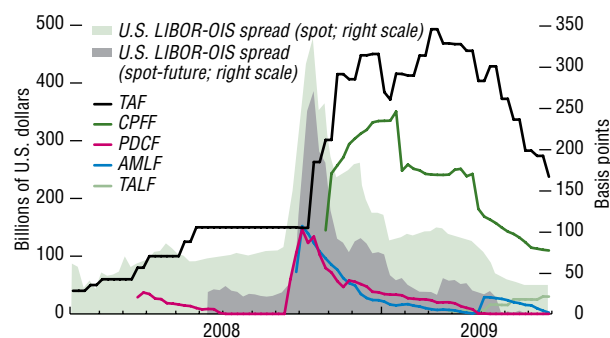


Sources: Haver Analytics; and national sources.

¹Net percentage change, a positive number indicates tightening of standards. Net percentage change refers to the difference between the percentage of banks that tightened standards and the percentage of banks that eased standards.

²Year-on-year percent changes through June 2009.

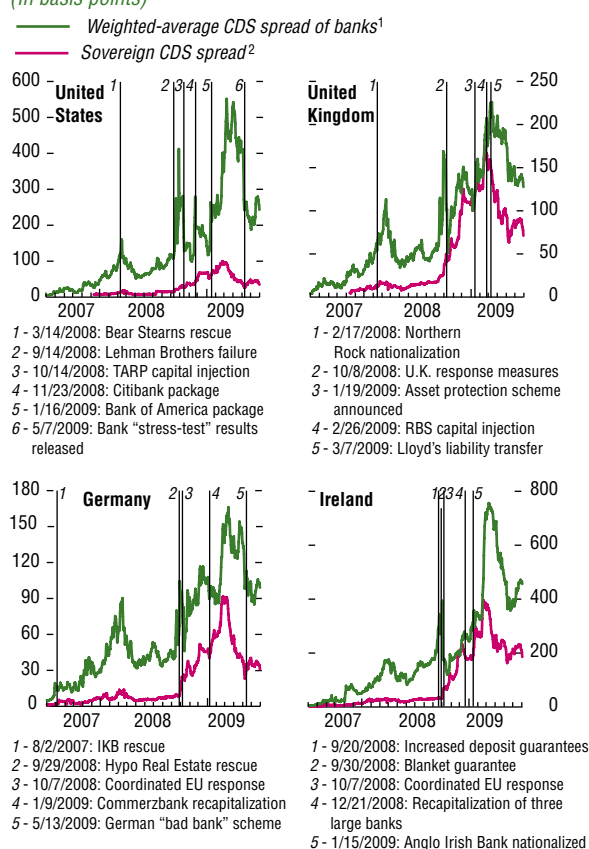
Figure 3.9. United States: Outstanding Amount of Unconventional Measures by the Federal Reserve



Sources: U.S. Federal Reserve; Bloomberg L.P.; and Datastream.

Note: OIS = overnight index swap; TAF = Term Auction Facility; CPFF = Commercial Paper Funding Facility; PDCF = Primary Dealer Credit Facility; AMLF = Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility; TALF = Term Asset-Backed Securities Loan Facility. The difference between the green and the gray shaded areas shows the U.S. LIBOR-OIS spread that is expected to remain over 1.5 years at each point in time since 2008.

Figure 3.10. Impact of Financial Sector Stabilization Measures on Credit Default Swap (CDS) Spreads
(In basis points)



Sources: Datastream; and national sources.

¹The asset-weighted average of CDS spreads of the top banks.

²Five-year sovereign CDS spreads.

trend, although there does not seem to be a direct link to the introduction of the guarantees. Mortgage rates also declined in the euro area, where no additional programs were introduced.

Japan's Experience during the Latter Part of Its "Lost Decade"

As discussed above, it is too early to conduct a full assessment of the long-term impact of crisis policies, as more time is needed to observe outcomes in both the financial and economic spheres. In that sense, the Japanese experience from the "lost decade" might serve as a unique precedent for investigating the effectiveness of a variety of interventions, since most of the measures that have been employed during the current crisis—both monetary and financial sector policies—were tested during the 1990s and early 2000s. That said, we should pay due attention to the differences in the underlying economic conditions.

Effectiveness of Quantitative Easing in Earlier Japanese Experience

After a temporary recovery in 2000 led by the global dot-com boom, the Japanese economy worsened again. (Box 3.2 provides a summary of the Japanese experience in the 1990s.) The Bank of Japan (BoJ) responded with a large quantitative easing intervention. The targeted amount of liquidity (defined as the current account balance held by banks with the BoJ) increased gradually, finally reaching 35 trillion yen during the peak of the policy, or about eight times required reserves (Figure 3.12).

During the quantitative easing period, despite the more serious nature of the crisis relative to the 1997–98 phase in terms of the number of failed banks (Figure 3.13), the TIBOR/LIBOR spread,¹⁷ which had spiked in 1997–98, did not move (Figure 3.14). This suggests that the massive liquidity provision under quantitative easing was effective in reducing liquidity and counterparty credit concerns in money markets,

¹⁷TIBOR is the Tokyo Interbank Offered Rate.

although the longer-term effect of quantitative easing on inflation is not clear (Figure 3.15).

Government Initiatives for Disposing of Nonperforming Loans

Quantitative easing, however, was not helpful in addressing the root causes of the financial crisis regarding doubts about bank solvency. In the fall of 2002, the Japanese government introduced the Program for Financial Revival, under which banks were urged to accelerate the disposal of their nonperforming loans after conducting a rigorous examination of their loan portfolio with more stringent standards for provisioning than before. The major banks also faced quantitative objectives for disposing of nonperforming loans. The liquidity provision under quantitative easing allowed for the implementation of these measures without disruption to the financial markets.

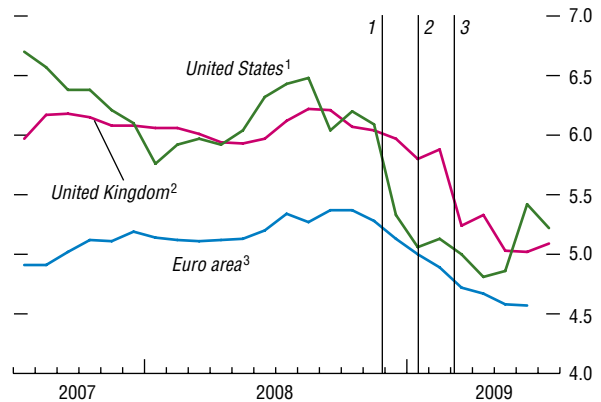
The stringent measures to cleanse bank balance sheets helped restore stability in Japan's financial system during the course of 2003, and there have been no bank failures since then. The blanket guarantee on bank liabilities initiated in 1996 was finally removed in March 2005. A year later, when the annual consumer price index growth turned positive, the BoJ terminated the quantitative easing policy, shifting to the short-term interest rate as its operating target for conducting monetary policy.

Lessons from the Japanese Experience

Some parallels drawn from the Japanese experience and the current crisis are discussed below.

- In Japan, government guarantees on bank liabilities, as a stand-alone measure, were not sufficient to arrest the downward spiral of financial stress. Although the Japanese government introduced such guarantees at an early stage, a prolonged financial crisis was not avoided. In the current crisis, the individual effectiveness of liability guarantees is hard to determine, as these were introduced mostly alongside other measures. Their early

Figure 3.11. Mortgage Rates
(In percent)



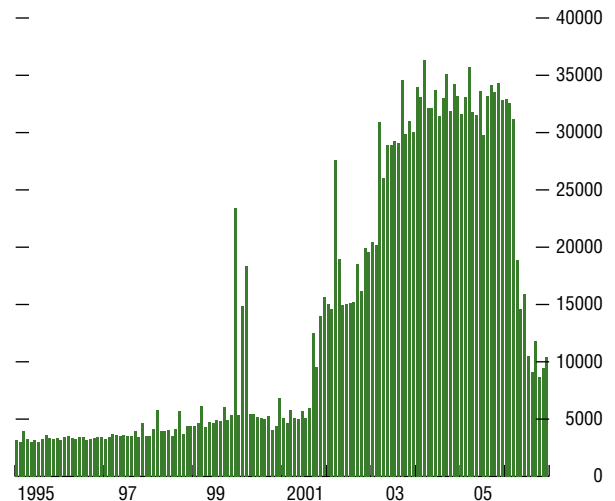
1 - United States: 11/25/2008: U.S. Federal Reserve announces government-sponsored enterprise asset purchasing program.
2 - United Kingdom: 1/19/2009: U.K. government to provide guarantees on eligible AAA-rated mortgage-backed securities.
3 - United States: 3/3/2009: U.S. Federal Reserve introduces Term Asset-Backed Securities Loan Facility.

Sources: Haver Analytics, Bank of England, and European Central Bank.
¹Conventional 30-year mortgage rate.

²Monthly average of U.K. resident banks' sterling weighted average interest rate on loans secured on dwellings to households, new advances, initial fixation over 10 years.

³Interest rate on loans to households for house purchase, initial fixation over 10 years.

Figure 3.12. Banking Sector Current Account Balance with the Bank of Japan
(In billions of yen)



Source: Bank of Japan.

Table 3.6. Three-Month LIBOR-Overnight Index Swap (OIS) Spread: Declines from Peak

Crisis Period	Euro Area	Japan	Sweden	Switzerland	United Kingdom	United States
Current LIBOR-OIS spread level (as of June 30, 2009), in basis points	50	37	44	32	78	37
Current LIBOR-OIS spread decline (as of June 30, 2009), in basis points	-149	-43	-112	-127	-166	-324
In percent of peak level (Lehman collapse) ¹	-75	-53	-72	-80	-68	-90
In standard deviations from peak level (weighted by periods) ²	-2.0	-3.4	-1.8	-0.5	-1.8	-1.5
<i>Memorandum items:</i>						
LIBOR-OIS peak level, in basis points	199	80	155	159	244	361
LIBOR-OIS peak level, in standard deviations	3.4	5.6	5.0	6.1	3.6	5.2

Source: IMF staff estimates.

¹The peaks of the LIBOR-OIS are specific to each country or region: euro area (10/13/2008), Japan (12/18/2008), Sweden (11/27/2008), Switzerland (11/12/2008), the United Kingdom (12/4/2008), and the United States (10/10/2008).

²The decline of the LIBOR-OIS spread series relative to their peak levels is expressed in terms of standard deviations from the median change in each subperiod weighted by the number of days in that subperiod (pre-Lehman, global crisis 1, and global crisis 2). Using such a standardized measure of changes in LIBOR-OIS spreads allows better comparability across sample countries (and helps quantify relative policy effectiveness over the longer term by allowing the different subperiods to reflect the different lengths of periods).

introduction in the United Kingdom and the United States did not forestall the crisis.

- Aggressive liquidity provision by the BoJ coupled with recapitalization by the government was effective in reducing financial market stress. As indicated in the event study results, this seems to hold in the current crisis as well. Although the 2002 crisis in Japan was much more severe than its 1997–98 experience in terms of the number of failed banks, financial markets remained surprisingly stable. Much of this has been attributed to the large amount of excess reserves provided by the BoJ during the quantitative easing policy.
- While massive liquidity provision by the BoJ was effective in reducing stress in the markets, it did not address the root cause of the financial crisis or the solvency of financial institutions. On the contrary, the high liquidity levels could have discouraged banks from taking aggressive action to cleanse their balance sheets. Japan only exited its “lost decade” after the introduction of the Program for Financial Revival in 2002, which dealt effectively with the solvency issue.

Contrary to conventional economic theory, the massive provision of excess reserves by the BoJ did not seem to have a discernible impact on credit growth. This has also been the case with the current crisis, especially in the United States,

where reserves have increased 80-fold. In Japan, the amount of bank loans outstanding continued to decline for nine years and growth did not turn positive until 2006 (with an associated significant drop in the money multiplier). There are two likely factors, which are not mutually exclusive but whose relative impact is hard to analyze: (1) there was no strong demand for credit, since large-scale deleveraging was taking place in the real sector (corporates in particular); and (2) on the supply side, even with massive reserves at hand, banks were reluctant to extend credit because impaired assets continued to reside on their balance sheets. This points all the more urgently to the need for well designed and communicated policy initiatives for dealing with impaired assets.

Disengagement: A Conventional Primer for Unwinding Unconventional Policies

In addition to assessing the short- and longer-term effectiveness of crisis policies, it is important to consider the ease with which these can be unwound and the degree to which they distort the market. The large variety of measures introduced during the current crisis as well as cross-border considerations render the sequencing of disengagement important.

The market response to a particular crisis policy is not necessarily a criterion for how easy it is to exit such a policy, though ineffective interventions, if these can be clearly identified, should be removed early. Moreover, an insignificant market response to an intervention or its low utilization by institutions and markets does not necessarily mean that such a policy is a failure, since its presence alone may have provided a stabilizing influence. It is therefore difficult to predict how financial stability will be affected by a premature unwinding.

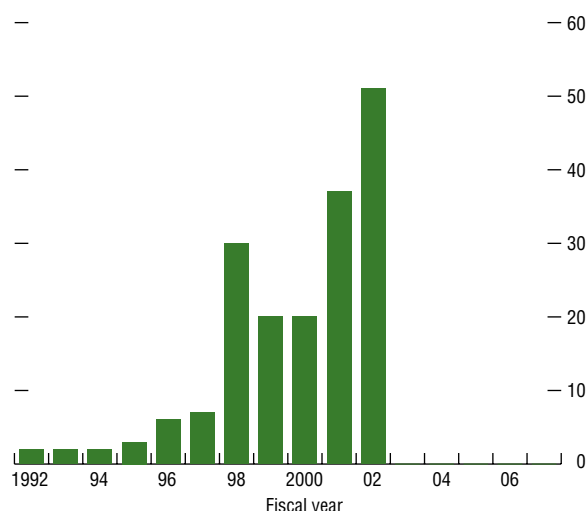
Objectives of Exit Strategies

It is important to develop at an early stage credible and coherent disengagement strategies to roll back crisis interventions when market conditions permit and the economic outlook is on a firm recovery path. Successful disengagement will require coherent sequencing and clear communications from monetary, regulatory, and fiscal authorities. Specific unwinding plans will need to be tailored to the various policy areas and carefully coordinated, providing assurances to markets on achieving medium-term policy goals, while avoiding the risk of a premature withdrawal of support when conditions are still fragile.

Central banks can usefully devise and communicate plans to unwind unconventional measures to ensure a smooth return to market-based financial intermediation and to forestall concerns that excessive liquidity could eventually drive a resurgence of inflation. Some liquidity support measures have already started to unwind naturally as market conditions normalize, but central banks will need to ensure that they have the tools to start tightening the policy stance, while recognizing that they may have to keep some illiquid assets on their balance sheets for some time.

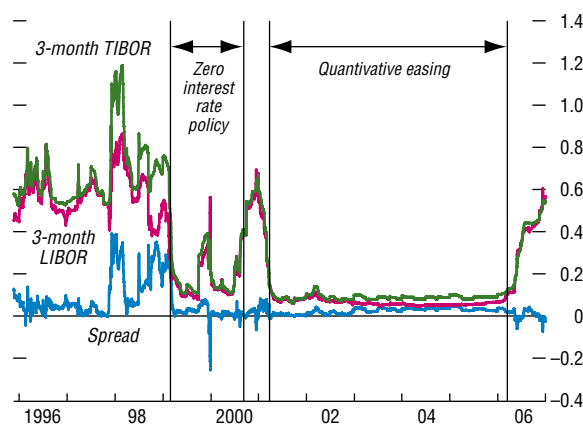
In light of the large fiscal costs of the crisis, governments, too, will need to consider how to remove financial risks acquired from their interventions. As the recovery becomes firmly established, forceful fiscal consolidation

Figure 3.13. Failed Banks Assisted by Deposit Insurance Corporation of Japan
(In numbers)



Source: Deposit Insurance Corporation of Japan.

Figure 3.14. Three-Month Spread between TIBOR and LIBOR
(In percent)



Source: Bloomberg L.P.

Box 3.1. Usage of Unconventional Central Bank Facilities

This box examines the current usage levels of various unconventional central bank market operations.

Central Bank Facilities

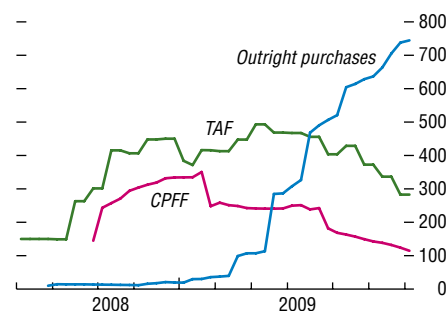
In the United States, the Federal Reserve introduced a variety of instruments to provide short-term liquidity to the money markets, including the Term Auction Facility (TAF) and the Commercial Paper Funding Facility (CPFF) in an earlier stage of the crisis (see table). Later, the Fed launched programs that use longer-term instruments as collateral for loans, such as the Term Asset-Backed Securities Loan Facility (TALF, up to five years) as well as outright purchases of agency debt, agency mortgage-backed securities (MBS), and U.S. treasury securities. There is still a large amount of room for further outright purchase of agency MBS. Moreover, actual subscriptions for the TALF have been limited, while the program could expand to \$1 trillion. On the other hand, outstanding amounts from the TAF and the CPFF have been shrinking in recent months as liquidity concerns in money markets have receded (see figure).¹

The Bank of England, which had relied upon existing instruments for liquidity provision, introduced the Asset Purchase Facility in March 2009, under which it can purchase government bonds (gilts), commercial paper, and corporate bonds on an outright basis.

Note: Kazuhiro Masaki prepared this box.

¹The focus of the discussion is on the TAF and CPFF as the two largest of the short-term liquidity provision facilities.

Outstanding Amount of U.S. Federal Reserve's Operations
(In billions of U.S. dollars)



Source: U.S. Federal Reserve.

Note: Total outright purchases of agency debt, agency mortgage-backed securities, and U.S. treasury securities. For U.S. treasury securities, the figures are the changes from end-March 2009. TAF = Term Auction Facility; CPFF = Commercial Paper Funding Facility.

The ceiling for purchases under this facility was raised in August 2009 from £125 billion to £175 billion.

The European Central Bank (ECB) has extensively used its Long-Term Refinancing Operations for liquidity provision. Since last autumn, auctions have been conducted on a fixed-rate, full allotment basis in order to fully accommodate the demand for liquidity of banks. The duration of the operations has been lengthened gradually up to one year. In addition, the ECB announced in June 2009 that it will start purchasing covered bonds up to €60 billion, which is relatively small for the size of its balance sheet.

becomes necessary to ensure the sustainability of public finances.¹⁸

To avoid an overly abrupt adjustment at the global level, disengagement will need to be

¹⁸A discussion of the fiscal implications of government interventions in the financial system is beyond the scope of this chapter. See IMF (2009b).

considered in a multilateral context. Multilateral coordination will be important to mitigate cross-border distortions for some types of interventions during both the exit phase and the post-crisis period.

This section elaborates on these main objectives of disengagement strategies and lays out elements for planning the unwinding process.

Major Crisis Interventions Introduced by Central Banks

	Maximum Amount	Amount Used as of end-June 2009
Bank of England (in billions of pounds sterling)		
Outright purchases of assets		
Asset Purchase Facility ¹	175	105
Bank of Japan (in billions of yen)		
Short-term liquidity provisions		
SFSOFCF ²	Unlimited	7,467
Outright purchases of assets		
Commercial paper	3,000	197
Corporate bonds	1,000	174
European Central Bank (in billions of euros)		
Short-term liquidity provisions		
Long-term refinancing operations ³	Unlimited	728
Outright purchases of assets		
Covered bonds	60	0
U.S. Federal Reserve (in billions of U.S. dollars)		
Short-term liquidity provision		
TAF	— ⁴	282
CPFF	— ⁵	114
Long-term liquidity provision		
TALF	1,000	25
Outright purchases of assets		
Agency mortgage-backed securities	1,250	462
Agency debt	200	97
Treasury securities	300	184

Sources: Bank of England; Bank of Japan; European Central Bank; and U.S. Federal Reserve.

Note: TAF = Term Auction Facility; CPFF = Commercial Paper Funding Facility; TALF = Term Asset-Backed Securities Loan Facility;

SFSOFCF = Special Funds-Supplying Operations to Facilitate Corporate Financing.

¹Purchasing commercial paper, corporate bonds, and gilts.

²Providing liquidity against collateral of private credit instruments at a fixed rate, full allotment basis up to three months.

³Providing liquidity at a fixed rate, full allotment basis up to one year.

⁴The amount is determined at each auction.

⁵There is a limit per issuer.

The Bank of Japan (BoJ) launched the Special Funds-Supplying Operations to Facilitate Corporate Financing (SFSOFCF), which provides liquidity on a fixed-rate, full allotment basis against corporate debt as eligible collateral. In addition, the BoJ started purchasing commercial

paper and corporate bonds on outright basis.² Actual subscriptions have been very limited compared to the maximum allocated amount.

²Corporate bonds with a residual maturity up to one year are eligible.

Central Bank Interventions

For expository purposes, it is useful to discuss separately the mechanics of the central bank's unwinding process, which depend on the tools that the central bank has at its disposal, and its monetary policy targets. Clearly the two go hand-in-hand. The central bank has to consider when and how to withdraw

from the segments of the markets in which it had intervened (asset side). The objective is to return to the use of the interest rate as the monetary policy instrument aiming at price stability and, where relevant, the outlook for growth. This can be done even in the face of high excess reserves, although the scale of reserve accumulation to date is a challenge.

In terms of mechanics, when the central bank holds short-term assets, it can easily mop up excess reserves by simply letting these assets mature. (Box 3.3 discusses the role of excess reserves as an indicator of liquidity and discusses their role in this crisis.) In particular, if liquidity facilities are demand-driven, unwinding takes place automatically when funding markets improve and banks reduce their demand for precautionary excess liquidity. This unwinding process can be encouraged further if borrowing from the central bank is provided at a rate that would restore normal market incentives.

As suggested by Figure 3.16, in the case of central banks whose increase in reserves is larger than the increase in short-term instruments, such as the Bank of England (BoE) and the Federal Reserve, retiring short-term instruments would not be sufficient to mop up excess reserves entirely. The ECB, on the other hand, which has provided liquidity through relatively short-term instruments (up to one year), can absorb excess reserves fully by reducing just part of these short-term instruments. It should be noted, however, that the ECB has also increased the duration of its liquidity provision after the one-year liquidity operation it carried out earlier this summer, so reducing excess reserves would take a bit longer if the ECB let the borrowing expire at maturity.

When the central bank extends liquidity by purchasing long-term instruments, such as government and corporate bonds or a variety of impaired structured credit products, it would need to sell or exchange them in order to unwind excess liquidity.¹⁹ Specifically, central banks such as the Fed and the BoE that increasingly relied upon long-term instruments (some with maturities of up to 30 years) will likely need to sell or exchange a substantial part of their long-term holdings in the process of disengaging.

¹⁹If assets on the central bank balance sheet remain impaired, their sale would incur a loss for the central bank. The decision about whether the central bank balance sheet would be cleansed of impaired assets through, for example, an exchange for government securities, would need to be part of a comprehensive fiscal package that deals with the legacy of the crisis.

Asset sales can proceed if a market for the assets exists, which is not necessarily the case for some central bank holdings. Sales of relatively illiquid instruments or large quantities should proceed with caution as selling could destabilize still fragile markets. (See Box 3.4 for a discussion of the changes in the balance sheets of the major central banks during the crisis.) Moreover, when central banks hold large portfolios of government debt, the government should avoid the temptation to influence their disposal and respect the independence of the central bank.

On the liabilities side, the central bank can use additional instruments of market operations, such as liquidity-draining repo operations, and central bank bills, to absorb excess reserves (Table 3.7). In addition, by remunerating excess reserves, the central bank can determine the policy rate by setting a floor on the overnight rate.^{20,21} These operations could prove to be highly costly for a central bank, as they would also channel interest income from the central bank to banks. One of the concerns at present is whether the technical modalities of the withdrawal of excess liquidity will impair the ability of central banks to control interest rates, their main monetary policy tool, and whether the impact of the present high level of liquidity on credit growth could become inflationary.²² Experience since the fall of 2008—as well as Japan’s experience earlier in this decade—suggests that the existence of excess reserves

²⁰Interest-paying deposit facilities, where banks can store their liquidity surplus with the central bank, have a similar function depending on rates applied to the facilities.

²¹Raising reserve requirements can also be used when excess reserves have an inflationary impact through an aggressive credit expansion by banks. However, given the size of excess reserves at the major central banks, an unprecedented increase in reserve requirement ratios would likely be needed to have a meaningful impact. In addition, it is difficult to forecast banks’ precautionary demand for reserves precisely, if banks still feel nervous about their liquidity condition. Moreover, the policy signal of raising reserve requirements—often interpreted by markets as a permanent measure—may not be most fitting for managing the transition phase of exiting from a crisis.

²²Keister and McAndrews (2009) elaborate on how remunerating reserves addresses the risk of uncontrolled credit creation.

in itself does not necessarily have an inflationary effect when the financial system is seriously impaired. However, the timing of unwinding excess liquidity and, hence, the extent to which the central bank can rely fully on remuneration to deal with excess reserves, depends critically on the condition of the financial system.

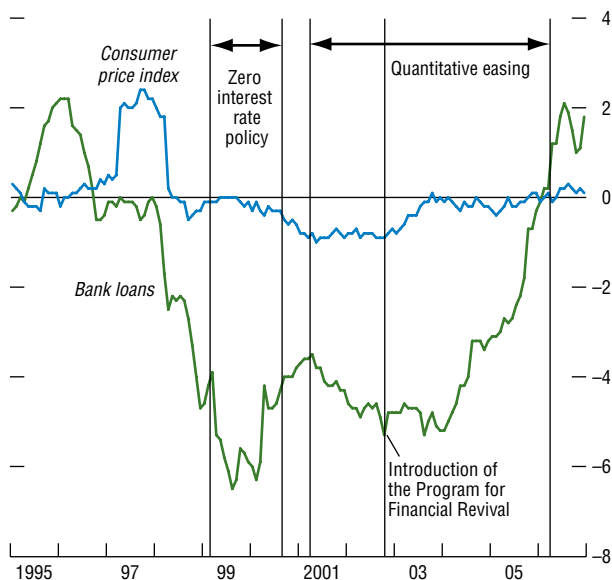
In sum, both the timing and the modalities of removing liquidity from the system are crucial to preserving price stability in the transition to the post-crisis period. It is yet unclear how the technical aspects of removing liquidity will interact with normal monetary policy decisions regarding the interest rate. A central bank could mop up excess reserves by issuing bills, performing liquidity-draining repo operations, auctioning fixed-term deposits, and/or raising the overnight rate by remunerating excess reserves. The remuneration of excess reserves could work as a useful monetary policy instrument in the transition period, when large amounts of excess reserves in the financial system may pose a risk of uncontrolled credit creation, although a monetary policy framework that relies entirely on remuneration has not been fully tested and may have specific drawbacks that would need to be addressed.²³

Therefore, the central bank should prepare credible plans regarding the timing and modalities of unwinding crisis interventions, including the introduction of additional operational tools as needed, so as to be able to withdraw the monetary stimulus in a timely manner if inflation expectations begin to rise. Additionally, the central bank should attempt to ensure that capital and money markets will not be adversely affected during this process.

²³The remuneration of excess reserves at a rate close to the liquidity-providing rate of the central bank could create an environment in which bank treasurers can borrow from and lend to the central bank at low cost. In this context banks may have little incentive to trade reserves in the overnight interbank deposit market. This could have a negative effect on the functioning of the money market and could lead, for example, to questions regarding pricing and the relevance of money market indices.

Figure 3.15. Japan: Bank Loans and the Consumer Price Index

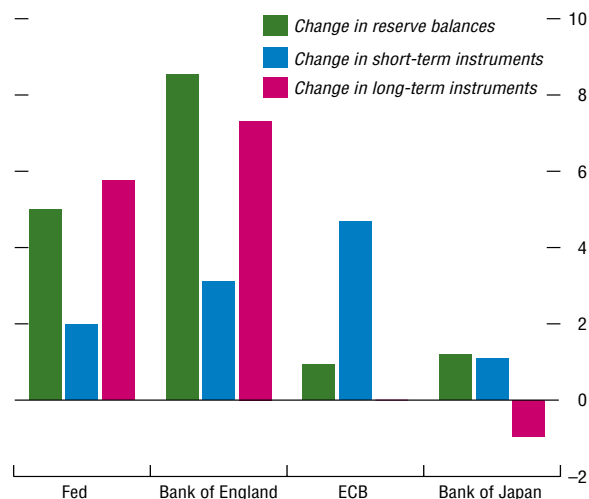
(Year-on-year changes; in percent)



Sources: Bank of Japan; and the Ministry of Internal Affairs and Communications of Japan.

Figure 3.16. Changes in the Major Components of Central Banks' Balance Sheets

(In percent of nominal GDP in 2008)



Sources: Bank of England; Bank of Japan; European Central Bank (ECB); and U.S. Federal Reserve.

Note: Changes between end-June 2007 and end-June 2009. Short-term instruments are of maturity up to one year; long-term instruments are one-year maturity or longer (at the time of intervention).

Box 3.2. Interventions during Japan's 1990s Financial Crisis

This box summarizes the crisis measures employed in Japan during the 1990s, prior to the introduction of quantitative easing in 2001.

The Japanese financial crisis became serious in 1995, when several regional banks and credit unions failed—virtually the first bank failures in the postwar history. The Bank of Japan (BoJ) initiated unprecedented measures such as emergency liquidity assistance. In an attempt to avoid a system-wide financial crisis, the government quickly responded by introducing a blanket guarantee on bank liabilities.

However, the blanket guarantee in itself was not effective in preventing larger-scale failures in subsequent years. In fact, Japan experienced the most acute phase of the financial crisis toward the end of 1997. After an outright failure of a medium-sized broker—the first default in the Japanese interbank market—money-market funding conditions tightened significantly due to mounting concerns about counterparty risk. Under these circumstances, several financial institutions, including Yamaichi Securities, one of the four major dealers, were forced to close within a couple of weeks.

After those large-scale failures, the use of taxpayer money finally gained political support and in March 1998 the first round of capital injections

took place. However, since the injections were carried out on a voluntary basis, banks were reluctant to apply for them and their low usage failed to stabilize the financial market.

During the fourth quarter of 1998, two of the largest banks in Japan, Long-Term Credit Bank and Nippon Credit Bank, were nationalized as part of a newly introduced resolution framework. In March 1999, a second round of capital injections took place, which, unlike the first round, included an examination of banks, urging them to apply for sufficient capital so as to raise their capital-adequacy ratio to about 10 percent. On the monetary policy front, the BoJ introduced a zero-interest rate policy in mid-February 1999 by providing excess reserves into the banking system, though on a smaller scale than the quantitative easing of later years. These crisis measures were helpful in ending the most acute phase of the financial crisis, as shown by the TIBOR/LIBOR spread.¹

¹The TIBOR (Tokyo Interbank Offered Rate) is a reference rate that is compiled by the Japanese Bankers' Association. Most of the reference banks for TIBOR are Japanese banks, while the reference banks for LIBOR are dominated by non-Japanese banks. The spread between TIBOR and LIBOR is often used as an indicator for measuring financial stress for Japanese banks during the financial crisis beginning in the late 1990s, because the crisis was specific to Japanese banks.

Note: Kazuhiro Masaki prepared this box.

Government Policy Regarding the Financial Sector

The timing of unwinding the government's crisis interventions should be determined by how much of their intended goals has been achieved, whether they have unintended harmful side effects that distort the markets, and by the size of fiscal costs, including contingencies. Guarantees by the government on bank liabilities or the losses stemming from their assets are examples of this kind of contingent liabilities. Regarding the ease of unwinding, some mea-

sures can be removed by simply letting them expire, while others require additional financial transactions to roll them back, which may have implications, including for the functioning of potentially still fragile markets.

Interventions made by the government can be categorized as in the paragraphs that follow (Table 3.8).

(1) Government Guarantees on Bank Debt²⁴

²⁴In addition to guarantees on banks' wholesale liabilities, a number of governments have expanded deposit

Table 3.7. Supplementary Operations for Managing the Central Bank Balance Sheet

	U.S. Federal Reserve	European Central Bank	Bank of England	Bank of Japan
Issuance of central bank bills (debt certificates)	Not available (Supplementary Financing Program used instead)	Not used	x	x
Reverse-repos	x	Not used (deposit auctions would be used instead)	Not regularly used	x
Remuneration on excess reserves	x (Recent)	Deposit facility for surplus reserves	x (Recent)	x (Recent)

Sources: Bank of Japan; Bank of England; European Central Bank; and U.S. Federal Reserve.

The government can withdraw the guarantee by simply not extending it, although guarantees on existing debt should remain in place until the date specified at the time of issuance. In addition, as conditions normalize, a reduction in the risk premium for nonguaranteed debt could create an incentive for banks to repay the guaranteed bonds early, given the additional fee that needs to be paid for the guarantee.

Although in a crisis bank debt guarantees help preserve financial stability by supporting funding liquidity, they are highly distortionary, since the government assumes the credit risk in place of the debt-issuing entity, thereby reducing the market incentive to monitor credit risk.²⁵ In addition, the measure carries contingent liabilities for the government, whose potential fiscal cost might be substantial. A timely exit from such guarantees is necessary, while international coordination is important to prevent cross-bor-

der arbitrage, potentially distorting international capital flows.

(2) Recapitalization

While selling of government stakes in the marketplace may have a negative impact on equity markets, repayment from recapitalized banks would normally signal an improved financial position for banks, with a potentially positive effect. This was demonstrated in the United States, where markets welcomed the repayment of Troubled Assets Recovery Plan funds by several financial institutions. The fact that the government owns a stake in financial institutions per se does not necessarily have a direct distortionary impact, as long as the recapitalized banks are managed on a commercial basis. However, the loss of a level playing field may influence market prices for bank securities, particularly if the government owns a large stake, since the public will likely presume that the government guarantees recapitalized banks' liabilities.

(3) Asset Purchases by Government

In some cases the government has purchased impaired, illiquid assets to help banks clean their balance sheet. As such, the measure is not likely to have a major distorting impact on banks' investment decisions going forward. These assets can be resold in the market, or governments could hold on to them until they expire. Here the most important government goal should be to generate

insurance by raising the maximum protected amount (some countries offer unlimited guarantees on certain types of depositors). The unwinding of expanded deposit insurance is not addressed in this section as it is primarily a crisis measure to protect retail depositors.

²⁵As an indicator of the degree of market distortion created by the public sector's assumption of private sector credit risk, we calculated the difference in the risk premium between government-guaranteed and nonguaranteed debt issued for a sample of three major banks. In the second quarter of 2009, the average risk premium for government-guaranteed paper was 350 basis points lower than for nonguaranteed paper for the banks in our sample.

Table 3.8. Reversibility and Impact of Financial Sector Measures

	Additional Transactions Required for Unwinding	Market Impact of Unwinding	Distortion to Market Mechanism	Contingency for Fiscal Cost
Guarantee on new liabilities	Not required	Relatively small Depends on market conditions at exit	Significant	Potentially significant
Recapitalization	Required	Sales in markets: Potentially large Repayment with market funding: Potentially large Repayment with retained earnings: Small	Minority stakes: Relatively small Controlling stakes: Relatively large, especially when: (1) the recapitalized bank is run by the government, or (2) implicit guarantee by the government is observed	Limited downside risk
Asset purchase	Required	Depending on how disposal of purchased assets is conducted	Small, though it depends on the type of asset	Limited downside risk (depending on purchase price and leverage)
Guarantee on existing assets (insurance)	Not required	Minimum	Relatively small	Potentially significant

the highest possible return by managing them well.

Since the appetite by the market for some of these instruments is likely to be small for some time to come, they may need to be held by the government for an extended period. If the government sells the assets only when there is sufficient demand, the market impact would be small. The potential cost to the government is largely determined by the price at which assets are sold and the amount of assets held by the government, both of which vary across countries and depend on market conditions.

(4) Asset Guarantees (Insurance) by Government

As long as this guarantee does not need to be utilized, it is relatively easy to unwind by simply letting it expire. Given that banks pay a guarantee fee, they are likely to have an incentive to end the guarantee as soon as conditions allow. The market impact of unwinding this measure is likely to be relatively small, if it is only unwound when the banks' financial position has improved or when the uncertainty about their underlying assets is adequately reduced. The potential fiscal

costs depend on the size of the guarantee, which can be substantial. Unwinding the measures eliminates the uncertainty about future government finances related to the guarantee.

The size of the overall fiscal costs of supporting the financial system during the crisis varies across countries and depends crucially on the size of government's crisis intervention in the financial system, and the length of time that the crisis policies need to remain in place. Those factors need to be considered when designing the disengagement.

Cross-Border Coordination of Exit Strategies

In globalized financial markets, lack of cross-border coordination could lead to unexpected consequences, including a disruption of international capital flows. On the other hand, given that the modalities and timing of recovery paths are likely to differ across countries, some divergence of unwinding may be natural and even desirable for some types of crisis policies.

In general, measures should be taken to prevent regulatory and financial arbitrage across jurisdictions, particularly where guarantees

Box 3.3. Excess Reserves as an Indicator of Funding Liquidity Concerns

This box discusses why excess reserves may be a more accurate barometer of liquidity provision during the crisis than the change in the overall size of the central bank balance sheet. It goes on to compare developments in excess reserves across the four main central banks.

Indicators for Gauging the Magnitude of Liquidity Provision by Central Banks

During a financial crisis, specifically one with funding liquidity problems, the size of the central bank's balance sheet is often used as an indicator of the amount of liquidity extended to the banking system. However, since currency in circulation remains largely unchanged in the short run, focusing on the total liabilities of the central bank may underestimate the impact of liquidity provided to the banking system. Banks' deposits with the central bank (alternatively called the "current account balance" or "reserves") may be a good additional indicator—and in some cases more accurate—for analyzing the supply and demand dynamics of liquidity provision and their implication for the financial system.

Reserves under Normal Circumstances

When conducting open market operations, the central bank, as the sole provider of reserves, determines the amount of reserves to be supplied to the banking system so that the actual overnight interest rates in the money market (the price of reserves) is determined to be close to the target rate set by the central bank based on its estimate of banks' demand for reserves on that day.¹ During normal times and in systems where central banks do not remunerate reserves, reserve balances rarely exceed required reserves as banks have no incentive to hold them.

Note: Kazuhiro Masaki prepared this box.

¹Banks may demand reserves for a variety of reasons, including (1) to meet reserve requirements; (2) for funds settlement between banks; and (3) to secure against a potential liquidity shortage (precautionary demand). Under normal circumstances, however, meeting reserve requirements is sufficient to cover the other types of demand, except for such special occasions as high payment days (e.g., at year-end).

Reserve Balances

(In percent of nominal 2008 GDP)

	Reserve Balances before Crisis (a) ¹	Reserve Balances end-June 2009 (b)	Ratio (b)/(a)
U.S. Federal Reserve	0.06	5.06	83.95
European Central Bank	2.03	2.96	1.46
Bank of England	1.23	9.73	7.89
Bank of Japan	1.85	3.09	1.67

Sources: Bank of England; Bank of Japan; Bloomberg L.P.; European Central Bank; U.S. Federal Reserve; and IMF, International Financial Statistics.

¹Average balance of April–June 2007.

Reserves during the Financial Crisis

Since the outbreak of the financial crisis in the summer of 2007, several major central banks have increased their reserves provision dramatically, although the relative magnitude has varied across countries. The dramatic rise in reserve balances suggests that banks' precautionary demand for reserves increased significantly due to their heightened liquidity concerns and that the central banks accommodated this demand to stabilize the financial markets. Several points relating to this development are worth noting:

- With the overnight interest rate approaching zero, the opportunity cost of holding excess reserves decreased, which might have increased precautionary demand. Put differently, excess reserves have worked as liquidity insurance with affordable premia.
- Some central banks (most notably, the Fed) started paying interest on excess reserves, giving banks an incentive to hold excess reserves. Remuneration changed the supply and demand dynamics of reserves, although the impact depends on the risk-adjusted differential between what the central bank and what the market would pay.
- Some central banks introduced new facilities, according to which liquidity can be drawn at the request of banks (e.g., full allotment refinancing operations at the European Central Bank). This allows the reserve balance to respond more swiftly to changing liquidity conditions.

Box 3.3 (concluded)*Cross-Country Comparison*

The magnitude of the increase in reserve balances varies significantly across the four main central banks (see table). A comparison of the balance at end-June 2009 with the average balance before the crisis shows that the change in the United States is by far the largest in absolute terms (84-fold).² Increases of reserve balances

²Average reserve balances before the crisis (April to June 2007) are used as a proxy for required reserves in the steady state because the concept of required reserves varies from country to country and, therefore, could lead to misleading comparisons. For example, vault cash can be used to meet the reserve requirement in the United States, while in some cases financial institutions not subject to reserve requirements keep balances with the central bank even under normal circumstances (Japan).

in the European Central Bank and the Bank of Japan are comparatively modest, at less than 100 percent of the average balance. However, such a comparison may be misleading, not least because there is a significant difference in the size of reserve balances with the central banks in relation to the size of the economy. Specifically, before the crisis, the ratio of the average reserve balances to nominal GDP was about 1 to 2 percent in the euro area, Japan, and the United Kingdom, while the same ratio was less than 0.1 percent in the United States.

In terms of the magnitude of the recent liquidity provision relative to GDP, the United Kingdom (9.73 percent) exceeds the United States (5.06 percent), while the euro area and Japan are comparatively modest at 2.96 and 3.09 percent, respectively.

apply to cross-border institutions or markets. Crisis policies that have a large distorting impact on financial markets would warrant cross-border coordination for unwinding, as arbitrage transactions across national borders with different degrees of guarantees could cause a disruption of international capital flows. Maintaining a level playing field across countries is essential for avoiding such arbitrage consequences.

A potential for cross-border arbitrage is particularly relevant when the removal of guarantees on bank liabilities is not coordinated across countries. Specifically, in cases of countries whose liability guarantee applies to all banks operating within the jurisdiction, including subsidiaries, banks can choose the location in which they issue debt through their subsidiaries in different jurisdictions. Spreads between guaranteed and nonguaranteed debt in various jurisdictions can be monitored so that such opportunities can be countered or anticipated.

On the other hand, cross-border coordination might be less crucial for measures dealing with banks' impaired assets, depending on the assets. Since already-purchased assets that are held on the government's balance sheet are unlikely to have a major distorting impact on market mechanisms, the government can enjoy some latitude in completing their unwinding. The government should carefully determine the timing of reversal so as to achieve the highest return with the minimum market impact. Since the pace of the recovery of the market for impaired assets is likely to vary across countries, some divergence in this area is also to be expected.

Conclusions and Policy Takeaways

Although it may be premature for a comprehensive assessment of the effectiveness of the authorities' crisis interventions, it is possible to examine different aspects of this complex area and to draw some preliminary policy conclu-

Box 3.4. Implications of the Changes on Central Bank Balance Sheets

As a result of unconventional interventions, central bank balance sheets have expanded and changed in composition. This box examines the potential risks involved and the implications for withdrawing the large amounts of excess liquidity provided during the crisis.

Basic Structure

A central bank provides the “monetary base” (i.e., banknotes in circulation and reserves held by banks with the central bank) by conducting monetary operations with financial institutions and/or by purchasing financial instruments. As an increase in liabilities goes hand-in-hand with an increase in assets (intervention in financial markets), so too the central bank must reduce its assets to reduce the monetary base on its liability side.

Note: Wouter Elsenburg and Kazuhiro Masaki prepared this box.

Changes during the Crisis

Under normal circumstances, central banks set the amount of reserves so that the overnight interest rate in the money market reaches the targeted policy rate. Banks have no strong incentive to hold additional liquidity, and actual reserve balances are about equal to required balances in most cases (see Box 3.3). Since the outbreak of the crisis these relationships have broken down, as central banks were no longer using reserve balances primarily to conduct monetary policy but rather to provide liquidity to financial institutions that were unable to access it in the interbank market. This in turn put downward pressure on overnight interest rates. Although it is not a direct concern at present—as central banks have been reducing overnight rates in response to lower inflation expectations and a deteriorating economic outlook—central banks are likely to reduce the

U.S. Federal Reserve

(In millions of U.S. dollars)

	27 June 07	1 July 09		27 June 07	1 July 09
Assets			Liabilities		
U.S. treasury bills	277,019	18,423	Currency in circulation	812,339	911,609
Primary credit	5	35,708	Government general account	4,039	78,142
Term Auction Facility		282,808	Supplementary Financing Program		199,939
Commercial Paper Funding Facility		114,693	Reserve balances	9,730	722,043
AMLF		14,807	Other	76,424	133,088
U.S. treasury notes	513,478	645,047			
Agency MBS, federal agency		560,272			
TALF		25,021			
Bear Stearns, AIG-related		105,616			
Other	112,030	242,426			
Total	902,532	2,044,821	Total	902,532	2,044,821

Note: AMLF = Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility; MBS = mortgage-backed securities; TALF = Term Asset-Backed Securities Loan Facility.

Bank of England

(In millions of pounds sterling)

	27 June 07	1 July 09		27 June 07	1 July 09
Assets			Liabilities		
Short-term operations	31,469	0	Banknotes in circulation	39,786	46,413
Long-term operations	14,999	91,212	Short-term operations (reverse)		0
Asset Purchase Facility		105,585	Reserve balances	17,354	140,453
Other	33,268	29,784	Other	22,596	39,715
Total	79,736	226,581	Total	79,736	226,581

Short-term instruments (less than one year)

Long-term instruments (one year or longer)

Box 3.4 (concluded)

level of excess liquidity. Until this process has been completed, central banks can control the policy rate through a variety of instruments.

Changes in the Risk Profile

The purchase of assets such as mortgage-backed securities and commercial paper, by central banks has increased their credit and valuation risks (see tables). In addition, extending liquidity through new facilities that have broadened the set of eligible securities that central banks accept as collateral as well as the number of eligible counterparties has also raised counterparty credit risk.

In addition, the crisis has changed the income position of central banks, although the net effect is not necessarily clear cut. On the one hand, low returns on central bank assets that correspond to both banknotes and reserves have reduced revenue. On the other hand, liquidity injections have increased the amount

of reserves over which interest is received, thereby increasing central bank profits.

Issues with Withdrawing Liquidity

Looking ahead, central banks may face some important trade-offs. A careful exit strategy might warrant a gradual reduction of reserves, as a quick sell-off could disrupt financial markets. If, at the same time, inflation expectations start increasing, central banks may need to increase the remuneration rate they pay on excess reserves as a means to implement the targeted policy rate. Although this extra cost for the central banks could be offset by the extra revenue resulting from the expanded balance sheet, central banks face a substantial income risk. In addition to remunerating excess reserves, central banks have a variety of other options for reducing liquidity such as issuing central bank bills, reverse repos, or increasing the reserve requirement.

European Central Bank

(In millions of euros)

	29 June 07	26 June 09		29 June 07	26 June 09
Assets			Liabilities		
Gold and foreign currency	338,836	475,476	Banknotes in circulation	633,076	762,146
Main refinancing operations	313,499	167,902	Government account	69,701	153,378
Long-term refinancing operations	150,002	728,598	Current account balances	182,086	268,244
Marginal Lending Facility	1,104	326	Deposit facility	1,100	236,235
Other	405,012	625,017	Other	322,490	577,316
Total	1,208,453	1,997,319	Total	1,208,453	1,997,319

Bank of Japan

(In billions of Japanese yen)

	30 June 07	30 June 09		30 June 07	30 June 09
Assets			Liabilities		
Japanese government bills (short-term)	21,493	20,871	Banknotes in circulation	75,837	76,739
Short-term repo	18,538	24,278	Current account balances	9,691	15,746
Commercial paper		197	Other	14,543	17,357
Corporate bonds ¹		174			
Japanese government bonds (long-term)	49,653	45,182			
Other	10,387	19,140			
Total	100,071	109,842	Total	100,071	109,842

¹Corporate bonds with a residual maturing up to one year.

Short-term instruments (less than one year)

Long-term instruments (one year or longer)

sions. This chapter has followed a multi-pronged approach by assessing (1) short-term effectiveness of policies in terms of their immediate impact in stabilizing the market; (2) longer-term effectiveness by looking at debt volumes and price indicators; and (3) effectiveness in terms of the ease with which policies can be unwound. A number of parallels have been drawn between the effectiveness of interventions during Japan's "lost decade" and those during the current crisis.

Although policymakers are now naturally looking to the effectiveness of their crisis interventions in the longer term, a number of conclusions can be drawn from the results of the event study regarding short-term effectiveness in reducing the market turmoil. Such effects may be short-lived, but nonetheless they could be useful if they provide information on what calmed financial markets and, hence, improve the policy response to future crises that exhibit similar types of market stress. The event study conclusions are summarized below.

- Liquidity support announcements were initially effective, as measured by the reduction in the LIBOR-OIS spread. They lost significance as the crisis worsened and markets began to anticipate the provision of additional liquidity as the crisis evolved from one of liquidity to one of solvency.
- In almost all cases, announcements of capital injections were effective in reducing credit risk, while announcements of guarantees on bank liabilities were effective only in a few cases. Announcements of government support of bank assets, through either guarantees or outright purchases, were effective in the short run in even fewer cases.
- The results of the event study illustrate that the short-term impact of interventions depended on the particular circumstances that prevailed during each phase of the crisis.

The results of the event study that focus on short-term effectiveness in calming markets have a number of similarities with the Japanese crisis of the previous decade.

- In Japan, as well as now, government guarantees on bank liabilities as a stand-alone

measure were not sufficient in arresting the downward spiral of financial stress at the peak of the crisis.

- Aggressive liquidity provision by the BoJ coupled with recapitalization by the government was effective in reducing financial market stress.
- While massive liquidity provision by the BoJ was effective in reducing stress in the markets, it did not address the root cause of the financial crisis or the solvency of financial institutions.

The chapter also examined longer-term effectiveness by looking at volumes of issuance and general price movements of liquidity and credit risk indicators that the authorities have attempted to influence. While tying the specific policy interventions to longer-term effectiveness is very difficult due to intervening events and other confounding factors, the initial conclusions are that some market prices appear to be stabilizing and issuance is picking up.

While the evidence is, as yet, circumstantial, the rebound in bank debt issuance following bank debt guarantees is striking, especially in the United Kingdom. While overall bank credit appears relatively unresponsive, some specific credit markets have responded well—for example, the TALF in the United States has encouraged some types of securitization and the covered bond markets in Europe have rebounded following the ECB's introduction of the covered bond purchase plan. The longer term responsiveness of prices in some targeted markets is also evident: the LIBOR-OIS spread has retraced much of its widening and mortgage rates are lower.

Regarding the criteria for planning the disengagement of crisis interventions by central banks and governments, some key principles are summarized below.

- In principle, the interest rate policy of central banks should be guided by inflation expectations and the economic outlook, as is the case with monetary policy during normal circumstances. However, under the current circumstances, the unwinding

of market interventions by central banks, including quantitative easing, should also take into account financial market conditions depending on the types of interventions.

- The reversibility of unconventional measures differs significantly depending on the types of interventions. For the measures that require additional transactions to unwind or those that will have a major market impact at the time of exit, a gradual unwinding would be warranted. In such cases, disengagement should be designed and communicated so that the unwinding can be completed in an orderly manner. For instance, central banks could start reducing excess reserves before a policy rate increase becomes imminent, although if a rate increase is needed to stem inflation expectations, the central bank need not delay. As for the reprivatization of intervened banks, a credible plan should be formulated and communicated as early as possible.
- Regarding the monetary stimulus provided by unconventional policies, if policy rates are very low, the absorption of excess reserves could help ensure better control over monetary policy, since the two are intertwined, and skillful management of the central bank balance sheet is warranted. The central bank could use additional instruments such as sales of its own bills to mop up liquidity or remuneration on excess reserves. The use of these instruments would come at the cost of reduced income for the central bank.
- In determining the sequencing of disengagement from various government financial sector measures, once financial stability has been established, priority should be given to exiting from those that have a significant distortionary impact on financial markets or involve considerable contingent liabilities for the government. Based on these criteria, it would be reasonable to unwind government guarantees on bank debt earlier than disposing of impaired

assets acquired by the public sector. In both cases, however, the relevant markets need to be able to withstand the disengagement without reverting to unstable financial market conditions.

- Cross-border coordination is especially important for measures that have a major distortionary impact on financial markets in order to discourage arbitrage transactions that could cause disruptions to international capital flows. This is especially relevant for government guarantees of cross-border bank liabilities, where market participants can easily take advantage of arbitrage opportunities. The timing for the withdrawal of guarantees should be discussed by the relevant national authorities.

Given the complexities of disengagement, clear communication about unwinding strategies—not only *when* to start the process, but also *how* the entire process is designed (pace, duration, etc.)—is imperative to retain market stability and manage expectations, especially regarding inflation. In particular, policymakers need to send clear messages that starting the exit process does not necessarily mean a rapid withdrawal of policy support.

Managing expectations in financial markets is essential to achieve a smooth transition to the post-crisis environment. For example, although careful and early planning for disengagement is advised, it would not help to pre-announce dates for reversing policies, as this would be likely to provide arbitrage opportunities. On the other hand, policymakers can usefully allow market participants to prepare for disengagement in advance of the actual unwinding. It could be desirable, for example, to identify trends for a set of financial and/or macroeconomic indicators that can be used as guideposts for timing the unwinding, while keeping in mind that such guideposts can sometimes be difficult to interpret when there are large, short-term fluctuations. Nonetheless, policymakers should attempt to provide some guidance to markets prior to disengaging so that the chances of renewed instability are avoided.

Annex 3.1. Financial and Economic Stress Indices²⁶

This annex defines the construction of the financial and economic stress indices.

Financial Stress Index

The financial stress index draws partly on the index used in IMF (2008a) and consists of the following data series:

- (a) LIBOR-OIS spread of country or currency area;
- (b) CDS spreads of local banks, weighted by the size of total assets;
- (c) The inverse of the stock prices of local banks, weighted by the size of total assets;
- (d) The inverse of tangible common equity of local banks, weighted by the size of total assets;
- (e) Country lending standards; for the euro area countries covered in the study, the euro area survey was used;
- (f) Amount of nonfinancial credit extended per country.

All these indicators are standardized by subtracting the mean and dividing by the standard deviation for every observation. In addition, all lower frequency series are converted into daily/weekly series by linearly interpolating between the available data points.

Economic Stress Index

The economic index consists of the following series:

- (a) Inverse of consumer confidence;
- (b) Inverse of business confidence;
- (c) The average spread of A, AA, and BB rated corporates vis-à-vis government bonds;
- (d) The inverse of the stock prices of nonfinancial companies.

All lower frequency series are converted into weekly series, by linearly interpolating between the available data points.

²⁶Wouter Elsenburg and Sylwia Nowak prepared this annex.

The sample period for the indices is from January 1, 2007 to June 30, 2009, a total of 130 weekly observations.

Banks Included in Indices

The banks were selected based on size and data availability. The banks included by country are as follows:

- Austria: Bank Austria, Erste Bank, Volksbank.
- France: BNP Paribas, Société Générale, Credit Agricole, Natixis.
- Germany: Deutsche Bank, Commerzbank, BHV, Deutsche Postbank.
- Greece: Ergasias.
- Ireland: Bank of Ireland, Allied Irish Bank, Anglo Irish Bank.
- Italy: UniCredito, Intesa, Monte di Paschi, Popolare.
- Netherlands: ING, Fortis, Rabobank.
- Spain: Santander, Bilbao, Banesto, Banco Popular, Español.
- Sweden: Skandinaviska, Svedska, Swedbank.
- Switzerland: UBS, Credit Suisse.
- United Kingdom: Barclays, RBS, HSBC, HBOS, Lloyds, Standard Chartered.
- United States: JP Morgan, Bank of America, Citigroup, Wachovia, Wells Fargo, National Citi Corp.

Annex 3.2. Event Study Methodology and Data²⁷

The event study assesses the effects of a policy intervention on the price of a particular asset or index of assets, such as the LIBOR-OIS spread, as well as composite measures of financial and economic stress. This annex describes the methodology of different parametric and nonparametric event study test statistics that analyze the market response to policy events since the onset of the financial crisis in July 2007.

The effect is examined over a short period of time before and after each policy announcement—the *event window*—covering one day prior to the announcement, the day of the announce-

²⁷Andy Jobst prepared this annex.

ment, and three days after the announcement.²⁸ The daily changes of the indicator variable are assessed (for example, the LIBOR-OIS spread) within each event window. In order to determine whether these differences are economically meaningful and statistically significant, these changes are measured conditional on the relative change of volatility before and during each event window. In addition, the analysis also considers the possibility of asymmetric tail behavior of abnormal changes and the incidence of abnormal changes independent of any distributional assumptions.

The event study technology aggregates the abnormal differences of the selected market indicator within each observation window to construct cumulative abnormal differences. These differences are averaged across the same type of policy measure to calculate average cumulative abnormal differences for each country during each of the three identified crisis periods. Studying the day-to-day differences in the series over a short period of time implies that there is no need to model time-varying behavior of the LIBOR-OIS spread, including nonlinearities and nonstationarity.

We assume that the daily changes of the LIBOR-OIS spread during the crisis period constitute abnormal changes (without reliance on historical sensitivity to general market movements in conventional market model methods), given that the average pre-crisis change in this spread was close to zero.²⁹ However, the expectation of positive and negative spread changes

offsetting each other over a short period of time cannot be applied to the other market indicators. Thus, the expected daily change of the market indicator, estimated to be the average daily change over the previous 20 working days, is subtracted from the actual daily change on each day of the event window in order to obtain abnormal differences.

Based on the historical information about the time trend and volatility of daily changes of the market indicators, we perform tests of means before and after the announcements³⁰—both parametric and nonparametric—to judge whether the event induces a significant market response.³¹

We define the *parametric* test statistic as the ratio between average cumulative abnormal differences and three different measures of historical volatility of the market indicator over an estimation period of 20 days before the event window: (1) the square root of the sum of squared differences; (2) the standard deviation of simple differences; and (3) the expected prediction error (derived from a simple autoregressive process with a one-period lag) adjusted by the ratio between the volatility during both the estimation and event periods. As opposed to the first two (conventional) measures of volatility (Mikkelsen and Partch, 1986), the alternative specification of volatility in (3) accounts for changes in volatility on a day-to-day basis within the event window relative to the empirical experience. The last specification gives some weight in the volatility measure to cases in which crisis policies may have been anticipated by markets. The standardized abnormal changes derived from these parametric measures are tested for convergence to both the standard normal distribution and a generalized extreme value distribution calibrated to the higher moments of daily changes during the

²⁸The results from the event study analysis are robust to shortening the event window from five to three days. However, we do not consider lengthening the event window due to clustering of the events, especially in the fall of 2008. Further, we implicitly assume that starting the event window one day prior to the official announcement is sufficient to capture the possibility that the policy measures could have been anticipated one day in advance.

²⁹In contrast to event studies using equity prices that often control for moves in the overall stock market (a market model) or control for multiple variables (a factor model), this assumption implies a zero-factor model of abnormal returns based on a random walk of changes in levels.

³⁰We specify both parametric and nonparametric tests in line with Patell (1976), Brown and Warner (1985), Boehmer, Musumeci, and Poulsen (1991), and McKinlay (1997).

³¹Studying the day-to-day differences in the series with permanent changes over a short period of time implies that there is no need to model time-varying behavior, including nonlinearities and nonstationarity.

estimation window. The latter null hypothesis of expected changes of abnormal returns restricts statistical significance only to those observations that are truly exceptional even at a time of large changes in the market indicator.

In light of the time trend of market indicators during the different crisis periods under consideration, nonparametric tests are also used. Based on Corrado and Zivney (1992), we apply a standard sign test, which determines whether the incidence of positive or negative responses to a particular type of policy measure is statistically significant under normality. However, such a test statistic captures only the dominant direction of market responses and ignores the relative magnitude of market response in either direction. Thus, we introduce the new sign-size test that can accumulate the different magnitudes of individual market responses to the various event types. Using this test, a crisis measure would be deemed significant only if there is a positive market response, which, on average, is also larger than any negative response to the same type of policy measure over the sample time period.

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