

SUMMARY

Two developments stand out among the changes in international banking since the global financial crisis. First, direct cross-border lending as a share of total banking assets has declined, mostly because of the retrenchment of European banks. Second, the share of local lending by foreign bank affiliates has remained steady. Global banks in particular have refocused their activities on some key markets, leaving space for other banks to expand. As a result, intraregional financial linkages have deepened, especially in Asia.

Although the cutback in cross-border lending was triggered by the crisis, regulatory changes and weaknesses in bank balance sheets have contributed significantly to the subsequent retrenchment. Better-capitalized banks were more likely to maintain cross-border lending. Macroeconomic factors have also played a role.

The relative shift on the part of foreign banks away from cross-border lending and toward more local lending through affiliates has a positive effect on the financial stability of host countries. Cross-border lending compounds adverse domestic and global shocks. In contrast, foreign-owned subsidiaries, particularly those with better-capitalized parent banks, tend to behave less procyclically than domestic banks around domestic crises.

In principle, international banking has benefits that are not examined in this chapter. For example, global banks contribute to the allocation of global savings across countries, with positive effects on investment and growth. The reduction in cross-border lending may diminish some of those benefits.

Policymakers should therefore strive to maximize the benefits of international banking while mitigating risks. The findings of this chapter lend support to recent financial reforms that strengthen the resilience of global banks. They also emphasize the need for more international cooperation to deal with regional or global shocks.

Introduction

International banking has changed since the global financial crisis. Two developments stand out. International banks, especially European ones, have reduced their cross-border lending, that is, their direct lending to non-affiliated entities in other countries. At the same time, loans extended locally by banks' affiliates abroad have remained steady. Other changes include a retrenchment of international banks from certain market segments, the emergence of new actors to fill the resulting gaps, and some regionalization where global banks are replaced by ones with a more regional focus.

The drivers of these changes have been both internal and external to the banking sector. The sharp and prolonged process of deleveraging of banks and households since 2008 has had a strong effect on credit supply and demand. Large U.S. and European banks have been cleaning up their balance sheets and selling legacy assets while trying to reduce their reliance on less stable funding sources, such as short-term wholesale funding. At the same time, banks have been pressed by supervisors to shore up capital, while abstaining from reducing domestic credit supply. Different economic conditions across countries and recent financial reforms, such as those aiming at restricting certain types of operations by banks, as well as new capital and liquidity standards, have also affected banks' global operations and their organizational structure.

The reduction in cross-border banking flows can in principle have opposite effects on financial stability. The retrenchment in cross-border lending may reduce risk sharing and diversification for banking groups (Allen and others 2011), because investing or lending abroad allows banks to reduce their exposure to domestic shocks (Schoenmaker and Wagner 2011). From the perspective of recipient countries, cross-border lending may also lower the volatility of domestic credit because foreign banks, which are less exposed to domestic shocks, are more able to withstand local stress. Then again, cross-border flows are also likely to contribute to the transmission of foreign shocks and may thus increase volatility (Bruno and Shin, forthcoming; IMF 2014c). For example, deleveraging by international banks can reduce funding sources for banks in host countries. These banks in turn may be forced to contract lending even in the absence of domestic credit problems. Moreover, cross-border lending is often seen as less stable than local lending through local subsidiaries and branches (Schnabl 2012), partly because host

countries can restrict the ability of parent banks to withdraw liquidity from their subsidiaries.¹ The overall financial stability effect of the observed patterns of changes in global banking is therefore unclear without further examination.

This chapter provides a comprehensive picture of recent changes in international banking, analyzes what is driving those changes, and investigates the potential consequences for financial stability. The results should not be interpreted as providing a full cost-benefit analysis of the changing patterns of banking globalization. In particular, the role of international banks in the global allocation of savings and in contributing to financial deepening is not explored.²

The analysis finds that, jointly with bank balance sheet weaknesses, regulatory changes can explain a substantial portion of the decline in the ratio of cross-border claims to GDP between the precrisis and postcrisis periods. The results are based on data collected in a survey conducted specifically for this chapter. Macroeconomic factors, including monetary policy factors, have also played a role.

The financial stability implications of the relative shift away from cross-border lending and toward more local lending by branches and subsidiaries may be positive from the perspective of host countries. A comparison reveals that cross-border banking flows have historically been much more volatile and sensitive than portfolio flows to global financial conditions. Consequently, a reduction in their relative importance is likely to reduce the global transmission of volatility and contagion. The analysis also finds that cross-border lending is associated with a strong transmission of global shocks to domestic banking systems, and does not help dampen local shocks. By contrast, confirming existing findings in the literature, the chapter finds that local lending by foreign subsidiaries is more resilient in the face of domestic shocks.

The strengthening of regional linkages, particularly in Asia, implies a heightened exposure to shocks emanating from within the region. It also means that shocks originating outside the region can propagate faster within the region once they hit a country's

¹The shift toward local funding may also enhance the effectiveness of monetary policy by tightening the link between domestic interest rates and credit supply (Forbes 2014).

²For example, foreign bank presence is also often associated with greater efficiency and competition in host countries' banking sectors (Claessens and Laeven 2004; Cull and Martínez Pería 2010). Enhanced competition in turn may also affect financial stability; these issues are not explored here.

banks. This prospect may call for a strengthening of regional safety nets to address idiosyncratic and regional shocks.

Financial reforms that contribute to strengthening the soundness of parent banks can help limit the transmission of negative foreign shocks by affiliates of foreign banks. Increased cooperation among national regulators and supervisors—not only in matters of cross-border resolution, but also on the implementation of Basel standards and on accounting standards—is key to reconciling banking globalization with financial stability.

What Has Changed?

From Cross-Border Banking to Multinational Banking

Cross-border bank lending has declined since the global financial crisis, while international banks have shifted their international business models toward more local operations. Cross-border claims as a share of total banking assets of host countries have not recovered to their precrisis level (Figure 2.1, panel 1).³ Local loans extended by affiliates of foreign banks did fall slightly in 2007 and 2008 but have since stabilized. Their share in total foreign claims (the sum of cross-border claims plus loans extended through affiliates abroad) has thus grown from less than 43 percent to about 49 percent. Most of those loans are in local currency; their share rose mildly after the crisis, most likely because of foreign currency funding pressures (McGuire and von Peter 2009), and has not returned to its precrisis level even after the pressures abated (Figure 2.1, panel 2).

The shift from cross-border banking to multinational banking with more local and likely locally funded operations is more pronounced in some banking systems than in others. McCauley, McGuire, and von Peter (2012) show that global French and Spanish banks in particular have increased the share of their

local operations whereas internationally operating Japanese banks continue to conduct mostly cross-border operations. Differences in business models can be related to differences in funding models. Multinational banks tend to rely less on wholesale funding and were thus less affected by disruptions in the wholesale funding market during the crisis.

One question is whether the precrisis level of cross-border claims reflected an anomaly—that is, the outcome of a temporary, unsustainable boom. Although this question extends beyond the scope of the chapter, it is worth noting that international claims (which include cross-border claims and local claims of foreign bank affiliates in foreign currency—see Figure 2.2) grew steadily between 2002 and 2007, with the growth rate picking up only somewhat in 2007 (Figure 2.1, panel 1). This at least indicates that the observed levels in 2007–08 were part of a longer-term trend (which may well have been unsustainable).

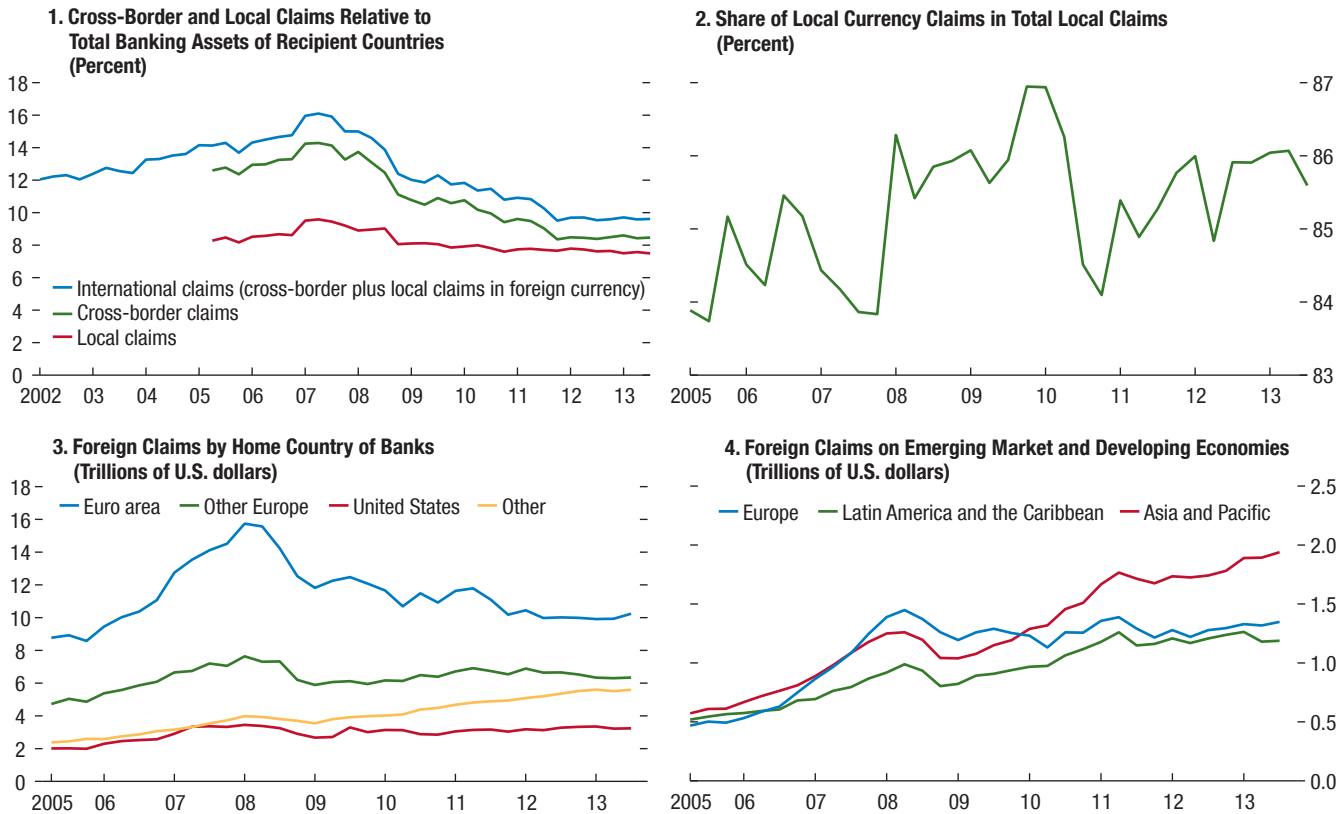
The reduction in cross-border lending and lending through affiliates is mainly due to euro area banks; banks from other areas have only partially offset that reduction (Figure 2.1, panel 3). Foreign claims of European banks dropped sharply in the wake of the global crisis and have continued to decline since then. The drop in claims from euro area banks has been general across all regions of the world. Claims vis-à-vis non-euro-area countries have dropped more than intra-euro-area claims. U.S. and U.K. banks also retrenched in 2008, but their foreign claims have partially recovered. Foreign claims from other areas, particularly from Japan, have grown quickly.

Foreign claims on emerging market and developing countries dropped in all regions in 2008 and have exhibited different recovery patterns. Claims on the Asia and Pacific region have nearly doubled since their 2008 trough (Figure 2.1, panel 4). Those on Latin America and the Caribbean have also exceeded their precrisis peak, although growth has slowed since 2011. Meanwhile, outstanding claims on emerging and developing Europe are still hovering slightly below their precrisis levels.

Overall, international banks have somewhat reduced the number of branches and subsidiaries they hold abroad. Based on a sample of 64 countries, including both advanced and emerging market economies, the total number of affiliates of foreign banks shrank by about 5 percent between 2008 and 2013. The drop essentially comes from a reduction in the number of subsidiaries, especially in the European Union, while the total number of branches has risen marginally

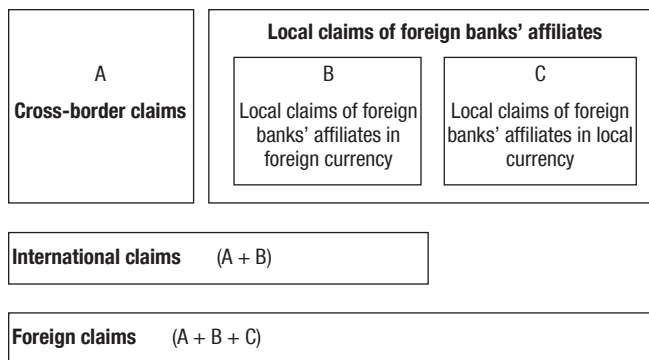
³Strictly speaking, “banking claims” include not only loans but also deposits with other banks and holdings of securities and participations. Following the Bank for International Settlements’ terminology, “foreign banking claims” are defined as the sum of “cross-border claims” (for example, a direct loan of a bank in a given country to a firm in another country) and “local claims” of affiliates of foreign banks in local or foreign currency (for example, a loan from a branch or subsidiary of a foreign bank in a given country to a firm in that same country). “International claims” include cross-border claims and only the part of local claims denominated in foreign currency. See Figure 2.2. This chapter considers claims reported on a consolidated basis; that is, intragroup positions are netted out.

Figure 2.1. Developments in Foreign Banking Claims

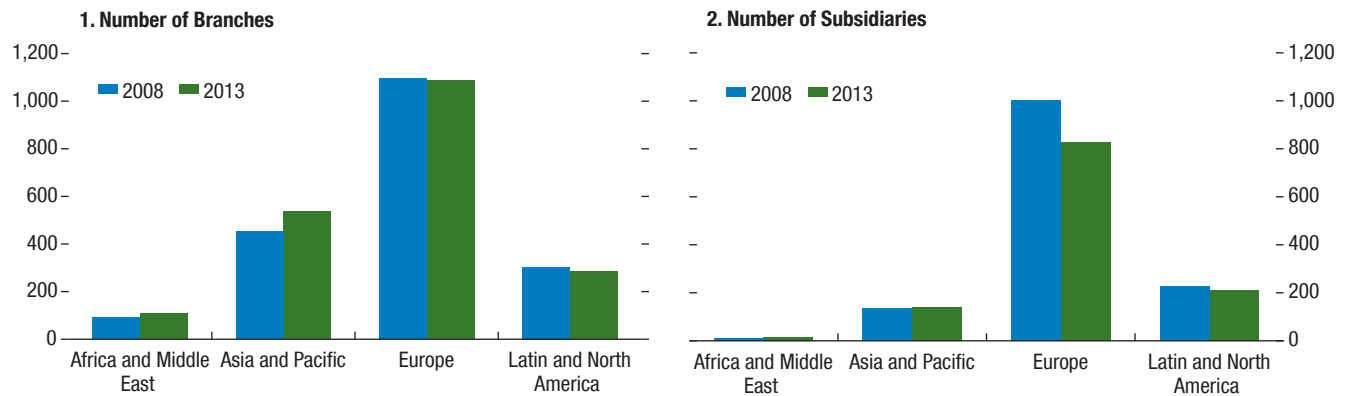


Sources: Bank for International Settlements (BIS), Consolidated Banking Statistics; IMF, International Financial Statistics database; and IMF staff calculations. Note: Claims include deposits and balances placed with other banks, loans and advances to banks and nonbanks, and holdings of securities and participations. Foreign claims are the sum of cross-border claims and local claims of affiliates of foreign banks. International claims include cross-border claims and local claims in foreign currency. In panel 1, the ratios are calculated by dividing claims of all BIS reporting countries by total bank assets for all host countries with available data for each period. In panel 2, the share of local claims in local currency is estimated by dividing local claims in local currency on an immediate risk basis by the total local claims on an ultimate risk basis, after correcting for the difference in foreign claims in the two bases. Panels 1, 3, and 4 are based on ultimate risk basis data. The data in panels 1, 2, and 3 are adjusted for statistical breaks following Cerutti (2013). The observation period ends in 2013:Q3. In panel 3, "Other" consists of Australia, Canada, Chile, India, Japan, Singapore, Taiwan Province of China, and Turkey.

Figure 2.2. Types of Claims in Bank for International Settlements Consolidated Statistics



Source: Cerutti, Claessens, and McGuire 2012. Note: Cross-border claims and total local claims of foreign banks' affiliates are reported on an ultimate risk basis (that is, allocated to the country in which the final risk lies) whereas international claims are compiled on an immediate risk basis (allocated to the country of residence of the immediate counterparty). Cross-border claims do not include intragroup positions. See Annex 2.1.

Figure 2.3. Number of Branches and Subsidiaries of Foreign Banks in 2008 and 2013, by Region

Sources: National authorities; and IMF staff estimates.

Note: Africa and Middle East = Bahrain, Botswana, Israel, Jordan, Kuwait, Nigeria, Oman, Qatar, Saudi Arabia, South Africa, United Arab Emirates; Asia and Pacific = Australia, China, Hong Kong SAR, India, Indonesia, Japan, Republic of Korea, Malaysia, New Zealand, Philippines, Singapore, Thailand; Europe = Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Russia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, the United Kingdom; Latin and North America = Argentina, Brazil, Canada, Chile, Colombia, Costa Rica, Mexico, Paraguay, Peru, and the United States. See Fiechter and others 2011.

(Figure 2.3). There is no evidence of increased subsidization at the expense of branches.⁴ Since 2008, only 7 of the 64 sample countries experienced an increase in the number of foreign subsidiaries and a simultaneous decline in the number of foreign branches.

The decline in the number of foreign affiliates partially reflects the refocusing of global banks' international operations on core markets and businesses. Having strengthened their balance sheets and reduced risk exposures to meet risk-based requirements, global banks are reallocating capital to core businesses and markets, shrinking capital markets activities, rebalancing their business models away from capital-intensive activities to more fee-based businesses, and refocusing their geographical presence on fast-growing markets (Claessens and van Horen 2014) or on markets in which they have a competitive edge (see Chapter 1 of the October 2014 *Global Financial Stability Report*).

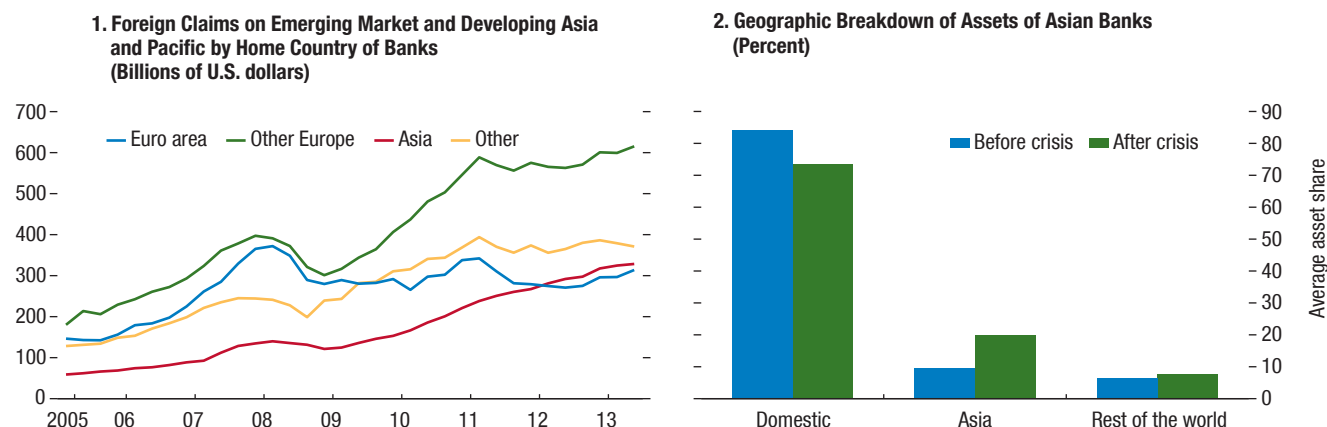
⁴Operating in the form of a subsidiary versus a branch has legal implications. Subsidiaries are entities legally independent from the parent bank and have to fulfill regulatory requirements, including capital and liquidity ratios, on a stand-alone basis in the host country. In addition to consolidated supervision by the home supervisor, subsidiaries are regulated and supervised by the authorities in the host country. In contrast, branches are an integral part of the parent company and are typically subject to more limited supervision by host supervisors (Fiechter and others 2011; IMF 2013b). Host country authorities generally prefer the subsidiary model, and some countries are implementing measures that require foreign banks to operate as subsidiaries under certain conditions.

A Trend toward Regionalization?

The reduction in the exposures of euro area banks to some regions has left a gap that local banks have, at least partially, filled. In Asia in particular, the retrenchment of euro area banks has been accompanied by increased regionalization. According to data from the Bank for International Settlements (BIS), foreign banking claims of euro area banks in the emerging and developing Asia and Pacific region have declined since 2008 and have not recovered to their precrisis level, despite the region's high growth (Figure 2.4, panel 1). This decline has been more than offset by the expansion of banks from Asian countries, particularly Japan. The increase in claims of other European countries, which likely reflect those of British banks with a very large Asian presence, such as HSBC and Standard Chartered, was remarkable in 2009 and 2010, but growth has since slowed. Claims of Chinese banks are not reported to the BIS, but anecdotal evidence suggests a significant increase.

An analysis of Asian banks' geographical allocation of assets shows an increased concentration in the region. The share of regional assets more than doubled between the precrisis and postcrisis periods, rising from about 10 percent to close to 20 percent of total assets, whereas the share of domestic assets declined from 84 percent to 73 percent (Figure 2.4, panel 2). These changes reflect in particular the recent

Figure 2.4. Banking Regionalization in Asia



Sources: Bank for International Settlements, Consolidated Banking Statistics; and IMF staff calculations.

Note: Foreign claims are the sum of cross-border claims and local claims of affiliates of foreign banks. “Asia” consists of Australia, India, and Japan. “Other” consists of Canada, Chile, Turkey, and the United States. The panel is based on ultimate risk basis data. China does not report its banking claims to the Bank for International Settlements.

Sources: Datastream/Worldscope; and IMF staff calculations.

Note: Average geographic breakdown of Asian banks’ assets as a percentage of their total assets before and after the global financial crisis (from 2002 to 2007 and from 2008 to 2013, respectively).

internationalization and regionalization of Chinese banks (see Box 2.1 for a comparison of the internationalization strategies of Chinese and Japanese banks).

Other regions of the world do not show a comparable degree of regionalization. In Latin America, the retrenchment of European banks was short-lived and has been accompanied by an increase in lending by U.S., Canadian, and Latin American banks. Colombian banks, for instance, have aggressively expanded in Central America.⁵ In emerging Europe, the share of European banks in total foreign claims declined slightly, reflecting both the deleveraging that took place in the region in the aftermath of the crisis and the effect of the Vienna Initiative in preventing a sudden and massive reduction in cross-border financing (Figure 2.5, panel 2). In Africa, the rapid regional expansion of pan-African banks in recent years has contributed to increasing cross-country linkages across that continent (Box 2.2).

Correlation networks based on banks’ stock returns illustrate patterns in financial interconnections across

different markets.⁶ Figure 2.6 shows the networks in 1998–2007 and 2010–14 using data from both advanced and emerging market and developing economies. Each colored square represents a bilateral correlation between two banks’ stock returns after removing the effect of strong common factors (for instance, a shock to the whole banking industry). Significant correlations tend to be clustered by countries and regions, which underscores the importance of local factors such as common balance sheet or market exposures, common accounting practices, or technological linkages. More than 90 percent of the significant correlations in both periods are between banks within the same region. Although most banks are not directly connected to one another, the combination of strong linkages within countries and regions and the presence of a few cross-regional links (via so-called hub banks) may allow for rapid transmission of shocks across regions.

⁵Colombia does not report international banking statistics to the BIS; the regional expansion of Colombian banks is therefore not reflected in Figure 2.5, panel 1.

⁶The correlation networks used in this section are derived from spatial-econometric techniques described in Saldías and Craig (forthcoming) and Bailey, Holly, and Pesaran (forthcoming), applied to banks’ daily stock returns. These networks are obtained by applying first spatial dependence methods to detect and filter the effects of strong common factors and then a thresholding procedure to select the significant bilateral correlations.

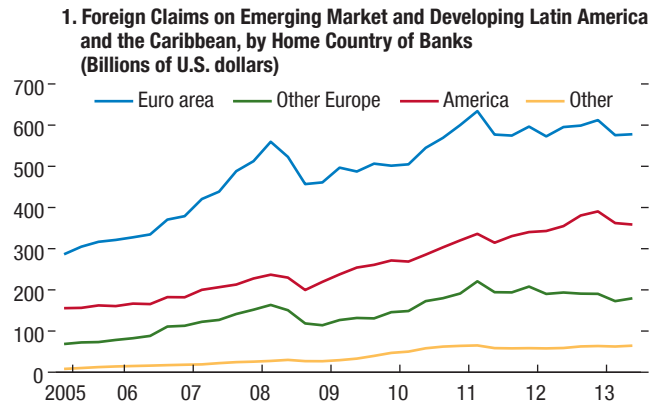
Intraregional linkages increased in the postcrisis period in Europe, Middle East, and Africa (EMEA) countries and especially in Asia. Cross-regional linkages, represented by colored squares outside the diagonal blocks in Figure 2.6, were more frequent during the precrisis period (1998–2007). EMEA banks in particular exhibited many linkages with banks in Asia and the Americas, which contributed to the propagation of the crisis across regions. The regionalization of banking linkages since 2010 partially reflects increased correlations within countries, illustrated by a larger concentration of colored squares within each diagonal block, especially in Asia, but also actual growth in the share of regional cross-country interconnections after the crisis.

Changes in Corporate Borrowing

The decline in cross-border lending by banks has been accompanied by a surge in international nonfinancial corporate bond issuances (Figure 2.7, panel 1). This surge has been driven to a large extent by the rapid increase in bond issuances from emerging markets (see Chapter 1 of the October 2014 *Global Financial Stability Report*). Faced with bank credit constraints, firms, especially large ones, may have turned to capital markets to obtain financing. The low level of interest rates has also encouraged risk taking by private investors and fueled the demand for higher-risk debt securities. One question is to what extent the reduction in cross-border banking and the expansion in direct capital market borrowing by nonfinancial firms may have affected their borrowing costs.

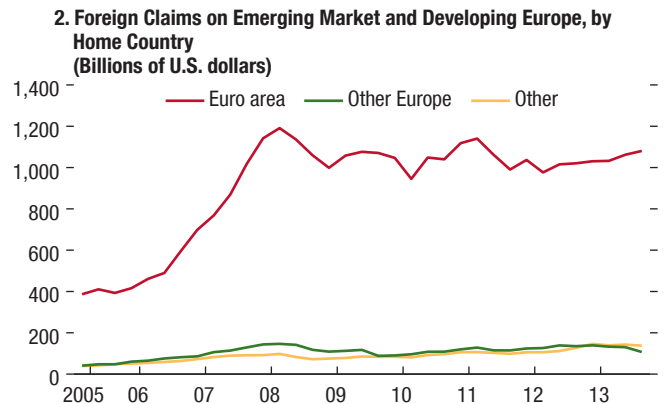
All else equal, a less globalized banking system may imply greater heterogeneity of bank funding costs for firms across countries. The decline in cross-border lending may limit arbitrage opportunities for firms and reduce competitive pressures for domestic banks when capital markets are shallow. It also makes lending interest rates more dependent on the condition of the domestic banking sector. The cross-country divergence of bank lending rates was one of the features of the euro area crisis and the main sign of the fragmentation of euro area financial markets (see Box 2.4 and Chapter 1 of the October 2013 *Global Financial Stability Report*). Higher dispersion of corporate borrowing costs at the global level would potentially have adverse consequences for private investment in some countries because firms with profitable investment opportunities may struggle to obtain funding

Figure 2.5. Trends in Latin America and Europe



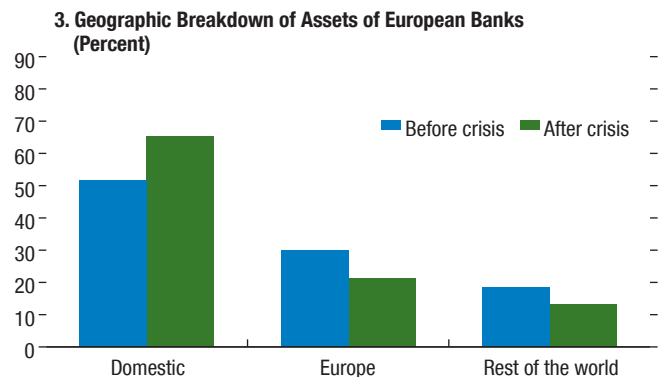
Sources: Bank for International Settlements, Consolidated Banking Statistics; and IMF staff calculations.

Note: Based on ultimate risk basis data. “America” consists of Canada, Chile, and the United States. “Other” consists of Australia, India, Japan, and Turkey.



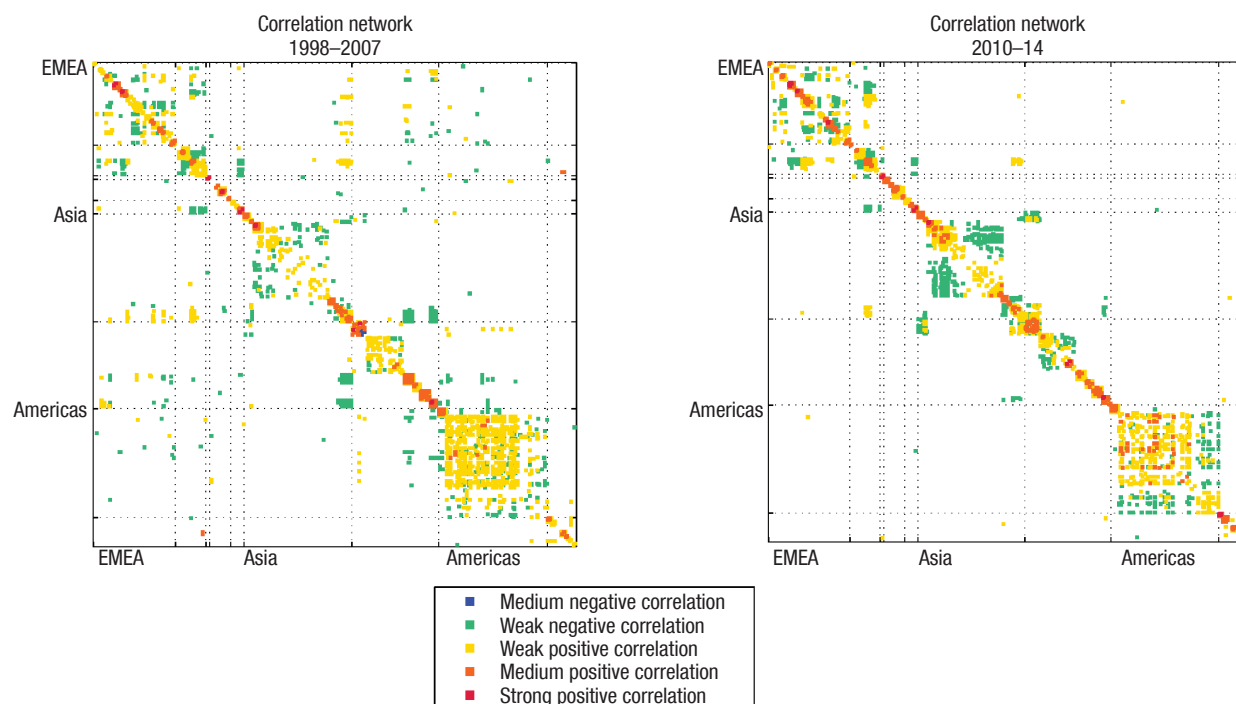
Sources: Bank for International Settlements, Consolidated Banking Statistics; and IMF staff calculations.

Note: Based on ultimate risk basis data. “Other” consists of Australia, Canada, Chile, India, Japan, Turkey, and the United States.



Sources: Datastream/Worldscope; and IMF staff calculations.

Note: Average geographic breakdown of European banks’ assets as a percentage of their total assets before and after the global financial crisis (from 2002 to 2007 and from 2008 to 2013, respectively).

Figure 2.6. Precrisis and Postcrisis Geographic Correlation Networks from Banks' Stock Returns


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

Note: The networks are constructed from daily stock returns of 506 banks located in 62 countries. Each colored square represent a bilateral correlation between two banks after removing the effect of strong common factors. The matrix is symmetric, which allows for identifying clusters by square areas. The banks are grouped into nine sub-regions and three regions (Europe, Middle East, and Africa; Asia; and Americas), then sorted by country (alphabetically) and size (market capitalization) within each region. The nine sub-regions are advanced European economies, emerging and developing Europe, Commonwealth of Independent States, advanced Asian economies, emerging and developing Asia, advanced American economies, Latin America and the Caribbean, Middle East, North Africa, Afghanistan, and Pakistan, and sub-Saharan Africa. The sub-regions follow the country classification in the *World Economic Outlook*. EMEA = Europe, Middle East, and Africa.

or face higher borrowing costs as a result of lower banking competition. Panel 2 in Figure 2.7 illustrates the changes in the dispersion of manufacturing firms' borrowing costs since 1990, after accounting for firm and country characteristics.⁷

There is no clear evidence of increased dispersion of corporate borrowing costs following the global financial crisis. Corporate borrowing costs have converged across countries since 1990, in line with the rise of financial globalization. The recent changes in international banking patterns described in this chapter do not seem to have reversed this trend. Although the cross-country dispersion of corporate funding costs seemingly rose slightly after 2008 and again after the

debt crisis in Europe in 2011, it has recently declined.⁸ However, in euro area countries, the dispersion of corporate borrowing costs did rise after 2008 compared with the precrisis period.

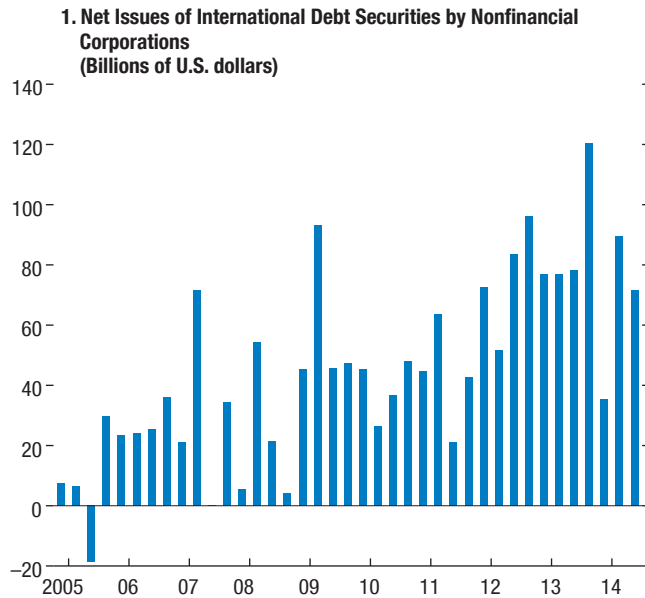
Summary

Cross-border lending is the dimension of global banking that has shrunk most sharply since the global financial crisis. Local claims of affiliates of foreign banks have remained more resilient despite an overall reduction in the number of foreign subsidiaries and branches. Euro area banks retrenched the most. Where they were replaced by other, more regionally focused

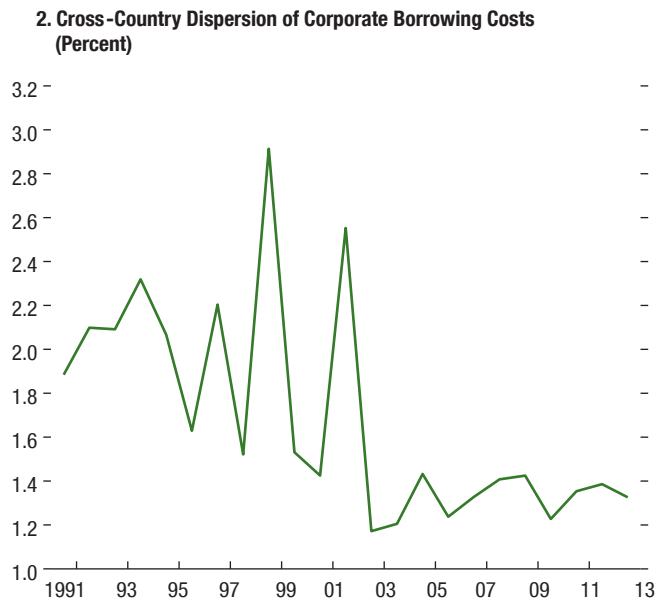
⁷This dispersion is interpreted as a sign of financial frictions that distort the allocation of resources among firms (Gilchrist, Sim, and Zakrajšek 2013).

⁸Because the borrowing cost measure is backward looking (it represents the average interest cost on outstanding debt and not the cost on newly obtained loans), the estimation does not capture the most recent changes in borrowing costs.

Figure 2.7. Changes in Corporate Borrowing



Sources: Bank for International Settlements, Debt Securities Statistics; and IMF staff estimates.



Sources: Datastream/Worldscope; IMF staff estimates.

Note: The figure plots the standard deviation of median manufacturing firms' borrowing costs across countries, after accounting for firm and macroeconomic characteristics, including country risk. The two spikes in the figure correspond to the years following the Asian crisis in 1998, and the Argentine crisis in 2001. Corporate borrowing costs are computed from listed firms' balance sheet and income statement data as the ratio of firms' interest expenses to total debt.

banks, international banking linkages have become more regional. Yet these developments do not seem to have led to a larger dispersion of corporate borrowing costs.

The Drivers of the Changes in International Banking

Changes in Regulations on Banks' International Operations

This section examines the drivers of the previously described changes in international banking. The analysis builds on the results of a confidential survey about the regulations applicable to banks' international operations in both home and host countries (see Annex Table 2.1.1 for a list of the survey questions). Answers were collected from bank supervisors in 40 countries that are among the top recipients of international banking claims according to BIS data.⁹

The survey results show that many countries tightened regulations on banks' international operations or strengthened their supervision between 2006 and 2014, while a more limited number loosened them (Figure 2.8). The supervisory authorities in many countries are now more likely than before to limit banks' activities—for instance, by imposing ring-fencing measures in a discretionary way. Many resolution authorities obtained more powers over local branches of foreign banks. Some countries amended banking secrecy laws to enhance information sharing about banks' operations and balance sheets with foreign supervisors. In contrast, a few countries have loosened regulations regarding foreign banking presence (for example, conditions for a foreign bank's acquisition of a domestic bank) and activity (for example, cross-border lending and borrowing).

The proportion of countries that tightened their regulations on banks' international operations is higher in advanced economies than in emerging market economies (Figure 2.9). There is, however, little evidence that countries that experienced

⁹Survey respondents were Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, Croatia, Denmark, Finland, France, Germany, Greece, Hong Kong SAR, Hungary, Indonesia, Ireland, Italy, Japan, Luxembourg, Malaysia, Mexico, the Netherlands, Norway, the Philippines, Portugal, Romania, Russia, Saudi Arabia, Singapore, the Slovak Republic, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, the United Kingdom, and the United States.

Box 2.1. The International Expansion of Chinese and Japanese Banks

This box compares the international expansion strategies of Chinese and Japanese banks and discusses some implications for financial stability.

Banks headquartered in China and Japan expanded rapidly after the global financial crisis. Strong balance sheets, growth opportunities outside the domestic economy, and the retrenchment of euro area and U.S. banks from Asia have been common factors behind their international expansions. However, their growth also differs in several important ways, including scales, business lines, and funding patterns.

The scale of international expansion

Japanese banks and, to a more limited extent, Chinese banks, have increased their assets and loans overseas as a share of total assets and loans, respectively (Figure 2.1.1). From 2009 to 2013, the average ratio of overseas loans to total loans for the three largest Japanese banks rose from 15 percent to 25 percent.¹ The same numbers for the four largest Chinese banks were 6.1 percent and 9.2 percent.

This box was prepared by Kai Yan.

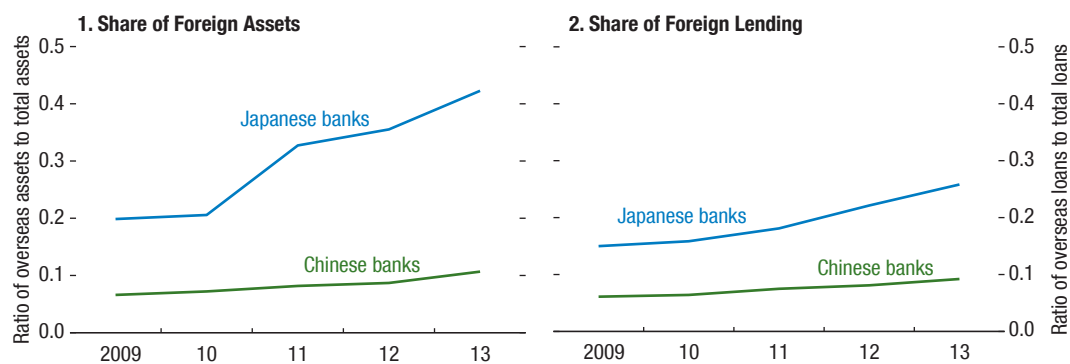
¹The data set includes the four largest banks in China (Industrial and Commercial Bank of China, China Construction Bank, Bank of China, and Agricultural Bank of China), and the three largest banks in Japan (Mitsubishi, Mizuho, and Sumitomo). Mizuho does not report assets and liabilities based on geographic segments. The average for Japanese banks in Figure 2.1.1, panel 1, and Figure 2.1.3, panel 2, is thus computed using data for the two remaining banks.

Although Chinese banks expanded rapidly after the financial crisis, their global business is still limited in scale and much smaller than that of Japanese banks, which were among the world’s biggest creditors before the Japanese banking crisis of the late 1990s. The internationalization of Chinese banks remains primarily driven by a follow-your-customer strategy. In contrast, limited domestic growth prospects and new business opportunities abroad for Japanese banks, particularly following the retrenchment of European banks, added incentives for them to expand abroad (Lam 2013). The degree of internationalization also varies greatly among the four largest Chinese banks. The proportion of both international assets and international loans has exceeded 20 percent for the Bank of China, but is still less than 5 percent for the Agricultural Bank of China.

Business models and expansion strategies

Both Chinese and Japanese banks generate major portions of their revenues abroad from net interest income (Figure 2.1.2). For Chinese banks, corporate loans amount to more than 80 percent of the total loan portfolio, with most of them coming from Chinese customers’ foreign subsidiaries. For Japanese banks, which showed resilience during the global financial crisis and which benefit from strong capital buffers, longer-term project finance and syndicated lending have also played a major role in their overseas expansion.

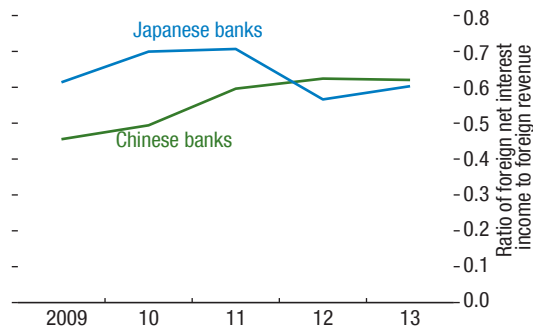
Figure 2.1.1. The Internationalization of Chinese and Japanese Banks



Sources: Banks’ annual reports; and IMF staff estimates.

Box 2.1 (continued)

Figure 2.1.2. Ratio of Foreign Interest Income to Foreign Revenue for Chinese and Japanese Banks



Sources: Banks' annual reports; and IMF staff estimates.

Japanese banks have also expanded assertively in non-lending activities. Overseas business strategies differ across banks, however. Mizuho Bank, which experienced 240 percent growth in foreign non-interest income in the past three years, emphasizes its syndicated loan business as one of the main sources of fee income. The revenue generated by Mitsubishi's three business lines (foreign exchange, corporate and investment banking, and fees and commissions), grew by 33 percent during the past three years.

Similarly, expansion strategies differ for the leading banks in the two countries. Chinese banks tend to expand their global presence through organic growth by opening foreign offices and branches. The increase in their business coverage mainly occurred in their subsidiaries in Hong Kong SAR.² In contrast, Japanese banks have completed major mergers and acquisitions to expand globally. The three Japanese megabanks combined spent more than 1 trillion yen acquiring foreign companies between 2012 and 2014. The acquisition targets range from banks to asset management companies.

²For example, of the 623 overseas affiliates of the Bank of China, almost all of those outside of mainland China and Hong Kong SAR are overseas branches and offices. Besides the traditional deposit, loan, and payment business conducted by those branches, all the other banking business abroad is conducted by Bank of China International, which is in Hong Kong SAR.

Funding pattern vulnerabilities

The risks of foreign expansion for banks can come from both the asset and liability sides. Such risks can stem from the concentration of exposure to certain countries and certain industries, or from dependence on unstable funding sources. This section focuses on funding vulnerabilities.

For Japanese banks, the overseas loan-to-deposit ratio is about 1.3, with little variation across banks (Figure 2.1.3). Chinese banks' average overseas loan-to-deposit ratio increased from about 1.5 to more than 2 during the past five years. The rise was primarily driven by the growth of the ratio for the Agricultural Bank of China, the least globalized of the four largest Chinese banks. At the opposite end, Bank of China, which is the most international of the four, has a loan-to-deposit ratio of less than 1. The inverse correlation between Chinese banks' foreign loan-to-deposit ratios and the degree of international activity suggests that the least globalized banks embarked on aggressive strategies to expand overseas.

Another indicator of vulnerability is the ratio of total overseas liabilities to overseas deposits, which measures banks' dependence on funding sources other than local deposits for their operations abroad. The overseas total liabilities-to-deposits ratio for Chinese banks has been rising steadily since 2009, indicating a growing reliance on nontraditional funding. By contrast, the same ratio has been declining for Japanese banks.

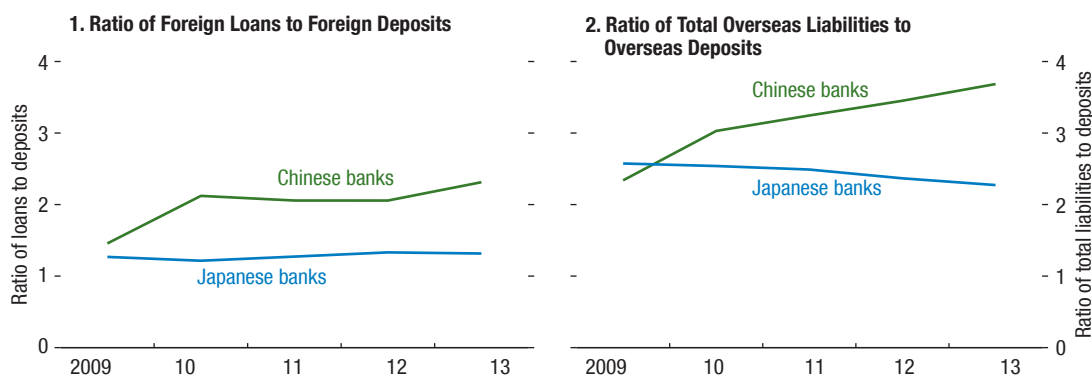
Both Chinese and Japanese banks have loan-to-deposit ratios consistently larger than 1. This shows that despite the increase in deposits collected abroad, banks still fall short of funding for their total external loans and have to rely on external wholesale funding to fill the gap. This growing reliance on wholesale funding could raise potential vulnerabilities from currency and liability mismatches.

Future prospects

Growth opportunities still abound for both Chinese and Japanese banks, as their domestic clients increase their outward expansion. Japanese banks can build on their already well-established market shares in project finance and syndicated loans to take advantage of a rise in infrastructure investment in Asia, whereas Chinese banks will benefit from the further liberalization of financial markets

Box 2.1 (continued)

Figure 2.1.3. Funding Vulnerabilities for Chinese and Japanese Banks



Sources: Banks' annual reports; and IMF staff estimates.

in China combined with the internationalization of the renminbi.

Both groups of banks face challenges, however. Constraints to their global expansion include cross-country differences in regulatory and supervisory

frameworks, the difficulty of raising local deposits, and the need to rely on external funding. In addition, Chinese banks' relatively simple business model and heavy reliance on domestic customers may also weigh on their ability to expand.

higher banking stress, such as some countries in the euro area, consistently tightened more than other countries.

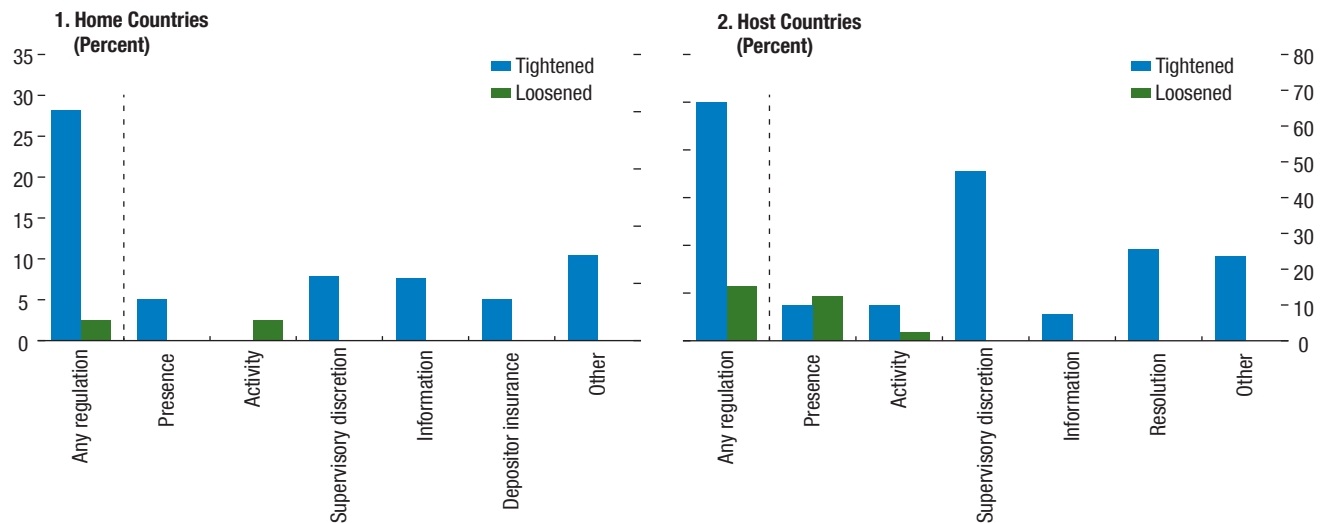
Changes in regulations targeting banks' international operations, as well as more general regulatory changes (such as those on bank capital requirements), can affect foreign banking claims in at least three ways. First and most simply, tighter regulations may reduce foreign bank lending just because bank activities in general are curtailed. Second, regulatory arbitrage may induce a countervailing effect: banks in countries that tighten banking regulations may increase their claims on countries that are less regulated (Houston, Lin, and Ma 2012; Ongena, Popov, and Udell 2013; Bremus and Fratzscher 2014).¹⁰ Third, regulatory changes may bring about a substitution effect between various types

of lending because their effects may differ across types of exposures.

Econometric Evidence

According to the econometric analysis, regulatory changes can explain a sizable fraction of the decline in cross-border claims on recipient countries. The analysis relates changes in cross-border lending and in lending by foreign affiliates to changes in regulations on international banking operations in both home and host countries. It uses the results of the above-mentioned survey, as well as changes in capital regulations and official supervisory power (Barth, Caprio, and Levine 2013), an indicator of the health of the banking sector in home countries, and other macroeconomic variables, including GDP growth and changes in exchange rates and real policy interest rates. The growth rate of international claims before 2007 is used to control for the precrisis boom (see

¹⁰The literature finds some evidence of regulatory arbitrage across countries, and Chapter 2 of the October 2014 *Global Financial Stability Report* shows the presence of regulatory arbitrage between banks and the nonbank financial sector.

Figure 2.8. Share of Countries that Changed Regulations on International Banking Operations between 2006 and 2014

Source: IMF staff calculations.

Note: Shares are calculated from the results of a survey about regulations on banks' international operations. The "any regulation" bar represents the share of countries that changed any regulation related to banks' international operations during 2006–14. The other bars correspond to the shares of countries that have changed any corresponding type of regulation.

Annex 2.1 for details). The results show that roughly half of the drop in cross-border claims (as a percentage of GDP) since the precrisis period (2005–07) can be attributed to regulatory changes. Figure 2.10 examines the sensitivity of the various types of claims to each explanatory variable and the contributions of the various factors to the observed changes in the claims-to-GDP ratio.

Tighter regulations on banks' international operations or capital regulations in home countries are associated with a reduction in lending from those countries (Figure 2.10, panel 1). This effect is intuitive, given that both impose limitations on banks' operations abroad and imply indirect restrictions through, for example, higher risk weights on foreign assets.¹¹ There is some indication that home countries with more powerful supervisors tend to experience stronger growth in foreign claims, possibly as a result of regulatory arbitrage.¹² The effect of

regulatory changes on local claims is not statistically significant.

The effect of regulatory changes in host countries depends on the type of regulation (Figure 2.10, panel 2). Countries that tightened their regulations on banks' international operations received lower volumes of cross-border loans. Changes in capital requirements do not seem to affect total foreign, cross-border, or local claims. However, tighter capital regulations are positively associated with changes in foreign claims on the public sector, which may be explained by a portfolio shift to safer assets to satisfy more stringent capital requirements (see Annex 2.1).

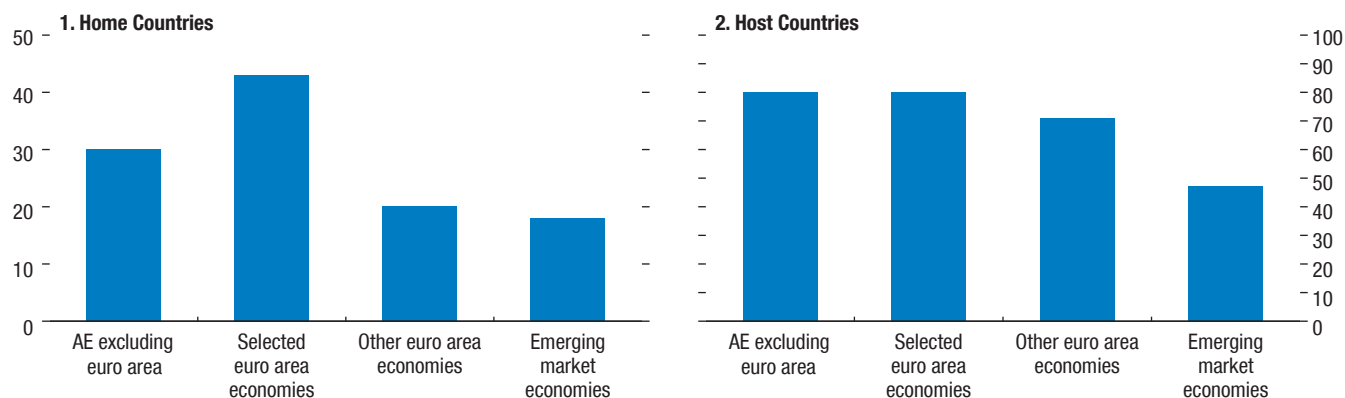
Higher precrisis bank-capital-to-total-assets ratios in the home country (a proxy for the health of the home country banking system) are associated with higher postcrisis growth in foreign claims (Figure 2.10, panel 3).¹³ The initial sharp drop in claims (up to 2009) may to a large extent be due to this factor, along with possible expectations of a tightening of regulatory standards. In particular, precrisis capitalization levels of European banks were on average substantially lower than in other countries. This result suggests

¹¹Figuet, Humblot, and Lahet (2015) estimate that the Basel III regulatory reforms could lead to a drop of 20 percent in cross-border claim inflows to emerging markets.

¹²Whereas the literature emphasizes the role of regulatory arbitrage, by which banks facing stronger supervisory power at home may increase foreign claims on countries with less supervisory power, the use of consolidated supervision by home supervisors weakens this argument.

¹³This result is consistent with previous studies on syndicated lending that also find that banks with strong balance sheets were better able to maintain lending during the crisis (Kapan and Minoiu 2013).

Figure 2.9. Share of Countries that Tightened Regulations on International Banking Operations between 2006 and 2014, by Region (Percent)



Source: IMF staff calculations.

Note: AE = advanced economies. Selected euro area economies are those with high borrowing spreads during the 2010–11 sovereign debt crisis and comprise Greece, Ireland, Italy, Portugal, and Spain. Other euro area economies comprise Austria, Belgium, Finland, France, Germany, Luxembourg, and the Netherlands. Countries that tightened regulations are defined as countries with a positive index of changes in regulations on banks' international operations (see Annex 2.1).

that although tighter capital requirements in home countries may initially curtail international banking operations, they can contribute to stabilizing banking flows later on once banks have built capital buffers. Countries with higher precrisis growth rates of foreign claims experienced a larger subsequent contraction in these claims, as foreign banks deleveraged to strengthen their balance sheets. Greater physical distance between home and host countries is associated with lower growth, particularly for local claims.

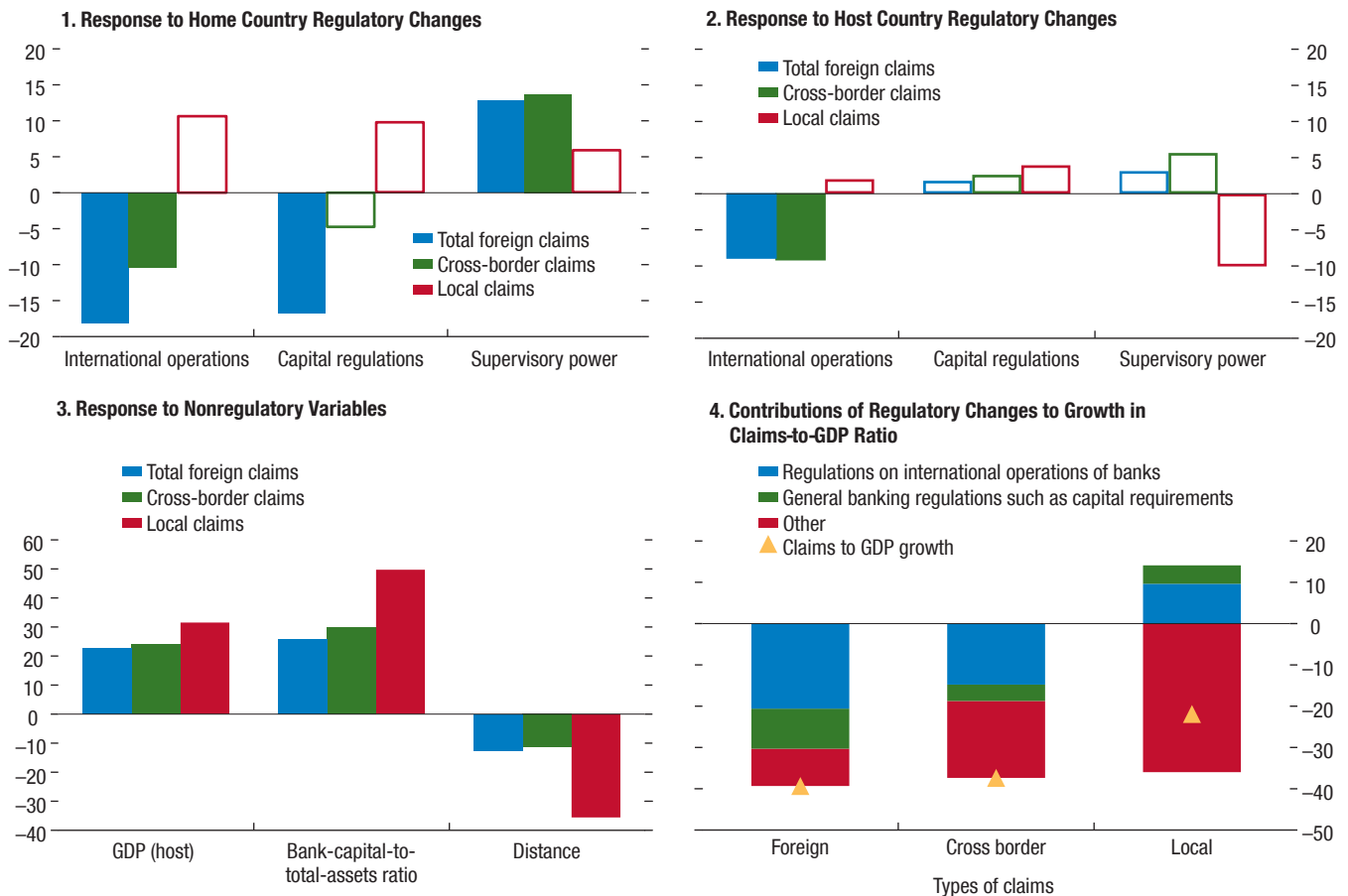
The overall effect of regulatory changes on foreign banking claims is comparable to that of nonregulatory factors (Figure 2.10, panel 4). Among regulatory changes, those directly targeted at the international operations of banks have a larger effect than more general banking regulatory or supervisory changes. All these results still need to be considered with caution. It is possible that the correlation between regulations and foreign claims does not reflect a causal relationship, but may rather be driven by other factors. For instance, the vulnerabilities revealed during the crisis may have caused both bank deleveraging and regulatory reforms in the postcrisis period. This concern is alleviated by adding many control variables, including banks' precrisis capital-to-assets ratios and the precrisis growth rate of international claims, to the regression. Moreover, extensive robustness checks (among others, with instrumental vari-

ables) provide additional evidence of the role played by regulatory changes (see Annex 2.1). In particular, the contribution of regulatory changes remains significant even when euro area countries are excluded from the sample or when the euro area is treated as a single country.

Accommodative monetary policies in the wake of the crisis may have slowed the decline in international banking activities while also supporting a shift to portfolio investment. After the global financial crisis, short-term interest rates effectively hit the zero lower bound in many economies, and central banks engaged in unconventional monetary policies aimed at stimulating their economies. Those policies helped reduce uncertainty and market volatility, lowered banks' funding costs, and bolstered their balance sheets, with a potentially positive effect on foreign banking claims. The results indeed suggest that international banking activities would likely have contracted more without such accommodative policies, confirming previous findings in the literature (Bremus and Fratzscher 2014; IMF 2014c).¹⁴

¹⁴Empirically examining the effect of unconventional monetary policies on capital flows is challenging, in part because long-term interest rates are endogenous to capital flows (Bernanke 2005). Estimates computed after incorporating long-term interest rates in the regression model broadly confirm the robustness of the results on the effect of regulatory changes while pointing to a significant effect of monetary easing (see Annex 2.1).

Figure 2.10. Effects of Regulations and Other Factors on International Banking Linkages
(Percent)



Source: IMF staff estimates.

Note: Panels 1, 2, and 3 show the effects of a one standard deviation increase in each variable on the growth rate of different types of claims. These are calculated by multiplying the estimated coefficient of the regression and the cross-sectional standard deviation of the corresponding independent variable. Nonshaded bars correspond to coefficients that are not significant at the 10 percent level. Panel 4 decomposes factors contributing to the growth of the claims-to-GDP ratio from 2005–07 to 2011–13 averaged across the observations of the regression. The factor contribution is calculated by multiplying the estimated coefficient by the average of the independent variable. Country samples vary depending on the type of claims. “Regulations on international operations of banks” is the sum of the contributions of international operations regulatory changes in home and host countries. “General banking regulations such as capital requirements” is the sum of the contributions of the other regulation variables. See Annex 2.1 for details.

Effects on Financial Stability

Cross-Border Lending and the Volatility of Capital Flows

Cross-border banking flows dropped more sharply and more durably than other capital flows in reaction to the global financial crisis. Both cross-border banking flows and portfolio flows declined strongly in 2008, but portfolio flows recovered much more quickly and have remained positive on average since early 2009. By contrast, cross-border banking flows have been slightly negative since 2009 (Figure 2.11,

panel 1). Yet there is no clear evidence of substitution between the various types of flows at the country level.

All else equal, the reduction in cross-border banking flows can be expected to reduce the sensitivities of total capital inflows to global financial shocks. A comparison of the sensitivity of different types of flows to the Chicago Board Options Exchange Market Volatility Index (VIX) shows that cross-border banking claims are more sensitive to global conditions than are local claims, whose sensitivity to global shocks is close to that of portfolio flows (Figure 2.11, panel 2). This

Box 2.2. The Expansion of Pan-African Banks: Opportunities and Challenges

This box describes the recent expansion of pan-African bank groups (cross-border banks headquartered in Africa), the benefits these groups offer, and the financial stability risks they entail.

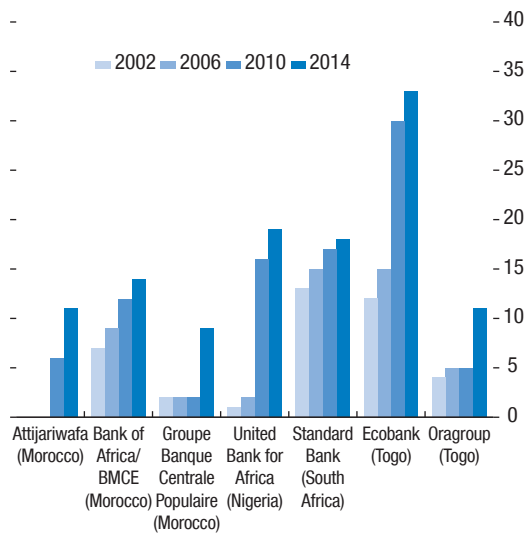
The face of African finance is changing rapidly with the strong expansion of pan-African banks across the continent in recent years. Reflecting a number of converging push and pull factors and aided by improved political and macroeconomic stability and robust economic growth, the number of operations of the seven largest groups has more than doubled since the mid-2000s (Figure 2.2.1). Specific factors contributing to this expansion include increasing trade linkages between African countries, which have induced banks

to follow their clients, and the declining role of more traditional players such as European banks.

The growth of pan-African banks offers a number of opportunities and benefits. Anecdotal evidence suggests that the expansion of these banks has improved competition and given rise to economies of scale, especially in host countries with small local markets. Pan-African banks are driving innovation, offering opportunities to enhance financial inclusion, and in some cases contributing to lowering borrowing costs. For example, in the East African Community, Kenyan banks have introduced innovative business models such as agency banking into neighboring countries. Similarly, Moroccan banks' focus on small and medium enterprise development is being exported to francophone West Africa, while Nigerian banks

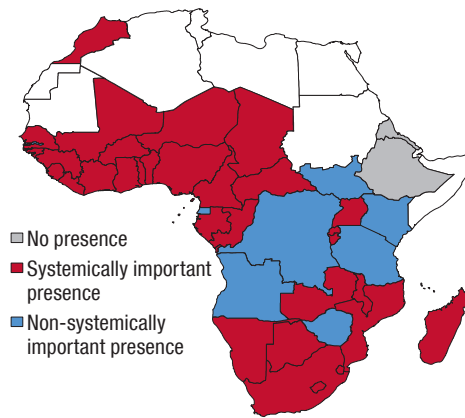
This box was prepared by Alexandra Peter.

Figure 2.2.1. Major Pan-African Banks: Cross-Border Expansion, 2002–14
(Number of subsidiaries in sub-Saharan Africa; percent)



Source: Bank websites and annual reports.

Figure 2.2.2. Major Pan-African Banks: Systemic Importance by Country, 2013



Sources: Banks' annual reports; Bankscope; IMF Monetary and Financial Statistics; and IMF staff calculations.
 Note: The countries highlighted in red are those where any of the seven largest pan-African banks has a systemically important presence defined as a deposit share of more than 10 percent of the banking system's deposits. This includes the home countries of the pan-African banks.

Box 2.2 (continued)

are expanding their branch networks across their host countries, including in rural areas. African banks have also become lead arrangers for syndicated loans, filling the gap left by European banks (IMF 2014a). From a home country perspective, the geographical expansion of pan-African banks increases diversification and provides further growth and profit opportunities for banks.

However, as these groups have developed in reach and complexity, significant supervision gaps, governance issues, and questions about cross-border resolution have emerged that could pose risks to national and regional financial stability if unaddressed. With their rapid

expansion, the largest pan-African banks have become systemically important in many of their host countries, raising concerns about spillover risks (Figure 2.2.2). Most groups conduct their foreign operations through subsidiaries, which rely on local deposits for funding, somewhat mitigating potential contagion. However, with limited information about intragroup exposures and interconnections within pan-African banks and cross-border cooperation between supervisors just emerging, undetected risks could be mounting. In addition, pan-African groups have become more complex, encompassing nonbank activities that could give rise to additional contagion channels (IMF, forthcoming b).

result confirms previous evidence that net bank flows have consistently been the most volatile type of capital flow (see Chapter 4 of the April 2011 *World Economic Outlook*). It suggests that the observed changes in international banking may yield a reduction in contagion, but potentially may also reduce flows that help countries dampen external and domestic shocks.¹⁵ These issues are examined next.

International Banking Linkages, Adverse Shocks, and Credit

The analysis now turns to the role that foreign banks can play in mitigating or amplifying the effect of adverse local and foreign shocks.¹⁶ This question is tackled from both a macroeconomic (country-level) and microeconomic (bank-level) perspective. The analysis focuses on the effect of international banking linkages on the *changes* in domestic credit growth

¹⁵Recent changes, such as the growing issuances of nonfinancial corporate bonds or changes in the mix of global portfolio investors (see Chapter 2 of the April 2014 *Global Financial Stability Report*) might, however, affect the sensitivity of portfolio flows to future shocks.

¹⁶Many studies have looked at the role of international banking linkages in the transmission of shocks to host countries (for example, Cetorelli and Goldberg 2011), while ignoring the role those linkages may play in smoothing the effect of domestic shocks. The analysis in this chapter considers both effects, thereby providing a more comprehensive assessment of the stabilizing role of foreign banks. For other effects of banking globalization, in particular the role of foreign bank participation in financial development in developing countries, see Goldberg (2009) and Detragiache, Tressel, and Gupta (2008).

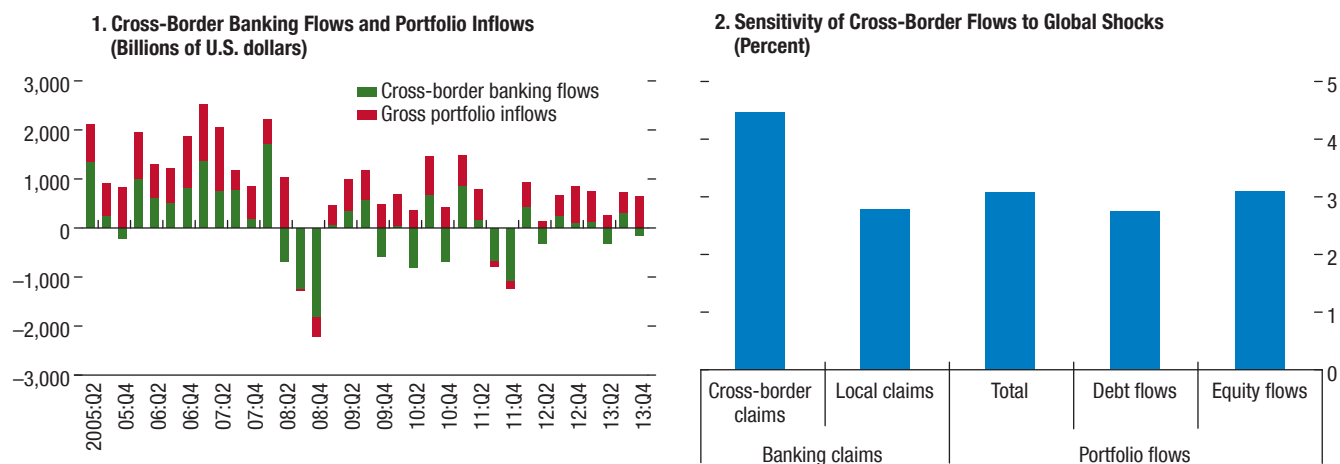
in response to shocks. Bank credit is one of the main channels of transmission of financial shocks to the real economy and plays a crucial role in the ability of economic agents to withstand negative shocks.

International banking linkages for each country are measured in three ways. The first measure is the ratio of cross-border claims to the total assets of the banking sector in recipient countries. This measure excludes local lending by foreign branches and subsidiaries in both foreign and domestic currencies (and, given the consolidated nature of the data, also excludes intragroup lending). The second measure uses international claims (the sum of cross-border claims and local claims in foreign currency) relative to banking sector assets in recipient countries. Because local claims in foreign currency are more likely to be funded by external borrowing, this measure may better capture the overall dependence of a country on foreign bank lending. The third measure uses the ratio of foreign subsidiaries' and branches' local claims in local currency to total banking assets.

Measuring linkages through cross-border and international claims

Host countries with higher cross-border or international claims tend to be more exposed to global shocks.¹⁷ In times of global stress, credit growth drops more in these countries (Figure 2.12, panel 1). This finding can be related to the literature pointing to the financial stability risks associated with bank

¹⁷Global stress (shocks) is measured by the VIX.

Figure 2.11. Changes in Capital Flows


Sources: Bank for International Settlements (BIS); IMF, International Financial Statistics; and IMF staff calculations.

Note: Cross-border banking flows are computed as changes in cross-border banking claims from the BIS Consolidated Banking Statistics on an ultimate risk basis. These data are not compiled on a residency basis and therefore are not fully consistent with the flows reported in the balance of payments. For panel 2, all flows are normalized by the average of their absolute values over the sample period. The bars in panel 2 represent the changes in flows following a one-unit increase in the VIX (Chicago Board Options Exchange Market Volatility Index).

wholesale funding (see Berkmen and others 2012). In fact, a substantial portion of precrisis cross-border lending by major banks was financed by tapping wholesale markets. Cross-border lending itself may also reflect cross-border wholesale funding between non-affiliated banks.¹⁸

Similarly, host countries do not enjoy a diversification benefit when they are hit by domestic shocks. All else equal, cross-border lending by international banks may be expected to be more resilient around domestic shocks. For example, the balance sheets of global banks will be less affected by economic stress in any given host country. This should enable these banks to curtail lending less than their local peers do. However, the opposite seems true. In the face of higher domestic banking stress, countries with more international banking linkages in the form of cross-border or international claims tend to see a larger, not smaller, contraction in lending.¹⁹ This suggests that

¹⁸Other than during stress periods, cross-border and international claims are associated with higher domestic credit growth in host countries. This may reflect the role that cross-border lending can play as a complement to domestic lending in relaxing credit constraints, and in contributing to financial deepening in countries with small domestic banking sectors. It may, however, also suggest a contribution of cross-border lending to unsustainable local credit booms (see next section).

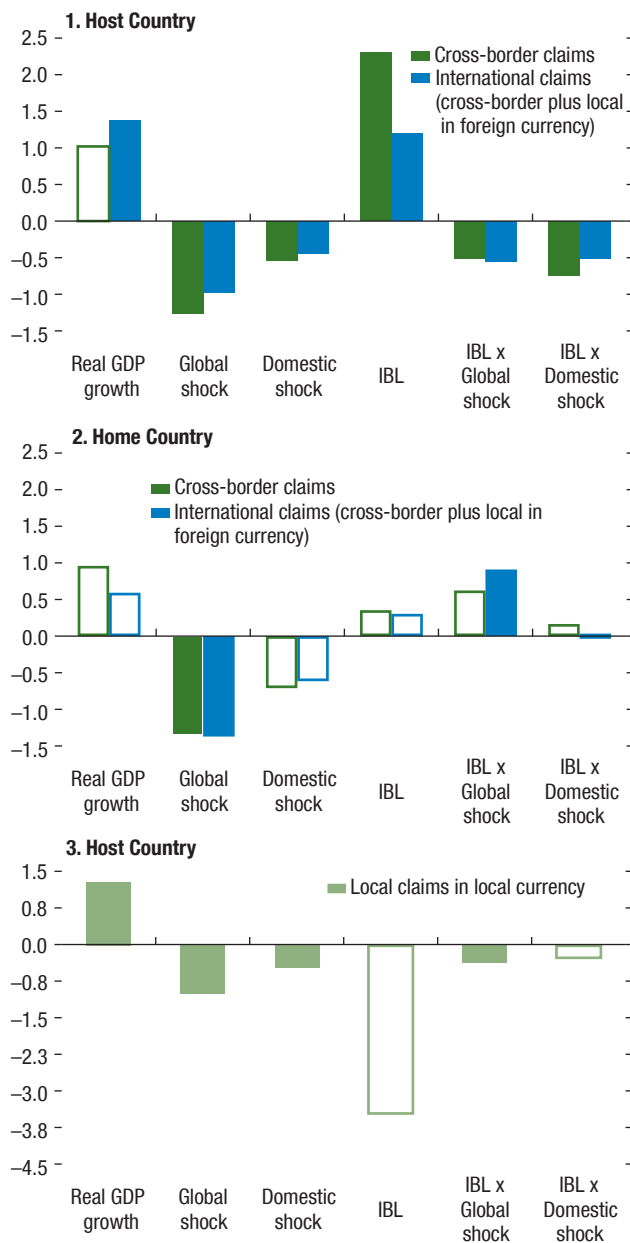
¹⁹Domestic stress (shocks) is measured by the average expected default frequency of the domestic banking sector (weighted by the

cross-border lending does not dampen the impact of domestic shocks.

By contrast, countries that are home to banks with large foreign assets experience some stabilizing benefits. Domestic credit is less affected during times of global stress in countries that are home to banks with large international operations (Figure 2.12, panel 2). This outcome may be related to the fact that banks in these countries have more leeway to adjust their operations worldwide and support the domestic entities—a form of home bias in which international banks are more inclined to maintain credit at home during times of global stress, potentially at the expense of their foreign operations (Giannetti and Laeven 2012). No such result is observed, however, for domestic shocks. One possible reason is that international banks, in the face of troubles at home, would rather maintain or expand their more profitable overseas operations than support domestic credit. The underlying assumption is that a global shock affects global banks' activities in a similar way both at home and abroad, while a domestic shock hurts the profitability of domestic operations relative to foreign ones.

size of the domestic banks). The average expected default frequency of all listed domestic firms, which represents a broader measure of domestic stress, is used as a robustness check; the main results remain unchanged.

Figure 2.12. Effect of International Banking Linkages on Domestic Credit Growth (Percent)



Source: IMF staff estimates.
 Note: IBL = international banking linkages. The bars show the effects of a one standard deviation increase in each variable on domestic credit growth. These are calculated by multiplying the estimated coefficient of the regression and the standard deviation of the corresponding independent variable. Nonshaded bars correspond to coefficients that are not significant at the 10 percent level. The estimation period spans 2002–13, depending on data availability.

These results do not depend on the severity of domestic or foreign shocks. The analysis finds little evidence that the stabilizing role of global banks may be either impeded or enhanced during extreme shocks or crises.

Measuring linkages through local currency lending by foreign banks

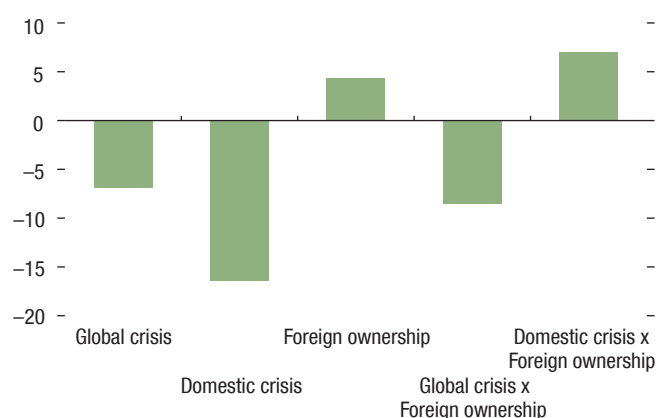
Linkages in the form of higher local currency lending by foreign subsidiaries or branches do not amplify domestic shocks (Figure 2.12, panel 3). Cross-border and international claims do not capture the local activities of foreign branches and subsidiaries well. One reason is that local claims are mostly denominated in local currency and are therefore more likely to be funded by local deposits. Another reason is that on a consolidated basis, cross-border claims cannot account for intragroup funding flows, although these are known to play a stabilizing role during periods of heightened risk (Reinhardt and Riddiough 2014; De Haas and van Lelyveld 2010). Intragroup funding can help support local lending by foreign banks’ affiliates. In fact, countries with a high share of local lending in local currency by foreign banks do not experience stronger credit contractions when they are hit by domestic shocks.

A more in-depth look at subsidiaries’ lending

An examination of the behavior of individual banks suggests that lending by foreign-owned subsidiaries is in fact more stable during domestic crises. The micro-level analysis uses balance sheet data for a large number of domestic and foreign-owned banks (see Annex 2.2 for details). The regression model compares the growth rate of loans by foreign-owned subsidiaries in a given country with that of domestic banks in periods of stress.²⁰ The growth rate of lending by foreign-owned subsidiaries is higher than that of lending by domestic banks during domestic banking crises, but lower during global crises (Figure 2.13). These results emphasize the beneficial role played by local lending of foreign-owned subsidiaries during domestic crises. This finding is consistent with the literature reporting that lending by subsidiaries is more stable than direct cross-border lending (Peek and Rosengren 2000; De Haas and van

²⁰Branches of foreign banks are excluded from the analysis because of the lack of balance sheet data. Using regulatory data, Hoggarth, Hooley, and Korniyenko (2013) provide an interesting analysis of the behavior of foreign bank branches in the United Kingdom.

Figure 2.13. Lending Growth by Domestic and Foreign-Owned Banks during Crises
(Percent)



Source: IMF staff estimations.

Note: The bars represent the values of the estimated coefficients of the independent variables in a regression of lending growth at the bank level comparing lending by domestic and foreign-owned banks (see Annex 2.2). The estimation period spans 1998–2013, depending on data availability.

Lelyveld 2006; McCauley, McGuire, and von Peter 2012; Schnabl 2012).

Foreign subsidiaries with better-capitalized parent banks and parent banks with more stable funding sources tend to react less procyclically. Higher capitalization of the parent bank is associated with higher lending growth by its subsidiaries during stress periods (Figure 2.14, panel 1; and Annex Table 2.2.3). High dependence of parent banks on nondeposit funding sources is destabilizing during both domestic and global crises (Figure 2.14, panel 2). The results highlight the role played by parents' dependence on nondeposit funding sources in increasing contagion, an intuitive and well-known result in the literature (Cetorelli and Goldberg 2012; Porter and Serra 2011).²¹

A high reliance of subsidiaries on domestic deposits for their funding is also found to help stabilize lending during both domestic and global stress. This result holds for all banks, whether domestically or foreign

²¹A comparison of the credit growth of foreign banks with that of domestic banks in Central, Eastern, and Southeastern Europe showed that the tightening in parent banks' funding conditions explained most of the difference in the credit slowdown in 2008–11 (IMF 2013a).

owned (Figure 2.14, panel 3) and further underscores the importance of banks' liability structures for financial stability (see Chapter 3 of the October 2013 *Global Financial Stability Report*).

International Banking Linkages and the Incidence of Crises

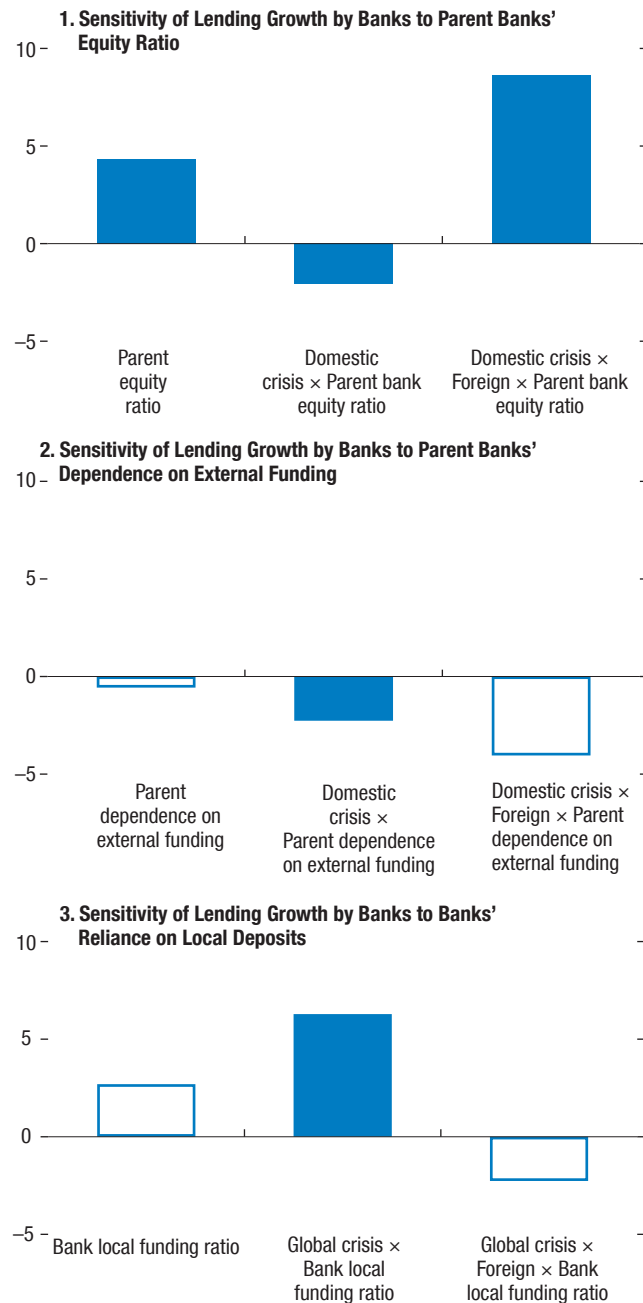
If certain forms of international banking linkages can aggravate the effect of domestic shocks, do they also increase the *incidence* of crises more generally? The previous section found that cross-border banking linkages tend to facilitate the transmission of global shocks and aggravate the effect of domestic ones on host countries but are also associated with higher domestic credit growth on average. Given that rapid credit growth is considered a powerful indicator of systemic risk buildup, this section directly investigates the effect of international banking linkages on the probability of a banking crisis (see Annex 2.3 for more details).

On average, a higher degree of international banking linkages does not seem to be significantly correlated with the probability of domestic banking crises (Table 2.1). This result is not surprising, since the existing literature does not provide a definitive answer. Although Demirgüç-Kunt, Levine, and Min (1998) find that foreign bank presence tends to lower the probability that a country will experience a banking crisis, more recent work by Minoiu and others (forthcoming) suggests a positive relationship between a country's banking interconnectedness and the probability of a banking crisis.

Policy Implications

As evidenced by the regulatory survey results, the challenges of the recent financial crisis prompted a number of countries to take crisis-resolution measures and impose new requirements on banks. The response was global, with the Group of 20 playing a major role in setting up the agenda for financial reforms (Viñals and others 2010). National regulatory reforms followed, although they were not always well coordinated across countries. Structural banking reforms aiming to reduce interconnectedness between intermediaries may have intentionally introduced some degree of fragmentation to the market, including across borders (FSB 2014). Measures frequently

Figure 2.14. Effect of Parent and Subsidiary Characteristics on Subsidiary Lending Growth (Percent)



Source: IMF staff estimations.
 Note: The bars represent the values of the estimated coefficients of the independent variables multiplied by the standard deviation of the parent or subsidiary characteristic of interest in a regression of lending growth at the bank level, comparing lending by domestic and foreign-owned banks (see Annex 2.2). Nonshaded bars correspond to coefficients that are not statistically significant at the 10 percent level. The marginal effect of each parent and subsidiary characteristic on lending growth by foreign subsidiaries during crises corresponds to the sum of the coefficients on the interaction terms Crisis x Characteristic and Crisis x Foreign x Characteristic. The estimation period spans 1998–2013.

used include the separation of specific activities into different legal entities, restrictions on business models, heightened regulatory requirements on a subconsolidated basis, and requirements to operate as subsidiaries instead of branches. These regulatory changes clearly had an effect on the patterns of international banking.

With regard to financial stability, the findings of the empirical analysis in this chapter lend support to a “multinational” banking model rather than a cross-border one (see Table 2.2). In contrast to international banks, which are mainly engaged in cross-border transactions out of their home countries, multinational banks operate locally through subsidiaries or branches (McCauley, McGuire, and von Peter 2012). All else equal, the shift to more local as opposed to cross-border operations results in a decline in the sensitivity of capital flows to global shocks and yields a reduction in contagion. Foreign banks operating locally rather than through cross-border transactions tend to contract credit much less following domestic shocks in host countries. More local claims may also translate into higher effectiveness of macroprudential policies given that local measures are less likely to be circumvented (Viñals and Nier 2014; IMF 2014d).

Governments can enhance the resilience to financial shocks. A higher reliance of *affiliates* on local funding sources increases their resilience to global shocks. At the *parent* level, higher capitalization levels and more stable funding sources positively contribute to financial stability in host countries. The results therefore support recent financial reforms aimed at strengthening banks’ capital and liquidity buffers, especially the buffers of global systemically important banks. The results also call for the close monitoring of cross-border and foreign currency lending, given that both tend to compound domestic and global shocks.²²

However, limiting cross-border lending across the board may jeopardize other benefits and create new risks, most of them not examined here. The analysis finds a positive effect of cross-border lending on domestic credit growth in *host countries* in normal times. Moreover, *home countries* benefit from having cross-border banking claims during times of global stress. However, the chapter does not consider

²²Lower dependence of banks on external funding, along with stronger supervision, was shown to also reduce the fiscal costs of banking crises (IMF, forthcoming a).

Table 2.1. Effects of International Banking Linkages on the Incidence of Crises

	International Banking Linkages Measured with		
	Cross-Border Claims	International Claims	Local Claims
Real GDP Growth (year-over-year change, lagged)	-0.03	-0.05*	-0.05*
Credit Growth (lagged)	0.08***	0.06***	0.06***
Foreign-Exchange-Reserves-to-GDP Ratio (lagged)	-2.59	-1.96	-1.81
Foreign-Debt-to-GDP Ratio (lagged)	0.39**	0.48***	0.43***
Current-Account-Balance-to-GDP Ratio (lagged)	-0.14***	-0.16***	-0.15***
International Banking Linkages (lagged)	0.16	0.19	-0.14
Observations	1,324	1,840	1,792
Number of Countries	46	46	45
Chi-squared	41.8	47.5	46.5

Source: IMF staff estimates.

Note: IBL = international banking linkages. Banking crises are defined as in Laeven and Valencia (2013). The estimates are derived from a random effects panel probit model. The estimation period spans 2002–13, depending on data availability. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

the positive role cross-border flows can play in the allocation of global savings across countries, and the resulting benefits for investment and growth. Some of these benefits would likely be lost if divergences in the implementation of reforms agreed to at the global level and the ensuing regulatory fragmentation were to lead to a further retrenchment of global banks.²³ In addition, the changes in the provision of cross-border credit could raise new financial stability risks. As international issuances of corporate bonds continue to increase and bank direct cross-border lending declines, the locus of risks is shifting away from banks to nonbanks. Such a shift may complicate surveillance of the global financial system (see Chapter 3 of this *Global Financial Stability Report* and Chapter 2 of the October 2014 *Global Financial Stability Report*).

One policy challenge would therefore be to make the global financial system safer for cross-border lending. Doing so requires a more harmonized institutional and regulatory framework, with more cooperation and coordination among national regulators and supervisors. The analysis highlights the destabilizing effects of cross-border lending during shock episodes; therefore, the efforts should first focus on reducing the risks in times of crisis. In that regard, mutually compatible resolution frameworks could provide a global safety net, preventing the ad hoc imposition of ring-fencing measures.

²³Furthermore, the chapter does not consider the particular case of banking unions, within which the distinction between cross-border and local claims is less relevant because of full regulatory and supervisory integration and the existence of common safety nets.

In particular, stronger intraregional banking linkages call for enhanced regional cooperation. Regionalization may increase vulnerability to regional crises. Dealing with such crises requires agreement on the resolution of regional banks and the availability of adequate fiscal backstops at the regional level. Box 2.3 provides a description of the progress made in this regard with the European banking union.

International forums have an important role to play in the advancement of regulatory standards and in ensuring their consistent application across countries (see Box 2.4 for a discussion of areas that warrant attention by financial regulators). Progress along these dimensions would reduce the scope for regulatory arbitrage between countries as well as between regulated banks and the shadow banking system.

Conclusion

The reduction in cross-border lending and the move toward more local and locally funded operations, partly fostered by regulatory reforms, should positively affect financial stability in host countries. The analysis in this chapter provides evidence that cross-border banking tends to aggravate adverse domestic and global shocks in host countries. In contrast, local lending by foreign banks is less sensitive to global shocks than are cross-border lending and portfolio inflows in general. Moreover, lending by foreign-owned subsidiaries, especially when their parents are well capitalized and less dependent on nondeposit funding sources, can help stabilize credit growth in the face of adverse domestic

Table 2.2. Main Findings of the Analysis of the Effects of International Banking Linkages on Domestic Credit Growth

Measure of International Banking Linkages	Effect on Domestic Credit Growth by Banks during Periods of	
	Adverse Domestic Shocks	Adverse Global Shocks
Cross-Border Claims	Amplifies the effect of the shock	Amplifies the effect of the shock
Local Lending through Branches and Subsidiaries	Dampens the effect of the shock	Amplifies the effect of the shock
Parent and Subsidiary Characteristics	Effect on Lending Growth by Foreign Subsidiaries during Periods of	
	Domestic Crises	Global Crises
Higher Parent Capitalization and Lower Parent Dependence on Nondeposit Funding	Dampens the effect of the crisis	Dampens the effect of the crisis
Higher Reliance of Subsidiaries on Local Deposits	Dampens the effect of the crisis	Dampens the effect of the crisis

Source: IMF staff.

shocks. Countries that are home to banks with large foreign assets still enjoy some risk diversification benefits from their international exposures.

However, the chapter does not look into the other benefits usually associated with cross-border banking flows. Although the decline in cross-border lending may reduce the international transmission of shocks, it may dampen benefits in other domains, such as financial deepening, the efficient allocation of global savings, and the diversification of financing sources.

Overall, the findings lend support to recent regulatory reforms strengthening the resilience of global banks while calling for further progress on the consistent implementation of regulatory standards and cross-border resolution. Given the trade-offs, an important policy challenge is to make the global financial system safer for cross-border lending. Only with sufficient international cooperation on the regulation and supervision of global banks can the full benefits of banking globalization be realized with no increased risk to financial stability.

Box 2.3. Banking Union in Europe

This box describes the banking union in Europe as a policy response to financial fragmentation in the euro area.

The global financial crisis and its aftermath led to fragmentation of euro area financial markets along national borders, peaking in the summer of 2012. Bank borrowing and lending costs became highly correlated with sovereign yields and both diverged markedly across countries (Figure 2.3.1; Goyal and others 2013). Local banks relied on their sovereigns as backstops in times of stress, linking the financial health of the sovereign and the banking sector: when banking sector conditions deteriorated, the sovereign's fiscal space to backstop shrank, and vice versa. Moreover, in a currency union, individual member states cannot use interest or exchange rates to support banks in response to local macroeconomic conditions.

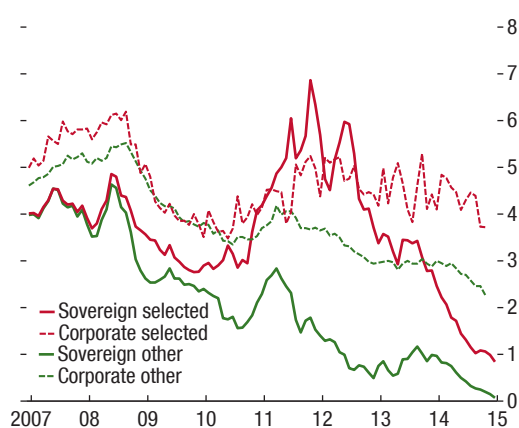
To short-circuit bank-sovereign linkages and safeguard the functioning of the currency union and single market, policymakers formulated a plan for a banking union in the euro area, in which nationally distinct banking supervision and resolution frameworks would

be replaced by a shared and common framework.¹ The banking union goes a step further than European Union-wide initiatives to harmonize banking practice across countries, by establishing centralized mechanisms for these functions.²

Like many European institutions, the euro area mechanisms are layered on top of existing national institutions. Under the Single Supervisory Mechanism, which began operation in November 2014, the European Central Bank (ECB) is the overarching supervisory authority, directly supervising 120 significant banks—which together make up almost 85 percent of total euro area bank assets—and overseeing the supervision of the other 3,500 or so less significant banks in the euro area by their respective national competent authorities. Moreover, the ECB can take over the direct supervision of any less significant bank if it deems it necessary to ensure the integrity of euro area supervision or if the bank becomes systemically important.

Similarly, under the Single Resolution Mechanism, the newly established, stand-alone Single Resolution Board oversees the resolution of banks by national resolution authorities and directly handles the resolution of large and cross-border banks. Following European Union-wide practice, resolution may involve a bail-in of up to 8 percent of bank liabilities. Importantly, as of January 2016, the board will also have access to a common, industry-funded backstop called the Single Resolution Fund to facilitate resolution if needed. The eventual size of the industry backstop is planned to be €55 billion by 2024 (about 1 percent of covered deposits in the euro area). Together, these tools should help minimize recourse to taxpayer-financed bailouts. Moreover, as of December 2014, the European

Figure 2.3.1. Sovereign Bond and Corporate Lending Rates in the Euro Area
(Percent; GDP weighted)



Sources: Bloomberg, L.P.; and Haver Analytics.

Note: Sovereign rates are the yields on five-year bonds. Corporate lending rates are for bank loans longer than five years. The rates for Belgium and Portugal reflect all maturities. "Selected countries" are those which experienced high borrowing spreads during the 2010–11 debt sovereign crisis and comprise Ireland, Italy, Portugal, and Spain. "Other countries" are Belgium, France, Germany, and the Netherlands.

This box was prepared by John Bluedorn.

¹Plans for banking union began in earnest shortly after the European Central Bank's August 2012 announcement of the Outright Monetary Transactions instrument that contained and alleviated the turmoil in euro area financial markets.

²The key European Union initiatives include the Single Rulebook, to establish a common bank capital definition and implement Basel III prudential requirements (adopted in June 2013; phased in by 2019); the Bank Recovery and Resolution Directive, establishing common practices for bank resolution at the national level, which minimizes taxpayer support for banks, partly through the "bail-in" of bank creditors in resolution (adopted April 2014; in full force January 2016); and the Deposit Guarantee Scheme Directive, harmonizing rules for national deposit guarantee schemes and ensuring their upfront funding and uniform functioning (adopted April 2014; phased in by 2025).

Box 2.3 (continued)

Stability Mechanism may directly recapitalize banks under restructuring, acting as a kind of common fiscal backstop to the banking union. However, the hurdles for its use are very high (for example, bail-in must be exhausted), and the funding available is capped at €60 billion, which could be rapidly depleted in a systemic crisis.

By centralizing and sharing bank supervision and resolution, the banking union will eliminate the distinction between home and host supervisors for

euro area banks; enforce a high, common supervisory standard; enable the cross-border flow of bank liquidity; and ensure common and consistent treatment of investors and depositors in cases of bank distress. This centralization should help foster the single market and reduce fragmentation. However, a number of the practicalities and modalities still need to be worked out for the new institutions. Moreover, without an effective common fiscal backstop, the risk that bank-sovereign linkages could reemerge in a systemic crisis remains.

Box 2.4. Global Banks: Regulatory and Supervisory Areas in Need of Attention

This box highlights areas that warrant further attention from policymakers to make regulation and supervision of globally active banks more effective.

Cooperation and coordination

A pragmatic approach is needed to tackle the challenges global banking poses to national policymakers. Mutually shared objectives as well as a stronger cooperation and coordination process among regulators and supervisors are paramount.

- *Build trust through strengthened cooperation and coordination:* The international response to the financial crisis has markedly improved the regulatory framework. However, more attention could be devoted to strengthening supervision (Viñals and others 2010). Building and maintaining trust among supervisors is essential for effective cooperation among more integrated countries, especially during times of crisis. Confidence-building measures include the signing of memoranda of understanding (MoUs) or active participation in regional networks.^{1,2} In general, policymakers should strive to remove any legal

This box was prepared by Johannes Ehrentraud.

¹MoUs establish a set of details for cooperation and information exchange with other supervisory authorities. Although such agreements failed to facilitate cooperation during the global financial crisis, their format could be revamped to include specific timelines and escalation procedures (IMF 2014a). For systemically important institutions, the Financial Stability Board (FSB) recommends setting up crisis management groups and institution-specific cross-border cooperation arrangements (FSB 2014).

²Examples include the Group of Banking Supervisors from Central and Eastern Europe or the Association of Supervisors of Banks of the Americas.

impediments to cross-border cooperation among supervisory authorities, thus enabling them to share information effectively.³

- *Establish a dedicated framework for reforms with a cross-border reach:* The unilateral adoption of measures without international agreement can encourage other countries to take similar unilateral measures, leading to a spiral of regulatory fragmentation. Financial stability might be compromised if national approaches, introduced in the absence of an international standard, confront global banks with competing or contradictory requirements. In the long term, countries should consider moving toward an international system for mutual consultation of reform proposals with considerable cross-border reach. While retaining national autonomy for safeguarding financial stability, such a process could ensure broader application of substituted compliance with foreign regulatory regimes and internalize the effects of extraterritorial measures.⁴

Consistency

The details of the implementation and application of reforms deserve more attention. Inconsistent implementation of international standards across countries may

³In some countries, banking secrecy laws prevent authorities from sharing information with others if their counterparty's legal system provides the option of sharing the data with tax authorities.

⁴Substituted compliance describes the circumstances in which authorities permit legal subjects to use compliance with regulations in another jurisdiction as a substitute for compliance with local regulations. Deferring to the regulatory regimes of other countries often involves the determination of equivalence of the other countries' regulatory regimes.

Box 2.4 (continued)

cause global banks to book their transactions in jurisdictions with light-touch regulation or more preferential accounting rules.

- *Basel framework:* In 2012, the Basel Committee on Banking Supervision established a Regulatory Consistency Assessment Program to facilitate consistency in the adoption and implementation of Basel standards.⁵ Current challenges to ensuring a level playing field include different phase-in requirements and transitional adjustments in banks' regulatory capital calculations, and excessive variability in the calculation of risk-weighted assets in banks using an internal-ratings-based approach. In Europe, the Capital Requirements Regulation and Capital Requirements Directive include a large number of options allowing for national discretion in the application of certain regulatory rules (Lautenschläger 2014). Further efforts are thus required to ensure that national discretion does not undermine the consistency of agreed-upon reforms.⁶
- *Accounting:* Although commissioned by the Group of 20 countries in 2009, convergence efforts by the International Accounting Standards Board and the U.S. Financial Accounting Standards Board have not yet produced a single set of global standards. For banks, one key area of divergence is the standards for credit loss provisioning. Diverging accounting approaches are costly for compliance and hamper comparability in loan loss estimates. They also create an uneven playing field because banks in different parts of the world will

⁵Main elements of the Regulatory Consistency Assessment Program are the implementation and monitoring of Basel standards and consistency assessments carried out on a jurisdictional and thematic basis.

⁶In 2010, the FSB established a framework for encouraging stronger adherence to international standards. The three main elements are (1) FSB members' commitment to implement standards and publish evidence of their adherence, (2) periodic peer reviews for FSB and non-FSB members, and (3) a toolbox with positive and negative measures, including identification of non-cooperative jurisdictions (FSB 2010a, 2010b). This framework could be strengthened.

be required to hold different loan loss reserves for a given level of loan portfolio riskiness.

Resolution and organizational banking structures

Effective cross-border resolution regimes would allow for more flexibility in the choice of legal structures for banking groups.

- *Advancing cross-border bank resolution:* The Key Attributes, which are the international standard for resolution regimes for financial institutions, are to be implemented in Financial Stability Board member jurisdictions by end-2015. They provide resolution authorities with comprehensive resolution powers. However, a number of considerable challenges remain. In some cases, there may be significant asymmetry of power in interactions between home and smaller host countries where the operations are not material to the institution's overall health. Moreover, national interests may still trump incentives for cooperative cross-border strategies. More work is needed on proposals for total loss-absorbing capacity, greater harmonization of creditor hierarchies, and depositor preference between countries (IMF 2014a).⁷
- *Legal banking structures:* Given a cooperative international environment, banking groups that find it more useful to be organized either as branches or as subsidiaries can be consistent with financial stability outcomes.⁸ In some situations, however, imposing subsidiarization might seem preferable from a financial stability perspective but has efficiency costs for banks that would otherwise prefer to organize themselves through a branch structure in light of their business model. Harmonizing cross-border resolution regimes and burden-sharing agreements, along with effective cooperation and information sharing in crisis times, may change authorities' current preference for certain structures with regard to financial stability.

⁷In November 2014, the FSB issued a consultation paper on a common international standard on total loss-absorbing capacity for global systemic banks.

⁸See Fiechter and others (2011) for an exhaustive discussion.

Annex 2.1. Regression Analysis of the Drivers of the Decline in Foreign Banking Claims²⁴

This annex describes the data and the regression model used to examine the drivers of the decline in foreign claims and provides more detailed results. Annex Table 2.1.1 lists the questions used to construct the model's regulatory index. Annex Table 2.1.2 provides a summary of data definitions and sources, and Annex Table 2.1.3 gives the coefficient estimates.²⁵

Data on Foreign Banking Claims and the Regulatory Index

The dependent variable is the growth rate of foreign banking claims from a home country to a host country. In addition to total foreign claims, subcategories by type of claim and counterparty sector are also used. The data come from the BIS Consolidated Banking Statistics on an ultimate risk basis.²⁶ Statistical breaks are adjusted following Cerutti (2013). Quarterly claims over the period 2005:Q2–2013:Q3 are annualized and averaged over the precrisis (2005–07) and postcrisis periods (2011–13). The growth rate is computed by dividing the change in claims between the two periods by the average level in the two periods.²⁷

The main explanatory variables of interest are the indices of changes in regulations on banks' international operations in home and host countries, based on the results of a survey conducted for the purpose of this chapter. Survey questions are classified into six categories

each for home and host countries, as shown in Annex Table 2.1.1. Each country-category pair is assigned a value of 1, 0, or –1 when the number of answers reporting a tightening of regulations is greater than, equal to, or smaller than, respectively, the number of answers reporting a loosening. The final index is calculated as a simple average of the scores for the six categories.

Regression Model

The regression model takes the following form:

$$\Delta \text{claims}_{ij} = \alpha + \beta \text{home}_i + \gamma \text{host}_j + \delta \text{bilateral}_{ij} + \varepsilon_{ij},$$

in which $\Delta \text{claims}_{ij}$ denotes the growth rate of claims from home country i to host country j . The terms home_i and host_j are vectors of variables specific to home and host countries, respectively. Each of these vectors includes three indices of regulatory changes (one based on the survey results and two based on World Bank data on capital requirements and supervisory power; see Annex Table 2.1.3), the change in the exchange rate against the U.S. dollar,²⁸ the GDP growth rate, and the real policy interest rate. In addition, home_i includes an indicator of banking sector health in the precrisis period. The term bilateral_{ij} is a vector of bilateral variables, comprising the log of the physical distance between the home and host countries, a common language dummy, two variables capturing the importance of the claims from the home country in the host country and of the claims in a given host country from the home country perspective in the precrisis period, and the growth rate of bilateral international claims in the precrisis period.²⁹ The coefficients α , β , γ , and δ are parameters or vectors of parameters, and ε_{ij} is the residual.

The results reported in the text are broadly robust to the following specification changes: First, the indices on changes in capital requirements and supervisory power (computed from World Bank data) are excluded, which is an important robustness check given that the indices are not available for some BIS reporting countries, including Japan and the United Kingdom. Second, real long-term interest rates in home and host countries are used instead of real policy interest rates to control for unconventional monetary policy effects. Third, euro

²⁴The author of this annex is Hibiki Ichiue.

²⁵For more details, see Ichiue and Lambert (forthcoming).

²⁶The BIS Consolidated Banking Statistics record the consolidated positions of reporting banks' worldwide offices, excluding interoffice positions. They comprise two subsets, compiled on different bases: an immediate risk basis and an ultimate risk basis. The immediate risk basis data allocate banking claims to the country of residence of the immediate counterparty; the ultimate risk basis data allocate claims to the country in which the final risk lies. The immediate risk basis data offer better coverage of time series and countries. In addition, they distinguish between international claims (sum of cross-border claims and local claims in foreign currency) and local claims in local currency, whereas the ultimate risk basis data provide a breakdown between cross-border claims and total local claims (sum of local claims in both foreign and local currencies). The immediate risk basis data, however, do not reflect risk transfers and have limitations in capturing banks' bilateral risk exposures. These issues are irrelevant when immediate risk basis data are aggregated by country of origin. The analysis described in this annex uses bilateral claims and thus relies on ultimate risk basis data.

²⁷The literature often uses log differences to calculate growth rates. However, such a method naturally discards data when claims are zero at the start or end of the period and cannot capture home countries' entry into or exit from host countries, which may actually result from changes in regulations or other factors.

²⁸The BIS Consolidated Banking Statistics are reported in U.S. dollars by converting claims in other currencies. Changes in claims from one period to another may then only reflect valuation effects following exchange rate fluctuations with the actual underlying position remaining unchanged (Cerutti 2013).

²⁹Pre-crisis values of the variables of bank health and bilateral importance are used to mitigate endogeneity concerns.

area countries are either excluded from the sample or aggregated and treated as a single country. Fourth, the *International Country Risk Guide* country risk rating is added to the variables for host countries. Fifth, home countries' sovereign rating index or a banking crisis dummy is added to the regression. Finally, the indices for the changes in regulations in home countries are instrumented by the capital regulation index and supervisory power index from the World Bank in 2003 and 2006, to deal with possible endogeneity bias. The choice

of instruments is justified by the possibility of regulation contagion as discussed in Demirgüç-Kunt and Detragiache (2002) and Houston, Lin, and Ma (2012).

Annex Table 2.1.3 reports the detailed results for different types of banking claims. The model is also estimated using the difference between the growth rates of different types of claims as the dependent variable. Significant nonzero coefficients confirm that two different types of claims have different sensitivities to some of the explanatory variables. These results are not reported.

Annex Table 2.1.1. Survey on the Regulation of Banks' International Operations

Category	Questions
Home Country Regulations	
Presence	Are domestic banks prohibited from acquiring foreign banks? Do domestic banks need their domestic supervisor's approval to acquire a foreign bank? Are domestic banks prohibited from establishing branches overseas? Do domestic banks need their domestic supervisor's approval to establish a branch overseas? Are domestic banks prohibited from establishing subsidiaries overseas? Do domestic banks need their domestic supervisor's approval to establish a subsidiary overseas? Are the requirements to obtain permission to establish a branch stricter than those applicable to subsidiaries?
Activity	Are domestic banks prohibited from making cross-border loans? Are domestic banks prohibited from purchasing foreign securities? Are there restrictions on the type of activities (for example, corporate and retail lending, residential mortgage, trade finance, long-term infrastructure finance, investment banking) that domestic banks can conduct overseas that do not apply to domestic operations? Are there additional regulatory requirements for domestic banks operating outside their home country beyond what would be required for similar operations conducted domestically?
Depositor Insurance	Are foreign depositors covered by deposit insurance?
Information	Do banking secrecy laws in your country limit your ability to share information about banks' operations and balance sheets with foreign supervisors?
Supervisory Discretion	Can the supervisor limit the range of activities a consolidated group may conduct and/or the locations in which activities can be conducted (including the closing of foreign offices) in specific circumstances (as per Basel Core Principle 12.6)?
Other	Did the authorities introduce other structural measures (such as Volcker reform, Vickers proposals, and others) that could weigh on the decision of some banks to expand internationally?
Host Country Regulations	
Presence	Is foreign ownership of domestically incorporated banks prohibited? Do foreign banks need the host country supervisor's authorization to acquire a domestic bank? What is the maximum percentage of foreign ownership of a domestic bank legally allowed? Are foreign banks prohibited from operating in the form of branches? Are the requirements for establishing a branch stricter for foreign banks than for domestic banks? Are there additional and/or different regulatory requirements for foreign-owned banks versus domestic banks?
Activity	Are there restrictions on the type of activities (for example, corporate and retail lending, residential mortgage, trade finance, long-term infrastructure finance, investment banking) that foreign banks can conduct domestically and that do not apply to domestic banks? Are there restrictions on domestic currency cross-border borrowing by banks? Are there restrictions on foreign currency cross-border borrowing by banks? Are banks required to fund part or all of their domestic operations with local deposits? Are there restrictions on the share of funding a domestically incorporated bank can obtain from a foreign parent? Are there restrictions on lending by domestically incorporated banks to a foreign parent?
Supervisory Discretion	Can the supervisory authorities impose ring-fencing measures in a discretionary way?
Information	Do banking secrecy laws in your country limit your ability to share information about banks' operations and balance sheets with foreign supervisors?
Resolution	Does the resolution authority have resolution powers over local branches of foreign firms and the capacity to use its powers either to support a resolution carried out by a foreign home authority or, in exceptional cases, to take measures on its own initiative (as per Key Attribute 7.3)?
Other	Did the authorities introduce other structural measures (such as Volcker reform, Vickers proposals, and others) that could weigh on the decision of some banks to retrench from your country?

Source: IMF staff.

Annex Table 2.1.2. Definition of the Variables

Variable	Description	Source
Claims	The dependent variable is the growth rate of bilateral claims from the precrisis period (2005–07) to the postcrisis period (2011–13), which is calculated from the change in average claims between the pre- and postcrisis periods. The precrisis growth rate of bilateral international claims, computed between 2002–04 and 2005–07, is used as a control variable.	BIS
International Operations Regulatory Index	An index constructed from answers to survey questions about regulation changes for 2006–14. See the text of this annex for more detail.	IMF
Capital Regulatory Index	Difference between Barth, Caprio, and Levine (2013) indexes in 2006 and 2011.	Barth, Caprio, and Levine (2013)
Official Supervisory Power Index	Difference between Barth, Caprio, and Levine (2013) indexes in 2006 and 2011.	Barth, Caprio, and Levine (2013)
Exchange Rate	Change in the exchange rate against the U.S. dollar between 2005–07 and 2011–13.	IMF, IFS
GDP	Growth rate from 2005–07 to 2011–13.	IMF, WEO
Real Policy Interest Rate	Change in the policy rate (or an alternative interest rate if not available) minus the one-year-ahead expected inflation rate between 2005–07 and 2011–13.	Central banks, Consensus Forecasts
Bank-Capital-to-Total-Assets Ratio	Average of the ratio in 2005, 2006, and 2007.	World Bank
Distance	Log distance between two cities, mostly capitals, in home and host countries. The distance to Hong Kong SAR is proxied by the distance to Taiwan Province of China.	http://privatewww.essex.ac.uk/~ksg/data-5.html
Common Language Dummy	The variable is equal to 1 when the home and host countries use a common language and zero otherwise.	Rose (2004)
Importance of Host in the Claims from Home	Ratio of bilateral claims from a home country to a host country to total claims from the home country to all host countries, averaged over 2005, 2006, and 2007.	BIS
Importance of Home in the Claims on Host	Ratio of bilateral claims from a home country to a host country to total claims from all home countries to the host country, averaged over 2005, 2006, and 2007.	BIS

Source: IMF staff.

Note: BIS = Bank for International Settlements; IFS = *International Financial Statistics*; WEO = *World Economic Outlook*.

Annex Table 2.1.3. Results of Country-Level Regression for the Drivers of the Changes in Foreign Banking Claims

	Foreign Claims	By Instrument		By Sector		
		Cross Border	Local	Nonbank	Banks	Public
Regulatory Index (changes)						
International Operations (home)	-179.60***	-136.95*	131.74	-184.27**	20.88	249.65
International Operations (host)	-41.62**	-42.73**	9.26	28.17	-42.23*	6.91
Capital (home)	-7.09***	-2.02	3.96	-6.67***	0.43	4.14
Capital (host)	0.66	0.97	1.50	2.52	-2.01	7.47***
Supervisory Power (home)	3.88***	3.89***	1.73	2.23*	1.24	10.17***
Supervisory Power (host)	1.08	1.96	-3.51	2.10	0.93	-0.02
Exchange Rates (percent appreciation against US\$)						
Home	2.89***	3.01***	-7.23***	0.01	4.21***	-10.26**
Host	0.07	0.20	1.28**	0.07	0.25	0.18
GDP (percent change)						
Home	0.39	0.44	7.07***	0.15	8.87***	1.82***
Host	0.88***	0.93***	1.22***	1.24***	0.12	0.65***
Real Policy Interest Rate (percentage point changes)						
Home	-1.54	0.68	55.21***	-7.60*	61.62**	7.77
Host	-5.00***	-6.27***	-2.58	-8.45***	-5.71**	-1.27
Bank-Capital-to-Total-Assets Ratio (percent in 2005–07)						
Home	10.50***	12.07***	18.52***	13.82***	12.51**	8.82***
Bilateral Geographic and Cultural Variables						
Distance (log, km)	-11.72***	-10.78**	-33.19***	-14.08***	1.76	-9.26*
Common Language Dummy	-3.50	-3.73	-3.66	-13.60	15.01	-1.40
Bilateral Share (percent in 2005–07)						
Host Country's Share of Claims from Home	0.77	0.82	-1.31	1.00	-2.65**	-1.11*
Home Country's Share of Claims on Host	0.86**	-0.10	0.63	0.17	1.40**	0.05
Bilateral Lagged Claims (percent changes from 2002–04 to 2005–07)						
International Claims	-0.18***	-0.17**	-0.36**	-0.19**	0.27**	-0.03
Number of Observations	518	433	328	424	352	417
R^2	0.27	0.27	0.22	0.28	0.26	0.19

Source: IMF staff estimates.

Note: km = kilometer; White's (1980) robust standard errors are used. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Annex 2.2. Analysis of the Role of International Banking Linkages in Mitigating or Amplifying Shocks³⁰

This annex summarizes the analysis of the role played by global banks in mitigating or amplifying domestic and global shocks. The analysis uses panel data techniques on country-level and bank-level data to estimate the impact of international banking linkages on credit growth.

Country-level analysis

International banking linkages are measured in three ways, by (1) the ratio of cross-border claims to the total assets of the banking sector, (2) the ratio of international claims to total banking assets, and (3) the ratio of foreign subsidiaries' and branches' local claims in local currency to total banking assets. The second measure includes foreign currency domestic claims of foreign bank affiliates whereas the first one focuses exclusively on cross-border claims.³¹ All of these variables are available from the BIS and adjusted for statistical breaks following Cerutti (2013). Other measures, such as the ratio of foreign claims to the nonfinancial sector to total domestic credit to the nonfinancial sector, are used for robustness checks.

Global (foreign) stress is measured by the VIX. Results are similar when an alternative measure is used (such as average credit default swap (CDS) prices of the global systemically important banks identified by the Financial Stability Board). Domestic stress is measured by the average expected default frequency (EDF) of the domestic banking sector (weighted by the size of the domestic banks). The EDF is used instead of CDS prices because the former has much better data coverage—CDS data are only available for the largest banks. Since the EDF can be contaminated by global stress, a measure of domestic stress purged of the effect of global stress (residual of a regression of the EDF on the VIX) is used as a robustness check. The average EDF for all listed firms, a broader measure of domestic shock, is also considered. The results are unchanged. Alternative specifications include a dummy for the

global financial crisis (2008–09) and a dummy for domestic banking crises (Laeven and Valencia 2013).

The econometric specification is as follows:

$$\begin{aligned} \Delta bankcredit_{i,t} = & \alpha_i + \beta_1 X_{i,t-1} + \beta_2 domestic\ shock_{i,t} \\ & + \beta_3 global\ shock_t + \beta_4 IBL_{i,t-1} \\ & + \gamma_1 IBL_{i,t-1} \times domestic\ shock_{i,t} \\ & + \gamma_2 IBL_{i,t-1} \times global\ shock_{i,t} \\ & + \beta_5 domestic\ crisis_{i,t} \\ & + \beta_6 global\ crisis_t + \gamma_3 IBL_{i,t-1} \\ & \times domestic\ shock_{i,t} \times domestic\ crisis_t \\ & + \gamma_4 IBL_{i,t-1} \times foreign\ shock_{i,t} \\ & \times global\ crisis_t + \varepsilon_{i,t}, \end{aligned}$$

in which $\Delta bankcredit_{i,t}$ is the quarterly growth in bank claims to the private sector available from the IMF *International Financial Statistics*; α_i and $X_{i,t-1}$ capture country-level effects with country fixed effects and the real GDP growth rate; *domestic shock*_{*i,t*} and *global shock*_{*t*} are measured by the EDF of the banking sector and the VIX, respectively; and *IBL*_{*i,t-1*} is the measure of international banking linkages. The main coefficients of interest are the γ coefficients that capture the interaction between the level of international banking linkages and the sensitivity of credit to domestic and foreign shocks. The baseline model is supplemented by the inclusion of dummies for domestic and global crises (*domestic crisis*_{*i,t*} and *global crisis*_{*t*}) and their interactions.

Annex Table 2.2.1 summarizes the results from the panel regressions. Driscoll-Kraay standard errors are used to account for the potential heteroskedasticity and autocorrelation of standard errors. The results are robust to adding one lag of the dependent variable on the right-hand side to account for the persistence of credit growth or the possibility of boom-bust cycles, and to including additional country-level control variables. They also hold for subsamples of advanced economies and emerging markets and when the European countries are excluded from the sample. Finally, the results are robust to the exclusion of Vienna Initiative countries.

The above analysis is from the perspective of countries that are host to foreign banks. Annex Table 2.2.2 summarizes the results of the panel regressions from the perspective of the home country of international banks. For this specification, international banking linkages are

³⁰The authors of this annex are Pragyant Deb and Kai Yan.

³¹To be precise, the first measure is not exactly a subset of the second measure because cross-border claims are reported on an ultimate risk basis whereas international claims are compiled on an immediate risk basis. See Annex 2.1.

measured by the ratio of nondomestic claims of banks domiciled in the country to the total domestic banking sector assets of the country. International banking linkages are measured in two ways: (1) ratio of cross-border claims to domestic banking assets and (2) ratio of international claims (including both cross-border claims and local claims of affiliates in foreign currency) to domestic banking assets. Local claims in local currency are less relevant from a home country perspective and are therefore not considered in this analysis.

Bank-Level Analysis of the Stabilization Role of Foreign Banks

The analysis uses balance sheet data for a panel of banks during the period 1998–2013. The data set contains 25,568 domestic- or foreign-owned subsidiaries over 15 years, though the number of active banks for which balance sheet data are available is much smaller and varies from year to year.

The data set is constructed in two steps. First, subsidiary banks are matched with their parent banks using ownership data from 2007 to 2013 from Bankscope's ownership database, which is extended back to 1998 (Porter and Serra 2011). The data set includes commercial banks, savings banks, cooperative banks, and bank holding companies. Adjustments are made to correct for missing or incorrectly identified parents, when possible. Independent banks or banks with no parent are considered to be their own parent. Second, bank parents' and subsidiaries' financial statement data since 1998 are obtained from Bankscope. Balance sheet data are annual, as of year-end, and on a consolidated basis. Unconsolidated balance sheet data are used to control for subsidiaries' characteristics. Country-level data are the same as used in the macro-level analysis.

Observations that show an annual growth rate of loans of more than 100 percent are dropped. These observations are likely to correspond to newly estab-

lished subsidiaries operating for only a few months in their year of incorporation and represent fewer than 3 percent of the total number of observations.

The econometric specification is the following:

$$\begin{aligned} \Delta loan_{i,j,k,t} = & \alpha X_{i,t-1} + \rho foreign_i + \beta bankcrisis_{k,t} \\ & + \theta bankcrisis_{k,t} \times foreign_i + \delta bankcrisis_{k,t} \\ & \times X_{i,t-1} + \gamma bankcrisis_{k,t} \times X_{i,t-1} \times foreign_i \\ & + controls_{j,k,t} + \varepsilon_{i,j,k,t}, \end{aligned}$$

in which $foreign_i$ is a dummy variable equal to 1 if the bank is owned by a foreign bank. The variable $bankcrisis_{k,t}$ is now a dummy variable equal to 1 if the host country of the bank is having a banking crisis. In some specifications, $bankcrisis_{k,t}$ is replaced by a global financial crisis dummy, which equals 1 during the global financial crisis (2008–09). The term $X_{i,t-1}$ still denotes the bank-level characteristics of interest. We subtract the mean of $X_{i,t-1}$ from $X_{i,t-1}$ to facilitate the interpretation of the results. The two-way interaction terms can therefore be interpreted as the marginal impact of being in the treatment group (when the dummy is equal to 1) when the bank's characteristics are that of an average bank.

The coefficients ρ , θ , and γ are the focus of the analysis. A statistically significant ρ suggests that the lending behavior of foreign-owned subsidiaries differs on average from that of domestic banks. The coefficient θ measures the stabilization role played by foreign-owned subsidiaries during banking crises. The coefficient γ measures the way in which different characteristics of the parent bank or subsidiaries affect foreign subsidiaries' credit growth during crises. A negative and significant γ suggests that foreign-owned subsidiaries of a banking group with certain characteristics are less likely to support credit growth during financial crises.

The model is estimated with a standard fixed effects panel estimation method, with Driscoll-Kraay standard errors. Annex Table 2.2.3. reports the detailed results.

Annex Table 2.2.1. Credit Growth Panel Regressions from the Perspective of Host Countries of Foreign Banks

	International Banking Linkages Measured with					
	Cross-Border Claims		International Claims		Local Claims	
Real GDP Growth (year-over-year change, lagged)	0.26	0.31	0.35**	0.36**	0.34**	0.35**
Domestic Shock (average EDF)	-2.43*	-2.38	-2.29*	-1.19	-2.81**	-1.6
Global (foreign) Shock (VIX)	-12.99**	-17.19***	-11.19**	-13.35**	-12.00**	-14.03**
International Banking Linkages (lagged)	2.36***	2.10***	1.29**	1.25*	-1.47	-1.72
IBL × Domestic Shock	-4.43***	-4.97***	-3.37***	-3.44***	-0.77	-0.51
IBL × Global Shock	-2.26**	-0.15	-2.34***	-1.48	-0.76*	-1.14*
Domestic Crisis		-1.06		-2.27*		-2.35*
IBL × Domestic Shock × Domestic Crisis		12.22*		2.28		2.2
Global Crisis (2008–09)		1.98		1.78		1.77
IBL × Foreign Shock × Global Crisis		-1.96		-0.83		0.24
Number of Observations	1,486	1,486	2,174	2,174	2,135	2,135
Number of Countries	49	49	49	49	49	49
R ²	0.12	0.13	0.09	0.10	0.09	0.11

Source: IMF staff estimates.

Note: EDF = expected default frequency; IBL = international banking linkages; VIX = Chicago Board Options Exchange S&P 500 Volatility Index. The dependent variable is the quarterly growth in bank claims to the private sector. Country fixed effects are included, but not reported. Driscoll-Kraay standard errors are used to take into account potentially heteroscedastic and autocorrelated standard errors. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Annex Table 2.2.2. Credit Growth Panel Regressions from the Perspective of Home Countries of Foreign Banks

	International Banking Linkages Measured with	
	Cross-Border Claims	International Claims
Real GDP Growth (year-over-year change, lagged)	0.25	0.17
Domestic Shock (average EDF)	-2.64	-2.8
Global (foreign) Shock (VIX)	-13.99**	-15.69**
International Banking Linkages (lagged)	2.86	2.11
IBL × Domestic Shock	4.48	-0.05
IBL × Global Shock	19.49	25.39*
Number of Observations	749	1,250
Number of Countries	23	27
R ²	0.12	0.09

Source: IMF staff estimates.

Note: EDF = expected default frequency; IBL = international banking linkages; VIX = Chicago Board Options Exchange S&P 500 Implied Volatility index. The dependent variable is the quarterly growth in bank claims to the private sector. Country fixed effects are included, but not reported. Driscoll-Kraay standard errors are used to take into account potentially heteroscedastic and autocorrelated standard errors. * $p < 0.10$; ** $p < 0.05$.

Annex Table 2.2.3. Bank-Level Evidence on Foreign Bank Stabilization Role during Crises

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Loan Growth						
Host Country GDP Growth	0.52**	0.41***	0.43***	0.58***	0.35***	0.34***	0.54***
Domestic (host country) Banking Crisis	-16.46***	-20.02***	-19.97***	-21.12***			
Global Crisis	-6.92**				-10.35***	-11.42***	-13.76***
Foreign Ownership Dummy	4.35***	-0.82	-2.36	0.14	6.69*	4.41	3.89**
Domestic Crisis × Foreign	7.05***	3.06	4.00**	2.23*			
Global Crisis × Foreign	-8.59***				-7.22***	-5.54**	-4.85***
Parent Equity Ratio		62.95***			66.45***		
Foreign × Parent Equity Ratio		-38.08			-73.72		
Domestic Crisis × Parent Equity Ratio		-30.21*					
Domestic Crisis × Foreign × Parent Equity Ratio		126.05*					
Global Crisis × Parent Equity Ratio					-38.80		
Global Crisis × Foreign × Parent Equity Ratio					143.25***		
Parent Dependence on Ext. Funding			-0.36			0.61	
Foreign × Parent Dependence on Ext. Funding			-2.02**			3.42***	
Domestic Crisis × Parent Dependence on Ext. Funding			-1.46**				
Domestic Crisis × Foreign × Parent Dependence on Ext. Funding			-2.61				
Global Crisis × Parent Dependence on Ext. Funding						-3.48***	
Global Crisis × Foreign × Parent Dependence on Ext. Funding						-3.07**	
Subsidiary Local Funding Ratio				21.77***			11.18
Foreign × Subsidiary Local Funding Ratio				-8.00**			-8.87
Domestic Crisis × Subsidiary Local Funding Ratio				16.29***			
Domestic Crisis × Foreign × Subsidiary Local Funding Ratio				-0.18			
Global Crisis × Subsidiary Local Funding Ratio							26.08***
Global Crisis × Foreign × Subsidiary Local Funding Ratio							-9.41
Constant	18.35***	15.84***	15.90***	16.28***	16.12***	16.50***	18.37***
Observations	13,167	7,557	7,437	11,022	7,557	7,437	11,022
Number of Banks	2,031	1,491	1,471	1,751	1,491	1,471	1,751
R ²	0.14	0.10	0.10	0.13	0.09	0.09	0.14

Source: IMF staff calculations.

 Note: Ext. = external. The dependent variable is the annual growth rate of loans by banks. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Annex 2.3. Analysis of the Effect of International Banking Linkages on the Probability of a Banking Crisis³²

This annex summarizes the analysis of the effect of banking linkages on the incidence of banking crises using a discrete response model (probit). International banking linkages are measured as in Annex 2.2.

The dependent variable, host country banking crisis, is defined as in Laeven and Valencia (2013). Following the literature, the crisis variable takes the value 1 in the first year of a crisis, is set to missing for the subsequent two years (as banks are impaired in the aftermath of a banking crisis), and is zero in the noncrisis years.³³ The sample period covers the period 2002–13 (2005–13 when international banking linkages are measured with cross-border claims). The probit model takes the following form:

$$P(\text{hostcrisis}_{i,t}|X) = F(\alpha X_{i,t-1} + \beta IBL_{i,t-1} + \gamma \text{global shock}_t + \delta IBL_{i,t-1} \times \text{global shock}_t + \varepsilon_{i,t}),$$

in which $X_{i,t-1}$ denotes the set of variables used in the benchmark specification. Drawing on the crisis prediction literature, $X_{i,t-1}$ controls for credit growth in the run-up to the crisis, real GDP growth rate, foreign

exchange reserves, foreign debt, and the current account balance. These variables are obtained from the IMF's International Financial Statistics database. $IBL_{i,t-1}$ measures the level of international banking linkages in country i . The term global shock_t captures global (foreign) stress measured by the VIX. The Greek letters α , β , γ , and δ are parameters or vectors of parameters of the explanatory variables and their interactions, and $\varepsilon_{i,t}$ is the residual.

Annex Table 2.3.1 shows the detailed results from the probit regressions. Similar results are obtained using a logistic (or logit) regression model. Although these regressions include country-level control variables, they do not include country fixed effects. Whereas the inclusion of fixed effects biases the results of the probit regressions but not those of the logit regressions, the logit specification with fixed effects ignores all countries that did not have a crisis during the sample period, leaving a relatively small and potentially non-representative sample of countries. Including or substituting the measure of global stress with a dummy for the global financial crisis does not change the results.

The results are robust to the use of additional explanatory variables such as financial depth (measured by credit-to-GDP ratio and a more inclusive measure developed by IMF [forthcoming c]), government primary deficit, inflation, real effective exchange rate misalignment, and other country-level controls for governance and supervisory powers. In addition, alternate definitions of crises, derived from episodes of slowdown in GDP growth rates and domestic credit, yielded similar results.

³²The author of this annex is Pragyant Deb.

³³Minoiu and others (forthcoming) and Gourinchas and Obstfeld (2012) drop four years of observations after the crisis. This chapter uses only two years to account for quarterly frequency of the data and the shorter period under consideration.

Annex Table 2.3.1. Detailed Probit Regression Results

	International Banking Linkages Measured with					
	Cross-Border Claims		International Claims		Local Claims	
Real GDP Growth (year-over-year change, lagged)	-0.03	0.03	-0.05*	-0.01	-0.05*	-0.01
Credit Growth (lagged)	0.08***	0.05***	0.06***	0.04**	0.06***	0.04**
Foreign-Exchange-Reserves-to-GDP Ratio (lagged)	-2.59	-4.89*	-1.96	-3.02	-1.81	-2.94
Foreign-Debt-to-GDP Ratio (lagged)	0.39**	0.36*	0.48***	0.48***	0.43***	0.42**
Current-Account-Balance-to-GDP Ratio (lagged)	-0.14***	-0.15***	-0.16***	-0.17***	-0.15***	-0.17***
International Banking Linkages (lagged)	0.16	0.29	0.19	0.31	-0.14	-0.69
Global (foreign) Shock (VIX)		7.26***		6.36***		5.78***
IBL × Global Shock		-0.86		-0.82		-6.57
Observations	1,324	1,284	1,840	1,800	1,792	1,753
Number of Countries	46	46	46	46	45	45
Chi-squared	41.78	44.60	47.51	59.72	46.51	62.54

Source: IMF staff estimates.

Note: IBL = international banking linkages; VIX = Chicago Board Options Exchange S&P 500 Implied Volatility Index. Banking crises are defined as in Laeven and Valencia (2013). The estimates are derived from a random effects panel probit model. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

References

- Allen, Franklin, Thorsten Beck, Elena Carletti, Philip Lane, Dirk Schoenmaker, and Wolf Wagner. 2011. *Cross-Border Banking in Europe: Implications for Financial Stability and Macroeconomic Policies*. London: Center for Economic and Policy Research.
- Bailey, Natalia, Sean Holly, and Hashem Pesaran. Forthcoming. “A Two Stage Approach to Spatiotemporal Analysis with Strong and Weak Cross-Sectional Dependence.” *Journal of Applied Econometrics*.
- Barth, James R., Gerard Caprio, and Ross Levine. 2013. “Bank Regulation and Supervision in 180 Countries from 1999 to 2011.” Working Paper No. 18733, National Bureau of Economic Research, Cambridge, Massachusetts.
- Berkmen, Pelin, Gaston Gelos, Robert Rennhack, and James Walsh. 2012. “The Global Financial Crisis: Explaining Cross-Country Differences in the Output Impact.” *Journal of International Money and Finance* 31 (1): 42–59.
- Bernanke, Ben S. 2005. “The Global Saving Glut and the U.S. Current Account Deficit.” Remarks at the Sandridge Lecture, Virginia Association of Economists, Richmond, Virginia, March 10.
- Bremus, Franziska, and Marcel Fratzscher. 2014. “Drivers of Structural Change in Cross-Border Banking since the Global Financial Crisis.” Discussion Papers of DIW Berlin 1411, German Institute for Economic Research, Berlin.
- Bruno, Valentina, and Hyun Song Shin. Forthcoming. “Cross-Border Banking and Global Liquidity.” *Review of Economic Studies*.
- Cerutti, Eugenio. 2013. “Banks’ Foreign Credit Exposures and Borrowers’ Rollover Risks: Measurement, Evolution, and Determinants.” Working Paper No. 13/9, International Monetary Fund, Washington.
- Cerutti, Eugenio, Stijn Claessens, and Patrick McGuire. (2012). “Systemic Risks in Global Banking: What Can Available Data Tell Us and What More Data Are Needed?” BIS Working Papers No. 376, Monetary and Economic Department, Bank for International Settlements, Basel, Switzerland.
- Cetorelli, Nicolas, and Linda S. Goldberg. 2011. “Global Banks and International Shock Transmission: Evidence from the Crisis.” *IMF Economic Review* 59 (1): 41–76.
- . 2012. “Banking, Globalization and Monetary Transmission.” *Journal of Finance* 67 (5): 1811–43.
- Claessens, Stijn, and Luc Laeven. 2004. “What Drives Bank Competition? Some International Evidence.” *Journal of Money, Credit, and Banking* 36 (3): 563–83.
- Claessens, Stijn, and Neeltje van Horen. 2014. “The Impact of the Global Financial Crisis on Banking Globalization.” Working Paper No. 14/197, International Monetary Fund, Washington.
- Cull, Robert, and María Soledad Martínez Pería. 2010. “Foreign Bank Participation in Developing Countries. What Do We Know about the Drivers and Consequences of This Phenomenon?” Policy Research Working Paper 5398, World Bank, Washington.
- De Haas, Ralph, and Iman van Lelyveld. 2006. “Foreign Banks and Credit Stability in Central and Eastern Europe. A Panel Data Analysis.” *Journal of Banking and Finance* 30 (7): 1927–952.
- . 2010. “Internal Capital Markets and Lending by Multinational Bank Subsidiaries.” *Journal of Financial Intermediation* 19 (1): 1–25.
- Demirgüç-Kunt, Asli, and Enrica Detragiache. 2002. “Does Deposit Insurance Increase Banking System Stability? An Empirical Investigation.” *Journal of Monetary Economics* 49 (7): 1373–406.
- Demirgüç-Kunt, Asli, Ross Levine, and Hong-Ghi Min. 1998. “Opening to Foreign Banks: Issues of Stability, Efficiency, and Growth.” In *The Implications of Globalization of World Financial Markets*, edited by Seongtae Lee. Seoul: Bank of Korea.
- Detragiache, Enrica, Thierry Tresselt, and Poonam Gupta. 2008. “Foreign Banks in Poor Countries: Theory and Evidence.” *Journal of Finance* 63 (5): 2123–60.
- Fiechter, Jonathan, İnci Ötker-Robe, Anna Ilyina, Michael Hsu, André Santos, and Jay Surti. 2011. “Subsidiaries or Branches: Does One Size Fit All?” Staff Discussion Note No. 11/04, International Monetary Fund, Washington.
- Figuet, Jean-Marc, Thomas Humblot, and Delphine Lahet. 2015. “Cross-Border Banking Claims on Emerging Countries: The Basel III Banking Reforms in a Push and Pull Framework.” *Journal of International Financial Markets, Institutions, and Money* 34: 294–310.
- Financial Stability Board (FSB). 2010a. “FSB Framework for Strengthening Adherence to International Standards.” Financial Stability Board, Basel.
- . 2010b. “Promoting Global Adherence to International Cooperation and Information Exchange Standards.” Financial Stability Board, Basel.
- . 2014. “Structural Banking Reforms.” Financial Stability Board, Basel.
- Forbes, Kristin. 2014. “Financial ‘Deglobalization’? Capital Flows, Banks, and the Beatles.” Speech at Queen Mary University, London, November 18.
- Giannetti, Mariassunta, and Luc Laeven. 2012. “The Flight Home Effect: Evidence from the Syndicated Loan Market during Financial Crises.” *Journal of Financial Economics* 104 (1): 23–43.
- Gilchrist, Simon, Jae W. Sim, and Egon Zakrajšek. 2013. “Misallocation and Financial Market Frictions: Some Direct Evidence from the Dispersion in Borrowing Costs.” *Review of Economic Dynamics* 16 (1): 159–76.
- Goldberg, Linda. 2009. “Understanding Banking Sector Globalization.” *IMF Staff Papers* 56 (1): 171–97.
- Gourinchas, Pierre-Olivier, and Maurice Obstfeld. 2012. “Stories of the Twentieth Century for the Twenty-First.” *American Economic Journal: Macroeconomics* 4 (1): 226–65.
- Goyal, Rishi, Petya Koeva Brooks, Mahmood Pradhan, Thierry Tresselt, Giovanni Dell’Ariccia, Ross Leckow, Ceyla Pazarba-

- sioglu, and an IMF Staff Team. 2013. "A Banking Union for the Euro Area." IMF Staff Discussion Note No. 13/01, International Monetary Fund, Washington.
- Hoggarth, Glenn, John Hooley, and Yevgeniya Korniyenko. 2013. "Which Way Do Foreign Branches Sway? Evidence from the Recent UK Domestic Credit Cycle." Financial Stability Paper 22, Bank of England, London.
- Houston, Joel, Chen Lin, and Yue Ma. 2012. "Regulatory Arbitrage and International Bank Flows." *Journal of Finance* 67 (5): 1845–95.
- Ichiue, Hibiki, and Frederic Lambert. Forthcoming. "The Decline in Foreign Banking Claims: An Analysis with New Regulatory Survey Data." IMF Working Paper, International Monetary Fund, Washington.
- International Monetary Fund (IMF). 2013a. *Central, Eastern, and Southeastern Europe—Regional Economic Issues*, Washington, April.
- . 2013b. "Key Aspects of Macroprudential Policy." IMF Policy Paper, International Monetary Fund, Washington, June.
- . 2014a. "Cross-Border Bank Resolution: Recent Developments." IMF Policy Paper, Washington, June 2. <http://www.imf.org/external/np/pp/eng/2014/060214.pdf>.
- . 2014b. "The Financing of Infrastructure in Sub-Saharan Africa: A Changing Landscape." Chapter 3, *Regional Economic Outlook: Sub-Saharan Africa*, Washington, October.
- . 2014c. "Global Liquidity—Issues for Surveillance." IMF Policy Paper, International Monetary Fund, Washington, March 11. <http://www.imf.org/external/np/pp/eng/2014/031114.pdf>.
- . 2014d. "Staff Guidance Note on Macroprudential Policy." IMF Policy Paper, International Monetary Fund, Washington, December.
- . Forthcoming a. "From Banking to Sovereign Stress—Implications for Public Debt." IMF Policy Paper, International Monetary Fund, Washington.
- . Forthcoming b. "Pan-African Banks: Opportunities and Challenges for Cross-Border Oversight." African Department Paper, International Monetary Fund, Washington.
- . Forthcoming c. "Rethinking Financial Deepening: Stability and Growth in Emerging Markets." Staff Discussion Note, International Monetary Fund, Washington.
- Kapan, Tümer, and Camelia Minoiu. 2013. "Balance Sheet Strength and Bank Lending during the Global Financial Crisis." Working Paper No. 13/102, International Monetary Fund, Washington.
- Laeven, Luc, and Fabian Valencia. 2013. "Systemic Banking Crises Database." *IMF Economic Review* 61 (2): 225–70.
- Lam, Raphael. 2013. "Cross-Border Activity of Japanese Banks." Working Paper No. No. 13/235, International Monetary Fund, Washington.
- Lautenschläger, Sabine. 2014. "Start of the Single Supervisory Mechanism: From the Comprehensive Assessment to Day-to-Day Supervision." Speech at the Euro Finance Week, Frankfurt, November.
- McCauley, Robert, Patrick McGuire, and Götz von Peter. 2012. "After the Global Financial Crisis: From International to Multinational Banking?" *Journal of Economics and Business* 64 (1): 7–23.
- McGuire, Patrick, and Götz von Peter. 2009. "The US Dollar Shortage in Global Banking and the International Policy Response." BIS Working Paper 291, Bank for International Settlements, Basel.
- Minoiu, Camelia, Chanhyun Kang, V. S. Subrahmanian, and Anamaria Bera. Forthcoming. "Does Financial Connectedness Predict Crises?" *Quantitative Finance*.
- Ongena, Steven, Alexander Popov, and Gregory F. Udell. 2013. "'When the Cat's Away the Mice Will Play': Does Regulation at Home Affect Bank Risk-Taking Abroad?" *Journal of Financial Economics* 108 (3): 727–50.
- Peek, Joe, and Eric S. Rosengren. 2000. "Implications of the Globalization of the Banking Sector: The Latin American Experience." *Federal Reserve Bank of Boston Conference Series* 44 (June): 145–85.
- Porter, Nathan, and Cesar Serra. 2011. "Evidence from Cross-Border Banking Groups." In "Mapping Cross-Border Financial Linkages: A Supporting Case for Global Financial Safety Nets." IMF Strategy, Policy, and Review Department (June 1), International Monetary Fund, Washington.
- Reinhardt, Dennis, and Steven J. Riddiough. 2014. "The Two Faces of Cross-Border Banking Flows: An Investigation into the Links between Global Risk, Arms-Length Funding, and Internal Capital Markets." Working Paper 498, Bank of England, London.
- Rose, Andrew K. 2004. "Do We Really Know That the WTO Increases Trade?" *American Economic Review* 94 (1): 98–114.
- Saldías, Martín, and Ben Craig. Forthcoming. "Spatial Dependence and Data-Driven Networks of International Banks." Federal Reserve Bank of Cleveland Working Paper.
- Schnabl, Philipp. 2012. "The International Transmission of Bank Liquidity Shocks: Evidence from an Emerging Market." *Journal of Finance* 67 (3): 897–932.
- Schoenmaker, Dirk, and Wolf Wagner. 2011. "The Impact of Cross-Border Banking on Financial Stability." Tinbergen Institute Discussion Paper 11-054/DSF18.
- Viñals, José, and Erlend Nier. 2014. "Collective Action Problems in Macroprudential Policy and the Need for International Coordination." *Financial Stability Review* 18, Banque de France, Paris.
- Viñals, José, Jonathan Fiechter, Aditya Narain, Jennifer Elliott, Ian Tower, Pierluigi Bologna, and Michael Hsu. 2010. "The Making of Good Supervision: Learning to Say 'No.'" IMF Staff Position Note No. 10/08, International Monetary Fund, Washington.
- White, Halbert. 1980. "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity." *Econometrica* 48 (4): 817–38.

SUMMARY

Financial intermediation through asset management firms has many benefits. It helps investors diversify their assets more easily and can provide financing to the real economy as a “spare tire” even when banks are distressed. The industry also has various advantages over banks from a financial stability point of view. Nonetheless, concerns about potential financial stability risks posed by the asset management industry have increased recently as a result of that sector’s growth and of structural changes in financial systems. Bond funds have grown significantly, funds have been investing in less liquid assets, and the volume of investment products offered to the general public in advanced economies has expanded substantially. Risks from some segments of the industry—leveraged hedge funds and money market funds—are already widely recognized.

However, opinions are divided about the nature and magnitude of any associated risks from less leveraged, “plain-vanilla” investment products such as mutual funds and exchange-traded funds. This chapter examines systemic risks related to these products conceptually and empirically.

In principle, even these plain-vanilla funds can pose financial stability risks. The delegation of day-to-day portfolio management introduces incentive problems between end investors and portfolio managers, which can encourage destabilizing behavior and amplify shocks. Easy redemption options and the presence of a “first-mover” advantage can create risks of a run, and the resulting price dynamics can spread to other parts of the financial system through funding markets and balance sheet and collateral channels.

The empirical analysis finds evidence for many of these risk-creating mechanisms, although their importance varies across asset markets. Mutual fund investments appear to affect asset price dynamics, at least in less liquid markets. Various factors, such as certain fund share pricing rules, create a first-mover advantage, particularly for funds with high liquidity mismatches. Furthermore, incentive problems matter: herding among portfolio managers is prevalent and increasing.

The chapter does not aim to provide a final verdict on the overall systemic importance of the potential risks or to answer the question of whether some asset management companies should be designated as systemically important. However, the analysis shows that larger funds and funds managed by larger asset management companies do not necessarily contribute more to systemic risk: the investment *focus* appears to be relatively more important for their contribution to systemic risk.

Oversight of the industry should be strengthened, with better microprudential supervision of risks and through the adoption of a macroprudential orientation. Securities regulators should shift to a more hands-on supervisory model, supported by global standards on supervision and better data and risk indicators. The roles and adequacy of existing risk management tools, including liquidity requirements, fees, and fund share pricing rules, should be reexamined, taking into account the industry’s role in systemic risk and the diversity of its products.

Prepared by Hiroko Oura (team leader), Nicolás Arregui, Jonathan Beauchamp, Rina Bhattacharya, Antoine Bouveret, Cristina Cuervo, Pragnan Deb, Jennifer Elliott, Hibiki Ichiue, Bradley Jones, Yoon Kim, Joe Maloney, Win Monroe, Martin Saldias, and Nico Valckx, with contributions by Viral Acharya (consultant), and data management assistance from Min-Jer Lee, under the overall guidance of Gaston Gelos and Dong He.

Introduction

In recent years, credit intermediation has been shifting from the banking to the nonbank sector, including the asset management industry.¹ Tighter regulations on banks, rising compliance costs, and continued bank balance sheet deleveraging following the global financial crisis have contributed to this shift. In advanced economies, the asset management industry has been playing an increasingly important role in the financial system, especially through increased credit intermediation by bond funds.² For emerging markets, portfolio flows—many of which are channeled through funds—have shown steady growth since the crisis. Globally, the

¹In this chapter, the definition of the asset management industry includes various investment vehicles (such as mutual funds, exchange-traded funds, money market funds, private equity funds, and hedge funds) and their management companies (see Annex 3.1). Pension funds and insurance companies are excluded, as are other types of nonbank financial institutions.

²See October 2014 *Global Financial Stability Report*.

industry now intermediates assets amounting to \$76 trillion (100 percent of world GDP and 40 percent of global financial assets; Figure 3.1).

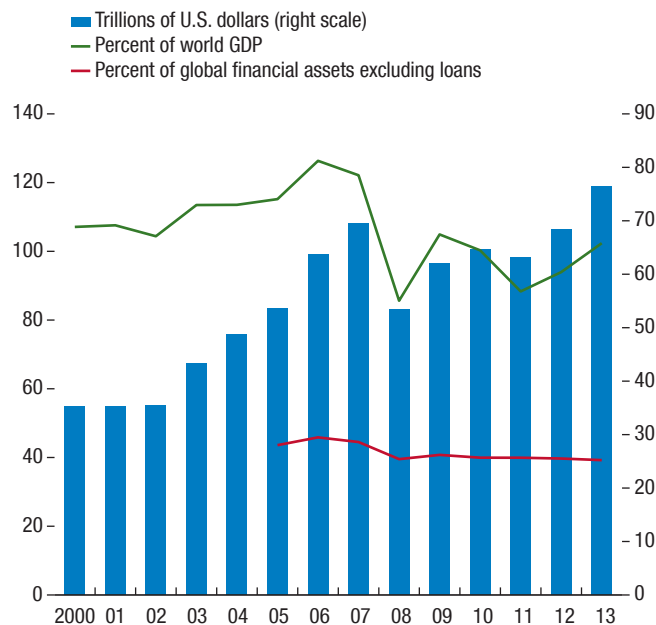
The larger role of the asset management industry in intermediation has many benefits. It helps investors diversify their assets more easily and can provide financing to the real economy as a “spare tire” even when banks are distressed. The industry also has advantages over banks from a financial stability point of view. Banks are predominantly financed with short-term debt, exposing them to both solvency and liquidity risks. In contrast, most investment funds issue shares, and end investors bear all investment risk (see Figure 3.2, and see Annex 3.1 for a primer on the industry). High leverage is mostly limited to hedge funds and private equity funds, which represent a small share of the industry.³ Therefore, solvency risk is low in

³However, these funds can still be a source of systemic risk, as shown during the Long-Term Capital Management episode in 1998. Mutual funds and exchange-traded funds do incur portfolio leverage

Figure 3.1. Financial Intermediation by the Asset Management Industry Worldwide

The asset management industry intermediates substantial amounts of money in the financial system.

1. World Top 500 Asset Managers' Assets under Management¹

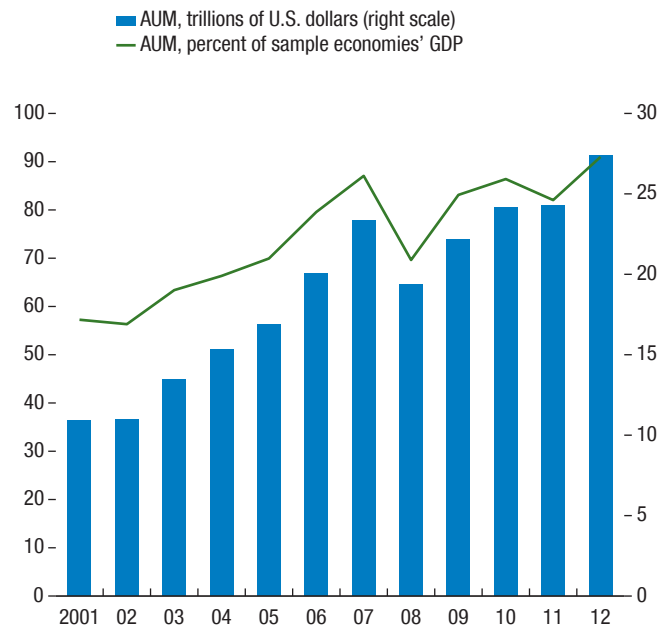


Sources: Bloomberg, L.P.; McKinsey (2013); Pensions and Investments and Towers Watson (2014); IMF, World Economic Outlook database; and IMF staff estimates.

¹The change of asset under management is determined both by valuation changes of underlying assets as well as net inflows to funds.

The growth of investment funds has been particularly pronounced among advanced economies during the past decade.

2. Size of Investment Funds in Selected Advanced Economies



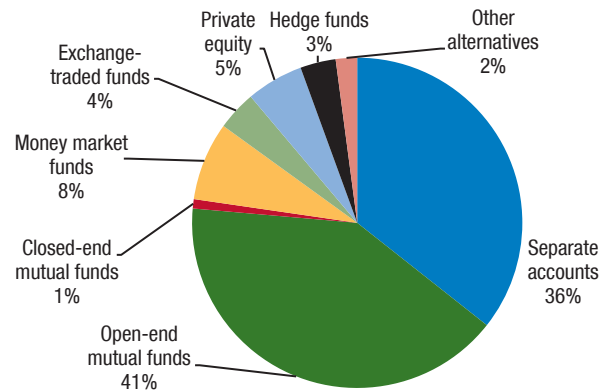
Sources: Organisation for Economic Co-operation and Development; and IMF World Economic Outlook database.

Note: AUM = assets under management. Economies comprise Canada, Germany, Ireland, Japan, Luxembourg, United Kingdom, and United States. Investment funds include mutual funds, money market funds, and exchange-traded funds.

Figure 3.2. Products Offered by Asset Managers and Their Recent Growth

Plain-vanilla products and privately offered separate account services dominate the markets as measured by assets under management.

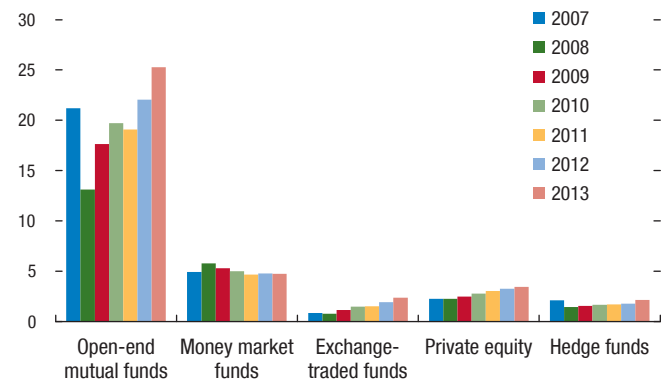
1. Asset Managers' Intermediation by Investment Vehicles
(Percent of \$79 trillion total assets under management, end-2013)



Sources: BarclayHedge; European Fund and Asset Management Association; ETFGI; Organisation for Economic Co-operation and Development; Pensions and Investments and Towers Watson (2014); Preqin; and IMF staff estimates.

Open-end funds, exchange-traded funds, and private equity funds have shown strong growth since the global financial crisis.

2. Recent Growth of Selected Investment Vehicles
(Assets under management in trillions of U.S. dollars)



Sources: BarclayHedge; European Fund and Asset Management Association; Organisation for Economic Co-operation and Development; Preqin; and IMF staff calculations.

most cases (see October 2014 *Global Financial Stability Report*). Intermediation through funds also brings funding cost benefits and fewer restrictions for firms compared with bank financing—it does, however, also expose firms to more volatile funding conditions, so the advantages have to be weighed against the risks.

Nevertheless, the growth of the industry has given rise to concerns about potential risks.⁴ By now, the assets under management of top asset management companies (AMCs) are as large as those of the largest banks, and they show similar levels of concentration.⁵ For emerging markets, the behavior of fund flows has for some time been a key financial stability concern, as extensively discussed in the April 2014 *Global Financial Stability Report*. Similarly, risks from hedge funds

through derivatives and securities lending, about which only limited information is disclosed. However, most publicly offered products have regulatory leverage caps that are generally much lower than those for banks (see Table 3.1).

⁴A report by the Office of Financial Research (2013) summarizing potential systemic risks emanating from the industry spurred an active discussion among academics, supervisors, and the industry. A large number of qualitative analyses on this topic (CEPS-ECMI 2012; Elliott 2014; Haldane 2014) are available, but comprehensive, data-based evidence is still limited.

⁵In this chapter, the term AMC does not include asset management companies set up to handle distressed assets in the context of bank restructuring and resolution.

and money market funds are already well recognized. However, the importance of “plain-vanilla” products is less well understood (Feroli and others 2014). At the individual fund level, plain-vanilla funds face liquidity risk: the shares of open-end mutual funds and exchange-traded funds are usually redeemable or tradable daily, whereas assets can be much less liquid. However, the extent to which such risks at the level of an individual institution can translate into systemic risk is subject to ongoing research and debate.

Potential systemic risks from less leveraged segments of the industry are likely to stem from price externalities in financial markets and their macro-financial consequences. Systemically important effects may arise if features of the industry tend to amplify shocks or increase the likelihood of destabilizing price dynamics in certain asset markets compared with a situation in which investors invest directly in securities. These effects can have broader economic implications. For example, if intermediation through funds raises the probability of fire sales of bonds that are held by key players in the financial sector or that are used as collateral, then the risk of destabilizing knock-on effects on other institutions rises, with potentially important macro-financial consequences. Similarly, if funds exacerbate the volatility of capital flows in and out of

emerging markets or increase the likelihood of contagion, significant consequences will be endured by the recipient economies.⁶

Some key features of collective investment vehicles may give rise to such destabilizing dynamics compared with a situation without intermediaries. Conceptually, it is important to distinguish clearly between the types of risks that result from the presence of intermediaries and those that are merely a reflection of the behavior of end investors and would occur in the absence of intermediaries (Elliott 2014). Two main risk channels that are important in this context, even for unleveraged funds, are (1) incentive problems related to the delegation of portfolio management decisions by end investors to funds, which, among other things, may lead to herding, and (2) a first-mover advantage for end investors (that is, incentives not to be the last in the queue if others are redeeming from a fund), which may result in fire-sale dynamics. These issues are discussed in detail in this chapter.

In recent years, the importance of such risks is likely to have risen in advanced economies because of structural changes in their financial systems. Not only has the relative importance of the asset management industry grown, but banks have also retrenched from

⁶Other risks include operational risks and risks related to securities lending, which are not discussed in detail in this chapter. See Cetorelli (2014).

many market-making activities, possibly contributing to a reduction in market liquidity (October 2014 *Global Financial Stability Report*). Consequently, large-scale trading by funds could potentially have a larger effect on markets than in the past. Moreover, the role of fixed-income funds has expanded considerably—and price disruptions in fixed-income markets have potentially larger consequences than large price swings in equity markets. The volume of products offered to the general public in advanced economies has grown considerably.⁷ Finally, the prolonged period of low interest rates in advanced economies has resulted in a search for yield, which has led funds to invest in less liquid assets, and is likely to have exacerbated the risks described above (October 2014 *Global Financial Stability Report*).

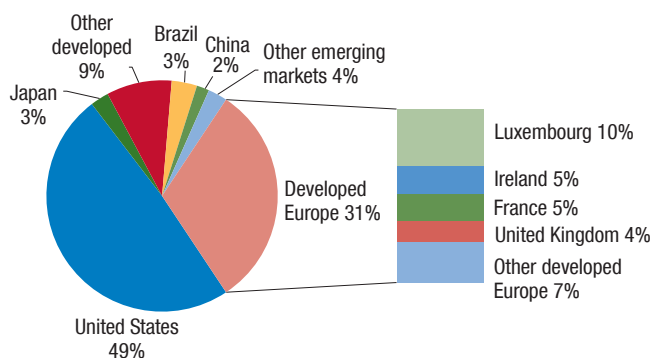
These considerations have sparked a policy discussion about intensifying oversight across advanced and emerging economies. In 2014, the Financial Stability Board (FSB) and International Organization of Securities Commissions (IOSCO) proposed assessment methodologies to identify investment funds that might be global systemically important financial institutions (G-SIFIs) and as such would be regulated differently from the others (FSB and IOSCO 2014). This proposal was revised in March 2015, and includes approaches for identifying both investment funds and asset managers as G-SIFIs (FSB and IOSCO 2015). Market regulators in major jurisdictions (Figure 3.3), such as the U.S. Securities and Exchange Commission (SEC), are considering revising their approach to the oversight of asset managers and the products they offer, including through stress testing requirements. This is a paradigm shift. Until recently, securities regulators have mainly focused on investor protection, with limited attention to financial stability risks.

This chapter aims to shed more light on the empirical relevance of these issues, thereby contributing to the understanding of the systemic risk implications of the asset management industry. This task is challenging given that the risks of concern have not yet or only partially materialized in advanced economies; inference, therefore, often has to be indirect. So far, the literature has only examined partial aspects of these problems in individual markets. This chapter provides an account of key risk profiles of the largest segments in the industry and an in-depth, original, data-based analysis of some of

⁷Retail investors are often seen to be less sophisticated and informed than institutional investors, and more prone to chase returns (Frazzini and Lamont 2008). This possibly exacerbates the incentive problems mentioned earlier.

Figure 3.3. Key Domiciles of Mutual Funds
(Mutual funds by domicile, percent of total assets under management, end-2014)

The mutual fund industry is dominated by U.S. and European funds. Among emerging market economies, Brazil has the largest fund sector.



Sources: European Fund and Asset Management Association; and IMF staff calculations.

the main issues featured in the public discussion, backed by interviews with asset managers and supervisors. The key questions are the following:

- What are the potential sources of financial stability risks from the asset management industry, particularly from the less leveraged, plain-vanilla segments?
- What is the empirical evidence on the various specific risk channels?
- What existing internal risk management and oversight tools can be used to mitigate financial stability risks? What needs to be done to better monitor and mitigate these risks?

The detailed empirical analysis finds evidence for many mechanisms through which funds can create and amplify risks, although their importance varies across asset markets:

- Mutual fund investments appear to affect asset price dynamics, at least in less liquid markets. The impact, however, does not seem to have risen over time. Assets that are held in a concentrated manner by funds perform worse during periods of stress.
- Various factors create run risk, including certain fund share pricing rules. To some extent, however, risks are mitigated by funds' liquidity management.
- The evidence points to the importance of incentive problems between end investors and portfolio managers. Herding among U.S. mutual funds has been rising across asset markets, particularly among retail-oriented funds (whose end investors are more fickle and for whom assessing the skills of portfolio managers is more difficult). The patterns of fund inflows by end investors also encourage poorly performing portfolio managers to take excessive risks.
- However, larger funds and funds belonging to larger AMCs do not necessarily contribute more to systemic risk. The investment *focus* appears to be relatively more important than *size* when gauging systemic risk.

Overall, the evidence calls for strengthening the microprudential supervision of risks and adopting macroprudential oversight of the industry:

- Currently, most securities regulators focus on investor protection and do not intensively supervise risks of individual institutions with the help of risk indicators or stress tests. This practice needs to be changed, supported by global standards on microprudential supervision and more comprehensive data.

- Moreover, macroprudential oversight frameworks should be established to address financial stability risks stemming from the industry. These stability risks originate in price externalities that can be missed by microprudential regulators and asset managers.
- The roles and adequacy of existing risk management tools, including liquidity requirements, fees, and fund share pricing rules, should be reexamined, taking into account the industry's role in systemic risk and the diversity of its products.

The chapter first lays out conceptual issues related to the nature of potential financial stability risks from the industry. Next, various empirical exercises are conducted to identify different behavioral patterns of mutual fund investors and their financial stability implications. The chapter then examines the industry's oversight framework and makes recommendations for reducing financial stability risks.

Financial Stability Risks of Plain-Vanilla Funds: Conceptual Issues

Plain-vanilla mutual funds and ETFs—the largest segment of the industry—do not suffer much from the known vulnerabilities of hedge funds and money market funds. Reforms are already underway to address risks related to hedge funds (which can incur high leverage and engage in complex strategies with few disclosure requirements) and money market funds (some of which offer redemptions at a constant nominal value per fund share, making their liabilities similar to deposits and vulnerable to runs). In general, these specific risks apply less to typical mutual funds and ETFs (Table 3.1 and Annex 3.1).

Risk Transmission Channels

Intermediation through plain-vanilla funds is, however, not risk free (Figure 3.4):⁸

⁸Apart from Table 3.1 and Annex 3.1, this chapter does not cover separate accounts in detail because of data limitations. However, SIFMA (2014) indicates that these accounts mainly invest in simple securities portfolios with little leverage. For pension fund and insurance company investors, separate accounts are bound by overall investment restrictions set by their respective regulators. Redemption risks appear to be limited as well because institutional investors tend to internalize the cost of their sales, and large redemptions can be settled in kind.

Table 3.1. Summary Characteristics and Risk Profiles of Major Investment Vehicles

Vehicle	2013 AUM (trillions of U.S. dollars)	Publicly Offered	Collective Investment Schemes	Typical Redemption and Trading Practice	Typical Settlement Method	Solvency Risk	Leverage through Borrowing ^{1,2}	Portfolio Leverage ² (Derivatives)	Main Investor Clientele	Disclosure Gap ³
Open-End Mutual Fund	25	Yes	Yes	End of day	Cash	Low	Possible with cap	Yes with cap	Retail, institutional	Low
Closed-End Mutual Fund	0.5	Yes	Yes	N.A. (primary) Intraday (secondary)	Cash	Low	Some yes with cap	Yes with cap	Retail, institutional	Low
Money Market Fund	4.8	Yes	Yes	End of day	Cash	Low	Possible with cap	Yes with cap	Retail, institutional	Low
Exchange-Traded Fund	2.3	Yes	Yes	Infrequent (primary) Intraday (secondary)	In kind (primary) Cash (secondary)	Low	Possible with cap	Yes with cap	Retail, institutional	Low
Synthetic ETF	0.1 ⁴				Cash	Low	Possible with cap	High derivative use	Institutional	
Private Equity Fund	3.5	No	Yes	N.A. (closed-end with long-term finite life)	Cash	High ⁵	Some yes, no cap	No information	Institutional	Medium
Hedge Fund	2.2	No	Yes	Quarterly + lock-up period + 90 days advance notice	Cash	High ⁵	High no cap	High no cap	Institutional	Medium
Separate Account ⁶	22 ⁷	No	No	No information	Cash or in kind	Low	No information ⁸	No information ⁸	Institutional	High

Sources: BarclayHedge; Deutsche Bank (2014); ETFGI; EFAMA (2014); ICI (2014a, 2014c); McKinsey (2013); Metrick and Yasuda (2011); Morningstar (2012); OFR (2013); Preqin; PriceWaterhouseCoopers (2013); and IMF staff estimates.

Note: AUM = assets under management; ETF = exchange-traded fund; N.A. = not applicable.

¹Borrowing includes issuing debt or taking bank loans.

²No cap means no regulatory cap, and with cap means there are regulatory caps on the leverage. For public funds in the United States, leverage is capped at 33 percent of assets including portfolio leverage. European Undertakings for Collective Investment in Transferable Securities (UCITS) funds can borrow up to 10 percent of assets, but only temporary borrowing is allowed and it should not be used for investment.

³Disclosure in this column is about securities, borrowing through loans, and cash holdings information. Across all products, there is very little information about derivatives and securities financing transactions (repurchase agreements and securities lending transactions), their counterparties, and collateral.

⁴The figure covers European-listed synthetic exchange-traded funds. Synthetic products are mainly seen in Europe and to a lesser extent in Asia. See Annex Table 3.1.1 for a description of synthetic products.

⁵In addition to taking leverage, these types of funds risk their own capital and balance sheets when investing given that they commingle client investors' money with their own money for investment.

⁶This is different from "separate account" used among insurance companies. See Annex Table 3.1.1 for description.

⁷The figure is based on the U.S. data reported in OFR (2013) and the European data reported in EFAMA (2014).

⁸Investment strategy should be in line with the mandate set by clients and their regulatory requirements (such as insurance and pension fund regulations).

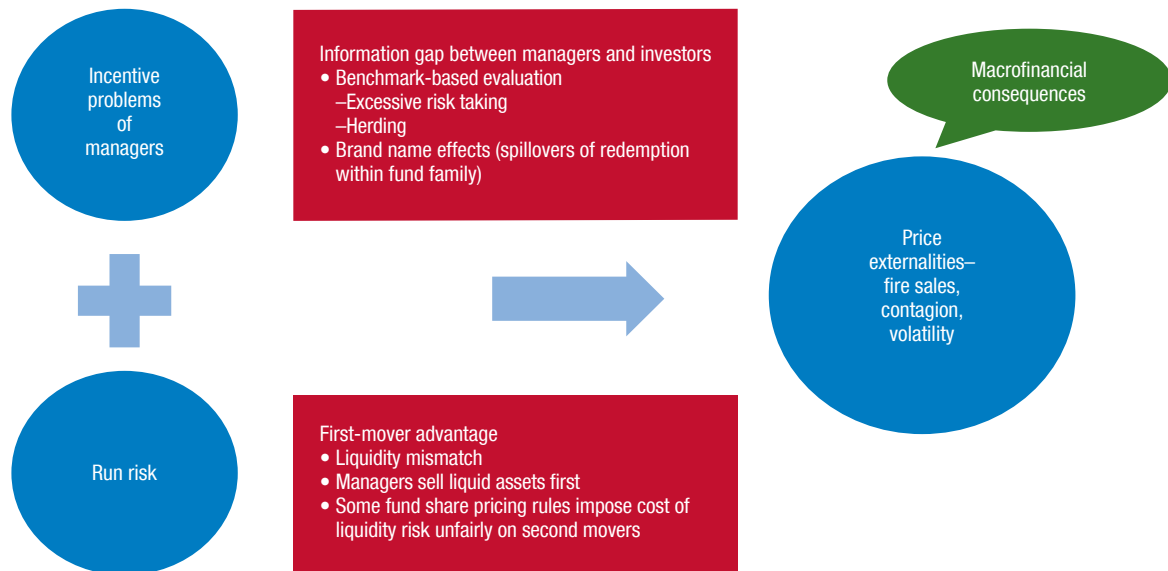
- The delegation of investment decisions introduces incentive problems between end investors and portfolio managers that can induce destabilizing behavior and amplify shocks. Investors delegate day-to-day portfolio management to portfolio managers. Investors cannot directly observe managers' daily actions or their skills, and therefore provide incentives to managers to act in investors' interests (Rajan 2005).⁹ A common (and imperfect) way of establishing

⁹Legally, asset managers have a duty to act as fiduciaries on behalf of their clients.

incentives is to evaluate funds relative to their peers and relative to benchmarks. This form of evaluation, in turn, can lead to a variety of trading dynamics with potentially systemic implications, such as herding or excessive risk taking (Box 3.1).^{10,11}

¹⁰Similarly, the same type of informational issues can make it difficult for investors to distinguish between problems at the fund level versus problems at the AMC level, possibly leading to "brand name" effects, in which operational and reputational concerns about one fund spill over to others in the same fund family.

¹¹Separate issues arise from passive, index-linked investing. Increasing investment of this form has been argued to distort asset

Figure 3.4. Unleveraged Open-End Funds and Systemic Risk

Source: IMF staff.

- Easy redemption options can create run risks due to a first-mover advantage.¹² Investors can have an incentive to exit faster than the others even without constant net asset value (NAV) or guaranteed returns if the liquidation value of fund shares declines as investors wait longer to exit. This decline in value could happen for various reasons. First, asset managers may use cash buffers and sell relatively more liquid assets first in the face of large redemptions. Second, certain funds have fund share pricing rules that pass the costs of selling assets—possibly at fire-sale prices—on to the remaining investors (Box 3.2). Such effects are intensified when funds are investing in relatively less liquid assets, and thereby create large mismatches between the market liquidity of assets and liquidity offered to end investors (October 2014 *Global Financial Stability Report*).¹³

prices and risk-return tradeoffs (Wurgler 2010 and Box 3.1). This chapter does not explore these issues.

¹²The incentive to redeem quickly is often referred to as “strategic complementarity,” and is similar to the mechanism behind bank runs (as in Diamond and Dybvig [1983]). More generally, problems related to the delegation of investment decisions or first-mover advantage are also present in other forms of financial intermediation, albeit to different degrees. For instance, pension funds and insurance companies face much lower redemption risks.

¹³A related issue concerns the pricing of infrequently traded securities. The October 2014 *Global Financial Stability Report* discusses some of the issues related to the so-called matrix pricing.

A large proportion of funds issue easily redeemable shares, and liquidity mismatches have been rising (Figures 3.5 and 3.6). Open-end funds are exposed to redemption risk because investors have the ability to redeem their shares (usually on a daily basis) while funds have increasingly been investing in relatively illiquid securities such as high-yield corporate bonds and emerging market assets.

Large-scale sales by funds may exert significant downward asset price pressures, which could affect the entire market and trigger adverse feedback loops. The effects on asset prices could have broader macrofinancial consequences, affecting the balance sheets of other actors in financial markets; reducing collateral values; and reducing credit financing for banks, firms, and sovereigns. The effects could also be spread unevenly across jurisdictions. For instance, the main impact of trades by funds domiciled in advanced economies could be felt in emerging markets (see April 2014 *Global Financial Stability Report* for details).

Although these potential risks and propagation channels are recognized as theoretical possibilities, there is disagreement about their importance in practice. Advanced economies have experienced few cases in which asset management activities outside of hedge funds and money market funds triggered or amplified

Box 3.1. Possible Incentive Problems Created by Delegated Management

The delegation of investment decisions introduces incentive problems between end investors and fund managers, which can induce destabilizing behavior and amplify shocks. As discussed in the primer on the asset management industry (Annex 3.1), end investors delegate day-to-day control of portfolios to managers. Investors cannot directly observe managers' abilities, nor do they see every single trade and portfolio position. Investors, therefore, provide incentives to asset managers to act in investors' interests (Rajan 2005). A common way of providing incentives is to evaluate asset managers relative to their peers and to benchmarks. This evaluation can take direct or indirect forms: (1) managers' compensation can be linked to relative performance (Ma, Tang, and Gomez 2013) or (2) investors inject money into funds that perform well relative to their benchmarks. The effect of the latter is similar to the effect of the former if compensation increases with assets under management (AUM). These incentive problems, in turn, can lead to a variety of dynamics with potentially systemic implications (Stracca 2006). More specifically, they can lead to the following:

- *Excessive risk taking*—If a fund's AUM grow more with good performance than shrink with poor performance, incentives are created to incur more risk when the fund is falling behind (Chevalier and Ellison 1997; Ferreira and others 2012; see the example in Table 3.1.1). Similar incentives exist in a “tournament” setting, in which funds are evaluated based on their interim performance (say, in the middle of the year) compared with peers (Basak, Pavlova, and Shapiro 2008).¹

- *Contagion*—By contrast, if fund managers become more risk averse in response to past losses, and if they are evaluated against their peers or benchmarks, they may be induced to retrench to the benchmark in response to losses. This behavior, in turn, can induce the transmission of shocks across assets and result in momentum trading (Broner, Gelos, and Reinhart 2006). See Calvo and Mendoza (2000), Chakravorti and Lall (2003), and Ilyina (2006) for other types of models linking benchmark-based compensation to contagion.
- *Herding, return chasing, and incentives to run*—Evaluation relative to average performance tends to induce risk-averse portfolio managers to mimic the behavior of peers (Scharfstein and Stein 1990; Arora and Ou-Yang 2001; Maug and Naik 2011). Incentives to herd are reinforced because end investors can exit funds quickly, and mutual fund managers cannot afford to wait until their peers' private information is revealed and incorporated fully in asset prices (Froot, O'Connell, and Seasholes 2001). Vayanos (2004) shows that when fund managers lose AUM because of poor performance, “flights to quality” may occur. Feroli and others (2014) construct a model in which performance evaluation relative to benchmarks creates incentives for fund managers to join sell-offs during downturns and chase yield during upturns. Buffa, Vayanos, and Woolley (2014) discuss theoretically how such benchmark-centric assessments can contribute to the buildup of bubbles.
- *Churning and noise trading*—Delegated portfolio management may induce managers to churn (engage

Table 3.1.1. An Illustrative Example of Asset Managers' Incentives for Risk Taking

Because investors reward winners more than they punish poor performers, it pays to take risks.

Options	Likelihood (percent)	Outcome: Change in Net Asset Value	Net Inflows to Fund (millions of U.S. dollars)	Additional Fee Income (1 percent of assets under management, in millions of U.S. dollars)
Benchmark Portfolio	100	Same as benchmark	0	0
	50	10% in excess of benchmark	100	1
Gamble	50	10% below benchmark	-20	-0.2
	Expected outcome		Same as benchmark	40

¹This is also known as the “risk-shifting” problem. More generally, risk shifting arises when earnings for managers are convex based on their compensation. Limited liability also contributes to the convexity of manager earnings. See Ross (2004) for a qualification of the payoff convexity argument. See also Massa and Patgiri (2009).

Box 3.1 (continued)

in noise trading) to signal their talent and superior knowledge, given that it is difficult to identify talent and effort (Allen and Gorton 1993; Dow and Gorton 1997; Dasgupta and Prat 2006).

- *Market depth and volatility*—Performance evaluation relative to a benchmark may lead to higher price volatility of securities that are included in the benchmark. Since information acquisition may be hindered by these relative-performance-based

contracts, the depth of the market may be reduced (Igan and Pinheiro 2012). Basak and Pavlova (2014) develop a general-equilibrium asset price model that incorporates incentives for institutional investors to do well relative to their index. The induced investment patterns create excess correlations among stocks belonging to an index. It also increases the volatility of index stocks and of the overall market.

Box 3.2. Fund Share Pricing Rules and First-Mover Advantage

Certain forms of fund share pricing can give rise to a first-mover advantage for investors to run. The key factor is how investment losses and trading costs are distributed between buy-and-hold and redeeming fund shareholders. If these are borne by the fund and therefore by the buy-and-hold shareholders, investors can recover more cash by redeeming early.

Inflexible net asset value (NAV) pricing can generate a first-mover advantage for an open-end mutual fund (Table 3.2.1). In the United States, funds issuing redeemable securities are required to sell, redeem, or repurchase such securities based on the NAV of the security “next computed” after receipt of the order. Transaction costs—trading fees, market

Table 3.2.1. Comparison of Fund Pricing Rules
(Millions of U.S. dollars)

Transactions	UCITS Swing Pricing (Full)	UCITS-AIF Dual Pricing	U.S. Open-End Mutual Fund (1940 Act)
Beginning NAV	100	100	100
Net Flows	-15	-15	-15
Purchases	+5	+5	+5
Redemptions	-20	-20	-20
Total Costs of Selling Assets (0.1 percent, including bid-ask spread)	0.015	0.015	0.015
Transaction Costs Incurred by Investors Purchasing Fund Shares	-0.005 ¹	0	0
Transaction Costs Incurred by Investors Redeeming Fund Shares	0.020	0.015	0
Transaction Costs Incurred by Fund and Remaining Investors	0	0	0.015 ²
Ending NAV	85.000	85.000	84.985
Memo	Estimated transaction costs borne by trading investors		Actual transaction costs borne by fund

Source: BlackRock (2014b).

Note: AIF = Alternative Investment Fund (European directive governing products including hedge funds and private equity funds); NAV = net asset value (mutual fund share price, per share); UCITS = Undertaking of Collective Investment in Transferable Securities (European Union directive governing publicly offered investment funds). In the United States, investment companies (as defined) are regulated primarily under the U.S. Investment Company Act of 1940.

¹Because fund NAV has swung to the bid price because of net redemptions, purchasing investors benefit to the extent that they purchase units that are cheaper than preswung NAV. This benefit is offset by the costs paid by redeeming clients.

²In certain circumstances, portfolio managers may choose to use cash buffers or borrow funds (or both) to meet redemptions without incurring transaction costs.

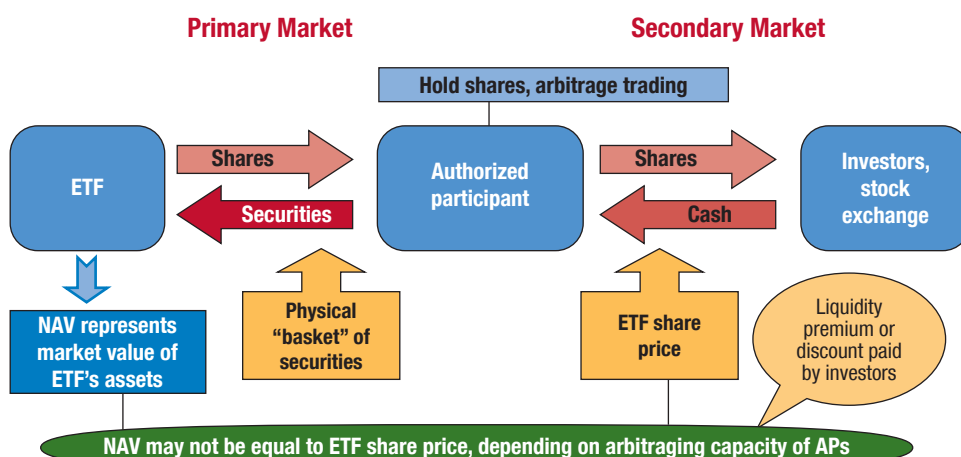
Box 3.2 (continued)

impact, and spread costs—are borne by the funds. This reduces a fund’s NAV, possibly by a substantial amount if market liquidity dries up. The European framework, in contrast, allows for pricing rules such as swing- or dual-pricing rules, as described in Table 3.2.1, that adequately impose transaction costs on redeeming shareholders instead of the fund. This helps reduce remaining shareholders’ incentive to run.

The share pricing practice of exchange-traded funds (ETFs) is different from that of open-end mutual funds. As shown in Figure 3.2.1 and Annex 3.1, ETFs do not directly transact with end investors. “Authorized participants”—typically major

broker-dealers—trade in between. Only authorized participants trade with ETFs in the primary market, and trades are usually settled in kind. Intraday liquidity to end investors is offered in the secondary market by authorized participants.¹ The key difference between ETFs and mutual funds in the context of first-mover advantage is that ETFs are not required to pay cash back to investors at NAV.² Authorized participants trade ETF shares with clients or on stock exchanges at the ETF share price determined in the secondary market. Therefore, depending on market conditions, an ETF’s share price could be higher or lower than the ETF’s indicative NAV.

Figure 3.2.1. Structure of Exchange-Traded Funds



Source: IMF staff.

Note: AP = authorized participant; ETF = exchange-traded fund; NAV = net asset value.

¹Although there is a widespread perception that ETFs face higher redemption risks because they offer intraday liquidity to shareholders, intraday liquidity (offered in the secondary market) is not the same as intraday redemption (offered in the primary market). Primary market activities, which result in fund flows, are much less frequent than secondary market trading (ICI 2014c; BlackRock 2014a).

²In the United States, ETFs operate with the Securities and Exchange Commission’s special exemption from the 1940 Act requirement that open-end funds repay redeeming shareholders at the next NAV calculated after an order is submitted (ICI 2014b).

Box 3.2 (continued)

Redeeming shareholders need to pay for the cost of market liquidity risk by accepting an ETF share price below NAV if market liquidity dries up. Authorized participants are usually arbitrageurs, and if they see a major gap between NAV and ETF share prices, they trade in the direction to close the gap. If investors find it easier to sell ETF shares relative to the underlying assets, this will tend to result in a discount to NAV. The discount can be accentuated when funding conditions reduce authorized participants' arbitrage capacity (Figure 3.2.2). The cost of "fire sales" of ETF shares is borne by the trading shareholders, not by the ETF or buy-and-hold shareholders, reducing buy-and-hold shareholders' incentive to run.

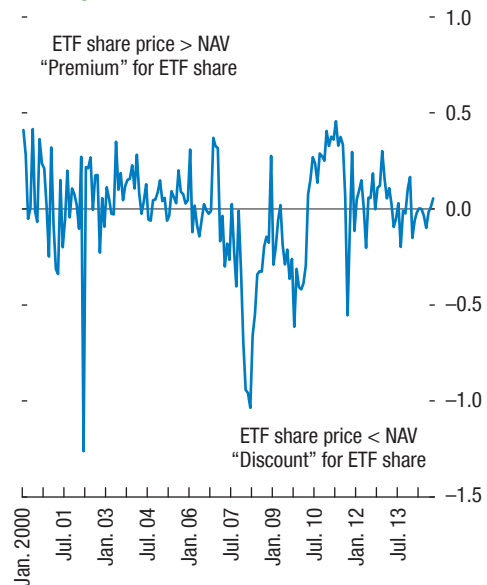
Economically, these flexible fund share pricing rules are similar to countercyclical redemption and purchase fees that reflect market liquidity cost and are added to NAV. If a U.S. 1940 Act fund imposes purchase and redemption fees that are retained by the fund³ and reflect the bid-ask spreads for transactions (or ETF NAV and share price gap), the outcome would be similar to that of funds with flexible share pricing rules. At the same time, such fees also help ensure equality between buy-and-hold investors and trading investors.

³Current U.S. rules do allow for the introduction of fees that are added to funds' NAV, which can then be distributed to remaining shareholders.

Figure 3.2.2. Difference between NAV and ETF Share Price

(Percent of NAV, all countries, equity funds)

The ETF share can be traded in the secondary market at a discount to NAV when markets are under generalized stress.



Sources: Bloomberg, L.P.; and IMF staff calculations.
Note: ETF = exchange-traded fund; NAV = net asset value.

systemic distress.¹⁴ The realization of brand risk and redemptions from PIMCO funds in September 2014 did not result in major disruptive market movements because, overall, bond funds continued to receive net inflows. However, the academic literature has documented contagion and amplification effects for some

¹⁴There have been some cases of non-money market mutual fund distress in emerging markets. For example, in 2001, a fund managed by Unit Trust of India, which was outside the ambit of the Securities and Exchange Board's jurisdiction, became unable to meet its obligations due to the absence of timely corrective action to bring the sale/repurchase price of the units in line with the fund's net asset value. With a risk of a run on the Unit Trust of India and possible adverse financial market impact, India's government came out with a rescue package. The total bail-out amounted to US\$76 million.

markets, in particular emerging markets.¹⁵ Moreover, recent structural shifts in many markets following the global financial crisis require a fresh review of the evidence.

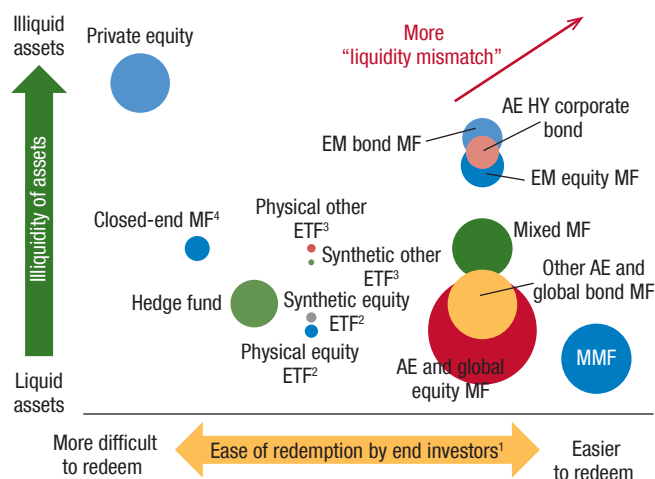
Against this backdrop, this chapter empirically explores the precise channels through which mutual funds and ETFs can affect financial stability. The aim

¹⁵In addition to the literature on emerging markets discussed in the April 2014 *Global Financial Stability Report*, various studies examine the role of funds in transmitting shocks across markets in advanced economies. Using U.S. data during the global financial crisis, Hau and Lai (2010) find that mutual funds helped transmit shocks from bank equities to nonfinancial firms' equities, and Mancini, Massa, and Yasuda (2012) find that mutual funds that incurred losses from securitized debt sold off corporate bonds, which induced a price impact on bonds held by these funds.

Figure 3.5. Liquidity Mismatches

(Size of bubbles represents relative global assets under management as of end-2013)

The mismatch between the redemption risk to funds and market liquidity of funds' assets is most notable among bond mutual funds—especially corporate and emerging market debt funds, though these are relatively smaller segments.



Sources: BarclayHedge; Deutsche Bank; ETFGI; European Fund and Asset Management Association; Lipper; Prequin; and IMF staff estimates.

Note: The liquidity ranking of assets is based on IMF staff's judgment. AE = advanced economy; EM = emerging market; ETF = exchange-traded fund; HY = high yield; MF = mutual fund; MMF = money market fund.

¹For ETFs, the ease-of-redemption measure ranks lower than that for open-end MFs (all MFs in the figure excluding closed-end MFs) because end investors do not directly redeem shares from funds (see Annex 3.1 and Box 3.2).

²Generally, equity derivatives markets are less liquid than cash equity markets.

³For bonds, especially corporate bonds, derivatives markets can offer better market liquidity than the cash bond market. For some firms, the notional principal for their credit default swaps is larger than their outstanding debt.

⁴Closed-end mutual funds tend to invest in relatively less liquid assets than open-end mutual funds (Chordia 1996; Deli and Varma 2002). Some funds may repurchase shares.

is not to provide a final verdict on the overall systemic importance of the potential risks, or draw definite conclusions about whether certain AMC's and their funds should be designated as SIFIs. Rather, the chapter carries out a quantitative analysis of a number of key risk transmission and amplification channels, testing some of the underlying hypotheses, and updating and complementing the existing literature. Given the current absence of a broad-based empirical assessment of the issues, this chapter fills an important gap. In particular, whereas most existing studies cover equity markets, the analysis here also covers bond markets. The chapter does not discuss all sources of risk. In particular, operational risks, risks related to hidden

leverage and securities lending, and issues related to resolution are only touched upon (FSOC 2014).¹⁶

Financial Stability Risks of the Mutual Fund Industry: Empirical Analysis

This section examines various aspects of potential financial stability risks using a wide range of macro- and micro-level data. Three main questions are explored. First, does fund investment affect asset price dynamics? Second, what determines fund flows and how do funds manage liquidity? And third, what is the degree of herding and interconnectedness, and what is the relationship between a fund's contribution to systemic risk and its size?¹⁷

Mutual Fund Investment and Asset Price Dynamics

Aggregate mutual fund flows and asset prices

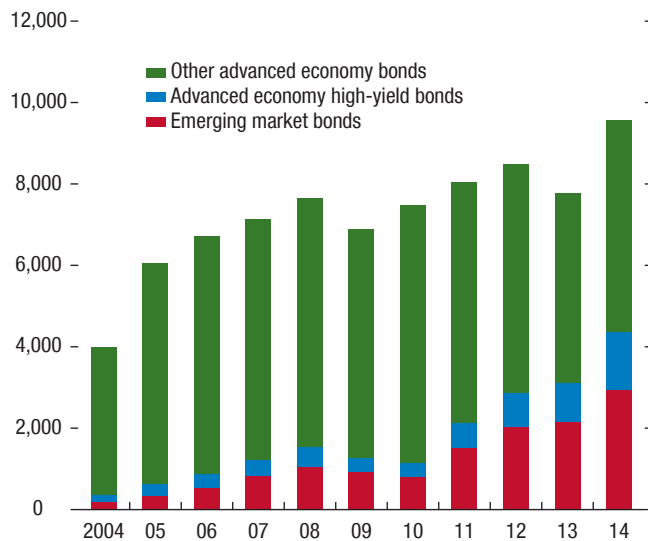
Do fund flows affect asset price dynamics in the United States and in emerging markets? For mutual funds to have a destabilizing effect, fund trades must first, at least in the aggregate, have an impact on prices. The literature suggests the existence of price pressures related to mutual fund flows.¹⁸ The analysis here updates and complements such findings, analyzing weekly net inflows to U.S. mutual funds investing in U.S. equities and various types of U.S. bonds, and their relationship to the respective market index returns. It also investigates mutual fund investment flows into bonds and equities in a number of emerging markets (see Annex 3.2 for details). The analysis goes

¹⁶Furthermore, the analysis in the chapter does not cover separate accounts held at funds.

¹⁷The main data sources for mutual funds are Lipper (a global mutual fund database with information at the fund level); the Center for Research in Security Prices (CRSP) U.S. mutual fund database (with security-by-security asset holdings information and details of fee structures); EPFR Global; and Lipper's eMaxx, which shows global mutual fund ownership of bonds at the security level.

¹⁸Studies include Warther (1995); Edelen (1999); Edelen and Warner (2001); Cao, Chang, and Wang (2008); and Ben-Raphael, Kande, and Wohl (2011). The main conclusion from these studies is that aggregate mutual fund flows affect contemporaneous stock returns. Coval and Stafford (2007) show that sudden increases or decreases in net flows to funds result in price pressure effects even in the extremely liquid U.S. equity market. Manconi, Massa, and Yasuda (2012) document a price impact on corporate bonds following sell-offs by funds. Similarly, Jotikasthira, Lundblad, and Ramadorai (2012) document that investor flows domiciled in developed markets induced fire sales in emerging markets, with a significant price impact. Feroli and others (2014) analyze several subsegments of bond fund flows, and find evidence for flow-price feedback loops, except for U.S. Treasuries.

Figure 3.6. Growth in Bond Funds by Investment Focus
(Assets under management of bond funds worldwide; billions of U.S. dollars)



Sources: Lipper; and IMF staff calculations.

beyond most of the literature by examining the price impact of the “surprise” component of fund flows, following Acharya, Anshuman, and Kumar (2014).^{19,20}

The evidence is consistent with mutual fund flows affecting asset returns in smaller, less liquid markets (Table 3.2). Surprise outflows are associated with lower same-week asset returns in emerging markets, and to a lesser extent in U.S. high-yield bond and municipal bond markets. The annualized price impact is not negligible: bond returns rise by about 5 percentage points when aggregate fund inflows are higher than the top 25th percentile, and fall by a similar magnitude for outflows exceeding the top 25th percentile across bond categories. In emerging markets, and also in the U.S. municipal bond market, the negative price effects from sell-offs tend to be larger than the positive price effects from purchases. The price impact of surprise flows is significantly larger when global risk aversion (as measured by the Chicago Board Options Exchange Market Volatility Index, or VIX) is high. More-

¹⁹As will be shown later in this chapter, mutual fund flows partly respond to past fund returns and are therefore partially predictable. Surprises are measured by the residuals of a standard vector autoregression model for flows and returns; see Annex 3.2.

²⁰In contrast to much of the literature, this analysis uses weekly, not monthly, data, which allows for better identification of the effects. Nevertheless, inference remains difficult at this frequency.

Table 3.2. Mutual Fund Flows and Asset Returns

	Emerging Markets		United States			
	Equity	Bond	Equity	All Bond	High-Yield Bond	Municipal Bond
Estimation Periods	2004–14	2004–14	2007–14	2007–14	2007–14	2007–14
Single Equation Model with Excess Asset Return as Dependent Variable						
Surprise flows have significant impact on returns	Yes	Yes	Yes in 2012–14	Yes in 2008–10	Yes*	Yes
Asymmetry: Impact of surprise inflows is different from impact of surprise outflows	Outflows have larger impact than inflows	Outflows have larger impact than inflows	Limited**	Inflows have larger impact than outflows	No	Outflows have larger impact than inflows
VIX sensitivity: Surprise flows have higher impact on returns when the VIX is high	Yes	Yes	Limited**	Limited**	Yes	Yes
Vector Autoregression with Unadjusted Flows and Returns						
Flows help predict returns	No	Yes	No	Yes***	No	Yes***

Sources: Bank of America Merrill Lynch; Morgan Stanley; Bloomberg, L.P.; EPFR Global; ICI; and IMF staff estimates.

Note: VIX = Chicago Board Options Exchange Market Volatility Index. Surprise flows are residuals from a vector autoregression model, VAR, with two endogenous variables (mutual fund flows into each asset class and representative benchmark asset returns for the respective market over the one-month Eurodollar deposit rate) and the VIX (contemporaneous and lagged) as an exogenous variable. Mutual fund flows to emerging markets are investment flows into each country from all mutual funds from various jurisdictions covered by EPFR Global. U.S. fund flows data are investors’ flows into mutual funds with a stated investment focus, covering funds domiciled in the United States. U.S. data are from Investment Company Institute, except for U.S. high-yield bond funds, which come from EPFR Global. Explanatory variables in the base single equation model include contemporaneous and lagged surprise flow, lagged excess return, the VIX, and the volatility of excess return (estimated with a generalized autoregressive conditional heteroskedasticity, GARCH, model). The model is estimated for the whole indicated period as well as rolling three-year periods in between. The results in the bottom line are based on generalized impulse responses.

*For the entire sample period, the results are not significant. However, three-year subperiod estimates show that the coefficient on contemporary surprise flows is always statistically significant and positive, but declines steadily over time. Limited ** indicates significance between the 5 percent and 10 percent significance levels. ***Indicates not robust to all specifications.

over, bond markets show evidence of nonlinearities, with unusually large surprise inflows or outflows associated with a disproportionate impact on bond returns. There is no evidence, however, for an increase in the price impact over time—if anything, the evidence across markets indicates a decline in the effect.²¹

The price impact pattern provides support for the existence of a first-mover advantage only in less liquid markets. Flows helping to predict price movements would be consistent with the presence of incentives to run.²² Such predictive power of flows is more likely to be present in less liquid markets. In line with this notion, the evidence indicates that flows have an impact on future returns of emerging market bonds, and to a lesser extent, in U.S. bond and municipal bond markets. For the latter two markets, however, the results are not robust across econometric specifications. Possibly, the considered aggregate bond categories may be too broad and too liquid to unambiguously pick up the effect.²³

Effect of mutual fund holdings and their concentration on bond yields

Does concentration of holdings among mutual funds matter during periods of stress? Some mutual funds have a large footprint in specific market segments, raising concerns that decisions by a few portfolio managers may have a large price impact in those markets. Since the global financial crisis, mutual fund bond holdings and their concentration have risen somewhat (Figure 3.7, panels 1 and 2).²⁴ The evidence in the literature suggests that concentration matters for stock price dynamics, in particular during periods of volatility.²⁵ This section investigates this issue further

²¹The evidence on contemporaneous price effects does not conclusively prove that fund flows drive returns. For example, fund flows and returns could both be driven by news. Still, this would leave the question open of why mutual fund flows behave distinctively (since not everybody can trade in the same direction in response to news).

²²The argument (as laid out in Stein [2014]) is that if outflows are first met with cash and the sale of more liquid assets, while less liquid assets are sold gradually, predictable downward pressure would be created on the prices of these less liquid assets. This, in turn, would create an incentive for end investors to pull out quickly if others are withdrawing.

²³See also Collins and Plantier (2014). Moreover, the effects are more likely to be present at times of stress, and are therefore not easily picked up in an estimation spanning a long period.

²⁴Concentration is measured by identifying, for each individual bond, the largest five investors among mutual funds. Alternative measures (top 10 investor holdings and Herfindahl index) yield similar results.

²⁵Greenwood and Thesmar (2011) report that fragility, measured by the concentration of mutual fund ownership of large U.S. stocks

using security-level bond ownership data, assessing whether mutual fund holdings and their concentration were correlated with the degree of bond yield changes around the global financial crisis and the taper shock in 2013, after controlling for bond-specific characteristics (see Annex 3.2 for details). The analysis goes beyond the literature to date by covering different asset markets, including corporate bonds for advanced economies, and corporate and public sector bonds for emerging market economies.

The findings suggest that larger mutual fund holdings and greater ownership concentration adversely affect bond spreads in periods of stress (Figure 3.7, panels 3 and 4). During the period of sharp price adjustments around the global financial crisis in 2008, bonds with larger fund ownership and those with a higher concentration of ownership experienced higher increases in credit spreads. Possibly, this is related to incentives to run created by funds. In the face of price drops of assets held by their fund, end investors may be induced to redeem quickly, for fear that they could be disadvantaged if they exit late. The effect was most pronounced among those securities with the highest initial spreads. This may suggest that funds either try to actively alter their holdings in a crisis by reducing exposures to riskier bonds, or are forced to sell riskier securities to meet investor redemptions. Investor concentration made bonds from emerging market and developing economies more vulnerable to the 2013 taper episode, but this was not the case for bonds from advanced economies.

Behavior of Fund Flows and Fund Liquidity Management

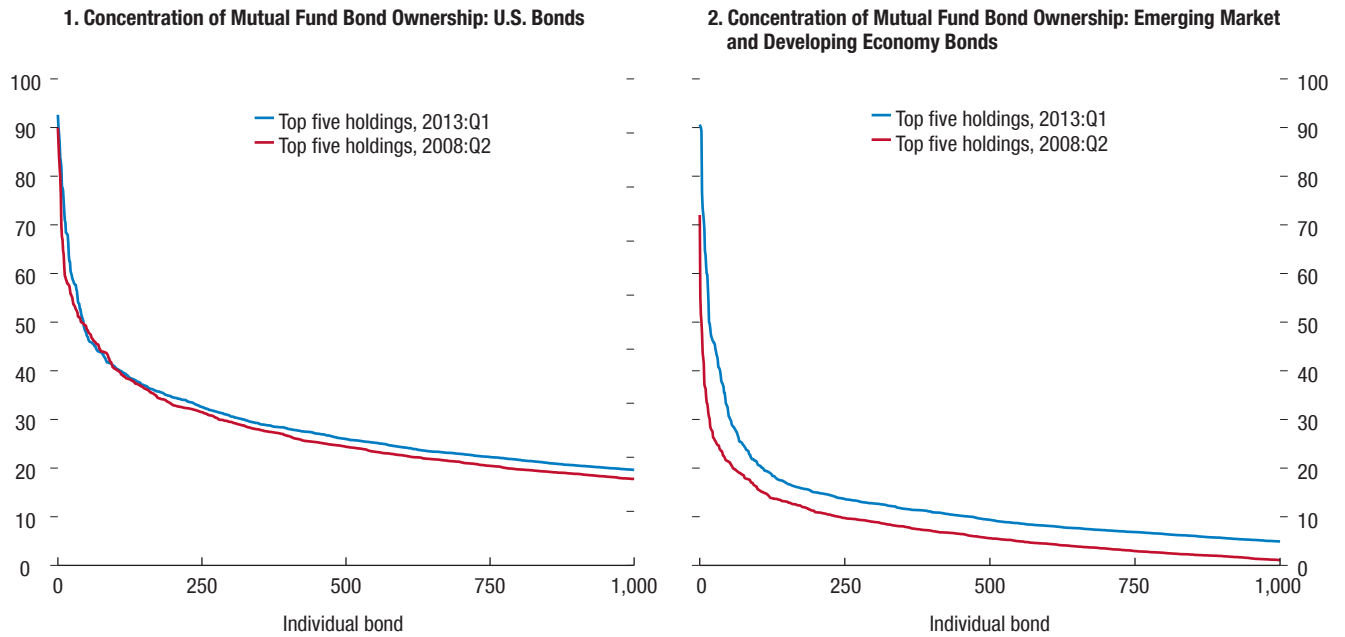
Roles of end investors and asset managers

Mutual fund investments are driven by the decisions of both end investors (fund flows) and asset managers (portfolio rebalancing). A fund's investment in a specific asset can increase either because the fund receives money from end investors that is proportionally allocated to all assets, or because the portfolio manager invests relatively more money into the asset (portfolio rebalancing). To ascertain the relative importance of each factor, the analysis compares the variances of (1) changes in the return-adjusted weights of each security in a fund's portfolio and (2) fund flows (see Annex 3.2). For U.S.-domiciled funds, the results indicate that about 70 percent of

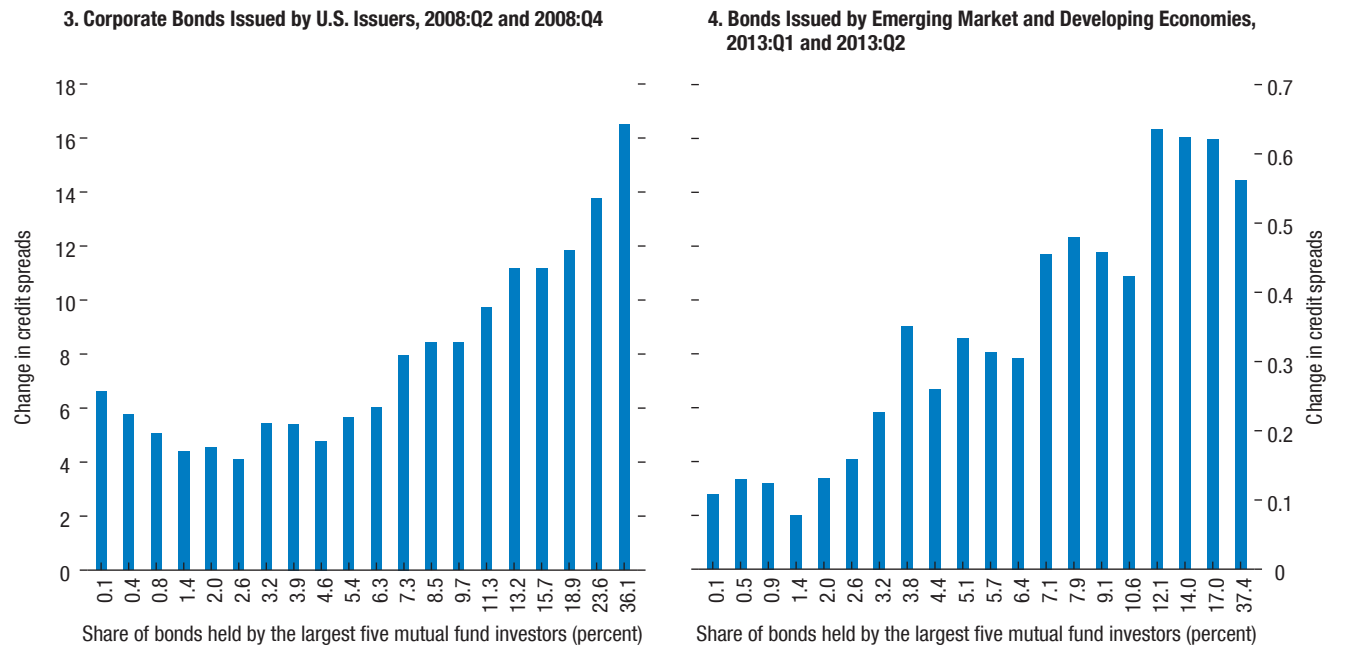
and the correlation of trading among investors, strongly predicts price volatility over 1990–2007. For Spanish stocks, Desender (2012) finds that ownership concentration is valued positively (negatively) by the stock market during down (up) market periods.

Figure 3.7. Bond Ownership Concentration and Its Effects on Credit Spreads

Mutual fund concentration in bond markets has increased somewhat since the global financial crisis.
(Share of individual bonds held by the five largest mutual funds in 2008 and 2013, percentage points)



Bonds with higher mutual fund holding concentration were more adversely affected during stress periods in 2008 and 2013.
(Increase in credit spreads by share of bonds held by the five largest mutual funds, percentage points)



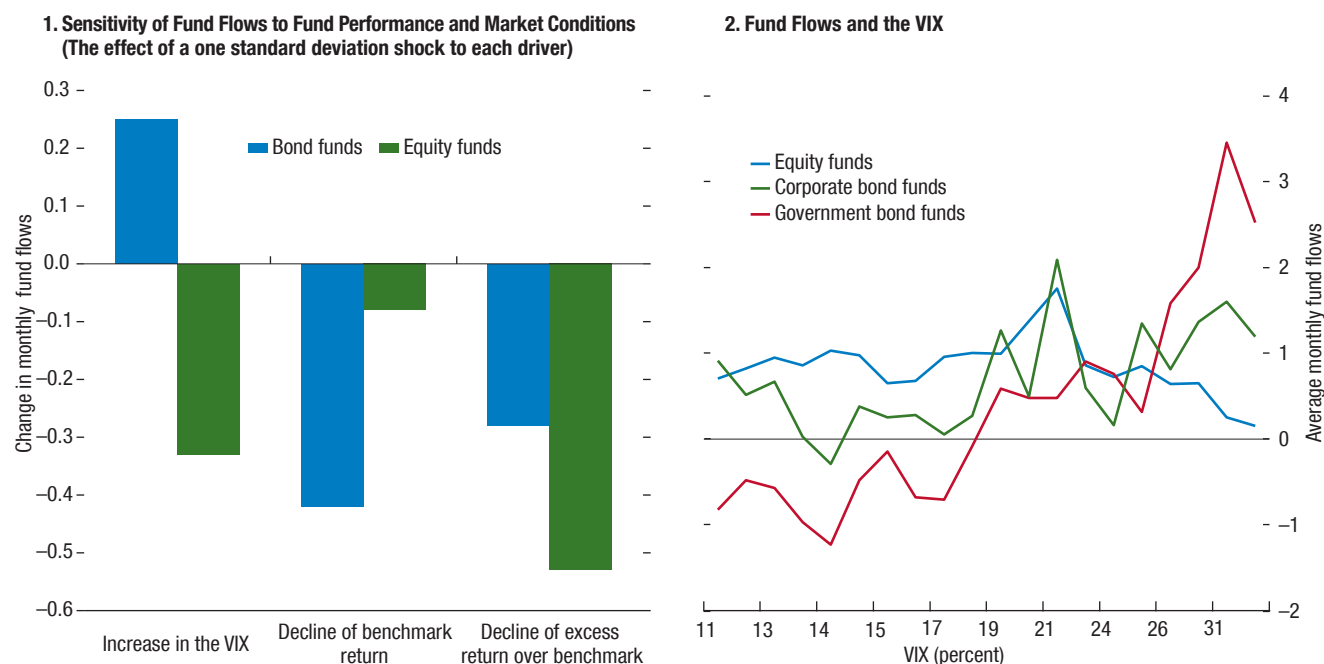
Sources: eMaxx; and IMF staff calculations.

Note: In all panels, holdings by the five largest mutual funds are identified for each individual bond. Bonds are sorted in different buckets on the horizontal axis according to the share of the bond held by the five largest mutual funds. The vertical axes in panels 3 and 4 show the average change in credit spreads (bond yields over benchmark government bond yields of the same currency and similar maturity) for bonds in each bucket, between 2008:Q2 and 2008:Q4, and 2013:Q1 and 2013:Q2, respectively.

Figure 3.8. Drivers of Fund Flows from End Investors
(Monthly fund flows, percent of total net assets)

Fund flows are strongly influenced by asset class performance, a fund’s own performance, and the VIX.

Periods with high VIX see a flight to quality from equity to bond funds, especially to government bond funds.



Sources: Bloomberg, L.P.; and IMF staff estimates. Additional data: Calculated based on data from the survivor-bias-free U.S. mutual fund database ©2014 Center for Research in Security Prices (CRSP®), The University of Chicago Booth School of Business.

Note: VIX = Chicago Board Options Exchange Market Volatility Index. Estimates in panel 1 are based on a regression of fund flows on the VIX, benchmark performance (lagged), excess performance over benchmark (lagged), age, and size. The model is estimated using share-class-level data covering 1998–2014. For more details on estimations and data, see Annex 3.2. Panel 2 splits observations into 20 quantiles based on the VIX. For each of these quantiles, the simple average for the VIX and fund flows is reported by type of fund.

the variance of funds’ flows into assets is attributable to managers’ decisions, with the remaining 30 percent attributable to end investors. This decomposition does not, however, take into account that, as discussed earlier, managers’ behavior is to a significant extent indirectly driven by the incentives provided by end investors, including through the pattern of inflows.

Determinants of fund flows

Given the importance of fund inflows for mutual fund investment and induced price effects, this section investigates the determinants of net fund injections by end investors. The analysis uses monthly net inflows for U.S. mutual funds and ETFs at the funds’ share-class level for open-end bond and equity funds, covering the period 1998–2014 (Annex 3.2).²⁶ Explanatory

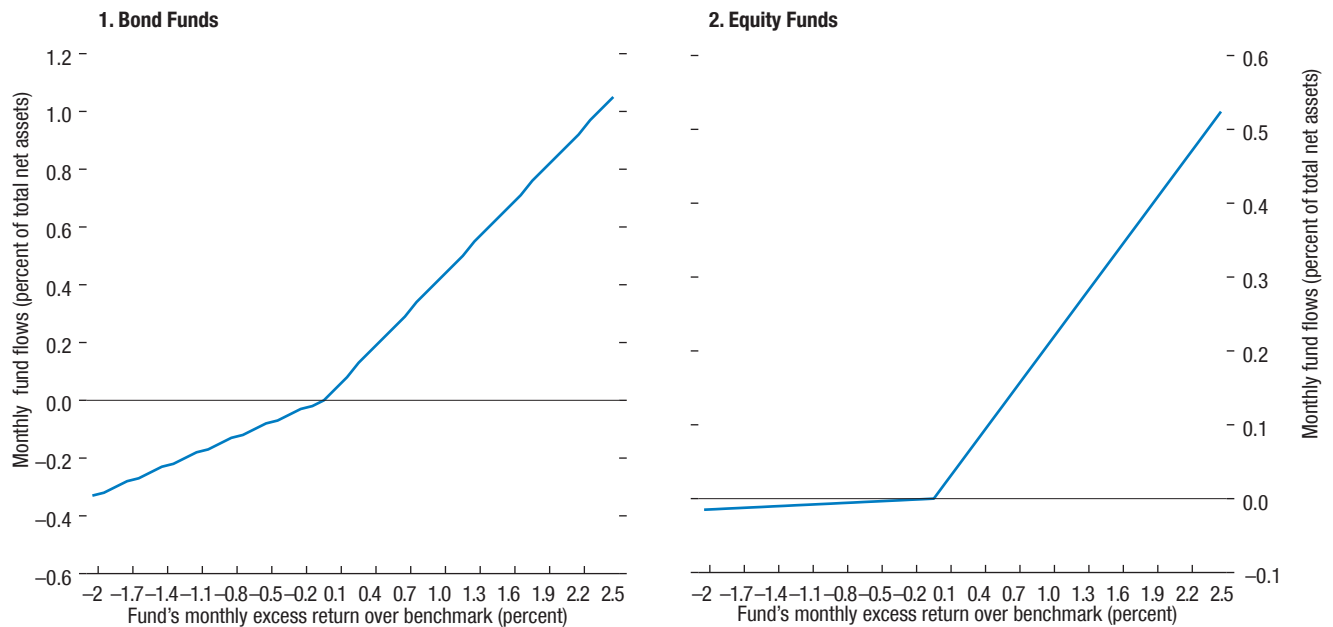
variables include fund performance (benchmark return and fund return in excess of the benchmark return), the VIX, fund characteristics (size, age, clientele) and structures (purchase and redemption fees, and dummies for index funds and for ETFs), and the liquidity of the underlying asset class.

End investors’ flows to funds, especially those from retail investors, are procyclical and display a “flight to quality” during times of stress (Figure 3.8):

- Fund flows increase after good market performance of the respective asset class. This indicates that investors pursue momentum strategies, increasing their allocation to asset classes that have performed well in the past, and selling past losers.
- End investors engage in a flight to quality during episodes of stress. As uncertainty (measured by the

²⁶A mutual fund can issue multiple classes of shares that only differ in the structure of various types of fees (FINRA 2011). The sample includes U.S.-domiciled open-end mutual funds and ETFs, irrespective of their investment focus. For instance, U.S. funds

investing in emerging market debt are included. The focus is on the United States because of data availability on fees, as a result of more comprehensive disclosure requirements.

Figure 3.9. Convexity of Fund Flow–Performance Relationship

Sources: Bloomberg, L.P.; and IMF staff estimates. Additional data: Calculated based on data from the survivor-bias-free U.S. mutual fund database ©2014 Center for Research in Security Prices (CRSP®), The University of Chicago Booth School of Business.

Note: Estimates in the two panels are based on a regression of net inflows on VIX, benchmark performance (lagged), excess performance over benchmark (lagged), and age. The model allows for different slopes for negative and positive values of excess performance over benchmark. The estimation uses share-class-level data covering 1998–2014. For more details, see Annex 3.2.

VIX) rises, end investors shift away from equity funds to bond funds, especially to sovereign bond funds. A closer look at subgroups of bond funds and emerging market assets reveals that investors also flee from corporate and emerging market bonds when the VIX rises.²⁷

- Relative performance is a main driver of fund inflows. This behavior by end investors provides incentives for herding, as discussed earlier.
- Investors disproportionately pour money into funds with strong recent performance, creating an incentive for managers of poorly performing funds to increase risks. Funds with excess returns over their benchmark receive disproportionately more inflows (Figure 3.9). In line with the existing evidence based on U.S. equity mutual fund data (Chevalier and Ellison 1997), investors inject money into winning funds to a greater extent than they punish poor performers (implying a convexity in the performance-inflow relationship). Thus, poorly performing fund managers have an incentive to take more risky bets (see Box 3.1

²⁷Based on similar analysis for funds (from all jurisdictions) investing in emerging market assets using EPFR Global. This is in line with the findings of the April 2014 *Global Financial Stability Report*.

for details). The convexity is weaker for bond funds. Similar to the findings in Ferreira and others (2012), an analysis for non-U.S. funds shows that convex patterns are observed in some but not all economies, with equity funds generally displaying more convexity.

Client types, fees, and to some extent the market liquidity of assets and fund characteristics influence the sensitivity of fund flows to performance (Figure 3.10):

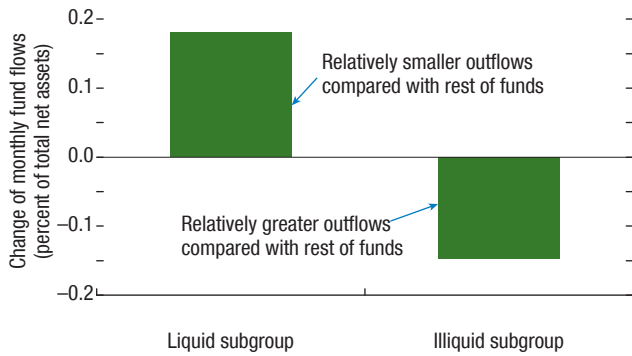
- Institutional investors appear to be less influenced by recent past performance. However, this result is not robust across all subperiods considered. Institutional investors are likely to be more sophisticated than retail investors, and findings in the April 2014 *Global Financial Stability Report* show that flows from institutional investors to emerging market assets are less sensitive to changes in the VIX.²⁸

²⁸However, in the presence of more fundamental financial and macroeconomic problems, institutional investors withdraw more aggressively than retail investors. For instance, Schmidt, Timmermann, and Wermers (2013) point out that institutional investors were the first ones to recognize problems with money market funds and instigated a run in 2009. The April 2014 GFSR finds that institutional investors sold off more when emerging market sovereigns were downgraded to below investment grade.

Figure 3.10. Liquidity Risk and Fund Structures

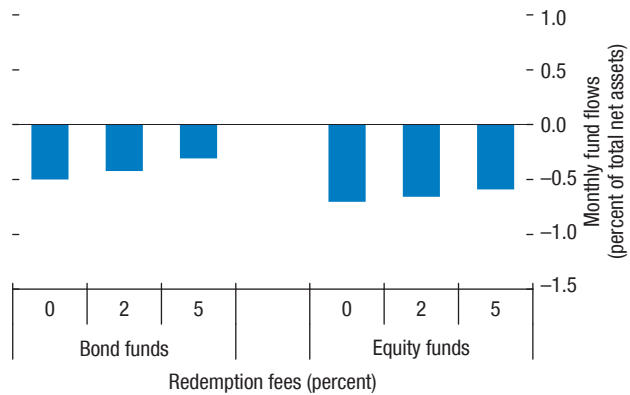
Among equity funds, fund flows of funds investing in liquid stocks are less sensitive to performance.

1. Relative Sensitivity of Equity Fund Flows to Performance
(Response of flows into liquid and illiquid funds to a one standard deviation decline in benchmark returns, difference with respect to rest of funds)



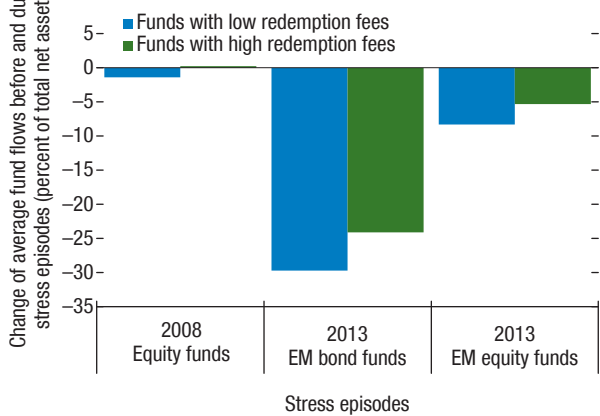
Redemption fees are effective in mitigating outflows.

2. Fund Flows by Redemption Fees
(The effect of a one standard deviation decline of returns)



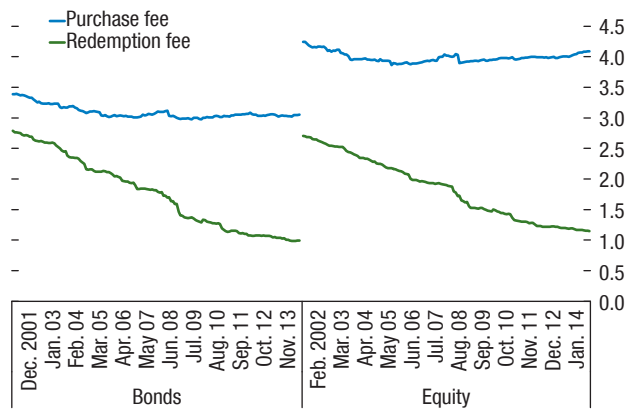
Redemption fees have helped mitigate redemptions during stress episodes, especially for emerging market funds.

3. Redemptions during Stress Episodes, by Redemption Fee Levels



However, mutual fund fees, especially redemption fees, have declined during the past 15 years because of competitive pressures in the industry.

4. Trend of Mutual Fund Fees
(Simple average, percent)



Source: IMF staff estimates. Additional data: Calculated based on data from the survivor-bias-free U.S. mutual fund database ©2014 Center for Research in Security Prices (CRSP®), The University of Chicago Booth School of Business.

Note: EM = emerging market; VIX = Chicago Board Options Exchange Market Volatility Index. Fees are maximum reported fees in the prospectus. Redemption fees include narrowly defined redemption fees and contingent deferred sales charges. Estimates in panels 1 and 2 are based on a regression of net inflows on the VIX, benchmark performance (lagged), excess performance over benchmark (lagged), age, size, and the reported fund characteristics (added one at a time) interacted with excess performance over benchmark (lagged). The estimation uses share-class-level data covering 1998–2014. Panel 3 computes the difference between average flows before the crisis period and average flows during the reported stress episodes (September to December 2008 for the global financial crisis, and May to September 2013 for the tapering episode). Fund flows are standardized by the beginning-of-period total net assets. Funds are classified as having low redemption fees if redemption fees are equal to zero. Funds are classified as having high redemption fees if redemption fees are greater than or equal to 3 percent in 2008 and 1 percent in 2013. For more details on estimations and data, see Annex 3.2.

- Fees are generally effective in dampening redemptions following short-term poor performance, though competitive pressures in the industry challenge their use. In particular, redemption fees appear to be effective. However, among bond funds, the effectiveness of fees appears to vary across fund types: the fees dampen redemptions for emerging market bond funds, but not for U.S. government bond or corporate bond funds. Moreover, competitive pressures and transparency requirements in the industry have driven down fees during the past 15 years (Figure 3.10, panel 4), which would make it difficult for individual funds to adopt adequate fees in line with their investment risk without sector-wide coordination or regulation.²⁹
- The sensitivity of redemptions to benchmark performance is larger for equity funds investing in less liquid stocks. This result is in line with the findings in Chen, Goldstein, and Jiang (2010) for U.S. equity funds. As discussed by Stein (2014), a higher redemption sensitivity of less liquid funds is consistent with the existence of a first-mover advantage. Although one would expect the evidence to be stronger for bond funds (because of their larger liquidity mismatches; Figure 3.5), that is not the case. One reason could be that bond funds with higher liquidity mismatches manage their liquidity risk more carefully, as discussed in the following section.

Brand name effects are present, albeit weak. This analysis examines 18 events in which a “flagship fund” of a large AMC experienced large redemptions (see Annex 3.2 for details). The test is whether funds in the fund family hit by the flagship shock experience larger outflows than similar funds not in the fund family. Out of the 18 events, 10 cases show statistically significant negative brand name effects, 3 cases show statistically positive effects, and the other 5 cases show no significant effects (Figure 3.11).

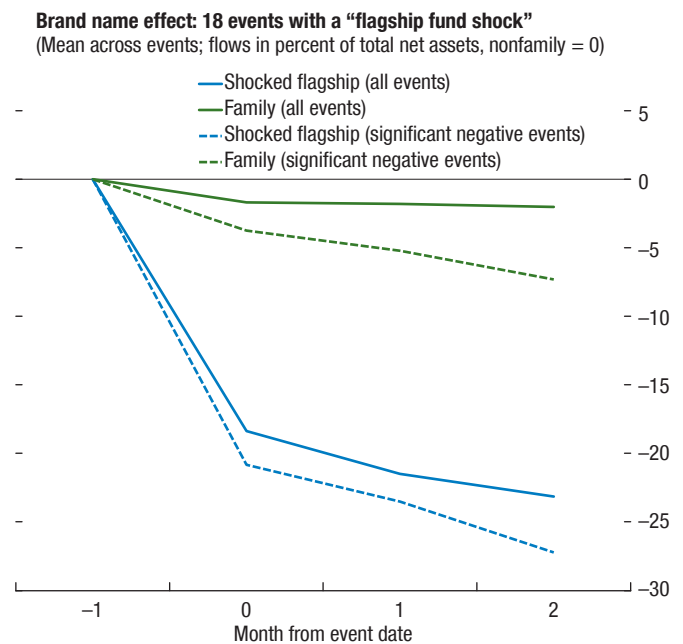
How do funds manage liquidity risks?

The effects of fund flows on fund investment can be cushioned by liquidity risk management. For instance, if a fund holds sufficient cash buffers when

²⁹Figure 3.10 shows the maximum charge reported in the fund’s prospectus. In practice, funds often offer discounts, reducing effective fees to much lower levels. ICI (2014b) reports that effective purchase fees declined from nearly 4 percent in 1990 to 1 percent in 2013.

Figure 3.11. Brand Name Effects

(Cumulative fund flows from event date in percent of total net assets, mean difference from median comparator funds)



Source: IMF staff estimates. Additional data: Calculated based on data from the survivor-bias-free U.S. mutual fund database ©2014 Center for Research in Security Prices (CRSP®), The University of Chicago Booth School of Business. Note: “Flagship shocks” for large asset management companies are identified as periods with large outflows from flagship funds (10 percentage points above those of the median of funds with shared investment objectives). Regression analysis for each of those events is used to test whether funds in the affected flagship family receive lower net inflows relative to nonfamily funds. See Annex 3.2 for details.

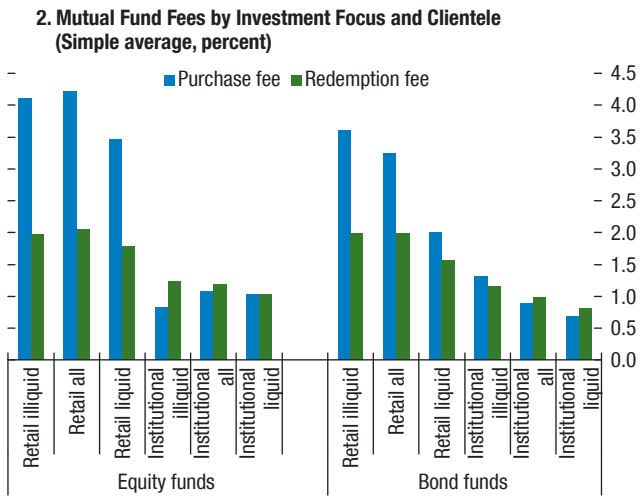
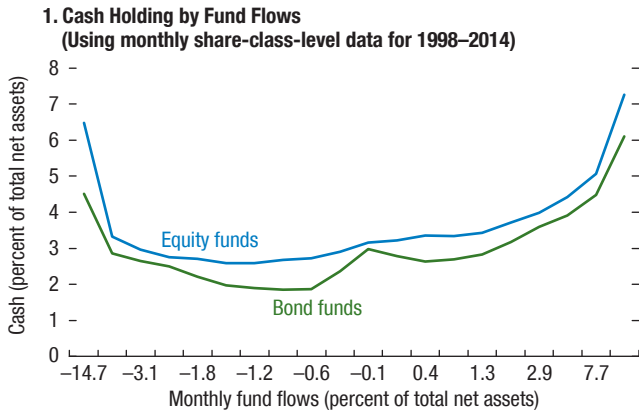
faced with large redemptions, the effect on sales pressures will be dampened. Moreover, funds’ share pricing rules and redemption policies can be designed to reduce redemption risks. Existing research (though somewhat old and focused on equity funds) shows that funds investing in illiquid assets tend to take the form of closed-end funds with no redemption risk, charge fees for fund share purchases and redemptions, and hold more cash (Chordia 1996; Deli and Varma 2002). This section looks at how fund managers use these tools to manage liquidity risks by examining their cash holding patterns in relation to flow volatility, current fund flows, and various fund characteristics, including liquidity of assets and client type (institutional or retail). In contrast to previous studies, the analysis here also covers bond funds and uses more recent data.³⁰

³⁰Funds can also manage liquidity using derivatives, something not studied here because of a lack of data.

Figure 3.12. Funds' Liquidity Risk Management

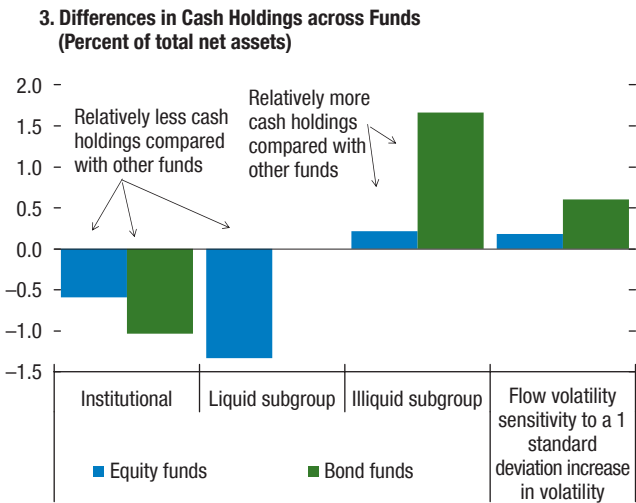
Cash holdings are high for those funds experiencing large inflows or outflows.

Funds charge higher fees to retail investors and when investing in illiquid assets...



...and hold more cash when investing in relatively illiquid assets, facing higher fund flow volatility. They hold less cash when they have predominantly institutional clients.

Generally, asset managers choose cash buffers and fee policies to limit liquidity risks, though competitive pressures have been reducing the use of redemption fees (Figure 3.12):



- Asset managers appear to actively manage their liquidity risks with precautionary cash buffers (Figure 3.12). Cash holdings are high for those funds experiencing very large outflows (in line with a precautionary motive) and inflows (presumably because managers take some time to fully invest new money). Estimation results confirm that funds also hold higher cash buffers when they face more volatile flows from investors and when these investors are primarily less stable retail investors. Similarly, cash holdings are higher for funds investing in relatively less liquid assets.
- Funds with higher liquidity risks tend to charge higher fees (Figure 3.12, panel 2). Fees are generally set lower for institutional investors. Funds investing in more illiquid assets tend to set higher fees than those investing in liquid assets.

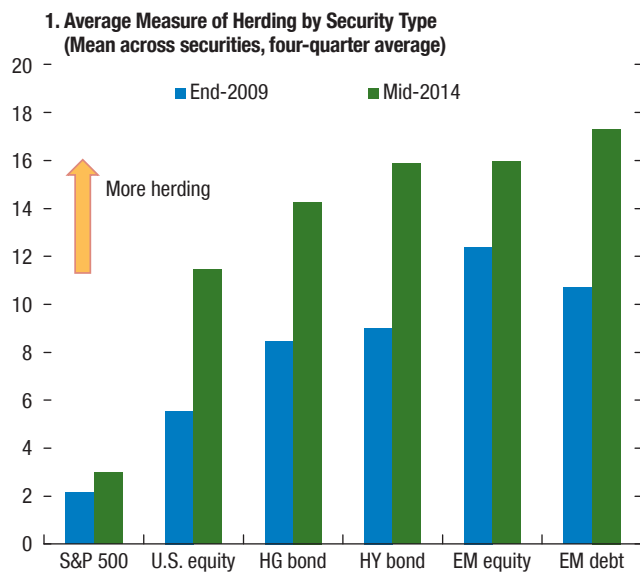
Herding, Interconnectedness, and Contribution to Systemic Risk

Herding (correlated trading)

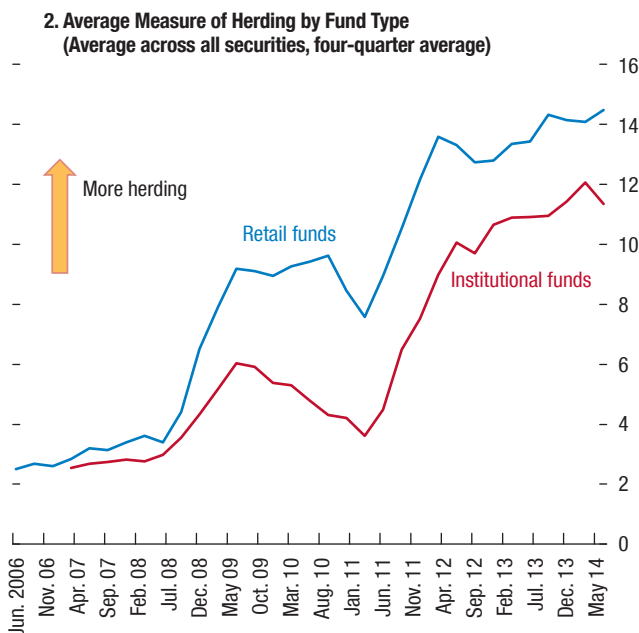
How prevalent is herding? Empirical evidence of mutual fund herding is abundant, although reported mag-

Figure 3.13. Herding among U.S. Mutual Funds
(Percent)

Recently, U.S. mutual funds have been herding more in U.S. equity and corporate bond markets.



Retail funds tend to herd more than institutional funds.



Source: IMF staff estimates. Additional data: Calculated based on data from the survivor-bias-free U.S. mutual fund database ©2014 Center for Research in Security Prices (CRSP®), The University of Chicago Booth School of Business.

Note: EM = emerging market; HG = high grade; HY = high yield. The herding measure is that proposed by Lakonishok, Shleifer, and Vishny (1992). It assesses the strength of correlated trading among mutual funds investing in each security, controlling for their overall trade trends (see Box 2.5 of April 2014 *Global Financial Stability Report*). Note that the market as a whole cannot trade in the same direction, since at any given time there must be a buyer for each seller. The measure is 0 when there is no sign of herding among mutual funds. It is calculated every quarter, looking at the fund-level activity in each security, and then averaged across securities. The measure is computed when there are at least five funds that changed the holdings of a security in each quarter for each security. The CRSP database contains security-by-security holdings of all U.S.-domiciled open-end mutual funds, covering more than 750,000 securities. To make the analysis computationally feasible, this chapter works with subsamples of securities that are randomly selected. Except for the S&P 500 sample, the herding measure is calculated with 50,000 randomly selected securities for each of the subgroups. In panel 1, the difference in herding across neighbor categories is statistically significant at the 5 percent confidence level, except for the case of EM debt versus EM equity, and HY bond versus HG bond. The difference in herding by fund type (panel 2) is significant at the 1 percent confidence level.

nitudes vary across markets (Grinblatt, Titman, and Wermers 1995; Wermers 1999; Borensztein and Gelos 2003; Choi and Sias 2009; Brown, Wei, and Wermers 2013). Using data on security-by-security holdings of U.S. open-end mutual funds, the degree of herding is measured using the method developed by Lakonishok, Shleifer, and Vishny (1992).³¹ This is a measure of correlated trading within this investor group. Even though it does not conclusively allow for an identification of

“herding” in a strict sense (namely, actions taken only because investors see other investors taking them), at a minimum it does provide an informative measure of the degree to which this class of investors moves together, regardless of the underlying reasons.

Herding among U.S. mutual funds is on the rise across fund styles (Figure 3.13). This finding is true for both U.S. equities and corporate bonds in recent years. For U.S. equities, mutual funds appear to co-move more during distress episodes. Retail-oriented funds show consistently higher levels of herding than do institutional-oriented funds. This could be because retail investors are more prone to quickly reallocate money from funds with poor recent performance to funds with high recent returns (Frazzini and Lamont 2008), possibly because it is more difficult for them than for institutional investors to assess and monitor portfolio managers. This difficulty in assessing and monitoring managers and the result-

³¹See Box 2.5 in the April 2014 *Global Financial Stability Report* for details. The Lakonishok, Shleifer, and Vishny (1992) index is a highly robust measure for detecting herding (in the sense of correlated trading patterns). It does, however, have a bias toward underestimating the magnitude of herding. Correcting for this bias is difficult and methods for doing so are the subject of ongoing debate. The downward bias increases with lower transaction numbers. Given that over the past five years, the data show a mild decline in the number of transactions per security, the results likely underestimate the true increase in herding shown in Figure 3.1.

ing volatility of inflows would exacerbate the role of incentive problems described earlier in driving herding behavior. The rise in herding coincides with the adoption of unconventional monetary policies in the United States, and could be related to an accentuated search for yield by mutual funds.³² Herding levels are higher for emerging market and high-yield assets and lowest for the S&P 500 market, consistent with the notion that herding is more likely to be prevalent in relatively more opaque and less liquid markets (Bikhchandani, Hirshleifer, and Welch 1992).

Linkages between parent asset management companies and funds

Mutual funds and most other investment vehicles have few direct solvency linkages with their AMCs. AMCs' own balance sheets are legally separated from those of the mutual funds they manage, as required by regulations.³³ This separation does not necessarily apply to other types of investment vehicles, though. For some hedge funds and private equity funds, AMCs' assets can be comingled with clients' assets. Another example of linkage is AMC parents' support for funds during crisis episodes. In 2008, because of reputational concerns, some financial institutions provided emergency liquidity support for money market funds and other fixed-income funds their group AMCs were managing (Moody's 2010).

Interconnectedness through ownership

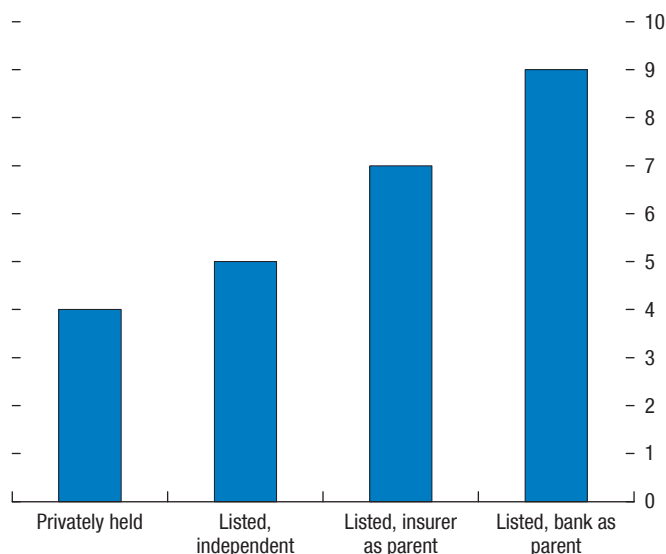
Banks and insurance companies are major owners of AMCs, and the overall stability implications of these arrangements are unclear (Figure 3.14). Without proper oversight of related-party exposures and concentrated exposures, funds could be used as funding vehicles for their AMC's parent banks.³⁴ Moreover, many such banks are G-SIFIs. These interrelationships increase the concentration of financial services providers across various subsegments of the financial sector, creating potentially very influential and complex mega conglomerates. Information sharing between a bank and its group AMC is another

³²For high-grade bonds, econometric estimates of the relationship between herding and proxies for unconventional monetary policy show a positive, albeit weak, link.

³³See Annex 3.1. AMCs' own balance sheets are also much smaller than the clients' money they manage (2 percent to 12 percent of assets under management for the top AMCs).

³⁴For instance, certain types of synthetic ETFs could be used by their AMCs' parent banks to obtain cash in exchange for collateral securities that banks do not want to keep on hand.

Figure 3.14. Ownership Structure of the 25 Largest Global Asset Management Companies (Number)



Sources: Pensions and Investments and Towers Watson (2014); and IMF staff calculations.

Note: Parent banks include Amundi, Bank of New York Mellon, BNP Paribas, Deutsche Bank, Goldman Sachs, HSBC, J.P. Morgan Chase, Natixis Global Asset Management, and UBS. Parent insurance companies include Allianz (for PIMCO), Axa, Metlife, Generali, Legal and General Group, and Prudential.

potential concern. Massa and Rehman (2008) provide evidence that such information sharing exists for banks and AMCs, most likely through informal channels. However, bank affiliation could also have effects that may be desirable from a financial stability point of view, including access to a central bank's emergency liquidity facility through AMCs' parent banks and more supervisory scrutiny.

Interconnectedness through bank funding

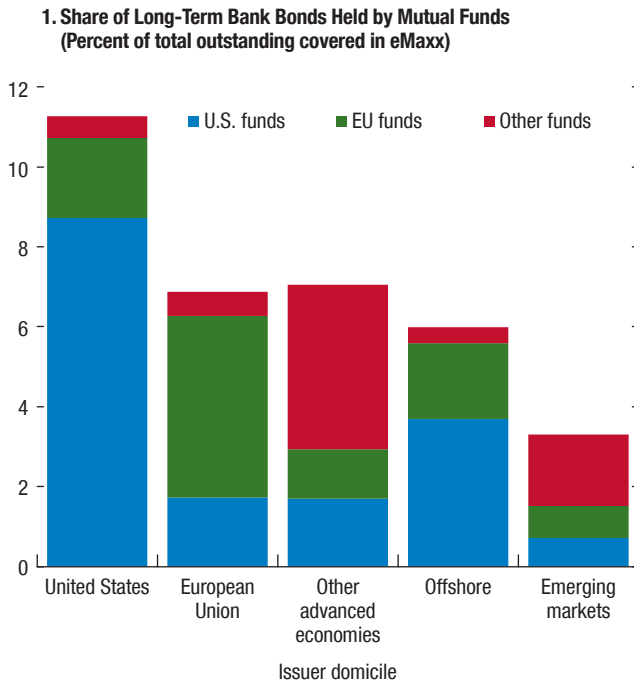
The roles of mutual funds as funding providers for banks appear to vary across instruments and countries (Figure 3.15). Mutual funds are more important providers of long-term bank financing in the United States than in other economies. However, their role appears to be less important than that of money market funds' role in short-term (bank) funding.

The relationship between size and contribution to systemic risk

An actively discussed question in global regulatory fora is whether large asset managers and funds should be designated as SIFIs and receive more intense oversight. This section does not intend to fully answer this ques-

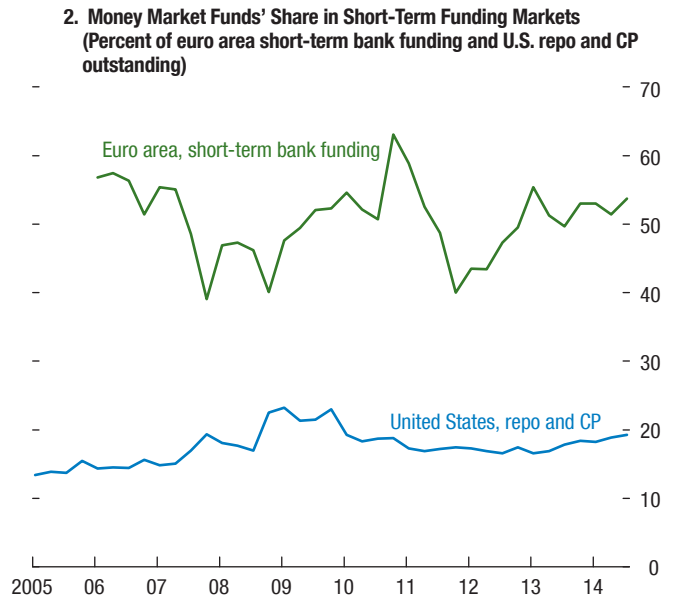
Figure 3.15. Bank Financing by Mutual Funds and Money Market Funds

Mutual funds invest in long-term bank bonds, but generally they are not the main holders of bank bonds...



Sources: eMaxx; and IMF staff calculations.
Note: EU = European Union.

... whereas money market funds play a more significant role in short-term funding markets.



Sources: European Central Bank; Federal Reserve; and IMF staff estimates.
Note: CP = commercial paper; repo = repurchase agreement.

tion. As discussed earlier, each segment of the industry has its distinctive risks, many of which are hard to quantify because of data gaps. However, the analysis attempts to partially address the issue by asking how funds' contribution to systemic risk in advanced economies relates to fund size, investment focus, and size of their AMCs, using the conditional value-at-risk (CoVaR) method (see Annex 3.2).

Funds' contributions to systemic risk depend relatively more on their investment focus than on their size (Figure 3.16). Estimations based on a sample of about 1,500 funds (not shown) reveal that investment orientation, VaR, and fund size, among other characteristics, are significantly related to a fund's contribution to systemic risk (Annex 3.2). The relative importance of size, however, differs across market segments.

For a given fund size, the systemic risk contribution bears little relation to the size of a fund's AMC (Figure 3.16, panel 2). The average contribution to systemic risk does not increase with a fund's AMC's size (the picture looks the same when the investment focus of funds is controlled for), at least not for the top asset managers considered here. Although this exercise only

examines one segment of the broad asset management industry and CoVaR is only one of the many possible systemic risk measures, it highlights the importance of incorporating product-line and investment-focus perspectives, in addition to mere size, when discussing the designation of AMCs and funds as SIFIs.

Revamping the Oversight Framework to Address Financial Stability Risks

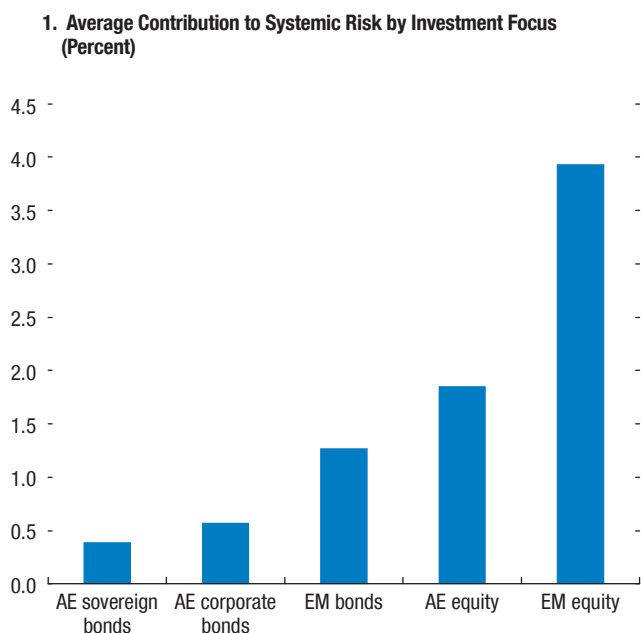
Key Features of Current Regulation

The industry is regulated, albeit with a focus on investor protection. Substantial regulatory requirements are in place for publicly offered funds.³⁵ Regulation focuses on investors being given sufficient information to understand the investment product, on investors'

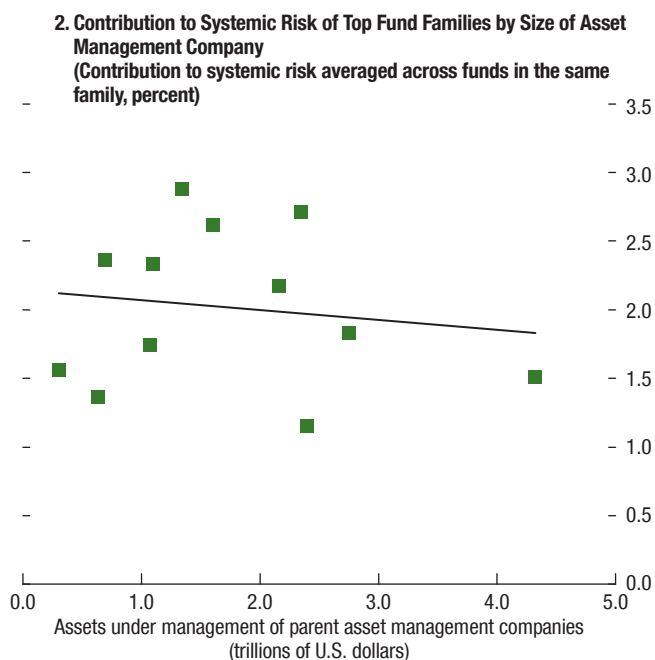
³⁵Regulatory frameworks for funds appear to be generally strong around the globe—the IMF and World Bank assessments of securities regulation under the IOSCO Principles show a generally high level of compliance with principles dealing with disclosure to investors and other consumer-protection-related standards. Some emerging market and developing economies, however, have serious gaps in their legal frameworks that fail to adequately separate the funds' assets from those of the asset manager. This raises risks to customer assets.

Figure 3.16. Contribution to Systemic Risk by Mutual Funds

The systemic risk contribution differs across funds' investment orientations.



A fund's systemic risk contribution is not related to its AMC's size.



Sources: Lipper; Pensions and Investments and Towers Watson; and IMF staff estimates.

Note: AE = advanced economy; AMC = asset management company; CoVaR = conditional value-at-risk; EM = emerging market. The impact of fund A's distress on systemic risk is measured by the difference of CoVaR when fund A is in a normal state (median VaR) and in a distressed state (worst 5 percentile VaR). The financial system consists of an equity index for banks and insurers from AEs and about 1,500 mutual funds, taking the largest 100 funds (globally) for each of the five investment focus categories (AE sovereign, AE corporate bond, EM bond, AE equity, and EM equity) and for three different fund domiciles (the United States, Europe, and the other advanced economies). Weekly net asset value data are used to compute fund returns and monthly total net asset (TNA) data to measure the size of each fund from January 2000 to November 2014. The system is measured by a TNA-weighted average of fund returns (the results are robust when the simple average is used instead). The assets under management of the AMC include assets managed with different investment vehicles such as separate account and alternative funds. Caution should be taken in comparing the precise ranking of systemic risk contributions across fund categories since the sample period may not capture the realization of relevant tail risks. Moreover, the measure does not identify whether the contribution is causal or driven by a common factor.

assets being protected from fraud and other risks, and on asset managers not taking advantage of investors. For these purposes, disclosure, investment restrictions (including concentration limits), caps on leverage, liquidity risk management, pricing and redemption policies, and separation of client assets from those of AMCs play important roles (Table 3.3). Regulatory requirements for privately offered products have also been strengthened since the global financial crisis. AMCs that offer investment products are subject to rules that focus on protecting clients from fraud or negligence and that aim to ensure the business continuity of the AMC.

The importance of liquidity risks to the industry is recognized and is an integral part of current regulation and industry practices:

- Regulatory requirements to manage liquidity risks exist, though they are often rather general. Funds are generally restricted to liquid assets or required to maintain certain liquid asset ratios; they must have risk management frameworks (data collection, profiling of redemptions, and stress testing) in place. Many asset managers have internal liquidity risk management frameworks for their funds, with regular monitoring of clients' liquidity needs and stress testing. These liquidity management tools are in line with FSB suggestions (FSB 2013).
- For very large redemptions, funds also have a variety of tools, subject to local regulatory requirements. For macroprudential purposes, the FSB (2013) and the October 2014 *Global Financial Stability Report* suggest that regulation and fund contracts should include tools, such as fees, gates, side-pockets, and

Table 3.3. Selected Regulations for Publicly Offered Funds

Issues	Requirements
Investment Restrictions	<ul style="list-style-type: none"> Typically, investments in illiquid securities and complex products are restricted and positions cannot be concentrated in a single issuer. Use of leverage and derivatives is capped. Public funds in the United States, for example, can only employ leverage of up to 33 percent of assets, including portfolio leverage embedded in derivatives. UCITS funds can only temporarily borrow up to 10 percent of assets. UCITS funds can invest in financial derivatives, subject to conditions on underlying assets, counterparties, and valuation, and exposure cannot exceed the total net value of the portfolio.
Liquidity	<ul style="list-style-type: none"> Publicly offered funds are subject to liquidity requirements. Specific fund classes, such as money market funds, have extensive liquidity requirements. In the United States, funds can hold only a limited amount of illiquid assets. “Liquid asset” is defined only broadly by regulation, but more detailed definitions can be included in fund contracts. In the European Union, regulators provide a list of assets that are eligible to meet liquidity requirements, but there is no liquidity ratio requirement. A similar approach is followed by other jurisdictions, such as Brazil. In Singapore, liquidity requirements differ by fund type. Funds are expected to have risk management frameworks, including liquidity risk management, but few jurisdictions provide details on how these frameworks should work. In 2011, IOSCO established its Principles of Liquidity Risk Management for Collective Investment Schemes.
Pricing of Fund Assets, Fund Shares, and Redemption	<ul style="list-style-type: none"> Portfolios are generally priced at market value for NAV calculation, although some illiquid assets are valued following fair value accounting rules. However, during times of distress, some prices may not reflect accurate market values, especially when there are limited market transactions. Rules are in place aiming to ensure that prices for purchases and redemption of shares are set so as to treat investors fairly, but some rules can result in a first-mover advantage (see Box 3.2 for details). Various jurisdictions allow suspension of redemption as an extreme measure. Under the European Union’s UCITS scheme, funds can specify redemption restrictions, typically used for funds investing in less liquid securities.

Source: IMF staff.

Note: IOSCO = International Organization of Securities Commissions; NAV = net asset value; UCITS = Undertaking for Collective Investment in Transferable Securities (a type of publicly offered fund governed by the European Union UCITS directive).

suspension of redemptions, to manage large redemptions.³⁶ Existing regulation and fund contracts indeed allow for these tools. In addition, asset managers can make use of credit lines, delays in cash payout upon redemption (within regulatory limits), and payment in kind.³⁷ The available tools often vary depending on local requirements.³⁸ For extreme measures, such as suspensions, funds are usually required to obtain permission from regulators, and they are strictly limited to extraordinary circumstances to prevent abuse. Consequently, restrictions on redemptions have been

³⁶Gates constrain redemption amounts to a specific proportion on any one redemption day. Suspension is full closure of a fund to redemption. Side-pockets legally separate impaired or illiquid securities to prevent them from affecting a fund’s return until market conditions stabilize.

³⁷Asset managers argue that payment in kind is particularly useful for institutional clients. For instance, when institutional clients are simply changing portfolio managers, they are willing to accept securities instead of cash and transfer the securities to a new manager to avoid losses related to large-scale sales. Transfer of securities from one manager to another is straightforward because the securities are kept at a custodian bank, segregated from the AMC’s assets.

³⁸For instance, in some countries, funds are not allowed to take credit lines or pay in kind to retail investors. The minimum redemption frequency for publicly offered funds is set differently across jurisdictions, and funds are not allowed to delay settlement beyond the limit (seven days in the United States and two weeks in the European Union).

used only rarely in advanced markets, and are generally associated with the failure or winding down of a fund—redemptions are suspended to ensure that pricing of the shares is fair across investors when a portfolio has become too difficult to price (IOSCO 2011).

Limitations of Current Oversight

The current oversight framework is not set up to fully address risks, neither at the institutional nor systemic level:

- *Regulation lacking in specificity*—Key regulations, especially regarding liquidity requirements and liquidity risk management, are broad and lack specific guidance, allowing for wide-ranging interpretations and practices across jurisdictions (Table 3.3). For instance, liquid asset requirements are often stipulated without a precise definition of “liquid assets.” Requirements for risk management frameworks are often not detailed in legislation. Regulatory requirements themselves also vary substantially across jurisdictions, reflecting the broad-principle-based approach of global standards (IOSCO Principles).
- *Insufficient supervision of individual and systemic risks*—Supervision of funds and asset managers

is generally weak across jurisdictions.³⁹ In many jurisdictions, oversight of funds has been focused on disclosure to protect retail investors. Regular supervision of risks is generally not the focus of supervisors.⁴⁰ As a result, no financial soundness indicators have been developed for the industry, and stress testing of funds and AMCs by regulators has been rare—a major contrast with bank supervisory practice. For some regulators, the number of asset managers and funds impose resource challenges. Moreover, international coordination and guidance on supervisory practices is sparse, since the IOSCO Principles focus on regulations. Good practices by asset managers provide some comfort, but in the presence of liquidity and price externalities, each fund and asset manager is likely to underestimate liquidity needs and the potential for correlated price effects in the presence of large shocks (Liang 2015).

Improving Oversight

Securities regulators should enhance the microprudential oversight of risks (Table 3.4):

- *Enhance regulation by providing more specifics for funds' liquidity requirements*—Key regulations should provide a clearer definition of liquid assets. More specific guidance should be given to match the liquidity profile of each fund category to its redemption policy.
- *Strengthen the microprudential supervision of risks related to individual institutions*—Regulators should regularly monitor market conditions and review whether funds' risk management frameworks are sufficient, especially with regard to liquidity risks. Greater resources should be devoted to supervising risks, including developing analytical and stress-testing capacities so that regulators can effectively challenge asset managers' practices.
- *Ensure that funds do not take excessive leverage*—Caps limit overall leverage of publicly offered funds. Nevertheless, leverage and its regulatory

³⁹A consistent finding in Financial Sector Assessment Programs of the IMF and the World Bank is that most jurisdictions with substantial asset management industries have sound regulatory frameworks but show weaknesses in the intensity of supervision of funds and asset managers.

⁴⁰There are some exceptions. For instance, supervisors in France and Brazil have risk-oriented and data-driven financial stability risk management frameworks that foresee collecting the data and using them to monitor potential risks; the supervisors can conduct stress testing on their own, and challenge asset managers if risks are found.

compliance should be regularly monitored with better data on derivatives.⁴¹

- *Adopt approaches based on products, activities, or both*—Focusing on activities and products in addition to size seems appropriate given that the industry is diverse and differences in investment focus seem to matter significantly for funds' contribution to systemic risk.
- *Raise the quality of supervisory practices across jurisdictions by introducing global standards*—International standards and guidelines for better supervision should be significantly expanded and enhanced. Supervisors should share best practices, especially in the area of liquidity risk. For instance, coordinated efforts should be undertaken to develop financial soundness indicators as well as stress-testing frameworks for the industry. The IMF could play a key role here, based on its experience in developing common financial soundness indicators and stress-testing frameworks for banks.⁴²

A macroprudential perspective should be integrated into the oversight of the industry, and the adequacy of existing tools for macroprudential purposes should be reexamined:

- *Bring a macroprudential focus on systemic risk to oversight of the sector*—As illustrated by the empirical analysis, price externalities are the key channel of systemic financial stability risk from this industry. Thus, assessments of individual institutions are not sufficient for assessing systemic risk. Incorporating monitoring of linkages to other sectors that rely on the industry for financing may even be necessary.⁴³
- *Existing risk management tools and rules could be used with a view to safeguard financial stability*—To

⁴¹Adam and Guettler (forthcoming) document that, among U.S. corporate bond funds, (1) the use of credit default swaps (CDS) rose from 20 to 60 percent between 2004 and 2008; (2) CDS are mostly used to enhance credit risk taking, rather than hedging; (3) funds belonging to a larger fund family are more likely to use CDS; (4) underperforming funds often increase their CDS exposures to enhance returns; and (5) CDS users tend to perform worse on average than non-users.

⁴²The *Global Financial Stability Report* began reporting financial soundness indicators for banks in 2003. At first, the data were collected from national authorities or commercial databases without harmonizing methods. The effort has since developed into a more harmonized statistical framework (<http://www.imf.org/external/np/sta/fsi/eng/fsi.htm>), with a full compilation guide. The IMF now periodically publishes details of the indicators. It has also been contributing to the building of common stress-testing frameworks (IMF 2012).

⁴³The October 2014 *Global Financial Stability Report* discusses how cooperation between microprudential, macroprudential, and business conduct regulators could be carried out in practice.

Table 3.4. Summary of Analysis and Policy Implications for Mutual Funds and ETFs

Results	Policy Implications
Does Fund Investment Affect Asset Prices?	
<i>Flow-price impact analysis:</i> Fund flows affect aggregate asset prices, at least in less liquid markets, in both advanced and emerging market economies.	<ul style="list-style-type: none"> Regulators need to monitor financial stability risks from the industry from a macroprudential perspective, especially in smaller, less liquid, fixed-income markets. Adequacy of concentration limits may need to be reconsidered.
<i>Concentration and price-impact analysis:</i> Mutual funds' concentration in bond markets has risen. During stress episodes, bonds with more concentrated mutual fund ownership tend to experience larger price drops.	
What Drives Run Risk? What Can Be Done to Mitigate It?	
<i>End investors:</i> End investors, especially retail investors, chase past returns and display a flight to quality during times of stress, making fund flows procyclical.	<ul style="list-style-type: none"> Properly pricing-in the cost of liquidity is important in reducing the first-mover advantage, by avoiding passing on to remaining investors the costs associated with the sales of illiquid assets. Regulators should examine the benefit of flexible NAV pricing rules (such as swing and dual pricing), illiquid asset valuation rules, and ETF structures to adequately reflect liquidity risk costs. Consider imposing minimum redemption fees for funds with large liquidity mismatches. Fees that are added to NAV avoid harming investors as a whole, while pricing-in the cost of liquidity. More generally, the adequacy of the requirements for liquid assets and liquidity risk management should be reexamined, incorporating financial stability risks from the industry.
<i>First-mover advantage:</i> In line with the notion of a first-mover advantage, among equity funds, redemptions are more sensitive to returns for less liquid funds. However, the same is not true for bond funds (which generally have higher liquidity mismatches than equity funds). In emerging markets, fund flows predict future price movements, consistent with a first-mover advantage.	
<i>Funds' liquidity risk management:</i> Funds use various liquidity management tools. They hold higher cash buffers when they experience large outflows, face higher redemption risks, are retail focused, and invest in illiquid assets. Fees are generally effective in reducing redemptions.	
Does Asset Managers' Behavior Amplify Risks?	
<i>Managers' decision vs. end investors' decision:</i> Portfolio managers' trading accounts for about 70 percent of the variance in funds' investments.	<ul style="list-style-type: none"> Ensure that managers are in compliance with regulatory requirements and are not taking excess risks (including hidden leverage). Reduce information gaps between managers and investors (and regulators) by upgrading disclosure requirements to better reflect the fund's economic risks, especially regarding the use of derivatives and securities financing transactions. Financial stability risks from mutual funds could stem from many small funds taking similar positions. Regulators should pay attention to this possibility, not just focus on the positions of large funds.
<i>Excessive risk taking:</i> By rewarding winners disproportionately more than punishing losers, end investors encourage excessive risk taking by managers in various advanced economies. The tendency is stronger for equity funds than for bond funds.	
<i>Herding:</i> Herding among U.S. mutual funds has been intensifying, particularly in smaller, less liquid markets. Retail-investor-oriented funds tend to herd more.	
<i>Brand name effects:</i> Evidence suggests that large redemption shocks to a flagship fund often spill over to other funds in the family, although the effects have been weak so far.	
Contribution to Systemic Risk and Size	
<i>Fund size and systemic risk:</i> Generally, larger funds contribute more to systemic risk, but the investment focus of funds matters more.	<ul style="list-style-type: none"> The SIFI discussion for funds and asset managers should take into account specific risks of products in addition to size. Oversight of the industry should not simply focus on large funds and AMCs.
<i>Parent AMC size and its funds' systemic risk:</i> There is little relationship between a fund's contribution to systemic risk and its AMC's size.	

Source: IMF staff.

Note: AMC = asset management company; ETF = exchange-traded fund; NAV = net asset value; SIFI = systemically important financial institution.

mitigate price externalities, rules on investment restrictions (such as concentration limits), liquidity requirements, and redemption policies may need to be updated in line with funds' risk profiles (October 2014 *Global Financial Stability Report*).

- *Further efforts should be aimed at reducing the first-mover advantage*—As discussed, and partly confirmed in the empirical analysis, a first-mover advantage can arise for various reasons. Some of these are difficult

to address, such as the liquidity pecking order of sales. Others, however, such as the degree of liquidity mismatches, can at least partially be addressed with good supervision. Most important, accounting-based illiquid asset valuation rules and inflexible fund share pricing rules that increase investors' incentives to run should be revised. In this context, so-called swing- or dual-pricing rules could play a role (Box 3.2). Charging redemption fees, which are found to be effective

in smoothing redemptions, is another alternative for pricing-in the cost of liquidity. However, competitive pressures have probably resulted in fee levels that are likely too low from a financial stability perspective (Figure 3.10, panel 4). Therefore, coordinating on an industry-wide minimum level of fees for funds investing in illiquid assets could be considered.⁴⁴ In doing so, fee policies should match funds' specific characteristics rather than impose one-size-fits-all requirements.⁴⁵

- *Caution is needed in the use of gates and suspensions*—They should be part of the toolkit. Nonetheless, their imposition may also send negative signals to the market and lead to preemptive runs ahead of the instruments coming into force (FSB 2013; October 2014 *Global Financial Stability Report*).
- *Be equipped with “better” data*—Publicly offered funds disclose substantial information. However, the disclosed data—aimed at investor protection—are often not sufficient for nor suited to systemic financial stability analysis. For instance, many jurisdictions do not require standardized quantitative disclosure of derivatives and securities financing transactions, such as outstanding positions, details on collateral, and counterparties.⁴⁶ Better disclosure and reporting is also important for reducing information gaps that lead to incentive problems of delegated portfolio management. Supervisors should also make further efforts to collect data on privately offered products, including separate accounts. Even though investor-protection concerns with regard to these products are lower, their investment patterns can affect financial markets.

⁴⁴These fees would not have to benefit the AMC but could be added to NAV and be redistributed to investors. For instance, in the United States, Rule 22c-2 under the 1940 Investment Company Act as amended provides that the fund board of an open-end fund must consider whether to impose a redemption fee (up to 2 percent) that flows back into the fund's NAV (BlackRock 2014b).

⁴⁵Nevertheless, the imposition of such a fee would raise various practical problems, including those related to cross-border coordination. An inadequate framework could also drive investors away from this industry to other, less regulated products.

⁴⁶In the United States, mutual funds disclose only qualitative information on their derivatives positions. In the European Union, heightened concerns about the use of derivatives by synthetic ETFs in 2011 (see Annex 3.1) have led the industry to voluntarily disclose detailed derivatives positions, including derivatives exposures, counterparties, and the type and amount of collateral. This practice has subsequently evolved into requirements for ETFs and more broadly for UCITS (ESMA 2012). In Brazil, supervisors obtain information from the central counterparty and from exchanges that clear derivatives transactions.

Various other aspects not covered in the empirical analysis in this chapter deserve attention by national authorities. Improving the liquidity and transparency of secondary markets, specifically for longer-term debt markets, would reduce risks related to liquidity mismatches.⁴⁷ For example, expanding trade reporting initiatives to all global fixed-income sectors should help reduce the opacity of secondary markets (October 2014 *Global Financial Stability Report*). Compensation structures for portfolio managers may merit scrutiny (Box 3.1). The composition of benchmark indices also deserves attention, with a view to minimizing possible associated distortions. The authorities could assess their ability to provide emergency liquidity to break vicious feedback loops between funding and market liquidity in times of stress. However, providing emergency liquidity creates clear moral hazard risk and therefore requires enhanced supervision (October 2014 *Global Financial Stability Report*).

Conclusion

Financial stability risks can emanate from intermediation through asset managers even in the absence of leverage and guaranteed returns. The discussion in this chapter stresses the importance of separating the effects that stem from end investors, and would be present even in the absence of financial intermediaries, from those that are introduced by the presence of asset managers. The delegation of day-to-day portfolio management introduces fundamental incentive problems between end investors and fund managers, which can induce destabilizing behavior and amplify shocks. In addition, easy redemption options can create risks of runs because of the presence of a first-mover advantage. The destabilization of prices in certain asset segments (particularly bonds) can affect other parts of the financial system through funding markets and balance sheet and collateral channels.

The chapter has shed some light on the importance of various dimensions of these risks. Complementing and expanding on existing studies, the analysis finds evidence consistent with the notion that mutual fund investments affect asset price dynamics, at least in less liquid markets. Some factors point to the existence of incentives to run in segments of the industry. The observed pattern of fund inflows and redemptions by end investors creates incentives for fund managers to herd and, in

⁴⁷Evidence suggests that herding declines with transparency (Gelos 2011).

some markets, for poorly performing fund managers to increase risk. Indeed, herding among U.S. mutual funds has been rising across asset markets. Funds managed by larger AMCs do not necessarily contribute more to systemic risk; investment focus appears to be relatively more important than size when gauging systemic risk.

Although these risks are not fundamentally new, their relevance has risen with structural changes in the financial sectors of advanced economies. The relative importance of the asset management industry has grown, and banks have also retrenched from many market-making activities, contributing to a reduction in market liquidity. Moreover, the role of fixed-income funds, which entail larger contagion risks than traditional equity investment, has expanded considerably. A broader range of products are available to less sophisticated investors. Last, the prolonged period of low interest rates in advanced economies has resulted in a search for yield, which has led funds to invest in less liquid assets.

The chapter offers five main policy messages:

- First, securities regulators should enhance microprudential supervision of risks stemming from individual institutions building on regulators' own risk analysis and stress testing, supported by global standards for supervision and better data and risk indicators.
- Second, regulatory and supervisory reforms are needed to incorporate a macroprudential approach.
- Third, liquidity rules, the definition of liquid assets, investment restrictions, and reporting and disclosure rules could be enhanced.
- Fourth, consideration should be given to the use of tools that adequately price-in the cost of liquidity, including minimum redemption fees, improvements in illiquid asset valuation, and mutual fund share pricing rules.
- Fifth, given that the industry is diverse and that differences in investment focus seem to matter significantly for funds' contribution to systemic risk, a product- or activity-based emphasis seems to be important.

Annex 3.1. Primer on the Asset Management Industry

Investment vehicles are broadly separated into “collective investment schemes” (referred to as “funds” in this chapter) that pool money from a number of investors and invest in financial assets, and what are called “separate accounts” or “discretionary mandates” that manage the money of single institutional investors or high net worth individuals (Annex Table 3.1.1). Collective

investment schemes are further divided into various products. Most of them are open-end mutual funds investing in equities (Annex Figure 3.1.1).

Funds are often established as legal entities (corporations or trusts) that must be separated from an asset manager, and a fund’s assets are kept at a custodian, segregated from the assets of AMCs (Annex Figure 3.1.2). This segregation of an AMC and the funds it manages is a key component of the regulatory framework for investor protection.

Annex Table 3.1.1. Features and Risk Profiles of Key Investment Vehicles

Vehicle	Features and Risk Profiles
Separate Account	<ul style="list-style-type: none"> Providers of separate account services privately manage the money of institutional investors (including pension funds, insurance companies, and sovereign wealth funds) or high net worth individuals. Little is known about this segment because contracts are private and can vary substantially across clients. An industry survey (SIFMA 2014) indicates that these accounts entail simple securities portfolios with little leverage. The accounts are also subject to client investors’ regulatory requirements. Redemption risk for this group is moderate because institutional investors tend to internalize the cost of their sales, and large redemptions can be paid in kind (especially if clients are changing asset managers).
Open-End Mutual Fund	<ul style="list-style-type: none"> These funds issue “redeemable equity securities” and stand ready to buy back their shares at their current net asset value (NAV)—the price per share of a fund. These funds invest in generally liquid publicly traded bonds and equities. Many of the funds offer daily liquidity to clients, making liquidity risk the key risk for the fund. In particular, some funds invest in relatively illiquid securities (for example, corporate bonds instead of equity). This is often referred to as “liquidity transformation” that could lead to “liquidity mismatch,” which makes the fund vulnerable to redemptions. These funds have little leverage through borrowing, though they could be taking portfolio leverage using derivatives (the same applies for money market funds and exchange-traded funds, below). Although regulations impose caps on the use of leverage, little quantitative information is available.
Closed-End Mutual Fund	<ul style="list-style-type: none"> These funds issue a fixed number of shares in the primary market that trade intraday on the secondary stock market at market-determined prices. Investors buy or sell shares through a broker, but cannot redeem their shares directly from the fund, so these funds do not suffer much liquidity risk. However, their popularity suffers from the fact that their shares are usually traded in the secondary market at a lower value than their NAV. Many closed-end funds borrow additional money, often using preferred shares, and they also take portfolio leverage, subject to regulatory limits (ICI 2014a).
Money Market Fund (MMF)	<ul style="list-style-type: none"> These funds invest in short-term cash equivalent instruments such as commercial paper, Treasury bills, and certificates of deposit, and play a major role in short-term funding markets. MMFs experienced major runs and liquidity distress during the global financial crisis. All U.S. MMFs offered constant NAV (mutual fund price per share) at \$1 per share. This structure created a first-mover advantage because funds continued to honor the \$1 per share repayment even though their actual NAV was worth less as the result of losses from asset-backed commercial paper, which was perceived to be liquid and safe before the crisis. Constant NAV MMFs continue to exist in the United States and several other jurisdictions.
Exchange-Traded Fund (ETF)	<ul style="list-style-type: none"> ETF shares are traded in primary and secondary markets (see Box 3.2 for details). ETF shares can be created or redeemed in the primary market between the fund and “authorized participants” (APs) in large units. APs are typically large securities dealers. Only primary market transactions cause fund flows to ETFs. The settlement between ETFs and APs are usually in kind, meaning that the exchange of ETF shares and the basket of securities is in line with the ETF’s investment objectives. APs then trade the ETF shares in the secondary market with clients and counterparties on stock exchanges. This intraday trading in secondary markets provides intraday liquidity to end investors. Most ETFs are index funds, tracking the performance of a specific index.
Synthetic ETF	<ul style="list-style-type: none"> Synthetic ETFs are offered mainly in Europe. Instead of directly holding underlying assets (called physical ETFs), synthetic ETF returns are generated using derivatives, especially swaps. Synthetic ETFs could be used for various investment strategies, ranging from simple index tracking to leveraged and short-selling strategies. The extensive use of derivatives (asset swaps) has led to strong concerns about portfolio leverage, counterparty risks, and the quality of collateral for asset swaps. A number of official sectors expressed such concerns in 2011, including the Financial Stability Board (2011) and the IMF. In response, many ETF providers reduced synthetic products and expanded the disclosure of derivatives positions, including a list of counterparties and the collateral basket for asset swaps (Morningstar 2012).

(continued)

Annex Table 3.1.1. Features and Risk Profiles of Key Investment Vehicles (continued)

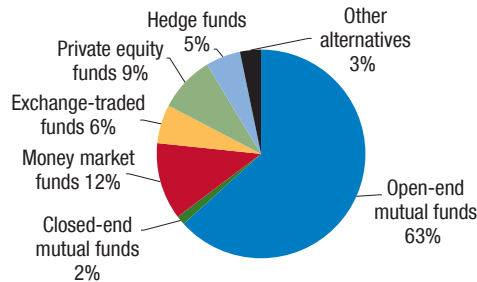
Vehicle	Features and Risk Profiles
Private Equity Fund	<ul style="list-style-type: none"> • Private equity is a broad term that refers to any type of equity participation in which the equity is not freely tradable on a public stock market, such as equities of private companies and public companies that are delisted. • Private equity funds often monitor and participate in managing the companies whose equity they hold. They aim to maximize financial returns by a sale or an initial public offering of the companies. • There are four main subclasses among private equity funds: (1) <i>venture capital</i> that invests in early-stage, high-potential, growth startup companies; (2) <i>buyout funds</i> that acquire existing business units or business assets; (3) <i>mezzanine funds</i> that invest in both growth equity and the subordinate debt layer—namely, the “mezzanine” between senior debt and equity—of buyout transactions; and (4) <i>distressed asset funds</i>, which are a specialized segment of buyouts that target mature and distressed companies. In addition, there are real estate and infrastructure funds. • Some private equity funds could be leveraged, but they are smaller components of the private equity industry (Metrick and Yasuda 2011). • Moreover, these alternative investment vehicles offer limited liquidity to end investors, matching the funds’ long-term investment horizon. • Contagion risks are also limited because private equity funds invest in companies not traded in markets.
Hedge Fund	<ul style="list-style-type: none"> • These funds cover a large variety of investment strategies, ranging from publicly traded equity (highly liquid holdings) to distressed debt vehicles and structured credit products (highly illiquid holdings). Use of leverage and derivatives also varies considerably depending on the strategy. Unlike mutual funds, hedge funds have no cap on leverage. • Hedge funds tend to be more nimble than mutual funds regarding their investment strategy, leading to potentially rapid alterations in their risk characteristics. Depending on their funding and trading strategies, there can be significant interconnection with other financial institutions.

Sources: ICI (2014a, 2014c); Metrick and Yasuda (2011); Morningstar (2012); TheCityUK (2012); and IMF staff.

Annex Figure 3.1.1. Investment Vehicles by Size, Domicile, and Investment Focus

Most assets are managed with simple investment vehicles.

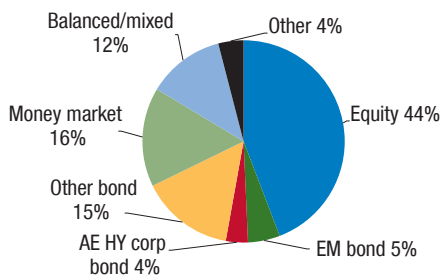
1. Investment Vehicles
(Percent of \$43 trillion total assets under management, end-2013)



Sources: BarclayHedge; European Fund and Asset Management Association; ETFGI; Organisation for Economic Co-operation and Development; Preqin; and IMF staff calculations.

Most mutual funds invest in equities. (Bond funds, especially high-yield corporate and emerging market debt funds, are smaller components.)

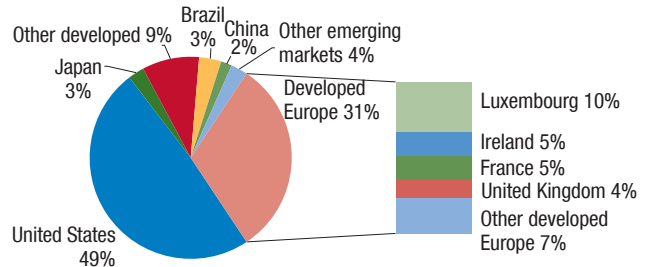
3. Mutual Funds by Investment Focus
(Percent of \$30 trillion total assets under management, end-2013)



Sources: European Fund and Asset Management Association; Lipper; and IMF staff calculations.
Note: AE = advanced economy; EM = emerging market; HY = high yield.

The mutual fund industry is dominated by U.S. and European funds, but Brazil and China show a notable presence among emerging markets.

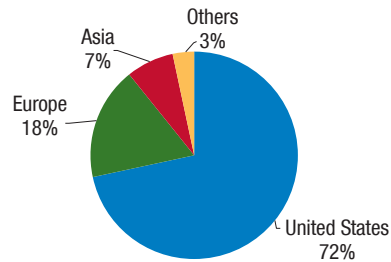
2. Mutual Funds by Fund Domicile
(Percent of \$32 trillion total assets under management, 2014:Q2)



Sources: European Fund and Asset Management Association; and IMF staff calculations.

Exchange-traded funds are offered predominantly in the United States, where the use of exotic structures is restricted.

4. Exchange-Traded Funds by Region
(Percent of \$2.3 trillion total assets under management, end-2013)



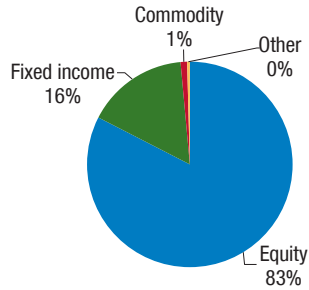
Sources: Deutsche Bank; and IMF staff calculations.

(continued)

Annex Figure 3.1.1. Investment Vehicles by Size, Domicile, and Investment Focus (continued)

Exchange-traded funds primarily invest in equities.

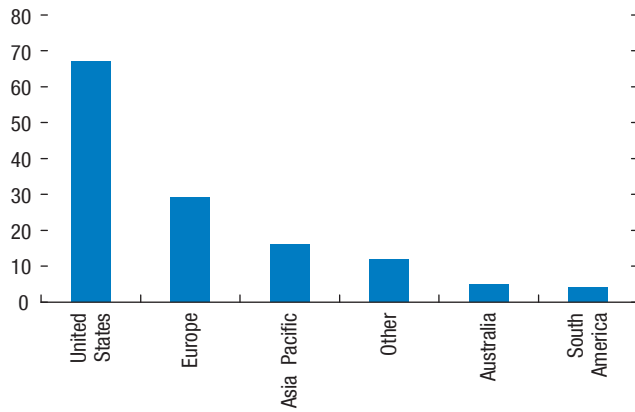
5. Exchange-Traded Funds by Investment Focus
(Percent of \$2.3 trillion total assets under management, end-2013)



Sources: Deutsche Bank; and IMF staff calculations.

Private equity funds are primarily located in the United States and Europe.

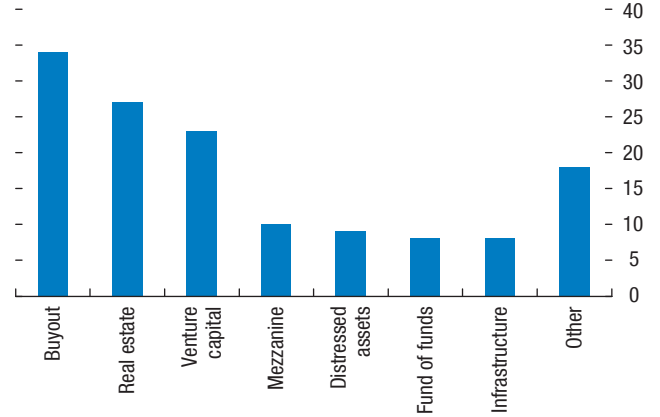
7. Private Equity Funds by Location of Offices
(Percent of total number of funds participating in Preqin's survey, 2014)



Source: Preqin.
Note: Some funds have offices in multiple countries.

A large number of private equity funds are involved in buyout, venture capital, and real estate funds.

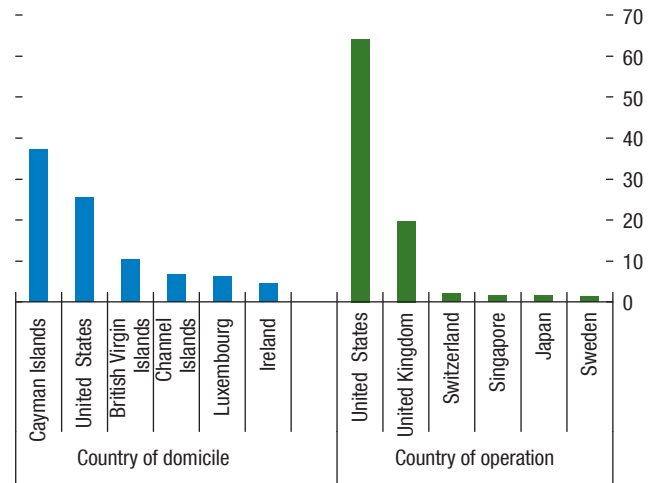
6. Private Equity Funds by Type
(Percent of total number of funds participating in Preqin's survey 2014)



Source: Preqin.
Note: Some funds are involved in multiple investment strategies.

A large number of hedge funds are domiciled in off-shore jurisdictions.

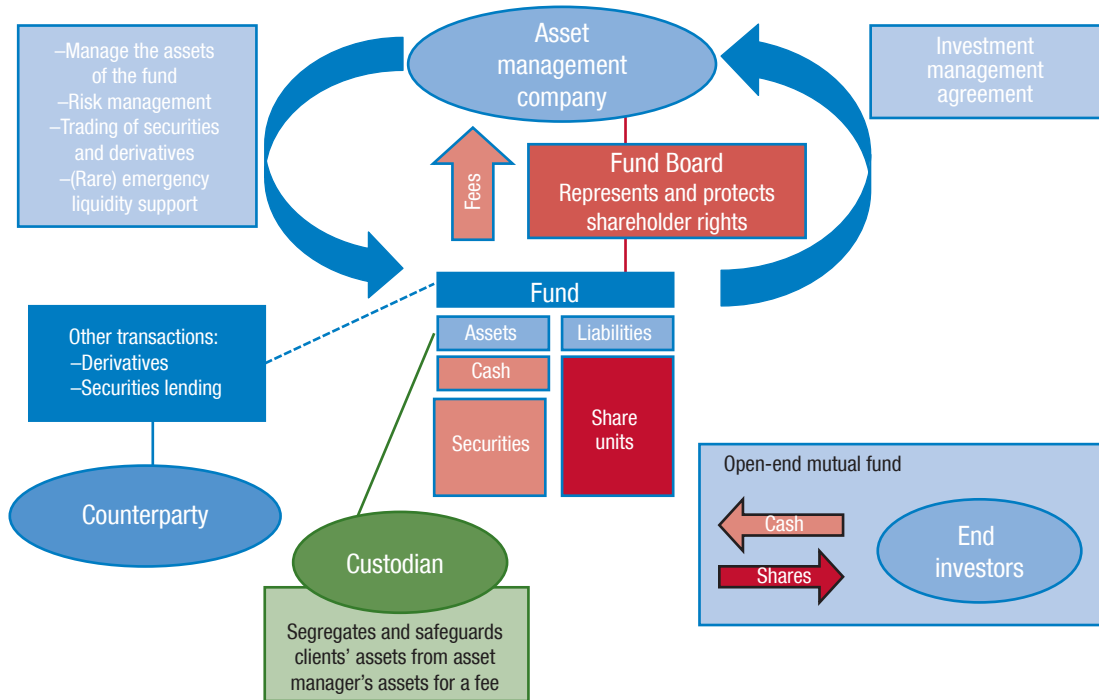
8. Hedge Funds by Country
(Percent of \$1.4 trillion total assets under management covered in Hedge Fund Research, 2014)



Sources: Hedge Fund Research; and IMF staff calculations.

Annex Figure 3.1.2. Operation of a Fund

A fund signs an investment management agreement with an asset management company (AMC), which manages the fund's portfolio, risks, trading of securities, and securities financing transactions. End investors are equity shareholders of a fund and are the owners of the funds' assets in the sense that each share represents an investor's proportional ownership of the fund's asset holdings and the income those assets generate. However, end investors do not have full control over a fund. They typically cannot ascertain the exact makeup of a fund's portfolio at any given time, nor can they directly influence which securities the fund manager buys and sells or the timing of these trades. Fund boards represent and protect shareholder rights vis-à-vis AMCs.



Source: IMF staff.

Note: Examples of asset management companies are BlackRock, Franklin Templeton, and PIMCO; examples of funds are BlackRock iShare Core S&P 500 ETF and PIMCO total return funds. Custodians are usually large banks such as Bank of New York Mellon, J.P. Morgan, and State Street. Funds often lend the securities they hold to various counterparties to earn fee income (securities lending). Securities borrowers usually provide cash collateral. Counterparties are usually investment banks, prime brokers, and other broker-dealers that are engaged in short-selling of the borrowed securities.

Annex 3.2 Empirical Framework

Aggregate flow-price relationship

The aggregate flow-price relationship analysis examines whether mutual fund flows have an impact on asset prices at the macro level. Mutual fund flows to 23 emerging markets⁴⁸ are investment flows into each country from all mutual funds from various jurisdictions covered by EPFR Global. U.S. fund flows data are investors' flows into mutual funds with a stated investment focus, covering funds domiciled in the United States. U.S. data are from ICI, except for U.S. high-yield bond funds data, which come from EPFR Global. The analyses investigate weekly flows, but the results are similar using monthly flows. The price impact is measured by the total excess return of the respective index for each asset class in dollar terms over the one-month Eurodollar deposit rate.

The analysis here focuses first on surprise flows following Acharya, Anshuman, and Kumar (2014). As shown in the fund flows analysis later in this annex, mutual fund investors chase past returns, making fund flows predictable to some extent. Markets are likely to have priced in the effects from predictable flows by the time the money arrives, which limits the correlation between flows and returns. One would instead need to examine the part of fund flows that is not priced in the market. Surprise flows are estimated as residuals μ_{Fjt} for each asset class j from the following vector autoregression (VAR) model with the Chicago Board Options Exchange Market Volatility Index (VIX) as an exogenous variable.

$$\begin{bmatrix} R_{jt} \\ F_{jt} \end{bmatrix} = \mathbf{A} + \mathbf{B}_1 \begin{bmatrix} R_{jt-1} \\ F_{jt-1} \end{bmatrix} + \dots + \mathbf{B}_p \begin{bmatrix} R_{jt-p} \\ F_{jt-p} \end{bmatrix} + \boldsymbol{\gamma}_0 VIX_t + \dots + \boldsymbol{\gamma}_q VIX_{t-q} + \begin{bmatrix} \mu_{Rjt} \\ \mu_{Fjt} \end{bmatrix} \quad (3.1)$$

R_t and F_t are excess index return and fund flows, respectively, and p and q are the lengths of lags. For U.S. assets, the model is estimated with a standard

⁴⁸Economies include current emerging markets as well as "graduated" emerging markets that were considered to be emerging at some point during the sample period. For equities, the sample includes Argentina, Brazil, Chile, China, Colombia, the Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Jordan, Korea, Malaysia, Mexico, Pakistan, Peru, the Philippines, Poland, Russia, South Africa, Taiwan Province of China, and Turkey. For bonds, the sample additionally includes Bulgaria, Lebanon, Sri Lanka, Ukraine, Uruguay, and Vietnam, but excludes the Czech Republic, India, Israel, Jordan, Korea, and Taiwan Province of China.

VAR. For emerging market assets, a panel VAR excluding the VIX is applied. The details of the variable definitions are given in Annex Table 3.2.1.

Various single-equation models are estimated to investigate the relationship between surprise flows and asset returns. More specifically, the following models are estimated for each asset class j , using a panel regression with country fixed effects and robust standard errors (with clusters to correct for heterogeneity within countries, in addition to cross-country heterogeneity) for mutual fund flows into emerging market assets, and ordinary least squares (with Newey-West standard errors corrected for autocorrelation and heteroscedasticity) for end investor asset flows into U.S. mutual funds.

Base model:

$$R_{jt} = \alpha + \sum_{p=1}^P \beta_p R_{jt-p} + \sum_{q=0}^Q \gamma_q \hat{\mu}_{Fjt-q} + \sum_{r=0}^R \delta_r VIX_{t-r} + \sum_{s=0}^S \theta_s Asset\ Volatility_{jt-s} \quad (3.2)$$

Model with asymmetry:

$$R_{jt} = \alpha + \sum_{p=1}^P \beta_p R_{jt-p} + \sum_{q=0}^Q \{\gamma_{1q} \hat{\mu}_{Fjt-q} + \gamma_{2q} \hat{\mu}_{Fjt-q} \times Indicator(1\ if\ \hat{\mu}_{Fjt-q} > 0)\} + \sum_{r=0}^R \delta_r VIX_{t-r} + \sum_{s=0}^S \theta_s Asset\ Volatility_{jt-s} \quad (3.3)$$

Model with nonlinearity by the levels of the VIX:

$$R_{jt} = \alpha + \sum_{p=1}^P \beta_p R_{jt-p} + \sum_{q=0}^Q \gamma_{1q} \hat{\mu}_{Fjt-q} + \gamma_{2q} \hat{\mu}_{Fjt} \times Indicator(1\ if\ VIX_t > Threshold_t) + \sum_{r=0}^R \delta_r VIX_{t-r} + \sum_{s=0}^S \theta_s Asset\ Volatility_{jt-s} \quad (3.4)$$

in which $\hat{\mu}$ is the estimated residual in equation 3.

In addition, the section examines the dynamic relationship between unadjusted (that is, nonsurprise) flows and returns to assess the presence of a first-mover advantage. The analysis is based on generalized impulse response functions from VARs as in equation (3.1). In addition, impulse responses based on Cholesky decompositions using both possible orderings were computed.

Concentration and its effects on bond yields

The concentration analysis is based on the Lipper eMaxx bond ownership data, as used in Manconi, Massa, and Yasuda (2012). This database contains details of institutional holdings for each fixed-income security, covering \$7 trillion in total fixed-income secu-

Annex Table 3.2.1. List and Definition of Variables for Empirical Exercises

Variables	Description	Data Source
Aggregate Flow and Return Analysis		
EM equity flows	Weekly mutual fund equity investment flows into each economy from all mutual funds covered by EPFR Global.	EPFR Global
EM bond flows	Weekly mutual fund bond investment flows into each economy from all mutual funds covered by EPFR Global.	EPFR Global
U.S. equity flows	Flows from end investors to U.S.-domiciled mutual funds investing in domestic equities.	ICI
U.S. bond flows, all bonds	Flows from end investors to U.S.-domiciled mutual funds investing in domestic bonds (both government and corporate).	ICI
U.S. HY corp. bond flows	Flows from end investors to mutual funds investing in U.S. high-yield corporate bonds.	EPFR Global
U.S. muni. flows	Flows from end investors to U.S.-domiciled mutual funds investing in municipal bonds.	ICI
EM equity returns	MSCI country equity index.	Bloomberg, L.P.
EM bond returns	Country index from J.P. Morgan EMBIG Global Index.	Bloomberg, L.P.
U.S. equity returns	MSCI country equity index.	Bloomberg, L.P.
U.S. bond returns, all bonds	Bank of America Merrill Lynch total return index for U.S. government and corporate bonds.	Bloomberg, L.P.
U.S. HY corp. bond returns	Bank of America Merrill Lynch total return index for U.S. high-yield corporate bonds.	Bloomberg, L.P.
U.S. muni. returns	Bank of America Merrill Lynch total return index for U.S. municipal bonds.	Bloomberg, L.P.
Benchmark yield	One-month Eurodollar deposit rate.	Bloomberg, L.P.
VIX	Chicago Board Options Exchange Market Volatility Index.	Bloomberg, L.P.
Asset volatility	Staff estimates based on asset returns data and GARCH in mean model.	IMF staff
Price Impact of Concentration in Bond Markets		
Spread	Bond yield minus the yield of benchmark sovereign bond with the same currency and similar maturity.	Bloomberg, L.P.
Concentration	Share of bonds held by the largest five mutual fund investors for each bond. Quarterly.	eMaxx
Bid-ask spread	Bid-ask yield spreads for each bond (end of quarter).	Bloomberg, L.P.
Modified duration	Computed from bond's yield to maturity, coupon rate, and time to maturity, assuming semi-annual distributions (end of quarter).	Bloomberg, L.P.
Issue size	Log of issuance size.	eMaxx
Covenants ratio	The number of covenants attached to a bond relative to a maximum of 18.	Bloomberg, L.P.
Drivers of Fund Flows and Liquidity Risk Management		
Fund flow	For each fund (i) and time (t), fund flows (it) = [TNA(it)–TNA(it–1)×(1+return(it))]/TNA(it–1). Return(it) is computed by CRSP based on NAV. Monthly.	CRSP
Performance	Monthly excess fund return (changes of NAV) over benchmark, averaged over prior three months.	CRSP
Benchmark performance	Monthly return of benchmark index, averaged over prior three months. The same benchmark is assigned for funds with the same broad investment focus (for instance, S&P 500 for U.S. domestic equity funds).	DataStream L.P.
HIGH_VIXD	High VIX dummy equals 1 when VIX > 30 percent.	DataStream L.P.
Cash	Cash and cash equivalents holdings in percent of total portfolio. Quarterly.	CRSP
Flow volatility	Standard deviation of flows over the prior 12 months, divided by the mean flows over the same period.	CRSP
Fund Characteristics		
Size (S/M/L)	Dummies based on 20th and 80th percentiles.	CRSP
Age	Years since initial offer.	CRSP
Purchase fee	Maximum in prospectus.	CRSP
Redemption fee	Maximum in prospectus (sum of type R [redemption] and C [contingent deferred sales charge]).	CRSP
Index dummy	1 if index fund.	CRSP
ETF dummy	1 if ETF.	CRSP
Institutional dummy	1 if institutional but not retail in CRSP.	CRSP
Liquid bond fund dummy	1 if a fund's investment focus is one of the following: short-term U.S. government funds and Treasury funds or short-term investment-grade debt funds.	CRSP
Illiquid bond fund dummy	1 if a fund's investment focus is one of the following: corporate debt BBB rated funds, EM local currency debt funds, EM debt funds, or high current yield funds.	CRSP
Liquid equity fund dummy	1 if a fund investment focus is S&P 500.	CRSP
Illiquid equity fund dummy	1 if a fund's investment focus is one of the following: micro/small cap funds; equity global small company; equity international small company; emerging markets, China, India, and Latin America.	CRSP

Note: corp. = corporate; CRSP = Survivor-bias-free U.S. mutual fund database, Center for Research in Security Prices; EM = emerging market; ETF = exchange-traded fund; HY = high yield; ICI = Investment Company Institute; EMBIG = Emerging Markets Bond Index Global; GARCH = generalized autoregressive conditional heteroscedasticity; muni. = municipal; S/M/L = small, medium, large; VIX = Chicago Board Options Exchange Market Volatility Index.

rities (based on par value) held by more than 19,000 funds. Institutional investors covered in the database are U.S. and some European insurance companies; U.S. mutual funds; top U.S. public pension funds; and European, Canadian, and Asian mutual funds. Data are based on disclosure information of security-level holdings by these institutional investors (especially for mutual funds and U.S. insurance companies). This analysis focuses on a subcomponent of these data, specifically corporate bonds for advanced economies and both sovereign and corporate bonds for emerging market economies.

The casual observation on the effects of ownership concentration on spreads in Figure 3.7 is confirmed with formal empirical analysis, reported in Annex Figure 3.2.1. The dependent variable is the change in individual bond yield spreads over a benchmark sovereign bond yield with the same currency and similar maturity between 2008:Q2 and 2008:Q4 and between 2013:Q1 and 2013:Q2. This change is regressed on various control factors and measures of mutual fund sector concentration. The following cross-section model is estimated using a quantile regression approach (for quantile $j=10$ th, 25th, 50th, 75th, 90th percentile), because a preliminary analysis indicates the presence of nonlinearities between the dependent and independent variables (see Annex Table 3.2.1 for the list of variables):

$$\begin{aligned} \Delta Spread_{ij} = & \alpha_j + \beta Spread_{ij,t=0} \\ & + \gamma Bond\ Characteristics_{ij,t=0} \\ & + \delta Concentration_{ij,t=0} \end{aligned} \quad (3.5)$$

Control factors are *Spread*, which is the initial level of the yield spread to control for the credit risk of the security; and bond-specific characteristics, including liquidity (bid-ask spread), bond price sensitivity to interest rate changes (duration), issue size, and covenants, in line with Manconi, Massa, and Yasuda (2012). Concentration is measured primarily by the share of bonds held by the largest 5 funds, but key results are robust to other definitions, such as the share held by the largest 10 funds, the share held by all mutual funds, and the Herfindahl index among mutual fund investors. All explanatory variables are measured as of 2008:Q2 or 2013:Q1 to control for possible endogeneity. Outliers in observed market price data were reduced by winsorizing the 5 percent tail of the respective distributions.

Relationship between a fund's liquidity risk and its management

The main mutual fund and ETF data source is the CRSP survivor-bias-free database covering publicly offered open-end mutual funds domiciled in the United States. Even though CRSP's data cover only U.S.-domiciled funds, CRSP provides more details on funds' fee structures and assets, including quarterly security-level holdings, than other global fund databases such as EPFR Global or Lipper for Investment Management. These global data are used for some additional robustness tests or for extending some analysis to funds domiciled outside the United States.

Data are cleaned for outliers. In line with Coval and Stafford (2007); Jotikasthira, Lundblad, and Ramadorai (2012); and Jinjark and Zheng (2014), the data are excluded if they meet the following conditions: (1) monthly returns are higher than 200 percent or lower than -50 percent; (2) monthly change in total net assets (TNA) is higher than 200 percent or lower than -100 percent; or (3) fund TNA is less than US\$5 million. In addition, for cash balance analysis, portfolio allocation weight data by broad asset types are discarded if the sum of allocation weights is less than 95 percent or greater than 105 percent. Weights may have a negative value because of derivatives and securities held in short positions. Outliers are removed by discarding data when any single weight takes a value of less than -100 percent.

The roles of portfolio managers and end investors

Following Raddatz and Schmukler (2012), a fund's net investment in a security is divided into fund flows from end investors and the contribution of the changes of portfolio weights to the security, determined by portfolio managers. The term F_j is the total investment in security j (net of valuation effects) from all funds i in the sample. This investment is divided into

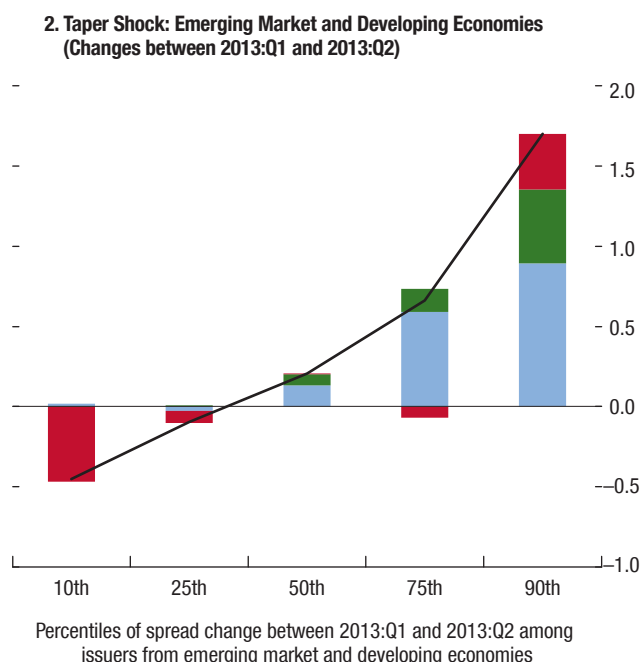
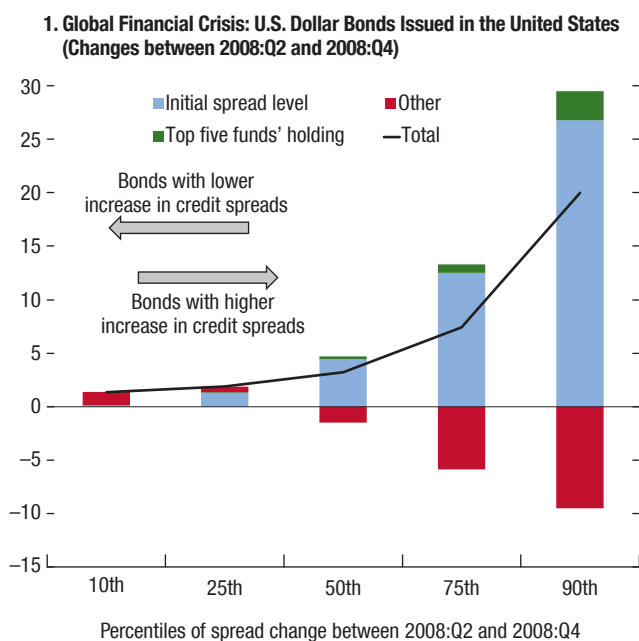
$$\begin{aligned} F_j = & \sum_i \frac{\text{Fund } i\text{'s holding of asset } j}{\text{Total asset } j \text{ held by all funds in sample}} \times \Delta w_{ij} \\ & + \sum_i \frac{\text{Fund } i\text{'s holding of asset } j}{\text{Total asset } j \text{ held by all funds in sample}} \\ & \times \text{Fund flows to } i \end{aligned} \quad (3.6)$$

In the equation, Δw_{ij} is the change in portfolio weight of fund i to asset j , net of valuation effects. The first term of the equation represents manager's choice and

Annex Figure 3.2.1. Drivers of Changes in Credit Spreads during Stress Episodes
(Changes in credit spreads in percentage points, by the levels of the spread changes)

During the global financial crisis, bonds that were held in a more concentrated manner were adversely affected, especially those with high initial spread levels.

The same was true for emerging market and developing economy bonds during the “taper shock” episode.



Sources: eMaxx; and IMF staff estimates.

the second represents end investor’s choice. Then, the variance of F_j is calculated as the sum of each component’s variation. This variance is estimated on a quarterly basis for all funds covered in the CRSP database for the period 2005:Q1–2014:Q4, excluding securities held by fewer than five funds.

Fund flows analysis

This analysis studies the drivers of monthly net flows for U.S. mutual funds and ETFs at the funds’ share-class level for open-end bond and equity funds, covering the period 1998–2014.⁴⁹ Explanatory variables include fund performance and benchmark performance, the VIX, and various fund characteristics (size, age, clientele, purchase and redemption fees, fund types, and the liquidity of the underlying asset classes). The list of variables used in the analysis is explained in Annex Table 3.2.1. The following model (for share

class i , month t , and benchmark j) is estimated with share-class fixed effects and year fixed effects as in Chen, Goldstein, and Jiang (2010), and using robust standard errors. An analogous specification was run including the interaction terms with benchmark performance instead of excess return over benchmark.

$$\begin{aligned}
 \text{Fund flows}_{it} = & \beta_0 \text{Benchmark Performance}_{j,t-1} \\
 & + \beta_1 \text{Performance}_{i,t-1} + \beta_2 \text{VIX}_t \\
 & + \beta_3 \text{HIGH_VIXD}_t + \beta_4 \text{VIX}_t \\
 & \times \text{HIGH_VIXD}_t \\
 & + \lambda \text{Fund Characteristics}_i \\
 & + \delta \text{Performance}_{i,t-1} \\
 & \times \text{Fund Characteristics}_i \quad (3.7)
 \end{aligned}$$

The test for convexity in the flow-performance relationship follows a piecewise-linear specification as in Sirri and Tufano (1998) and Ferreira and others (2012). This approach measures different linear slopes for the lowest

⁴⁹A fund may issue several classes of shares. The only difference across share classes is fees. “Fund’s TNA” means the sum of TNA of each share class issued by the fund.

20th, middle 60th, and top 20th percentiles of performance. Each month, funds are ranked according to their performance, ranging from zero (poorest performance) to one (best performance). The following model is estimated,

$$\begin{aligned}
 Fund\ flows_{it} = & \beta_0 Benchmark\ Performance_{jt-1} \\
 & + \beta_1 VIX_t + \beta_2 HIGH_VIXD_t \\
 & + \beta_3 VIX_t \times HIGH_VIXD_t \\
 & + \lambda Fund\ Characteristics_i \\
 & + \delta_1 Low_{i,t-1} + \delta_2 Mid_{i,t-1} \\
 & + \delta_3 High_{i,t-1}, \tag{3.8}
 \end{aligned}$$

in which the three levels of relative performance are defined as follows:

$$\begin{aligned}
 Low_{i,t-1} &= \min\{0.2, Rank_{i,t-1}\} \\
 Mid_{i,t-1} &= \min\{0.6, Rank_{i,t-1} - Low_{i,t-1}\} \\
 High_{i,t-1} &= Rank_{i,t-1} - (Low_{i,t-1} + Mid_{i,t-1}) \quad Rank \in [0,1]
 \end{aligned}$$

Analysis of redemption fees in times of stress

This analysis examines the role of redemption fees during times of stress. It covers two stress events: the 2008 global financial crisis and the taper episode in 2013. We compute the difference between average flows before the crisis periods (May to August 2008 and December 2012 to April 2013) and average flows during the stress periods (September to December 2008 and May to September 2013) for funds with high and low redemption fees. Funds are classified as having low redemption fees if redemption fees are equal to zero. Funds are classified as having high redemption fees if redemption fees are greater than or equal to 0.03 percent in 2008 and 0.01 percent in 2013.⁵⁰ Flows are standardized by the beginning-of-period TNA. For 2008, the focus is on equity funds because there is evidence of flight to quality into bond funds. For 2013, the focus is on emerging market equity and bond funds.

Cash holdings analysis

Drivers of fund cash holdings are investigated by estimating the model in equation (3.9). For share class i and quarter t , the model is estimated with a pooled panel regression at the share-class level, including year fixed effects and using robust standard errors. Because

⁵⁰The 2013 analysis studies emerging market funds, and therefore yields very few observations when using the 0.03 threshold.

the cash balance shows a U-shaped pattern with respect to fund flows (Figure 3.12), the model estimates a different coefficient for funds with large outflows (fund flows below $\delta = -1.5$ percent of TNA).⁵¹

$$\begin{aligned}
 Cash_{it} = & \beta_1 Flow\ volatility_{it} + \beta_2 Fund\ flow_{it} \\
 & + \beta_3 I(Fund\ flow_{it} < \delta) + \beta_4 Fund\ flow_{it} \\
 & \times I(Fund\ flow_{it} < \delta) \\
 & + \lambda Fund\ Characteristics_i \tag{3.9}
 \end{aligned}$$

Brand name effect analysis

“Flagship shocks for large AMC’s” are identified as follows: First, a “shock” happens when a fund’s flow-to-TNA ratio is below the median of its peer group (those with the same Lipper investment objective code) by 10 percentage points or more. Second, a fund with a “shock” is identified as “flagship” when its TNA is the largest of the funds administered by the same AMC (a fund family) at the end of the month before the shock. Third, the flagship shock corresponds to a large AMC if the flagship fund’s asset manager was among the top 25 as measured by end-year TNA for the shock year or any of the previous four years.

There are “brand name effects” if, in the three months including and after the flagship shock ($s, s+1, s+2$; where s is the event month), funds in the same family receive significantly lower inflows relative to comparator funds outside the family.⁵² For each event (period s), a separate cross-sectional regression model is estimated for the difference between the cumulative net inflows to each fund i between dates s and $s+2$ and the median cumulative net inflows for funds with the same investment objective j . Explanatory variables are lagged excess return, age, and a flagship family dummy.

$$\begin{aligned}
 & Cumulative\ Fund\ flow_{ij_{[s,s+2]}} \\
 & - Median(Cumulative\ Fund\ flow_{j_{[s,s+2]}}) \\
 & = \beta_1 Performance_{is-1} + \beta_2 Age_{it} \\
 & + \beta_3 Family\ Dummy(i \in I^s) \\
 & \text{for all events } s \text{ and for all funds } i \text{ with} \\
 & \text{investment objective } j \tag{3.10}
 \end{aligned}$$

⁵¹The cash holdings empirical analysis excludes sectoral, hedged, and short equity funds.

⁵²Some of the identified flagship events overlap. Overlapping cases are treated as a single event and the family dummy is set to 1 if a share class belongs to either of the affected flagships’ families.

i identifies the funds (at share-class level) that are managed by the same AMC that manages the “shocked” flagship fund (excluding the flagship itself).

Systemic risk

Systemic risk is measured for the system of mutual funds, banks, and insurance companies from advanced economies.

- Mutual funds’ NAV and total net asset data are from Lipper. For each of the three fund domicile areas (the United States, Europe, and other advanced economies) and the five asset classes (advanced economy equities, advanced economy sovereign bonds, advanced economy corporate bonds, emerging market equities, and emerging market bonds), a sample consisting of the top 100 funds, measured by total net assets, was selected, resulting in 1,500 funds. Data covering January 2000 to November 2014 were cleaned by dropping funds with fewer than 10 observations and excluding observations with weekly NAV returns of less than –60 percent or greater than 80 percent.
- For the banking and insurance sectors, weekly returns are computed using Thomson Reuters equity indices for European and U.S. banks and insurance companies.
- The system’s return is computed as the average of funds, banks, and insurance returns weighted by their relative asset size. Data on total assets of banks, insurance companies, and mutual funds are from quarterly flow-of-funds data for the United States and the euro area. An alternative measure using a simple average was also used, yielding similar results.

Systemic risk is estimated following the static CoVaR approach put forward by Adrian and Brunnermeier (2011), using quantile regressions. First, the returns of the system are regressed on the returns of each individual institution i when that institution has the lowest 5th percentile returns:

$$R_t^{System,i} = \alpha_i + \beta_i R_t^i + \varepsilon_{it}. \quad (3.11)$$

Then, CoVaR is computed as the VaR of the system conditional on institution i being in distress (defined as when its return R^i is below its 5 percent VaR, $-VaR_{50\%}^i$):

$$CoVaR_i = \hat{\alpha}_i + \hat{\beta}_i R^i = \hat{\alpha}_i - \hat{\beta}_i VaR_{50\%}^i. \quad (3.12)$$

The contribution to systemic risk of an institution i is computed as the difference between the $CoVaR_i$ when

institution i is in distress and the $CoVaR_i$ when institution i has median return ($\Delta CoVaR_i$):

$$\begin{aligned} \Delta CoVaR_i &= CoVaR_{50\%}^i - CoVaR_{50\%}^i \\ &= -\hat{\beta}_i (VaR_{50\%}^i - VaR_{50\%}^i). \end{aligned} \quad (3.13)$$

The relationship between fund size and its contribution to systemic risk is examined with the following cross-section regression model:

$$\begin{aligned} \Delta CoVaR_{ij} &= Constant_j + \alpha VaR_i + \gamma Logsize_i \\ &+ \delta Return_i + \varepsilon_i. \end{aligned} \quad (3.14)$$

The model controls for asset class (j) specific fixed effects and fund i ’s risk (VaR) and return (average in the sample period). Fund size is the log of average size in U.S. dollars over the sample period. Fixed effects are positive and significant for advanced economy equities and emerging market equities and bonds, negative for advanced economy sovereign bonds, and not significant for advanced economy corporate bonds. All the other coefficients for control variables are significant and positive at the 5 percent level. The coefficient for size is positive and significant at the 10 percent level. Alternative regressions that allow the parameters on VaR, size, and returns to vary by asset class show qualitatively similar results.

References

- Acharya, Viral, Ravi Anshuman, and Kiran Kumar. 2014. “Foreign Fund Flows and Stock Returns: Evidence from India.” Unpublished. New York University.
- Adam, Tim, and André Guettler. Forthcoming. “Pitfalls and Perils of Financial Innovation: The Use of CDS by Corporate Bond Funds.” *Journal of Banking and Finance*.
- Adrian, Tobias, and Markus K. Brunnermeier. 2011. “CoVaR.” Working Paper 17454, National Bureau of Economic Research, Cambridge, Massachusetts.
- Allen, Franklin, and Gary Gorton. 1993. “Churning Bubbles.” *Review of Economic Studies* 60 (4): 813–36.
- Arora, Navneet, and Hui Ou-Yang. 2001. “Explicit and Implicit Incentives in a Delegated Portfolio Management Problem: Theory and Evidence.” Working Paper, University of North Carolina, Chapel Hill.
- Basak, Suleyman, and Anna Pavlova. 2014. “Asset Prices and Institutional Investors.” *American Economic Review* 103 (5): 1728–58.
- , and Alexander Shapiro. 2008. “Offsetting the Implicit Incentives: Benefits of Benchmarking in Money Management.” *Journal of Banking and Finance* 32 (9): 1882–993.

- Ben-Raphael, Azi, Shmuel Kande, and Avi Wohl. 2011. "The Price Pressure of Aggregate Mutual Fund Flows." *Journal of Financial and Quantitative Analysis* 46 (2): 585–603.
- Bikhchandani, Sushil, David Hirshleifer, and Ivo Welch. 1992. "A Theory of Fads, Fashion, Custom and Cultural Change as Informational Cascades." *Journal of Political Economy* 100: 992–1026.
- BlackRock. 2014a. "ETFs Help Improve Market Stability." October.
- . 2014b. "Fund Structures and Systemic Risk Mitigants." *Viewpoint*, September.
- Borensztein, Eduardo, and Gaston Gelos. 2003. "A Panic Prone Pack? The Behavior of Emerging Market Mutual Funds." *IMF Staff Papers* 50 (1): 43–63.
- Broner, Fernando A., Gaston Gelos, and Carmen M. Reinhart. 2006. "When in Peril, Retrench: Testing the Portfolio Channel of Contagion." *Journal of International Economics* 69 (1): 203–30.
- Brown, Nerissa, Kelsey Wei, and Russ Wermers. 2013. "Analyst Recommendations, Mutual Fund Herding, and Overreaction in Stock Prices." *Management Science* 60 (1).
- Buffa, Andrea, Dimitri Vayanos, and Paul Woolley. 2014. "Asset Management Contracts and Equilibrium Prices." Working Paper 20480, National Bureau of Economic Research, Cambridge, Massachusetts.
- Calvo, Guillermo A., and Enrique G. Mendoza, 2000. "Rational Contagion and the Globalization of Securities Markets." *Journal of International Economics* 51 (1): 79–113.
- Cao, Charles, Eric Chang, and Ying Wang. 2008. "An Empirical Analysis of the Dynamic Relationship between Mutual Fund Flow and Market Return Volatility." *Journal of Banking and Finance* 32 (10): 2111–23.
- Center for European Policy Studies—European Capital Markets Institute (CEPS-ECMI). 2012. "Rethinking Asset Management from Financial Stability to Investor Protection and Economic Growth." Report of a CEPS-ECMI Task Force.
- Cetorelli, Nicola. 2014. "Hybrid Intermediaries." *Federal Reserve Bank of New York Staff Reports* 705.
- Chakravorti, Suji, and Subir Lall. 2003. "Managerial Incentives and Financial Contagion." Working Paper 2003–21, Federal Reserve Bank of Chicago.
- Chen, Qi, Itay Goldstein, and Wei Jiang. 2010. "Payoff Complementarities and Financial Fragility: Evidence from Mutual Fund Outflows." *Journal of Financial Economics* 97 (2): 239–62.
- Chevalier, Judith, and Glenn Ellison. 1997. "Risk Taking by Mutual Funds as a Response to Incentives." *Journal of Political Economy* 106 (6): 1167–200.
- Choi, Nicole, and Richard W. Sias. 2009. "Institutional Industry Herding." *Journal of Financial Economics* 94 (3): 469–91.
- Chordia, Tarun. 1996. "The Structure of Mutual Fund Charges." *Journal of Financial Economics* 41 (1): 3–39.
- Collins, Sean, and Christopher Plantier. 2014. "Are Bond Mutual Fund Flows Destabilizing? Examining the Evidence from the 'Taper Tantrum'." Working Paper, Investment Company Institute, Washington.
- Coval, Joshua, and Erik Stafford. 2007. "Asset Fire Sales (and Purchases) in Equity Markets." *Journal of Financial Economics* 86 (2): 479–512.
- Dasgupta, Amil, and Andrea Prat. 2006. "Financial Equilibrium with Career Concerns." *Theoretical Economics* 1 (1): 67–93.
- Deli, Daniel, and Raji Varma. 2002. "Closed-end versus Open-end: The Choice of Organizational Form." *Journal of Corporate Finance* 8 (1): 1–27.
- Desender, Kurt. 2012. "Ownership Structure and Stock Price Performance during Turbulent Financial Markets." Unpublished, Universidad Carlos III de Madrid.
- Deutsche Bank. 2014. *ETF Annual Review and Outlook*. January 16.
- Diamond, Douglas W., and Philip H. Dybvig. 1983. "Bank Runs, Deposit Insurance, and Liquidity." *Journal of Political Economy* 91 (3): 401–19.
- Dow, James, and Gary Gorton. 1997. "Noise Trading, Delegated Portfolio Management, and Economic Welfare." *Journal of Political Economy* 105 (5): 1024–50.
- Edelen, Roger. 1999. "Investor Flows and the Assessed Performance of Open-end Mutual Funds." *Journal of Financial Economics* 53 (3): 439–66.
- , and Jerold Warner. 2001. "Aggregate Price Effects of Institutional Trading: A Study of Mutual Fund Flow and Market Returns." *Journal of Financial Economics* 59: 195–220.
- Elliott, Douglas. 2014. "Systemic Risk and the Asset Management Industry." Economic Studies at Brookings, Brookings Institution, Washington.
- European Fund and Asset Management Association (EFAMA). 2014. "Asset Management in Europe: Facts and Figures: 7th Annual Review." European Fund and Asset Management Association, Brussels.
- European Securities and Markets Authority (ESMA). 2012. "Guidelines for Competent Authorities and UCITS Management Companies." ESMA/2012/832EN, Paris.
- Ferreira, Miguel, Aneel Keswani, Antonio Miguel, and Sofia Ramos. 2012. "The Flow-Performance Relationship around the World." *Journal of Banking and Finance* 36 (6): 1759–80.
- Feroli, Michael, Anil K. Kashyap, Kermit Schoenholtz, and Hyun Song Shin. 2014. "Market Tantrums and Monetary Policy." Chicago Booth Research Paper 14–09, University of Chicago Booth School of Business, Chicago.
- Financial Industry Regulatory Authority (FINRA). 2011. "Understanding Mutual Fund Classes." Investor Alert, Financial Industry Regulatory Authority, Washington.
- Financial Stability Board (FSB). 2011. "Potential Financial Stability Issues Arising from Recent Trends in Exchange-Traded Funds." Financial Stability Board, Basel.
- . 2013. "Strengthening Oversight and Regulation of Shadow Banking: Policy Framework for Strengthening

- Oversight and Regulation of Shadow Banking Entities.” FSB Policy Document, Financial Stability Board, Basel.
- Financial Stability Board (FSB), International Monetary Fund (IMF), and World Bank. 2011. “Financial Stability Issues in Emerging Market and Developing Economies.” Report to the G-20 Finance Ministers and Central Bank Governors, Financial Stability Board, Basel.
- Financial Stability Board (FSB) and International Organization of Securities Commissions (IOSCO). 2014. “Assessment Methodologies for Identifying Non-bank Non-insurer Global Systemically Important Financial Institutions.” Consultation Document, Financial Stability Board, Basel.
- . 2015. “Assessment Methodologies for Identifying Non-bank Non-insurer Global Systemically Important Financial Institutions.” The Second Consultation Document, Financial Stability Board, Basel.
- Financial Stability Oversight Council (FSOC). 2014. “Notice Seeking Comment on Asset Management Products and Activities.” U.S. Department of the Treasury, Washington. <http://www.treasury.gov/initiatives/fsoc/rulemaking/Pages/open-notice.aspx>.
- Frazzini, Andrea, and Owen A. Lamont. 2008. “Dumb Money: Mutual Fund Flows and the Cross-Section of Stock Returns.” *Journal of Financial Economics* 88 (2): 299–322.
- Froot, Kenneth A., Paul G. J. O’Connell, and Mark S. Sea-sholes. 2001. “The Portfolio Flows of International Investors.” *Journal of Financial Economics* 59 (2): 151–93.
- Gelos, Gaston. 2011. “International Mutual Funds, Capital Flow Volatility, and Contagion: A Survey.” IMF Working Paper 11/92, International Monetary Fund, Washington.
- Greenwood, Robin, and David Thesmar. 2011. “Stock Price Fragility.” *Journal of Financial Economics* 102 (3): 471–90.
- Grinblatt, Mark, Sheridan Titman, and Russ Wermers. 1995. “Momentum Investment Strategies, Portfolio Performance, and Herding: A Study of Mutual Fund Behavior.” *American Economic Review* 85 (5): 1088–105.
- Haldane, Andrew. 2014. “The Age of Asset Management?” Speech at the London Business School, April 4.
- Hau, Harald, and Sandy Lai. 2010. “The Role of Equity Funds in the Financial Crisis Propagation.” Research Paper No. 11–35, Swiss Finance Institute, Geneva.
- Igan, Deniz, and Marcelo Pinheiro. 2012. “The Effects of Relative Performance Objectives on Financial Markets.” MPRA Paper 43452, University Library of Munich.
- Ilyina, Ana. 2006. “Portfolio Constraints and Contagion in Emerging Markets.” *IMF Staff Papers* 53 (3): 351–74.
- International Monetary Fund (IMF). 2012. “Macrofinancial Stress Testing—Principles and Practices.” Washington.
- . 2014. “Staff Guidance Note on Macroprudential Policy.” Washington.
- International Organization of Securities Commissions (IOSCO). 2011. “Principles on Suspensions of Redemptions in Collective Investment Schemes.” Madrid.
- Investment Company Institute (ICI). 2014a. “The Closed-end Fund Market, 2013.” *ICI Research Perspective* 20 (1).
- . 2014b. *ICI Factbook 2014*. Washington: Investment Company Institute.
- . 2014c. “Understanding Exchange-Traded Funds: How ETFs Work.” *ICI Research Perspective* 20 (5).
- Jinjarak, Yothin, and Huanhuan Zheng. 2014. “Granular Institutional Investors and Global Market Interdependence.” *Journal of International Money and Finance* 46: 61–81.
- Jotikasthira, Chotibhak, Christian Lundblad, and Tarun Ramadorai. 2012. “Asset Fire Sales and Purchases and the International Transmission of Funding Shocks.” *Journal of Finance* 67 (6): 2015–50.
- Lakonishok, Josef, Andrei Shleifer, and Robert Vishny. 1992. “The Impact of Institutional Trading on Stock Prices.” *Journal of Financial Economics* 32 (1): 23–44.
- Liang, Nellie. 2015. “Asset Management and Financial Stability.” Presentation at the Brookings Institution, January 9.
- Ma, Linlin, Yuehua Tang, and Juan-Pedro Gomez. 2013. “Portfolio Manager Compensation in the U.S. Mutual Fund Industry.” <http://ssrn.com/abstract=2024027> or <http://dx.doi.org/10.2139/ssrn.2024027>.
- Manconi, Alberto, Massimo Massa, and Ayako Yasuda. 2012. “The Role of Institutional Investors in Propagating the Crisis of 2007–08.” *Journal of Financial Economics* 104 (3): 491–518.
- Massa, Massimo, and Rajdeep Patgiri. 2009. “Incentives and Mutual Fund Performance: Higher Performance or Just Higher Risk Taking?” *Review of Financial Studies* 22 (5): 1777–815.
- Massa, Massimo, and Zahid Rehman. 2008. “Information Flows within Financial Conglomerates: Evidence from the Banks-Mutual Funds Relation.” *Journal of Financial Economics* 89 (2): 288–306.
- Maug, Ernst, and Narayan Naik. 2011. “Herding and Delegated Portfolio Management: The Impact of Relative Performance Evaluation on Asset Allocation.” *Quarterly Journal of Finance* 1 (2): 265–92.
- McKinsey. 2013. *Financial Globalization: Retreat or Reset?* McKinsey Global Institute.
- Metrick, Andrew, and Ayako Yasuda. 2011. “Venture Capital and Other Private Equity: A Survey.” *European Financial Management* 17 (4): 619–54.
- Moody’s. 2010. “Sponsor Support Key to Money Market Funds.” August 9.
- Morningstar. 2012. “Synthetic ETFs under the Microscope: A Global Study.” Morningstar ETF Research.
- Office of Financial Research (OFR). 2013. “Asset Management and Financial Stability.” Office of Financial Research, U.S. Department of Treasury, Washington.
- Pensions and Investments and Towers Watson. 2014. “The World’s 500 Largest Asset Managers.” Towers Watson, New York.
- PriceWaterhouseCoopers. 2013. *Asset Management 2020: A Brave New World*. London: PriceWaterhouseCoopers.
- Raddatz, Claudio, and Sergio Schmukler. 2012. “On the International Transmission of Shocks: Micro-Evidence from

- Mutual Fund Portfolios.” *Journal of International Economics* 88 (2): 357–74.
- Rajan, Raghuram G. 2005. “Has Financial Development Made the World Riskier?” Paper presented at The Greenspan Era: Lessons for the Future. Federal Reserve Bank of Kansas Symposium, Jackson Hole, Wyoming.
- Ross, Stephen. 2004. “Compensation, Incentives, and the Duality of Risk Aversion.” *Journal of Finance* 59 (1): 207–25.
- Scharfstein, David, and Jeremy Stein. 1990. “Herd Behavior and Investment.” *American Economic Review* 90 (3): 465–79.
- Schmidt, Lawrence, Allan Timmermann, and Russ Wermers. 2013. “Runs on Money Market Mutual Funds.” Working Paper, January. http://econweb.ucsd.edu/~lschmidt/Schmidt_Timmermann_Wermers.pdf.
- Securities Industry and Financial Markets Association (SIFMA). 2014. “SIFMA Asset Management Group’s Comments to the FSB and SEC in Response to OFR Study and in Regards to Separate Accounts.” Securities Industry and Financial Markets Association, New York and Washington.
- Sirri, Erik R., and Peter Tufano. 1998. “Costly Search and Mutual Fund Flows.” *Journal of Finance* 53 (5): 1589–622.
- Stein, Jeremy C. 2014. “Comments on ‘Market Tantrums and Monetary Policy,’ a paper by Michael Feroli, Anil K. Kashyap, Kermit Schoenholtz, and Hyun Song Shin.” Paper presented at the U.S. Monetary Policy Forum, New York, New York, February 28.
- Stracca, Livio. 2006. “Delegated Portfolio Management: A Survey of the Theoretical Literature.” *Journal of Economic Surveys* 20 (5): 823–48.
- TheCityUK. 2012. *Private Equity 2012*.
- Vayanos, Dimitri. 2004. “Flight to Quality, Flight to Liquidity, and the Pricing of Risk.” Working Paper 10327, National Bureau of Economic Research, Cambridge, Massachusetts.
- Warther, Vincent A. 1995. “Aggregate Mutual Fund Flows and Security Returns.” *Journal of Financial Economics* 39 (2-3): 209–35.
- Wermers, Russ. 1999. “Mutual Fund Herding and the Impact on Stock Prices.” *Journal of Finance* 54 (2): 581–622.
- Wurgler, Jeffrey. 2010. “On the Economic Consequences of Index-Linked Investing.” Working Paper 16376, National Bureau of Economic Research, Cambridge, Massachusetts.

