Summary

The asset allocation decisions of investors are at the core of financial flows between markets, currencies, and countries. This chapter aims to identify the fundamental drivers for these decisions and determine whether their influence has been altered by the global financial crisis and the subsequent low interest rate environment in advanced economies. In particular, the chapter investigates whether changes in investor behavior pose downside risks for global financial stability.

To set the stage, the longer-term developments in global asset allocation show three main trends: (i) a gradual broadening of the distribution of assets across countries, implying a globalization of portfolios with a slowly declining home bias; (ii) a long-term decline in the share of assets held by pension funds and insurance companies in favor of asset management by investment companies; and (iii) the increasing importance of the official sector in global asset allocation through sovereign wealth funds and managers of international reserves.

The analysis shows that private asset allocation is driven most strongly by positive growth prospects and falling risks in the recipient countries, while interest rate differentials between countries play a lesser role. The analysis does not, however, imply that capital flows in general do not respond to interest rate differentials, since other components, including investment flows of short-term leveraged investors (such as those from the carry trade)—which this chapter does not examine—might still be affected by changes in interest rates.

Beyond these longer-term trends and investment drivers, the empirical results and survey responses indicate that asset allocation strategies of private and official institutional investors have changed since the onset of the global financial crisis. Most importantly, investors are more risk conscious, including regarding the risks associated with liquidity and sovereign credit. Also, the structural trend of investing in emerging market assets has accelerated following the crisis; and with many first-time investors taking advantage of the relatively better economic performance of these countries, the risk of a reversal cannot be discounted if fundamentals (such as growth prospects or country or global risk) change. For larger shocks, the impact of such reversals could be of the same magnitude as the pullback in flows experienced during the financial crisis.

In touching on the potential effect of regulation on the asset allocation of institutional investors, the chapter suggests that initiatives like Solvency II for European insurance companies may push these institutions away from their traditional role of taking on longer-term risky assets, potentially dampening the positive impact of one class of "deep pocket" investors.

Regarding sovereign wealth funds and reserves management, the chapter suggests that sovereign asset allocation may provide a counterweight for changing private sector behavior. As heightened risk awareness and regulatory initiatives push private investors to hold "safer" assets, sovereign asset managers may take on some of the longer-term risks that private investors now avoid.

This chapter aims to describe recent changes in the global asset allocation of long-term investors, explain the drivers of those changes, offer an assessment of the associated risks that may be building up in the context of the current extraordinary economic and policy environment, and investigate their more lasting implications. In particular, it will explore to what extent the persistence of low interest rates in advanced economies has fundamentally altered global asset allocation and associated investment decisions of long-term unleveraged investors and whether any changes in behavior of those investors hold downside risks for global financial stability.

In this context, the chapter will focus on the following questions:

- What are the trends in global asset allocation in the past decade, and what are their determinants? Do trends and determinants differ by country or region?
- Have the financial crisis, the sovereign debt crisis in Europe, and low interest rates in advanced economies fundamentally altered investment decisions, perhaps pressing long-term investors toward riskier investments to augment their poor returns in advanced economies? Are there growing risks for a reversal of investment flows to emerging economies, and if so, how would that affect capital flows? In the longer term, is financial stability compromised as a result of these developments?

The chapter takes as its point of departure the asset allocation decision of the individual investor. This sets it apart from much of the existing literature, which focuses on investment flows from the macroeconomic point of view, and derives most of its analysis from balance of payments flow data.[1] In this chapter's more integrated view, changes in asset allocation over time are the fundamental driver of financial flows into and out of markets, currencies, and countries. We focus on unleveraged (real money) investors, including individuals, public and private pension funds, insurance companies, and managers of sovereign wealth, which together are a sizable source of underlying capital flows.

An extensive literature links asset allocation to an investor's objectives and the risk and return characteristics of individual assets (Annex 2.1). It is assumed that investors behave predictably when such characteristics change: when the return of an asset increases without changes in its riskiness, investors are expected to want to hold more of that asset. Similarly, when an asset is seen as more risky (because its return is more variable, for example, or the risk of default increases) without offering a higher return, investors would want to hold less of it.

The financial crisis has raised the possibility that some of the parameters in these relationships—or even investors' objectives themselves—have changed. Anecdotal evidence abounds, and can sometimes seem contradictory. For example, investors, spooked by the financial turmoil, are said to have become much more sensitized to risk, including to "tail events," that is, events with a small probability but with large (adverse) effects, and are seeking to protect themselves against associated potential losses. Similarly, after disruptions in some markets during the height of the financial turmoil, investors are more focused on market liquidity, which is the ease with which an asset can be sold. These structural changes interact with cyclical factors: despite increased sensitivity to risk, persistent low interest rates may push some investors (especially those with the need to earn a certain minimum return to match expected payouts on their liabilities) to take on additional risk in alternative assets and in smaller, potentially less liquid markets to increase returns on their assets.

The question from the perspective of financial stability is whether any such changes in investor behavior, especially by real-money investors, could be making financial institutions, markets, or economies more vulnerable to unexpected shocks. Such vulnerabilities could result in (i) unexpected large losses for institutional investors (if pension funds and insurance companies take additional risk on their balance sheets), (ii) the risk of disruptions in financial markets (if the demand for assets suddenly changes, thereby affecting prices and market liquidity), or (iii) the risk of economic disruption (if there are large capital flows in or out of countries). These disruptions might

Note: This chapter was written by S. Erik Oppers (team leader), Ruchir Agarwal, Serkan Arslanalp, Ken Chikada, Pascal Farahmand, Gregorio Impavido, Peter Lindner, Yinqiu Lu, Tao Sun, and Han van der Hoorn. Research support was provided by Yoon Sook Kim.

[1]See, for example, Forbes and Warnock, 2011; and IMF, 2011b and 2011c.

be especially acute in less liquid emerging markets. Awareness of such potential outcomes is important for investors so they can adequately protect themselves, as well as for policymakers so they can establish measures to reduce threats to financial stability.

This chapter looks at these issues in detail, using available public and private data, the views of investors and other market participants, and the results of a recent survey conducted by the IMF (Annex 2.2). First, the chapter uses these data sources to look at the two broad categories of investors—private and official holders—focusing on long-term trends from a database of $60 trillion in institutional investments. It also looks at developments in sovereign asset allocation, which covers some $14 trillion in assets. That segment has been growing rapidly in size—and therefore in importance for the overall assessment of implications for financial stability. A detailed database of a subset of equity and bond funds is then used to investigate the fundamental determinants of global asset allocation by private investors, such as economic growth, interest rates, and measures of risk. The chapter also looks at evidence of a shift in investor behavior since the crisis. It then uses the results of the econometric estimates for a "stress test" of investment flows across countries, estimating the effects of large changes in underlying factors on asset allocation flows. The chapter ends with implications of our findings for investors and policymakers.

Longer-Term Trends in Global Asset Allocation

Stylized Facts on Private Sector Institutional Investment

Existing aggregated data do not provide a comprehensive view of asset allocation on a truly global scale, but a dataset from the OECD is useful for analysis of the longer-term trends in the global allocations flowing from advanced economies.[2] The OECD data cover consistent data for assets under management by institutional investors domiciled in 17 OECD countries.[3] They show that after strong growth in the second half of the 1990s and stagnation in the early 2000s, assets almost doubled between 2002 and 2007, to $63 trillion (Table 2.1 and Figure 2.1). During the financial crisis, they declined to about $53

[2]National flow-of-funds data are useful, but higher-frequency data are available for only a few jurisdictions, and methodologies are not fully consistent. The OECD publishes a consistent set covering its membership (*OECD Annual Statistics on Institutional Investors' Assets*), based mostly on flow-of-funds data. The frequency is only annual, and the data are often published with a delay due to the necessary consistency checks and manipulations. Also, the OECD set covers only investment flows originating in OECD countries and does not show the destination of these flows. Private databases covering mutual fund investments at much higher frequency are useful for statistical analysis (see the section below on Determinants of Private Asset Allocation), but the series are of limited length, and their coverage may change over time as individual funds are added to the database.

[3]See note to Table 2.1 for a list.

Table 2.1. Assets under Management by Institutional Investors

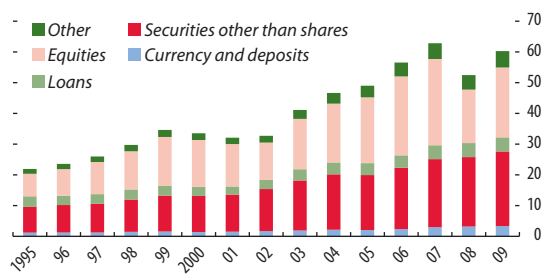
	1995	2000	2005	2006	2007	2008	2009
				(In trillions of U.S. dollars)			
Institutional Investors	21.9	33.5	49.0	56.6	62.8	52.5	60.3
Investment funds[1]	6.3	12.1	18.2	21.5	24.9	20.6	24.0
Insurance companies	8.0	10.4	16.3	18.1	19.9	18.3	20.0
Autonomous pension funds	7.2	10.8	14.3	16.5	17.7	13.3	15.9
Other institutional investors	0.5	0.5	0.5	0.6	0.7	0.6	0.7
				(In percent of GDP)			
Institutional Investors	103.0	147.6	162.0	178.1	181.7	143.3	173.7
Investment funds[1]	29.8	53.4	60.3	67.8	72.1	56.3	69.2
Insurance companies	37.7	45.6	53.9	57.1	57.5	50.0	57.7
Autonomous pension funds	33.8	47.4	47.3	51.8	51.2	36.3	45.9
Other institutional investors	2.5	2.2	1.6	1.9	1.9	1.6	2.0

Sources: OECD; and IMF Staff estimates.

Note: Data based on the following 17 OECD countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Japan, Luxembourg, the Netherlands, Norway, Spain, Turkey, the United Kingdom, and the United States. The data may reflect some double-counting of assets, such as those owned by defined contribution pension funds and managed by investment companies.

[1]Investment funds include closed-end and managed investment companies, mutual funds, and unit investment trusts.

Figure 2.1. Asset Allocation of Institutional Investors
(In trillions of U.S. dollars)



Sources: OECD; and IMF staff estimates.
Note: Data based on the assets under management by institutional investors in 17 OECD countries (see Table 2.1 for list). "Other" includes commercial loans and credits; financial derivatives; short-term investments; investments in hedge funds, private equities, and commodities; and miscellaneous assets.

trillion at end-2008 before rebounding to $60 trillion at end-2009 (compared with $72 trillion in total bank assets).[4] As a share of GDP, total assets under management rose some 75 percentage points, to over 180 percent of GDP, between 1995 and 2007. They fell to 143 percent of GDP by end-2008, with the largest relative drop in assets for pension funds (which have the largest share of assets in equities).

Investors domiciled in the United States still account for almost half of all assets under management in the 17 OECD countries, although their share is declining (Figure 2.2). The most marked change among countries with large investment holdings has been a large drop in the share of Japanese investors. Also, asset concentration has declined, with investments domiciled in the five countries with the largest holdings declining from about 90 percent of total assets in 1995 to about 80 percent in 2009.

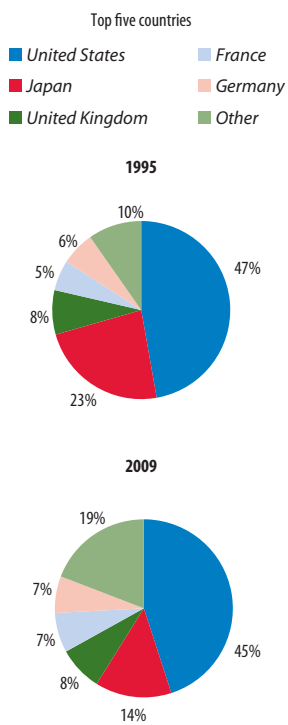
The share of assets under management by type of institutional investor has changed considerably over the 1995–2009 period (Figure 2.3). During that time, the share of pension funds and insurance companies declined markedly, while investment funds saw their share increase from 29 percent to 40 percent of total assets under management. This is likely due in part to the long-run shift from (generally corporate) defined benefit to (generally individual) defined contribution pension systems (especially in the United States). Assets in defined contribution plans are increasingly managed by investment funds.

By asset class, the value of securities other than shares (mostly bonds) has risen fairly steadily, while the value of equities has fluctuated more strongly (see Figure 2.1). Equity price declines dominated the decline in the total value of assets under management between 1999 and 2001 and again in 2008. Over the full 1995–2009 period, the proportion of shares and other equities rose to more than two-fifths, and the proportion of loans declined.

The asset allocation of institutional investors differs markedly by country (Figure 2.4). U.S. investors hold about equal shares of equities and bonds, while investors in France hold a majority of assets in bonds

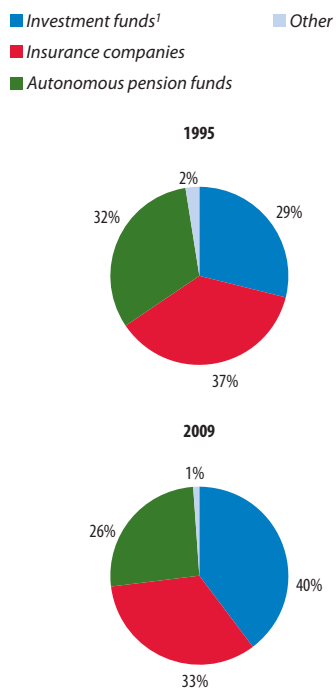
[4]The OECD dataset does not indicate the effect of valuation changes, but national flow-of-funds data from the G-4 suggest that most of the decline in total assets under management during the crisis was due to valuation changes (especially in equities).

Figure 2.2. Assets of Institutional Investors by Country
(In percent of total assets under management)



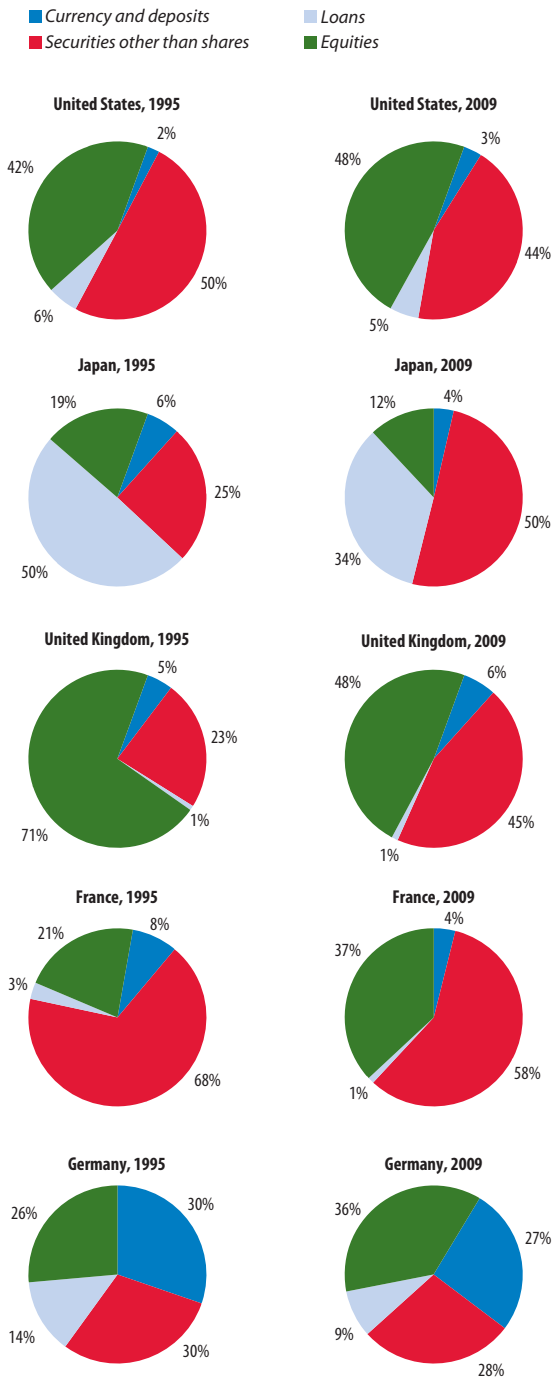
Sources: OECD; and IMF staff estimates.
Note: Data based on the assets under management by institutional investors in 17 OECD countries (see Table 2.1 for list). Percentages may not sum to 100 due to rounding.

Figure 2.3. Assets under Management by Type of Institutional Investor
(In percent of total)



Sources: OECD; and IMF staff estimates.
Note: Data based on the assets under management by institutional investors in 17 OECD countries (see Table 2.1 for list).
[1]Investment funds include closed-end and managed investment companies, mutual funds, and unit investment trusts.

Figure 2.4. Global Asset Allocation of Institutional Investors by Selected Country
(In percent)



Sources: OECD; and IMF staff estimates.
Note: Data based on the assets under management by institutional investors in 17 OECD countries (see Table 2.1 for list). Data exclude assets classified in "other" category.

and those in Germany hold almost one-third of their assets in currency and deposits. Although the shares by asset class have changed over the past decade and a half, the main stylized facts by country remain mostly intact.

The diversity in asset allocation across countries reflects in part differing investment structures, but not differences in holdings by type of investor, which are similar across countries (Figure 2.5). For example, in France, savings for retirement are concentrated in insurance products, and insurance companies globally tend to invest heavily in fixed income securities. In contrast, autonomous pension funds hold more than one-third of institutional assets in the United States, and they generally invest more heavily in equities.

Stylized Facts on Official Sector Investment Vehicles

While the overwhelming majority of financial assets is owned and managed by private investors, sovereign investors have grown to become important players in international capital markets. Sovereign wealth funds (SWFs) hold some $4.7 trillion in assets (SWF Institute, 2011; see Table 2.2 for a selection of SWFs), while international foreign exchange reserves amount to $10 trillion (Figure 2.6).[5] Taken together, the value of assets in SWFs and foreign exchange reserves is equal to about one-fourth of the assets under management of private institutional investors.

The asset allocation of SWFs varies widely depending on their specific objectives. A typical classification of SWFs by objective includes fiscal stabilization funds, national savings funds, pension reserve funds, and reserve investment corporations (IMF, 2007; see also Table 2.23 in Annex 2.3). Equities constitute a significant proportion of the holdings in national savings funds, pension reserve funds, and reserve investment corporations, and those SWFs are likely to have investment objectives similar to private investors. Stabilization funds tend to avoid riskier assets and focus instead on fixed income and cash. Still, specific factors—including the age of the SWF, its investment horizon, its funding source, and vary-

[5]Using the IMF's definition of foreign exchange reserves and sovereign wealth funds; see Annex 2.3.

ing expectations of the relative performance of asset classes—lead to differences in asset allocations even among SWFs with similar objectives (Figure 2.7).

International reserves are held for monetary policy and balance of payments purposes, and therefore reserve managers typically have a much more conservative asset allocation strategy than do SWF managers (Box 2.1). The objectives of reserve managers are traditionally safety, liquidity, and return, in that order (IMF, 2001a). The requirement that reserves be available at short notice and at low cost to meet balance of payments needs and financial stability objectives leads to an allocation that is traditionally dominated by short-term government bonds issued by only a few countries.

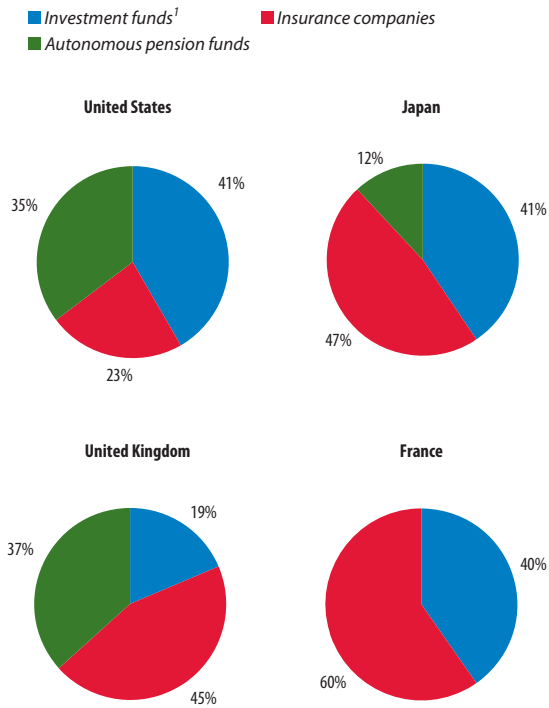
However, global foreign exchange reserve holdings (excluding gold) have grown so fast in recent years that their size for many countries now exceeds that needed for balance of payments and monetary purposes. After having expanded almost fourfold between 2000 and 2008, reserve levels declined briefly during the global financial crisis and then rebounded quickly. Today, reserve levels in several emerging and developing economies well exceed levels traditionally considered adequate (IMF, 2011a).

Therefore, an increasing share of reserves could be available for potential investment in less liquid and longer-term risk assets. A new IMF estimate puts core reserves needed for balance of payments purposes in emerging market economies at $3.0–$4.4 trillion, leaving $1.0–$2.3 trillion potentially available to be invested beyond the traditional mandate of reserve managers, in a manner more like that of SWFs.[6] Some central banks have facilitated this distinction by splitting their reserves into a "liquidity tranche" and an "investment tranche," with the latter aiming to generate a higher return over the long run (Borio and others, 2008). To date, taken together, however, these investment tranches are still small, and government bonds remain the dominant asset class in reserves.

Overall, the above analysis of private and public long-term investors suggests the following longer-

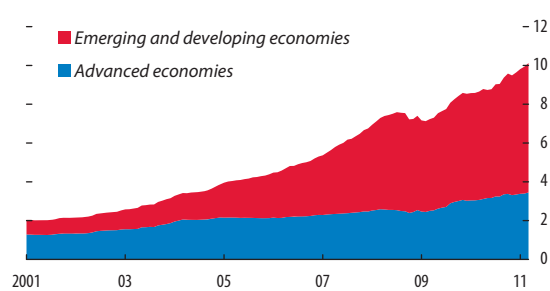
[6]This metric for reserve adequacy is developed in IMF (2011a); the suggested adequacy range is 100–150 percent of the metric based on 2009 data, leading to the ranges given here.

Figure 2.5. Assets under Management by Type of Institutional Investor and Selected Country, 2009
(In percent)



Sources: OECD; and IMF staff estimates.
Note: Data based on the assets under management by institutional investors in 17 OECD countries (see Table 2.1 for list). Percentages may not sum to 100 due to rounding.
[1]Investment funds include closed-end and managed investment companies, mutual funds, and unit investment trusts.

Figure 2.6. Foreign Exchange Reserves, Excluding Gold
(In trillions of U.S. dollars)



Source: IMF, International Financial Statistics.

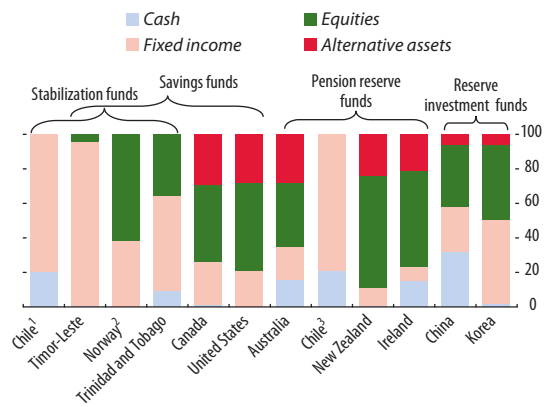
Table 2.2. Assets of Selected Sovereign Wealth Funds
(In billions of U.S. dollars)

Country	Sovereign Wealth Fund	End-2007	End-2010
Australia	The Future Fund	44.9	70.3
Canada	Alberta Heritage Savings Trust Fund	16.7	15.5
Chile	Economic and Social Stabilization Fund	14.0	12.7
Chile	Pension Reserve Fund	1.5	3.8
China	China Investment Corporation	200.0	409.6
Ireland	National Pensions Reserve Fund	31.1	30.3
Korea	Korea Investment Corporation	15.5	37.6
New Zealand	New Zealand Superannuation Fund	10.7	14.0
Norway	Government Pension Fund-Global	373.1	525.1
Singapore	Temasek	134.1	153.0
Timor-Leste	Petroleum Fund of Timor-Leste	2.1	6.9
Trinidad and Tobago	Heritage and Stabilization Fund	1.8	4.0
United States	Alaska Permanent Fund	39.4	38.8

Sources: Sovereign wealth fund websites; and IMF staff calculations.

Note: Australia (January 31, 2008, excluding Telstra); China (September 29, 2007); Singapore (March 31, 2008 and March 31, 2011); and Trinidad and Tobago (September 30, 2007 and September 30, 2010).

Figure 2.7. Selected Sovereign Wealth Funds: Asset Allocation by Type of Fund, December 2010
(In percent)



Sources: Sovereign wealth fund websites; and IMF staff estimates.
Note: Data for China, December 2009. For Australia, excluding Telstra; for Ireland, excluding directed investments.
[1]Economic and Social Stabilization Fund.
[2]Norway's Government Pension Fund has also been classified as a pension reserve fund.
[3]Pension Reserve Fund.

term trends in asset allocation: (i) global assets are being more widely distributed across countries; (ii) in relative terms, assets are being moved from pension funds and insurance companies in favor of management by investment companies; and (iii) the official sector is becoming increasingly important in global asset allocation through SWFs and managers of international reserves. These trends will be explored in more detail in the sections below.

Determinants of Private Asset Allocation

The Role of Private Asset Managers

Private asset managers play a key role in global asset allocation. The real-money managers on which this chapter places its focus (as distinct from managers of leveraged money, such as hedge funds and carry traders) include private wealth managers, mutual fund managers, insurance fund managers, and pension fund managers. They manage institutional money (such as from pension funds and insurance companies) as well as retail funds and private wealth. They allocate investments to equities, fixed income instruments, and a host of alternative investment classes, such as real estate, commodities, and hedge funds.[7]

Private fund managers provide a range of services for their real-money investing clients. Beyond offering a range of investment funds with predefined mandates, their services may include: (i) advice to inform clients' own investment decisions; (ii) fulfilling a broad individual investment mandate for large

[7]Hedge funds are not covered in our investigation directly as asset managers, although they are considered as an "investment class" for private asset managers.

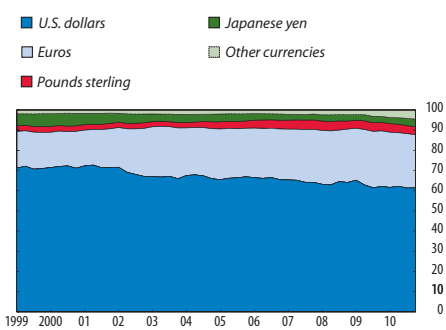
Box 2.1. Asset Allocation of Reserve Managers

Available data are used to investigate to what extent reserve managers respond to market-based incentives when deciding on the currency composition of international reserves.

The objectives of reserve managers are typically different from those of other investors because reserves are explicitly held for balance of payments or monetary policy purposes. The asset allocation and management of reserves are traditionally driven by safety, liquidity, and return, in that order (IMF, 2001a). Further, trade links and the composition of foreign debt may influence currency preferences of international reserve managers.

Despite these differences in their behavior relative to other investors, reserve managers could nevertheless respond to some of the same incentives that motivate private investors, such as investment returns and measures of risk. For example, in principle, reserve managers can hold their assets in any of several reserve currencies that have deep and liquid exchange markets and that can quickly be converted into a different currency if necessary. Given the dominance of short-term government bonds in reserve managers' portfolios, short-term interest rate differentials between major reserve currency countries could therefore affect their asset allocation.

Currency Composition of Official Foreign Exchange Reserves
(In percent)



Source: IMF, Currency Composition of Official Foreign Exchange Reserves database.
Note: The figure displays allocated reserves only. Over the observation period, unallocated reserves have roughly doubled as a share of total reserves, from 23 percent in early 1999 to nearly 45 percent at end-2010.

Note: Prepared by Ruchir Agarwal. Research assistance was provided by Michael Kamya.

Considering that the currency composition of reserves is equivalent to their country destination, the question of whether reserve managers allocate assets on the same basis as their private sector counterparts can be examined using the IMF's Currency Composition of Official Foreign Exchange Reserves (COFER) database. The database contains country-level data on currency composition from the 1960s to the present. The COFER information is submitted by IMF member countries on a confidential and voluntary basis; at present, the database covers 56 percent of total world foreign reserves. The COFER data show that, in the aggregate, the currency composition of reserves changed with the introduction of the euro but has been fairly stable in recent years despite large swings in exchange rates (see figure).

The investigation here uses quarterly data from 1999 to 2010 for 102 countries. The data include a number of the variables used in the main text for the analysis of private mutual fund data; they also include variables to measure the conventional objectives of reserve managers, including debt-to-GDP ratios and export and import propensities. The four dependent variables used here are the shares of total reserves allocated to the four major reserve currencies—the U.S. dollar, the euro, the pound sterling, and the Japanese yen—which constitute more than 90 percent of total reserve holdings for most of the countries in our sample.

The analysis produced the following key results:

- Reserve managers appear to respond to U.S. interest rates: increases in the U.S. dollar interest rate are associated with a rebalancing away from the euro and toward the dollar (first row of the table).
- An increase in the volatility of the euro/dollar exchange rate tends to favor the dollar as a reserve currency at the expense of the euro.
- The shares of the other two main reserve currencies, the pound and the yen, appear to be

Box 2.1 *(continued)*

unaffected by interest rates or exchange rate volatility.

- Economic growth differentials (which are found to be important for private asset allocation) appear not to be important for the currency composition of international reserves.
- At the start of the global financial crisis (summer of 2007), there was a drop in the share of the U.S. dollar in international reserves that was not related to the other explanatory variables in the regression.

Regression Results for the Currency Composition of Reserves

	U.S. Dollar Share	Euro Share	Pound Sterling Share	Yen Share
U.S. policy rate	0.0048***	-0.0029**	-0.0008	0.0003
Euro policy rate	-0.0016	0.0026	-0.0003	-0.0011
U.K. policy rate	-0.0036	0.0018	0.0011	0.0009
Japan policy rate	0.0146	-0.0112	-0.0015	0.0014
Euro-U.S. exchange rate volatility	0.0109***	-0.0061**	-0.0008	0.0009
U.K.-U.S. exchange rate volatility	-0.0058	0.0015	0.0016	0.0002
Japan-U.S. exchange rate volatility	0.0020	-0.0002	-0.0008	0.0007
U.S. GDP forecasts	-0.0006	-0.0012	0.0001	0.0003
Euro GDP forecasts	0.0010	-0.0029	0.0002	-0.0002
U.K. GDP forecasts	-0.0012	0.0021	0.0007	0.0001
Japan GDP forecasts	0.0011	-0.0002	-0.0003	0.0002
Crisis dummy 1	-0.0158**	0.0013	0.0031	0.0029
Crisis dummy 2	-0.0046	-0.0012	-0.0003	0.0043**

Sources: IMF, Currency Composition of Official Foreign Exchange Reserves (COFER) database; Consensus Economics; and IMF staff estimates.

Note: The table presents results of a system of regression equations estimated using seemingly unrelated regressions. The dependent variables are shares of foreign reserves allocated to the four major reserve currencies. The omitted category is "other" currencies, and the shares of the five categories add up to 1. Data for the dependent variable are from the COFER statistical database, quarterly from 1999 to 2010 for 102 countries. The policy rate variables measure the short-term policy rate for the four major currencies. The exchange rate volatility is computed as the exchange rate volatility of each country (with the U.S. dollar as base currency) over a rolling period of one year. GDP forecasts are mean forecasts of one-year GDP growth acquired from Consensus Economics. Crisis dummy 1 represents the period June 2007–August 2008 (global credit crunch). Crisis dummy 2 represents the period starting in September 2008 (Lehman Brothers bankruptcy). The regression also controls for total government debt-to-GDP ratio, real GDP per capita, import share of GDP, export share of GDP, and foreign exchange regimes. ***, ** , and * denote statistical significance at the 1 percent, 5 percent, and 10 percent levels of confidence, respectively, based on robust standard errors.

investors; and (iii) providing "stock picking" services within a more narrowly defined mandate. Thus, their approach to asset allocation ranges from the strategic, or long term, to the tactical, or short term.

Many other institutional investors (including those that determine their own strategic asset allocation) use private asset managers to manage all or part of their portfolio. Consequently, the assets under management of private asset managers include a substantial share of those from pension funds and insurance companies and a small but growing proportion of sovereign assets (Table 2.3).

Table 2.3. Asset Managers' Assets under Management: Origin of Funds
(In percent)

	2006	2008	2010
Pension funds	24.6	26.2	25.8
Endowments	2.4	2.4	2.4
Insurance companies	15.5	17.2	18.0
Sovereigns	0.9	1.2	1.5
Retail	36.2	32.9	33.0
Exchange traded funds	0.2	0.1	0.4
Banks	2.9	2.7	2.7
Unspecified	17.3	17.2	16.3

Source: IMF Survey on Global Asset Allocation.

Note: Figures are averages of 52 respondents.

Factors Determining Private Asset Allocation

What determines the longer-term trends in asset allocation revealed by the OECD data, particularly their geographical destination? The OECD dataset itself is less useful for answering that question because of its annual frequency, slower updates, smaller set of origin countries, and lack of information on the destination country for investments. For our empirical investigation, we use a dataset compiled by Emerging Portfolio Fund Research (EPFR). EPFR provides global fund flows and asset allocation data from some 20,000 equity funds and 10,000 bond funds with $14 trillion in total assets. The investors are a mix of retail and institutional investors; EPFR estimates that 70 percent of assets are institutional, mainly from pension funds and insurance companies. It covers funds registered in most major developed market jurisdictions and offshore domiciles. EPFR samples a subset of funds to give insights into the destination countries for equity and bond investments. Data at a monthly frequency are used below, covering the period from January 2005 to May 2011. EPFR has widened its coverage of fund flows over time, which may raise data consistency issues; the period of study was chosen to minimize these concerns.

Using the EPFR data, this section addresses the following questions: (i) What global and domestic factors have driven the asset allocation of international bond and equity fund investors? and (ii) Has their investment behavior changed fundamentally after the global financial crisis? To capture the truly global picture, a panel regression is estimated covering 50 advanced and emerging market economies for which we have complete and consistent data. The regressions are run separately for equity funds and bond funds, and are estimated for the whole sample and for five geographic groupings separately.[8]

On the basis of theoretical underpinnings (Annex 2.4), the following factors are used in the regression analysis to explain global asset allocation.

- Return factors: (i) policy rate differentials of countries relative to the simple G-4 average; and (ii) the one-year-ahead GDP growth forecast from Consensus Economics.
- Volatility factors: these represent the variance of returns as measured by (i) the volatility of host country expected inflation; (ii) the volatility of GDP growth; and (iii) the volatility of the exchange rate.
- Risk tolerance: perceptions of risk are (i) country risk, as proxied by the measure of country risk compiled by the International Country Risk Group; and (ii) global risk, as proxied by the Chicago Board Options Exchange Market Volatility Index (VIX).
- Other variables of interest: (i) an IMF measure of capital controls (both on inflows and outflows);[9] (ii) the covariance between country returns and world portfolio returns (to capture the diversification effect); (iii) the covariance between country returns and changes in world portfolio returns (to capture intertemporal hedging demand); and (iv) dummies to account for any structural changes in investor behavior that may have occurred after the global financial crisis.[10]

The analysis yields the following main results about the drivers of flows into equity and bond funds (Table 2.4):

- Interest rate differentials in most cases have no statistically significant effect on flows into equity and bond funds. These results are generally invariant to using policy rate differentials relative to the G-4 (as used in the baseline regression), nominal policy rates, nominal or real long-term interest rates (for countries where long-term rates are available), nominal or real long-term interest rate

[8]The regressions are run on flow data, since the stock data are generally nonstationary. The dependent variables are defined for each country as the valuation-adjusted flows into equity and bond funds in the country, divided by the stock at the beginning of the month. All variables are used at a monthly frequency. For variables of higher frequency, the end-of-month value is used. All regressions include country fixed effects to account for any country-specific factors not identified by the other explanatory variables. Dropping country fixed effects does not alter the signs or statistical significance of the results.

[9]The model employs a six-month lagged capital control measure, for two reasons. First, capital control measures are expected to take effect with a time lag. Second, large flows could in fact prompt the imposition of capital controls, forcing an opposite (positive) sign in the regression; the lagged capital control variable addresses this concern of reverse causality.

[10]Two crisis dummies are included, one for the period between June 2007 and August 2008 (global credit crunch) and one for the period starting in September 2008 (Lehman Brothers bankruptcy).

Table 2.4. Summary of Panel Regression Results on Equity and Bond Flows

	Hypothesized Signs		World		Asia		Latin America		Europe, Middle East, and Africa		G-7 Countries		Non-G-7 Advanced Countries	
	Equities	Bonds	Equities	Bonds	Equities	Bonds	Equities	Bonds	Equities	Bonds	Equities	Bonds	Equities	Bonds
Expected return indicators (first moment)														
Policy rate differential (host-G-4 average)	-/+	+	-	-	- **	-	-	-	+	- ***	+	-	+ ***	+
GDP growth forecast	+	+	+ ***	+ ***	+ **	+	+ **	+ ***	+ **	+ ***	+ **	+ ***	+ ***	+ ***
Volatility indicators (second moment)														
Inflation volatility	-	-	-	- **	- **	- **	+	+	+	- *	- *	- **	- **	- **
GDP growth volatility	-	-	- ***	- ***	- ***	- ***	- ***	- ***	- ***	- ***	+	- ***	- ***	- ***
Exchange rate volatility	-	-	- ***	- ***	- **	- ***	-	-	- ***	- ***	- ***	- **	- ***	- ***
Covariance indicators														
Return covariance (cross-country)	-	-	-	- ***	+	- ***	+ ***	- ***	- ***	- ***	+	- ***	+	- ***
Return covariance (intertemporal)	-	-	-	+	+	+ ***	- ***	- ***	+ *	+	- *	+	- ***	-
Risk indicators														
Country risk	-	-	- *	- ***	- **	- ***	-	-	-	- ***	-	-	-	+
VIX Index	-	-	- ***	- ***	- ***	- ***	- ***	- ***	- ***	- ***	- ***	- ***	- ***	- ***
Control variables														
Capital control index	-	-	-	- ***	- ***	-	+	+ **	+	-	- *	- ***	-	- ***
Crisis dummy 1	-/+	-/+	- ***	- ***	- **	- ***	+	- ***	- ***	- ***	- ***	- ***	- ***	- ***
Crisis dummy 2	-/+	-/+	- *	- ***	+	- ***	+ ***	- ***	-	- ***	- ***	-	- ***	- **

Source: IMF staff estimates.

Note: This table summarizes the results of the panel regression on equity and bond flows. +/- indicate the sign of estimated coefficients. ***, **, and * denote statistical significance at the 1 percent, 5 percent, and 10 percent levels of confidence based on robust standard errors. Coefficients that are statistically significant and have signs different than expected are in red. Dependent variables are monthly equity and bond flows as a proportion of assets dedicated to each country at the beginning of the month. The policy rate differential is the difference between the policy rate in the host country and the simple average policy rate for G-4 countries. GDP growth forecast is the one-year-forward GDP forecast for the host country, provided by Consensus Economics. Inflation volatility, GDP growth volatility, and exchange rate volatility are the standard deviation of inflation, GDP growth, and exchange rate forecasts, respectively, over the past year. Country risk is a measure of country risk from International Country Risk Group (ICRG). The VIX index is used as a measure of global risk. Return covariance (cross-country) is a measure of the covariance of country returns with the world portfolio return (cross-country correlation factor). Return covariance (intertemporal) is a measure of the covariance of country returns with changes in the world portfolio return (intertemporal correlation factor). Capital control index is the 6-month lagged capital control index produced by the Monetary and Capital Markets Department at the International Monetary Fund. Crisis dummy 1 represents the period June 2007–August 2008 (global credit crunch). Crisis dummy 2 represents the period starting in September 2008 (Lehman Brothers bankruptcy). All independent variables, except for control variables, are in first-differences. A time trend is included.

The regions in the table are broadly based on the Morgan Stanley Capital International (MSCI) regional classification and are as follows:

- Asia (excluding Australia, Japan, New Zealand): China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Thailand
- Europe, Middle East, and Africa (EMEA): Bulgaria, Croatia, Czech Republic, Egypt, Hungary, Nigeria, Poland, Romania, Russia, Saudi Arabia, Slovenia, South Africa, Turkey
- Latin America: Argentina, Brazil, Chile, Colombia, Mexico, Venezuela
- G-7: Canada, France, Germany, Italy, Japan, United Kingdom, United States
- Non-G-7: Australia, Austria, Belgium, Denmark, Finland, Greece, Ireland, Israel, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland

differentials relative to the G-4, and lagged policy rate differentials.[11] The implications of this finding are discussed further below.

- Improving GDP growth prospects in general positively affect flows. Globally, an increase in the forecast GDP growth rate in the investment destination country leads to an increase in bond and equity investments. GDP growth is important for equity investors because higher GDP would lead to higher corporate earnings growth, making equities more attractive. It could also affect bond investors if higher GDP growth reduces credit risk, making bond investments more attractive.
- A rise in country risk generally reduces flows. The regression analysis confirms that, in many cases, an

[11]Because policymakers may use policy rates to dampen undesirable capital flows (which may partly flow into bond and equity investments), the regression may suffer from an "endogeneity" problem. To get around this issue, a regression was run with lagged policy rate differentials. Expected changes in foreign exchange rates (proxied by the forward less the spot rate) are not included in the regression because any expected change would be captured by the interest rate differential through covered interest parity.

increase in country risk in emerging markets reduces their attractiveness for equity and bond investors. The effect is not statistically significant in advanced economies, perhaps partly because these showed little variation in country risk until recently.

- A rise in global risk generally reduces flows. Globally and for all regions, an increase in global risk (proxied by the VIX variable) discourages flows into equities and bonds.
- Lower return covariance generally leads to increased flows. In many cases, lower covariance of a country's equities and bonds leads to higher flows into these investments. This is as expected, since an asset that tends to have low covariance to other assets in the portfolio reduces the risk of the overall portfolio.
- Higher uncertainty tends to reduce flows. Uncertainty about future exchange rates and GDP growth, measured by changes in the volatility of exchange rates and GDP forecasts, are found in general to reduce flows into equities and bonds.
- Capital control measures show only weak effects. Capital control measures negatively affect bond flows on a global scale but not in most of the regressions for emerging markets. This weak finding may result in part because such controls are usually placed on money market and exchange rate instruments and not on longer-term equity and bond investments, where the interests of real-money investors lie; this is consistent with findings in other IMF studies.[12] Also, there is evidence that controls tend to lose effectiveness as market participants find ways to circumvent them, which occurs as long as the return on the controlled transaction exceeds the cost of circumvention.
- The crisis appears to have had an enduring effect on investor behavior. We find structural breaks in investor behavior after the global financial crisis. After the initial stage of the crisis (June 2007 to August 2008), there was a general slowdown in both equity and bond flows to all regions. However, after the second stage (beginning in September 2008), there was an increase in equity flows to Latin America (although there was no statistically significant effect on Asian equity investments). There is for now no firm evidence that these effects have faded.[13]

The above findings show the main "pull" and "push" factors for these investors' asset allocations. The main pull factor is the long-term growth prospects in destination countries, which may be diminished to some extent by rising country risk. The main push factor is the risk appetite of global investors. These factors are robust over the period studied (2005–11).[14]

The most notable of the above findings is that interest rate differentials do not significantly affect real-money investor flows. Neither bond nor equity flows respond to changes in interest rate differentials, globally and for nearly all regions. This result is not fully in line with previous findings (see, for example, IMF, 2011b).[15] A few of the possible explanations are the following:[16]

- The result applies only to real-money flows in and out of bond and equity investment funds. Short-term flows, usually seen as more interest sensitive, are less likely to be invested through these funds; leveraged flows (including from the carry trade), which are not captured in these data, may still respond to differentials in policy rates and other interest rates.

[12]For a detailed discussion see IMF (2010), Chapter 4, "Global Liquidity Expansion: Effects on 'Receiving' Economies and Policy Response Options."

[13]Specifically, the explanatory power of the second crisis dummy variable does not improve significantly if it is terminated before the end of the sample, suggesting that the structural breaks in the regression at the time of the crisis continue through the end of the sample.

[14]The push and pull factors that are found to be important accord with those indicated in the IMF Survey on Global Asset Allocation that accompanied the development of this chapter. The survey is discussed below and in Annex 2.2.

[15]Although Forbes and Warnock (2011) also found weak evidence for the effect of global interest rates on gross capital flows using balance of payments data.

[16]One possible explanation was not borne out in the data. Countries with high interest rate differentials may carry risks of large and sudden devaluations (the "peso problem"). There may therefore be a heterogeneous impact of policy rate differentials on bond flows that may increase the standard error of the estimated coefficient, rendering it insignificant. To try to solve this potential problem, the regression was rerun including an interaction term defined as the product of the policy rate differential and the county risk. Whereas the interest rate differential was positively associated with bond flows when the interaction term is included for the global sample, the results in the regional regressions were unchanged, with bond flows not significantly positively responsive to interest rate differentials.

- The EPFR data include bond funds that hold bonds with a wide range of maturities, which respond differently to changes in rates at different points along the yield curve. Therefore, the effect of short-term rates on bond flows, presumably concentrated on short-term bonds, is obscured by possible differing (and perhaps opposing) effects on long-term bonds. The converse appears also to be true, as using long-term rates in the regressions does not change the results. Thus, whereas different interest rates along the yield curve may affect flows into bonds of different maturities, their effect on total flows into bonds of all maturities is not statistically significant in these data.

The finding of this study that interest rate differentials do not affect bond and equity flows should not be extended to capital flows *in general*, for two reasons. First, flows in and out of bond and equity investments may come out of domestic funds, and to the extent that they do, they would not directly affect capital flows. Second, as noted, capital flows may be dominated by other types of investments, including flows from leveraged investors (such as the carry trade), which this analysis does not cover. Still, for some countries (especially emerging markets, which may have a smaller domestic investor base and are traditionally underweighted in portfolios of international investors), flows in and out of bond and equity funds may to a considerable extent lead to corresponding cross-border flows.[17]

The Risk of Sudden Reversals

The regressions in the previous section found that a number of variables had significant effects on asset allocation, but the question remains, how economically important are these effects? This is important in the context of the potential for sudden reversals of flows. If there are unexpected changes in the risk or return factors that were found in the regressions to be important for global asset allocation, trends in investment flows may reverse. If these reversing flows are large, they may be disruptive to asset markets, and—to the extent that flows out of bonds and equities also exit the country—they would affect the balance of payments.

The econometric results from the previous section allow an examination of this issue through explicit sensitivity analyses, or "stress tests," of investment flows to emerging market regions. In these tests, we apply shocks as follows: (i) a negative shock to the one-year-ahead forecast of the GDP growth rate (a drop in growth expectations), (ii) a positive shock to the variances of the growth forecasts (an increase in the uncertainty to the growth outlook), and (iii) a positive shock to the VIX (an increase in global risk). Besides calculating the effects of these three shocks separately, we also calculate (iv) the impact if all three shocks occur simultaneously.[18] Case (i) could simulate a number of macroeconomic scenarios, including a convergence of global growth rates through a drop in the expected growth rate in emerging economies (leading to a shift of investments away from emerging markets). The shocks are calibrated using historical data by region and are set equal to two standard deviations of the available time series covering 1996–2011, putting them among the 5 percent most severe during that period.[19]

The estimated effects of the simulated shocks are sizeable (Table 2.5 and Figure 2.8). The shocks to growth and global risk each result in annualized monthly flows out of equity funds of around 1 percent of GDP in two of the three regions, and the shock to growth uncertainty has even larger effects. For bonds, the shocks are somewhat smaller than for equities—although still sizeable. In a number of cases, the three shocks examined individually are each of roughly the same order of magnitude as the largest monthly flows out of bond and equity funds during

[17]Specifically, reducing their underweighting in international capital market indices may lead to increased portfolio flows into emerging markets, with corresponding capital inflows.

[18]To do so, we make the considerably simplifying assumption that the shocks have independent effects and are therefore additive.

[19]Regional standard deviations are as follows:
(1) Growth rate—for Asia, 1.98 percent; for Latin America, 1.38 percent; and for the Eastern Europe, Middle East, and Africa group, 1.73 percent.
(2) Forecast variance—0.57 percent, 0.50 percent, and 0.49 percent, respectively.
(3) VIX: 8.08 points for all regions.
The shocks are set equal to two standard deviations of the time series.

Table 2.5. Simulated Effects of Shocks on Regional Flows: Emerging Markets
(Monthly flows in billions of U.S. dollars)

Equity Funds			
	Asia	Latin America	Europe, Middle East, and Africa
	Simulated Effects		
Growth shock	-7.3	-3.2	-2.9
Growth uncertainty shock	-21.8	-6.9	-4.1
Global risk shock	-9.1	-3.6	-1.2
Sum of the above shocks	-38.3	-13.7	-8.2
	Largest Actual, January 2005–May 2011		
Largest net outflows	-11.9	-4.0	-4.4
(month)	(January 2008)	(February 2011)	(June 2006)
Largest net inflows	12.8	5.5	4.0
(month)	(October 2007)	(October 2010)	(January 2006)
Bond Funds			
	Asia	Latin America	Europe, Middle East, and Africa
	Simulated Effects		
Growth shock[1]	...	-1.0	-2.6
Growth uncertainty shock	-4.5	-3.6	-2.0
Global risk shock	-0.6	-0.8	-1.1
Sum of the above shocks	-5.1	-5.4	-5.6
	Largest Actual, January 2005–May 2011		
Largest net outflows	-1.9	-3.3	-2.6
(month)	(October 2008)	(October 2008)	(October 2008)
Largest net inflows	2.4	2.7	2.3
(month)	(April 2010)	(October 2010)	(October 2010)

Sources: IMF staff estimates; and EPFR.

Note: Simulated effects were calculated for respective regions by using the variables from the regressions (see text, "Factors Determining Private Asset Allocation") and applying (i) a negative two standard deviation shock to the one-year-ahead forecast for GDP growth rate; (ii) a positive two standard deviation shock to the variances of the growth forecasts (an increase in the uncertainty to the growth outlook); and (iii) a positive two standard deviation shock to the VIX (an increase in global risk).

[1]For Asia, the parameter was not significantly different from zero.

the crisis. A combined shock to growth, uncertainty, and global risk would lead to flows out of equity funds of between about 2 and 4 percent, larger than (and in some cases a multiple of) the largest outflows that were experienced during the crisis.

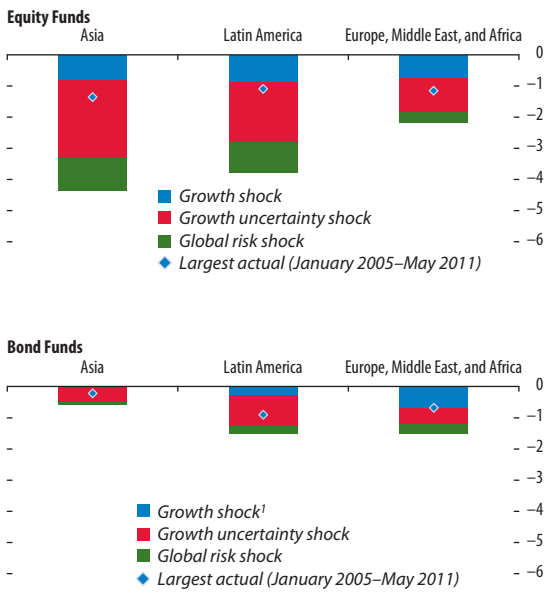
Effects of the Crisis

The empirical results show that investors' asset allocation behavior changed at the time of the crisis. The dummies included in the regressions to capture the effects of the crisis show that globally, and for most regions separately, investors changed their behavior toward equities and bonds in a way not captured by the regular drivers (that is, the other independent variables in the regression). This "crisis effect" began, first, at the onset of the crisis, in mid-2007, and continued around the time of the Lehman Brothers bankruptcy, in September 2008. These were statistically significant changes in behavior, but were they large enough to matter? A useful metric is the Z-score, which relates the size of the change in asset allocation at the time of the crisis to shocks that would normally have been experienced before the crisis.[20] Under the assumption of a normal distribution for shocks to investment flows, a Z-score of about 2 indicates that the shock would be classified as among the 5 percent most severe.

The Z-scores indicate that the crisis effect was quite large for bonds and advanced economy equities (Table 2.6). For bonds, the Z-score was in many cases close to or greater than 2, so that the outflows

[20]The Z-score is the size of the change implied by the dummy coefficient, minus the precrisis mean, divided by the precrisis standard deviation. Note that the Z-score is meaningless if the dummy is not statistically significant, as in such cases there is no statistically significant change at all in asset allocation at the time of the crisis.

Figure 2.8. Simulated Effects of Shocks on Regional Flows: Emerging Markets
(In percent, annualized flows relative to nominal GDP in 2010)



Sources: EPFR; and IMF staff estimates.
Note: For explanation and details, see Table 2.5.
[1]For Asia, the parameter was not significantly different from zero.

from bond funds during the crisis were among the 5 percent most severe compared to the precrisis period. For equities, there is a distinction between emerging markets and advanced markets. In emerging markets, although the coefficients for the first dummy (June 2007–August 2008) were generally significantly negative, the effects were small (i.e., in line with usual volatility in the precrisis period). In addition, the coefficients on the second crisis dummy (beginning in September 2008) were not significantly different from zero, except for Latin America, where the coefficient was positive and significant. In these cases, the low Z-scores imply that investors in emerging market equities continued during and after the crisis to let themselves be guided by the established drivers of asset allocation. Not so in advanced markets, where the "crisis" effect on equity funds was large, with Z-scores around 2, meaning that the crisis-induced outflows from equity funds in advanced markets were among the 5 percent most severe compared to the precrisis period.

How has the crisis changed investors' attitude toward asset allocation—what underlies the structural shifts we found in our analysis? The IMF recently conducted a Survey on Global Asset Allocation of 122 of the largest asset management companies and pension funds and plan sponsors, which collectively had about $20 trillion under management (Annex 2.2). The questions covered subjects such as the trends in total assets, geographical distribution of assets, shifts between asset classes, use of derivatives, the effects of the low interest rate environment, and the outlook for risks and returns. Combining the results of the survey with views gathered from discussions with asset managers offers insights into a number of crisis-related developments in the asset allocation of institutional investors.

The traditional (so-called mean-variance) approach toward a diversified risk-minimizing, return-maximizing portfolio of mainly traditional asset classes is viewed as having been unable to avoid losses during the crisis. As correlations between most traditional asset classes rose toward 1, the benefits of diversification diminished greatly, and most investment strategies suffered large losses. Investors are now looking for other strategies, including those that rely on underlying risk factors rather than

Table 2.6. Evaluating the Economic Significance of Crisis Indicator Coefficients

	World		Asia		Latin America		Europe, Middle East, and Africa		G-7 Countries		Non-G-7 Advanced Countries	
	Equities	Bonds	Equities	Bonds	Equities	Bonds	Equities	Bonds	Equities	Bonds	Equities	Bonds
Crisis dummy 1	-0.723***	-2.388***	-0.516**	-2.216***	0.205	-2.758***	-0.617***	-2.536***	-0.848***	-1.602***	-1.023***	-2.309***
	(-7.155)	(-16.002)	(-2.375)	(-8.895)	(0.927)	(-6.505)	(-3.102)	(-6.603)	(-4.152)	(-4.147)	(-13.087)	(-9.220)
Crisis dummy 2	-0.513*	-2.308***	0.327	-3.597***	1.033***	-4.119***	-1.285	-3.632***	-0.823***	-0.203	-0.741***	-0.906**
	(-1.914)	(-6.899)	(0.843)	(-7.363)	(5.464)	(-6.103)	(-1.104)	(-5.847)	(-3.295)	(-0.391)	(-8.102)	(-2.079)
Precrisis mean	0.61	1.03	0.83	1.16	0.95	1.65	0.45	1.32	0.38	0.34	0.58	0.65
Precrisis standard deviation	1.71	1.74	1.41	1.72	2.43	1.34	2.52	2.36	0.61	1.14	0.67	1.13
Z-score for crisis period 1	-0.78	-1.97	-0.96	-1.96	...	-3.30	-0.43	-1.64	-2.00	-1.70	-2.40	-2.63
Z-score for crisis period 2	...	-1.92	...	-2.76	0.04	-4.32	...	-2.10	-1.96	...	-1.98	-1.38

Source: IMF staff estimates.

Note: In the first two rows the table reports the regression coefficients and standard errors for the two crisis dummy variables from the regression analysis. The next two rows report the mean and standard deviation of the growth of equity and bond flows estimated for the period before June 2007 (the precrisis period). The last two rows report the Z-scores of both equity and bond flows using the mean and standard deviations reported in the previous two rows. The Z-score is defined as the regression coefficient minus the precrisis mean, divided by the precrisis standard deviation, and is one metric for gauging the size of the regression coefficients on the crisis dummy variables. Crisis dummy 1 refers to the period June 2007–August 2008, and crisis dummy 2 refers to the period starting in September 2008. … Indicates that the original estimate is not statistically significant, so no Z-score is calculated.

directly on asset classes for asset allocation decisions (Box 2.2).

However, no consensus on a preferred alternative allocation approach has emerged, and many real-money investors continue to use their traditional approach. Still, investors are planning to add other investment classes to help diversify their portfolios, attributing their lack of diversification in the crisis to their narrow set of investments and short time horizon. These real-money investors (including pension funds and insurance companies) are now more inclined to request asset allocation advice from professional asset managers, and investors' investment mandates are allowing more discretion around strategic allocations.

The precrisis trend toward improved risk management for asset allocation has clearly accelerated recently. Asset managers are paying closer attention to the market risk and credit risk of their portfolios, the value of the positions taken by their traders, and the procedures for countering excessive risks. For their part, investors are paying more attention to the risk management capabilities of their asset managers and are asking for more detailed attribution analysis (the contribution of various factors to losses or gains relative to the benchmark indices). Some investors are also more conscious of tail risk events (those with a low probability but a high impact) and the imprecision with which risks are measured. They are looking for more protection against tail risks, although such protection is difficult to engineer and can be costly. Many investors are avidly interested in it, but so far only a few are willing to pay for it.

Investors have become much more sensitized to the credit risk of sovereign issuers and are discriminating within this previously much more homogeneous asset class. This is particularly true for sovereigns in Europe, and especially in the euro area. Most private and institutional real-money investors exited the sovereign debt markets of the euro area countries seen to have the weakest fundamentals soon after the onset of the sovereign debt crisis, although they continue to be concerned about the implications of the crisis through cross-country and financial institution spillovers for their other investments. At the same time, within the context of improved risk-management systems, some investors (mainly insurers and pension funds) have chosen to hold more emerging market sovereign debt that offers better returns, including the prospect of currency appreciation. Other investors (for example, reserve managers) saw a reinforcement of the practice of holding only the highest quality sovereigns**.**

Investors with a longer horizon appear to have become so sensitive to liquidity risk that they do not want to take on their traditional role of providing market liquidity. Having suffered losses from forced sales during the crisis, many managers of retail mutual funds feel a need to keep them fairly liquid to guard against fire sales. Even long-term real-money investors, who should be able to capture a significant liquidity premium—that is, hold illiquid assets that earn a higher return because of their illiquidity—are hesitant to hold such assets. As noted below, this tendency is also aggravated by solvency regulations and accounting standards.

The crisis has also spurred a "back to basics" approach that seeks a better understanding of the risks involved with derivatives and other hedging instruments. Investors are requesting more information about counterparty risks, and some have limited their asset managers to the use of specific lists of acceptable counterparties. Use of assets as collateral is also being monitored and restricted. Derivatives that are traded or cleared through centralized counterparties are also viewed more favorably, as are more standardized over-the-counter contracts such as currency forwards and swaps. Many of these trends mean that hedging has become more expensive—although most institutional investors are willing to pay for this protection (see Table 2.20, in Annex 2.2).

Despite expectations that the low interest rate environment will be prolonged (Table 2.7), investors are reluctant to acquire more risky assets to increase yield.[21] Given their fixed liabilities, pension funds and insurance companies are feeling the pressure most, as many are still using high expected return targets that cannot be met without taking

[21]This may apply predominantly to pension and insurance companies, which are often required by regulation to follow conservative strategies (see also the section below, "Effects of New Regulatory Initiatives"). See Chapter 1 for a summary of developments for other types of investors.

Box 2.2. A New Asset Allocation Framework Using Risk Factors

Some institutional investors are using a new method of asset allocation, described here.

Asset allocation based on risk factors is gaining recognition among institutional investors. After the financial crisis, some institutional investors started to group investments on the basis of their risk and return profiles rather than according to traditional asset classes such as equities, bonds, and alternative assets. By doing so, asset managers say they are seeking to better understand the risks they are taking and therefore to better manage portfolio risk.

One case in point is the "new alternative asset classification" of the California Public Employees' Retirement System (CalPERS), which became effective in July 2011. The new asset classification consists of five categories—income, growth, real, inflation-linked, and liquidity (see first table). Compared with the traditional classification, this approach provides more information about the risk exposures of the pension fund. The new classification has not immediately changed the overall asset allocation except that the target share of real estate in the portfolio is 3 percentage points higher, cash 2 percentage points higher, and fixed income assets 4 percentage points lower.

Another case of note is that of the Alaska Permanent Fund Corporation, which in 2009 moved away from traditional asset classifications to group its investments by their risk and return profiles (see second table). The fund did not change the long-term target of achieving a 5 percent real rate of return on the assets in which the fund invests, but it judged that the new classification could help it better understand the risk profile of its portfolio. For example, corporate bonds and stocks are grouped together, given that in adverse economic

CalPERS Alternative Asset Classification

			Share (In percent)	
Risk Class	Translating into Asset Class	Purpose	June 2009	July 2011
Income	Global fixed income	Deliver stable income	20	16
Growth	Public and private equity	Positively exposed to economic growth	63	63
Real	Real estate, infrastructure, and forestland	Help preserve the real value of the pension fund	10	13
Inflation-linked	Commodities and inflation-linked bonds	Provide hedging against inflation	5	4
Liquidity	Cash and nominal government bonds	Supply liquidity when needed	2	4

Source: CalPERS.

Alaska Permanent Fund Corporation Asset Allocation

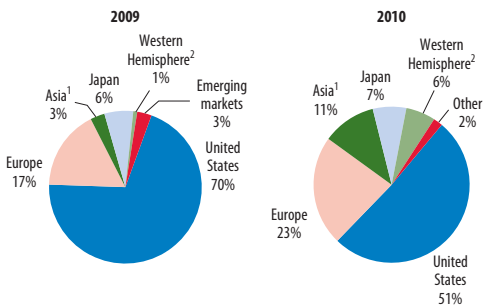
Risk Class	Translating into Asset Class	Purpose	Share, FY2010 (In percent)
Cash	Short-term liquid investments	Meet expected liabilities and manage liquidity needs	2
Interest rates	U.S. government bonds and international government bonds of other advanced economies	Provide insurance against severe equity market corrections	6
Company exposure	U.S. and non-U.S. stocks, corporate investment-grade and high-yield bonds, bank loans and private equity	Benefit in times of growth	53
Real assets	Real estate, infrastructure, and Treasury inflation protected securities	Protect the fund's real value over time	18
Special opportunities	Absolute return, real return mandate, distressed debt, structured credit, and other strategies as they arise	Take advantage of perceived market opportunities	21

Source: Alaska Permanent Fund Corporation.

Note: Prepared by Yinqiu Lu.

Box 2.2 *(continued)*

Alaska Permanent Fund: Regional Asset Allocation
(In percent)



Source: Alaska Permanent Fund Corporation.
[1]Excluding Japan.
[2]Excluding United States.

conditions they may perform similarly to each other. Under the new framework, the share of emerging Asia in the stock portfolio has risen (see figure). Cash was added as an asset class in the fiscal year 2010 allocation so that during periods of market turmoil the fund could avoid the need to sell other assets at fire sale prices to meet expected liquidity needs, especially the annual dividend payment.

Table 2.7. Expected Period before Policy Rate Rise
(In percent of respondents)

	Asset Managers	Pension Funds
In 1 year	0.0	0.0
In 2 years	14.1	12.2
In 3 years	50.0	55.1
In 5 years	20.3	18.4
Beyond 5 years	15.6	14.3

Source: IMF Survey on Global Asset Allocation.

Note: Share of respondents expecting the policy rates in advanced economies to return to end-2007 levels in each time period. Results are for 64 asset manager respondents and 49 pension fund respondents.

on higher-risk assets (see Box 2.3). Still, the IMF survey indicates that only about one-fifth of pension funds surveyed expect higher risk exposure in their portfolios in the next three years (see Table 2.18, in Annex 2.2). In addition, survey respondents indicate that the most important factor in cross-border investment decisions is not the "search for yield," which comes third after diversification and growth prospects (Table 2.8).

Investing in emerging markets is seen as potentially increasing portfolio returns without taking on excessive risk. A number of factors contribute to this view, including (i) underweighting of emerging markets in most portfolios (although exposure was already increasing before the crisis), so that emerging market assets can help diversify portfolios (see Table 2.9); (ii) low returns and increasing risk in advanced economies; (iii) a favorable view of the liquidity available in most large emerging markets; and (iv) an improvement in economic outcomes and a decline in policy risk in emerging markets.

The trend toward increased investment in emerging market equities was interrupted during the crisis, but is generally seen as ongoing (Figure 2.9). Investors were already adding significantly to their holdings in non-G-7 regions before the crisis, before pulling back in 2008. For bond investments, a pullback from all non-G-7 regions to the G-7 had already taken place before the crisis, and the trend toward further diversification is yet to resume fully: today, the non-G-7 share for bonds remains well below its peak in early 2006. However, since the crisis, diversification into the other regions has resumed for equity investments, which are more diversified today than they were before 2008.

Although emerging market assets are becoming more acceptable as a standard class to add to portfolios, a concern remains about their liquidity during a crisis and about other country risks. These concerns are likely to be more of an issue in the fixed income markets than in equities, although

Box 2.3. The Low Interest Rate Environment and Pension Funds

A protracted period of low interest rates has significant negative effects on the funding status of defined-benefit pension plans and could thus eventually have a financial impact on plan sponsors and beneficiaries.

One measure of the funding status, or solvency, of a defined-benefit (DB) pension plan is the ratio of the current market value of plan assets to its obligations. The obligations are the plan's actuarial liabilities, representing the present discounted value of all future retirement benefits earned to date. If the ratio is less than 1, the plan is underfunded.[1]

Declines in interest rates affect the asset and liability sides of a pension plan, as follows:

- They generate capital gains in existing bond holdings and thus increase asset values.[2]
- They lower the discount rate used to calculate the net present value of future benefit payments (typically the yield on long-term, high-quality domestic corporate bonds for accounting, and often long-term government bond yields for prudential regulation purposes) and thus increase the plan's liabilities.

Note: Prepared by Ken Chikada.

[1]For more detailed and technical discussions on the funding status of defined-benefit pension plans, see Impavido (2011).

[2]This represents the direct effect on bond prices only and abstracts from possible additional (macroeconomic) effects on other asset prices, such as stock prices and real estate values.

Hence, all other things equal, the net effect of changes in interest rates on the funding ratio depends on the maturity mismatch between assets and liabilities. As the liability side of pension plans generally has a longer average duration than the asset side, funding ratios tend to deteriorate with declines in interest rates.[3]

In general, declines in long-term interest rates worsen the funding ratio significantly, as illustratively shown in the following sensitivity analysis based on data from the United Kingdom (starting from a base of 100 for both assets and liabilities): a mere 0.1 percentage point decline in the discount rate increases pension liabilities by 2 percent while having only a negligible effect on the asset side (see shaded cells in the table, top panel). A similar effect on the funding ratio would result from a much larger—5 percent—decline in stock prices (shaded cells, bottom panel).

Declines in interest rates also have an income effect: as the higher-yielding bonds mature, they will be replaced with those having a lower yield.

In many major economies, the long-term decline in interest rates and improving life expectancy (the liability effect) have increased liabilities much faster than assets and thus have put downward pressure on funding ratios. Short-term fluctuations correlate with equity price swings (the asset effect), as witnessed by the sharp

[3]In contrast, banks typically have longer maturities for assets than for liabilities.

Impact of Changes in Gilt Yields on U.K. Defined-Benefit Pension Assets and Liabilities from a Base of 100

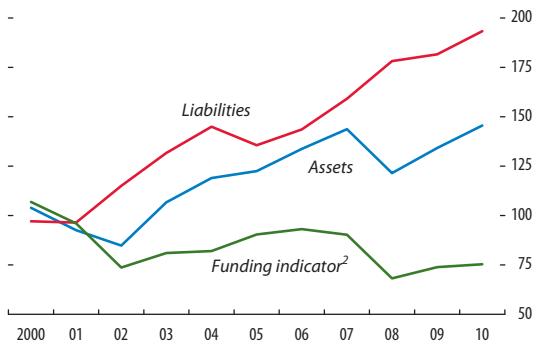
	–0.3%	–0.2%	–0.1%	Base	+0.1%	+0.2%	+0.3%
On assets (A)	101	101	100	100	100	99	99
On liabilities (B)	105	103	102	100	98	97	95
A minus B	–4	–2	–2	0	2	2	4
For comparison: impact of changes in equity prices on defined-benefit pension assets from a base of 100							
	–7.5%	–5.0%	–2.5%	Base	+2.5%	+5.0%	+7.5%
On assets	96	98	99	100	101	102	104

Source: PPF/The Pension Regulator (The Purple Book 2010).

Note: Sensitivity analysis based on dataset of 6,596 U.K. defined-benefit schemes on March 31, 2010. Shaded cells indicate roughly similar order of impacts on the funding ratio stemming from changes in bond yields and equity prices, respectively, assuming both the assets and liabilities start from a base of 100.

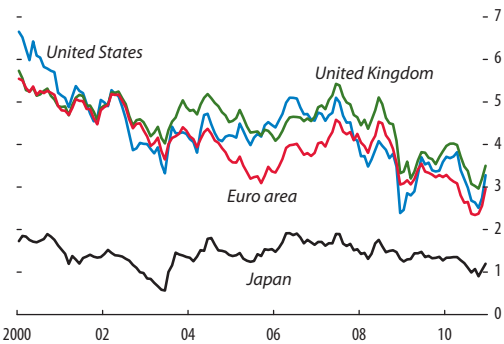
Box 2.3 *(continued)*

Defined-Benefit Pension Funds: Assets, Liabilities, and Funding Indicator for Major Economies[1]
(1998=100)



Sources: TheCityUK; and Towers Watson.
[1]Australia, Canada, France, Germany, Hong Kong SAR, Ireland, Japan, the Netherlands, Switzerland, the United Kingdom, and the United States.
[2]Assets divided by liabilities.

Ten-Year Government Bond Yields
(In percent)



Source: Bloomberg L.P.

drop in pension assets in 2008 and subsequent rebound in 2009 (see first figure).

Countries differ considerably in the stringency of their funding regulations for pension plans and hence in how much time and flexibility are allowed for addressing the underfunding of plans. The differences partly reflect how pension plans are linked financially to their sponsoring employers.[4] Where pension funds are more detached from sponsoring employers, such as in the Netherlands, relatively higher minimum funding ratios are required, as are quicker recovery plans in the event of underfunding. Where benefits are underwritten by sponsoring employers, such as in Japan, the United Kingdom, and the United States, longer recovery plans are allowed, but unresolved underfunding would eventually require increased contributions from employers.

Against this background, pension funds may change their asset allocation to hedge against market risks or to augment yields to improve their funding status. The sponsors may also shift their financial risks to the beneficiaries by closing the DB plan to new employees, or by moving existing staff (if possible) to a defined contribution scheme.

In an environment of persistently low interest rates, plan sponsors commonly hedge interest rate risk on the liability side by increasing asset allocations to bonds and extending their duration, thus decreasing the extent of the maturity mismatch. However, although this strategy helps mitigate adverse effects of further declines in interest rates, it does not necessarily improve an already worsened funding status.

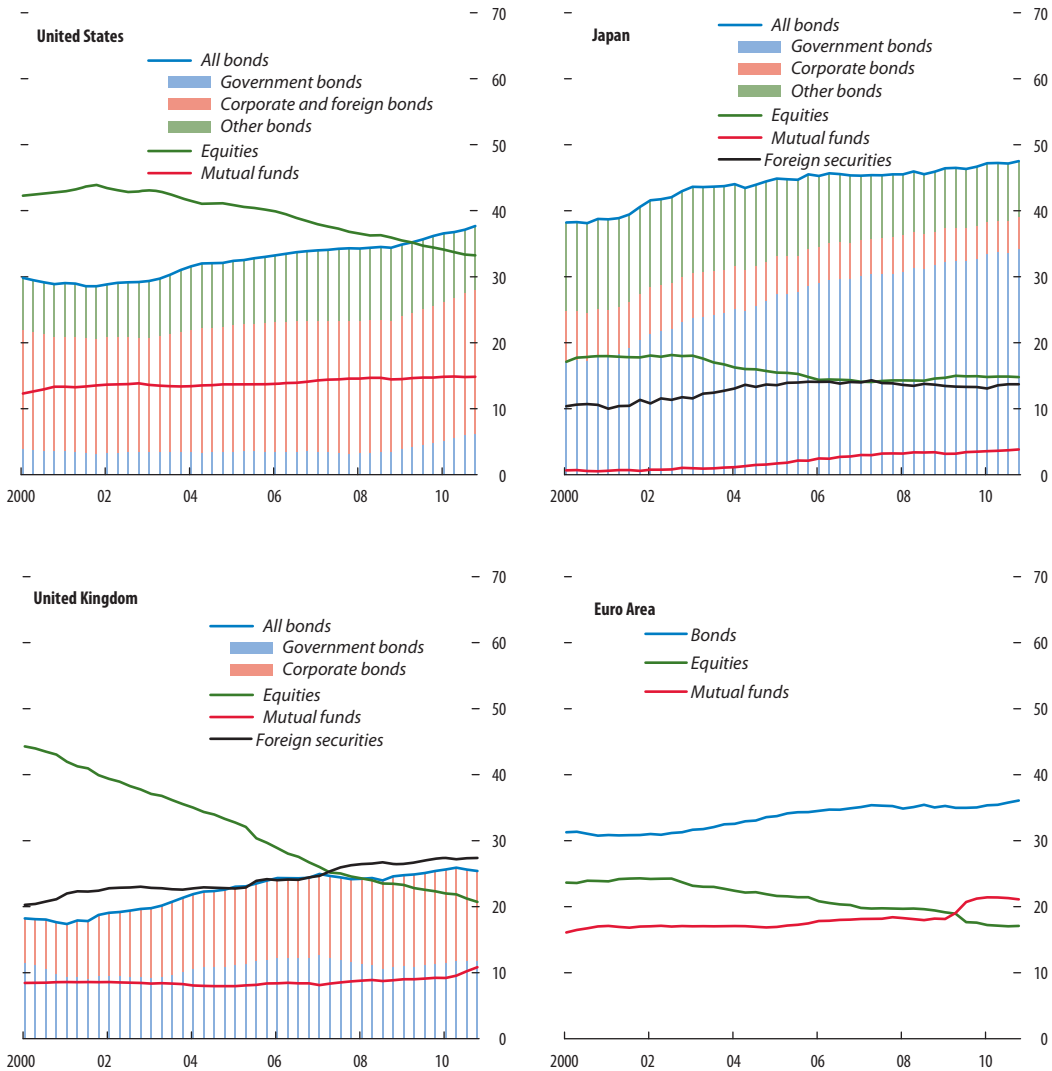
To address worsened funding ratios, long-term institutional investors may potentially be more inclined to "search for yield." That could mean a shift from bonds to equities and a likely increase in the volatility of the value of the portfolio. However, flow-of-funds data for pension funds and insurance companies in the G-4 economies over the past decade show instead a gradual but continuous increase in the bond

[4]Pugh and Yermo (2008); and Yermo and Severinson (2010).

Box 2.3 *(continued)*

Pension Funds and Insurance Companies: Asset Allocation for Selected Advanced Economies

(In percent of total financial assets, adjusted for effects of valuation changes)



Sources: National flow-of-funds data; and IMF staff estimates.

Note: For the United States and the euro area, the bond and equity holdings consist of both domestic and foreign securities. Government bonds for the United States include Treasury bills.

Box 2.3 *(continued)*

holding ratio, after accounting for the effects of valuation changes (see second figure).[5] In other words, rather than trying to enhance yields at the expense of having more volatility risk on the asset side, these investors as a whole seem to have been putting more emphasis on duration matching to address the effects of low interest rates on their liabilities.

[5]Using both flow and stock data from flow-of-funds accounts, an attempt can be made to exclude effects of valuation changes. For example, the bond holdings of an investor at time t can be calculated as follows:

$$\text{Bond holdings}_t = b_t = \frac{B_0 + \Sigma_{k=1}^{t} BF_k}{Q_0 + \Sigma_{k=1}^{t} QF_k}$$

where B_0 is the stock of bonds at $t = 0$; Q_0 is the stock of financial assets at $t = 0$; BF_k is the net acquisition of bonds (transaction flow) at $t = k$; QF_k is the net acquisition of financial assets (transaction flow) at $t = k$.

Table 2.8. Top Five Factors Considered in Cross-Border Investment since End-2006
(Ranked by scores)

	Asset Managers		Pension Funds	
Rank	Factors	Score	Factors	Score
1	Diversification	115	Diversification	106
2	Longer-term growth prospects	113	Longer-term growth prospects	100
3	Search for yield	93	Search for yield	40
4	Sovereign or country risk	60	Range of investments available	33
5	Market liquidity	58	Volatility	32

Source: IMF Survey on Global Asset Allocation.

Note: Shown are the five factors cited most frequently by respondents, who were asked to report their top four factors. Score is calculated as (4 * rank-1 factor) + (3 * rank-2 factor) + (2 * rank-3 factor) + (1 * rank-4 factor). Results are for 61 asset manager respondents and 40 pension fund respondents.

Table 2.9. Regional Allocation
(In percent)

	Asset Managers				Pension Funds			
	Bonds		Equities		Bonds		Equities	
	2006	2010	2006	2010	2006	2010	2006	2010
Own country of domicile	61.0	60.1	47.5	44.8	78.1	75.7	55.5	50.3
East Asia/Pacific	3.4	3.6	8.5	9.0	1.8	2.4	8.6	10.1
Europe	27.2	27.1	28.2	27.1	11.7	11.4	22.1	21.4
Latin America	0.8	0.8	1.8	2.6	0.3	0.9	0.8	2.5
Middle East/North Africa	0.1	0.2	0.2	0.3	0.0	0.3	0.2	0.4
North America	7.1	7.7	11.7	13.0	7.9	8.9	11.6	13.1
South/Central Asia	0.2	0.2	0.8	2.1	0.1	0.4	1.1	2.0
Sub-Saharan Africa	0.0	0.0	0.1	0.2	0.0	0.1	0.1	0.3

Source: IMF Survey on Global Asset Allocation.

Note: For asset managers, figures are averages for 29 respondents for bonds and 32 respondents for equities. For pension funds, figures are averages for 28 respondents.

some stocks became illiquid in the crisis and could do so again. However, the trend toward better risk management also prevails in this case, with many investors discriminating between different emerging markets rather than seeing them as a homogeneous asset class. Nonetheless, investors retain some home or regional bias.

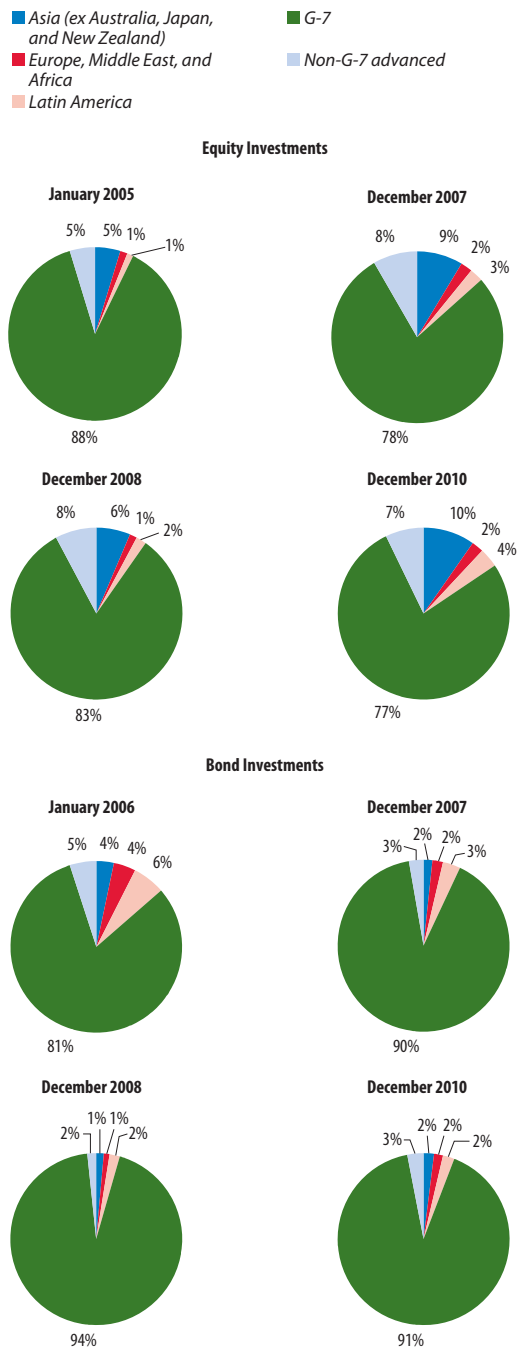
Besides emerging markets, alternative assets are drawing interest, but actual allocations currently show little evidence of a significant shift toward them (Table 2.10). The diversification offered by traditional asset classes provided limited protection during the financial crisis. In isolation, alternative assets (commodities, real estate, private equity, infrastructure, and hedge funds) may well carry higher risks, but their low (or even negative) correlation with other assets means that they may actually lower the risk in the overall portfolio, and the more sophisticated investors understand this mechanism. Still, the low liquidity of some of the alternative asset types is a concern, as investors may not be able to exit easily in times of turmoil.

Effects of New Regulatory Initiatives

Regulation geared toward institutional investors may have significant effects on their asset allocation. Previous studies have suggested a possible shift in asset allocation to bonds from equity as a consequence of a shift toward fair value accounting of pension schemes and related changes in solvency regulations in advanced economies in the mid-2000s (see OECD, 2005; Boeri and others, 2006; and Committee on the Global Financial System, 2007, 2011). Recent other examples of such regulations are the Basel III proposals for banks by the Basel Committee on Banking Supervision and the Solvency II proposals governing capital requirements for insurance companies in the European Economic Area. Both of these initiatives take a risk-based approach to minimum capital requirements.

In discussions as background for this chapter, some insurance companies indicated that Solvency II would encourage investment strategies opposite to those needed if their industry is to return to financial health. They noted that the risk-based capital

Figure 2.9. Regional Distribution of Equity and Bond Mutual Fund Investments[1]
(In percent)



Sources: EPFR; and IMF staff calculations.
[1]See Table 2.4 for list of countries.

Table 2.10. Asset Allocation by Asset Class
(In percent)

	Asset Managers			Pension Funds		
	2006	2008	2010	2006	2008	2010
Traditional asset classes						
Cash	6.9	8.9	6.5	1.7	2.1	2.4
Equities	39.7	31.2	34.5	51.4	40.3	44.9
Bonds	41.9	46.6	46.7	36.0	41.9	37.1
Subtotal	88.5	86.7	87.7	89.1	84.3	84.4
Alternative asset classes						
Real estate	4.4	5.2	4.7	5.2	6.7	5.6
Hedge funds	1.7	2.1	1.4	1.5	2.2	2.2
Private equity	0.5	0.6	0.6	2.7	4.5	4.6
Commodities	0.1	0.1	0.1	0.4	0.6	1.0
Other	4.8	5.4	5.5	1.0	1.7	2.1
Subtotal	11.5	13.3	12.3	10.9	15.7	15.6

Source: IMF Survey on Global Asset Allocation.

Note: Figures are averages for 55 asset manager respondents and 49 pension fund respondents.

charges imposed by Solvency II would discourage equity investments in favor of high-quality fixed-income securities, reducing returns and the flow of funds into new equity and riskier longer-term investments. This was seen as potentially detrimental to the interest of the holders of insurance products, to the extent that this effect is not entirely offset by reducing the portfolio risk for insurance company assets. Although Basel III has less direct effects on real-money investors, there are indirect effects in that these investors will be less inclined to invest in bank debt or equity, which will likely have lower returns due to higher capital and liquidity buffers.

Implementation of Solvency II and other regulatory incentives that aim to make individual institutions "safer" could also affect financial stability in a number of possible ways:

- First, some insurance companies fear that they will have insufficient time to prepare for prescribed changes because of uncertainty about the final content of the regulations. Given the likely long phase-in period, however, the risk of a rush to adjust asset allocations, with potential disruptive effects to asset markets, is probably small, but given the large assets under management in European insurance companies, it cannot be completely discounted.
- Second, pushing insurance companies toward higher-quality fixed-income securities and away from less liquid equities makes them more like other short-term investors, a development reinforced by mark-to-market accounting rules.[22] This lessens the diversity of investor types and raises the risk of similar responses to shocks and could therefore carry financial stability concerns.
- Third, the pressure to enhance yields in the low interest rate environment is growing, and the requirement for insurance companies to hold the bulk of their assets in safe, low-yielding assets may push them to become more aggressive with the remainder of their portfolio and may shorten their investment perspective.[23] Their investment behavior regarding this risky part of their portfolio might well become more volatile, leading to a risk of sudden reversals in some less liquid markets, including in emerging economies.

[22]See Committee on the Global Financial System (2011) and World Economic Forum (2011).

[23]For example, a Towers Watson Survey in June 2011 found that 46 percent of responding insurers were expecting to be more aggressive in their investment strategy in the next year (Towers Watson, 2011).

Conclusions and Policy Implications

The analysis in this chapter suggests that asset allocation by long-term real-money investors is driven most strongly by positive growth prospects and falling risks in the recipient countries; interest rate differentials play a lesser role. For flows into both equities and bonds, investors are focused mostly on growth potential when choosing investment destination countries, although country risk has a clear negative effect. As expected, a decline in global risk aversion increases investment in equities and bonds to all emerging market regions. Investment flows from real-money investors into bonds and equities are generally not significantly affected by differentials in interest rates. Care should be taken, however, not to extend this result to capital flows in general, which have a number of components not covered in this analysis. In particular, the investment flows of short-term leveraged investors (such as those from the carry trade)—which this chapter does not examine—might still be affected by changes in policy rates and other interest rates in the economy.

The implications of these findings for policymakers are that asset-allocation decisions are grounded mostly in the responsiveness and consistency of economic policy, not in specific policy actions. Policies geared toward macroeconomic stability and low inflation will enhance growth, reduce volatility in macroeconomic outcomes, and lower country risk, which the regression analysis in this chapter shows affects real-money investor flows positively. Yet the additional investment flows attracted by macroeconomic stability and strong growth prospects could have potentially destabilizing effects over the longer run, including asset price bubbles and credit booms. Monitoring and possible management of these flows should therefore be part of the larger framework of growth-enhancing policies.[24]

While the trend toward longer-term investment in emerging markets is likely to continue, shocks to growth prospects or other drivers of private investment could lead to large investment reversals. The structural trend of investing in emerging market assets accelerated following the crisis, driven mostly by relatively good economic and investment outcomes. Still, the sensitivity analysis in this chapter showed that a negative shock to growth prospects in emerging markets could potentially lead to flows out of emerging market equities and bonds. These flows could reach a scale similar to—or even larger than—the outflows these countries experienced during the financial crisis. Adverse dynamics are possible in such cases: if countries react with policies that are perceived to raise country or policy risk, this would tend to increase the desire for investors to exit. In addition, the reactions of other types of investors (including those that are leveraged—see Chapter 1) would likely compound these investment outflows, or even initiate them.

Policymakers should prepare for the possibility of a pullback from their markets in order to mitigate the risk of potentially disruptive liquidity problems, especially if market depth may not be sufficient to avoid large price swings. Emerging market policymakers should take advantage of periods of macroeconomic and financial stability to reinforce the resilience of their financial systems. Also, they should prepare contingency plans to maintain liquidity in asset markets during periods of market turmoil, perhaps using sovereign asset managers as providers of liquidity as other investors exit, as some did during the crisis (Box 2.4). Coordination between sovereign wealth managers would be important in these situations, to avoid a repeat of what happened during the crisis, when some reserve managers acted procyclically by moving out of unsecured bank deposits.

The global financial crisis changed longer-term asset-allocation strategies, chiefly by making investors more risk conscious and prompting a greater focus on portfolio risk management. The disruption of liquidity during the crisis and the recent sovereign risk concerns have made investors especially mindful of market liquidity risks and the importance of credit risk in sovereign bond markets—even in the most developed economies. There is strong anecdotal evidence that these events have altered asset allocation frameworks in a structural and lasting way. This structural shift can also be seen in the data: the regressions in this chapter show significant downward shifts in investment flows for the

[24]See Ostry and others (2010).

Box 2.4. Sovereign Asset Management and the Global Financial Crisis

Sovereign wealth funds were affected by, and responded to, the global financial crisis.

The global financial crisis affected all sovereign wealth funds (SWFs). Those that were more heavily invested in equities suffered especially large losses—in some cases, more than 30 percent—from the sharp downturn in prices of risky assets (see first figure). Key to the subsequent recovery of such funds was their ability and willingness to stay invested in risky assets and "ride out" the financial turmoil. As financial market conditions started to improve in early 2009, that longer-term approach paid off.

Governments used SWF assets during the crisis to support their economic, fiscal, and financial stability objectives. The new functions given to SWFs—some in line with their original mandate, others beyond it—included:

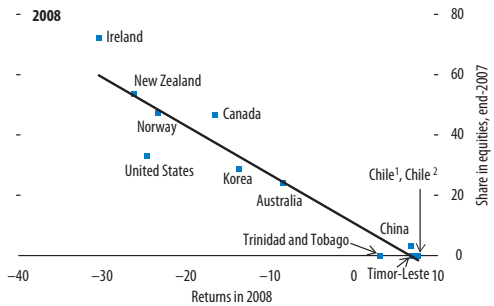
- Stimulus support: Assets of some SWFs financed stimulus packages to support economic activity.
- Deficit financing: Assets were drawn upon to finance rising fiscal deficits.
- Financial stability: Some SWFs were directed to deposit assets in domestic banks as a way to provide liquidity support, while others contributed assets to bank recapitalization. In some cases, SWF assets were earmarked to support deposit insurance schemes or were used to purchase domestic equities to boost markets and investor confidence.

The actions of sovereign wealth managers during the crisis were not always optimal, as some reserve managers acted procyclically by rapidly moving out of bank deposits (see second figure). Surveys, conducted annually by Central Banking Publications, and other studies (Pihlman and van der Hoorn, 2010) confirm that the risk aversion of reserve managers increased and that reserve managers participated in the global flight to quality and liquidity. Those developments were seen most clearly in the flight from unsecured bank deposits: the proportion of total reserves (including gold at market prices) invested in

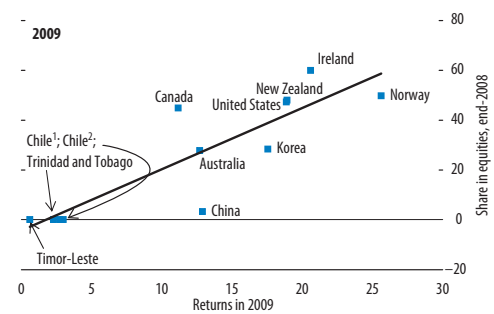
Note: Prepared by Yinqiu Lu, drawing on Kunzel and others (2010).

Sovereign Wealth Funds: Shares in Equities and Returns, 2008 and 2009

(In percent)



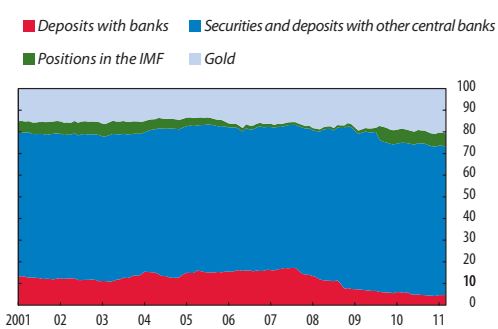
Sources: Sovereign wealth fund websites; and IMF staff calculations.
Note: For Australia, excluding Telstra; for Ireland, excluding directed investments; forChina, the share of equity as of end-2008.
[1]Pension Reserve Fund.
[2]Economic and Social Stabilization Fund.



Sources: Sovereign wealth fund websites; and IMF staff calculations.
Note: For Australia, excluding Telstra; for Ireland, excluding directed investments.
[1]Pension Reserve Fund.
[2]Economic and Social Stabilization Fund.

Instrument Composition of Official Reserves, Including Gold

(In percent)



Source: IMF, International Financial Statistics and Data Template on International Reserves and Foreign Currency Liquidity.

Box 2.4 *(continued)*

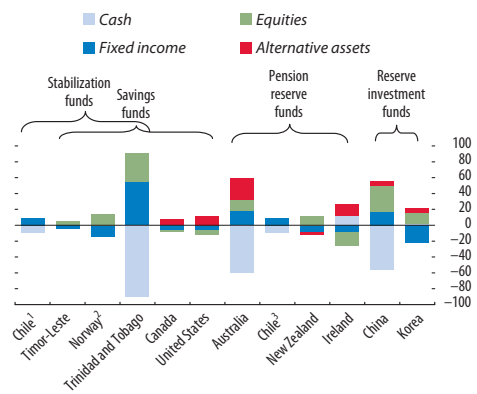
this asset class dropped rapidly from its peak of 17.2 percent in July 2007 to less than 5 percent in June 2010. That large move raised concerns that, by acting procyclically, reserve managers may have inadvertently contributed to the severity of the crisis (Niedermayer, 2009; Pihlman and van der Hoorn, 2010; Mminele, 2011). There have been calls recently to formally address this issue, for example through an update of the IMF's Guidelines for Foreign Exchange Reserve Management.

The asset allocation of SWFs in the aftermath of the crisis—and therefore the extent to which they may take on the risks that may now be avoided by private institutional investors—is subject to contesting influences.

- Like many private investors, SWFs' severe losses in the crisis have likely made them more aware of, and perhaps more averse to, various types of risk. In addition, changing mandates that could now include fiscal, economic, and financial stabilization objectives may require assets to be safer or more liquid.
- By contrast, however, the crisis and postcrisis experience showed sovereign asset managers that (i) additional diversification (including into assets that by themselves may be considered risky) may further reduce portfolio risk, especially in a crisis; and (ii) longer-term strategies, if maintained in times of turmoil, may significantly reduce portfolio damage.
- In addition, as with private investors, SWFs may be pushed toward riskier investments in part to generate higher returns under a potentially prolonged low interest rate environment.

The postcrisis adjustments in the asset allocations of SWFs show that the balance of these factors is pushing SWFs in the direction of providing more risk capital (see third figure). Like private asset managers, SWF managers have enhanced their efforts to diversify portfolios by increasing investments in equities and alternative assets (with some introducing such investment classes for the first time). These new investments have been financed by cash and, to a lesser extent, fixed income holdings. Also, mirroring private trends, many SWFs have increased investments in emerging markets.[1]

Sovereign Wealth Funds: Change in Asset Allocation by Type of Fund, December 2007– December 2010
(In percent)



Sources: Sovereign wealth fund websites; and IMF staff calculations.
Note: For Trinidad & Tobago, the change is between September 30, 2007 and December 31, 2010; for Australia, the change is between January 31, 2008 and December 31, 2010; for China, the change is between December 31, 2008 and December 31, 2009. For Australia, excluding Telstra; for Ireland, excluding directed investments.
[1]Economic and Social Stabilization Fund.
[2]Norway's Government Pension Fund, Global is also classified as a pension reserve fund.
[3]Pension Reserve Fund.

[1]Examples of geographic diversification to emerging markets abound. China Investment Corporation has indicated that it will shift some of its focus to emerging markets (*Financial Times*, January 16, 2011). Singapore's Temasek plans to increase its exposure to emerging markets in Asia, Brazil, and the Russian Federation and reduce its exposure to OECD countries, from one-third to one-fifth of its assets (www.temasek.com.sg/media_centre_news_speeches_120509.htm). Norway has opened offices in Shanghai and Singapore (www.nbim.no/en/press-and-publications/News-List/2010/nbim-opens-new-office-in-singapore).

full period after the start of the crisis in mid-2007, reflecting an adjustment of portfolio flows to the new assessment of risks. There is no evidence so far that this effect is fading. This may be evidence that risk aversion of institutional investors has fundamentally changed.[25]

The low interest rate environment in advanced economies since the crisis has not yet pushed investors into riskier investments to enhance yields but may do so if—as expected—interest rates in advanced economies stay low for an extended period. The results of the IMF Survey on Global Asset Allocation and other information about recent allocations indicate that investors have in general not yet moved into riskier assets to enhance yields.[26] Still, the pressure to do so is already strong and growing, especially for those institutional investors that need to earn a minimum absolute return (such as insurance companies that have sold products with minimum guaranteed returns and pension funds that are underfunded). As the low interest rate environment is expected to last for a number of years, such investors will be increasingly compelled to take on more investment risk as their financial situation continues to be unfavorable.

These financial incentives now facing institutional investors may interact with recent regulatory initiatives in a way that carry risks to financial stability. Initiatives like Solvency II and Basel III aim to make individual financial institutions safer, but may make institutional investors more like other short-term investors. As a result, they would be less likely to act as the "deep pockets" of financial markets that support riskier, long-term investment and are willing to hold such illiquid assets through market downturns. This would lessen their traditional role in fostering financial stability. Also, the requirement for insurance companies to hold the bulk of their assets in safe, low-yielding assets may push them to become more aggressive with the remainder of their portfolio to try to enhance portfolio returns. This may lead them to invest more aggressively in (smaller) emerging markets or alternative assets (commodities, real estate, private equity, infrastructure, and hedge funds). Investment returns on this risky part of their portfolio might well appear more variable under mark-to-market accounting rules (despite the improved diversification at the portfolio level over the longer run). Increased variability of returns may make asset allocation more volatile, leading to a risk of sudden reversals that may adversely affect financial stability, especially in less liquid markets.

As heightened risk awareness and regulatory initiatives are pushing private investors to hold "safer" assets, there may be a role for sovereign investors to take on some of the longer-term risks that private investors now avoid. Although the assets of SWFs are less than one-tenth of the total assets of pension funds and insurance companies, their role is likely to expand as sovereign assets grow. Their original purposes should remain intact, but as their assets grow beyond that needed for their original purpose, authorities could consider how their sovereign investment policies and financial markets can benefit from accommodating the supply of long-term investments. Sovereign asset allocation can also help foster longer-term financial stability, including by offsetting potentially destabilizing private investment behavior, especially during crises. That said, the extent to which SWFs and noncore reserves can be invested in longer-term, less liquid assets should be considered within a comprehensive framework for sovereign assets and liabilities management. Such a framework would link the asset allocation of sovereign investment (including its liquidity, duration, and market risks) to its investment objectives, taking into account its explicit or contingent liabilities.

Monitoring of trends in asset allocation is an additional useful tool to identify potential risks to financial stability, but its effective use will require more accurate, comprehensive, and timely data. Changes in asset allocation by investors are at the core of capital flows between institutions, markets, and countries. Direct monitoring of these changes

[25]Risk aversion is a concept that is considered innate, underpinning an investor's preferences. Changes in risk aversion would affect asset allocation only to the extent that they are not already reflected in shifts because of changes in actual and expected risks and returns. In the regressions, changes in risk aversion could therefore be loosely interpreted as shifts in asset allocation that cannot be explained by the explanatory variables, that is, as a structural break in the regressions.

[26]See, for example, OECD (2011).

will contribute to a more thorough understanding of the resulting flows and allow policymakers to identify more clearly any emerging risks to financial stability. However, relevant public data (mostly from national flow-of-funds accounts) are scarce, available with sometimes significant delays, and with differing methodologies. Private data are more timely and frequent but cover mostly investment funds and fail to capture most bank and official flows. Effective monitoring requires a major compilation effort to create a truly global dataset of higher frequency (at least quarterly, but preferably monthly) that includes asset allocation by type of investor, source and destination of funds, asset class, and maturity.[27]

[27]The IMF is contributing to this effort, including through the G-20 Data Gaps Initiative. See www.imf.org/external/np/g20/pdf/102909.pdf.

Annex 2.1. Asset Allocation: Theory and Practice[1]

Markowitz (1952) changed the way both academics and practitioners look at the portfolio selection problem. Markowitz's mean-variance approach became the basis for modern portfolio theory and the capital asset pricing model (CAPM) as well as for the application of continuous-time mathematics to the portfolio choice problem.

Formally, portfolio shares in the generic mean-variance model represent the solution to the optimization problem

$$\mathbf{w}^{\min} = \min\{\mathbf{w}'\boldsymbol{\Sigma}\mathbf{w}\} \quad (1)$$

subject to

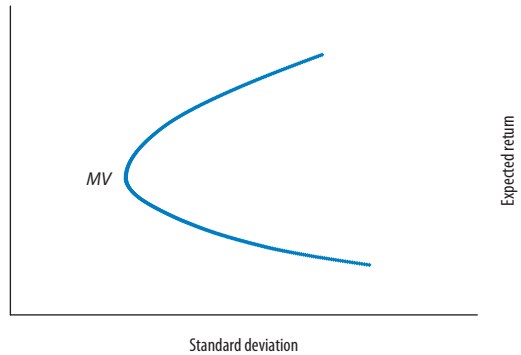
$$\mathbf{w}'\mathbf{r} = \hat{r} \quad (2)$$

and other constraints, where $\mathbf{w}$ is a column vector of portfolio shares, $\mathbf{r}$ is a column vector of expected returns, and $\boldsymbol{\Sigma}$ is the covariance matrix of returns; $\mathbf{w}$ and $\mathbf{r}$ are of dimension $n \times 1$; $\boldsymbol{\Sigma}$ is of dimension $n \times n$; and $\mathbf{w}^{\min}$ is the vector of portfolio shares that minimizes the volatility of the portfolio with expected return $\hat{r}$. Using the portfolio standard deviation σ_p as the only relevant risk measure, solving for different values of $\hat{r}$ yields a surface in σ-r space that represents all the points of a feasible minimum-risk portfolio for a given return, that is, the *minimum-variance frontier* (Figure 2.10). The upper part of the minimum-variance frontier—starting at MV, the point of minimum variance—is called the *efficient frontier*, as these portfolios dominate those on the frontier below MV, which provide a lower return for the same risk.

Starting in the 1970s, the mean-variance approach became the workhorse of most of those who allocate assets. In applied work using this approach, returns were generally assumed to come from a normal statistical distribution, where the mean and variance are sufficient to completely describe the shape of the distribution. The properties of the normal distribution made it easier to calculate various risk measures and simplified some of the mathematics of the model. At a minimum, it provided a benchmark against which other asset allocation models could be compared.

[1]Prepared by Peter Lindner.

Figure 2.10. Minimum Variance Frontier



However, as the mean-variance model became widely adopted for strategic asset allocation, a number of weaknesses to the approach gradually came to the fore.

First, expected returns and the covariance matrix of returns for *all* assets have to be either estimated or derived from analyst estimates. But investors typically have firm ideas about the returns of only a subset of assets. For another set of assets, they might have less precise ideas, and for the remainder, they might not have formed any idea about expected returns. To avoid having to establish a full set of expected returns, many investors simply used historical returns when other estimates were not available. In the case of fixed income assets, yields were often used as the estimate of expected returns. A significant problem is that historical estimates and yields have proved to be bad indicators of future returns. Similarly, although estimates of the matrix of return covariances were initially deemed fairly stable, recent statistical advances have shown that they are time-varying.[2]

A second, more fundamental problem appeared in many applications. When correlations between asset returns were high and they had similar volatilities, small changes in expected returns among them generated dramatic changes in the model-based portfolio allocations that were far greater than most users expected and, if implemented, would have imposed potentially large transaction

[2]Time-varying covariance matrices also presented a problem. However, covariance matrices that are estimated on the basis of a GARCH (generalized autoregressive conditional heteroskedasticity) model can accommodate changing volatilities and correlations.

costs. Those cases showed that mean-variance optimization algorithms do not discriminate well among such assets.

Users dealt with these drawbacks mainly by imposing constraints such as limiting certain assets to a much smaller share than the optimization algorithm would suggest. Although such procedures introduced a degree of arbitrariness, they were more in line with the standard practice that combines investment experience with quantitative methods.[3]

The Black-Litterman (BL) approach seeks to address these issues.[4] It derives a vector of implied expected returns from the existing weights of the market portfolio. Those returns become the starting point for further analysis, to which the investor's own return forecasts and confidence in those forecasts can be added. Further, return forecasts can be formulated on a relative basis (that is, the expected return of asset A is assumed only to be higher than that of asset B) to arrive at the optimal BL asset allocation. In many applications of the BL model, the weights of only those assets for which returns were modified would change appreciably upon recalculation.

Although the BL model alleviates some significant shortcomings of the mean-variance approach, its underlying distributional assumptions still pose particular challenges. These challenges were brought to the fore by ongoing market developments:

- Many assets—for example, options and credit-dependent bonds and derivatives—have returns that cannot be reasonably approximated by a normal distribution. The nonlinear payoff structures of many instruments (including derivatives) made it progressively harder to justify allocation algorithms based on linear approximations.
- A number of events focused attention on "tail risks," which, within the framework of a normal distribution, have an extremely small probability of occurring, but are realized more frequently than predicted by normality (including during the global financial crisis).[5] Also, many standard asset return distributions displayed asymmetry, or "skewness." These observations made the assumption of a normal distribution hard to maintain, and models that incorporate this assumption lead to unexpectedly large losses.

Hence, the global financial crisis weakened investors' trust in the mean-variance model. However, although advances have been made on the quantitative and statistical fronts, and more reliance is being placed on investment experience, no consensus approach has yet emerged to take the place of the mean-variance model.

[3]Doing so allows practitioners to incorporate elements like trading and market impact costs and the potential for market intervention by regulators, which are often hard to model.

[4]See Black and Litterman (1990 and 1992) and Idzorek (2005).

[5]For some assets, datasets, and data frequencies, models calculated probabilities on the order of 1 in 1 trillion for some observed returns—too small to be realistic.

Annex 2.2. Results of the IMF Survey on Global Asset Allocation[1]

In April and May 2011, the IMF asked the approximately 300 largest asset management companies and 200 largest pension funds and plan sponsors in the world to participate in a survey of perceived longer-term trends in global asset allocation.[2] A total of 122 firms participated: 68 asset management companies (hereafter, asset managers) and 54 pension funds or plan sponsors (pension funds). Their responses are summarized below. Survey participants are listed at the end of this annex (Table 2.22).

Assets under Management and Allocation Trend[3]

At year-end 2010, the asset managers in the survey had $16 trillion in assets under management, and the surveyed pension funds had $3 trillion (Table 2.11).[3] The participating asset managers, acting in various capacities, covered a wide range of investor types (Table 2.12).[4]

In terms of asset class allocation, shares for equities declined markedly between end-2006 and end-2010 for the asset managers and pension funds surveyed, while the shares for fixed income rose.[5] Shares for alternative investments (real estate, hedge funds, private equity, and commodities) increased marginally for pension funds after 2006 (Table 2.13).

[1]Prepared by Ken Chikada.

[2]The potential participants were identified with data in Towers Watson (2010a and 2010b) and other relevant information.

[3]The combined amount represented about one-fourth of the world total. The latest available data show that the global fund management industry had $71 trillion in total assets under management at year-end 2009 (TheCityUK, 2010).

[4]To a large extent, asset allocations of asset managers were driven by their clients' demands. Only 17 percent of asset managers replied that their asset allocations were not at all affected by client demands.

[5]The survey aimed to collect quantitative data since 2002, but many participants could not provide consistent data for 2002. We focus here on the data since 2006.

Global Asset Allocation and Underlying Factors

By region, assets were predominantly concentrated in advanced economies, particularly in the G-7 (Tables 2.14 and 2.15). However, allocations to emerging market economies increased noticeably, albeit from very low levels for some regions.

In general, both asset managers and pension funds put substantial importance on economic growth prospects when determining country allocations; in contrast, interest rate differentials between countries were not a dominant factor (Table 2.16). Also, asked specifically what factors led to changes in asset allocations into cross-border investments between end-2006 and end-2010, respondents cited the desire for portfolio diversification as playing a key role (Table 2.17).

The Low Interest Rate Environment and Risk-Return Profiles

After end-2006, a majority of asset managers and pension funds put more emphasis on controlling risk than on enhancing returns, and some even lowered their exposures to risky assets and accepted lower returns (Table 2.18).

A majority of asset managers and pension funds expected policy rates in advanced economies to remain below end-2007 levels for at least the next three years (Table 2.19).

Use of Derivatives

The hedging instruments most frequently used by asset managers and pension funds were currency forwards and futures, followed by options/swaptions and interest rate swaps (Table 2.20). Asset managers used a wider set of instruments more extensively than pension funds and used them more to enhance yields than did pension funds (Table 2.21). Consistent with the trend mentioned above to reduce risk exposures, usage of most hedging instruments increased since end-2006 for both asset managers and pension funds.

Table 2.11. Survey Participants' Assets under Management

(In billions of U.S. dollars)

	Asset Managers				Pension Funds			
	2002	2006	2008	2010	2002	2006	2008	2010
Assets under management	6,014	13,055	12,501	16,248	1,509	2,807	2,862	3,368
Number of respondents	51	63	67	68	52	53	53	54

Source: IMF Survey on Global Asset Allocation.

Table 2.12. Asset Managers' Assets under Management: Origin of Funds

(In percent)

	2006	2008	2010
Pension funds	24.6	26.2	25.8
Endowments	2.4	2.4	2.4
Insurance companies	15.5	17.2	18.0
Sovereigns	0.9	1.2	1.5
Retail	36.2	32.9	33.0
Exchange traded funds	0.2	0.1	0.4
Banks	2.9	2.7	2.7
Unspecified	17.3	17.2	16.3

Source: IMF Survey on Global Asset Allocation.

Note: Figures are averages of 52 respondents.

Table 2.13. Asset Allocation by Asset Class

(In percent)

	Asset Managers			Pension Funds		
	2006	2008	2010	2006	2008	2010
Traditional asset classes						
Cash	6.9	8.9	6.5	1.7	2.1	2.4
Equities	39.7	31.2	34.5	51.4	40.3	44.9
Bonds	41.9	46.6	46.7	36.0	41.9	37.1
Subtotal	88.5	86.7	87.7	89.1	84.3	84.4
Alternative asset classes						
Real estate	4.4	5.2	4.7	5.2	6.7	5.6
Hedge funds	1.7	2.1	1.4	1.5	2.2	2.2
Private equity	0.5	0.6	0.6	2.7	4.5	4.6
Commodities	0.1	0.1	0.1	0.4	0.6	1.0
Others	4.8	5.4	5.5	1.0	1.7	2.1
Subtotal	11.5	13.3	12.3	10.9	15.7	15.6

Source: IMF Survey on Global Asset Allocation.

Note: Figures are averages for 55 asset manager respondents and 49 pension fund respondents.

Table 2.14. Regional Allocation
(In percent)

	Asset Managers				Pension Funds			
	Bonds		Equities		Bonds		Equities	
	2006	2010	2006	2010	2006	2010	2006	2010
Own country of domicile	61.0	60.1	47.5	44.8	78.1	75.7	55.5	50.3
East Asia/Pacific	3.4	3.6	8.5	9.0	1.8	2.4	8.6	10.1
Europe	27.2	27.1	28.2	27.1	11.7	11.4	22.1	21.4
Latin America	0.8	0.8	1.8	2.6	0.3	0.9	0.8	2.5
Middle East/North Africa	0.1	0.2	0.2	0.3	0.0	0.3	0.2	0.4
North America	7.1	7.7	11.7	13.0	7.9	8.9	11.6	13.1
South/Central Asia	0.2	0.2	0.8	2.1	0.1	0.4	1.1	2.0
Sub-Saharan Africa	0.0	0.0	0.1	0.2	0.0	0.1	0.1	0.3

Source: IMF Survey on Global Asset Allocation.

Note: For asset managers, figures are averages for 29 respondents for bonds and 32 respondents for equities. For pension funds, figures are averages for 28 respondents.

Table 2.15. Top 10 Investment Destinations
(Ranked by scores)

	Asset Managers		Pension Funds	
Rank	Country	Score	Country	Score
1	United States	225	United States	226
2	United Kingdom	115	United Kingdom	159
3	Germany	100	Japan	112
4	France	97	Germany	52
5	Japan	77	France	48
6	Italy	52	Canada	37
7	Canada	42	Switzerland	27
8	Switzerland	28	Australia	15
9	Australia	23	Sweden	14
10	Brazil	22	Denmark	10

Source: IMF Survey on Global Asset Allocation.

Note: Shown are the 10 countries cited most frequently by respondents, who were asked to report their top five countries. Score is calculated as (5 * rank-1 country) + (4 * rank-2 country) + (3 * rank-3 country) + (2 * rank-4 country) + (1 * rank-5 country). Results are for 64 asset manager respondents and 52 pension fund respondents.

Table 2.16. Top Five Factors Considered in Country Allocation
(Ranked by scores)

	Asset Managers		Pension Funds	
Rank	Factors	Score	Factors	Score
1	Economic growth prospects	190	Economic growth prospects	137
2	Sovereign debt issues	87	Liquidity of relevant markets	71
3	Inflation prospects	78	Inflation prospects	48
4	Interest rate differentials between countries	73	Sovereign debt issues	43
5	Industry- or sector-specific characteristics	62	Interest rate differentials between countries	34

Source: IMF Survey on Global Asset Allocation.

Note: Shown are the five factors cited most frequently by respondents, who were asked to report their top four factors. Score is calculated as (4 * rank-1 factor) + (3 * rank-2 factor) + (2 * rank-3 factor) + (1 * rank-4 factor). Results are for 62 asset manager respondents and 43 pension fund respondents.

Table 2.17. Top Five Factors Considered in Cross-Border Investment since End-2006
(Ranked by scores)

	Asset Managers		Pension Funds	
Rank	Factors	Score	Factors	Score
1	Diversification	115	Diversification	106
2	Longer-term growth prospects	113	Longer-term growth prospects	100
3	Search for yield	93	Search for yield	40
4	Sovereign or country risk	60	Range of investments available	33
5	Market liquidity	58	Volatility	32

Source: IMF Survey on Global Asset Allocation.

Note: Shown are the five factors cited most frequently by respondents, who were asked to report their top four factors. Score is calculated as (4 * rank-1 factor) + (3 * rank-2 factor) + (2 * rank-3 factor) + (1 * rank-4 factor). Results are for 61 asset manager respondents and 40 pension fund respondents.

Table 2.18. Experience and Expectations of Portfolio Risk Exposures and Returns
(In percent of respondents)

	Asset Managers		Pension Funds	
Changes in risk exposure and return	Since end-2006	In the next 3 years	Since end-2006	In the next 3 years
Higher risk exposure and…				
…higher return	6.3	9.5	16.3	16.3
…same return	4.8	3.2	12.2	2.0
…lower return	6.3	3.2	4.1	2.0
Same risk exposure and…				
…higher return	3.2	14.3	2.0	6.1
…same return	20.6	41.3	18.4	34.7
…lower return	27.0	7.9	18.4	10.2
Lower risk exposure and…				
…higher return	0.0	3.2	2.0	0.0
…same return	11.1	7.9	4.1	6.1
…lower return	20.6	9.5	22.4	22.4

Source: IMF Survey on Global Asset Allocation.

Note: The table summarizes the answers to two survey questions: (i) How has the risk exposure and return of your portfolio changed compared to end-2006? and (ii) Given your expectations for the risk/return landscape going forward, how do you think the risk exposure and expected return of your portfolio will change in the next three years, compared to today? Results are for 63 asset manager respondents and 49 pension fund respondents.

Table 2.19. Expected Period before Policy Rate Rise
(In percent of respondents)

	Asset Managers	Pension Funds
In 1 year	0.0	0.0
In 2 years	14.1	12.2
In 3 years	50.0	55.1
In 5 years	20.3	18.4
Beyond 5 years	15.6	14.3

Source: IMF Survey on Global Asset Allocation.

Note: Share of respondents expecting the policy rates in advanced economies to return to end-2007 levels in each time period. Results are for 64 asset manager respondents and 49 pension fund respondents.

Table 2.20. Use of Hedging Instruments
(In percent of respondents)

		Among Users, Change in Use since End-2006	
Instruments	Currently Using	Increased	Decreased
Asset Managers			
Currency forwards	88.9	73.2	7.1
Futures	88.9	67.9	12.5
Options/swaptions	76.2	56.3	20.8
Interest rate swaps	69.8	59.1	9.1
Credit default swaps	57.1	58.3	22.2
Currency swaps	47.6	50.0	26.7
Correlation hedging	42.9	63.0	3.7
Forward rate agreement	38.1	50.0	12.5
Cross-currency swaps	36.5	52.2	17.4
Short sales	27.0	47.1	5.9
Political risk insurance	6.3	0.0	25.0
Pension Funds			
Currency forwards	69.2	69.4	13.9
Futures	59.6	74.2	6.5
Interest rate swaps	51.9	70.4	18.5
Options/swaptions	46.2	79.2	8.3
Credit default swaps	38.5	70.0	10.0
Forward rate agreement	32.7	70.6	0.0
Currency swaps	32.7	64.7	5.9
Cross-currency swaps	19.2	90.0	0.0
Correlation hedging	17.3	55.6	11.1
Short sales	11.5	83.3	0.0
Political risk insurance	1.9	0.0	0.0

Source: IMF Survey on Global Asset Allocation.

Note: Results are for 63 asset manager respondents and 52 pension fund respondents.

Table 2.21. Use of Derivatives to Enhance Yields
(In percent of respondents)

	Asset Managers	Pension Funds
Not at time of survey		
Never	33.8	49.1
Not any more	1.5	0.0
Yes at time of survey and change since end-2006		
Less use	6.2	1.9
No change	16.9	9.4
More use	41.5	39.6

Source: IMF Survey on Global Asset Allocation.

Note: Results are for 65 asset manager respondents and 53 pension fund respondents.

Table 2.22. Survey Participants

Asset Managers	Pension Funds
Allianz Global Investors	Arizona State Retirement System
APG All Pensions Group	Barclays Plc.
Arca Sgr SpA	Canada Pension Plan Investment Board
Artio Global Management LLC	Colorado Public Employees' Retirement Association
Aviva Plc	Doctors Pension Funds Services
Banco Itau Unibanco	Emergency Services & State Super (ESSSuper)
Bank of Montreal Financial Group	Exxon Mobil Corporation
BayernInvest Kapitalanlagegesellschaft mbH	Första AP-Fonden
BNP Paribas	GE Asset Management
Caisse de dépôt et placement du Québec	Government Pension Investment Fund
Caixa Gestão de Activos	Healthcare of Ontario Pension Plan
Colonial First State Global Asset Management	International Business Machines (IBM)
Credit Suisse AG	Illinois Municipal Retirement Fund
Cutwater Asset Management	Illinois Teachers Retirement System
Danske Capital	National Grid Plc.
DekaBank	Novartis
Delaware Investments	Pension Fund Association for Local Government Officials
Deutsche Asset Management	Public Employees' Retirement System of Nevada
Edmond de Rothschild Asset Management	Retirement Systems of Alabama
F&C Investments	Retirement Systems of Georgia
Fiera Sceptre Inc.	South Carolina Retirement System Investment Commission
HarbourVest Partners	State of Wisconsin Investment Board
Helaba Invest Kapitalanlagegesellschaft mbH	Stichting Pensioenfonds Metaal en Techniek
HSBC Asset Management	Strathclyde Pension Fund
Investment Solutions Limited	Sunsuper
Legal & General Group Plc	Texas Municipal Retirement System
MEAG MUNICH ERGO Asset Management	The State Pension Fund
Mitsubishi UFJ Financial Group Inc.	United Parcel Service
Mondrian Investment Partners Limited	United Technologies Corporation
Nikko Asset Management	Versorgungsanstalt des Bundes und der Länder
Nordea Investment Management AB	Verizon Investment Management Corp.
Pioneer Investments	
PNC Financial Services Group Inc.	
Rabobank	
SEB Wealth Management	
Stone Harbor Investment Partners LP	
Sun Life Financial	
Swiss Life	
TD Asset Management Inc.	
Tokio Marine & Nichido Fire Insurance Co., Ltd.	
UBS Global Asset Management	
Union Asset Management Holding	
Union Bancaire Privée, UBP SA	
van Lanschot Bankiers	
William Blair & Company	

Source: IMF Survey on Global Asset Allocation.
Note: Among participants, 23 asset managers and 22 pension funds chose to remain anonymous.

Annex 2.3. Defining Foreign Exchange Reserves and Sovereign Wealth Funds[1]

Foreign Exchange Reserves

The IMF's primary definition of reserve assets is contained in its BoP/IIP manual (IMF, 2009, Chapter VI, paragraph 6.64) as follows:

> Reserve assets are those external assets that are readily available to and controlled by monetary authorities for meeting balance of payments financing needs, for intervention in exchange markets to affect the currency exchange rate, and for other related purposes (such as maintaining confidence in the currency and the economy, and serving as a basis for foreign borrowing).

The IMF further defines reserve assets by stating that they "must be both denominated and settled in foreign currency" (paragraph 6.71) and "must be denominated and settled in convertible foreign currencies" (paragraph 6.72); and that "reserve assets, other than gold bullion, must be claims on nonresidents" (paragraph 6.65). These definitions place few restrictions on the asset classes that can be used for reserve asset investments. The main constraints are that they must be liquid ("readily available") and that they must constitute claims on "nonresidents" in "convertible foreign currencies."

Sovereign Wealth Funds

The International Working Group of Sovereign Wealth Funds (2008) defines sovereign wealth funds (SWFs) as "special-purpose investment funds or arrangements that are owned by the general government" (p. 3). "Created by the general government for macroeconomic purposes, SWFs hold, manage, or administer assets to achieve financial objectives, and employ a set of investment strategies that include investing in foreign financial assets" (p. 3). In addition, SWFs "are commonly established out of balance of payments surpluses, official foreign currency operations, the proceeds of privatizations, fiscal surpluses, and/or receipts resulting from commodity exports" (p. 3, note 7). This definition excludes, among other things, "foreign currency reserve assets held by monetary authorities for the traditional balance of payments or monetary policy purposes, state-owned enterprises (SOEs) in the traditional sense, government-employee pension funds, or assets managed for the benefit of individuals" (p. 3, note 6).

The above definition of SWFs covers three key elements: ownership, type of investments, and purposes and objectives.

- Ownership: SWFs are owned by the general government, which includes both central government and subnational governments.[2]
- Investments: The investment strategies include investments in foreign financial assets, and excludes those funds that invest solely in domestic assets.
- Purposes and objectives (Table 2.23): SWFs are created to invest government funds to achieve financial objectives, and (may) have liabilities that are only broadly defined, thus allowing SWFs to employ a wide range of investment strategies with a medium- to long-term timescale. The objective of SWFs is different than that of, for example, reserve portfolios held only for traditional balance of payments purposes. Under the definition, SWFs may include reserve assets, but reserve assets are generally not intended to be a part of SWFs.[3]

Furthermore, the statement of the International Working Group of Sovereign Wealth Funds (2008) that SWFs are "commonly established out of balance of payments surpluses, official foreign currency operations, the proceeds of privatizations, fiscal surpluses, and/or receipts resulting from commodity exports" (p. 3) reflects both the traditional origin of SWFs—the revenues received from mineral wealth—and the more recent approach of transferring excess reserves.

[1]Prepared by Peter Lindner.

[2]Note that the use of the word *arrangements* as an alternative to *funds* allows for a flexible interpretation of the legal arrangement through which the assets can be invested. SWFs vary in their institutional arrangements, and the way they are recorded in the macroeconomic accounts may differ depending on their individual circumstances. See also IMF (2001b).

[3]Likewise, the intention is not to exclude all assets on the books of central banks: SWFs can be on the books of central banks if they are held for other than balance of payments purposes (for example, intergenerational wealth transfer).

Table 2.23. Sovereign Wealth Fund Classification

Source	Year Established	Country	Policy Purpose			
			Macro Stabilization	Saving	Pension Reserve	Reserve Investment
Oil/Natural gas	1953	Kuwait	Kuwait Investment Authority, General Reserve Fund	Kuwait Investment Authority, Future Generations Fund		
	1976	Canada		Alberta Heritage Savings Trust Fund		
	1976	United Arab Emirates		Abu Dhabi Investment Authority		
	1976	United States		Alaska Permanent Fund		
	1980	Oman		State General Reserve Fund		
	1983	Brunei Darussalam		Brunei Investment Agency		
	1996	Norway	Government Pension Fund, Global	Government Pension Fund, Global	Government Pension Fund, Global	
	1999	Azerbaijan	State Oil Fund	State Oil Fund		
	2000	Iran, Islamic Republic of	Oil Stabilization Fund			
	2000	Mexico	Oil Revenues Stabilization Fund			
	2000	Qatar		Qatar Investment Authority		
	2000	Trinidad and Tobago	Heritage and Stabilization Fund	Heritage and Stabilization Fund		
	2001	Kazakhstan	National Fund	National Fund		
	2002	Equatorial Guinea		Fund for Future Generations of Equatorial Guinea		
	2004	São Tomé and Príncipe		National Oil Account		
	2005	Timor Leste	Petroleum Fund	Petroleum Fund		
	2006	Bahrain	The Future Generations Reserve Fund	The Future Generations Reserve Fund		
	2006	Libya		Libyan Investment Authority		
	2008	Russian Federation	Reserve Fund		National Wealth Fund	
Other commodity	1956	Kiribati		Kiribati, Revenue Equalization Fund		
	1996	Botswana		Botswana, Pula Fund		
	2006	Chile			Pension Reserve Fund	
	2007	Chile	Economic and Social Stabilization Fund			
Fiscal surpluses	1974	Singapore		Singapore, Temasek		
	1981	Singapore				Government of Singapore Investment Corporation
	1993	Malaysia		Khazanah Nasional BHD		
	2000	Ireland			Ireland, National Pensions Reserve Fund	
	2001	New Zealand			New Zealand Superannuation Fund	
	2006	Australia			Australia, Future Fund	
	2005	Korea, Republic of				Korea Investment Corporation
Foreign exchange reserves	1981	Singapore				Government of Singapore Investment Corporation
	2005	Korea, Republic of				Korea Investment Corporation
	2007	China				China Investment Corporation

Source: Kunzel and others (2010); and national authorities.

Reserve assets and assets held by an SWF can overlap, in that reserve assets can be held within an SWF. However, such overlap can occur only when the SWF is "permitted to transact in such assets only on terms specified by the monetary authorities or only with their express approval" (IMF, 2009, Chapter VI, paragraph 6.67).

Annex 2.4. Theoretical Foundation of the Regression Specification and Detailed Regression Results[1]

In the generic mean-variance (or Markowitz) model, an investor will choose portfolio shares for assets that minimize the variance of the portfolio's value for a given portfolio return.[2] The solution to that problem yields optimal portfolio shares that minimize the variance across all possible combinations of returns. Each investor can then choose a variance-return combination that maximizes the investor's welfare (which will depend on the investor's risk aversion). Later versions of the mean-variance model have used various "utility" functions (that is, functions that conveniently summarize the investor's preferences) derived from microeconomic principles. We employ the widely used constant relative risk aversion (CRRA) utility function U, which is time separable, that is, where total welfare is a simple sum of welfare in each separate period. This can be represented by the following:

$$max E_t \sum_{i=0}^{\infty} \delta^i U(C_{t+i}) = \sum_{i=0}^{\infty} \delta^i \frac{C_{t+i}^{1-\gamma} - 1}{1-\gamma} \quad (1)$$

where C_{t+i} denotes consumption at time $t + i$; γ is the coefficient of relative risk aversion, which is assumed not to depend systematically on the investor's wealth; δ^i is a discount factor; and E_t is the expectations operator, taking into account all information up through period t. The intertemporal budget constraint of the investor is given by

$$W_{t+1} = (1 + R_{p,t+1})(W_t - C_t) \quad (2)$$

where $R_{p,t+1}$ is the portfolio return between period t and $t + 1$, and W_{t+1} is wealth in period $t + 1$. Suppose portfolio returns depend on N risky assets and one risk-free asset. $\mathbf{R}_{t+1}$ is a vector of risky returns with N elements. It has a mean vector $E_t\mathbf{R}_{t+1}$, and a variance-covariance matrix $\mathbf{\Sigma}_{t+1}$. $\boldsymbol{\alpha}_t$ is a vector of allocations to the risky asset. The riskless asset has return $r_{f,t+1}$ from time t to $t + 1$.[3] The portfolio manager optimally chooses $\boldsymbol{\alpha}_t$ to maximize utility subject to the budget constraint.

For this problem, no closed-form solution exists that will yield explicit portfolio weights based on the other variables. However, based on a linearized approximation to the intertemporal budget constraint (see Campbell and Viceira, 2002, for details) we can derive the following solution to the portfolio problem:

$$\boldsymbol{\alpha}_t = \frac{1}{\gamma}\mathbf{\Sigma}_t^{-1}(E_t\boldsymbol{r}_{t+1} - r_{f,t+1}\boldsymbol{\iota} + \sigma_t^2/2) + (1 - \frac{1}{\gamma})\mathbf{\Sigma}_t^{-1}\sigma_{ht} \quad (3)$$

where $\boldsymbol{\iota}$ is a unit vector, and $\boldsymbol{\sigma}_{ht}$ is the vector of covariances of each risky asset return with revisions in expected future portfolio returns:

$$\boldsymbol{\sigma}_{ht} = Cov_t(\boldsymbol{r}_{t+1,} - (E_{t+1} - E_t)\sum_{j=1}^{\infty}\rho^j r_{p,t+1+j}) \quad (4)$$

where ρ is a parameter for the linearization. When the consumption-to-wealth ratio is constant, the covariance, $\boldsymbol{\sigma}_{ht}$, can be interpreted as the ratio of reinvested wealth to total wealth. One transformation of equation (2) allows us to restate $\boldsymbol{\sigma}_{ht}$ as the covariance of the risky asset return with the value function, v_t: $\boldsymbol{\sigma}_{ht} = Cov_t(r_{t+1}, -v_{t+1})$. This shows that the intertemporal component of asset demand is determined by the covariance of the risky asset's return with the investor's utility per unit wealth, which varies over time with investment opportunities.

Equation (3) illustrates that the demand for a risky asset depends on the weighted average of the risk premium (relative to its variance) and the asset's covariance with the revisions in the expectations of future portfolio returns (again relative to its variance), that is, an intertemporal term. The weights on these terms are proportional to the investor's risk tolerance (1/). This result, which assumes independently and identically distributed returns, therefore predicts that an investor will choose to allocate more portfolio wealth in a given asset i when it:

- offers high expected returns, that is, $E_t r_{t+1} - r_{f,t+1}\boldsymbol{\iota} + \alpha_t^2/2$ is high;
- has low variance, that is, the ith diagonal term in $\mathbf{\Sigma}_t$ is low;
- has low covariance with other assets in the portfolio, that is, the applicable nondiagonal terms in $\mathbf{\Sigma}$ are low; and
- offers a hedge against future declines in portfolio returns, that is, $\boldsymbol{\sigma}_{ht}$ is high.

[1]Prepared by Ruchir Agarwal, Serkan Arslanalp, and Tao Sun.
[2]Markowitz (1952).
[3]Lowercase r refers to log returns: $r = \log(1 + R)$.

When risk aversion increases, investors will bias their portfolio toward the risk-free asset. Therefore, in periods of elevated risk aversion, funds should flow out of risky bonds and equities to "risk free" instruments (which, from the perspective of a long-term investor, is an asset that approximates a long-term inflation-indexed bond with low default risk).

The independent variables in the regression in the chapter proxy for the various determinants in equation (3) above, as shown in the table below.

Table 2.24 gives the detailed regression results.

Model determinant	Equities		Bonds	
	Empirical equivalent	Proxy in regressions	Empirical equivalent	Proxy in regressions
Expected returns	Capital gains Dividends Country risk	Real GDP growth Real GDP growth Country risk	Coupon payments Default/credit risk Country risk	3-month interest rate Real GDP growth Country risk
Variance	Stock market volatility	Real GDP volatility	Inflation risk	Inflation risk
Covariance (diversification effect)	Covariance with world returns	Covariance of country equity returns with world portfolio returns	Covariance with world returns	Covariance of country bonds returns with world portfolio returns
Intertemporal hedge	Covariance with change in world returns	Covariance of country equity returns with changes in world portfolio returns	Covariance with change in world returns	Covariance of country bond returns with changes in world portfolio returns

Table 2.24. Determinants of Equity and Bond Flows: Panel Regression Results

	World		Asia		Latin America		Europe, Middle East, and Africa		G-7 Countries		Non-G-7 Advanced Countries	
	Equities	Bonds	Equities	Bonds	Equities	Bonds	Equities	Bonds	Equities	Bonds	Equities	Bonds
Policy rate differential (host–G-4 average)	-0.042	-0.145	-0.362**	-0.499	-0.068	-0.003	0.081	-0.636***	0.053	-0.519	0.412***	0.410
	(-0.597)	(-1.542)	(-2.391)	(-1.073)	(-0.840)	(-0.056)	(0.457)	(-3.246)	(0.152)	(-1.120)	(3.807)	(1.454)
GDP growth forecast	0.418***	0.775***	0.274**	0.168	0.506**	0.564***	0.483**	1.265***	0.359**	0.452***	0.256***	0.604***
	(4.389)	(5.557)	(2.426)	(0.790)	(2.509)	(5.189)	(2.364)	(5.479)	(2.054)	(3.418)	(3.376)	(2.777)
Inflation volatility	-0.095	-0.634**	-0.534**	-0.883**	0.293	0.147	0.654	-0.548*	-0.327*	-1.955**	-0.436**	-1.439**
	(-0.478)	(-2.145)	(-2.015)	(-2.058)	(1.441)	(0.218)	(1.065)	(-1.676)	(-1.890)	(-2.441)	(-2.501)	(-2.175)
GDP growth volatility	-1.908***	-4.654***	-2.835***	-7.134***	-2.997***	-5.597***	-2.423***	-3.405***	0.171	-3.410***	-1.029***	-3.463***
	(-4.958)	(-8.389)	(-3.110)	(-8.558)	(-5.029)	(-7.783)	(-2.983)	(-3.356)	(0.419)	(-4.256)	(-3.287)	(-5.481)
Exchange rate volatility	-0.389***	-0.835***	-0.485**	-1.161***	-0.268	-0.080	-0.556***	-1.104***	-0.361***	-0.850**	-0.334***	-1.063***
	(-3.630)	(-3.026)	(-2.165)	(-4.641)	(-0.677)	(-0.135)	(-4.177)	(-3.864)	(-2.805)	(-2.422)	(-5.757)	(-9.843)
Return covariance (cross-country)	-0.054	-0.462***	0.025	-0.656***	0.235***	-0.422***	-0.129***	-0.275***	0.002	-0.644***	0.019	-0.574***
	(-1.484)	(-6.532)	(0.721)	(-9.542)	(4.034)	(-10.262)	(-3.506)	(-2.989)	(0.036)	(-5.005)	(0.599)	(-13.405)
Return covariance (intertemporal)	-0.002	0.034	0.001	0.198***	-0.456***	-0.289***	0.120*	0.049	-0.136*	0.077	-0.173***	-0.030
	(-0.028)	(0.784)	(0.037)	(3.791)	(-6.069)	(-3.367)	(1.673)	(1.033)	(-1.867)	(1.167)	(-6.011)	(-0.690)
Country risk	-0.052*	-0.147***	-0.157**	-0.351***	-0.066	-0.282	-0.080	-0.151***	-0.019	-0.058	-0.023	0.005
	(-1.833)	(-2.996)	(-2.296)	(-4.957)	(-0.963)	(-1.594)	(-0.963)	(-2.981)	(-0.304)	(-0.796)	(-0.836)	(0.051)
VIX index	-0.047***	-0.071***	-0.084***	-0.073***	-0.096***	-0.079***	-0.044***	-0.117***	-0.022***	-0.047***	-0.024***	-0.051***
	(-8.368)	(-7.792)	(-10.264)	(-8.984)	(-6.437)	(-4.972)	(-3.892)	(-5.074)	(-9.109)	(-6.170)	(-6.977)	(-4.224)
Capital control index	-1.154	-3.897***	-7.776***	-1.605	0.364	5.839**	0.981	-3.070	-9.775*	-11.491***	-0.902	-8.481***
	(-1.125)	(-2.625)	(-3.342)	(-0.561)	(0.176)	(1.988)	(0.517)	(-0.951)	(-1.902)	(-2.915)	(-1.113)	(-5.989)
Crisis dummy 1	-0.723***	-2.388***	-0.516**	-2.216***	0.205	-2.758***	-0.617***	-2.536***	-0.848***	-1.602***	-1.023***	-2.309***
	(-7.155)	(-16.002)	(-2.375)	(-8.895)	(0.927)	(-6.505)	(-3.102)	(-6.603)	(-4.152)	(-4.147)	(-13.087)	(-9.220)
Crisis dummy 2	-0.513*	-2.308***	0.327	-3.597***	1.033***	-4.119***	-1.285	-3.632***	-0.823***	-0.203	-0.741***	-0.906**
	(-1.914)	(-6.899)	(0.843)	(-7.363)	(5.464)	(-6.103)	(-1.104)	(-5.847)	(-3.295)	(-0.391)	(-8.102)	(-2.079)

Table 2.24. *(continued)*

	World		Asia		Latin America		Europe, Middle East, and Africa		G-7 Countries		Non-G-7 Advanced Countries	
	Equities	Bonds	Equities	Bonds	Equities	Bonds	Equities	Bonds	Equities	Bonds	Equities	Bonds
Time trend	0.000	0.071***	-0.026***	0.105***	-0.034***	0.088***	0.033	0.099***	0.014**	0.033***	0.003	0.043***
	(0.052)	(10.724)	(-3.253)	(10.226)	(-4.048)	(6.367)	(1.575)	(9.091)	(2.361)	(3.651)	(1.227)	(5.639)
Constant	0.932	-7.071***	8.375***	-11.554***	4.979***	-12.243***	-4.228	-11.027***	-0.227	-2.464**	0.352	-3.551***
	(1.240)	(-6.913)	(4.193)	(-4.710)	(3.203)	(-9.145)	(-1.542)	(-5.524)	(-0.392)	(-1.990)	(1.385)	(-3.795)
Number of countries	50	50	9	9	6	6	13	13	7	7	15	15
Number of observations	2,966	2,845	504	504	395	397	527	461	490	485	1,050	998
R-squared (within)	0.160	0.472	0.271	0.510	0.147	0.490	0.214	0.615	0.295	0.526	0.400	0.475
R-squared (between)	0.047	0.003	0.493	0.288	0.068	0.003	0.370	0.173	0.073	0.351	0.121	0.210
R-squared (overall)	0.083	0.303	0.004	0.477	0.145	0.418	0.212	0.502	0.054	0.293	0.388	0.428

Source: IMF staff estimates.

Note: The table presents panel fixed-effects regressions on factors affecting equity and bond flows to advanced and emerging market economies between January 2005 and May 2011. The results are presented for the whole sample as well as for five separate regions. See notes to Table 2.4 for a definition of the regions. Dependent variables are monthly equity and bond flows as a proportion of assets dedicated to each country at the beginning of the month. The policy rate differential is the difference between the policy rate in the host country and the simple average policy rate for the G-4. GDP growth forecast is the one-year-forward GDP forecast for the host country, provided by Consensus Economics. Inflation volatility, GDP growth volatility, and exchange rate volatility are the standard deviation of inflation, GDP growth, and exchange rate forecasts over the past year. Country risk is a measure of country risk from International Country Risk Group (ICRG). The VIX index is used as a measure of global risk. Return covariance (cross-country) is a measure of the covariance of country returns with the world portfolio return (cross-country correlation factor). Return covariance (intertemporal) is a measure of the covariance of country returns with changes in the world portfolio return (intertemporal correlation factor). Capital control index is the 6-month lagged capital control index produced by the IMF's Monetary and Capital Markets Department. Crisis dummy 1 represents the period June 2007–August 2008 (global credit crunch). Crisis dummy 2 represents the period starting in September 2008 (Lehman Brothers bankruptcy). All independent variables, except for control variables (capital control index, crisis dummy 1, and crisis dummy 2), are in first-differences. A time trend is included. The values in parentheses are *t*-statistics. ***, **, and * denote statistical significance at the 1 percent, 5 percent, and 10 percent levels of confidence, respectively, based on robust standard errors.

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