CHAPTER 3

SAFE ASSETS: FINANCIAL SYSTEM CORNERSTONE?

Summary

The financial crisis and the heightened concerns about sovereign debt sustainability in many advanced economies have reinforced the notion that no asset can be viewed as truly safe. Recent rating downgrades of sovereigns previously considered to be virtually riskless have reaffirmed that even highly rated assets are subject to risks. The notion of absolute safety—implicit in credit rating agencies' highest ratings and embedded in prudential regulations and institutional investor mandates—can create a false sense of security, and it did prior to the crisis.

In this context, the chapter examines the various roles of safe assets; the effects of different regulatory, policy, and market distortions; and potential future pressure points that these distortions may create. Safe assets have varied functions in global financial markets, including as a reliable store of value, collateral in repurchase and derivatives markets, key instruments in fulfilling prudential requirements, and pricing benchmarks. In the absence of market distortions, safety is priced efficiently, reflecting sustainable demand-supply dynamics. However, heightened uncertainty, regulatory reforms, and crisis-related responses by central banks are driving up demand. On the supply side, the number of sovereigns whose debt is considered safe has fallen, which could remove some $9 trillion from the supply of safe assets by 2016, or roughly 16 percent of the projected total. Private sector production of safe assets has also declined as poor securitization in the United States has tainted these securities, while some new regulations may impair the ease with which the private sector can produce safe assets.

Demand and supply imbalances in global markets for safe assets are not new. Prior to the crisis, global current account imbalances encouraged safe asset purchases by official reserve managers and some sovereign wealth funds. Now, attention has focused on safe assets' capacity to meet new prudential requirements, increased collateral needs for over-the-counter (OTC) derivatives transactions or their transfer to centralized counterparties, and the increasing use of such assets in central bank operations. The shrinking set of assets perceived as safe, now limited to mostly high-quality sovereign debt, coupled with growing demand, can have negative implications for global financial stability. It will increase the price of safety and compel investors to move down the safety scale as they scramble to obtain scarce assets. Safe asset scarcity could lead to more short-term volatility jumps, herding behavior, and runs on sovereign debt.

To mitigate the risk to financial stability from a potentially bumpy, uneven path to a new price for safety, policy responses should allow for flexibility and be implemented gradually enough to avert sudden changes in what are defined as safe and less-safe assets. In general, policymakers need to strike a balance between the desire to ensure the soundness of financial institutions and the costs associated with a potentially too-rapid acquisition of safe assets to meet this goal. Specifically, careful design of some prudential rules could help increase the differentiation in the safety characteristics of eligible safe assets and would thus decrease the likelihood of cliff effects or runs on individual types of assets. On the supply side, desirable policies include improving fiscal fundamentals in countries subject to concerns about their debt sustainability, encouraging the private production of safe assets—such as well-conceived and regulated covered bond structures and placing securitization on a sounder footing—and building up the capacity of emerging economies to issue their own safe assets. These efforts can help to remove some of the impediments that may inhibit safe asset markets from moving to a new price for "safety."

In the future, there will be rising demand for safe assets, but fewer of them will be available, increasing the price for safety in global markets. In principle, investors evaluate all assets based on their intrinsic characteristics. In the absence of market distortions, asset prices tend to reflect their underlying features, including safety. However, factors external to asset markets—including the required use of specific assets in prudential regulations, collateral practices, and central bank operations—may preclude markets from pricing assets efficiently, distorting the price of safety. Before the onset of the global financial crisis, regulations, macroeconomic policies, and market practices had encouraged the underpricing of safety. Some safety features are more accurately reflected now, but upcoming regulatory and market reforms and central bank crisis management strategies, combined with continued uncertainty and a shrinking supply of assets considered safe, will increase the price of safety beyond what would be the case without such distortions.

The magnitude of the rise in the price of safety is highly uncertain given the broad-based roles of safe assets in global markets and regulations. Safe assets are used as a reliable store of value and aid capital preservation in portfolio construction. They are a key source of liquid, stable collateral in private and central bank repurchase (repo) agreements and in derivatives markets, acting as the "lubricant" or substitute of trust in financial transactions. As key components of prudential regulations, safe assets provide banks with a mechanism for enhancing their capital and liquidity buffers. As benchmarks, safe assets support the pricing of other riskier assets. Finally, safe assets have been a critical component of monetary policy operations. These widely varying roles of safe assets and the differential price effects across markets make it difficult to gauge the overall price of safety.

Assessing future supply-demand imbalances in safe asset markets is also made more complicated by the difference in emphasis that various groups of market participants place on specific safety attributes. From the perspective of conservative investors, for example, safe assets act as a store of value or type of insurance during financial distress. For official reserve managers and stabilization-oriented sovereign wealth funds, the ability to meet short-term contingent liabilities justifies a focus on the low market risk and high liquidity aspects of safety. From the perspective of longer-term investors—such as pension funds and insurance companies—safe assets are those that hold their value over longer horizons. Banks, collectively the largest holder of safe assets, demand safe assets for asset-liability management, for collateral, and for fulfilling their primary dealer and market-making responsibilities.

However, it is clear that market distortions pose increasing challenges to the ability of safe assets to fulfill all their various roles in financial markets. Even before the crisis, the rapid accumulation of foreign reserves and financial market underdevelopment in many emerging economies accounted for supply-demand imbalances in safe asset markets.[1] For banks, the common application of zero percent regulatory risk weights on debt issued by their own sovereigns, irrespective of risks, created perceptions of safety detached from underlying economic risks and contributed to the buildup of demand for such securities.[2] During the crisis, supply-demand imbalances and safe asset market distortions became even more obvious. Large-scale valuation losses on assets perceived as safe, first on AAA-rated tranches of mortgage-backed securities during the crisis, and more recently on some Organization for Economic Cooperation and Development (OECD) government debt, reduced the supply of relatively safe assets. Meanwhile, heightened uncertainty, regulatory reforms—such as new prudential and collateral requirements—and the extraordinary postcrisis responses of central banks in the advanced economies, have been driving up demand for certain categories of safe assets. Hence, safe asset demand is expanding at the same time that the universe of what is considered safe is shrinking.

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[1]See Caballero (2010); and Caballero and Krishnamurthy (2009).

[2]For euro area banks, zero percent risk weights can be applied to the debt issued by any euro area sovereign.

The tightening market for safe assets can have considerable implications for global financial stability, including an uneven or disruptive pricing process for safety. As investors scramble to attain scarce safe assets, they may be compelled to move down the safety scale, prompting the average investor to settle for assets that embed higher risks. In an extended period of low interest rates and heightened financial market uncertainty, changes in investors' risk assessment of the safety features of assets could lead to more frequent short-term spikes in volatility and the potential for a buildup of asset bubbles. Although regulatory reforms to make institutions safer are clearly needed, insufficient differentiation across eligible assets to satisfy some regulatory requirements could precipitate unintended cliff effects—sudden drops in the prices—when some safe assets become unsafe and no longer satisfy various regulatory criteria. Moreover, the burden of mispriced safety across types of investors may be uneven. For instance, prudential requirements could lead to stronger pressures in the markets for shorter-maturity safe assets, with greater impact on investors with higher potential allocations at shorter maturities, such as banks.

This chapter examines potential pressure points and distortions in the markets for safe assets and identifies how best to address them.[3] The shortage of safe assets has raised widespread concern in recent months, but no comprehensive, integrated view of the global demand and supply pressures has emerged as of yet. This chapter provides such a view. It first outlines the changes in investor perceptions as a result of the crisis and then identifies key demand and supply pressures. The chapter then outlines the resulting financial stability risks and concludes with potential policy implications.

The Safe Asset Universe

Characteristics of Safe Assets

It is important to recognize that there is no risk-free asset offering absolute safety. In theory, safe assets provide identical real payoffs in each state of the world.[4] True absolutely safe assets are a desirable part of a portfolio from an investor's perspective, as they provide full protection from credit, market, inflation, currency, and idiosyncratic risks; and they are highly liquid, permitting investors to liquidate positions easily.

However, in practice, all assets are subject to risks which, in an ideal world, should be reflected accurately in asset prices. The notion of absolute safety—implicit, for example, in credit rating agencies' highest ratings and embedded in prudential regulations and institutional investor mandates—can lead to an erroneously high level of perceived safety.[5] In turn, such inaccurate perceptions can expose regulated financial institutions and markets to higher credit and concentration risks. The onset of the global financial crisis revealed considerable underpricing of safety linked to over-reliance on credit ratings, adverse incentives from prudential regulations and private sector practices. The fact that even highly rated assets are not without risks was reaffirmed during the global financial crisis by losses on AAA-rated tranches of mortgage-backed securities and, more recently, by rating downgrades of sovereigns previously considered virtually riskless.

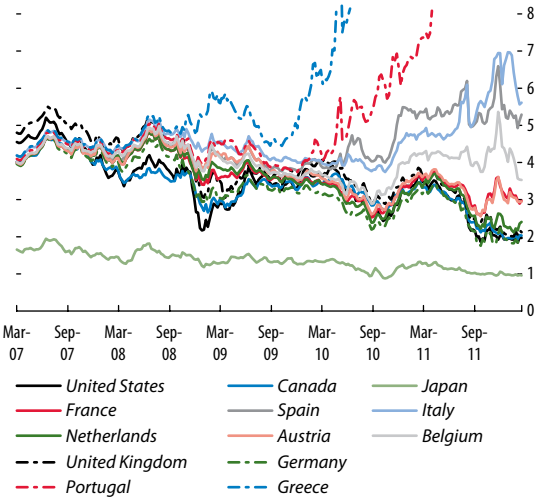
The global financial crisis appropriately prompted greater differentiation in the pricing of asset safety, with safety increasingly viewed in relative terms. Relative safety explains the considerable substitution away from other riskier asset classes into the debt of economies with perceived stronger fundamentals in recent months, including U.S. Treasuries (despite Standard & Poor's 2011 downgrade), German bunds, and Japanese government bonds. Investors' flight to relative safety has accounted for an increasing differentiation in the sovereign debt universe. Yields on some government bonds that ceased to be

[3]This chapter focuses on structural issues related to safe asset markets. Some short-term issues are discussed in Chapter 2.

[4]Theoretically, safe assets can be viewed as equivalent to a portfolio of Arrow-Debreu securities. An Arrow-Debreu security has an identical payoff in a particular state of the world across time, and a zero payoff in all other states. If an investor constructs a portfolio that includes an Arrow-Debreu security for each state of the world (assuming that financial markets are complete and investors are able to do so), he or she would effectively hold a safe asset.

[5]See IMF (2010b) for a more extensive discussion of ratings and their role in the crisis. The chapter recommends decoupling credit ratings from regulatory rules to avoid the buildup of inaccurate perceptions identified above.

Figure 3.1. Ten-Year Government Bond Yields in Selected Advanced Economies
(In percent)



Source: Bloomberg L.P.
Note: Yields greater than 8 percent are deliberately excluded to clarify developments in the low-yield range.

perceived as safe have spiked in the aftermath of the crisis, while yields on bonds viewed as safe havens irrespective of credit rating (such as those of the United States, Japan, and Germany, for example) have declined to historical lows (Figure 3.1).

A historical overview of sovereign debt ratings suggests that shifts in relative safety have precedents. Despite the limitations in the information content of sovereign debt ratings, the long time span of S&P ratings provides useful insights about the evolution of asset safety (Table 3.1):

- The current degree of differentiation across sovereigns in the OECD is more pronounced than in previous periods, with historically low ratings in southern Europe, Iceland, and Ireland, and downgrades in countries that had maintained AAA ratings since S&P reinstated sovereign ratings in the mid-1970s—Austria, France, and the United States.
- Sovereign ratings in Greece, Iceland, Ireland, Italy, Portugal, and Spain followed a sharp downward correction after an increase in the 1990s.
- OECD government debt was predominantly rated AAA during the 1990s.
- The share of unrated OECD sovereigns was high until the mid-1980s, in part reflecting low defaults and high perceptions of safety in the 1960s and the 1970s.[6]

The first three points suggest that during some periods, such as periods of calm, ratings did not sufficiently capture the credit quality of assets with varied underlying fundamentals.

In practice, relative asset safety can be seen by considering a continuum of asset characteristics. Safe assets meet the criteria of: (1) low credit and market risks, (2) high market liquidity, (3) limited inflation risks, (4) low exchange rate risks, and (5) limited idiosyncratic risks. The first criterion, low credit and market risks, is pivotal to asset safety, as a lower level of these risks tends to be linked with higher liquidity. However, high market liquidity depends on a wider array of factors, including ease and certainty of valuation, low correlation with risky assets, an active and sizable market, and low market correlation, among others.[7] Importantly, different investors place a different emphasis on each of these criteria. For example, investors with long-term liabilities—such as pension funds and insurance companies—place limited emphasis on market liquidity and thus consider less liquid, longer maturity assets as safe. If their potential payoffs are linked to inflation and no inflation indexed securities are available, pension funds emphasize the real capital preservation aspect of safe assets. Global reserve managers consider all of these aspects, in view of the high share of credit instruments denominated in foreign currencies and their need to maintain ready liquidity. Finally, demand for some noncredit instruments, such as gold, is largely driven by perceptions of its store of value, with less regard to its market risk.

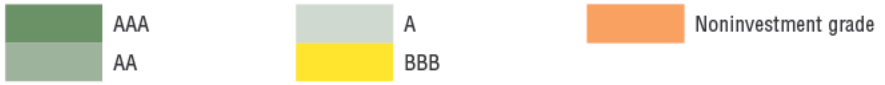
Changes in Safe Asset Perceptions

The global financial crisis was preceded by considerable overrating, and hence mispricing, of safety. In retrospect, high credit ratings were applied too often, both for private and sovereign issuers, and they did not sufficiently differentiate across assets with different underlying qualities.

[6]See also Gaillard (2011).
[7]For a more detailed discussion of the safety criteria for assets underlying liquidity risk management, see BCBS (2010a), pp. 5–6.

Table 3.1. Historical Overview of S&P Sovereign Debt Ratings of Selected OECD Countries, 1970–January 2012

Country	Year of First Rating	1970	1975	1980	1985	1990	1995	2000	2005	2010	2011	2012 (End-January)
Austria	1975	NR	AAA	AAA	AAA	AAA	AAA	AAA	AAA	AAA	AAA	AA+
Belgium	1988	NR	NR	NR	NR	AA+	AA+	AA+	AA+	AA+	AA	AA
Canada	1949	AAA	AAA	AAA	AAA	AAA	AA+	AA+	AAA	AAA	AAA	AAA
Denmark	1981	NR	NR	NR	AA+	AA	AA+	AA+	AAA	AAA	AAA	AAA
Finland	1972	NR	AAA	AAA	AAA	AAA	AA-	AA+	AAA	AAA	AAA	AAA
France	1975	NR	AAA	AAA	AAA	AAA	AAA	AAA	AAA	AAA	AAA	AA+
Germany	1983	NR	NR	NR	AAA	AAA	AAA	AAA	AAA	AAA	AAA	AAA
Greece	1988	NR	NR	NR	NR	BBB-	BBB-	A-	A	BB+	CC	CC
Iceland	1989	NR	NR	NR	NR	A	A	A+	AA-	BBB-	BBB-	BBB-
Ireland	1988	NR	NR	NR	NR	AA-	AA	AA+	AAA	A	BBB+	BBB+
Italy	1988	NR	NR	NR	NR	AA+	AA	AA	AA-	A+	A	BBB+
Japan	1959	NR[1]	AAA	AAA	AAA	AAA	AAA	AAA	AA-	AA	AA-	AA-
Luxembourg	1994	NR	NR	NR	NR	NR	AAA	AAA	AAA	AAA	AAA	AAA
Netherlands	1988	NR	NR	NR	NR	AAA	AAA	AAA	AAA	AAA	AAA	AAA
Norway	1958	NR[1]	AAA	AAA	AAA	AAA	AAA	AAA	AAA	AAA	AAA	AAA
Portugal	1988	NR	NR	NR	NR	A	AA-	AA	AA-	A-	BBB-	BB
Spain	1988	NR	NR	NR	NR	AA	AA	AA+	AAA	AA	AA-	A
Sweden	1977	NR	NR	AAA	AAA	AAA	AA+	AA+	AAA	AAA	AAA	AAA
Switzerland	1988	NR	NR	NR	NR	AAA	AAA	AAA	AAA	AAA	AAA	AAA
Turkey	1992	NR	NR	NR	NR	NR	B+	B+	BB-	BB	BB	BB
United Kingdom	1978	NR	NR	AAA	AAA	AAA	AAA	AAA	AAA	AAA	AAA	AAA
United States	1941	AAA	AAA	AAA	AAA	AAA	AAA	AAA	AAA	AAA	AA+	AA+



Sources: Standard & Poor's; and IMF staff estimates.

Note: The Organization for Economic Cooperation and Development (OECD) was established in 1961. Countries selected constituted the OECD membership in 1970. Ratings shown are S&P's long-term foreign currency ratings. NR = not rated.

[1]Sovereign rating suspended; see Bhatia (2002).

Table 3.2. Long-Term Senior Sovereign Debt Ratings and Implied Probabilities of Default

Interpretation of Rating	S&P Rating	Average Implied Five-Year Probability of Default *(in percent)* 2007	2011
Highest quality	AAA	0.108	1.266
High quality	AA+ AA AA-	0.110	2.423
Strong payment capacity	A+ A A-	0.213	2.684
Adequate payment capacity	BBB+ BBB BBB-	0.734	6.050
Likely to fulfill obligations, ongoing uncertainty	BB+ BB BB-	2.795	4.240
High-risk obligations	B+ B B-	4.041	18.410

Sources: Standard & Poor's; and IMF staff estimates.

Note: For each country, the implied probabilities of default are estimated from its observed CDS spreads. The probabilities of default shown here are averages for countries whose ratings fall within specific S&P rating ranges.

- AAA-rated securitizations were found to embed much higher default risks than warranted by their high ratings. For example, as of August 2009, 63 percent of AAA-rated straight private-label residential mortgage-backed securities issued from 2005 to 2007 had been downgraded, and 52 percent were downgraded to BB or lower.[8]
- Five-year probabilities of default associated with AAA-rated sovereign debt were about 0.1 percent in 2007, suggesting virtually no credit risk, but markets' implied default rates had risen to more than 1 percent by 2011 (Table 3.2). The large difference between the implied default probabilities within each rating bucket across the two periods suggests that the default probabilities do not increase consistently with the decline in ratings, reaffirming ratings should not be relied upon as the sole quantitative measure of safety.[9]
- Haircuts on the highest rated securitized instruments in the U.S. private bilateral repo market increased sharply from near-zero precrisis levels to more than 30 percent for certain instruments (see Gorton, 2009).
- In the euro area, the years following the creation of the monetary union were characterized by almost perfect convergence of government bond yields. As evidenced by greater risk differentiation since 2010, this development was arguably not justified on the basis of fiscal fundamentals of different euro area member states.

Empirical analyses confirm the mispricing of risk prior to the crisis. Returns show a high degree of homogeneity across assets of different quality within each asset class (Figure 3.2). Asset classes were grouped closely into asset pools with limited differentiation in terms of safety. These pools included: (1) U.S. debt (sovereign, agency, and corporate); (2) Japanese debt (sovereign and corporate); (3) European debt (sovereign and corporate), including EU covered bonds and highly collateralized bonds issued by German banks (Pfandbriefe); (4) emerging market sovereign debt; and (5) a more dispersed set including equity market indices, commodities, and currencies. The very tight clustering of euro area sovereign debt shown in Figure 3.2 confirms that, indeed, prior to the crisis, there was little price differentiation across assets of varied quality.[10] Moreover, sovereign debt instruments of advanced economies were found to have highly homogeneous exposures to aggregate risk factors.[11] This suggests that market prices did not embed information sufficient to differentiate the underlying risks of countries with weaker fundamentals.[12]

After the crisis, the differentiation in the perceived safety of various asset classes increased

[8]See IMF (2009a) for a detailed discussion of securitization and credit ratings flaws.

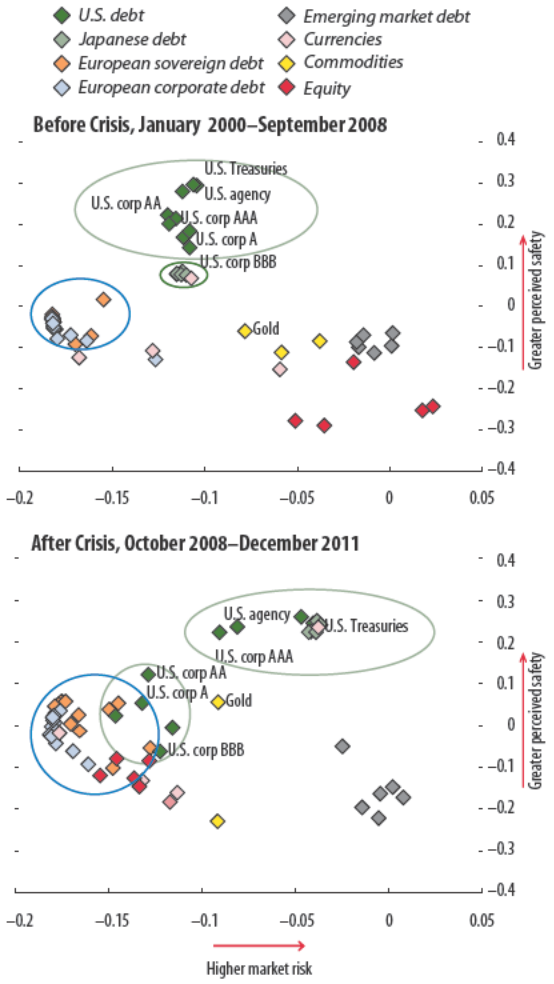
[9]The implied volatility of default falls from 6.050 to 4.240 between the BBB and BB rating groups and rises again for the B groupings, showing the large volatility across ratings.

[10]See Annex 3.1 for details.

[11]These factors include (1) the excess return on the global market portfolio as a measure of perceived market risk of an asset or a portfolio, (2) the VIX as a measure of market uncertainty, (3) the term spread as a measure of rollover or reinvestment risk, (4) a measure of market liquidity based on bid-ask spreads, (5) credit spreads between AAA and BBB corporate bonds, (6) innovations to the London interbank offered rate (LIBOR), and (7) a measure of future global inflation risk.

[12]The only noticeable difference was in exposures to the market factors, with U.S. debt appearing markedly safer than European debt.

Figure 3.2. Asset Exposures to Common Risk Factors before and after Global Crisis



Sources: Bloomberg L.P.; and IMF staff estimates.

Note: Based on principal component analysis of the assets' excess returns. Figure plots the factor loading, showing the influence of the excess return of a single asset on the common risk factors. The first principal component is positively correlated with global liquidity (measured by the M2 money supply of the G4 economies) and with market risk, which is proxied by the excess return on a global market portfolio. The second component is positively correlated with safety, which, as expected, shows a negative correlation with the VIX and thus has limited sensitivity to volatile market conditions. Axis arrows show direction of higher market risk and greater perceived safety.

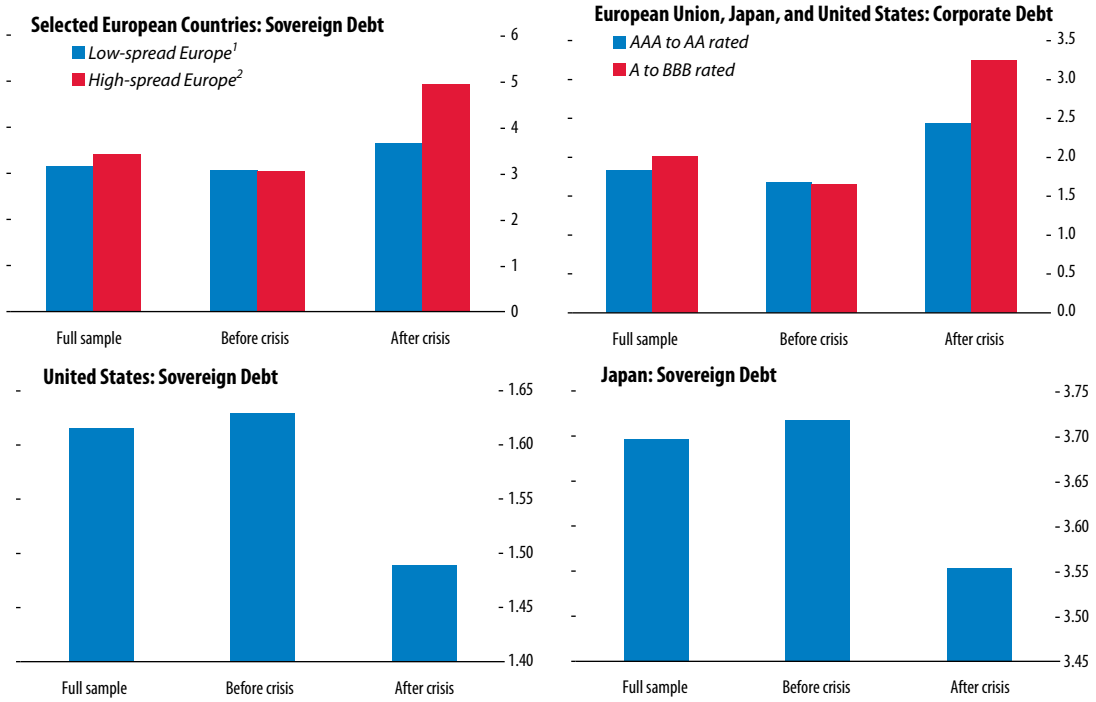
markedly.[13] The analysis suggests that investors have become more discerning in their assessment of safety. The results show increasing signs of greater differentiation in the perception of safety across European assets and a clear decoupling of highly rated U.S. debt—including sovereign, agency, and AAA-rated corporate securities—from lower-rated corporate instruments (Figure 3.2). AAA-rated U.S. corporate debt has become clustered with U.S. sovereign debt, and lower-rated U.S. debt with European entities. Altogether, sovereign debt and highly rated corporate debt in Japan and the United States have become more tightly clustered in a pattern suggesting that investors perceive assets in both countries as safer than those in Europe. Heightened uncertainty also bolstered the perceived safety of gold. Markets also appear to have put higher trust in the safety of the Japanese yen, whose differentiation from other currencies has increased markedly. Overall, perceptions of the relative safety of various currencies have remained tightly linked to the perceived safety of their respective countries' or regions' debt instruments, perhaps suggesting exposures to common risk factors. Detailed analysis (not shown) of the risk factors that affect safe asset returns indicates that the crisis has exacerbated differences in exposures to such factors across asset classes. For example, differences in inflation risk exposures across the portfolios became significant only after the crisis.

The evolution of the volatility of debt returns also confirms that the differentiation between safer and riskier debt instruments increased considerably as a result of the crisis. For example, before the crisis, this volatility—at roughly 3 percent—was almost identical across Europe. However, afterward, the volatility in peripheral euro area countries outstripped that in the rest of Europe by more than 1 percent a month, a nontrivial difference (Figure 3.3).[14] Importantly, U.S. and Japanese debt became less volatile after the crisis, suggesting an investor perception of increased safety.

[13]These patterns are confirmed by the statistical techniques of principal component analysis and hierarchical clustering.

[14]Excess returns represent the difference between the monthly returns on a given portfolio and the return on the one-month U.S. Treasury bill. Volatility is calculated as the standard deviation of monthly excess returns in the sample.

Figure 3.3. Volatility of Excess Returns in Debt Instruments before and after Crisis
(In percent)



Sources: Bloomberg L.P.; and IMF staff estimates.
Note: "Before crisis" refers to the period until December 2007; "after crisis" from January 2008 to October 2011. For Europe, threshold between the low- and high-spread countries is at 350 basis points.
[1]Austria, Denmark, Finland, France, Germany, Luxembourg, Netherlands, Norway, and United Kingdom.
[2]Portugal, Ireland, Italy, and Spain. Greece and Slovenia are excluded due to the lack of data.

Roles of Safe Assets for Various Participants

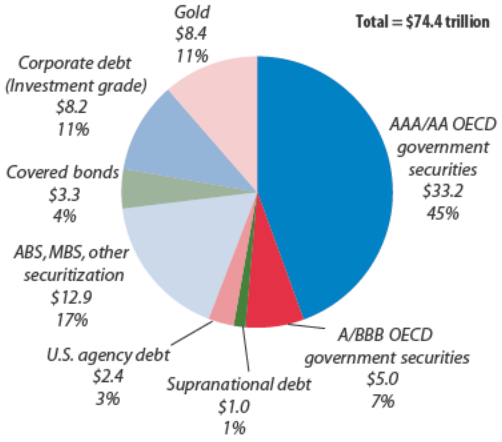
The Universe of Potentially Safe Assets

While many assets have some attributes of safety, the global universe of what most investors view as potentially safe assets is dominated by sovereign debt. As of end-2011, AAA-rated and AA-rated OECD government securities accounted for $33 trillion or 45 percent of the total supply of potentially safe assets (Figure 3.4). Although asset safety should not be viewed as being directly linked to credit ratings, they are used here as a rough indication of market perception. Securitized instruments—including mortgage-backed and other asset-backed securities and covered bonds—still play an important role as potentially safe assets, accounting for 17 percent of the global aggregate, followed by corporate debt (11 percent), and gold (11 percent). The markets for supranational debt and covered bonds are limited, collectively accounting for roughly 6 percent.

Overview of the Uses of Safe Assets

Safe assets have several broad-based roles in international financial markets. Their characteristics—including their steady income streams and ability to preserve portfolio values—are key considerations in investors' portfolio decisions. Safe assets serve as high-quality collateral critical to many transactions, including those in private repo, central bank repo, and OTC derivatives. They are integral to prudential regulations, influencing, at least in part, the amount of safe assets on banks' balance sheets. Safe assets are widely embedded in portfolio mandates and often act as performance benchmarks. Yields on government bonds are reference rates for the pricing, hedging, and valuation of risky assets. Finally, safe assets—at least in the case of advanced economies—have been a part of central banks' liquidity operations in response to the crisis.

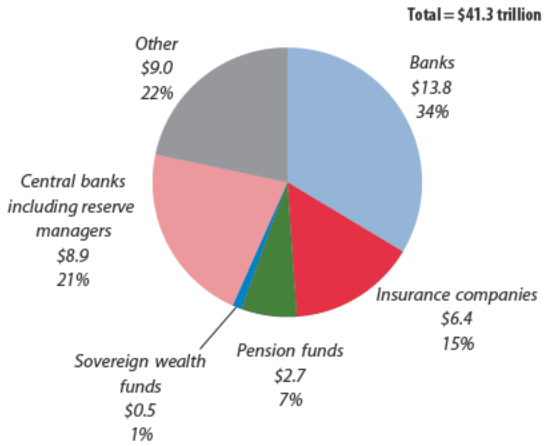
Figure 3.4. Outstanding Amounts of Marketable Potentially Safe Assets
(In trillions of U.S. dollars and percent of total)



Sources: Bank for International Settlements; Dealogic; the European Covered Bond Council (ECBC); SIFMA (the Securities Industry and Financial Markets Association); Standard & Poor's, World Gold Council; and IMF staff estimates.

Note: Data for government and corporate debt are as of 2011:Q2; supranational debt and gold, as of end-2011; covered bonds, as of end-2010; and U.S. agency debt and securitization, as of 2011:Q3. ABS = asset-backed securities; MBS = mortgage-backed securities; OECD = Organization for Economic Cooperation and Development.

Figure 3.5. Holdings of Government Securities Worldwide, by Investor Type, End-2010
(In trillions of U.S. dollars and percent of outstanding sovereign debt)



Sources: Bank for International Settlements (BIS); Bankscope; Organization for Economic Cooperation and Development; and IMF staff estimates.

Note: Banks include commercial, investment, and development banks; data for pension funds include only direct holdings; SWF holdings are an IMF staff estimate; reserve manager holdings are an IMF staff estimate based on a representative allocation of total official reserves to government securities and own government bond holdings by the Federal Reserve, Bank of England, and Bank of Japan. "Other" is estimated as a remainder based on BIS data on total outstanding government securities worldwide.

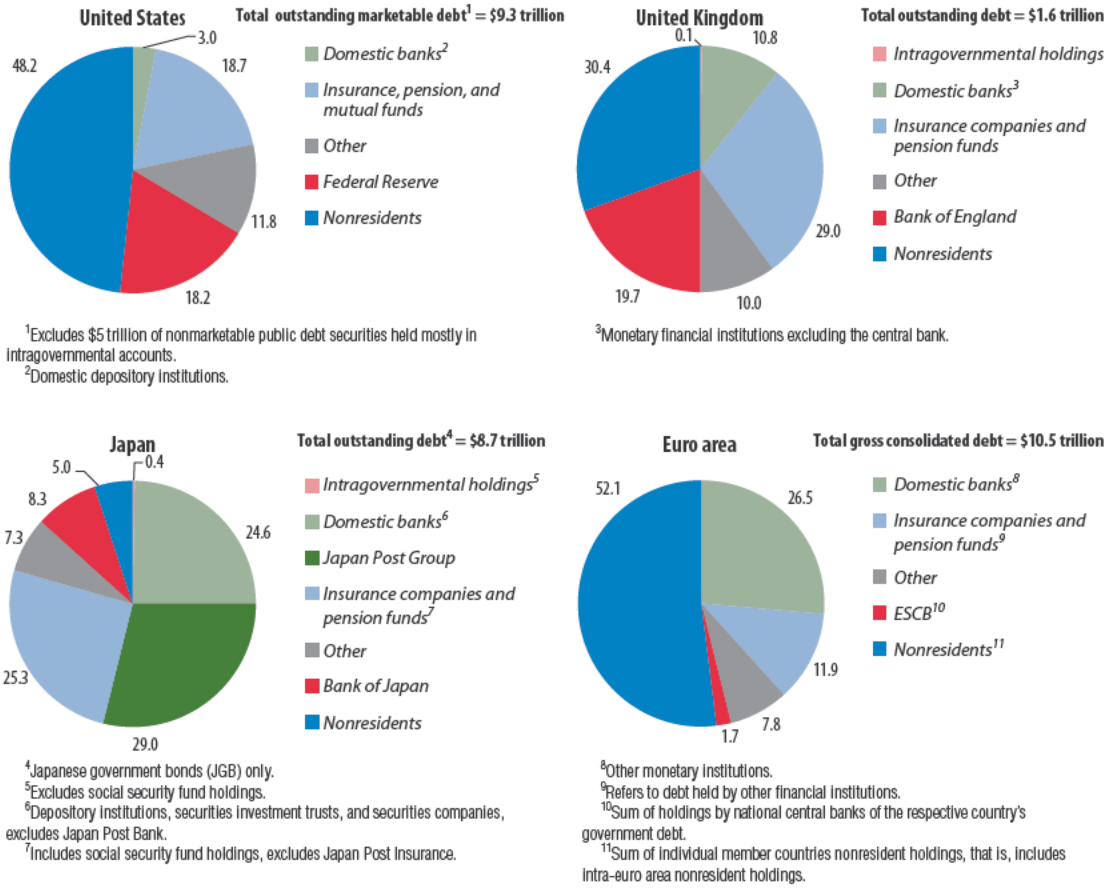
Each of these safe asset functions has a different degree of relevance for various types of investors.[15] For example, banks—which collectively account for the largest share of safe asset holdings—demand safe assets for several purposes (Figure 3.5): (1) managing their inherent maturity mismatches, (2) fulfilling their primary dealer and market-making functions, (3) obtaining preferential regulatory treatment through their sovereign debt holdings, and (4) using collateral for repo and derivatives transactions. Safe assets are critical to the conservative, value preservation policies of global reserve managers, and their need for ready liquidity. Value preservation is also a high priority for some types of sovereign wealth funds—particularly stabilization funds—whose fiscal stabilization role is similar to that of reserve managers. The demand for safe assets by insurance companies and pension funds—long-term safe asset investors—is largely driven by their need to bridge intrinsic asset-liability mismatches and preserve market value to meet long-term liabilities. Safe assets for nonfinancial corporations and individual investors largely take the form of sovereign debt, although the size of such holdings is limited.[16]

The extent of investor demand varies considerably across countries and has also changed as a result of the global financial crisis. In the United States, foreign investors have dominated the market for U.S.

[15]The classification and collection of data on holdings of government securities by investor type are yet to be standardized. At present, there is no comprehensive centralized database on government securities holdings. The issue is addressed by an ongoing initiative of the IMF, Bank for International Settlements, European Central Bank, and others to close existing data gaps.

[16]This chapter does not discuss in detail the demand for safe assets by individual investors and nonfinancial corporations. Their holdings of government securities are limited and typically unleveraged, unlike those of other investors, and are unlikely to pose considerable risks to global financial stability. Even in the United States, where they play a more prominent role relative to most other countries, households and nonfinancial corporations hold less than 11 percent of domestic government debt. In the euro area, their holdings, on average, account for less than 8 percent of total government debt (Lojsch, Rodríguez Vives, and Slavík, 2011). Customer bank deposits are considerably more sizable, amounting to roughly $40 trillion globally at end-2010. Their relevance for global financial stability, however, is related to tail-risk events—such as potential bank runs—that are beyond the scope of this chapter. In many countries, such deposits are covered by deposit insurance schemes that—within the covered maximum—provide a degree of safety to individual and corporate investors.

Figure 3.6. Sovereign Debt Holdings, by Type and Location of Investor
(In percent of total, June 2011 or latest available)



[1]Excludes $5 trillion of nonmarketable public debt securities held mostly in intragovernmental accounts.
[2]Domestic depository institutions.
[3]Monetary financial institutions excluding the central bank.
[4]Japanese government bonds (JGB) only.
[5]Excludes social security fund holdings.
[6]Depository institutions, securities investment trusts, and securities companies, excludes Japan Post Bank.
[7]Includes social security fund holdings, excludes Japan Post Insurance.
[8]Other monetary institutions.
[9]Refers to debt held by other financial institutions.
[10]Sum of holdings by national central banks of the respective country's government debt.
[11]Sum of individual member countries nonresident holdings, that is, includes intra-euro area nonresident holdings.

Source: IMF staff estimates based on Andritzky (forthcoming).
Note: The classification and collection of holdings data of government securities by investor type are yet to be standardized.

Treasuries in view of its large size and depth and its high perceived degree of safety. However, postcrisis monetary stabilization efforts increased the prominence of the Federal Reserve as a holder of government debt. In Europe and Japan, domestic banks have played an important role as sovereign debt investors, in each case accounting for about 25 percent of outstanding sovereign debt (Figure 3.6). In the United Kingdom, insurance companies and pension funds have been traditional holders of government securities, although the Bank of England and foreign investors assumed a more prominent role after the global financial crisis.

To assess emerging demand pressures in safe asset markets, the following subsections review the principal uses of safe assets by the largest market participants. The discussion in subsequent sections then turns to the ability of safe asset supply to keep up with potential demand, and the implications for financial stability of a further rise in safe asset supply-demand imbalances.

Use in Portfolio Construction

Probably the most basic use of safe assets is as a source of steady income and capital preservation in portfolio construction. The importance of this function varies considerably across investor types, based on their investment strategies and horizons.

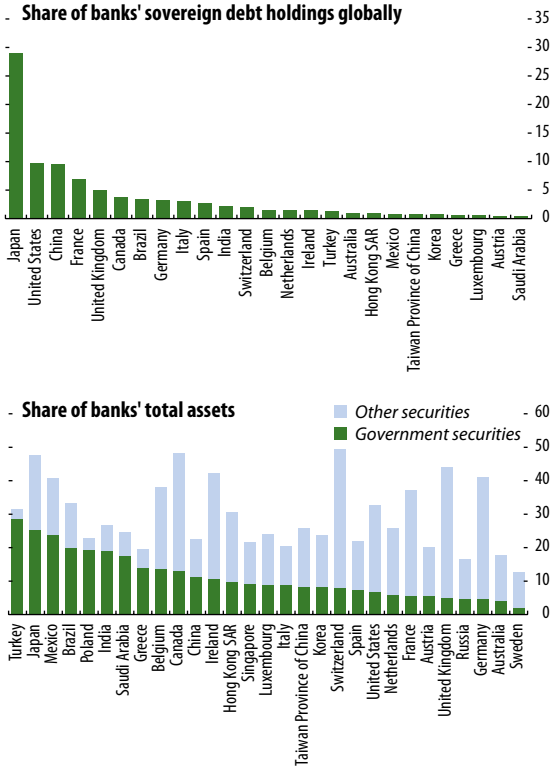
Banks

Banks have intrinsic incentives to hold safe assets to manage liquidity and solvency risks. Safe assets—particularly short-term government securities—play a key role in banks' day-to-day asset-liability management. Banks' inherent maturity mismatches justify their holding some assets with high market liquidity and stable returns. Shorter-term safe assets permit banks to curb unwanted maturity mismatches and manage their short-term funding needs. At times of stress, banks can also temporarily increase safe asset allocations to: (1) raise capital ratios via exchange for riskier assets, (2) access secured funding markets, or (3) counterbalance trading book losses to stabilize income.[17]

Banks' role in safe asset demand is particularly important, given that they are the largest holders of safe assets in the form of government securities. Their role is particularly pronounced in China, France, Japan, and the United States, where banks jointly account for about 55 percent of the roughly $14.8 trillion in sovereign debt held by banks globally (Figure 3.7, top panel). In some countries such holdings account for a considerable share of banking sector assets, as high as roughly 30 percent in Turkey, and more than 20 percent in Brazil, Mexico, and Japan (Figure 3.7, bottom panel).[18] Overall, sovereign debt plays a considerably more important role in the asset allocation of emerging market banks than of banks in advanced economies, which—with the exception of Japan—have higher allocations in riskier assets.

Banks' demand for government bonds is also linked to their symbiotic relationship with their respective governments. Some banks act as primary dealers and market makers for government bonds and support secondary market liquidity for such bonds through active trading. For example, 46 of the 71 banks that were part of the 2011 EU capital exercise are primary dealers of domestic government bills or bonds.[19] Primary dealer arrangements are also common in Canada, Japan, the United States, and other advanced economies, though their requirements and obligations vary considerably across countries.

Figure 3.7. Banks' Holdings of Sovereign Debt, by Selected Country, End-September 2011
(In percent)



Sources: Bankscope; and IMF staff estimates.
Note: Data are as of end-September 2011 or latest available. Estimates only reflect data for banks—mostly larger banks—with information in Bankscope.

Official Reserve Managers

Official reserve managers use safe assets in portfolio allocation, placing priority on safety, liquidity, and returns, in that order. Reserve managers put a premium on short-term safety in order to meet short-term contingent liabilities linked to balance of

[17]In some cases, banks hold cash at their respective central bank, which also serves as a store of value.

[18]However, banks' practice of excessive buying of sovereign debt is generally discouraged in less developed financial systems, in part to provide banks with incentives to enhance their intermediation role via lending to nonfinancial corporations and households.

[19]Based on Association for Financial Markets in Europe (2011); websites of national debt management offices or ministries of finance; and IMF staff calculations. Banks that are members of the Bund Issuance Auction Group or the Gilt-Edged Market Makers were considered primary dealers for Germany and the United Kingdom, respectively.

payments requirements and other financial stability considerations. Thus, from a reserve manager's perspective, liquidity and low credit and market risks are key aspects of asset safety, as assets need to be readily available for sale, without incurring valuation losses.

The upsurge in reserve manager demand for safe assets in the past decade has been linked to the considerable accumulation of global foreign exchange reserves. Official reserves increased from $2.2 trillion at end-2001 to $10.8 trillion at end-October 2011, with China's reserve holdings alone rising more than 15-fold from $0.2 trillion to $3.3 trillion. This rapid growth is in part linked to precautionary saving motives and higher risk aversion in the wake of the Asian crisis in the late 1990s.

Safe asset investments by reserve managers take the form of government and other securities, deposits at other central banks and international institutions, and gold. The securities portfolio (64 percent of total reserves) mostly consists of government securities, estimated at approximately $7 trillion as of end-October 2011.[20] Bank deposits, which had increased steadily as a share of reserves, declined considerably with the onset of the crisis as their perceived safety changed. Reserve managers withdrew roughly $0.5 trillion of deposits and other investments from the banking sector in a flight to safety during the global financial crisis (Figure 3.8).[21] Since the crisis, reserve managers have reversed their long-term position as net sellers of gold, and have turned into net buyers.[22] At end-October 2011, the official sector accounted for 22 percent of the global holdings of physical gold.[23]

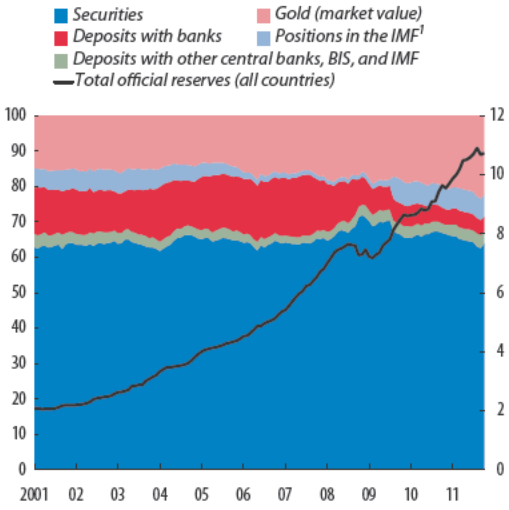
[20]IMF staff estimate derived from total global official reserve holdings (IMF, International Financial Statistics data); the share of securities in total official reserve holdings for countries subscribing to the IMF's Special Data Dissemination Standard (SDDS); and the share of U.S. Treasury securities in foreign official holdings of U.S. Treasury and corporate securities (TIC data), assuming that these shares are representative of global reserve portfolio allocations.

[21]See Pihlman and van der Hoorn (2010). Note that the jump in IMF positions in 2009 (Figure 3.8) was not related to asset allocation decisions by reserve managers but to the allocations of special drawing rights (SDR) provided by the IMF.

[22]Aggregated gold holdings (by fine ounce) of reserve managers reporting to the IMF SDDS increased in 2009, 2010, and the first 10 months of 2011. This may be partly related to the IMF's use of central banks' selling quotas to liquidate some of its own holdings.

[23]Based on data from the World Gold Council.

Figure 3.8. Official Reserve Accumulation, by Instrument
(Components in percent, left scale; total in trillions of U.S. dollars, right scale)



Source: IMF Composition of Official Foreign Exchange Reserves.
Note: BIS = Bank for International Settlements.
[1]Positions in the IMF comprise reserve tranche positions and SDR holdings.

Reserve managers' demand for sovereign debt is likely to persist, if not grow, in the medium term. Global official reserves are projected to rise by 11.3 percent in 2012 and by 61 percent by end-2016, indicating higher potential demands for sovereign debt, even if their relative share in reserve managers' portfolio contracts.[24] Some large reserve managers are already diversifying away from government securities, as their accumulated reserves have exceeded balance of payments and monetary policy needs.

Sovereign Wealth Funds (SWF)

The pattern of SWF safe asset allocations is highly heterogeneous. Safe asset demand by SWFs varies based on each fund's type, objectives, and investment horizons. Only a few types make extensive use of safe assets.

Stabilization funds typically have conservative asset allocations focused heavily on high-quality sovereign assets. Their investment horizons and liquidity objectives are close to those of global reserve managers, in view of their role in countercyclical fiscal policies. Hence, stabilization funds have low risk-return

[24]Reserve projections are based on the *World Economic Outlook*.

profiles and tend to invest mostly in fixed-income assets, particularly shorter-term sovereign instruments.

Pension reserve funds, *reserve investment corporations*, *and saving funds* have a very limited demand for safe assets. They tend to have longer investment horizons justified by their specific mandates and objectives: (1) they expect fund outflows far in the future (pension reserve funds), or (2) their mandate is to reduce reserve holding costs (reserve investment corporations), or (3) their express objective is to transfer wealth across generations (saving funds).

Current SWF holdings of sovereign debt are estimated to be at $500 billion to $600 billion, accounting for roughly 18 to 21 percent of SWFs' total assets. See Box 3.1 for the methodology behind this estimate. This is less than one-tenth of the amount of sovereign debt held by official reserve managers.

The potential for SWFs to exert pressure on sovereign debt demand is ambiguous. Several countries are currently setting up new stabilization funds, which invest heavily in sovereign debt. Existing SWFs, particularly in emerging economies, are also likely to continue to grow if relatively high commodity prices and current account surpluses persist, potentially raising sovereign debt demand. However, SWFs with long-term investment horizons have been increasing the share of real estate and alternative investments in their portfolios—a trend likely to continue. Also, many SWFs with dual objectives (for example, stabilization and saving) increasingly emphasize their saving mandates, resulting in higher allocations in riskier asset classes.

Insurance Companies and Pension Funds

Insurance companies and pension funds complement their risky asset holdings with safe asset allocations, mainly to match liabilities. At end-2010, insurance companies held approximately $6.4 trillion in government bonds, and pension funds held about $2.7 trillion.[25] Life insurance companies that offer mostly products with guaranteed returns place a higher priority on value preservation and thus maintain conservative portfolios with high allocations to long-term high-quality debt. Pension fund demand for safe assets is related to the nature of their liabilities and their risk tolerance.[26] Asset allocations at many pension funds are dominated by sovereign debt holdings. Across OECD countries, bonds—a large share of which are sovereign—accounted for 50 percent of aggregate pension fund assets at end-2010.

The low-interest-rate environment in advanced economies since late 2008 may marginally curb pension funds' demand for safe assets. A protracted period of low interest rates would put pressure on pension funds to shift to riskier assets as the present value of future payable benefits increases—an increase that is even greater if longevity risk is properly accounted for.[27] Under such conditions, pension funds may embark on a search for yield by shifting asset allocation to riskier assets. However, such a shift is likely to be gradual, given that pension funds tend to change their strategic asset allocations only slowly.[28]

The Role of Safe Assets as Collateral

Safe assets play a critical role as a source of high-quality, liquid collateral in a wide range of financial transactions. Their use as collateral spans private and central bank repo markets and OTC derivatives markets.

Private bilateral and tri-party repo markets depend heavily on safe assets as collateral.[29] While, in principle, any type of asset could be used as collateral in private repos, liquid assets with high credit quality are the preferred type of collateral and are associated with lower secured funding costs than other assets. The bilateral repo market is structured around global dealer banks that, in part, reuse the received collateral to meet demand by other financial institutions and

[25]Based on OECD data and IMF staff estimates. Holdings by pension funds do not account for indirect holdings of government bonds via mutual funds.

[26]For example, pension funds with inflation-linked liabilities tend to focus on real returns.

[27]See Chapter 4 for a discussion of the increase in pension fund liabilities due to longevity risk; also see IMF (2011b).

[28]See IMF (2011b).

[29]Tri-party repos are repurchase agreements in which a third party—a custodian bank or a clearinghouse—provides intermediation of transactions, including collateral allocation, collateral substitution, and marking to market. In the United States, the two key tri-party agents are Bank of New York Mellon (BNY Mellon) and JPMorgan Chase. In Europe, the tri-party repo market is dominated by Euroclear, Clearstream, BNY Mellon, and JPMorgan Chase (Singh, 2011).

Box 3.1. The Size of Sovereign Wealth Funds and Their Role in Safe Asset Demand

The amount of assets held by all sovereign wealth funds is estimated here to be about $2.8 trillion. However, these funds' investments in safe assets vary significantly by type of fund.

Due to the lack of a generally agreed definition of a sovereign wealth fund (SWF), estimates of their sizes vary considerably. Upper-end estimates—such as the often-cited $4.7 trillion from the Sovereign Wealth Funds Institute—double count by including central bank assets already captured in official reserves. Estimates here use the definition of SWF in the Santiago Principles, based on publicly available data for 30 SWFs meeting the definition, and explicitly excluding central banks and state-owned enterprises.[1] More than 70 percent of SWFs in the sample provide information on the size and allocation of their assets. Estimates for the rest are based on consensus estimates of size, and within-sample weighted averages for SWFs of the same type for approximations of asset allocations. SWFs that follow several objectives—including those of Azerbaijan, Norway, and Trinidad and Tobago—were categorized by prevailing operational objective based on judgment. In this fashion, the aggregate size of SWF assets is estimated here at $2.8 trillion.

SWFs' preferences for safe assets vary, depending on their mandates and objectives (see Figure 3.1.1):

Stabilization funds are set up to insulate government budgets and economies from commodity price volatility and external shocks. They are largely fixed-income investors and allocate an average of 69 percent of their assets to government securities.[2]

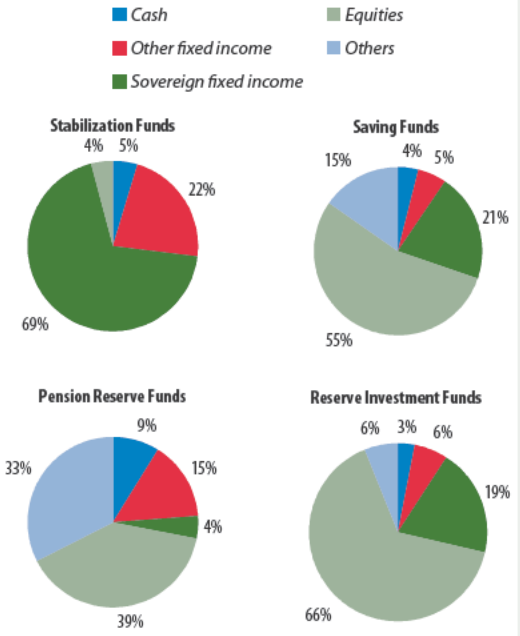
Pension reserve funds are established to meet future pension liabilities on the governments' balance sheets and have very long investment horizons. Therefore, they hold very small portfolio shares in sovereign securities, averaging about 4 percent.[3]

Note: Prepared by Abdullah Al-Hassan, Jukka Pihlman, and Tao Sun.

[1]See International Working Group of Sovereign Wealth Funds (2008).

[2]*Stabilization funds* are those in Azerbaijan, Bahrain, Botswana, Chile, Kiribati, Mexico, Oman, Russia, Timor-Leste, and Trinidad and Tobago. *Pension reserve funds*: Australia, Chile, Ireland, and New Zealand. *Reserve investment corporations*: China, Korea, and Singapore. *Saving funds*: Abu Dhabi, Alberta (Canada), Alaska (United States), Bahrain, Brunei, Kazakhstan, Kuwait, Malaysia, Norway, Qatar, Russia, and Singapore.

Figure 3.1.1. Asset Allocations at Sovereign Wealth Funds, by Type of Fund, End-2010[1]



Source: IMF staff estimates based on annual reports and other information from SWFs.

[1]Or latest available.

Reserve investment corporations that invest a portion of foreign reserves to reduce reserve holding costs pursue higher returns through high allocations to equities and alternative investments—for example, up to 50 percent in South Korea and 75 percent in the Government of Singapore Investment Corporation (GIC)—and have a fairly limited need for liquidity. The share of sovereign securities in their portfolios is, on average, about 19 percent.

Saving funds, which are mandated to share cross-generational wealth or manage strategic government investment portfolios, allocate high portfolio shares to equities and other investment instruments—40 percent (e.g., Libya Investment Authority) and higher (e.g., Singapore's Temasek). Their sovereign debt allocations are limited to an average of 21 percent.

[3]The only exception is the Pension Reserve Fund in Chile, which moved toward a riskier allocation in 2011.

play a key role in liquidity provision. The key collateral providers—and, thus, the ultimate demanders of safe assets for collateral purposes—include hedge funds, broker-dealers, and banks, among others.[30]

In the United States and Europe, collateral in private repo markets is dominated by sovereign debt securities. With a total size of approximately $1.7 trillion, the tri-party repo market is an important source of funding for U.S. financial institutions.[31] In the United States, U.S. Treasury and agency securities—traditionally viewed as safe assets—collectively accounted for 83 percent of collateral in the U.S. tri-party repo market at end-September 2011.[32] In Europe, sovereign debt accounted for 79 percent of EU-originated collateral in the repo market at end-2011.[33] Tri-party repos account for only about 11 percent of repo transactions in Europe, where they relied on more diversified collateral, comprising government securities (45 percent), and another 41 percent in corporate bonds, covered bonds, and equity.

The potential impact of private repo collateral on safe asset demand depends on various factors. For example, if ongoing strains in unsecured interbank funding markets in Europe persist, the importance of collateralized funding in European banks' funding structures may increase, leading to stronger near-term demand for safe assets (see Chapter 2). However, the prospect of further bank deleveraging may, in part, mitigate further upward demand pressures stemming from the banking sector if that process entails a reduction in the assets held on their balance sheets.

Central bank collateral policies are another factor that affects banks' incentives to hold safe assets to meet funding needs. Safe assets in the form of government securities are a principal form of collateral in central bank repo operations in many countries. Their prevailing role is linked in part to the historically lower volatility and greater liquidity of government securities, particularly in times of stress. It is also related to the intrinsic comfort of central banks that the probability of a sovereign default is (usually) low and that they take a highly senior position, reducing losses in the case of an outside counterparty default that is using sovereign collateral. However, during periods of severe market stress, central banks could (and did in the latest crisis) expand eligible collateral criteria to address market illiquidity (Annex 3.2).[34]

The potential move of standardized OTC derivatives contracts to central counterparties (CCPs) may spur demand for high-quality collateral. OTC derivative transactions are highly dependent on the use of collateral, with 80 percent of these including collateral agreements. In 2010, approximately 80 percent of collateral backing OTC derivatives transactions was in cash and an additional 17 percent was in government securities.[35] The shift of a considerable number of OTC derivatives transactions to CCPs under proposed changes to OTC derivatives regulation will elevate collateral demand by between $100 billion and $200 billion for initial margin and guarantee funds, though some of this will offset current needs in the OTC market (see Box 3.2). The resulting lower ability to rehypothecate, or reuse, the collateral in additional repo contracts when it remains within a CCP's default fund may intensify financial institutions' need for collateral to meet desired aggregate funding volumes.[36] Indeed, one CCP has already decided that high-grade corporate bonds will be accepted as initial margin for swap trades as a result of a shortage of high-quality assets.

Use in Prudential Regulations

Banks' high demand for safe assets was influenced in the past by the accommodative treatment of government bonds in prudential regulations, the most prominent of which are the following:[37]

[30]See also Copeland, Martin, and Walker (2010).

[31]The information on U.S. repo markets is from the Federal Reserve Bank of New York (www.newyorkfed.org/tripartyrepo/margin_data.html).

[32]Agency securities include mortgage-backed securities.

[33]Mostly in the form of British, French, and German sovereign securities. See ICMA (2012).

[34]Also see Cheun, von Köppen-Mertes, and Weller (2009), for example.

[35]See ISDA (2011).

[36]See Singh (2011).

[37]Large exposure limits may influence bank demand for government debt when such holdings are treated differently from other assets. In many economies, domestic and other zero percent risk-weighted government bonds are explicitly exempt from limits on large exposures. This treatment may give rise to the risk that banks accumulate very large positions vis-à-vis individual

Box 3.2. The Impact of Changes in the OTC Derivatives Market on the Demand for Safe Assets

Moving a critical mass of OTC derivatives to central counterparties (CCPs) is expected to entail higher upfront initial margin and contributions to guarantee funds that reside at the CCP. This would result in increased demand for collateral.

In response to the global financial crisis, authorities in many jurisdictions are encouraging greater use of CCPs for OTC derivatives transactions.[1] In particular, the G20 has agreed that by end-2012 all standardized OTC derivatives should be centrally cleared so as to lower counterparty credit risk through multilateral netting. The global nature of OTC derivatives markets has also highlighted the need for international coordination to establish minimum cross-border risk management standards and avert regulatory arbitrage in cases where CCPs compete with each other.

The expected changes in OTC market infrastructure will likely increase demand for safe assets via higher demand for collateral.[2] While a shift toward central clearing of standardized OTC contracts will eliminate some of the need for bilateral collateralization, the move of a critical mass of OTC derivatives to CCPs is expected to increase the demand for collateral. The higher demand would arise from an upfront initial margin that typically is not posted on bilateral interdealer trades, and from contributions to guarantee funds at the CCP, with the size of contributions depending on the amount of cleared contracts.[3]

The direct incremental initial margin and the guarantee fund contributions are expected to amount to between $100 billion and $200 billion.[4] The higher estimate would be associated with effective incentives to boost counterparty participation—via a mandated wholesale move for dealers or through the assignment of higher capital charges. Moreover, a proliferation of CCPs without mutual recognition may raise total CCP collateral requirements even further. The lower estimate is associated with exemptions of certain types of OTC derivative counterparties (such as sovereigns and "hedgers") or types of contracts (such as foreign exchange derivatives) from the central clearing mandate. More importantly, restrictions on the market reuse (rehypothecation) of collateral posted with CCPs may lower the effective supply of collateral in the market and hence increase the liquidity risk premium (Singh, 2011).[5] For current CCP requirements, see Annex 3.3.

Note: Prepared by Hanan Morsy.

[1]See IMF (2010a) for a more detailed discussion of these issues.

[2]Collateral requirements are based on a party's likelihood of default, the risk—market, credit, operational, and counterparty—of the derivative transaction being collateralized, its tenor, and liquidity. In OTC derivatives markets, collateral is posted as a form of down payment against potential losses in the event of counterparty default.

[3]Under current market practices, dealers typically do not post independent amounts—equivalent to initial margins in clearinghouses—to each other, and do not ask for collateral from some types of customers, namely most sovereign and quasi-sovereign entities and some corporate clients. However, some regulators intend to impose costs for trades that are not moved to CCPs.

[4]Based on the methodology used in IMF (2010a).

[5]See Singh (2011) for a more detailed discussion.

- *Capital requirements,* via widespread application of zero credit risk weights for own sovereign debt (see Box 3.3);[38] and
- *Liquidity requirements,* via the favorable treatment of government bonds in the determination of existing liquidity-based prudential regulations in some countries.

sovereigns that are treated as safe by regulation but may actually be risky.

[38]Under Basel II, risk weights on the most highly rated (equivalent of AA– or higher) sovereign debt exposures are set at zero under the standardized approach, and at a minimum positive value based on banks' own models under the internal ratings-based (IRB) approach. Under the standardized approach, at national discretion where the exposure is denominated and funded in the domestic currency, banks may apply a preferential treatment to domestic sovereign exposures. Where a sovereign asset class is perceived to be immaterial in size and risk profile, Basel II permits supervisors to allow the continued use of the standardized approach for that asset class by banks that are using the IRB approach for the rest of their portfolio. The Capital Requirements Directive (CRD) permits banks using the standardized approach to apply a zero risk weight to all sovereign exposures within the EU, and banks using the IRB approach may adopt the standardized approach for sovereign exposures, subject to supervisory approval and where the number of material counterparties is limited.

Box 3.3. Regulatory Risk Weighting of Banks' Government Debt Holdings: Potential Bias in Capital Adequacy Ratios

The potential removal of the zero percent risk weighting of banks' domestic sovereign debt holdings has implications for their solvency ratios. Many banks use zero percent risk weighting for sovereign debt, accounting for an upward bias in banks' capital adequacy ratios.[1] *The analysis estimates risk weights implied by the default rates embedded in sovereign credit default swap spreads, with spreads prior to the global crisis adjusted to reflect medium-term sovereign fiscal positions.*

To estimate the impact of a potential elimination of zero percent risk weighting for own local currency sovereign debt, precrisis risk weights on bank sovereign debt holdings are adjusted to reflect countries' medium-term fiscal fundamentals. Potential changes in banks' capital adequacy are assumed to be driven by risk weights based on default rates implied by sovereign credit default swap (CDS) spreads. CDS spreads do not only measure sovereign credit risk, because they depend on global and financial factors, and could be extremely volatile at times of market stress.[2] However, they are more forward-looking in nature and can capture increased fiscal risks better than many other market indicators.[3] When adjusted for fiscal fundamentals, they can provide a more realistic view of the sovereign risk bias in banks' capital adequacy ratios. However, given potential weaknesses in using CDS spreads, the exercise is repeated using bond yields and similar results are obtained during a period of compressed spreads.[4]

CDS spreads observed before the global crisis are adjusted to "true" risk fundamentals based on medium-term sovereign fiscal positions.[5] The magnitude of the precrisis bias in capital adequacy ratios depends on the share of sovereign debt holdings in total bank assets (the exposure at default—EAD), the evolution of sovereign debt probability of default (PD), and the recovery rate (or 1 minus LGD—loss given default).[6] The estimations are carried out using global bank-by-bank data, and are based on the conservative assumption that all sovereign debt is risk weighted at zero.[7] EAD varies considerably across regions. Historically, the share of bank sovereign debt holdings in total assets has been considerably smaller in the euro area, the United

Note: Prepared by Srobona Mitra and Christian Schmieder.

[1]Sovereign risk is partially captured and controlled by the Basel II framework. Under the standardized approach used by most banks, zero percent risk weights apply to all sovereigns rated AA– and above. Under the internal ratings-based approach, banks are expected to apply a minimum probability of default (floor) of 3 basis points. Banks could deviate from this floor and apply lower risk weighting—even at zero percent—subject to supervisory discretion. The credit quality of sovereign debt held for trading purposes or for sale on banks' balance sheets also affects capitalization via their profit and loss accounts. In addition, interest rate risk in the banking book related to sovereign exposures is captured by Pillar 2 of Basel II, with supervisors expected to require additional capital for this risk. Moreover, the introduction of a non-risk-weighted leverage ratio under Basel III will complement risk-weighted capital adequacy requirements.

[2]See Alper, Forni, and Gerard (2012) and Schaechter and others (2012).

[3]Previous research shows that CDS spreads are more forward-looking than bond spreads, despite issues with liquidity in the CDS market (Chan Lau, 2003). Alper, Forni, and Gerard (2012) show that CDS spreads can better capture increased fiscal risks compared to relative asset swap (RAS) spreads, for example.

[4]For a more detailed discussion of various methodologies and other sovereign risk considerations in the context of risk weighting, see European Parliament (2010). For methodologies used in rating agency analysis, see Standard & Poor's (2011) and Fitch Ratings (2011), for example.

[5]Adjustments of the precrisis sovereign CDS spreads (2002–07) are carried out on the basis of the following equation: $AdjCDS_t = CDS_t + 459.33 \times FII$, where FII is the IMF's Fiscal Indicators Index, a continuous 0–1 index of fiscal fundamentals derived from 12 indicators of near- and medium-term fiscal risk (IMF, 2011c). The estimation is carried out using annual panel data for 2008–11, regressing CDS spreads on FII, a constant, and past CDS spreads, taking into account period fixed effects. The goal is to capture the relationship between fiscal fundamentals and more differentiated CDS in the wake of the crisis, and apply it to the precrisis period. The adjusted CDS spreads imply higher probabilities of default (PDs) in the calculation of the risk weights of banks' sovereign debt holdings based on Basel's internal ratings-based (IRB) model. The adjusted capital adequacy ratios for a region are asset-weighted averages for the bank-by-bank ratios in that region. The capital adequacy ratio for 2010 is IRB-adjusted to reflect PDs from observed CDS spreads.

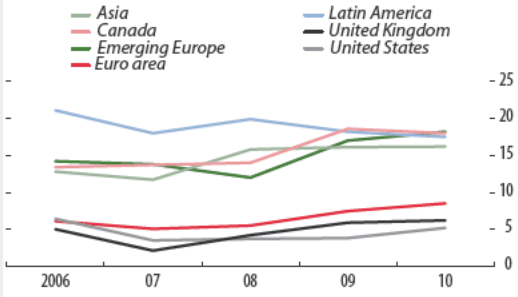
[6]The LGD is assumed to be a constant of 45 percent, a standard assumption in the literature. It is identical to the LGD used for senior unsecured debt in the Basel II foundation IRB approach.

[7]For simplicity, it is assumed that all government debt holdings are domestic and risk weighted at zero percent—a conservative assumption that overestimates the bias. For the euro area, this definition would include exposure to other euro area sovereigns. In countries with flexible exchange rates and in situations in which banks hold their own sovereign debt in domestic currency, sovereign debt may be considered safer.

Box 3.3 *(continued)*

Figure 3.3.1. Share of Banks' Assets Allocated to Government Debt

(In percent, held-to-maturity, average of banks weighted by equity)



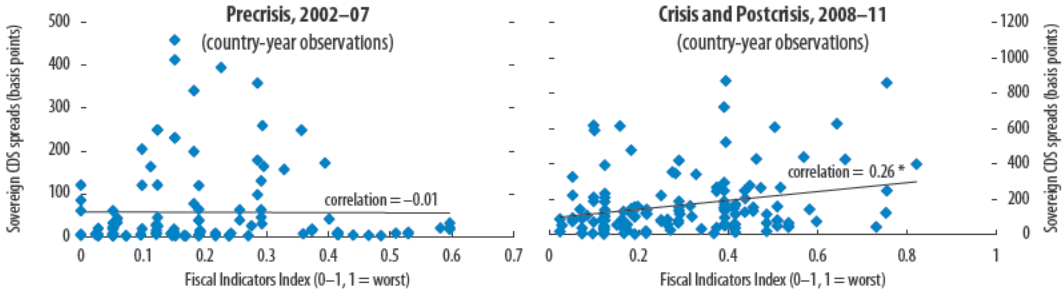
Sources: Bankscope; and IMF staff estimates.

Kingdom, and the United States than in other regions, notably emerging markets (Figure 3.3.1).

CDS spreads did not reflect adequately countries' fiscal fundamentals before the crisis, even though their differentiating power improved considerably afterward (Figure 3.3.2). As a result, the 2007 PD levels adjusted for fiscal fundamentals were considerably higher than those derived from actual CDS spreads. The differential between the two was particularly high for Europe, indicating weaker fiscal paths in some parts of Europe.

The estimated magnitude of capital adequacy bias was high for some regions. The 2007 bias is linked to a mixture of zero percent risk weighting and nondifferentiation of underlying fiscal risks in CDS spreads (Figure 3.3.3). Using internal ratings-based (IRB) risk weights

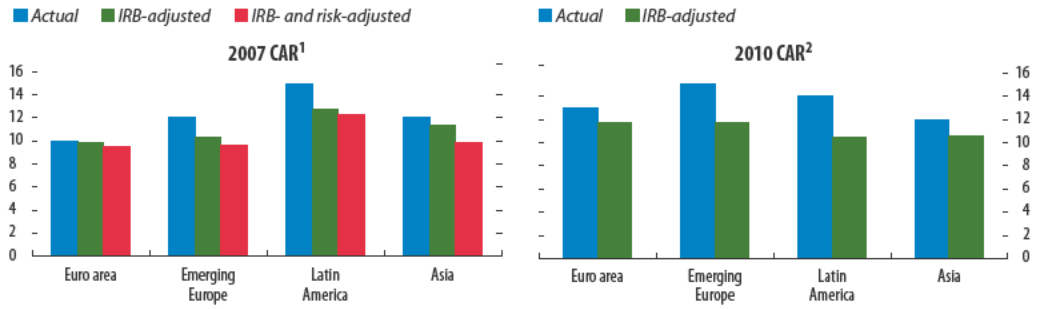
Figure 3.3.2. Sovereign CDS Speads and Fiscal Fundamentals—Precrisis, Crisis, and Postcrisis



Sources: Bloomberg L.P.; IMF (2011c); and IMF staff estimates.
*Significant at 5 percent level.

Figure 3.3.3. Capital Adequacy Ratios—Actual, IRB-Adjusted, and IRB- and Risk-Adjusted, 2007 and 2010

(In percent)



Sources: Bankscope; and IMF staff estimates.
Note: Data for each region are the median for all reporting banks. CAR = capital adequacy ratio; IRB = internal ratings-based.
[1]Actual = reported CAR; IRB-adjusted = CAR based on IRB risk weights for government security holdings, rather than zero, using observed CDS spreads in 2007 to extract estimates of probabilities of default (PDs); IRB- and risk-adjusted = IRB risk weights, using adjusted CDS spreads to extract estimates of PDs (adjusted CDS spreads = observed CDS spreads + 459.33 x IMF Fiscal Indicators Index).
[2]IRB-adjusted = CAR based on the observed sovereign CDS spreads and the associated PDs in 2010.

Box 3.3 *(continued)*

and PDs based on actual CDS spreads, the capital adequacy ratios are considerably lower for emerging markets. Adjusting further for risk differentiation (based on the observed differentiation seen during 2008–11), the capital adequacy ratios are even lower. The bias is low in advanced economies in view of their relatively low EADs. At end-2007, the difference between the observed capital adequacy ratio and the "IRB- and risk-adjusted" capital adequacy ratio ranged from 0.5 to 2 percentage points across the countries in Europe. In emerging economies, adjustments were in the range of 2 to 3 percentage points, given those banks' more sizable domestic sovereign exposures and higher CDS spreads due to worse medium-term fiscal fundamentals. In Canada, Japan, the United Kingdom, and the United States, downward revisions of the capital adequacy ratios were relatively low, in the 0.2 to 1.5 percentage point range. The bias was even higher for some regions in 2010 because of worse fiscal fundamentals and higher EADs.

Even now, the favorable capital treatment does not adequately reflect underlying economic risks and may lead to higher bank allocations to sovereign debt than warranted by more accurate risk-return considerations.[39] The current preferential treatment of sovereign exposures is based partly on national supervisors' practice of applying zero risk weighting on sovereign debt within the same currency area. Many countries' supervisors apply the zero percent risk weight to their own sovereign debt. The European Union Capital Requirements Directive applies preferential treatment to debt issued by cross-border euro area sovereigns despite the fact that the countries have given up independent monetary policy and that their fiscal fundamentals vary widely. Setting the risk weights at levels reflecting actual underlying risks and medium-term fiscal fundamentals would eliminate this bias. More generally, underestimation of government debt-related risks in bank portfolios can account for an upward bias in capital adequacy ratios.[40] The magnitude of potential capital adequacy bias could be high (see Figure 3.7 and Box 3.3).

Bank demand for government debt is likely to expand in the future. The advent of new regulations may force banks to hold even more safe assets. For example, on the liquidity side, unless banks alter their liability structure to moderate their liquidity needs, the requirements of the new Basel III Liquidity Coverage Ratio (LCR) alone could further increase the demand for safe assets by some $2 trillion to $4 trillion worldwide (see Box 3.4). An increase in the risk weights of riskier sovereigns could also spur stronger demand for the safest sovereign assets (see Box 3.3). In addition, business uncertainty is likely to put upward pressures on such demand.

The upcoming introduction of the LCR could influence how maturity risks associated with sovereign safe asset holdings are distributed within banks. Under Basel III, maturity restrictions on qualifying liquid assets are lifted, and assets—including government securities—with different terms to maturity are eligible to meet the LCR.[41] Government securities are a substantial component of the liquid assets required under Basel III; however, they are not the only qualifying liquid assets.

The upcoming implementation of the Solvency II regulations, although not yet finalized, may stimulate stronger demand by European insurance companies for certain assets. Under the current proposal for Solvency II, insurance companies would, for instance, not be required to hold regulatory capital against exposures to government bonds issued by member states of the European Economic Area, or government guarantees backed by multilateral development banks, regardless of the credit ratings or risk premiums of such instruments.[42] Solvency II may also boost the demand for highly rated safe assets because it links insurance companies' capital requirements to the credit ratings of their asset holdings.

[39]Basel I alloted zero percent risk weights to all OECD countries. Following the Asian crisis in the 1990s, Basel II provided greater risk-weight differentiation for sovereign debt.

[40]Capital adequacy ratios are measured as the ratios of regulatory capital to risk-weighted assets.

[41]See Hannoun (2011).

[42]Solvency II is expected to be fully implemented in 2014.

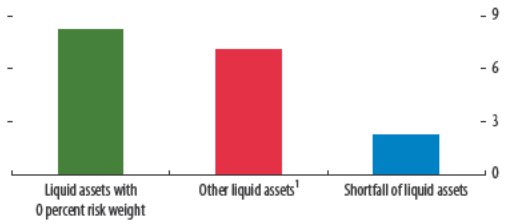
Box 3.4. Impact of the Basel III Liquidity Coverage Ratio on the Demand for Safe Assets

Unless they change their funding profiles, banks may need to increase their government debt holdings to ensure that they meet the liquidity requirements of the new Liquidity Coverage Ratio (LCR).

The introduction of the LCR under Basel III could be an important regulatory driver of bank demand for safe assets.[1] The liquidity buffer held by banks to fulfill the LCR requirement includes two types of liquid assets, both of which are supposed to have high credit quality and low market risk, traits presumed to translate into high market liquidity (Table 3.4.1): Level 1 assets are meant to exhibit characteristics akin to the safest assets; those in Level 2 are subject to a haircut and a limit on their quantity in the overall liquidity requirement. The LCR excludes lower-quality assets (below Levels 1 and 2) because in times of severe market stress, banks are either unable to sell them or are forced to accept considerable fire-sale haircuts.[2]

LCR requirements could have a sizable impact on the global demand for safe assets. To fulfill the Basel III LCR requirements by end-2009, large G20 banks would have required approximately $2.2 trillion in additional liquid assets, at least partly in the form of sovereign debt assets, according to the 2010 Quantitative Impact Study (QIS) of the Basel Committee on Banking Supervision (BCBS, 2010b) (Figure 3.4.1). An extrapolation for smaller G20 banks and non-G20 banks—not included in the QIS sample—shows that the potential need for qualifying liquid assets globally is in the range of $2 trillion to $4 trillion, equivalent to 15 percent to 30 percent of banks' total current sovereign debt holdings.[3] The combined sample approximately

Figure 3.4.1. Large G20 Banks: Available Liquid Assets and Expected Shortfall to Meet the Liquidity Coverage Ratio, End-2009
(In trillions of U.S. dollars)



Sources: The Quantitative Impact Study (QIS) (BCBS, 2010b); Bankscope; and IMF staff estimates.

Note: In its initial and follow-up data collection, the QIS covered 249 banks, which are from 23 of the Basel Committee's 27 member countries and cover most of the G20 countries. The value for liquid assets required to meet the Basel III liquidity coverage ratio was inferred from the QIS report, and the shortfall is as given in that report. A report with the European subset of the QIS data is CEBS (2010).

Note: Prepared by Maximilian Fandl and Christian Schmieder.

[1]See BCBS (2010a). To meet the LCR, banks need to maintain sufficient liquid assets to cover net cash flows over 30 days without external funding. Calibration of the LCR is subject to revision until end-2014.

[2]See BCBS (2010a) for exceptions for countries with insufficient amounts of assets at Levels 1 and 2.

[3]Estimates based on the latest QIS and relevant bank data; a more precise estimate would require an update of the QIS. The extrapolation for smaller G20 banks and non-G20 banks assumes that the proportions of assets to net outflows (the LCR ratios) are identical to those of the large G20 banks in the 2010 QIS. The estimate of required liquid assets is presented as a share of total sovereign debt holdings only to provide a sense of the relative magnitude of the potential liquid asset needs. Certainly, the liquid assets to meet the LCR may take the form of non-sovereign eligible assets.

Table 3.4.1. Liquid Assets Eligible for the Liquidity Coverage Ratio

Type of Asset	Haircut (in percent)	Description
Level 1	0	Cash and central bank reserves (to the extent they can be drawn down in times of stress) Zero percent risk-weighted marketable securities or sovereign guarantees (including subsovereigns and public sector), central banks, and certain multilateral institutions Nonzero percent risk-weighted, domestic currency debt securities issued by sovereigns or central banks Nonzero percent risk-weighted, foreign currency debt securities issued by sovereigns or central banks to the extent that holding such debt matches the currency needs of the bank's operations in that jurisdiction
Level 2	15	20 percent risk-weighted marketable securities or guarantees by sovereigns (including subsovereigns and public sector), central banks, and certain multilateral institutions Covered bonds with high ratings (AAA to AA–) Plain-vanilla corporate bonds by nonfinancial corporations with high ratings (AAA to AA–)

Source: Bank for International Settlements.

Box 3.4 *(continued)*

doubles the total assets and hence the required liquid assets, based on the assumption that the balance sheet structure of smaller G20 banks and non-G20 banks is identical to the QIS banks. However, banks have three more years to adapt their funding profiles to meet the LCR, at which time their needs for safe assets could be lower. A more continuous calibration of the qualifying liquid assets—including eligibility and haircuts—could ameliorate pressures on the markets for safe assets. It is worth noting that the estimates here cannot account for the cross-country variation in amounts demanded by individual institutions and potentially supplied by issuers of the required assets.

The Role of Central Bank Demand for Safe Assets

Some advanced economies' central banks have influenced the markets for safe assets via massive purchases of government securities (Figure 3.9).[43] Notably, the Federal Reserve and the Bank of England have resorted to such purchases in the wake of the crisis to boost system-wide liquidity and stimulate economic activity by lowering long-term interest rates. These policies have contributed to a substantial decline in the long-term yields on government securities. They have also been successful in compressing yields and improving market liquidity in certain non-government securities—including corporate bonds—thus enhancing this aspect of their perceived safety.[44]

- In the *United States*, the pace of the Federal Reserve's asset purchases accelerated markedly under QE2 (the second stage of the so-called quantitative easing program), even though the share of such purchases in overall holdings has not increased drastically compared with precrisis levels. During QE2, the Federal Reserve became the principal buyer of U.S. Treasury securities in the secondary market, while such purchases in other sectors—particularly the foreign official sector—slowed down.
- In the *United Kingdom*, the Bank of England increased its gilt holdings considerably—both in absolute terms and in terms of market share—in the two years since its first gilt purchase under the Asset Purchase Program in March 2009. As intended, the Bank of England increased its share in aggregate gilt holdings, while the shares of pension funds, insurance companies, and other financial institutions declined.

These large-scale purchase programs have turned the Federal Reserve and the Bank of England into large holders of long-term government securities, with some risks for safe asset markets. The longer-term purchases have resulted in a marked increase in the maturities of both central banks' government securities holdings. At end-January 2012, about 40 percent of the Bank of England's holdings consisted of securities with remaining maturities of 10 to 25 years (Figure 3.10).[45] In the United States, the share of longer-term securities in the Federal Reserve's portfolio increased to roughly 30 percent after the introduction of the Maturity Extension Program—also known as "Operation Twist."[46] The sizable presence of central banks in the long-term government securities markets may limit the room for further policy maneuver, and may constrain central bank flexibility in smoothly unwinding current monetary policies.[47] This can lead to a loss of asset safety in

[43]The Bank of Japan has been an active buyer of government debt since the introduction of quantitative easing in Japan in 2001 (terminated in 2006), and continues to be under its current Asset Purchase Program.

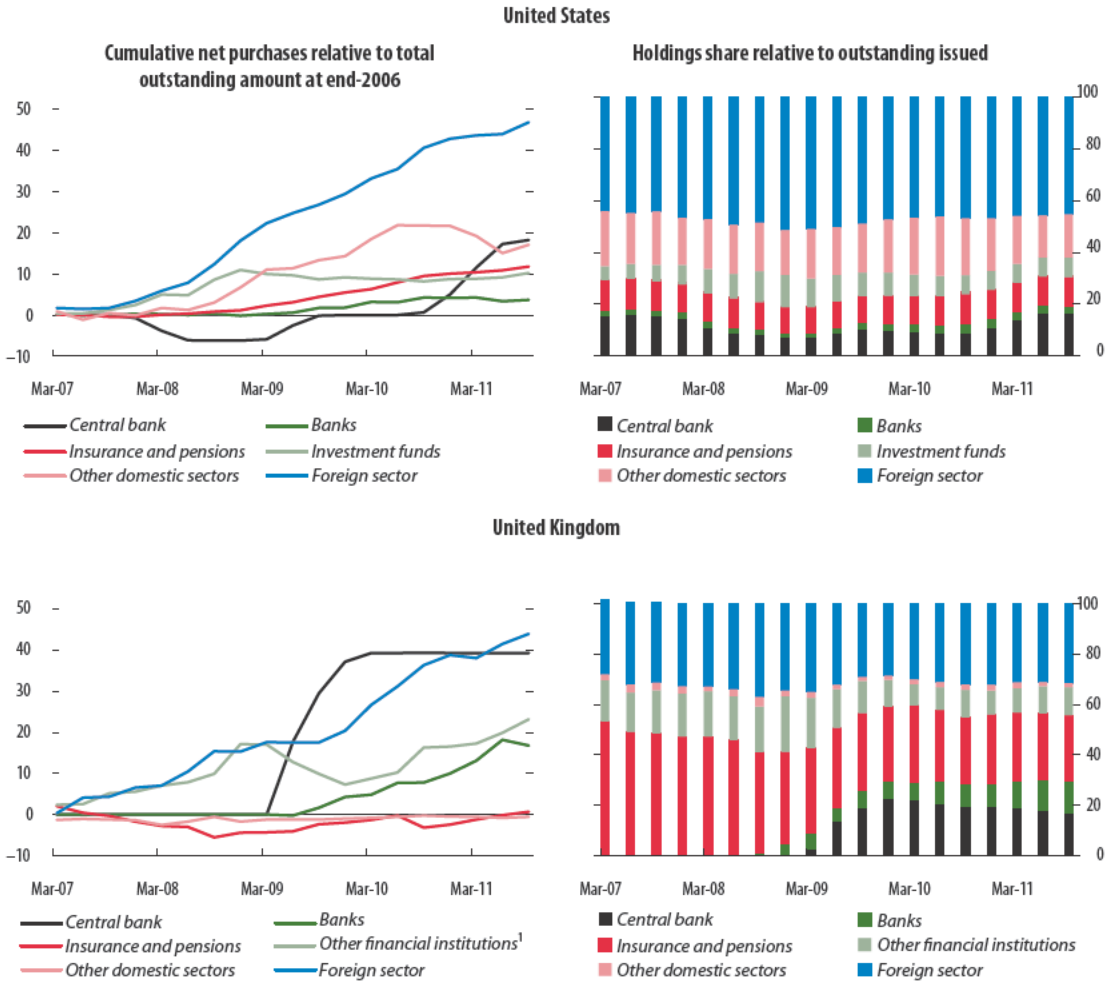
[44]See Yellen (2011); and Joyce, Tong, and Woods (2011). See IMF (2012) for a discussion of the role that central bank purchases of sovereign debt play in relieving the financial markets from absorbing large issuances. To the extent that central banks also supply central bank money (safe asset), reserve balances held by banks could increase, resulting in a change in composition of safe assets, rather than a decline (see the section below on "Central Bank Supply").

[45]Bank of England purchases are restricted to nominal gilts, with maturity initially capped at 25 years. However, the maturity restriction was subsequently relaxed as the purchase program expanded.

[46]Operation Twist was introduced to exert a downward pressure on long-term interest rates and support more accommodative broad financial conditions (Board of Governors of the Federal Reserve System, 2011).

[47]See Board of Governors of the Federal Reserve System (2011); and Fisher (2010).

Figure 3.9. Government Securities Purchases and Holdings by Sectors
(In percent)



Sources: Bank of England; national flow of funds data; and IMF staff estimates.
[1]For the U.K., includes financial institutions other than investment funds.

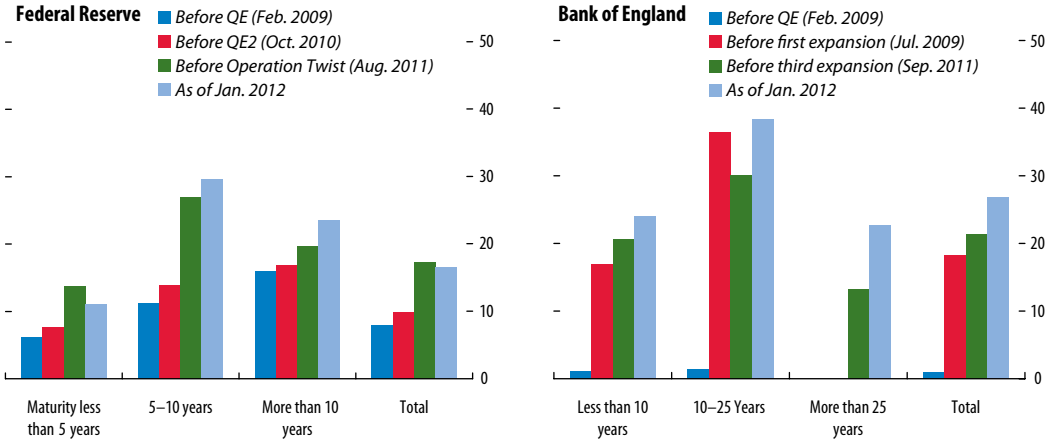
real terms and to higher currency risks. Large-scale asset purchases can also have an adverse effect on the political incentives to improve fiscal discipline because the back stop of central bank purchases keeps interest rates and thus funding costs low.

Use as Benchmark Securities

Safe assets play an important role as benchmarks both to judge relative performance and to assign prices to other assets. They serve: (1) as an integral part of the mandates of some pension, mutual, and sovereign debt funds globally, and as fund performance benchmarks (for example, market-neutral hedge fund strategies that attempt to be risk free); (2) as reference rates for the pricing, hedging, and valuation of a broad number of risky assets; and (3) as indicators of monetary and financial conditions (for example, an inverted government bond yield curve may signal an incipient economic contraction).

The integration of safe assets in the mandates of various funds suggests that potential shifts away from downgraded sovereign debt can lead to upward demand pressures on AAA-rated securities. Anecdotal evidence suggests that the most conservative global funds and mandates are now moving to AAA-rated

Figure 3.10. U.S. and U.K. Central Bank Holdings of Government Securities, by Remaining Maturity
(In percent of total amount outstanding)



Sources: Bank of England; Federal Reserve; U.K. Debt Management Office; U.S. Department of the Treasury; and IMF staff estimates.
Note: End of month figures. Government securities for the Bank of England exclude treasury bills, indexed bonds, and undated bonds. QE = quantitative easing.

bond indices. For example, some euro government bond fund mandates and benchmarks are increasingly reallocating to AAA-rated sovereign debt. This process could accelerate if debt sustainability concerns widen and sovereign downgrades persist. A reversal of the mandate changes could potentially span years: credit and risk committees of reserve managers, insurance companies, and pension funds would need to be persuaded that the risk-return trade-offs on downgraded entities were sufficiently stable and well performing before the committees readmit them to the benchmark.

Safe assets—via the government yield curve—are also a traditional benchmark in the pricing and valuation of risky assets in financial markets. The benchmark role of the government yield curve is linked to the historically high market liquidity and perceived safety of government securities. Fixed-income securities are often priced at a spread to a government debt instrument of the same maturity. Because of their perceived safety, sovereign yields have also been typically used as risk-free rate proxies in asset valuations. Moreover, the benchmark role of government securities is critical for local market development in emerging economies. The establishment of a liquid government bond yield curve is viewed as a precondition for the development of other market segments—including derivatives and corporate bond markets—typically priced off the government yield curve.

A potential deterioration in their status as the safest assets raises questions about the future role of government securities as benchmarks in the pricing and evaluation of riskier assets. For example, there was speculation that Standard & Poor's downgrade of U.S. sovereign debt from AAA to AA+ in 2011 would lead to a potential loss of the benchmark status of U.S. Treasuries with highly detrimental consequences. Theoretically, complete removal of U.S. sovereign debt would alter portfolio choices rather substantially (see Box 3.5), but to date, the downgrade has had little discernible effect on the status of the U.S. Treasuries as benchmark securities.

In the absence of viable alternatives, it is unlikely that major government securities markets would lose their benchmark role. The role of an alternative benchmark in asset pricing and valuation is often played by the swap curve, even if it is not based on instruments that are considered mostly risk free. For example, the swap curve is the principal asset pricing benchmark in the euro area, given that there are no common sovereign debt instruments and no homogeneous euro area sovereign yield curve.[48] Swap curves—based primarily on "plain vanilla" interest rate

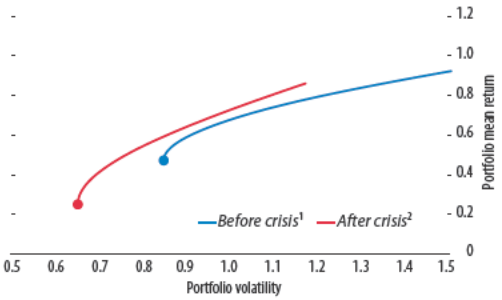
[48]The yield curve of the German bund may be regarded as an alternative benchmark. Also, the ECB publishes two euro area bond yield curves on a daily basis, one for all euro area countries and the other only for AAA-rated government bonds, but none of them is used as often as the swap curve in the euro area.

Box 3.5. The Impact of a Further Loss of Sovereign Debt Safety Illustrated in a Mean-Variance Framework

The impact of a hypothetical loss of sovereign debt safety can be assessed through its effect on portfolio choices in a typical mean-variance framework. The model estimates a mean-variance efficient frontier of returns of portfolios constructed from a set of base assets.[1] Even though the method assumes stable relationships among asset correlations across the experiments conducted below, it can help to illustrate the potential impact of the crisis and of a hypothetical elimination of safe assets on portfolio choices.

Contrary to intuition, the volatility of the optimal portfolios decreased after the crisis, thus raising the potential safety of bond portfolios for short-term investors.[2] The monthly volatility of the minimum variance portfolio decreased to 0.65 percent post-crisis from 0.85 percent in the period before 2008 (Figure 3.5.1). This result was driven by the sharp decline in the correlations across many of these assets after the global crisis, which allowed investors to reduce fluctuations in their portfolios despite stronger volatility in individual asset returns. This does not contradict the sharp increase of correlations across asset classes driven by the initial panic selling immediately after the failure of Lehman Brothers. More specifically, the crisis produced a decoupling of the returns of various sovereign bonds, giving investors the opportunity to better exploit the power of diversification and to construct portfolios whose ultimate volatility is much smaller. This highlights the importance of viewing asset safety from a portfolio perspective. For the minimum variance portfolio considered here, the crisis increased the role of U.S. sovereign debt—and of French, Spanish, and Finnish sovereign bonds—in the safest portfolio, and conversely reduced the importance of Pfandbriefe and Dutch, German, and Italian sovereign bonds.[3]

Figure 3.5.1. Efficient Frontier, before and after Crisis
(In percent)



Sources: Bloomberg L.P.; and IMF staff estimates.
[1]January 1997 through December 2007.
[2]January 2008 through October 2011.

A hypothetical deterioration of highly rated sovereign debt would likely have considerable repercussions for the ability of investors to protect themselves from risks. Potential sovereign debt problems are modeled via the estimation of an efficient frontier that excludes the debt of key countries, such as France, Germany, the United States, and peripheral euro area countries. The exclusion of U.S. debt would make investors less capable of shielding their portfolios from risks, as shown by the sharp inward contraction in the efficient frontier (Figure 3.5.2). The special role of U.S. debt in safe portfolios is even more discernible when one compares the considerable impact of a deterioration of U.S. debt markets to the negligible impact of potential

Note: Prepared by Tiago Severo.

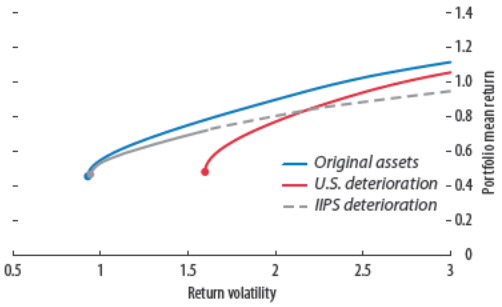
[1]The efficient frontier is the curve of minimum return volatilities for any given level of expected returns of portfolios constructed from base assets. The base assets consist of 14 sovereign debt instruments issued by major advanced economies, a highly collateralized bond issued by German banks (the Pfandbriefe), five broad stock indexes, and a short-term asset represented by the three-month Treasury bill. The efficient frontier is constructed from portfolios of the base assets to minimize the return volatility for any given level of expected returns. The expected returns on the assets and their variance-covariance matrix are estimated on the basis of a sample of monthly returns between January 1997 and October 2011.

[2]The precrisis period covers the beginning of 1997 to the end of 2007; the crisis period covers the period from January 2008 through October 2011.

[3]The basic intuition for explaining the increased role for Spanish bonds after the crisis is that they became less correlated with the sovereign bonds of core advanced economies, particularly Finland, the Netherlands, the United Kingdom, and the United States. Given that the sovereign bonds of these core countries gained importance in the minimum variance portfolio, the appeal of Spanish bonds also increased. Moreover, Spanish bonds are highly correlated with Italian bonds. Thus, during the crisis, the optimal portfolio had large short positions in Italian bonds, offset by long positions in Spanish bonds. Conversely, German bonds became less important because of their high correlation with U.S. bonds.

Box 3.5 *(continued)*

Figure 3.5.2. Debt Deterioration and the Efficient Frontier
(In percent)



Sources: Bloomberg L.P.; and IMF staff estimates.
Note: IIPS = Ireland, Italy, Portugal, and Spain.

problems in other markets (Figure 3.5.2, line for Ireland, Italy, Portugal, and Spain). This interpretation assumes that the correlation structure remains intact and that investors are predominantly making buy/sell decisions on the basis of risk and return rather than for liquidity or other reasons.

swaps—incorporate market perceptions of average bank credit risk and interest rate expectations and thus embed explicitly some credit risk. In view of this risk, the swap curve is typically above the Treasury yield curve, with swap spreads widening with market volatility and higher counterparty credit risks. However, at times of heightened sovereign risks, the swap curve is linked to the Treasury yield curve, in view of the linkages between sovereign and banking risks. Overall, in the absence of viable alternatives, markets will likely continue to use government yield curves or swap curves as benchmarks, even if they are not perceived to be based on truly risk-free assets.

The Supply of Safe Assets

From the preceding discussion, it is clear that the demand for safe assets is subject to considerable upward pressures. This section examines whether supply is likely to satisfy such demands. It analyzes, in turn, the role of sovereign issuers, the private sector, central banks, and emerging markets (Table 3.3).

Sovereign Supply

Traditionally, the issuance of sovereign debt by the advanced economies has been a key source of safe assets in global financial markets. Before the crisis, the safety of these instruments was underpinned by two features: the rarity of sovereign default, and the strength of advanced economies' political institutions, including government taxing power.

However, the recent considerable deterioration of some advanced economies' fiscal profiles has reduced the supply of sovereign debt perceived as safe. The sharp increase in advanced economies' public indebtedness after the global financial crisis, combined with low tax revenues and high current and future public expenditures, has raised concerns about the sustainability of their debt. Such concerns have been augmented by government difficulties—including the political gridlock in the United States and Europe—that have impaired the ability of advanced economies to devise credible adjustment strategies that properly balance short-term concerns about economic activity with long-term fiscal consolidation. Thus, while 68 percent of advanced economies carried a AAA-rating at end-2007, the proportion dropped to 52 percent by end-January 2012 (Figure 3.11, left panel).[49] This amounts to

[49]As discussed previously, ratings are subject to considerable deficiencies and should be viewed only as a loose indication of credit quality. They are used here given their extensive use by investors and ready availability over time; as earlier GFSR analysis showed, asset safety should not be viewed as being directly linked to credit ratings. See IMF (2010b) for a more extensive discussion of ratings and their role.

Table 3.3. Demand and Supply Factors and Their Anticipated Impact on Safe Asset Markets

Source of Demand	Investor Type	Important Short- to Medium-Term Factors	Expected Impact on Demand
Stable store of value in a portfolio management context	Reserve managers	Importance of safety considerations in strategic asset allocation and rising overall reserves, partly mitigated by increasing diversification and reallocation to sovereign wealth funds	↑
	Insurance companies and pension funds	Demand related to overall investment policy, but low-interest-rate environment may limit safe asset allocation by putting pressure on profitability	→
	Nonbank financial institutions	Flight to safety due to the European sovereign debt crisis (temporary effect related to the market turmoil)	↑
High-quality collateral for financial transactions	Banks and other financial institutions	Gradual shift of over-the-counter derivatives to central counterparties	↑
		Limits on the reuse of collateral and decreasing velocity of collateral	↑
		Increasing importance of secured funding sources for financial institutions with more differentiation in terms of applied haircuts in repo transactions[1]	→
Cornerstone in prudential regulations	Banks	Introduction of the liquidity coverage ratio (Basel III) (temporary effect)	↑
		Higher risk weights for riskier or downgraded sovereign debt	[2]
	Insurance companies	Treatment of sovereign debt and covered bonds under Solvency II	↑
Part of crisis-related liquidity provision	Central banks	Crisis-related monetary easing	↑
Benchmark for other assets	Banks and other financial institutions	Shift in the structure of demand toward assets that are perceived as relatively safer (e.g., U.S., U.K., Germany)	[3]

Source of Supply	Important Short- to Medium-Term Factors	Expected Impact on Supply
Sovereign issuers	Considerable deterioration of fiscal profiles in some advanced economies	↓
Private sector	Reduced effectiveness of traditional hedging instruments	↓
Central banks	Crisis-induced extension of liquidity provision	↑
Emerging markets	Restricted ability to generate safe assets (financial development, legal institutions, etc.) and lower degree of financial depth than advanced economies	→

Source: IMF staff.

Note: → indicates no impact; ↑ indicates an increase; ↓ indicates a decrease.

[1]Temporary effect due to disruptions of funding markets but possibly a more structural trend in the future.

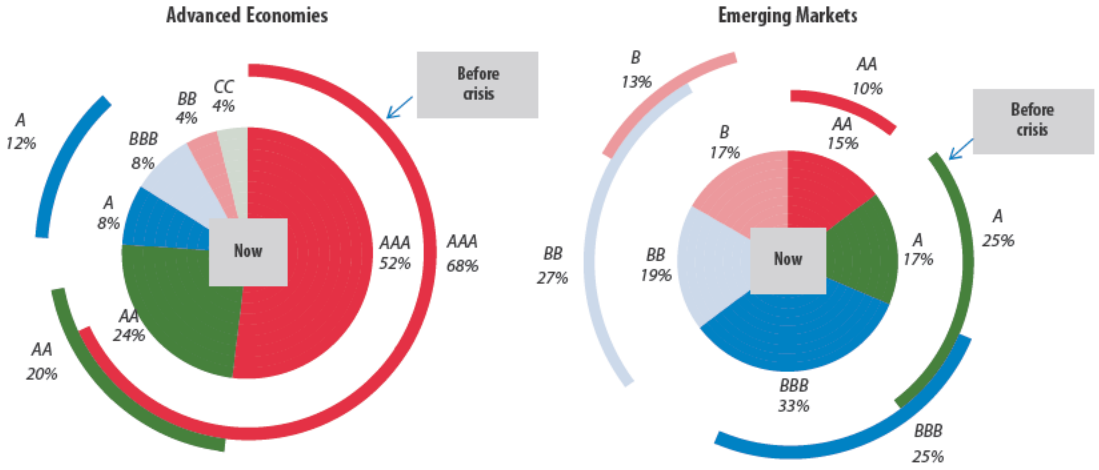
[2]Possibly less demand for riskier or downgraded sovereign debt and higher demand for relatively safer or higher-rated sovereign debt as substitute.

[3]Overall impact will depend on evolution of perceptions of safety for benchmark assets.

approximately $15 trillion of sovereign debt globally as of end-June 2011.

The experience of advanced economies shows that safety is a special characteristic of assets that can be lost very rapidly if market perception of soundness deteriorates. As the recent crisis in southern Europe suggests, once a country's ability or willingness to service its debt starts to be questioned by investors, they begin to move their holdings to other assets that are thought to be safer. Hence, deterioration in fiscal conditions has an important endogenous effect on the supply of safe financial instruments.

Figure 3.11. Distribution of Selected Advanced and Emerging Market Economies, by Sovereign Debt Rating
(In percent of total)



Source: IMF staff estimates based on S&P ratings of 25 advanced economies and 48 emerging market economies.

The considerable deterioration in the perceived safety of sovereign debt raises doubts about the ability of sovereigns to act as suppliers of safe assets, a role that they are best positioned to serve. The critical importance of advanced economies' sovereign debt is related to two factors: the very large stocks of these securities and their ability to readily meet the collateral and regulatory requirements faced by various investors. Regarding its formidable size, the aggregate general government gross debt of advanced economies amounted to over $47 trillion at end-2011, on average accounting for roughly 69 percent of each country's output (Figure 3.12). IMF projections suggest that the total outstanding government debt of this group of countries will rise to roughly $58 trillion by 2016, an increase of 38 percent in five years.[50] Unlike securitized instruments or covered bonds produced by the private sector, sovereign debt can generate safety that is intrinsic rather than synthetically created by combining the payoffs of risky instruments.

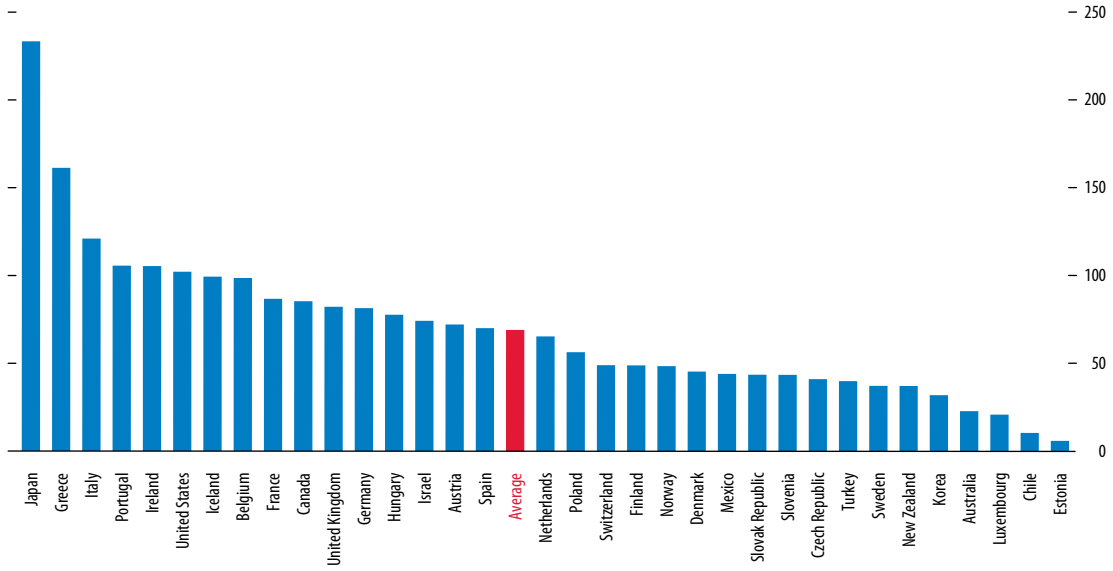
Both the lack of political will to reshape fiscal policies at times of rising concern over debt sustainability and an overly rapid reduction of fiscal deficits limit governments' capacity to produce assets with low credit risk. When large primary deficits—in line with those observed in 2010—persist over extended periods, it is difficult to return public sector fundamentals to sound levels. This suggests that unsustainable fiscal policies that are not reversed in a timely manner impair long-term asset safety. Conversely, up-front austerity measures could impair the sustainability of a country's public debt, especially if accompanied by rapid private sector deleveraging and a contraction in GDP. Thus, the pace of improvement of fiscal fundamentals needs to account for the impact on economic growth and take into consideration country-specific circumstances.

The fiscal deterioration in advanced economies can have considerable consequences. If levels of recent credit default swap (CDS) spreads on sovereign debt are used as the criterion for excluding certain countries as suppliers of safe assets, current and projected supply would drop significantly.[51] Using spreads above 350 basis points at end-2011 as the cutoff would exclude Greece, Hungary, Ireland, Italy, Portugal, Slovenia, and Spain, and the projected 2012 supply of safe assets would

[50]Outstanding government debt is measured in current prices. Projections of total outstanding debt are based on the *World Economic Outlook*.

[51]The exclusion of certain countries' assets is justified by investors' decisions to underweight or to exclude underperforming bonds, even where existing benchmarks are retained. See Chapter 2 for a discussion in the context of the recent removal of Portuguese bonds from the Citigroup World Government Bond Index.

Figure 3.12. OECD Countries: General Government Gross Debt Relative to GDP, End-2011
(In percent)



Source: IMF, World Economic Outlook database.

drop by $4.6 trillion (Figure 3.13).[52] This contraction would increase to $8.1 trillion, or approximately 16.4 percent of the 2012 total supply of advanced economy debt, if countries with five-year CDS spreads above 200 basis points at end-2011—including Belgium, France, Iceland, Poland, the Slovak Republic, and Turkey—are also excluded. Projections of advanced economy public indebtedness indicate that the exclusion of all 13 countries from the sample will reduce the supply of safe public debt by more than $9 trillion by 2016, or about 16 percent of the 2016 projected total.[53]

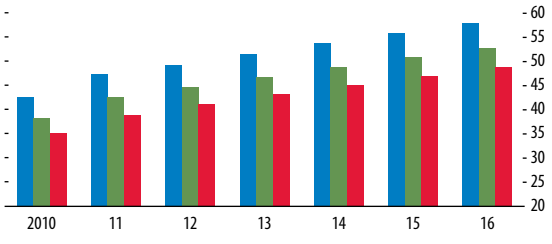
Private Sector Supply

The production of safe assets by the private sector largely collapsed with the onset of the global crisis. Total private sector securitization issuance declined from more

[52]The spreads are the prices paid for five years of protection (via CDS contracts) against default of the debt, with the price expressed in basis points of the nominal amount insured.

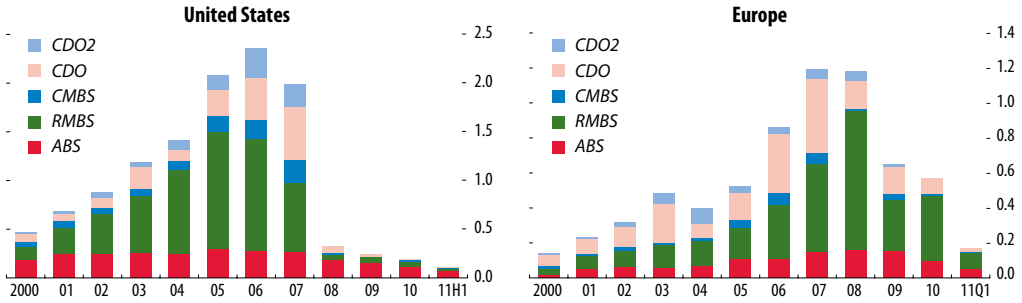
[53]The numbers are based on extrapolations rather than forecasts; realization of the latter depends critically on the developments in the Greek and euro area crisis discussions and other factors.

Figure 3.13. OECD Countries: General Government Gross Debt, 2010–16
(In trillions of U.S. dollars)



Sources: Bloomberg L.P.; and IMF, World Economic Outlook database.
Note: For 2012–16, the data are projections.
[1]Greece, Hungary, Ireland, Italy, Portugal, Slovenia, and Spain.
[2]Belgium, France, Greece, Hungary, Iceland, Ireland, Italy, Poland, Portugal, Slovak Republic, Slovenia, Spain, and Turkey.

Figure 3.14. Private-Label Term Securitization Issuance
(In trillions of U.S. dollars)



Sources: Association for Financial Markets in Europe; Board of Governors of the Federal Reserve System; Fitch Ratings; Inside Mortgage Finance; JPMorgan Chase & Co.; Merrill Lynch; and IMF staff estimates.

Note: ABS = asset-backed security; CDO = collateralized debt obligation; CDO2 = CDO-squared and CDOs backed by ABS and MBS; MBS = mortgage-backed security; RMBS = residential MBS; CMBS = commercial MBS.

than $3 trillion in the United States and Europe in 2007 to less than $750 billion in 2010 (Figure 3.14). The extraordinary volume of precrisis issuance was driven by the perception that the instruments were nearly risk-free while offering yields above those of the safest sovereigns. By construction, the high risk levels inherent to the lowest-rated (equity) tranches of the structured securities were expected to be offset by the near risk-free senior AAA-rated tranches. In reality, as the global financial crisis showed, the losses in the underlying portfolios were sufficiently large to threaten the solvency of even senior AAA-rated tranches. Moreover, the lack of information on the quality of the underlying assets made estimations of true asset value difficult and hence sensitive to sudden bad news. As a result, investors are still generally unwilling to invest much in these types of assets.

The ability of private issuers to generate safe assets depends critically on the inherent credit risk of issued instruments. These risks are determined not only by the issuers' default risk but also by the structure of such instruments. An interesting case in this regard is that of covered bonds, or German-style Pfandbriefe. Covered bonds are similar to traditional securitized instruments in being typically structured to ensure higher perceived safety than warranted by issuers' own credit profiles.[54] However, two critical aspects differentiate covered bonds from typical securitizations: the unobstructed access they provide to asset pools in case of an issuer default and, perhaps most importantly, the ongoing substitutability of asset pools that underlie these bonds. The latter feature ensures that the quality of asset pools is kept high at all times, as issuers are required to substitute or add collateral in case of credit quality deterioration (thus ensuring overcollateralization).

Aside from securitization, there are other, more conventional strategies that allow investors to effectively manufacture safe assets from combinations of risky payoffs. For example, investors who want to purchase a safe debt instrument may buy risky debt from a corporation or a sovereign and combine it with a CDS on the reference entity. As long as counterparty risk in the CDS market is small, the payoff of this portfolio will resemble that of safe debt from the perspective of credit risk.

However, policies implemented during the recent turmoil may have reduced the effectiveness of traditional hedging instruments. For example, the authorities' desire to avert a trigger on CDS payments and the imposition of voluntary losses on private investor holdings of Greek sovereign debt until recently impaired the integrity of this hedging mechanism. Similarly, prohibitions imposed by some advanced economy governments on short sales of sovereign debt constrain investors' hedging strategies and thus their ability to create synthetically safe assets. Some investors have responded to these measures by resorting to alternative strategies that mimic the hedging properties of the disallowed hedging mechanisms. For example, the earlier decision to avoid the trigger of the CDS on Greek sovereign debt may have induced investors to short bonds issued by other euro area countries to obtain sovereign risk protection.

[54]See Packer, Stever, and Upper (2007).

Box 3.6. Conventional Monetary Policy and Its Demand for Safe Assets under Normal Conditions

On the supply side, central banks can augment banking system reserve balances, primarily via open market operations. From the perspective of a bank, such reserve balances can be viewed as safe assets because they: (1) are most liquid (can be used for immediate settlements), (2) carry no market risk (nominal values remain constant), and (3) do not embed credit risk (at least in nominal terms, given central banks' ability to issue fiat money).[1] Central banks also supply banknotes—a medium of exchange without market and credit risks in the present context—to the general public.[2]

On the demand side, central banks conduct collateralized lending—including securities repo transactions—and outright securities purchases to provide the most liquid assets to the financial system (Table 3.6.1). Central banks generally do not engage in unsecured lending so as to protect themselves (and ultimately, to protect taxpayers should central banks need to be recapitalized) against financial losses related to counterparty defaults. In this context, eligible collateral for open market operations and standing facilities also tends to be restricted to high-quality securities. However, the types and range of such collateral vary considerably across central banks, in view of country-specific factors such as banking and financial market structures, number and diversity of counterparties, and statutory requirements.[3]

Similarly, eligible securities for outright purchases are generally limited to domestic government securities and, to a lesser extent, securities issued by central banks (Table 3.6.2). Because many countries have deep markets for government securities, such purchases are often used by central banks as a tool for injecting liquidity into the financial system while minimizing interference in domestic capital allocation and credit risk.

Table 3.6.1. Proportion of Central Banks Using Selected Tools for Open Market Operations, 2010
(In percent)

Outright purchase of securities	56.3
Securities repo	79.6
Collateralized lending	65.0

Source: IMF Information Systems for Instruments of Monetary Policy (2010).

Note: Results are for 103 central banks. Many central banks use more than one of the tools shown.

Table 3.6.2. Proportion of Central Banks Purchasing Selected Securities for Open Market Operations, 2010
(In percent)

Government securities	70.7
Central bank liabilities	43.1
Other	15.5

Source: IMF Information Systems for Instruments of Monetary Policy (2010).

Note: Results are for 58 central banks that conduct outright purchases of securities for open market operations. Many central banks purchase more than one of the types shown.

Note: Prepared by Ken Chikada.

[1] This in turn implies that central bank money is susceptible to inflation risk and thus is not entirely risk free.

[2] Central banks could also issue central bank bills or offer term deposits to financial institutions. Such instruments could be considered safe assets in a broader context, as they have zero credit risk and generally low market risk, given their short-term maturities. Also, they are typically used to absorb excess liquidity in the system and thus are tools for maturity and liquidity transformation within the central banks' liabilities.

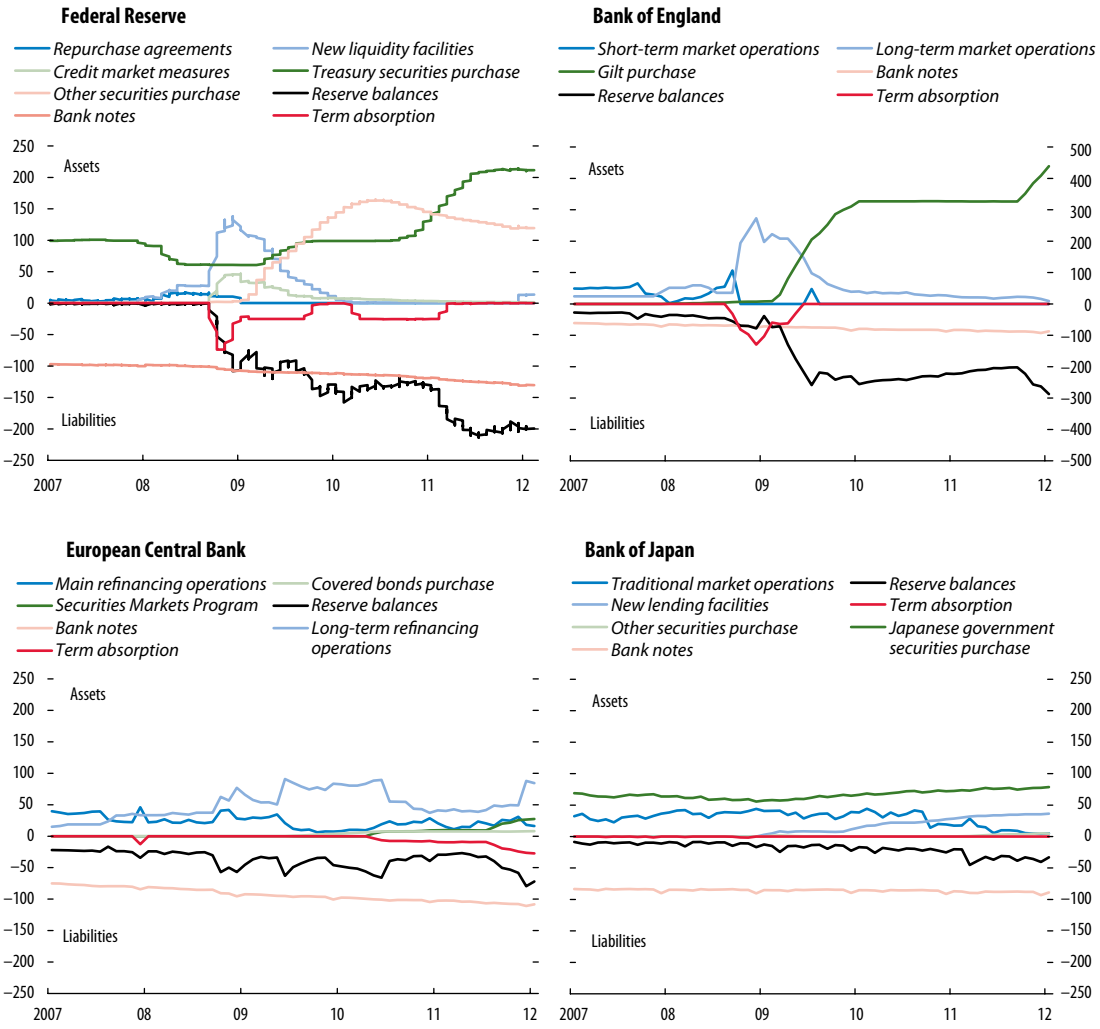
[3] See Chailloux, Gray, and McCaughrin (2008); and Cheun, von Köppen-Mertes, and Weller (2009) for more details on the collateral frameworks.

Central Bank Supply

In response to the global financial crisis, major central banks undertook the role of providing safer assets. In normal times, central banks enlarge or reduce the supply of central bank money in the system through exchanges of high-quality securities with longer maturities and less liquidity; thus they in effect conduct maturity and liquidity transformation within the safe asset universe (see Box 3.6).[55] In contrast, during the crisis, central banks could and actually did act as a backstop by temporarily exchanging riskier assets with safer ones (central bank money), in part via an expansion of eligible collateral types, with more frequent open market operations to a broader range of counterparties and at

[55] Liquidity here refers to closeness to cash.

Figure 3.15. Selected Advanced Economies: Changes in Central Bank Assets and Liabilities since the Global Crisis
(In percent relative to monetary base at end-2006)



Sources: Bloomberg L.P.; central banks; Haver Analytics; and IMF staff estimates.

Note: Monetary base here is defined as bank notes in circulation plus reserve balances (including excess reserves and overnight deposit facilities). Term absorptions consist of term deposits, reverse repo transactions, central bank bills (for the Bank of Japan), and U.S. Treasury Supplementary Financing Account (for the Federal Reserve). New liquidity facilities and new lending facilities include measures that were already terminated. New liquidity facilities of the Federal Reserve include U.S. dollar liquidity swap arrangements with central banks. Credit market measures of the Federal Reserve consist of facilities such as the Commercial Paper Funding Facility, Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility, and Term Asset-Backed Securities Loan Facility.

longer maturities. They also made direct or indirect purchases of securities that had lost liquidity—a key characteristic of safety—in specific market segments, including commercial paper, corporate bonds, and asset-backed securities (Figure 3.15).[56] While valuable as a crisis management tool, this process clearly has limits, as central banks assume the credit risk of the securities taken onto their balance sheets.

[56]This process is still under way in the euro area. For a more general discussion and assessment of unconventional monetary policies, see Borio and Disyatat (2009); and IMF (2009b), for example. In contrast to a central bank's traditional role as the lender of last resort, Tucker (2009) refers to this new role as the market maker of last resort.

As a result of these crisis-driven operations, the increase in central bank reserve balances was quite pronounced, particularly for the Federal Reserve, the Bank of England, and the European Central Bank. Spikes in central bank liabilities were initially facilitated by newly established liquidity facilities and longer-term open market operations that replaced traditional short-term market operations.[57]

- In the *United States*—where capital markets play a considerable role in corporate and household financing—direct nongovernment securities purchases and indirect purchases via credit market measures accounted for most of the marginal increase in Federal Reserve assets.
- In *Japan*, the increase in reserve balances and central bank assets was less pronounced, given that the Japanese financial system was less affected by the global financial crisis.
- In *Europe,* market stress prompted the ECB to resume covered bond purchases, broaden the criteria for collateral eligibility and, most recently, initiate the provision of longer-term liquidity (at a maturity of 36 months) to support bank lending and liquidity in the euro area market.[58] The ECB also launched the Securities Markets Program (SMP) to ease stress in the markets for peripheral euro area sovereign bonds, playing a role akin to a market maker of last resort. It also reabsorbed SMP-provided liquidity via weekly operations. From the banks' perspective, the two operations jointly amounted to an exchange of assets (bonds) with lost safety features for safe assets (term deposits offered by the central bank). The ECB's three-year longer-term refinancing operations have provided large amounts of liquidity to euro area banks, part of which could be used to purchase safer securities.

[57]Initially, the ample liquidity was partly offset by liquidity absorption operations to control policy interest rates. However, as the policy interest rates were subsequently cut closer to zero, use of absorption tools generally declined.

[58]Also, in November 2011, major central banks enhanced their capacity to provide dollar-based liquidity support to the global financial system by lowering the pricing on the existing temporary U.S. dollar liquidity swap arrangements.

Supply by Emerging Market Economies

The high demand for safe assets produced by advanced economies has been, in part, supported by the inability of emerging market issuers to contribute to the global supply of safe assets. Many emerging markets are still in the process of developing well-functioning financial systems, which are characterized by sound legal institutions and adequate property rights. The absence of market infrastructures on par with those of advanced economies means that governments, corporations, and individuals will continue to have difficulties pledging future cash flows associated with the issuance of local currency debt securities. Such limitations curb the supply of assets in local capital markets and limit the development of liquid financial markets, forcing some to seek assets outside their country, with attendant currency risks. Though shrinking, the disparity in the degree of financial depth between emerging markets and advanced economies is still considerable. At end-2009, emerging markets accounted for approximately 40 percent of global GDP (Kose and Prasad, 2010), but their contribution to financial depth was less than 20 percent of that of advanced economies (Table 3.4).

Financial Stability Implications

Considerable upward pressures on the demand for safe assets at a time of declining supply entails sizable risks for global financial stability. The unmet demand drives up the price of safety, with the safest assets affected first.[59] In their search for safety, investors that are unable to pay the higher prices are likely to settle for assets that embed higher risks than desired. These risks would also affect markets more broadly. For example, if prime collateral became too expensive, funding markets would need to accept lower-quality collateral and absorb risks that, depending on how far this process goes, may impinge on the trust that underpins effec-

[59]Quantification of demand pressures and forthcoming safe asset supply is difficult, given uncertainties in the economic and financial environment. Therefore, it is impossible to predict how demand pressures will translate into demand for specific assets (such as U.S. Treasuries) and how much of the projected supply will be considered safe.

Table 3.4. Top Five Financially Deep Worldwide Economies, as Share of Own GDP and of Global Financial Depth, 1989 and 2009

In Percent of Own GDP				In Percentage Contribution to Global Financial Depth			
1989		2009		1989		2009	
				World	**100**	**World**	**6.71**
Advanced economies				**Advanced economies**	**92.58**	**Advanced economies**	**82.03**
Japan	7.25	Ireland	21.61	United States	32.45	United States	29.28
Switzerland	6.48	United Kingdom	12.64	Japan	28.26	Japan	13.12
Belgium	5.45	Switzerland	11.48	United Kingdom	5.69	United Kingdom	7.73
United Kingdom	5.03	Netherlands	10.63	Germany	5.33	Germany	6.04
United States	4.51	Japan	9.31	France	4.53	France	5.40
Emerging markets				**Emerging markets**	**7.42**	**Emerging markets**	**17.97**
Lebanon	8.94	Hong Kong SAR	26.67	Brazil	1.94	China	7.13
Hong Kong SAR	7.44	Singapore	10.47	China	0.93	Brazil	1.63
Malaysia	4.92	Lebanon	7.44	Hong Kong SAR	0.67	Hong Kong SAR	1.56
Singapore	4.76	South Africa	6.47	Republic of Korea	0.66	Republic of Korea	1.15
South Africa	3.96	Malaysia	6.30	India	0.54	India	1.14

Source: Goyal and others (2011) based on data from the Bank for International Settlements, the World Bank, and an updated dataset of "external wealth of nations" constructed in Lane and Milesi-Ferretti (2007) for 50 economies, half advanced and half emerging, that collectively account for more than 90 percent of global GDP.

Note: Summing all assets and liabilities (held against residents and nonresidents) as a share of GDP gives a measure of the weight of total financial claims and counterclaims of an economy—both at home and abroad. Domestic claims are defined as the total of domestic financial liabilities, including broad money, resident claims on the banks, domestic securities, and stock market capitalization. The table also shows financial depth, as a share of global depth (right columns; each country's contribution is weighted by its GDP).

tive market functioning. Such frictions in funding markets can reduce the ability of financial institutions—including investment banks, asset managers, and hedge funds—to secure funding or onlend excess funds. This process was discernible in 2008 after the collapse of Lehman Brothers: because only short-term Treasuries continued to be widely accepted in repo operations, investors bid up their price to the point that their nominal yields turned negative.

Demand-supply imbalances in safe asset markets could also lead to more short-term volatility jumps, herding, and cliff effects. In an environment of persistent low interest rates and heightened financial market uncertainty, excess demand in the markets for safe assets can raise the frequency of short-term volatility spikes and potentially lead to asset bubbles. Rapid changes in investor perceptions of safety and insufficient differentiation in the risk categorization of assets, either in terms of creditworthiness or liquidity, could lead to cliff effects, in which deterioration in market conditions and a downgrade could lead to an automatic reclassification of assets to a lower category and a sudden price drop of those assets. Tying up high-quality collateral in CCP guarantee funds and initial margin to improve CCP solvency profiles may reduce liquidity in OTC derivative markets and, more generally, in repo markets; as a result, various shocks could lead to price spikes and shortages of high-grade collateral.[60]

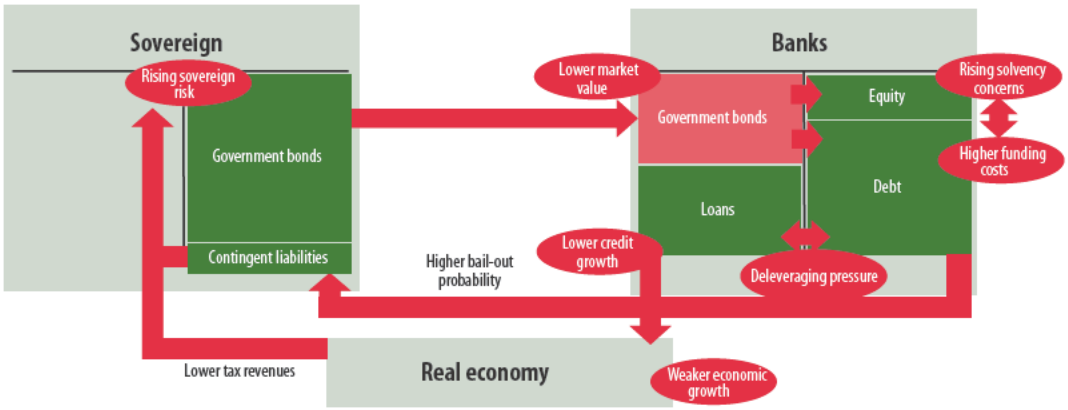
Banks are also exposed to unintended risks related to the preferential regulatory treatment of sovereign debt. The common use of zero percent risk weighting on banks' holdings of their own sovereigns' debt, and the extension of this practice to holdings of other sovereign debt within a monetary union, leads to harmful effects on bank resilience and intermediation. It encourages more leverage on safe assets and potential overinvestment in higher-risk sovereigns with favorable risk-return characteristics, leading to possible undercapitalization of banks in times of stress.

Banks' sizable sovereign exposures, in part related to regulatory incentives, can act as a contagion channel between sovereigns and the banking sector with knock-on effects to the economy. Sovereign risks can have a negative spillover to banks via valuation losses on sovereign debt holdings and, thus, a drop in collateral values. This risk could lead to exclusion of sovereign securities from collateral pools and may impair banks' ability to obtain secured funding (Figure 3.16).[61] Mounting sovereign risks may also

[60]Collateral posted in CCP guarantee funds and for initial margin cannot be rehypothecated, unlike in repo markets, and hence reduces collateral available for other uses.

[61]See Committee on the Global Financial System (2011); and IMF (2011a) for a detailed discussion of the transmission chan-

Figure 3.16. Government Bond Holdings and Risk Spillovers between Sovereign and Banks



depress the value of explicit and implicit government guarantees and thus elevate the credit and liquidity risks—particularly funding costs—of banks benefiting from such guarantees. In reverse, banking sector stress can create higher contingent liabilities for the sovereign sector or the need for outright government support. If risk weights suddenly increase, banks may be prompted to deleverage by curbing new lending, leading to a dampening effect on economic growth, and to secondary effects on sovereigns via weaker tax revenues. Ultimately, this could exacerbate negative feedback loops between sovereigns and the banking sector, as has been observed in parts of Europe in recent months (see Chapter 2).

A crucial mitigating factor that may have tempered the immediate concerns arising from a shortage of safe assets has been the provision of abundant liquidity by central banks. Although these measures will allow banks to continue to fund themselves in the short term and hold onto assets of all risk profiles, they will not remove the underlying tension in the markets for safe assets, as described here.

nels. As discussed in IMF (2011a), even in cases where heightened sovereign risk is not reflected on banks' financial statements—for example, via banking book sovereign exposures and valuations at amortized costs—creditor perceptions of balance sheet weakness and heightened bank credit risk can increase bank vulnerability since credit risk is assessed in economic rather than accounting terms.

Key Conclusions and Policy Implications

Flexibility in policy design and implementation is warranted to ensure a smooth adjustment to the upcoming supply and demand pressures on the markets for safe assets. Investors' cost of safety will inevitably rise, but an adjustment process that is too abrupt or too volatile may compromise financial stability. Stronger demand for certain assets deemed the safest will put upward pressure on their prices, while assets suddenly viewed as less safe may be subject to downward pressures. Arguably, the cost of safety was distorted before the crisis, but the demands arising from regulatory reforms and ongoing central bank policies suggest potentially substantial pressure on certain safer asset classes. Policymakers should be cognizant of the effects of existing and upcoming policies on spurring demand for safe assets.

Ultimately, efforts to ensure that fine distinctions across safe assets are reflected in regulation or policy responses could help alleviate discontinuities or cliff effects in their usage and pricing.

- As shown in Box 3.3, the common application of a zero percent risk weight on holdings of debt issued by a bank's own sovereign, irrespective of its risk, tends to inflate bank capital adequacy levels. This creates a perception of safety detached from underlying economic risks and leads to an inflated demand for such safer assets. Hence, for banks, sovereign debt should ultimately carry assigned risk weights that more accurately reflect

the relative credit risk of the issuing sovereign.[62] While a discussion of changes in risk weights for sovereign debt should be initiated, any alteration will need to be examined carefully in advance since establishing risk weights is particularly difficult in the context of sovereign debt. Measures such as CDS spreads are likely to be too volatile to be practically implementable; however, there is a range of other methods for estimating sovereign risk that could be considered.[63] Any change to risk weights should be introduced gradually and reviewed periodically to avoid market disruptions. It should be noted that the introduction of a non-risk-weighted leverage ratio under Basel III will complement risk-weighted capital adequacy requirements.

- The new liquidity coverage ratio in Basel III would require banks to hold more liquid assets to better address short-term funding pressures. The qualifying highly liquid assets mostly consist of the safest assets; as Box 3.4 shows, banks could require some $2 trillion to $4 trillion of such assets to meet the new ratio unless they adjust their funding profiles. It will be important to ensure that, when the regulation is formally implemented at end-2014, haircuts for liquid assets of different quality can be reviewed at appropriate intervals and reflect the differential risks across the eligible assets. Basel III's observation period for the ratio would allow the Basel Committee to revisit the calibration of haircuts to avoid sudden changes. Attention to the implementation of Solvency II for EU insurance companies is also warranted, as similar incentives to hold certain safe assets are also present.
- The use of safe assets as collateral for CCP default funds—in the context of the anticipated move of OTC contracts to CCPs—is another area where demand pressures can be alleviated by some flexibility in the definition of acceptable safe assets. By ensuring that CCP oversight allows for a broad range of collateral (with appropriate risk-based haircuts and minimum criteria for inclusion) alongside other risk management practices, undue pressures on certain types of safe assets can be avoided without compromising the soundness of the CCP.

Supply-side measures could stem upward price pressure on highly demanded safe assets.

- The issuance of government securities is not meant to be the sole means of satisfying the demand for safe assets. Nonetheless, countries that experience fiscal difficulties and face questions about their credit quality would obviously benefit from a strong and credible commitment to medium-term fiscal adjustment, not least because it could curb the downward migration in their credit ratings and could help them regain their debts' safe asset status.[64] Strategies to lower debt levels, improve debt management, and put in place better fiscal infrastructures are generally welcome, as they improve governments' creditworthiness, lower borrowing costs, and enhance economic growth prospects. However, in times of financial stress, these features also help support financial stability by reducing the chance of widespread fire-sales and avoiding rapid declines in the quality of collateral.
- The production of safe assets by the private sector is an important source of supply and should not be unnecessarily impeded. The private market can synthetically create safe assets via combinations of existing intrinsically risky instruments and hedging strategies. To ensure that such products fulfill their safety role, there is a need to introduce: (1) intensive supervision, (2) better incentives for issuers (aligning issuer's compensation with the longer-term performance of the created securities), (3) a robust legal framework, and (4) improved public disclosure to ensure that securitized products are well understood and market participants have the resources and information to price and manage the risks. Well-conceived and regulated

[62]Banks are already permitted to use their own models and apply nonzero risk weights to sovereign debt. Even without using their own models, banks are also permitted to hold more capital against sovereign risk.

[63]For a more detailed discussion of various methodologies and other sovereign risk considerations in the context of risk weighting, see European Parliament (2010). For methodologies used in rating agency analysis, see Standard & Poor's (2011) and Fitch Ratings (2011), for example.

[64]See IMF (2012) regarding the benefits for financial stability of addressing long-term fiscal challenges.

covered bond structures of mortgages (with overcollateralization and the ability to replace impaired loans) are one good example. Sound securitization can also play a role.[65] In contrast, short sale restrictions and hurdles to the use of CDS contracts inhibit the creation of synthetic safe assets. Importantly, the creation of such assets needs to be monitored closely to avert negative experiences similar to the sharp decline in the quality of structured credit products—perceived as safe in view of their AAA ratings—during the financial crisis.

- In emerging markets, prudent fiscal policies together with ongoing improvement in domestic financial infrastructure—including legal certainty, clearing and settlement systems, and transparent and regular issuance procedures—will support further deepening of local sovereign bond markets. Over the longer run, these improvements will facilitate the use of such securities as safe assets both within their domestic context and possibly in global markets.
- It has been suggested that the issuance of bonds that would rely on the ability and willingness of a group of countries to jointly and severally honor their payment obligations could be a source of safe asset production. By sharing creditworthiness, these securities would diminish the chance of sharp increases in borrowing costs due to country-specific events. However, such securities would be considered safe only to the extent that the framework within which they were issued ensured the fiscal sustainability of all the countries backing them. Moreover, while such assets could augment the quantity of safe assets available to investors (in terms of credit risk and market liquidity), sovereigns whose creditworthiness was higher than the pooled credit quality underlying the new bond would face higher borrowing costs.

[65]See IMF (2009a) for a discussion of what constitutes "safe" securitization.

One clear policy response to the crisis has been to make financial institutions more resilient, in part by encouraging them to hold safer assets. This additional policy step, in the context of a shrinking supply, will drive up the price of safety. By itself, this is an appropriate outcome, but the key will be to ensure that prices are allowed to adjust smoothly. In particular, regulatory reforms should be formulated so that the fine distinctions across the relative safety of various instruments and strategies are discernible to all institutions requiring safe assets. Moreover, regulations and market practices should be designed flexibly and phased in gradually according to an internationally agreed schedule, to avoid situations that could harm financial stability.

The provision of abundant liquidity by central banks, especially if in exchange for less liquid collateral, affords crucial temporary relief from some of the strains arising from a shortage of safe assets. Although such measures ensure stability of the financial system in the short term and represent an appropriate crisis management response, they will not provide the lasting answer to the problem of a demand-supply imbalance in safe assets. In sum, maintaining flexible and efficient markets in light of the changing supply and demand conditions for safe assets will help to guarantee a smooth adjustment process and thereby a safer, more stable financial system.

Annex 3.1. Exposures to Common Risk Factors

This exercise analyzes the information contained in the time series and the cross-section of asset returns to identify common factors across a broad set of potentially safe assets. A key objective of the analysis is to gauge how the global financial crisis may have affected commonalities and risk factor exposures across various assets and thus infer the changes in the relative riskiness of these assets. The analysis uses the excess returns of various assets relative to the return on the one-month U.S. Treasury bill, as a safe short-term instrument, to control for the variability in interest rate levels over time.

Methodology

Principal Component Analysis (PCA)

A key aspect of analyzing large sets of asset returns is that their behavior may, in reality, be related to a handful of common patterns. Intuitively, sets of different assets may behave similarly because of the effect of underlying unobservable factors. Statistical methods can assist when the nature of such factors cannot be determined reasonably a priori. PCA is a useful technique in this regard, as it reduces a set of asset returns to a smaller set of uncorrelated variables (principal components) that can capture most of the variability in the original data. Thus, PCA can help identify patterns in data and highlight their similarities and differences. It uses an orthogonal transformation to construct the principal components. The first principal component has as high a variance as possible (that is, accounts for as much of the variability in the data as possible). Each succeeding component in turn has the highest variance possible under the constraint that it be orthogonal to (uncorrelated with) the preceding components. The higher the degree of comovement in the original series, the fewer the number of principal components needed to explain a large portion of the variance of the original series.

Clustering Analysis

To understand the nature of the commonalities in asset returns, cluster analysis is used to identify the structure in the assets' correlation matrix before and after the crisis. The cluster analysis uses an algorithm to sort asset returns into groups in which the members of each group are as similar as possible. At the same time, the groups are formed to be as dissimilar from one another as possible. In effect, the cluster analysis creates groupings in a way that maximizes the average correlations between asset returns in the same group and minimizes such correlations across different groups. The cluster analysis uses Ward's method, which forms clusters so as to minimize the total within-cluster variance. Each step finds the pair of clusters that leads to a minimum increase in total within-cluster variance after merging that pair with the others. This increase is a weighted squared distance between cluster centers.

Data

An initial set of 127 global assets were examined as the broadest set from which investors could choose, spanning asset classes for sovereign and quasi-sovereign bonds, corporate bonds, commodity indices, currencies, and equity indices. Overall, the data cover the period between February 1977 and October 2011, although data availability varies across assets.[65] A narrower representative set of 56 assets across the various classes was used in the analysis to maintain a fully balanced sample, as is required by both techniques. Using monthly asset dollar returns, the excess total return for each asset (in dollars) was computed relative to the return on the one-month U.S. Treasury bill.

Empirical Results

The PCA identifies a few common factors that explain the patterns of correlations between excess monthly asset returns. A significant amount of commonality in the variation of monthly asset returns is captured by the first principal component, which accounts for half of the variation. Furthermore, the first two principal components collectively explain two-thirds of the variance in the asset returns. The first principal component is highly correlated with global liquidity, measured by the money supply (M2) of the G4 economies, and with the excess return on

Note: Prepared by Hanan Morsy.

[65]For most assets, the data start in the 1990s.

the global market portfolio.[66] This suggests that the first principal component is associated with different measures of market risk. The second principal component captures perception of safety, reflected by a high negative correlation with market volatility measured by the VIX index. The second principal component is also significantly related to liquidity and credit spreads, suggesting that it proxies for safety. Other econometric methods were used to check the robustness of the results, including factor model regressions.

The hierarchical clustering broadly confirms the results of the principal component analysis. Prior to the crisis, asset classes were grouped closely into asset pools, corresponding to (1) U.S. debt (sovereign, agency, and corporate); (2) Japanese debt (sovereign and corporate); (3) European sovereign and corporate debt, including highly collateralized bonds issued by German banks (Pfandbriefe) and EU covered bonds; (4) emerging market sovereign debt; and (5) equity market indices, commodities, and currencies. The tight clustering of euro area sovereign debt shows little pricing differentiation across assets of different credit quality.

Postcrisis, AAA-rated corporate securities appear to have decoupled from lower-rated instruments, clustering with U.S. sovereign debt, while corporate debt rated AA and below clustered with European entities. Gold clustered with lower-rated U.S. corporate debt, separated from other commodities. Japanese and U.S. sovereign and highly rated corporate debt have become more tightly clustered, suggesting that investor perceptions of asset safety for both countries differed markedly from those for Europe. All of the above suggests that investors became more discerning in terms of safety.

[66]Monetary policies created an environment of low interest rates, prompted a search for yield, and lowered funding costs for leveraged investors, thereby creating a push factor on asset prices across the globe and inducing prices to move in tandem.

The use of excess market portfolio returns—computed as the difference between the average returns for all assets in the sample and the return on the one-month U.S. Treasury bill—is motivated by the capital asset pricing model. Assets with large exposures to the market tend to be perceived by investors as risky since they typically perform poorly when markets are down. Data for the return on the one-month U.S. Treasury bill were downloaded from the website of Kenneth French (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french).

Annex 3.2. Central Bank Securities Policies since 2007

Table 3.5. Central Bank Changes in Policies on Collateral and Purchases of Nongovernmental Securities since 2007

	Federal Reserve	European Central Bank	Bank of England	Bank of Japan	Bank of Canada	Swiss National Bank
Collateral policies						
Broadening of type of securities eligible for collateral or repo	X[1]	X	X	X	X[2]	X
Easing in credit rating requirements		X		X	X[2]	
Easing in securities lending facilities	X[3]		X	X		
Nongovernment securities purchases[4]						
Commercial papers[5]	(X)[6]		X	X[7]		
Asset-backed securities	(X)[6]	X[8]				
Corporate bonds			X	X[7]		X[9]
Other securities	X[10]			X[11]		

Sources: respective central banks.

Note: The table does not cover all the measures taken by the central banks.

[1]By introducing new lending facilities accepting broader types of collateral. All the new facilities were either closed or expired.

[2]By introducing new lending facilities. All the new facilities were terminated or discontinued by April 2010.

[3]Term Securities Lending Facility. Closed in February 2010.

[4]Excludes securities purchased under resale agreements.

[5]Includes asset-backed commercial paper.

[6]By providing funding directly to borrowers and investors in the markets. The new facilities were either closed or discontinued.

[7]Purchases were terminated in December 2009 but resumed under the Asset Purchase Program established in October 2010.

[8]Covered bonds. Purchases were terminated in June 2010 but resumed in October 2011.

[9]Discontinued in December 2009.

[10]Direct obligations of, and mortgage-backed securities issued by, housing-related government-sponsored enterprises.

[11]Equity held by financial institutions (conducted as prudential policy and terminated in April 2010). Exchange-traded funds and real estate investment trusts purchased under the Asset Purchase Program established in October 2010.

Annex 3.3. Collateral Requirements of Central Counterparties for Over-the-Counter Derivatives

Central counterparty (CCP)-related collateral requirements mostly take the form of cash and government securities (Table 3.6). Initial margin—deposits from all transaction parties that act as buffers against potential losses to the CCPs following default of a clearing member—usually takes the form of cash and marketable securities issued by selected sovereigns and their agencies. To mitigate risk, various haircuts are applied to marketable bonds depending on their riskiness. The recent European sovereign debt crisis has had implications for CCPs, in terms of both the deterioration of collateral quality and the increase in the risks of counterparties directly linked to sovereign governments. Collateral eligibility rules for guarantee (or default) funds—comprised of clearing member deposits that act as additional buffers against potential losses under a range of stress scenarios—are usually stricter than those for initial margin, and only cash and marketable securities issued by selected sovereigns are acceptable.

The potential increase in the demand for qualified collateral—given the incremental initial margin and default fund requirements associated with moving all standardized over-the-counter derivatives to CCPs—may account for shortages in the supply of cash and government bonds. Large banks that are also clearing members may offer collateral transformation services to their customers to turn less liquid assets into CCP-acceptable ones through repos and swaps. This could potentially exacerbate liquidity pressures for CCPs during market downturns, when clearing members would need to provide liquid funds for their clients at a time when they themselves are being subjected to a liquidity freeze.

Table 3.6. Collateral Requirements of the Big Three CCPs Handling OTC Derivatives

<table>
<tr><th>Chicago Mercantile Exchange</th><th>Intercontinental Exchange (ICE) Clear</th><th>LCH.Clearnet Swapclear</th></tr>
<tr><td>Guarantee fund:
U.S. dollars, marketable U.S. Treasury securities, selected U.S. agency securities, and selected money market funds.</td><td rowspan="2">Guarantee fund and initial margin:
The U.S. operation (ICE Clear Credit) accepts cash of selected countries and marketable U.S. Treasury securities.

The U.K. operation (ICE Clear Europe) accepts cash of selected countries, and marketable securities issued by selected governments.</td><td>Default fund:
Cash in British pounds only.</td></tr>
<tr><td>Performance bond:
Cash of selected countries, marketable U.S. Treasury securities, selected U.S. government agency securities and agency mortgage-backed securities, selected foreign government bonds, stocks selected from the Standard & Poor's 500 index, selected money market mutual funds, and gold.[1]</td><td>Initial margin:
Cash of selected currencies and securities issued or guaranteed by selected governments and selected government agencies.[2]</td></tr>
<tr><td>Variation margin: Cash</td><td>Variation margin: Cash</td><td>Variation margin: Cash</td></tr>
</table>

Source: IMF staff discussions with CCPs.

Note: CCP = central counterparty; OTC = over the counter.

[1]For OTC interest rate swaps (but not for credit default swaps), the Interest Earning Facility 4 (IEF4) program allows participants to pledge corporate bonds into a tri-party account to meet the performance bond requirements.

[2]LCH.Clearnet also accepts performance bonds as initial margin.

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