

World Economic and Financial Surveys

# Global Financial Stability Report

## Potent Policies for a Successful Normalization

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April 2016

## **Potent Policies for a Successful Normalization**

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I N T E R N A T I O N A L M O N E T A R Y F U N D

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Cover and Design: Luisa Menjivar and Jorge Salazar  
Composition: AGS, An RR Donnelley Company

**Cataloging-in-Publication Data**

**Joint Bank-Fund Library**

Names: International Monetary Fund.  
Title: Global financial stability report.  
Other titles: GFSR | World economic and financial surveys, 0258-7440  
Description: Washington, DC : International Monetary Fund, 2002- | Semiannual | Some issues also have thematic titles. | Began with issue for March 2002.  
Subjects: LCSH: Capital market—Statistics—Periodicals. | International finance—Forecasting—Periodicals. | Economic stabilization—Periodicals.  
Classification: LCC HG4523.G557

ISBN 978-1-51350-677-7 (Paper)  
978-1-49836-328-0 (ePub)  
978-1-48431-450-0 (Mobipocket)  
978-1-48431-436-4 (PDF)

**Disclaimer:** The *Global Financial Stability Report* (GFSR) is a survey by the IMF staff published twice a year, in the spring and fall. The report draws out the financial ramifications of economic issues highlighted in the IMF's *World Economic Outlook* (WEO). The report was prepared by IMF staff and has benefited from comments and suggestions from Executive Directors following their discussion of the report on March 28, 2016. The views expressed in this publication are those of the IMF staff and do not necessarily represent the views of the IMF's Executive Directors or their national authorities.

**Recommended citation:** International Monetary Fund, *Global Financial Stability Report—Potent Policies for a Successful Normalization* (Washington, April 2016).

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## ASSUMPTIONS AND CONVENTIONS

The following conventions are used throughout the *Global Financial Stability Report* (GFSR):

- . . . to indicate that data are not available or not applicable;
- to indicate that the figure is zero or less than half the final digit shown, or that the item does not exist;
- between years or months (for example, 2014–15 or January–June) to indicate the years or months covered, including the beginning and ending years or months;
- / between years or months (for example, 2014/15) to indicate a fiscal or financial year.

“Billion” means a thousand million.

“Trillion” means a thousand billion.

“Basis points” refers to hundredths of 1 percentage point (for example, 25 basis points are equivalent to  $\frac{1}{4}$  of 1 percentage point).

If no source is listed on tables and figures, data are based on IMF staff estimates or calculations.

Minor discrepancies between sums of constituent figures and totals shown reflect rounding.

As used in this report, the terms “country” and “economy” do not in all cases refer to a territorial entity that is a state as understood by international law and practice. As used here, the term also covers some territorial entities that are not states but for which statistical data are maintained on a separate and independent basis.

### Further Information and Data

This version of the GFSR is available in full through the IMF eLibrary ([www.elibrary.imf.org](http://www.elibrary.imf.org)) and the IMF website ([www.imf.org](http://www.imf.org)).

The data and analysis appearing in the GFSR are compiled by the IMF staff at the time of publication. Every effort is made to ensure, but not guarantee, their timeliness, accuracy, and completeness. When errors are discovered, there is a concerted effort to correct them as appropriate and feasible. Corrections and revisions made after publication are incorporated into the electronic editions available from the IMF eLibrary ([www.elibrary.imf.org](http://www.elibrary.imf.org)) and on the IMF website ([www.imf.org](http://www.imf.org)). All substantive changes are listed in detail in the online tables of contents.

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## PREFACE

The *Global Financial Stability Report* (GFSR) assesses key risks facing the global financial system. In normal times, the report seeks to play a role in preventing crises by highlighting policies that may mitigate systemic risks, thereby contributing to global financial stability and the sustained economic growth of the IMF's member countries.

The current report finds that global financial stability risks have risen since October 2015. The report finds that the outlook has deteriorated in advanced economies because of heightened uncertainty and setbacks to growth and confidence, while declines in oil and commodity prices and slower growth have kept risks elevated in emerging markets. These developments have tightened financial conditions, reduced risk appetite, raised credit risks, and stymied balance sheet repair. A broad-based policy response is needed to secure financial stability. Advanced economies must deal with crisis legacy issues, emerging markets need to bolster their resilience to global headwinds, and the resilience of market liquidity should be enhanced. The report also examines financial spillovers from emerging market economies and finds that they have risen substantially. This implies that when assessing macrofinancial conditions, policymakers may need to increasingly take into account economic developments in emerging market economies. Finally, the report assesses changes in the systemic importance of insurers, finding that across advanced economies the contribution of life insurers to systemic risk has increased in recent years. The results suggest that supervisors and regulators should take a more macroprudential approach to the sector.

The analysis in this report has been coordinated by the Monetary and Capital Markets (MCM) Department under the general direction of José Viñals, Financial Counsellor and Director. The project has been directed by Peter Dattels and Dong He, both Deputy Directors, as well as by Gaston Gelos and Matthew Jones, both Division Chiefs. It has benefited from comments and suggestions from the senior staff in the MCM Department.

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Joe Procopio from the Communications Department led the editorial team and managed the report's production with support from Katy Whipple and Linda Kean and editorial assistance from Michelle Chen, Lucy Scott Morales, Sherrie Brown, Gregg Forte, EEI Communications, and AGS (an RR Donnelley Company).

This particular edition of the GFSR draws in part on a series of discussions with banks, securities firms, asset management companies, hedge funds, standards setters, financial consultants, pension funds, central banks, national treasuries, and academic researchers.

This GFSR reflects information available as of March 25, 2016. The report benefited from comments and suggestions from staff in other IMF departments, as well as from Executive Directors following their discussion of the GFSR on March 28, 2016. However, the analysis and policy considerations are those of the contributing staff and should not be attributed to the IMF, its Executive Directors, or their national authorities.

## EXECUTIVE SUMMARY

Risks to global financial stability have increased since the October 2015 *Global Financial Stability Report*. In advanced economies, the outlook has deteriorated because of heightened uncertainty and setbacks to growth and confidence. Disruptions to global asset markets have added to these pressures. Declines in oil and commodity prices have kept risks elevated in emerging market economies, while greater uncertainty about China's growth transition has increased spillovers to global markets. These developments tightened financial conditions, reduced risk appetite, raised credit risks, and stymied balance sheet repair, undermining financial stability.

Many market prices dropped dramatically during the turmoil in January and February, moving asset valuations to levels below those consistent with macroeconomic fundamentals that suggest a steady but slowly improving growth path (see the April 2016 *World Economic Outlook*). Instead, heightened market volatility and risk aversion may have reflected rising economic, financial, and political risks as well as weakened confidence in policies. The recovery in asset prices since February has reversed much of these losses and lowered volatility. Market sentiment has been supported by higher oil and commodity prices, stronger data out of the United States, and supportive actions by central banks. But the net impact of the turmoil has been a shock to confidence, with negative repercussions for financial stability.

The main message of this report is that additional measures are needed to deliver a more balanced and potent policy mix for improving the growth and inflation outlook and securing financial stability. In the absence of such measures, market turmoil may recur. In such circumstances, rising risk premiums may tighten financial conditions further, creating a pernicious feedback loop of fragile confidence, weaker growth, lower inflation, and rising debt burdens. Disruptions to global asset markets could increase the risks of tipping into a more serious and prolonged slowdown marked by financial and economic stagnation. In a situation of financial stagnation, financial institutions responsible for the allocation of capital and mobilization of savings might

struggle with impaired balance sheets for an extended period of time. Financial soundness could become eroded to such an extent that both economic growth and financial stability are adversely affected in the medium term. In such a scenario, world output could fall by 3.9 percent relative to the baseline by 2021.

Policymakers need to build on the current economic recovery and deliver a stronger path for growth and financial stability by tackling a triad of global challenges—legacy challenges in advanced economies, elevated vulnerabilities in emerging markets, and greater systemic market liquidity risks. Progress along this path will enable the world's economies to make a decisive break toward a strong and healthy financial system and a sustained recovery. In such a scenario, world output could expand by 1.7 percent relative to the baseline by 2018.

*Advanced economies must deal with crisis legacy issues.* Banks in advanced economies have become safer in recent years, with stronger capital and liquidity buffers and progress in repairing balance sheets. Despite these gains, banks came under market pressure at the start of the year, reflecting concerns about the profitability of banks' business models in a weak economic environment. Approximately 15 percent of banks in advanced economies (by assets) face significant challenges in attaining sustainable profitability without reform. In the euro area, market pressures also highlighted long-standing legacy issues, indicating that a more complete solution to European banks' problems cannot be further postponed. Elevated nonperforming loans urgently need to be tackled using a comprehensive strategy, and excess capacity in the euro area banking system will have to be addressed over time. In the United States, mortgage markets—which were at the epicenter of the 2008–09 crisis—continue to benefit from significant government support. Authorities should reinvalidate efforts to reduce the dominance of Fannie Mae and Freddie Mac and continue with reforms of these institutions.

Chapter 3 shows that across advanced economies, the contribution of the insurance sector—particularly life insurers—to systemic risk has increased, although not

yet to the level of the banking sector. This increase is largely a result of growing common exposures to aggregate risk, partly because insurers' interest rate sensitivity has risen and partly because of higher correlations across asset classes. In the event of an adverse shock, therefore, insurers are unlikely to fulfill their role as financial intermediaries at a time when other parts of the financial system are also struggling to do so.

These findings suggest that a more macroprudential approach to supervision and regulation of insurance companies should be taken. Measures could include regular macroprudential stress testing or the adoption of countercyclical capital buffers. Steps that would complement a push for stronger macroprudential policies include the international adoption of capital and transparency standards for the sector. In addition, the different behavior of smaller and weaker insurers warrants attention by supervisors.

*Emerging markets need to bolster their resilience to global headwinds.* Emerging market economies are faced with a difficult combination of slower growth, weaker commodity prices, and tighter credit conditions, amid more volatile portfolio flows. This mixture has kept financial and economic risks elevated. So far, many economies have shown remarkable resilience to this more difficult domestic and external environment, as policymakers have made judicious use of buffers in strengthened policy frameworks.

Commodity-related firms are cutting capital expenditures sharply as high private debt burdens reinforce risks to credit and banks. Commodity-exporting countries and those in the Middle East and the Caucasus are particularly exposed to strains across the real economy and the financial sector. The nexus between state-owned enterprises (SOEs) and sovereigns has intensified, and could increase fiscal and financial stability risks in countries with repayment pressures. More broadly, debt belonging to nonfinancial corporations with reduced ability to repay have risen to \$650 billion, or 12 percent of total corporate debt of listed firms considered in this report. Bank capital buffers are generally adequate, but will likely be tested by weaker earnings and the downturn in the credit cycle.

Emerging market economies generally have the tools to boost their resilience and counter the effects of lower commodity prices and the slowdown in growth and capital flows. Authorities in emerging market economies should continue to use their buffers and policy space, where available, to smooth

adjustment and strengthen sovereign and bank balance sheets. This includes using external buffers, fiscal and monetary policy, and macroprudential and supervisory frameworks, among other tools. Countries with insufficient buffers and limited policy space should act early by adjusting macroeconomic policies to address their vulnerabilities, including by seeking external support.

China's economic rebalancing is gaining traction. The country has made notable progress in rebalancing its economy toward new sources of growth and addressing some financial sector risks. In addition, stricter regulation of shadow banking activities has helped steer the composition of financing toward bank loans and bond issuance. Nevertheless, China's rebalancing is inherently complex, and commitment to a more ambitious and comprehensive policy agenda is urgently needed to stay ahead of rising vulnerabilities. Slowing growth has eroded corporate sector health, with falling profitability undermining the debt-servicing capacity of firms holding some 14 percent of the debt of listed companies, adding to balance sheet stresses across the system. A comprehensive plan to address the corporate debt overhang would assist a steady deleveraging process. Corporate deleveraging should be accompanied by a strengthening of banks and social safety nets, especially for displaced workers in overcapacity sectors. A comprehensive restructuring program to deal with bad assets and strengthen banks should be developed swiftly, along with a sound legal and institutional framework for facilitating bankruptcy and debt-workout processes.

Chapter 2 finds that spillovers of emerging market shocks to equity prices and exchange rates have risen substantially, and now explain more than a third of the variation in asset returns. This underscores the importance for policymakers in both advanced economies and emerging markets of taking account of economic and policy developments in emerging market economies when assessing domestic macro-financial conditions. Financial integration, more than economic size and trade integration, is key to an emerging market economy's role as receiver and emitter of financial spillovers. The level of integration explains, for example, why purely financial contagion from China remains less significant even as the impact of Chinese growth shocks is increasingly important for equity returns in both emerging market and advanced economies. As China's role in the global financial system continues

to grow, clear and timely communication of its policy decisions and transparency about its policy goals and strategies consistent with their achievement will be ever more important. Given the evident relevance of corporate leverage and mutual fund flows in amplifying spillovers of shocks, shaping macroprudential surveillance and policies to contain systemic risks arising from these channels will be vital.

*The resilience of market liquidity should be enhanced.*  
As discussed in previous reports, a comprehensive approach to reducing risks of liquidity runs on mutual funds and strengthening the provision of market

liquidity services is needed to avoid the risk of amplifying market shocks.

The stakes are high. First, rising risks of weakening growth and more instability must be avoided. Then, growth must be strengthened and financial stability improved *beyond the baseline*. An ambitious policy agenda is required, comprising a more balanced and potent policy mix, including stronger financial reforms together with continuing monetary accommodation. Increased confidence in policies will help reduce vulnerabilities, remove uncertainties, and touch off a virtuous feedback loop between financial markets and the real economy.

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## IMF EXECUTIVE BOARD DISCUSSION SUMMARY

*The following remarks were made by the Chair at the conclusion of the Executive Board's discussion of the Fiscal Monitor, Global Financial Stability Report, and World Economic Outlook on March 28, 2016.*

Executive Directors broadly shared the assessment of global economic prospects and risks. They noted that while the global economy continues to expand modestly, prospects have weakened across a wide range of countries, and downside risks are rising. Risks to global financial stability have also increased amid volatility in global asset markets, weaker confidence, and geopolitical tensions. Directors agreed that the current conjuncture increases the urgency of a broad-based policy response, both individually and collectively, to raise growth, manage vulnerabilities, and boost confidence.

Directors observed that growth in advanced economies is projected to remain modest, in line with the 2015 outcomes. A stronger recovery continues to be restrained by weak external demand, low productivity growth, unfavorable demographic trends, growing income inequality, and legacies from the 2008–09 global financial crisis. Meanwhile, deflation risks remain a concern in Japan and several euro area countries.

Directors noted the generally weakening outlook for emerging market and developing economies, reflecting tighter global financial conditions and a weaker commodity market outlook. Growth prospects differ considerably across countries, and many have demonstrated more resilience to shocks given existing buffers and strengthened fundamentals and policy frameworks. China's transition toward more sustainable growth, backed by ample policy buffers, is a welcome development; however, given the increasingly prominent role of China in the world economy and financial markets, challenges and uncertainties in the process could have potential international implications.

Directors concurred that the outlook for global financial stability is clouded by downside risks. They noted in particular market pressures on bank-

ing systems and life insurance sectors in advanced economies. Emerging market economies face volatile capital flows and exchange rate pressures, as well as corporate sector vulnerabilities. A more balanced and potent policy mix that includes strong supervision, macroprudential frameworks, and implementation of the regulatory reform agenda is therefore vital.

Directors underscored that a combination of structural reforms and supportive monetary and fiscal policies is needed to raise actual and potential output. They generally endorsed the main policy recommendations in the reports, although the appropriate mix should be tailored to each country's circumstances. Directors also highlighted the importance of clear communication of policy intentions, especially by large economies. Commitment by policymakers to facilitate cross-border trade flows and global rebalancing remains crucial and must be followed through in order to achieve strong, sustainable, and balanced global growth. The fragile conjuncture calls for concerted efforts to identify potential responses to downside risks were they to materialize, to ensure strong, well-coordinated oversight and global financial safety nets and to ring-fence spillovers from noneconomic shocks.

Directors broadly agreed that, in advanced economies, securing higher sustainable growth requires a bold three-pronged approach consisting of mutually reinforcing (1) structural reforms, (2) continued monetary policy accommodation, and (3) prudent fiscal support. Recognizing the need to avoid overburdening monetary policy and preserve debt sustainability, Directors saw as a key element of this strategy a well-designed and -sequenced country-specific structural reform agenda that takes into account both the short- and medium-term impact of reforms. Reforms that entail fiscal support and reduce barriers to entry in product and services markets would best

help strengthen near-term demand, while well-targeted tax and spending policies to encourage innovation and education investment could also play a useful role.

Directors stressed that accommodative monetary policy remains important, particularly in Japan and the euro area. Mindful of the side effects of extremely low—and, in some countries, negative—interest rates on domestic financial institutions, exchange rates, and other countries, they stressed the importance of complementary efforts to enhance policy transmission and accelerate balance sheet repair. The growing systemic importance of the insurance sector, in an environment of low interest rates, warrants a strong macroprudential approach to supervision and regulation.

Directors agreed that, where needed and where fiscal space is available, fiscal policy in advanced economies should be supportive of short- and medium-term growth—with a focus on boosting future productive capacity, in particular through infrastructure investment, and financing demand-friendly structural reforms. To preserve debt sustainability and anchor expectations, any fiscal relaxation should be based on a credible plan to return fiscal policy settings back toward targets over the medium term. Where fiscal space is limited, the emphasis should be placed on a more growth-friendly composition of the budget.

While recognizing the diverse challenges facing policymakers in emerging market and developing economies, Directors agreed that common policy priorities center on reducing macroeconomic and financial vulnerabilities and rebuilding resilience. They stressed that, in many countries, better fiscal and debt management frameworks that anchor longer-term plans will help mitigate procyclical policy and build resilience,

while structural reforms are urgently needed to raise productivity and remove bottlenecks to production. Exchange rate flexibility, where feasible, can help cushion external shocks, although its effects on inflation and the balance sheets of the private and public sectors would need to be monitored closely.

Directors noted that the positive growth effects of the decline in commodity prices in commodity-importing economies have been less pronounced than expected. Commodity-exporting countries, on the other hand, have been hit hard and many have run down their policy buffers. Some of these countries need to adjust public spending to lower fiscal revenues. This adjustment should be complemented by further efforts to improve revenue diversification and phase out poorly targeted and wasteful spending, including fuel subsidies. For commodity importers, depending on their needs, part of the windfall gains from lower oil prices could be used to finance critical structural reforms or growth-enhancing spending.

Directors concurred that, in low-income countries, policies must respond to the heightened challenges and vulnerabilities stemming from the difficult external environment, taking account of domestic circumstances. For many commodity exporters whose fiscal and external balances are deteriorating, a tight macroeconomic policy stance is required to preserve hard-won macroeconomic stability. Directors also stressed the need to make further progress toward the Sustainable Development Goals, particularly through economic diversification, domestic revenue mobilization, and financial deepening. Appropriate policy advice and adequate financial assistance from the IMF and development partners remain important in that regard.

## Financial Stability Overview

Since the last *Global Financial Stability Report* (GFSR) in October 2015, overall stability risks have increased (Figures 1.1 and 1.2). The outlook for financial stability has been clouded by disruptions to global asset markets reflecting setbacks to growth, greater uncertainty, and weaker confidence. This environment has led to tighter financial conditions (Box 1.1). Although some decompression of risk premiums and volatility is to be expected as the U.S. Federal Reserve begins the gradual process of normalizing monetary policy, the speed and intensity of market movements and reduced *risk appetite* suggest that other factors are at play.

The proximate causes of global market disruptions in January and February were as follows:

- *Higher macroeconomic risks*, as a combination of weaker data, deteriorating sentiment, and policy surprises roiled markets. More uncertain global growth prospects and declines in inflation expectations (Figure 1.3) have increased downside risks to the baseline growth forecast, as discussed in the April 2016 *World Economic Outlook* (WEO).
- *Oil and commodity prices continued to decline*. Concerns about slower growth, weaker commodity prices, and tighter credit conditions are reducing many emerging market economies' buffers, keeping *emerging market risks* elevated.
- *Uncertainty about economic rebalancing in China* as it tackles domestic and external imbalances. Spillovers

Prepared by staff from the Monetary and Capital Markets Department (in consultation with other departments): Peter Dattels (*Deputy Director*), Matthew Jones (*Division Chief*), Ali Al-Eyd (*Deputy Division Chief*), Jennifer Elliott (*Deputy Division Chief*), Magally Bernal, Carlos Caceres, John Caparusso, Sally Chen, Yingyuan Chen, Kay Chung, Fabio Cortes, Cristina Cuervo, Alfredo Cuevas, Martin Edmonds, Michaela Erbenova, Caio Ferreira, Ellen Gaston, Tryggvi Gudmundsson, Anastasia Guscina, Fei Han, Thomas Harjes, Sanjay Hazarika, Geoffrey Heenan, Dyna Heng, Henry Hoyle, Mustafa Jamal, Andy Jobst, Bradley Jones, David Jones, Ivo Krznar, Tak Yan Daniel Law, Alejandro Lopez Mejia, Inutu Lukonga, Paul Mills, Sherherya Malik, Rebecca McCaughrin, Marina Moretti, Aditya Narain, Erlend Nier, Evan Papageorgiou, Vladimir Pillonca, Juan Rigat, Fabiano Rodrigues Bastos, Christian Saborowski, Luca Sanfilippo, Juan Sole, Ilan Solot, Moez Souissi, Nobuyasu Sugimoto, Narayan Suryakumar, Shamir Tanna, Francis Vitek, and Jeffrey Williams.

to global financial markets from exchange rate pressure, drops in commodity prices, capital outflows, and notable declines in international reserves added to market strains.

- *Reduced confidence in policy traction*, along with less confidence in the ability of policymakers to offset the impact of rising economic, financial, and geopolitical risks on the outlook.

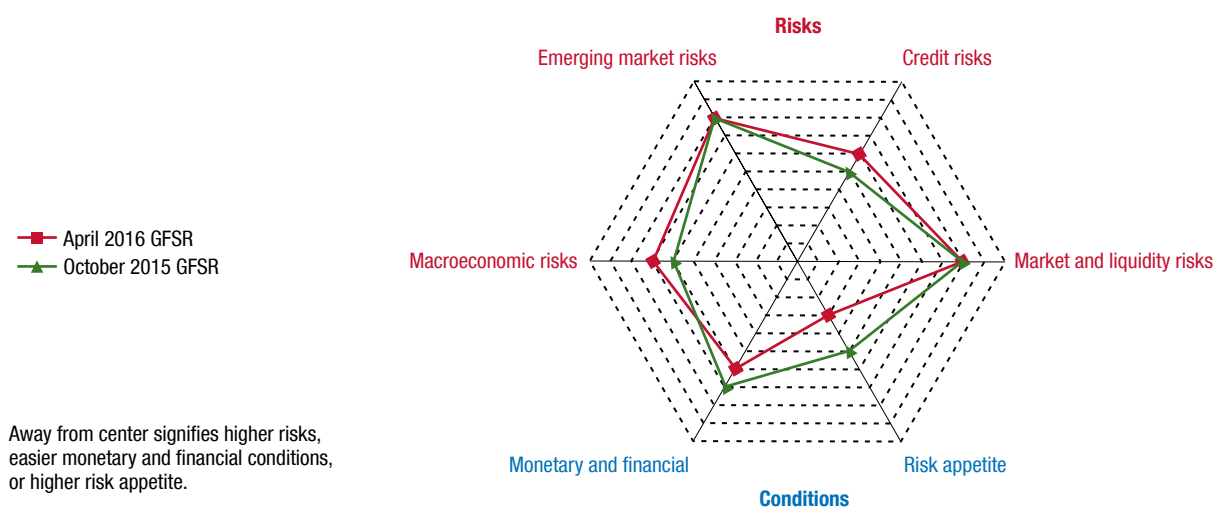
These shocks and developments in global markets are testing the resilience of emerging market and advanced economies alike:

- In advanced economies, *credit risks* have increased for the first time since 2011. Banks in many advanced economies came under renewed pressure from equity price declines and rising credit spreads. This pressure pushed bank valuations sharply lower in February, particularly for banks with the weakest business models and capital buffers (see the section on Advanced Economies: Banks' Legacy Problems and New Challenges).
- In emerging markets, excess capacity, especially in commodity-related sectors, is being unwound through sharp reductions in capital expenditures, while high private debt burdens reinforce risks to sovereign balance sheets, credit markets, and banks. This mix is further weighing on growth, deterring capital inflows, and weakening exchange rates (see the section on Emerging Market Economies and China's Complex Transition).

Despite significant policy efforts to support aggregate demand and strengthen the financial system, the risks from slowing growth, remaining balance sheet vulnerabilities, and tighter and more volatile financial conditions have become more apparent. *Monetary and financial conditions* have become less accommodative as risk premiums spiked alongside tighter financial conditions, keeping *market and liquidity risks* elevated. Financial markets appear to be questioning the ability of policymakers to fully offset recurring bouts of market disruption and deliver a stronger path for growth and financial stability. These misgivings stem from the



**Figure 1.1. Global Financial Stability Map: Risks and Conditions**



Source: IMF staff estimates.  
 Note: GFSR = *Global Financial Stability Report*.

overreliance on monetary policy and insufficient confidence-enhancing reforms and cyclical demand support.

Increased political uncertainty related to geopolitical conflicts, political discord, terrorism, refugee flows, or global epidemics loom over some countries and regions, and if left unchecked, could have significant spillovers on financial markets. The uncertainties associated with the possibility of British exit from the European Union could also weigh heavily on the outlook. Perceptions of limited policy space to respond to adverse shocks are exacerbating concerns about these risks.

In the absence of additional measures that deliver a more balanced and potent policy mix, episodes of market turmoil may occur, tightening financial conditions and eroding confidence. Further shocks and a broader deterioration of confidence could seriously damage the baseline outlook and increase the risks of tipping into a downside scenario of persistent low inflation and economic and financial stagnation, as discussed in the next section and noted in the April 2016 WEO.

Policymakers must deliver a stronger path for growth and financial stability. This vital and urgent need calls for a more balanced and ambitious set of policies to repair balance sheets and enhance growth prospects (see the section on Scenarios and Policies). Such measures will address growing downside risks and clear the way for a strong and balanced recovery and a supportive financial system.

### Global Market Disruptions and Risks to the Baseline

*The market turbulence earlier this year is a reminder that economic and financial shocks can rapidly reverberate throughout the world economy, threatening to overwhelm policy frameworks that are not sufficiently strong, and push countries into a phase of economic and financial stagnation.*

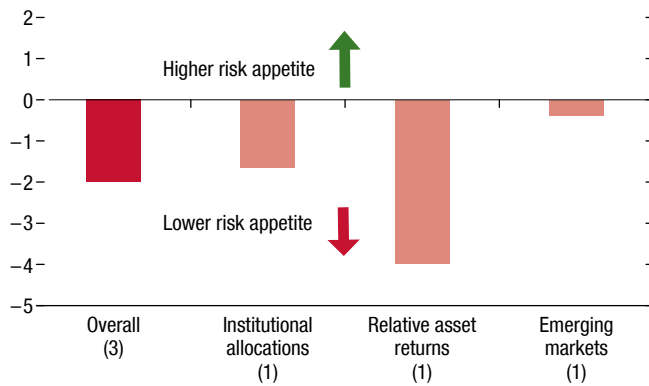
### What Does Market Turbulence Tell Us about the Risks to the Outlook?

Many market prices dropped dramatically during the turmoil in January and February, pushing asset valuations lower than levels consistent with the weakened baseline, given that macroeconomic fundamentals suggest a steady but slowly improving growth path (see the April 2016 WEO). Equity markets bottomed out in mid-February and have since recovered much of their losses.

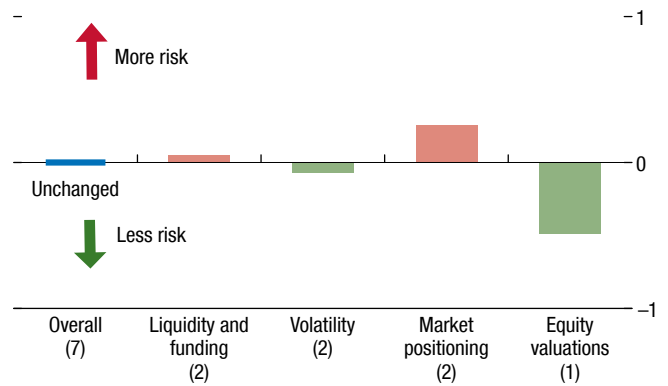
Despite the recovery in asset values from their February lows, current valuations still reflect higher economic, financial, and geopolitical risks amid weakened confidence in policy frameworks. Further shocks and a broader loss of confidence could impart more damage to the economic baseline and increase the risks of sliding into an adverse downside scenario of persistent disinflationary pressures and rising debt burdens. Such a situation would be marked by persistent low

**Figure 1.2. Global Financial Stability Map: Components of Risks and Conditions**  
 (Notch changes since the October 2015 Global Financial Stability Report)

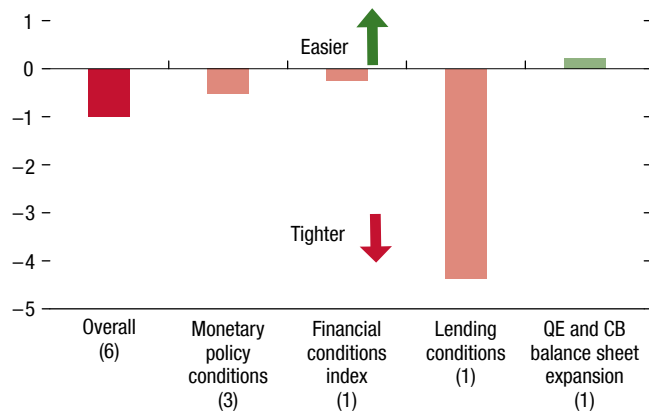
**1. Risk appetite** has decreased with continued outflows from emerging markets.



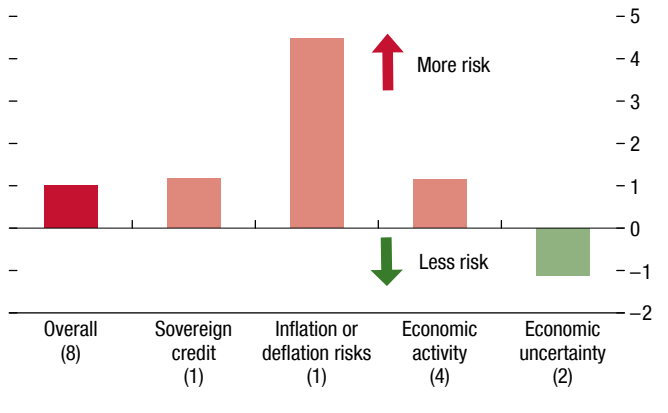
**2. Market and liquidity risks** remain high as volatility persists.



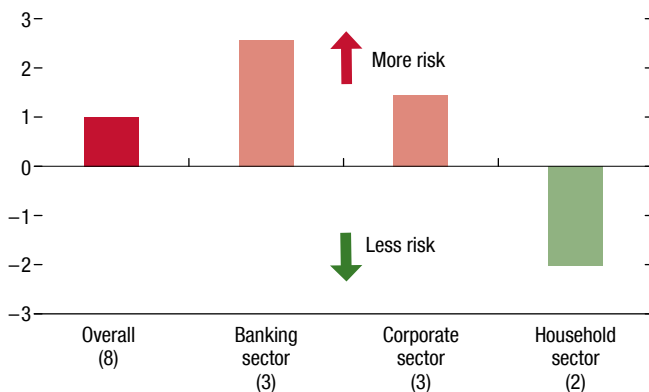
**3. Monetary and financial conditions** have tightened due to stricter lending standards.



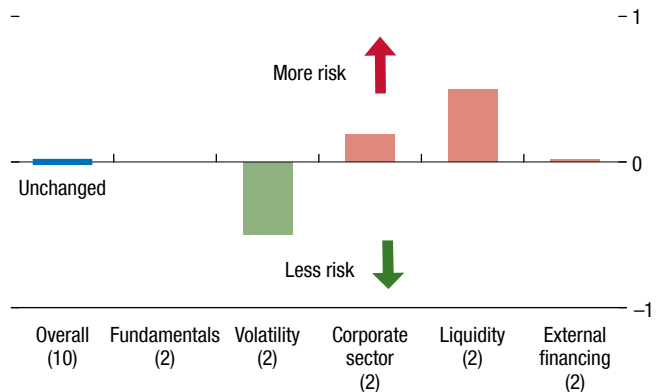
**4. Mixed incoming data and much-worse inflation** have led to higher macroeconomic risks.



**5. Credit risks** have increased as both firms and banks experience deterioration.



**6. Emerging market risks** remain elevated, with continued macro uncertainty and few signs of improving credit cycles.



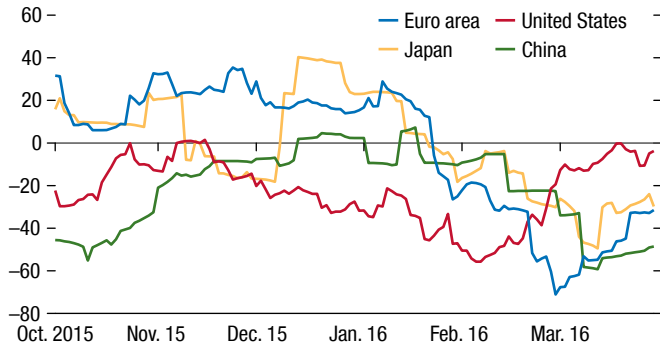
Source: IMF staff estimates.

Note: Changes in risks and conditions are based on a range of indicators, complemented by IMF staff judgment (see Annex 1.1 in the April 2010 *Global Financial Stability Report* and Dattels and others (2010) for a description of the methodology underlying the Global Financial Stability Map). Overall notch changes are the simple average of notch changes in individual indicators. The number below each label indicates the number of individual indicators within each subcategory of risks and conditions. For lending conditions, positive values represent slower pace of tightening or faster easing. CB = central bank; QE = quantitative easing.

**Figure 1.3. Recent Market Developments**

Worries of a global economic slowdown ...

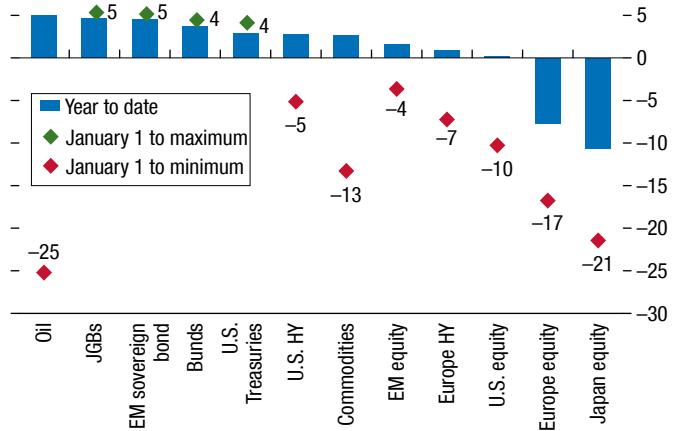
**1. Economic Surprise Indices**



Sources: Bloomberg, L.P.; and Citigroup.

... led to market turmoil and volatile equity and commodity prices ...

**2. Asset Class Returns, 2016 (Percent change)**

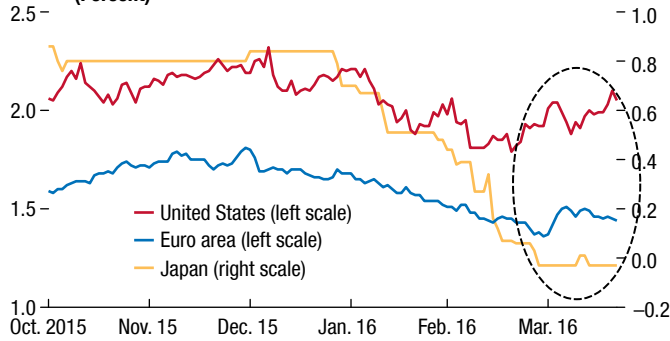


Sources: Bloomberg, L.P.; and IMF staff calculations.

Note: EM = emerging market economy; HY = high yield; JGB = Japan government bond.

... while disinflation worries have mounted ...

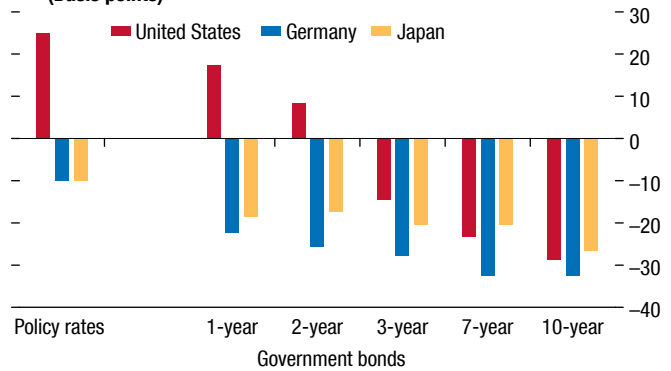
**3. Five-Year, Five-Year Swap Forward Rates (Percent)**



Source: Bloomberg, L.P.

... as have fears of a "low-for-long" downside.

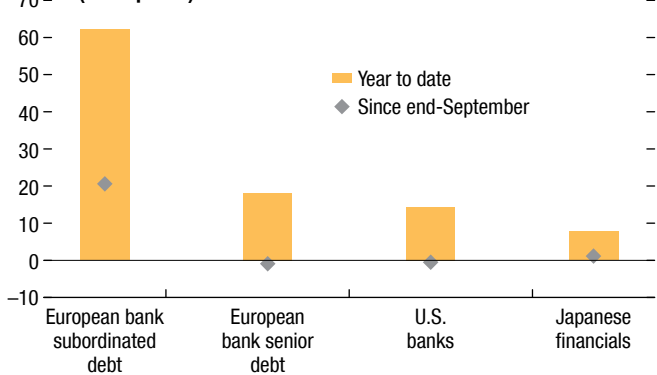
**4. Rate Changes, since End-September 2015 (Basis points)**



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

Credit concerns have intensified ...

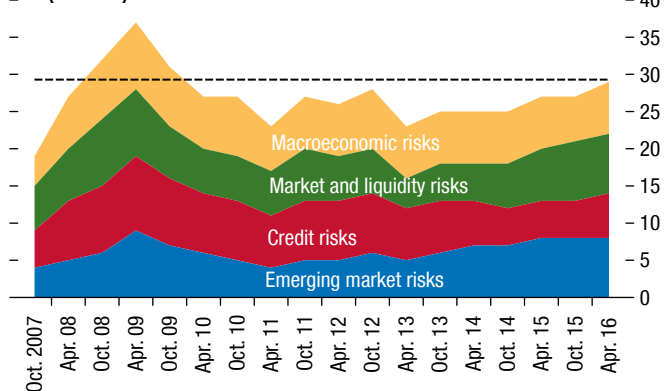
**5. Change in Bank Credit Default Swap Spreads (Basis points)**



Sources: Bloomberg, L.P.; Thomson Reuters Datastream; and IMF staff calculations.

... raising aggregate stability risks.

**6. Global Financial Stability Map Risk Indicators (Notches)**



Source: IMF staff estimates.

nominal growth and sustained, ultra-low, or negative rates that could push banks, insurers, and other savers toward *financial stagnation*. Key groups of financial institutions responsible for the allocation of capital, mobilization of savings, dissemination of information, and pricing of assets would struggle with low profitability and impaired balance sheets for a sustained period. Financial stagnation would erode soundness to such an extent that both economic growth and financial stability would be negatively affected in the medium term.

Equity markets provide some insights into these concerns. The synchronized global sell-off of equities in late 2015 and early 2016 lowered stock market valuations in a wide range of economies. By early March, equity indices had dropped by 10 percent or more in some exchanges: Japan's Nikkei had lost 11 percent as of March 3, China's Shanghai Composite was down 20 percent, and Frankfurt's DAX had lost almost 10 percent. Despite the recovery since the lows in February, these losses suggest that the underpinnings of equity valuations have weakened, especially following a period of deteriorating earnings expectations since the end of 2014. In fact, looking over the entire period, weaker earnings growth explains a large share of the fall in equity prices (Figure 1.4, panel 1).

The downward revision to earnings expectations has been motivated in large part by the possible impact of weak foreign demand on U.S. economic activity, a subdued medium-term outlook for the euro area, and rising uncertainty surrounding China's growth. The deterioration in external conditions and the stronger U.S. dollar have weighed heavily on U.S. firms that rely on exports, regardless of whether they are energy or non-energy companies (Figure 1.4, panel 2), especially those that have higher leverage (Figure 1.4, panel 3). Beyond these factors, however, markets may have overreacted to the deterioration of the outlook, thus overshooting the correction in equity valuations.

Nonetheless, worsening earnings are clearly an important factor behind the recent decline in equities in the United States and emerging market economies, even as low risk-free rates continue to sustain valuations, but not sufficiently to offset the negative pressure from a weaker outlook. This also suggests that the ability of monetary policy to sustain high valuations through a compression of equity risk premiums has waned amid the spike in volatility and global

uncertainty earlier this year.<sup>1</sup> *Equity risk premiums*—a measure of investors' required compensation for holding risky equities instead of "safe" assets, such as U.S. Treasury bonds—are no longer compressed, and in several cases have overshot their long-term means (Figure 1.4, panel 4).<sup>2</sup>

### Severe Declines in Oil Prices Added to Market and Credit Distress

Adding to adverse macroeconomic pressures, sector-specific shocks—notably in the energy sector and, more recently, in the financial sectors—accentuated the downward comovement across major equity markets.

Oil prices have fallen sharply since June 2014, hitting a 13-year low in February 2016 (Figure 1.5, panel 1). Although the shock has been acute for energy producers, a number of factors have muted the positive impact of a supply-driven oil decline, especially for net oil importers (see the section on Emerging Market Economies and China's Complex Transition). Two explanations are discussed that bear heavily on financial stability (see the April 2016 WEO for further discussion on the economic impact of low oil prices).

First, balance sheet effects may be exacerbating adverse spillovers. Lasting downward pressure on the currencies of oil producers raises the value of their foreign-denominated debt, further undercutting investment and growth prospects. Other non-oil commodity producers in many countries are also retrenching capital expenditures and output at the same time, in response to falling non-oil commodity prices, after expanding capital expenditures rapidly from 2010 to 2013 (see Figure 1.15).

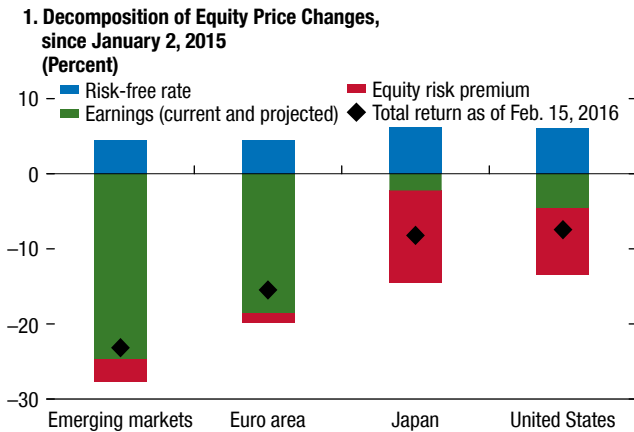
Second, the large size and rapid pace of the decline in oil prices could be causing some nonlinear effects. The retrenchment in energy-related firms has been so severe that it has spilled over into the

<sup>1</sup>The decomposition of equity prices was performed with a standard three-stage dividend discount model, where dividend growth initially follows the median forecasts, then reverts toward its long-term average, which is reached in the third and final phase. For details, see Annex 2 to the October 2014 GFSR and Panigirtzoglou and Scammell (2002).

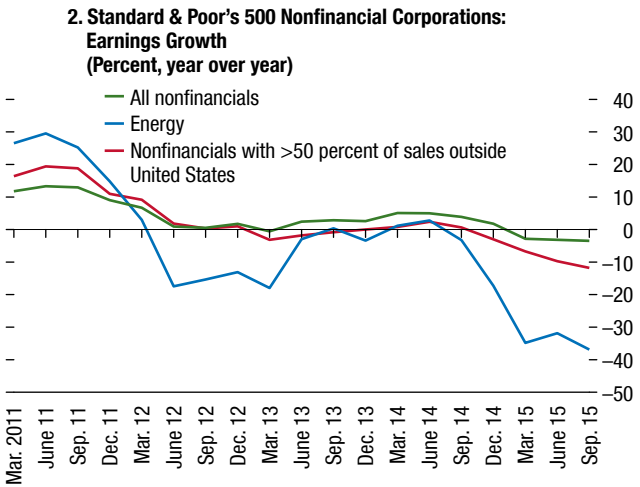
<sup>2</sup>The equity risk premium is a key indicator of investors' risk perceptions in that it measures how much compensation investors expect in excess of the risk-free interest rate on "safe" assets such as U.S. Treasury bonds; as such, it is an informative measure of perceived risks to financial stability. It is also a determinant of the cost of capital for corporations, influencing firms' investment decisions, and thus has macroeconomic implications.

**Figure 1.4. Equity Risk Premiums and Earnings Decompositions**

The corporate earnings outlook deteriorated into 2016 ...



... especially for exporters and energy companies ...

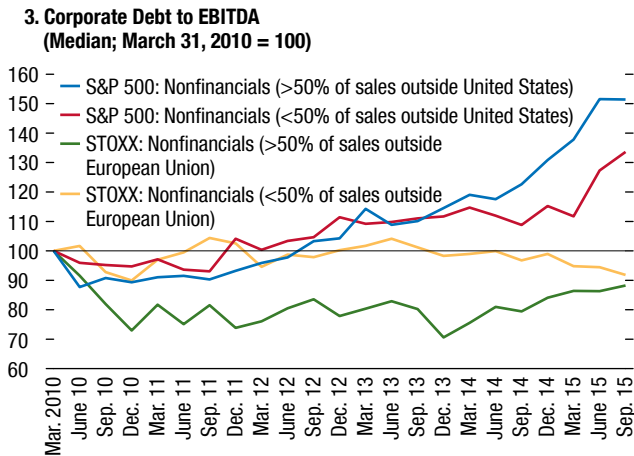


Sources: European Central Bank; Haver Analytics; Thomson Reuters I/B/E/S; and IMF staff estimates.

Sources: Factset; and IMF staff estimates.

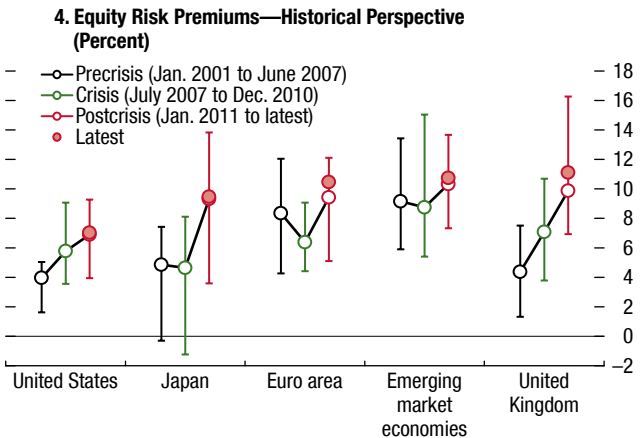
Note: Based on the five-year-ahead market consensus earnings per share.

... amid a bigger increase in leverage.



Sources: Factset; and IMF staff estimates.  
Note: EBITDA = earnings before interest, taxes, depreciation, and amortization; S&P = Standard & Poor's.

As equities come under pressure, risk premiums are reverting toward their historical means.



Sources: European Central Bank; Haver Analytics; Thomson Reuters I/B/E/S; and IMF staff estimates.  
Note: Based on five-year-ahead market consensus earnings per share.

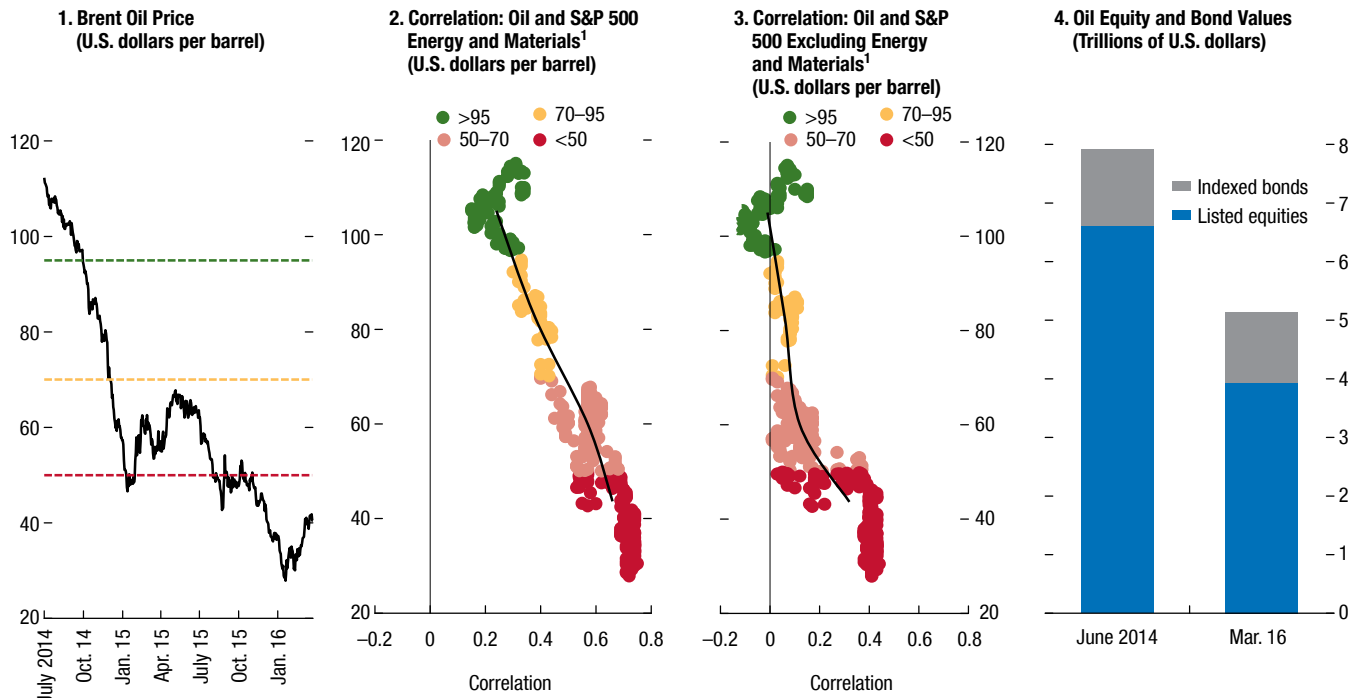
non-energy sectors of the global economy. Falling capital expenditures, increasing job layoffs, and the downstream impacts on ancillary businesses have broadened the effects of the oil shock beyond the energy sector, partially offsetting the positive benefits of lower energy costs.

In the United States, for example, the shale oil boom sparked an expansion of credit to the high-yield energy sector. The swiftness of the debt buildup during the shale oil bonanza was mirrored by the rapidly

deteriorating financial conditions of high-yield energy companies as oil prices plummeted.<sup>3</sup> Most companies

<sup>3</sup>Approximately 20 percent of U.S. high-yield energy and materials bonds are rated CCC or lower. The distress ratio of U.S. high-yield energy bonds (the percentage of bonds trading with a spread of more than 1,000 basis points) has reached 70 percent, the highest level since the global financial crisis and well above the 28 percent distress level of U.S. high-yield excluding energy bonds. Interest coverage ratios for U.S. high-yield bonds overall have fallen to their lowest levels since the 2000–01 recession. Non-energy firms,

Figure 1.5. Global Oil Prices, Equity, and Bond Markets



Sources: Bank of America Merrill Lynch; Bloomberg, L.P.; and IMF staff estimates.  
 Note: Based on five-year-ahead market consensus earnings per share. S&P = Standard & Poor's.  
<sup>1</sup> Six-month rolling correlation of the daily price of oil (Brent front contract) with the relevant Standard & Poor's 500 index from June 2014 to January 2016. Index is based on weights as of February 1, 2016.

have had to scale back investment more aggressively than in past cycles, and are unable to generate enough revenue to finance capital spending internally.<sup>4</sup> Access to capital markets has also become more restrictive and expensive. Debt issuance from high-yield energy firms has dwindled, with only \$1.7 billion issued during the past six months—a 94 percent decline compared with a year earlier.

An analysis of recent trends in oil prices and the different sectors of the Standard and Poor's 500 equity index provides some insight into these explanations. As expected, oil prices and energy sector valuations display a fairly linear relationship and positive correlation (Figure 1.5, panel 2): falling oil prices push down equity prices of energy firms. However, the relationship between oil and the non-energy sector is decidedly different. When the oil price decline is moderate

(Figure 1.5, panel 3, green dots), oil prices and prices of non-energy sector stocks follow no clear pattern, alternating between negative and positive correlation. But as oil prices fall to less than \$70 a barrel (orange dots), the correlation between non-energy stocks and oil prices gradually turns positive, especially as the oil price falls to less than \$50 a barrel (red dots). This relationship suggests that the negative impact of lower oil prices on both energy and non-energy firms became larger as the decline in the price of oil became more extreme. This relationship also holds for other advanced economy indices.

The magnitude of the oil shock can also be gauged by the mark-to-market impact on oil reserves. With proven global oil reserves estimated to be 1.6 trillion barrels, a price decline of \$70 a barrel would be equivalent to a mark-to-market loss of \$112 trillion. A further consequence for oil-related stocks has been a loss of more than \$2.6 trillion in value in the 18 months since June 30, 2014 (Figure 1.5, panel 4).

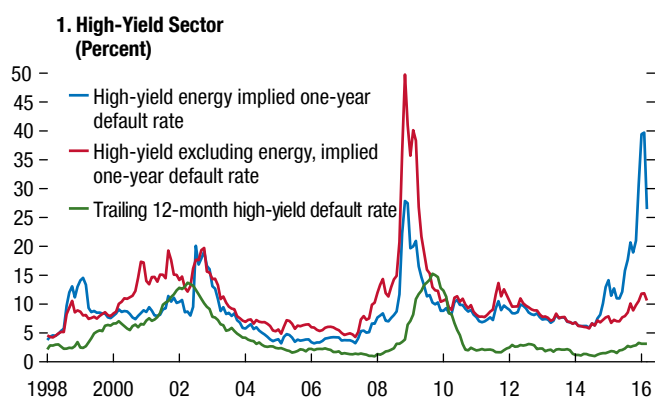
Although fundamentals remain fairly solid in the non-energy sector, the weakness in the U.S. high-

however, are in much better financial shape. Excluding energy, high-yield interest coverage ratios remain near cycle highs.

<sup>4</sup>Moody's expects earnings of oilfield services companies, which are largely a function of capital expenditures by energy exploration and production firms, to decline 25 to 30 percent as a result.

**Figure 1.6. U.S. High-Yield Markets and Lending Conditions**

The number of energy firms trading at distressed levels has risen sharply.



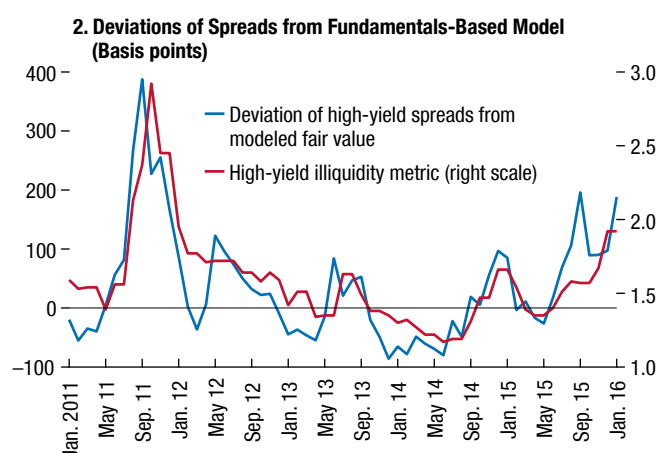
Source: Bank of America Merrill Lynch.

yield energy market threatens to spread to other high-yield sectors.<sup>5</sup> Symptomatic of a growing perception of credit risks, the share of bonds trading at distressed levels (that is, with spreads greater than 1,000 basis points) rose sharply in January and February, pressuring investors with exposure to lower-rated debt. Spreads on non-energy-related firms are much tighter than those in the energy sector, yet they too reached historically elevated levels. Spreads on non-energy firms also implied a default rate on those firms at recessionary levels. Only in 2002, in the wake of the bust in the telecommunications sector, and in 2009, on the heels of the global financial crisis, did default rates exceed the implied levels experienced in February (12 percent per year for the next few years) (Figure 1.6, panel 1).

Deteriorating liquidity conditions may have contributed to the widening of spreads beyond fundamentals. High-yield spreads have deviated significantly from what a fair-value model would indicate, and this widening is closely correlated to tighter market liquidity (Figure 1.6, panel 2). As of the end of January, the deviation from fair value reached its

<sup>5</sup>The pair-wise correlation between spreads of different high-yield sectors is currently significantly higher than in previous stress episodes. Additionally, consistent with greater intersector comovement, the standard deviation of yields remains significantly lower than in previous high-yield sell-offs.

Spreads deviated from fundamentals as liquidity conditions have deteriorated.



Sources: Barclays; and IMF staff calculations.

Note: High-yield illiquidity metric = Barclays Liquidity Cost Score (Dastidar and Phelps 2009).

highest level since 2011. Previous GFSRs have documented how poor liquidity increases the probability of transition to a high-volatility regime and how illiquidity and mutual fund redemption pressures may be exacerbated by the increasing amount of corporate debt held by mutual funds. The non-negligible share of high-yield debt in mutual funds has provided a channel through which spillovers may flow to other sectors.

### Economic and Financial Stagnation Risks Are Rising

Although under the baseline scenario the United States and other advanced economies are expected to continue to grow steadily, markets are exhibiting increased pessimism, suggesting that a softer global environment may not allow the data-dependent Federal Reserve to continue the normalization process as previously envisaged. Market expectations of inflation have eased significantly since the October 2015 GFSR (Figure 1.7). Market pricing of both the level and distribution of future inflation rates, as well as survey-based measures, shows a broadly similar pattern of falling inflation expectations across the euro area, Japan, and the United States. These measures may be distorted by recent liquidity conditions and the exaggerated impact of sharply lower oil prices, but the consistency of these different measures across countries is notable.

In line with the weaker inflation outlook, interest rate expectations have shifted downward as well. Thus, policy interest rates are expected to be cut further across advanced economies—and even deeper into negative territory in some cases—while in the United States, markets are pricing in a much higher risk of stalled normalization of monetary policy, notwithstanding continued improvements in the labor market (Figure 1.8, panels 1 and 2).

The unfavorable market assessment of inflation and policy interest rate expectations reflects growing concern about a mutually reinforcing dynamic of weak growth and low inflation that could produce sustained economic and financial weakness in various countries. Such a downside stagnation scenario is examined in the April 2016 WEO.

Worrisome signs are also seen in the evolution of global sovereign bond yields. Although term premiums are already compressed, they could become further compressed if expectations of lackluster growth become entrenched, as has been the case in episodes of stagnation elsewhere (Figure 1.8, panel 3). Notably, the term premiums of Japanese government bonds underwent a steep decline beginning in the late 1990s and throughout the 2000s, as deflation and negative growth expectations became widespread and drove term premiums and bond yields down to new historical lows.<sup>6</sup> Reminiscent of that trend, the share of government bonds in the euro area with a zero or negative yield increased from 33 percent in December 2015 to 43 percent in February 2016 (Figure 1.8, panel 4).

### Further Bouts of Market Turmoil or Disorderly Balance Sheet Deleveraging Could Erode Financial Stability without Stronger Policy Frameworks

If the growth and inflation outlooks degrade further, the risk of a loss of confidence would rise. In such circumstances, recurrent bouts of financial volatility could interact with balance sheet vulnerabilities. Risk premiums could rise and financial conditions could tighten, thereby creating a pernicious feedback loop of weak growth, low inflation, and rising debt burdens. These negative disruptions to global asset markets, operating through financial channels, could

lead to a worse outcome than the one envisaged in the WEO's economic stagnation scenario. The implications of this “global market disruption” scenario are analyzed below.

The global market disruption scenario (detailed in Annex 1.2) builds on the WEO economic stagnation scenario, and features further disruptions in global capital markets with increases in risk premiums in systemic economies, balance sheet deleveraging in the euro area and emerging economies, and losses in business and consumer confidence that reduce investment and raise saving worldwide:<sup>7</sup>

- *Loss in policy confidence could lead to rising global risk premiums.* A further sell-off in stock markets sparked by reduced risk appetite could lower real equity prices by 20 percent in the systemic economies (China, euro area, Japan, United Kingdom, and United States) over two years.
- *Advanced economy legacies could amplify downturns.* Higher risk aversion may interact with existing balance sheet vulnerabilities in the euro area. Banking sector and sovereign strains could reappear in high-spread euro area countries (see the section on Advanced Economies: Banks' Legacy Problems and New Challenges); banking sector stress might also appear (though to a lesser extent) in low-spread euro area countries. The resultant tightening of financial conditions in the euro area could be compounded by the need to build bank capital buffers to comply with regulations (see Table 1.3).
- *China could experience a disorderly deleveraging and the credit cycle could worsen in emerging markets.* In China, rising corporate sector strains caused by a further deterioration in balance sheet fundamentals (see the section on Emerging Market Economies and China's Complex Transition) might lead to a rise in credit market stress and more rapid deleveraging. This process could cause negative spillovers to other emerging market economies and the global economy, along the lines of the confidence shock observed in August 2015. In turn, these spillovers would further tighten financial conditions and could cause emerging market currencies to depreciate, reinforcing emerging market credit cycle downturns, with adverse consequences for companies with high foreign indebtedness (as discussed in Chapter 2).

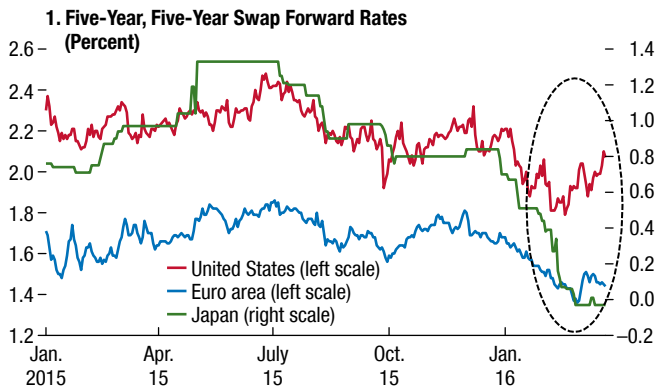
<sup>6</sup>According to IMF estimates based on the Wright model (2011), the Japanese term premium declined from more than 4 percent during 1990–98 to less than 0.4 percent during 1997–2007.

<sup>7</sup>The scenario is simulated using the global macrofinancial model documented in Vitek (2015).



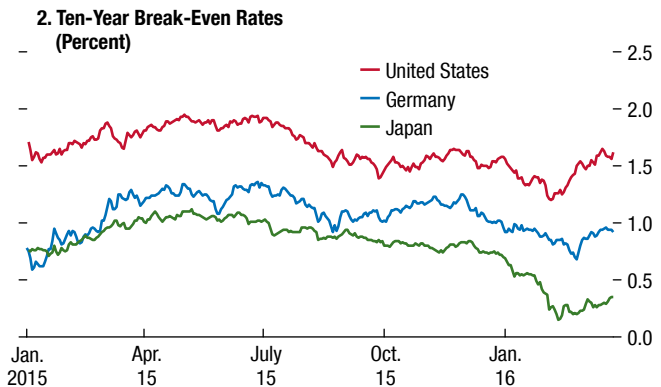
**Figure 1.7. Deterioration of Inflation Expectations**

Market-based inflation expectations have declined across the board ...



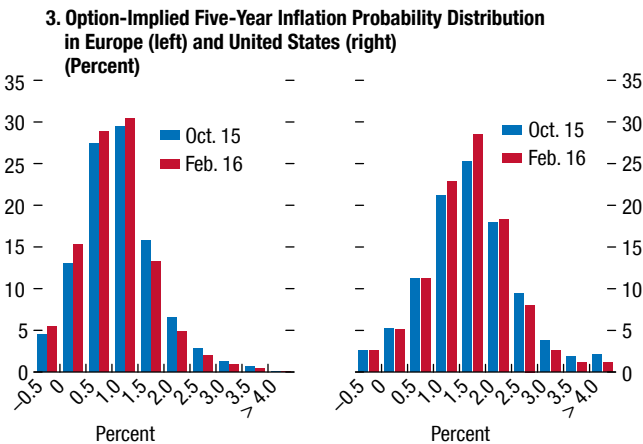
Sources: Bloomberg, L.P.; and Citigroup.

... with long-term indicators also declining.



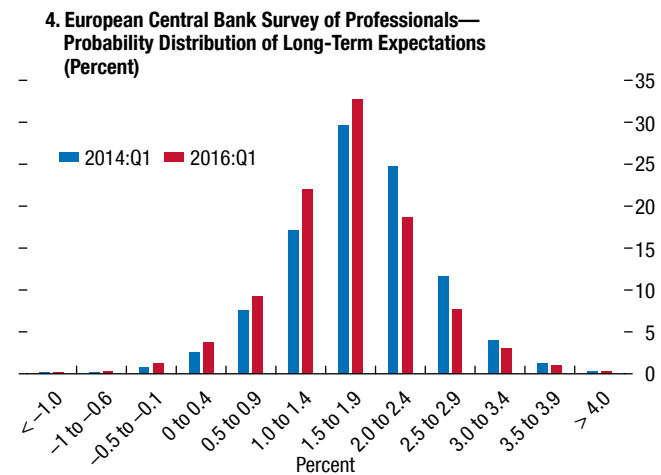
Sources: Bloomberg, L.P.; and IMF staff calculations.

The distribution of market-implied expectations has shifted further to the left tail in Europe ...



Source: IMF staff calculations.

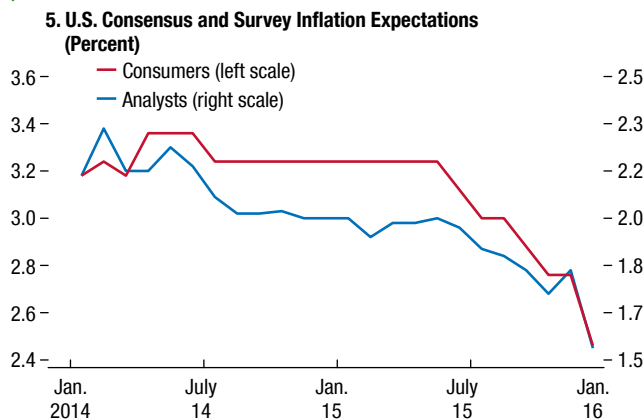
... while European surveys are more unfavorable than before the launch of quantitative easing.



Sources: European Central Bank; and Haver Analytics.

Note: Long term is four calendar years ahead in first and second quarter rounds and five in third and fourth quarter rounds.

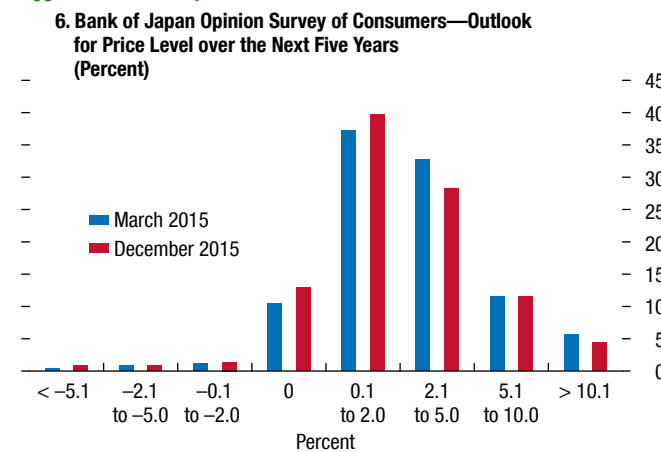
U.S. surveys have also deteriorated, among both consumers and professionals.



Sources: Bloomberg, L.P.; and Federal Reserve.

Note: The consumer series is the New York Federal Reserve three-year-ahead series, and the analysts' figure is the 2016 inflation consensus from Bloomberg, L.P.

Japan surveys have hinted at similar downward trends despite aggressive monetary action.

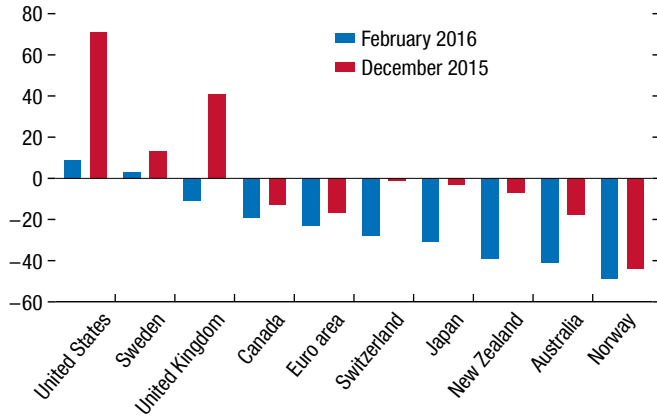


Sources: Bank of Japan; and Haver Analytics.

**Figure 1.8. Interest Rate Expectations and Bond Term Premiums**

Central banks are moving into negative territory ...

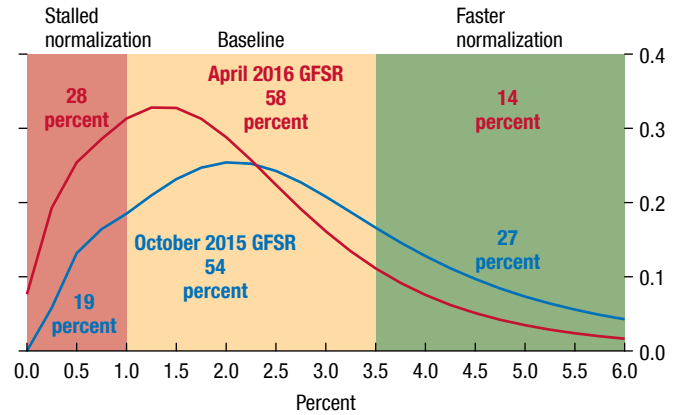
**1. Market-Implied Policy Rate Changes, over Year Ahead (Basis points)**



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

... and in the United States markets are pricing a high probability of stalled normalization.

**2. United States: December 2018 Federal Funds Rate Implied Probabilities (Probability)**

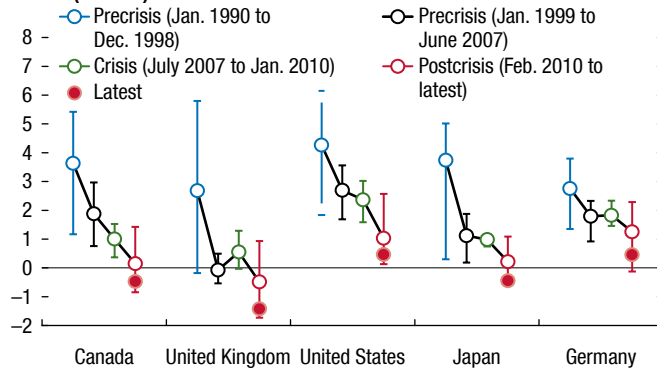


Sources: Bloomberg, L.P.; and IMF staff calculations.

Note: For this calculation, the market pricing of options expiring in December 2018 on three-month swaps was used to determine the probability that market participants are placing on a stalled normalization. The calculation assumes that the difference between the three-month swap rate and the effective federal funds rate would remain relatively stable, at 15 basis points. GFSR = *Global Financial Stability Report*.

Global term premiums are hitting record lows, suggesting higher risks of nominal stagnation ...

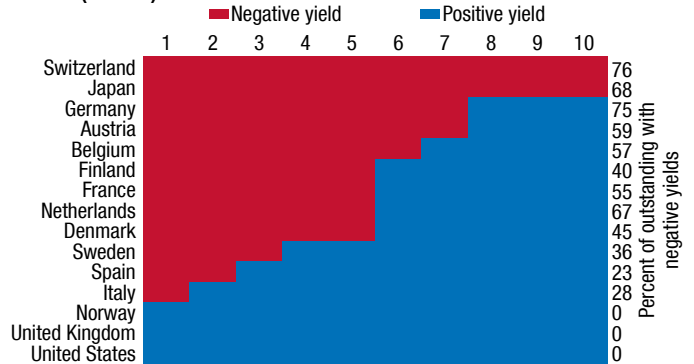
**3. Bond Term Premiums—Historical Evolution (Percent)**



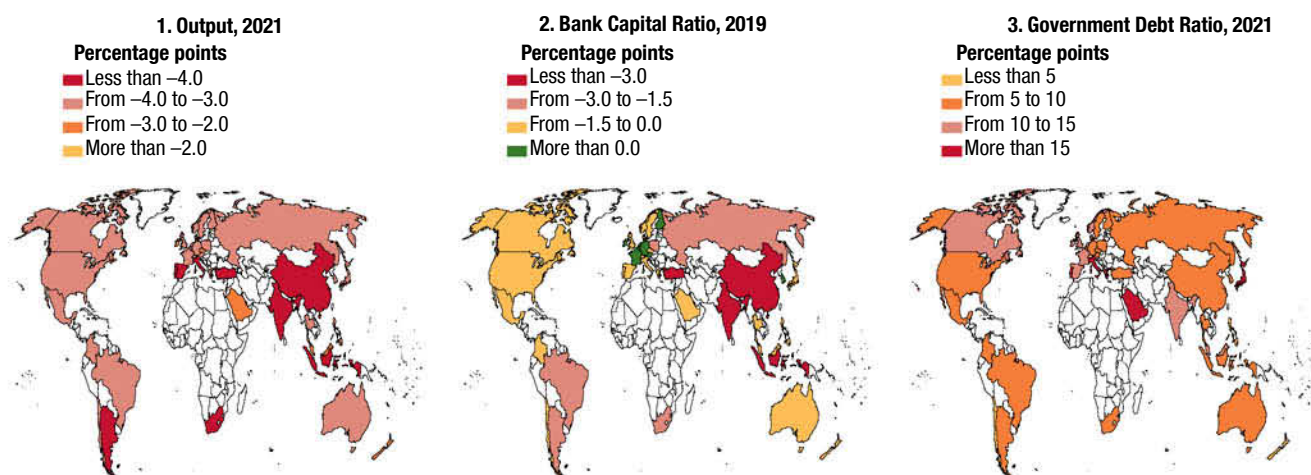
Sources: Bloomberg, L.P.; Bundesbank; Consensus Economics; Haver Analytics; Organisation for Economic Co-Operation and Development; and IMF staff estimates.  
Note: Based on Wright (2011).

... and pushing a greater share of global bonds into negative rates.

**4. Share of Sovereign Bond Markets with Negative Rates (Percent)**



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

**Figure 1.9. Simulated Peak Effects under Global Market Disruption Scenario**

Source: IMF staff calculations.

This global market disruption scenario would materially worsen economic and financial stability. World output could fall by 3.9 percent relative to the baseline by 2021, with output losses of 2.4 to 6.8 percent across economies reflecting differences in shocks, vulnerabilities, and the policy stance in each country. Banking sector capitalization could fall by 0.4 to 4.5 percentage points relative to the baseline across emerging markets by 2019, largely reflecting high credit loss rates, versus at most 0.4 percentage points across advanced economies.<sup>8</sup> Low nominal growth and weakening fiscal positions would increase government debt burdens, with the ratio of debt to GDP rising 4 to 22.9 percentage points above the baseline across advanced economies by 2021, and 3.9 to 15 percentage points across emerging market economies (Figure 1.9).

The disinflationary effects of the economic contractions could, in turn, induce major central banks to extend support, either by cutting policy interest rates further or postponing monetary policy normalization.<sup>9</sup> In response to consumer price inflation declines of 1.2 to 2.8 percentage points relative to the baseline across economies by 2019, central banks could cut policy interest rates by 1.1 to 1.9 per-

centage points relative to the baseline. This global disinflationary environment would be associated with energy and non-energy commodity price reductions of 40 and 22.4 percent relative to the baseline by 2021, respectively.

## Emerging Market Economies and China's Complex Transition

### China's Economic Rebalancing Is Proceeding

*China continues to navigate a complex transition to a slower and safer pace of growth and a more market-based financial system. China has advanced reforms and made notable progress in rebalancing the economy. Yet slowing growth has eroded corporate sector health, with falling profitability undermining the debt-servicing capacity of firms, adding to balance sheet pressures across the system. Corporate stress is reflected in rising problem assets held by banks. Bank loans to the corporate sector potentially at risk are substantial, but remain manageable given available buffers. Implementation of a more ambitious and comprehensive policy agenda is urgently needed to stay ahead of rising financial sector vulnerabilities and to ensure continued confidence in policymakers' ability to achieve a smooth transition.*

China has made notable progress in rebalancing its economy toward new sources of growth and addressing financial sector risks. The contribution of private consumption to growth is rising in line

<sup>8</sup>Bank capital ratios would deteriorate less in advanced economies than in emerging markets (Figure 1.9), primarily because of weaker credit cycle downturns in advanced economies.

<sup>9</sup>In the simulation, policy interest rates cannot be reduced to less than the zero lower bound.

with a more resilient labor market, strong wage and income growth, and pro-consumption measures. Investment has moderated further, with its contribution to growth falling from a peak of 8 percentage points in 2009 to 3 percentage points in 2015. The share of service sector activities has increased in both employment and output, supporting wage growth and consumption, while manufacturing activity has slowed. At the same time, a number of reform efforts underscore the authorities' commitment to economic transition:<sup>10</sup>

- Deposit rates were liberalized in the fourth quarter of 2015, ending all formal interest rate controls and complementing the deposit insurance scheme.
- The new exchange rate mechanism introduced in August 2015, and the emphasis on an exchange rate basket in December, are signs of the People's Bank of China's resolve to advance to a more flexible exchange rate regime.
- The IMF Executive Board determined the renminbi to be a freely usable currency and decided to include it in the basket of currencies that make up the special drawing right, effective October 1, 2016.
- Fiscal reforms have also advanced, with the new budget law aiming to regularize local government finances, steps toward improving public sector accounting, and progress in reforming the pension and tax systems.
- The negative list of sectors for domestic investment was reduced, as were items subject to price controls (from 100 to about 20), and natural monopolies are to be opened to private firms.
- Approvals required for outbound foreign direct investment were largely abolished.

In addition, stricter regulations on shadow banking activities have helped steer the composition of financing toward bank loans and bond issuance. This direction has benefited private companies, which have seen an increasing share of new corporate loans relative to loans to state-owned enterprises (SOEs), helping reallocate credit to more efficient sectors and firms.

As China's economy transforms, its pattern of consumption will continue to change, naturally spilling over to the rest of the world through trade, growth, and financial channels (see the April 2016 *Regional Economic Outlook Update: Asia and Pacific*). In partic-

ular, concerns over China's slowdown have weighed on global commodity prices, affecting currencies and capital inflows of economies with high commodity dependence or close trade ties with China (see the section on Emerging Market Economies Are Being Tested). Thus, a smooth transition to a new growth model is critical not just for China, but also for global economic and financial stability.

### Corporate Balance Sheet Health Has Deteriorated

Despite progress on economic rebalancing, corporate health is declining. Chinese corporate profitability has eroded during the past five years. This decline reflects structural features stemming from years of easy credit and overinvestment as well as cyclical factors—falling margins, declining investment income, and lower asset turnover—related to the weaker economic environment. China's domestic credit boom, which has resulted in a large credit overhang (in the range of 25 percent of GDP; Figure 1.10, panel 1), drove excess capacity in “old economy” sectors (such as mining, energy, steel, and other industrials). Along with a slowing Chinese economy and dampened global demand, this overhang has contributed to sustained low prices, downward pressures on production volumes, and lower profits (Figure 1.10, panel 2). The correction of oversupply in the Chinese property market has added to these strains through falling prices and lower demand for basic materials. These forces appear to be entrenched, underscoring the likelihood of continued balance sheet weakness and thus broader financial stability concerns.

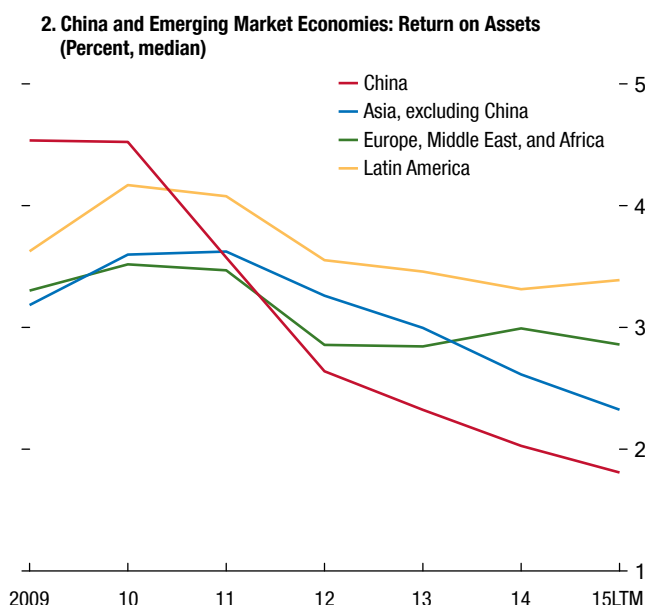
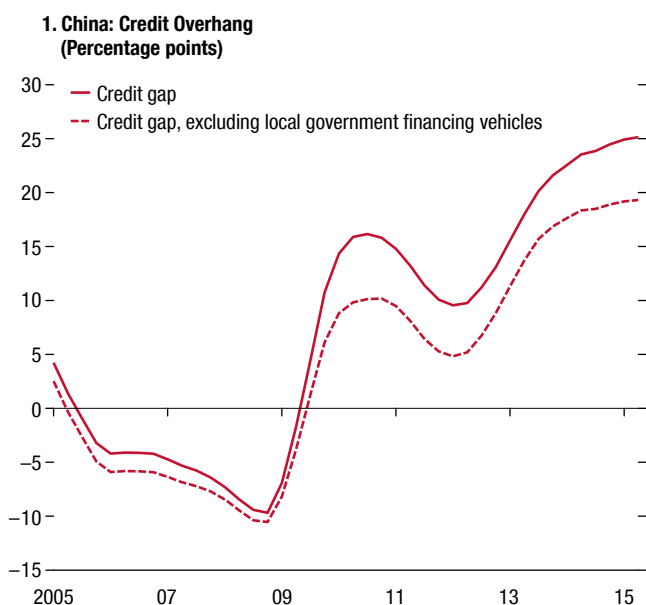
The ability of many Chinese listed firms to service their debt obligations is eroding, with higher debt and declining earnings capacity. Lower profitability and cash generation have pushed debt relative to earnings (debt/earnings before interest, taxes, depreciation, and amortization [EBITDA]) to a multiple of just under four for the median Chinese firm, more than doubling since 2010 (Figure 1.11, panel 1). Risks are concentrated in five sectors, including real estate, manufacturing, retail and wholesale (mainly industrial trading companies), mining, and steel (Figure 1.11, panel 2), that exhibit both high leverage and a high share of loss-making firms. More generally, earnings relative to interest expenses have fallen despite declining nominal interest rates (Figure 1.11, panel 3). Debt at risk (borrowing by companies unable to generate sufficient

<sup>10</sup>See IMF (2015c) for a more detailed discussion.

**Figure 1.10. China and Emerging Market Economies: Credit and Profitability**

China's credit boom has resulted in a credit overhang of 25 percent ...

... driving excess capacity and thus putting pressure on corporate earnings.



Sources: Bank for International Settlements; Haver Analytics; IMF, World Economic Outlook database; and IMF staff estimates.

Note: Credit overhang is measured by the credit gap, defined as the deviation of the credit-to-GDP ratio from trend, using a one-sided Hodrick-Prescott filter with a smoothing parameter of 400,000.

Sources: S&P Capital IQ; and IMF staff estimates.

Note: The China sample contains 3,280 firms. 15LTM = last 12 months.

earnings to cover debt interest payments) has increased to 14 percent of total sample debt from 4 percent over the period 2010–15 (Figure 1.11, panel 4).

Structural weakness and cyclical stresses are becoming more evident. For example, the payment capacity of weaker Chinese companies is increasingly stretched, impeding cash flows to their suppliers and thus transmitting stress across the system. Payables days have increased steadily from a median of 53 days in 2011 to 72 days in 2015 (Figure 1.12, panel 1). The buildup has been substantial for firms in the energy, construction materials, information technology, real estate, and manufacturing sectors (Figure 1.12, panel 2). Excess payables (more than 45 days' sales) are equivalent to some 40 percent of overall listed corporate credit (Figure 1.12, panel 3).<sup>11</sup> Continued access to financing,

including for SOEs carrying perceived implicit government guarantees, and lack of credit discipline have permitted weakening firms to accumulate large payables to suppliers. The broad and marked run-up in payables debt throughout supply chains strongly suggests widespread and rising corporate stress. More-leveraged firms (with leverage ratios greater than two times) now account for almost 60 percent of total debt, doubling from 2007 (Figure 1.12, panel 4).<sup>12</sup>

### Corporate Weakness Is Mirrored in Rising Bank Vulnerabilities

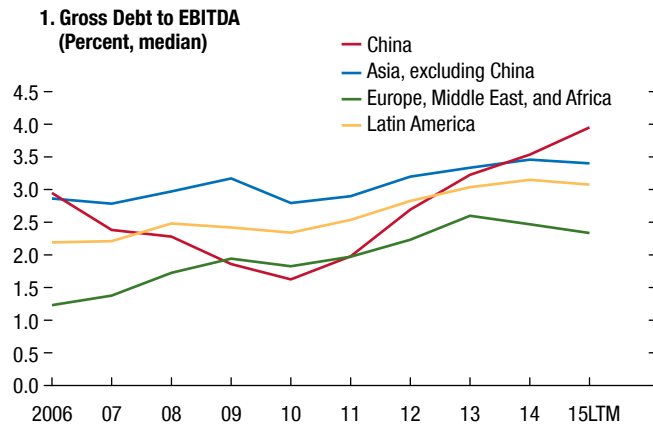
Increasing corporate stress is mirrored in rising problem assets held by banks. Reported problem loans amount to 5.5 percent of bank loans (\$641 billion, or 6 percent of GDP) after including “special mention loans,” for both corporate and household loan expo-

<sup>11</sup>Figure 1.12, panel 2, captures primarily listed firms. The excess of receivables compared with payables in each sector implies that the included firms are financing unlisted firms. Thus, cash flow and solvency metrics for unlisted firms could be worse than for listed firms, pointing to even greater debt-at-risk concerns than illustrated here.

<sup>12</sup>Average leverage among SOEs is about 200 percent.

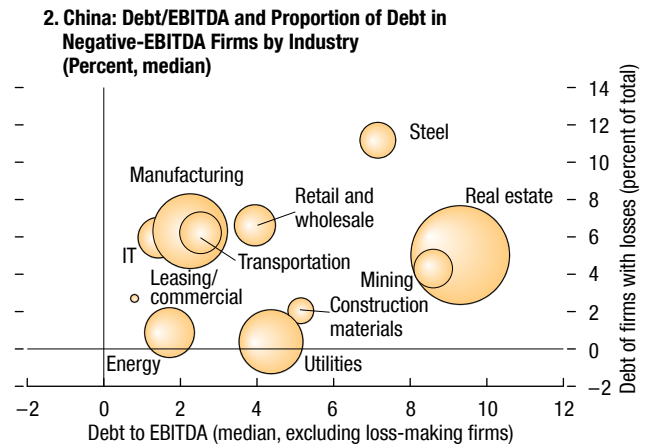
**Figure 1.11. Chinese Listed Companies: Leverage, Interest Coverage, and Debt-at-Risk**

Chinese firms' debt/EBITDA has more than doubled since 2010.



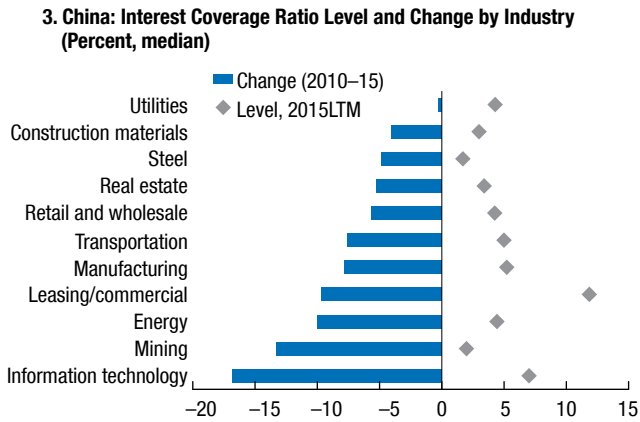
Sources: S&P Capital IQ; and IMF staff estimates.  
 Note: Ratios of companies with negative EBITDA are set to 10. The China sample contains 3,241 firms (2015LTM). EBITDA = earnings before interest, taxes, depreciation, and amortization; LTM = last 12 months.

Real estate, mining, and steel firms are among the most highly indebted and least profitable.



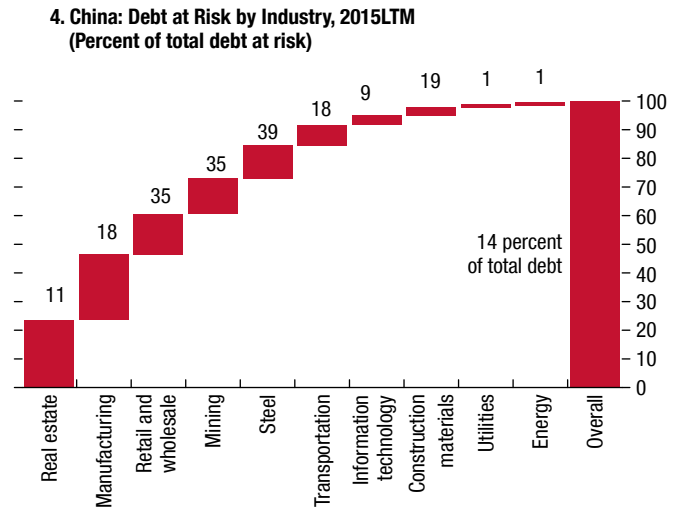
Sources: S&P Capital IQ; and IMF staff estimates.  
 Note: The size of the bubble represents the size of the sector based on its proportion of debt within the sample of listed corporations. The China sample contains 3,241 firms (2015LTM). EBITDA = earnings before interest, taxes, depreciation, and amortization; IT = information technology.

Declining profits have sharply lowered interest payment capacity in old economy industries ...



Sources: S&P Capital IQ; and IMF staff estimates.  
 Note: The China sample contains 2,878 firms (2015LTM). LTM = last 12 months.

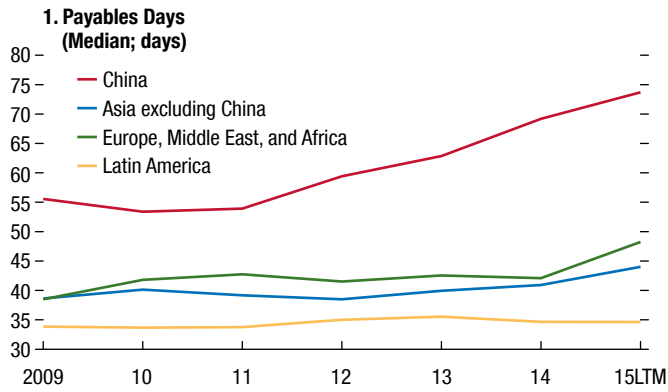
... which also account for the bulk of listed company debt-at-risk.



Sources: S&P Capital IQ; and IMF staff estimates.  
 Note: The numbers above the bars represent the total debt at risk as a proportion of total debt within the industry. The sample contains 2,871 firms (2015LTM), including 2,607 listed firms and 264 unlisted firms. Debt-at-risk is defined as the debt of corporates with interest coverage ratio of below 1. Interest coverage ratio is EBITDA/interest expense of the corporate. 2015LTM = last 12 months; EBITDA = earnings before interest, taxes, depreciation, and amortization.

**Figure 1.12. Chinese Listed Companies' Performance**

Listed firms' payables days have risen from 55 to 75 days during 2011–15 ...



Sources: S&P Capital IQ; and IMF staff estimates.  
 Note: Payables or receivable days = payables or receivables/annual sales × 365.  
 LTM = last 12 months.

Excess working capital balances are large and rising relative to reported corporate debt ...

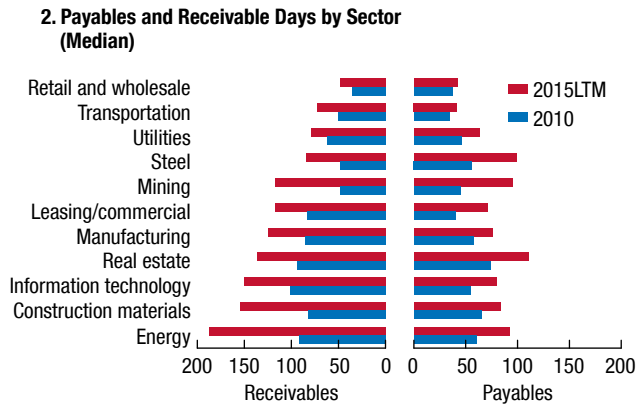
**3. Long-Term Payables (Days > 45; percent of corporate debt)**



Sources: S&P Capital IQ; and IMF staff estimates.  
 Note: LTM = last 12 months.

... with “old economy” industries showing the greatest deterioration.

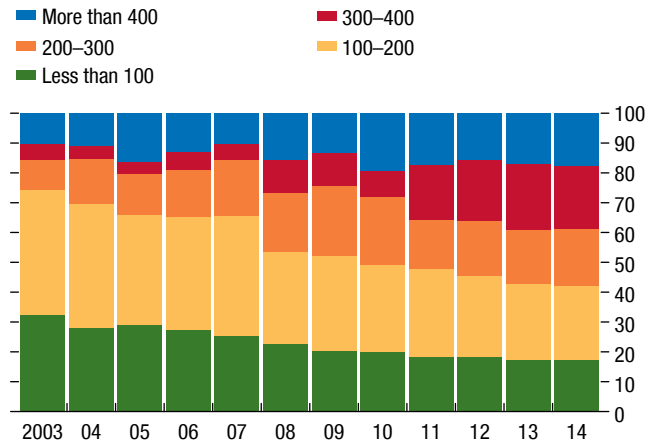
... with “old economy” industries showing the greatest deterioration.



Sources: S&P Capital IQ; and IMF staff estimates.  
 Note: Payables or receivable days = payables or receivables/annual sales × 365.  
 LTM = last 12 months.

... while listed firms with leverage ratios greater than 2 account for nearly 60 percent of corporate liabilities.

**4. China: Debt-to-Equity of Listed Firms (Percent)**



Sources: WIND database; and IMF staff estimates.

defined as a bank loan to a borrower that has an interest coverage ratio (EBITDA divided by interest expenses) below one. Put another way, it is a loan to a borrower that doesn't have sufficient income to cover its interest payments. A loan potentially at risk as discussed in this report is thus not the same as a nonperforming loan (NPL) as reported by banks and supervisors, which meets a regulatory standard (usually nonpayment of interest or principal for a predetermined time), and recognition of an NPL

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triggers accounting consequences. Not all of these loans potentially at risk will translate into actual NPLs that lead to bank losses. First, companies can meet their interest obligations by selling assets, drawing on cash buffers, or restructuring their operations. Second, in cases of nonpayment, banks can take steps to recover collateral, seize assets, or restructure the underlying loan.

Considering estimates of bank loans potentially at risk and assuming a 60 percent loss ratio suggests that potential bank losses on these loans could amount to \$756 billion (7 percent of GDP). Assuming a lower loss ratio of 45 percent—a Basel II norm for defaulted loans—yields potential bank losses of \$567 billion, or 5 percent of GDP (refer to Annex 1.1).

A key message of this report is that although these estimates of losses on loans potentially at risk are substantial, at about 7 percent of GDP, they are manageable given existing bank and policy buffers and the continued strong underlying growth in the economy. Estimated losses are equivalent to around 1.9 years of projected banking system pretax profits for 2015. Bank Tier 1 capital totals about \$1.7 trillion, or 11.3 percent of system risk-weighted assets, and bank reserves are \$356 billion.<sup>13</sup> Beyond bank buffers, China's public debt level—at 43 percent of GDP in 2015—provides space to address current estimates of potential bank losses. The Chinese authorities are also working to reduce excess capacity in inefficient industries and to improve the health of the corporate sector. Nevertheless, prompt action to address rising corporate sector vulnerabilities is essential to ensure that the costs of addressing potential losses on bank lending remain manageable. Continued strong growth in lending to an increasingly weak corporate sector will undermine actual and potential growth because an increasing share of new credit will be used just to roll over existing debts, instead of being used to finance new projects and investment and contribute to the dynamism of the corporate sector. Avoiding this outcome will require reform of both the corporate and banking sectors to ensure credit is channeled more efficiently to healthier companies and priced appropriately.

<sup>13</sup>Even though this level of capital meets the regulatory minimum, it is somewhat lower than those of a number of its peers, which average 12 percent.

### Weak Corporate Health Increases Risks in Bond and Equity Markets

Chinese firms are increasingly turning to the corporate bond market as their borrowing needs rise. Measures to liberalize the bond market—such as expanding access to foreign investors and domestic firms, and removing quota limits and delegating issuance approval to banks—are a positive reflection of China's rebalancing efforts. However, corporate bond issuance has surged and yields have dropped despite the slowing economy and deteriorating corporate health (Figure 1.13, panels 1 and 2). Debt issuance has been substantial in sectors suffering from price pressures, overcapacity, and rising balance sheet weakness, namely the real estate, mining, and manufacturing sectors (Figure 1.13, panel 3), while retail exposure to the bond market is increasing through wealth management products.<sup>14</sup>

A larger bond market that is well regulated and efficiently priced would be an additional source of funding for viable firms and help facilitate a smooth deleveraging of corporate balance sheets. But the surge in issuance comes amid high and rising corporate leverage, while the pricing of credit risk is significantly distorted in overcapacity sectors (largely due to perceived implicit state guarantees) despite some tentative evidence of widening spreads (Figure 1.13, panel 4).

The combination of corporate balance sheet weakness and inefficiencies in bond and equity markets poses a potentially serious challenge for financial stability. For example, an abrupt repricing of credit risk could drive a sudden rise in corporate stress, crystallizing concerns about banks' NPLs and bringing to the fore underlying problem assets and associated capital needs. Investor confidence would be damaged in such an environment, including directly through any losses on wealth management products and equity holdings, possibly leading to a marked reduction in the provision of credit (a "credit crunch"). In this instance, the risk of a disorderly deleveraging scenario with severe negative implications for financial stability and economic growth would increase.

Deteriorating corporate health has also manifested itself in equity markets, broadening financial stability risks despite limited direct real economy linkages. Financial connections and stability concerns have

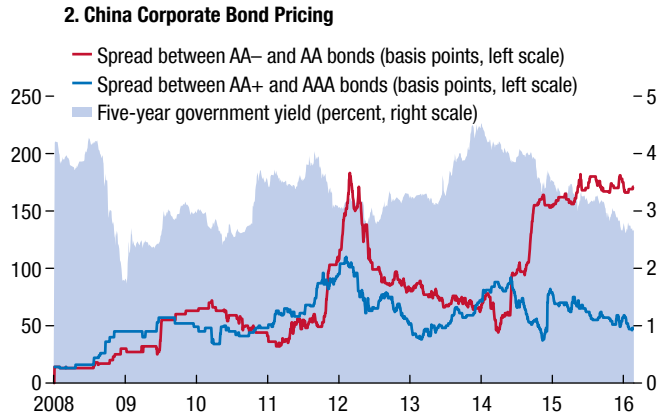
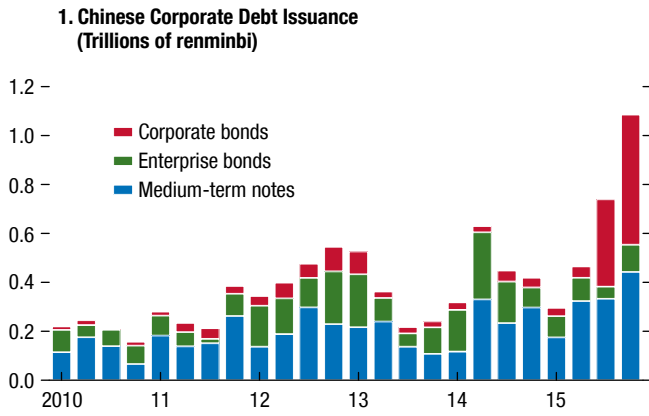
<sup>14</sup>About 50 percent of wealth management products sold by banks to retail investors have bonds and money market paper as underlying assets, as compared with 40 percent in 2014.



**Figure 1.13. China: Corporate Bond Issuance and Pricing**

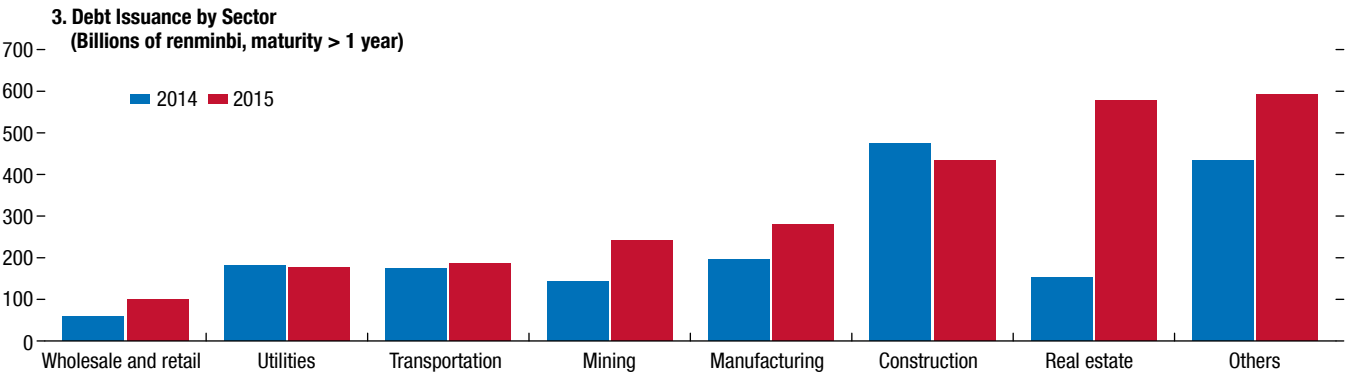
Domestic corporate bond issuance has recently surged ...

... but borrowing costs remain quite low despite declining corporate balance sheet health.

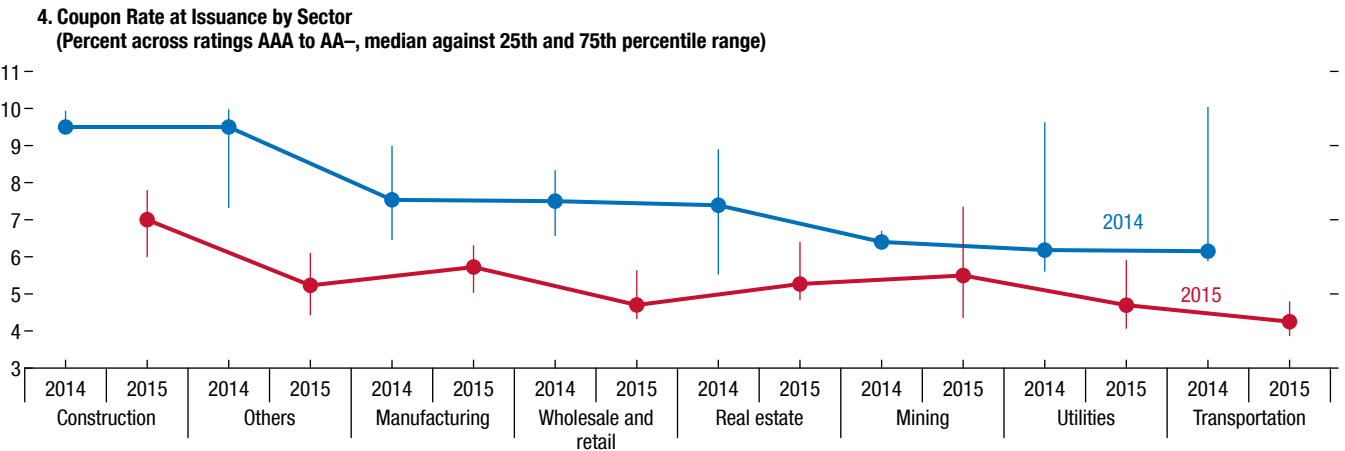


Sources: ChinaBond; and WIND.  
 Note: Enterprise bonds are issued by state-owned enterprises often for the financing of large infrastructure projects. Corporate bonds includes listed medium-term notes and nonlisted debt.

Sources: ChinaBond; and WIND.  
 Note: AA- in Chinese rating terminology is the lowest-rated corporate bond index published by ChinaBond, and is broadly comparable to international high-yield bonds.



Sources: ChinaBond; and WIND.  
 Note: Others includes services (information technology, media, social, among others), insurance firms, and agriculture.



Sources: ChinaBond; and WIND.  
 Note: Others includes services (information technology, media, social, among others), insurance firms, and agriculture.

increased with rising equity market volatility, even as equity market leverage (Figure 1.14, panel 1) and overvaluation have been reduced. Correlations between the Shanghai composite index and equity indices from other major economies have risen since last August,

increasing the transmission of volatility to and from other markets (Figure 1.14, panel 2).

Another trend that could amplify equity market risks is the growth in share-collateralized lending by company owners borrowing against the value of their

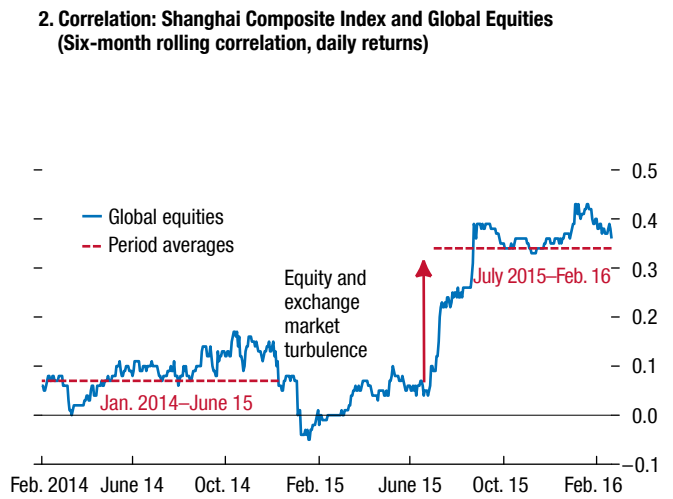
**Figure 1.14. China: Equity Markets and Exchange Rates**

Margin balances have declined ...



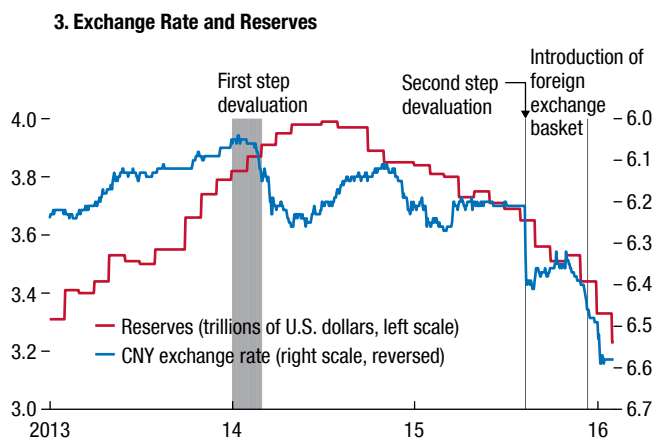
Source: CEIC.

... but spillovers to and from global markets have increased.



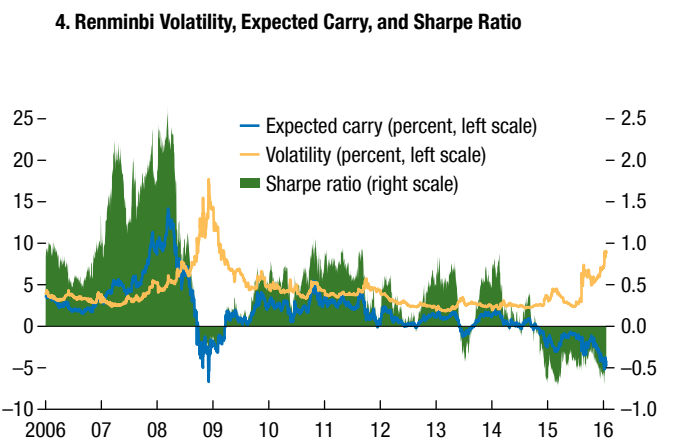
Sources: Bloomberg, L.P.; Morgan Stanley Capital International; and IMF staff calculations.  
 Note: Global equities is the Morgan Stanley Capital International All Country World Index.

International reserves have declined against periodic devaluations of the renminbi ...



Source: Bloomberg, L.P.  
 Note: CNY = onshore renminbi spot rate.

... reinforcing pressures from the unwinding of carry trade positions.



Sources: People's Bank of China; and IMF staff calculations.  
 Note: Expected carry is defined as the difference between Chinese one-year government bond yields and the renminbi 12-month nondeliverable forward implied yield; the Sharpe ratio is defined as the expected carry divided by the US\$-CNY one-year implied volatility, derived from at-the-money options.

equity. Share-collateralized lending schemes increase risks for borrowers, banks, and brokers and act as an accelerant for downward price spirals. The total value of stock pledged as collateral for loans topped RMB 3 trillion at the end of 2015, up 29 percent from July of that year.<sup>15</sup> This amount translates into an estimated RMB 1.2 trillion of loans (assuming an average loan-to-value ratio of 40 percent), which is greater than the volume of margin financing (RMB 1 trillion) outstanding at the end of 2015. When the value of share collateral declines, additional sales of shares by company owners are needed to meet shortfalls, reinforcing pressures on equity prices. Falling equity prices encourage liquidation of these positions by banks and brokers, further exacerbating equity price declines. Given the adverse feedback loop between share price and collateral value, these schemes are often last-ditch efforts to raise funds; their rise underscores borrowers' balance sheet pressures. For banks and brokers, rising borrower vulnerability could crystallize potential losses and affect their ability to intermediate and provide funding. Brokers could be particularly hard hit because they tend to carry thinner liquidity buffers than banks.

### Capital Outflow Pressures from China Have Increased

Turbulence in China's domestic financial markets could add to capital outflows and exchange rate pressures. Capital outflows began in early 2014, triggered in part by an intervention by the People's Bank of China to address expectations of continued currency appreciation, but picked up pace in the second half of 2015. Meanwhile, the pressure on foreign exchange reserves continued, falling by roughly \$100 billion in January, compared with an average of \$115 billion in 2015:Q4, though it moderated in February to \$29 billion.

Capital outflows have been driven in part by an unwinding of the carry trade that followed the rapid appreciation in effective terms during the first half of 2014, as evidenced by the sharp outflows in loans and deposits. Meanwhile, direct investment abroad and bank loans to nonresidents have accelerated. Some outflows are expected given China's economic transition as well as changing expectations for returns on renminbi-denominated assets. On net, China's

<sup>15</sup>A situation in which owners of more than 5 percent of a company pledge their own shares as collateral.

growing current account surplus, low external debt, large reserves, and remaining capital controls should allow flows to stabilize. Notably, the scope for external debt to continue to drive balance of payments pressure appears limited. The outstanding stock of foreign debt at the end of 2015 is about \$1.4 trillion (13.5 percent of GDP, about half in local currency), of which \$650 billion is loans and deposits. By the estimates in this analysis, if all carry-trade-related liabilities were unwound, the stock of loans and deposits would settle around \$600 billion, roughly the level seen in 2011–12. Moreover, China's recent measures easing a number of capital account restrictions for inflows and opening up its bond market to foreigners could encourage capital inflows in the medium term.

Still, vulnerabilities remain. Domestic savings are large (M2 is 200 percent of GDP); the outlook for resident firms' and households' foreign asset accumulation is uncertain. Should the pace of asset accumulation accelerate, these outflows could weigh on the external outlook. A number of vulnerabilities reinforce these pressures. Successive episodes of monetary policy easing and periodic depreciations of the renminbi have increased uncertainty about the future exchange rate regime and deepened expectations of further depreciation (as captured by the gap between the spot and forward exchange rates). Moreover, the attractiveness to international investors of holding renminbi-denominated assets has waned with a drop in returns on the associated carry. Against such a backdrop, domestic residents' confidence in the stability of the onshore capital market is crucial; an increase in domestic capital market volatility could well spur capital outflow.

### A More Ambitious and Comprehensive Policy Approach Would Help Address Vulnerabilities, Anchor Expectations, and Foster a Smooth Deleveraging

China's unprecedented rebalancing to a new growth model and greater market determination of asset prices is inherently complex. This process has been bumpy at times, as expected, given the magnitude of adjustment required to address China's domestic and external imbalances. Nevertheless, the transition has become more complicated amid uneven reform efforts, rising vulnerabilities in the corporate and financial sectors, and sustained capital outflows and exchange rate pressures. Recent announcements around the March National People's Congress suggest that reform efforts

to address corporate vulnerabilities in the overcapacity sectors, especially coal and steel, may be accelerated, which is a welcome development.

Smooth rebalancing and orderly deleveraging of past excesses now require urgent implementation of a more ambitious and comprehensive policy and reform agenda. Measures to address vulnerabilities will inevitably slow growth in the near term. Achieving a safer and more sustainable pace of growth should be carefully managed, and the rebalancing process should be supported through an appropriate macroeconomic policy mix (IMF 2015c). Clear communication and consistent implementation of policies are central to upholding public confidence and retaining healthy policy buffers. Policies to alleviate strains coming from a structural decline in corporate balance sheets, associated risks for banks and financial markets, and pressures on capital outflows will improve prospects for a smooth rebalancing.

- *A comprehensive plan to address the corporate debt overhang would assist a steady deleveraging process.* This plan would include faster write-offs of bad debt (as called for in IMF 2015c), thereby promoting corporate restructuring and hardening budget constraints for inefficient SOEs by eliminating implicit government guarantees. Corporate governance frameworks, particularly for SOEs and state-owned banks, should be strengthened in tandem with these measures to guard against the future buildup of excessive debt. Slowing the overall pace of credit growth would help address the credit overhang and system leverage. Increasing the number of defaults of nonviable firms should be carefully phased in and clearly communicated to help facilitate better pricing of credit risks in domestic financial markets.
- *Stock markets should be allowed to find equilibrium levels* without official support for prices, except to prevent disruptive price movements, and leveraged buying should be regulated more tightly.
- *Corporate deleveraging should be accompanied by a strengthening of bank balance sheets and social safety nets, especially for displaced workers in overcapacity sectors.* A comprehensive restructuring program to deal with bad assets and recapitalize banks should be developed, along with a sound legal and institutional framework for facilitating bankruptcy and debt-workout processes. The recent announcement of a RMB 100 billion fund to ameliorate the effects of the layoffs in the steel and coal sectors is encour-

aging in this regard. A further strengthening of the pension and health insurance systems would facilitate a smoother economic transition by enhancing the capacity of institutional investors to act as a stabilizing force in domestic bond and equity markets.

- *The supervisory framework should be continually upgraded to meet the needs of an increasingly complex financial system.* Although significant progress has been made in building supervisory capacity and strengthening the macroprudential framework, more effective coordination and information sharing among the regulatory bodies is essential. Better coordination would enhance the agility and effectiveness of supervisory actions and contribute to smooth and coherent policy formulation, communication, and implementation. Increased transparency would improve confidence in supervisors. The authorities intend to conduct a comprehensive review of the regulatory and supervisory framework in comparison with international standards and codes during the upcoming Financial Sector Assessment Program.

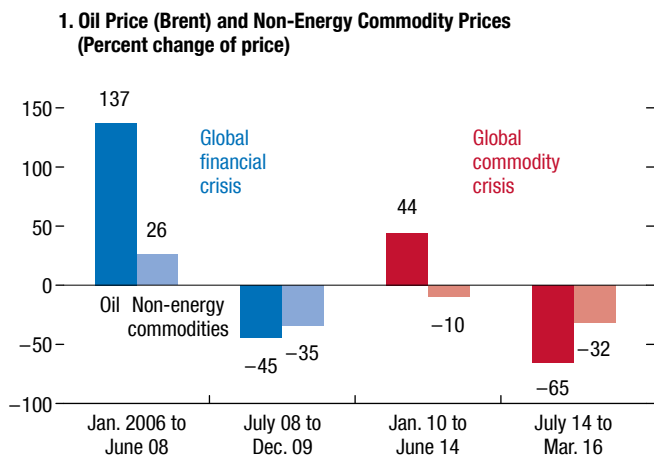
### Emerging Market Economies Are Being Tested

*The resilience of emerging market economies is being tested by slower growth, weaker commodity prices, and tighter credit conditions. Commodity-related firms are cutting capital expenditures sharply as high private debt burdens reinforce risks to credit and banks. Commodity-exporting countries and those in the Middle East and the Caucasus are particularly exposed to strains across the real economy and the financial sector. Though emerging market economies have faced multiple shocks, most have shown resilience with few crisis-like situations. Many countries accumulated buffers during the boom years, and some of these buffers have begun to be drawn down as economies make the necessary adjustments to shifting external conditions. The nexus between SOEs and sovereigns has intensified, and could increase fiscal and financial stability risks in countries with repayment pressures. Bank capital buffers are generally adequate, but will likely be tested by weaker earnings and the downturn in the credit cycle.*

Most emerging market economies have undergone several severe shocks in recent quarters (Figure 1.15). Growth continues to slow across most economies, commodity prices have collapsed, assets have repriced markedly (at times violently), and domestic vulnerabilities

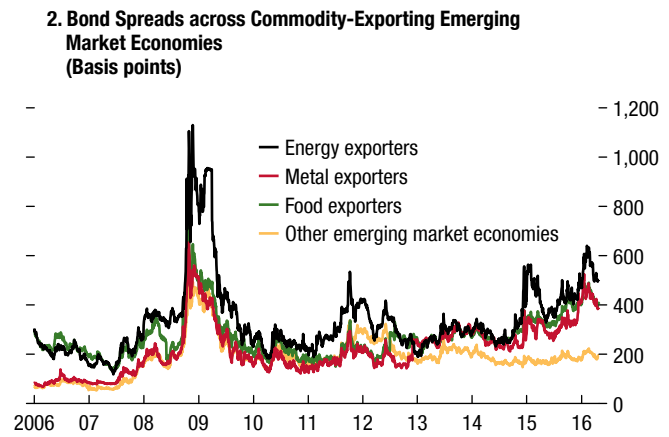
**Figure 1.15. The Global Commodity Crisis**

The big ramp-up and eventual collapse of oil prices ...



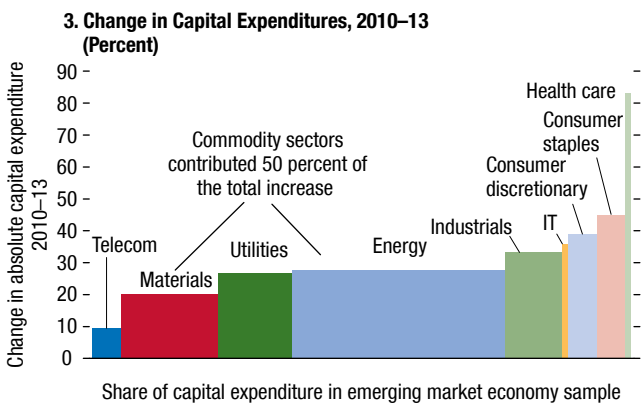
Source: Bloomberg, L.P.

... is reflected in the borrowing costs of emerging market economies.

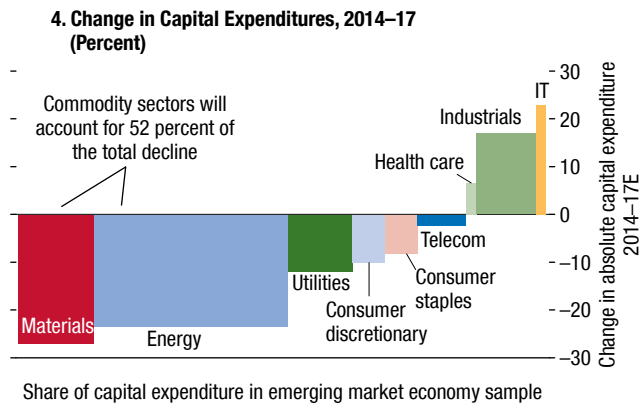


Sources: JPMorgan Chase & Co.; and IMF staff calculations.

Commodity sectors account for the bulk of corporate capital expenditures and affect overall economic investment.



Sources: S&P Capital IQ; and IMF staff calculations.  
Note: IT = information technology; Telecom = telecommunications.



Sources: S&P Capital IQ; and IMF staff calculations.  
Note: E = estimated; IT = information technology; Telecom = telecommunications.

have intensified. The *global commodity crisis*—the sharp decline in oil and other commodity prices since 2014—has added to corporate and sovereign vulnerabilities.

Many countries have used their buffers to absorb these shocks and provide support to growth, but after nearly two years of commodity price declines and downward growth revisions, some economies may be running out of room to maneuver. Financial and economic risks in emerging market economies remain elevated along the following four dimensions: (1) the big decline in corporate capital investment; (2) increased credit risk arising from the deterioration of corporate (and sover-

eign) fundamentals and oncoming refinancing pressures, jointly dubbed the *corporate-sovereign nexus*; (3) banking sector spillovers; and (4) depletion of buffers and policy space in some economies. This section examines these shocks and risks, and delineates the countries and regions with the highest financial stability concerns.

**Capital Expenditures of Commodity Economies Matter for All Economies**

Although commodity exporters' hard-currency (J.P. Morgan Emerging Markets Bond Index Global)

sovereign bond spreads have widened to levels last seen in early 2009, spreads for countries with a low commodity intensity of exports have barely budged and remain close to post-2009 lows (Figure 1.15 and Table 1.1).<sup>16</sup> This condition suggests that the repricing of external sovereign debt has reflected balance sheet concerns in commodity-exporting countries specifically.

Corporate capital investment continues to decline in many emerging market economies in reaction to falling profitability and slowing growth, with materials and energy firms expected to account for half of the decline through 2017 (Figure 1.15, panels 3 and 4). Capital expenditures of commodity-related firms are expected to decline by about 25 percent in the period 2014–17. Because of their large share in economic investment, oil-related capital expenditures in some economies tend to have a broad dampening effect on the entire economy's investment, even in net importers of oil, such as Brazil (Table 1.1).

### Corporate and Sovereign Credit Risks Have Risen and Feed into Each Other

Previous GFSRs have highlighted the increase in corporate sector leverage in many emerging market economies, along with an overall decline in their debt-repayment capacity. Firm-level data suggest that the deterioration in company fundamentals is more pronounced in Asia (led by China), and remains elevated in Latin America and in Eastern Europe, the Middle East, and Africa (Figure 1.16, panel 1). Debt belonging to nonfinancial corporations with reduced ability to repay (interest coverage ratio less than one) has risen to \$650 billion, or 12 percent of total corporate debt of firms in the sample of firms from the major emerging market economies. The role of SOEs in debt is important. Indicators of corporate health and debt at risk for the major emerging market economy SOEs show similar levels of deterioration since 2010, even excluding China, because many big SOEs are commodity firms (Figure 1.16, panel 2).

Companies in the energy sector have indeed issued the most debt since 2012 among nonfinancial firms, particularly in Colombia, Kazakhstan, Nigeria, and Russia, and have seen their corporate debt reprice

<sup>16</sup>Non-commodity-exporting countries in the J.P. Morgan Emerging Markets Bond Index Global Diversified account for roughly one-third of the index.

accordingly (Table 1.1).<sup>17</sup> Markets have differentiated between firms in commodity-related sectors, such as metals, mining, oil and gas, and firms in other sectors, and between firms in countries with a large share of oil-related debt and firms in other countries (Figure 1.16, panel 3; and Table 1.1).<sup>18</sup> Firms are now seeking to deleverage by paying down debt, cutting back on capital investment and shedding assets. Russian firms also dealt with the large depreciation of the ruble without significant spillovers to foreign currency debt, while also managing to delever. Nevertheless, the ongoing recession in Russia continues to pose risks to financial stability.

With weakening corporate balance sheet fundamentals and rising costs and risk perceptions, continued market access for refinancing may become more difficult for some corporations. Firms with short maturity profiles and high borrowing costs could run into problems. Indonesian, Kazakh, and Nigerian firms have both relatively short-term debt (with median maturity of four years or less) compared with other emerging market economies (Figure 1.16, panel 4), and high borrowing spreads (Table 1.1).

Countries with large state-owned corporate sectors and limited fiscal space may see greater stress spill over from sovereign vulnerabilities to the corporate sector or vice versa. This feedback loop could adopt different forms. In one direction, sovereign stress may reduce the value of default protection accorded to SOEs by implicit or explicit government guarantees. For example, in Brazil the sovereign's adverse debt profile, fiscal pressure, and ongoing recession have contributed to the widening of Petrobras's credit spread.

In the other direction, SOE contingent liabilities, if recognized, could worsen sovereign debt dynamics. The fiscal impact of weaker SOEs could be substantial if the sovereign has to assume their short-term liabilities. Contingent liabilities are largest in Kazakhstan, Mexico, Russia, South Africa, and Venezuela, and are also sizable for other emerging market economies, such

<sup>17</sup>The large share of oil-related debt in Argentina (raised by the state oil producer YPF) is the result of the small issuance of non-oil-related debt because of the country's high borrowing costs. Issuance is bound to increase when Argentina regains access to global financial markets.

<sup>18</sup>Corporate bond spreads for Latin America appear higher than other regions owing to the region's higher dependence on oil and commodities than Asia, where only the higher-quality corporations are able to issue debt and be included in corporate bond indices.

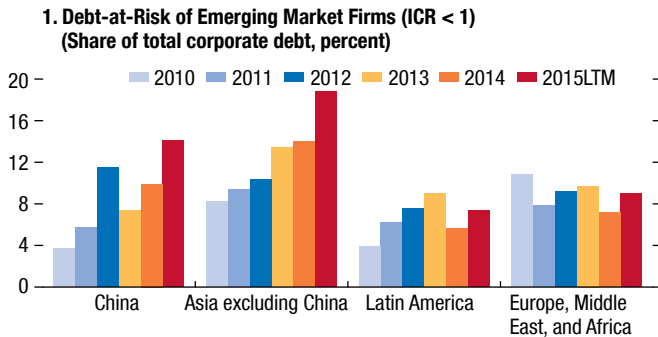
**Table 1.1. The Effects of Energy Commodities on Emerging Market Economies and Other Economies and Their Buffers and Policy Indicators***(Percent, unless otherwise noted)*

	Effect of Energy Commodities Price Decline					Market Pricing				Buffers			Policy Indicators				
	Oil Price Change in Local Currency (year over year; 2015)	Debt Issued by Energy Firms Since 2012		Share of Energy Firms		Dollar Bond Spreads (bps)				Bank	External		Fiscal		Monetary		
		U.S. dollars (billions)	In Total Nonfinancial Corporate Debt	Capex in Total Nonfinancial Corporate Capex (LTM)	Assets in Total Nonfinancial Corporate Assets (LTM)	Sovereign		Corporate			Tier 1 Capital (in risk-weighted assets)	Reserves to Short-Term External Financing Requirements (multiples; 2016E)	Current Account plus Foreign Direct Investment (Percent of GDP; 2016E)	Primary Balance (2016E; GDP)	General Government Debt (2016E; GDP)	Real 10-year Bond Yields	Inflation Gap
						Average 2016 Level	Δ June 30, 2014, to Dec. 31, 2015	Average 2016 Level	Δ June 30, 2014, to Dec. 31, 2015								
<b>Asia</b>																	
China	-32	250	15	28	19	203	57	372	-6	11.3	6.3	3.1	-2.4	47	1.9	-1.3	26
Hong Kong SAR	-35	...	...	18	5	...	...	...	...	...	...	1.1	0.8	...	...	...	45
India	-32	13	19	26	19	175	-8	375	97	10.5	1.9	0.1	-2.4	66	2.6	0.0	-3
Indonesia	-28	8	31	25	24	363	101	760	172	18.6	1.2	-1.3	-1.2	28	3.7	0.0	11
Malaysia	-20	4	7	52	29	265	175	215	44	13.9	...	2.8	-1.5	56	0.5	...	9
Philippines	-32	2	10	5	3	144	11	523	105	13.8	5.2	2.7	1.4	36	1.4	-0.5	...
Singapore	-30	4	10	14	9	...	...	232	24	...	...	31.5	0.6	98	-0.3	...	20
Thailand	-29	11	19	36	29	...	...	262	65	13.8	4.2	8.5	0.2	44	0.8	-1.9	17
<b>Central and Eastern Europe</b>																	
Hungary	-28	0	...	65	67	229	-6	273	21	...	2.3	5.8	1.1	75	1.0	-1.1	-25
Kazakhstan	21	6	59	67	66	455	131	1,010	346	...	...	-0.2	-4.3	22	-3.8	...	...
Poland	-28	1	26	20	20	135	14	302	53	14.0	1.0	0.3	-1.1	52	1.2	-2.2	1
Romania	-27	...	...	88	50	216	27	...	...	...	0.8	0.1	-1.5	40	2.4	-2.4	...
Russia	-22	68	52	52	51	326	69	565	158	8.5	3.3	4.1	-3.7	18	3.4	8.9	6
Turkey	-19	1	10	5	6	340	88	398	71	12.3	0.5	-2.2	0.2	31	-0.2	1.8	16
<b>Middle East</b>																	
Bahrain	-35	...	...	...	...	...	...	507	231	...	2.0	-2.7	-14.7	82	4.8	...	...
Kuwait	-33	...	...	29	18	...	...	466	189	...	1.0	-0.8	-27.6	19	...	...	...
Saudi Arabia	-35	1	5	13	5	...	...	138	27	16.2	5.0	-9.8	-16.6	17	...	...	3
United Arab Emirates	-35	5	25	11	4	...	...	335	87	16.6	...	-0.7	-10.5	21	...	...	...
<b>Africa</b>																	
Nigeria	-29	1	51	28	21	659	361	1,245	578	16.3	2.1	-2.1	-3.9	13	3.3	...	...
South Africa	-13	3	22	15	7	452	209	505	207	13.8	0.9	-4.8	-0.2	51	2.0	0.0	-2
<b>Latin America</b>																	
Argentina	-1	7	71	67	42	486	-262	735	48	...	0.2	1.2	-4.8	61	...	...	...
Brazil	-3	54	34	32	22	538	357	956	551	12.1	2.0	1.3	-1.7	76	7.2	4.2	12
Chile	-24	9	25	6	6	279	151	394	73	9.5	1.0	-0.3	-2.8	20	1.4	0.4	...
Colombia	-13	12	63	51	30	384	200	745	505	11.4	1.2	-1.7	0.2	49	3.0	2.8	...
Ecuador	-35	...	...	...	...	1,443	921	...	...	...	...	-1.5	-1.1	38	9.3	...	...
Mexico	-24	61	46	32	19	373	181	427	164	13.3	2.0	-0.3	-0.5	55	2.6	-0.9	6
Peru	-25	2	17	6	5	283	116	481	146	...	3.4	-1.1	-1.1	25	3.0	1.4	...
Venezuela	-35	13	...	...	...	3,379	1,879	...	...	...	...	-6.1	-23.4	36	...	...	...

Sources: Bank for International Settlements; Bloomberg, L.P.; Consensus Economics; Fitch; IMF, Financial Soundness Indicators, International Financial Statistics, and World Economic Outlook databases; Moody's; S&P Capital IQ; and IMF staff calculations. Note: Bond spread levels and changes are colored by their quartiles across countries: green for first, yellow for second, orange for third, and red for fourth. The inflation gap is defined as the distance of the latest headline inflation (year over year) from the lower or upper inflation band or inflation target if no band is available and no value data (...) if no inflation target exists. Credit gap is defined as the distance of the latest credit to GDP metric from its long-term trend fitted from a Hodrick-Prescott line. Reserves refers to official reserve assets as of 2015:Q4 or latest in 2015 as reported in IMF, International Financial Statistics database. Official reserve assets may not include sovereign wealth fund assets. Short-term external financing requirements refer to short-term external debt and current account. capex = capital expenditure; E = estimated; LTM = last 12 months.

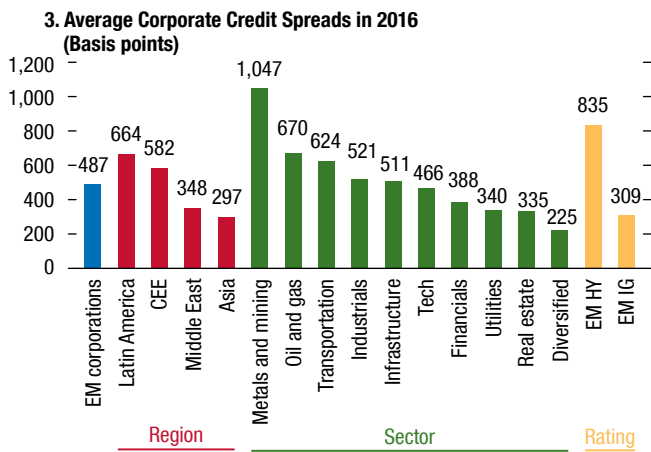
**Figure 1.16. Corporations, Sovereigns, and Their Nexus**

Emerging market economy firm fundamentals have deteriorated in Asia, and remain weak in most emerging market economies ...



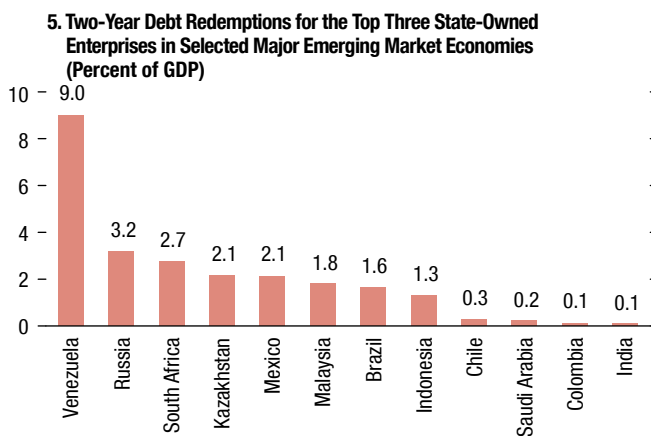
Sources: S&P Capital IQ; and IMF staff calculations.  
Note: Debt-at-risk is defined as the debt of corporates with interest coverage ratio of below 1. Interest coverage ratio is EBITDA/interest expense of the corporate. 2015LTM = last 12 months; EBITDA = earnings before interest, taxes, depreciation, and amortization; ICR = interest coverage ratio.

The deterioration in fundamentals and commodity prices is reflected in market prices.



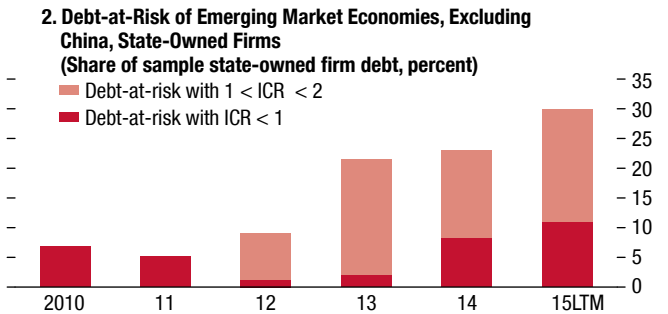
Sources: JPMorgan Chase & Co.; and IMF staff calculations.  
Note: CEE = central and eastern Europe; EM = emerging market economy; HY = high yield; IG = investment grade.

State-owned enterprise debt redemption is large in some countries.



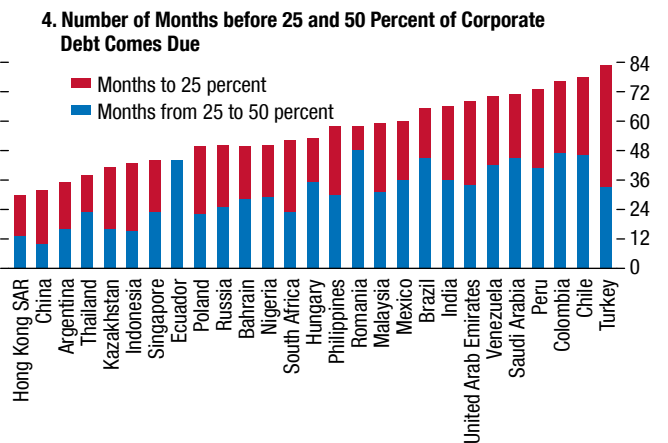
Sources: S&P Capital IQ; and IMF staff calculations.

... with state-owned enterprises leading the deterioration.



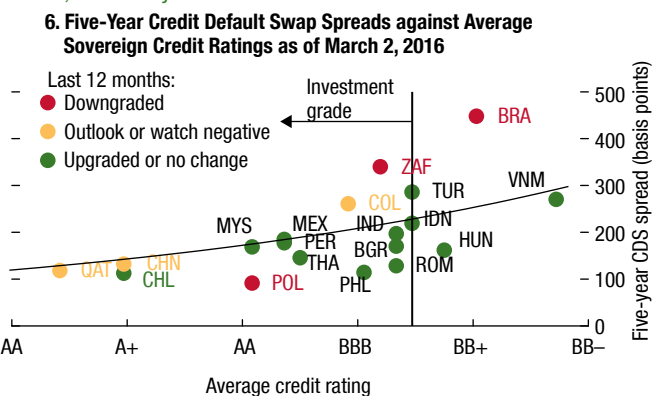
Sources: S&P Capital IQ; and IMF staff calculations.  
Note: 15LTM = last 12 months; ICR = interest coverage ratio.

Corporate refinancing pressures are acute in some economies.



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

Sovereign risk perceptions appear acute in Brazil, Colombia, South Africa, and Turkey.



Sources: Bloomberg, L.P.; rating agencies; and IMF staff calculations.  
Note: Data labels in the figure use International Organization for Standardization country codes. CDS = credit default swap.



as Brazil, Indonesia, and Malaysia (Figure 1.16, panel 5). As such, increased perceptions of repayment stress on the debt of Petrobras (Brazil) and Eskom (South Africa) may have fed into the sovereign credit spread. This is one of the factors that may have pushed sovereign credit default swap spreads higher than implied by their credit ratings, predisposing credit rating downgrades and adding to existing concerns about sovereign risks (Figure 1.16, panel 6).

Frontier markets, especially commodity exporters, were also hit hard during recent bouts of financial market turbulence. Some frontier market economies have postponed their plans for international bond issuance or had to borrow at higher costs than before (e.g., Mongolia). The volume of corporate issuance in 2015 declined to a quarter of the pace of issuance in 2014, to levels seen at the time of the global financial crisis. Focusing on the behavior of spreads and credit ratings using two complementary approaches (signaling and risk zone),<sup>19</sup> a significant deterioration in market access indicators for many frontier economies is found (Table 1.2). The most pronounced worsening of spreads during the 18 months prior to December 2015 is observed in Angola, Egypt, El Salvador, Ghana, Iraq, Kenya, Mongolia, Tanzania, Tunisia, and Zambia. Although credit ratings are lagging indicators and do not move as fast or as frequently as spreads, credit downgrades in Angola, El Salvador, Mongolia, and Zambia occurred during the same period as the worsening spreads.

### Bank Buffers May be Tested, Especially in the Middle East and Other Oil-Heavy Economies

Although many emerging market economy banking systems remain profitable and adequately capitalized, rapid credit growth and a worsening credit cycle will pressure bank buffers. Many emerging market economy banks have aggregate return-on-equity ratios

<sup>19</sup>The signaling approach identifies vulnerability thresholds for spreads and ratings by minimizing the noise-to-signal ratio over historically observed loss of market access episodes. Unlike the signaling approach, which relies on aggregating information across countries, the risk zone approach accounts for cross-country heterogeneity by delineating various thresholds (percentiles) from country-specific empirical distributions for spreads and ratings. This can flag whether an indicator is, for example, in a zone of high, elevated, or low risk, relative to its historical norms. A country is categorized as “high risk” if the relevant indicator breaches both the vulnerability threshold and its 75th percentile established under the risk zone approach.

of more than 10 percent, which is well above most advanced economy banks. These higher ratios are due to higher net interest margins and higher underlying growth rates, but also to higher balance sheet leverage.<sup>20</sup> However, multiple shocks to the real economy from lower domestic growth, lower commodity prices, and prolonged currency depreciation will likely reduce earnings and capital buffers for banks in emerging market economies as NPLs and provisions rise (Figure 1.17, panel 1). Given higher expected default rates on corporate and household loans from the turn in the commodity cycle and the advanced stage of the credit cycle, capital buffers in emerging market banks may be tested (Figure 1.17, panel 2).<sup>21</sup> An IMF study also finds that financial sector deepening at too fast a pace carries risks (Sahay and others 2015). Box 1.2 provides an assessment of Brazilian corporations and their spillovers to bank stability.

Emerging market economies in the Caucasus and Central Asia (CCA), and the Middle East and North Africa (MENA) regions are particularly sensitive to oil price developments because of their extreme dependence on the oil sector through the macroeconomy and government ownership of banks.<sup>22</sup> Of the 32 countries that make up the two subregions, half depend on hydrocarbons for GDP and fiscal and export revenues, and another 7 are indirectly linked to oil prices through trade, remittances, and other financial ties with oil-dependent economies (Figure 1.18).<sup>23</sup> The domestic macroeconomic environment, in turn, drives financial sector performance, since banks largely depend on domestic and regional economies for funding, asset expansion, and income. Oil-dependent governments (such as in Algeria, Azerbaijan, Iraq, Islamic Republic of Iran, Kazakhstan, Turkmenistan, Uzbekistan, and the Gulf Cooperation Council [GCC])

<sup>20</sup>Averaging a multiple of 13.5 for banks in the major emerging market economies—as measured by total assets to total common equity—against a multiple of 9.3 in the United States.

<sup>21</sup>Chilean banks meet regulatory minimum capital requirements and are considered adequately capitalized for local regulations.

<sup>22</sup>For a more in-depth analysis of the risks to the CCA and MENA regions, please see Lukonga and others (forthcoming).

<sup>23</sup>Oil-exporting countries include Azerbaijan, Bahrain, Iraq, Islamic Republic of Iran, Kazakhstan, Kuwait, Oman, Qatar, Saudi Arabia, Turkmenistan, the United Arab Emirates, Uzbekistan, and Yemen, as well as Libya and Sudan, but the latter two are not covered in this section. Among the net oil importers, Egypt, Jordan, and Lebanon are linked to oil through trade and remittances with the GCC, and Armenia, Georgia, the Kyrgyz Republic, and Tajikistan are linked through trade and remittances with Russia and Kazakhstan.

Table 1.2. Loss-of-Market-Access Indicators

	Sovereign Dollar Bond Spreads (basis points)			Sovereign Credit Ratings	
	Average 2015 Level	Average 2016 Level	Δ June 2014 to Dec. 2015	S&P 2014	S&P 2015
<b>Asia</b>					
Mongolia	610	989	279	B+	B
Sri Lanka	421	615	223	B+	B+
Vietnam	259	325	87	BB-	BB-
<b>Central and Eastern Europe</b>					
Belarus	921	588	59	B-	B-
Bulgaria	233	249	-10	BBB-	BB+
Croatia	283	316	69	BB	BB
Georgia	421	515	165	BB-	BB-
Serbia	280	301	12	BB-	BB-
Ukraine	2,375	860	41	CCC	B-
<b>Middle East</b>					
Egypt	409	604	232	B-	B-
Iraq	746	1,189	514	...	B-
Jordan	249	402	186	BB-	BB-
Lebanon	402	482	100	B-	B-
Pakistan	500	587	65	B-	B-
Tunisia	378	638	318	...	...
<b>Africa</b>					
Angola	638	1,042	545	BB-	B
Côte d'Ivoire	459	584	132	...	...
Ghana	755	1,224	388	B-	B-
Kenya	489	703	303	B+	B+
Senegal	485	633	205	B+	B+
Tanzania	572	875	446	...	...
Zambia	686	1,243	553	B+	B
<b>Latin America</b>					
Belize	781	1,079	60	B-	B-
Costa Rica	449	568	208	BB	BB
Dominican Rep.	385	496	111	B+	BB-
El Salvador	497	741	246	BB-	B+

Sources: Bloomberg, L.P.; Dealogic; Fitch; Moody's; Standard & Poor's; and IMF staff calculations.

Note: Based on EMBI Global sovereign spreads. In ascertaining vulnerability to loss of market, we followed the methodology described in IMF 2015b. Red = high risk; orange = elevated risk; yellow = medium risk; green = low risk (see footnote 19).

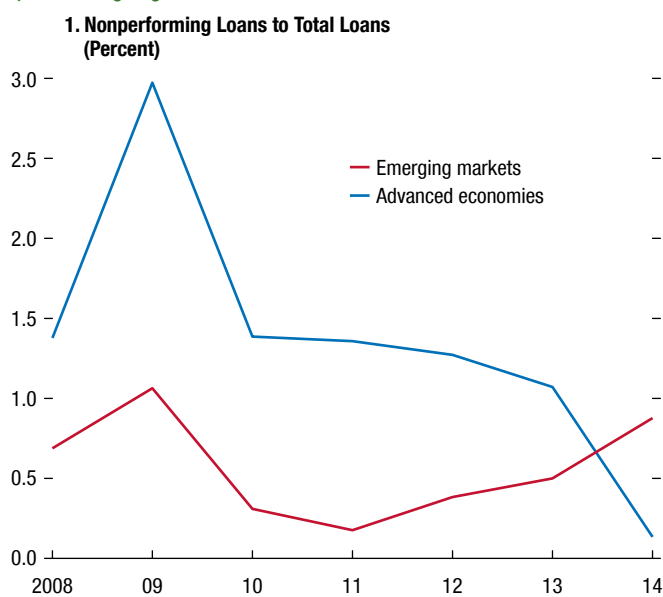
member countries) also have substantial stakes in the banking systems through which oil-related deposits in many cases are channeled.

Financial strains have emerged more rapidly in response to falling oil prices in the CCA and non-GCC oil exporters, but the GCC is also facing increasing pressures. Many CCA countries—both oil exporters and importers—have registered an immediate

increase in NPLs, declines in capital adequacy ratios, slower growth in the money supply, and declines in private sector credit (Figure 1.19). The number of restructured bank loans and of undercapitalized banks and banks seeking recourse to central bank financing have also risen. In MENA, pressures have been felt in capital and financial markets whereas the impact on bank asset quality has so far been moderate. Algeria,

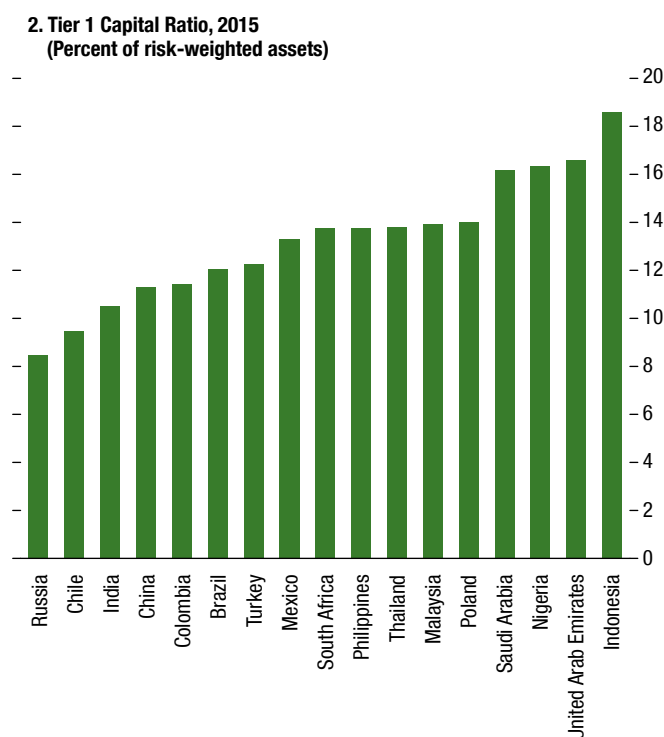
**Figure 1.17. Banking System Health**

Rising bad loans and slowing growth will likely raise required provisions going forward ...



Sources: Bankscope; and IMF staff calculations.

... and loss-absorbing buffers may be tested.



Sources: Bank of Thailand; CEIC; and IMF, Financial Soundness Indicators database.

Note: Data are as the latest available date in 2015. Data for Thailand are from the Bank of Thailand. Data for China are from the China Bank Regulatory Commission via CEIC.

Bahrain’s wholesale Islamic banking sector, Iraq, and Islamic Republic of Iran registered some deterioration in financial soundness indicators, but in some cases not directly related to the oil price decline. Banking system liquidity, though still high, has shrunk, and private sector credit growth has begun to slow in many countries (Figure 1.19, panels 3 and 4).

**Countries with External Imbalances are Particularly Vulnerable to Shocks**

A worsening outlook may call more attention to international reserves as a stabilizing mechanism, given that exchange rates have already depreciated substantially in many countries, and further declines could trigger policy concerns about inflation or have a dislocating impact on balance sheets and the real economy. Argentina, Malaysia, Romania, South Africa, and

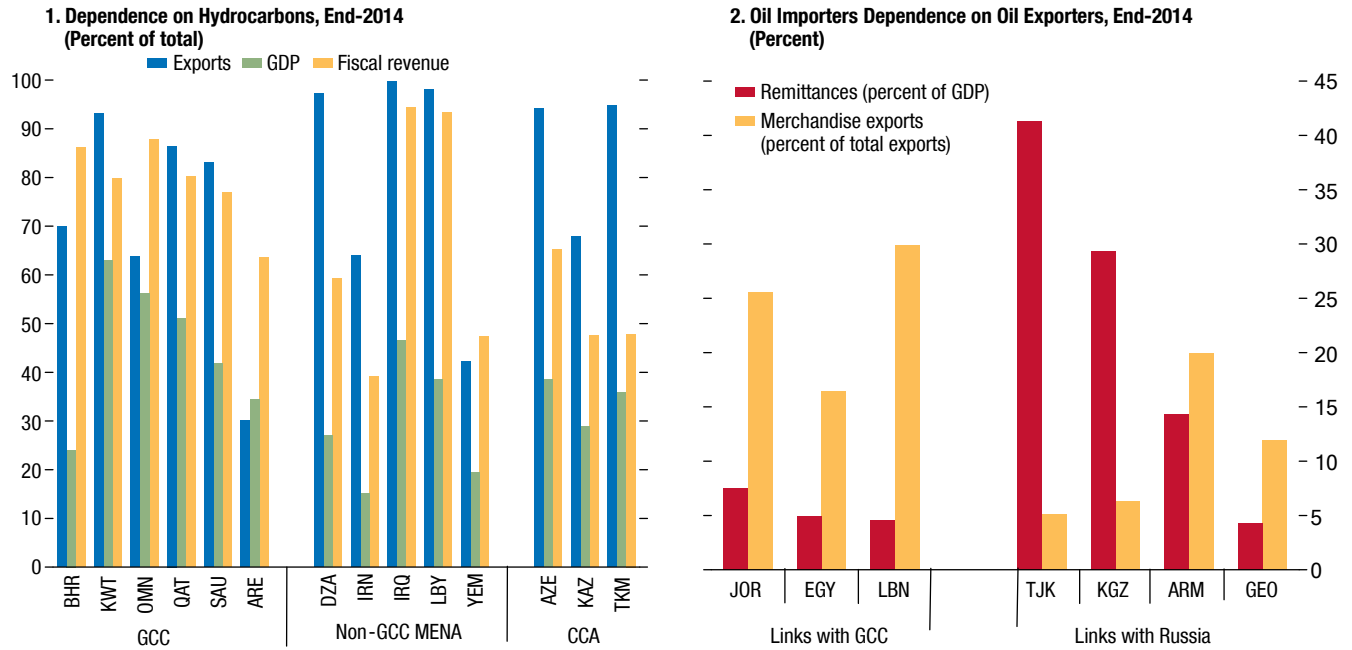
Turkey may need more reserves because their reserve levels are not high relative to their short-term external financing requirements (see Table 1.1).<sup>24</sup> External imbalances remain elevated for the oil-exporting countries of Bahrain, Ecuador, Saudi Arabia, and Venezuela, where direct investment does not cover the current account deficit and new portfolio investment may be constrained. South Africa and Turkey continue to have significant external imbalances, despite being net oil importers. South Africa continues to deal with infrastructure bottlenecks, primarily in electricity production, that hold back exports, while export commodity prices also fell. Turkey’s domestic-demand-driven growth leads to persistent import growth,

<sup>24</sup>Argentina’s access to international capital markets after the settlement with holdout investors should significantly reduce the need to increase reserves to fund foreign currency financing requirements.

**Figure 1.18. Oil Prices and Economic Links in the Caucasus and Central Asia, and Middle East and North Africa Regions**

Extreme economic dependence on hydrocarbons in oil exporters ...

... and oil importers through trade and remittances.



Sources: IMF, Direction of Trade Statistics database; national authorities; and IMF staff estimates.  
 Note: Data labels in the figure use International Organization for Standardization country codes. CCA = Caucasus and Central Asia; GCC = Gulf Cooperation Council; MENA = Middle East and North Africa.

and the need to finance the current account deficit with portfolio flows exposes the economy to external shocks. In contrast, Hungary, India, and Thailand have used the opportunity provided by lower import prices to substantially improve their external positions.

**Countries Need to Use Their Buffers and Deploy Policy Space Faster**

The tighter link between firms (SOEs in particular) and sovereigns in some cases may require greater use of resources to help facilitate the adjustment to lower commodity prices. Many emerging market economies have used their reserves to smooth external shocks and should continue to do so as warranted and where they are sufficient. Countries with insufficient buffers and limited policy space should act early to address their vulnerabilities and to seek help in the form of bilateral loans, swap lines, or precautionary funding with the IMF or other multilateral organizations.

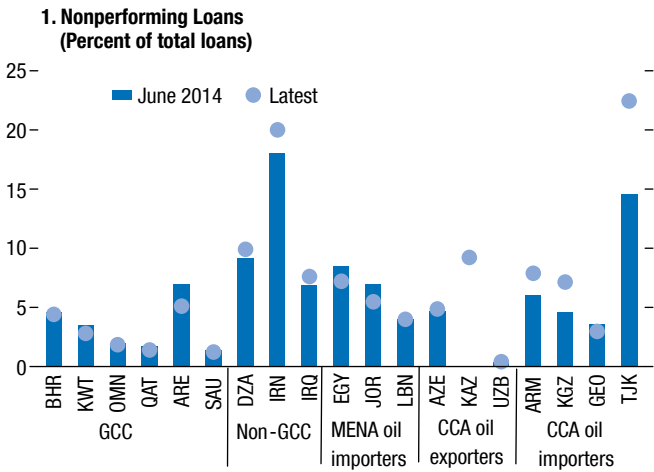
In many emerging market economies the space for further fiscal expansion is generally more constrained

now than during the global financial crisis because economies issued more debt to finance growth policies and sidestep the worst of the global fallout. Emerging market economies and firms with high yields and spreads may have greater difficulty financing spending and debt rollovers, even if their absolute debt levels are low because foreign demand for emerging market assets has fallen. In Brazil, restoring fiscal sustainability requires a fiscal consolidation strategy that addresses structural sources of expenditure pressure; although fiscal consolidation efforts may generate some short-term headwinds, they are necessary for a turnaround in sentiment and a return to economic growth. For more on the fiscal risks of other emerging market economies, see Box 1.3 of the April 2016 *Fiscal Monitor*.

Hungary and Poland may have more monetary policy space since inflationary pressures are under control (or absent) and the credit overhang does not pose a stability issue. Brazil and Turkey are in the late stage of the credit cycle and are faced with persistent inflationary pressures, leaving little room for monetary

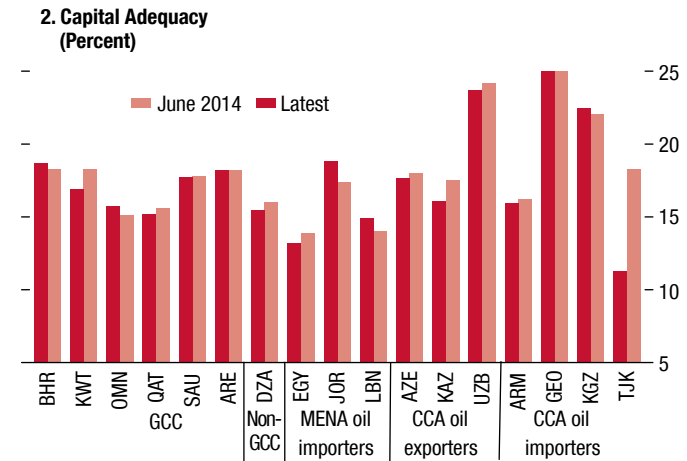
**Figure 1.19. Performance of the Banking System in the Caucasus and Central Asia, and Middle East and North Africa Regions since June 2014**

Nonperforming loans have increased in some countries ...



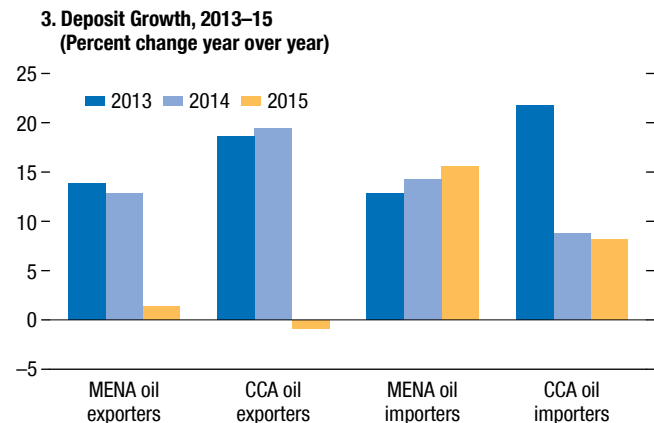
Sources: IMF, Direction of Trade Statistics database; national authorities; and IMF staff estimates.

... and capital adequacy ratios have slipped.



Source: Audited bank financial statements.

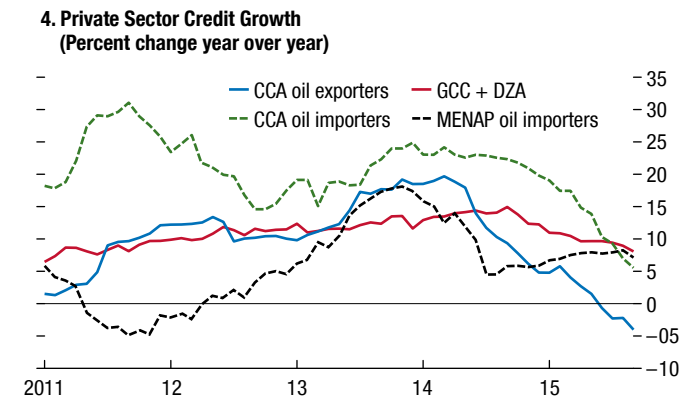
System-wide liquidity has declined ...



Source: Country authorities.

Note: For Algeria, Iraq, and Qatar, nonperforming loan figures are for end-December 2014 and not June. Data labels in the figure use International Organization for Standardization country codes. CCA = Caucasus and Central Asia; GCC = Gulf Cooperation Council; MENAP = Middle East and North Africa and Pakistan.

... and private sector credit growth has generally slowed.



Source: Country authorities.

policy easing because of the risk that it may reinforce currency weakness.

Portfolio outflows exerted pressure on several emerging market economies in 2015. The recent stabilization and resumption of bond inflows presents an opportune moment for policymakers to evaluate vulnerabilities and rebuild policy space. Further dollar appreciation or monetary policy tightening by the Federal Reserve has the potential to introduce more portfolio flow volatility, which can test external buffers and policy space again.

**Emerging Market Economies Have Tools to Boost Their Resilience**

- Policymakers will need to deploy a range of tools to counter the effects of the end of the commodities boom and slowdown in capital flows. Countries may use available fiscal space to boost demand, although many are constrained by ratings and cost concerns given that commodity-related revenues will likely have fallen just when aggregate demand support may be desirable. Those without inflation concerns may use monetary easing in a countercyclical man-

ner. Currency depreciation has provided a cushion in some countries, but greater reliance on the use of foreign reserves may be needed in some cases to prevent inflation from rising or to stave off the balance sheet effects of depreciation.

- *The implementation of reforms to macroprudential and supervisory frameworks should be accelerated, and supervisory resources will be required to ensure credible and timely responses.* Coordination across agencies and central banks, as well as enhanced supervision of banks, will be needed.
- *Policymakers should closely and proactively monitor corporate vulnerabilities, particularly those arising from exposures to commodity producers and foreign currency risk.* Concentration of exposures should be evaluated and reduced if necessary. Foreign currency lending to unhedged borrowers in the banking system should be assessed, and limits on further foreign currency lending to unhedged borrowers, tightening of net-open-position limits for banks, and foreign currency liquidity requirements should be deployed where there are significant foreign currency liabilities.
- *The slowing of the credit cycle will begin to dent bank asset quality, but there is time to mitigate the impact.* This deterioration should be managed in a credible and transparent manner. Banks that have built capital buffers can now use them to cushion bad-debt losses, but where buffers were not built in the boom years, more capital may be needed and policymakers will have to balance necessary prudential tightening against the risk of being excessively procyclical. Supervisors will need to become more intrusive and examine underwriting standards to ensure sound new lending and avoid a further buildup of risk. Supervisors will need to work with banks and their boards to plan responses, which could include limiting dividend distributions or expansion of business lines. Given the role of state-owned banks and state-owned or quasi-sovereign companies in many emerging markets, special attention should be paid to these exposures.
- *Skillful management of corporate distress will be key.* Policymakers should put in place contingency plans to manage corporate insolvencies, including a framework that ensures timely market-based restructuring (through formal and informal mechanisms), one that minimizes moral hazard but may provide limited scope for state support (depending

on the country circumstance and policy space). The European debt crisis showed that countries with efficient legal frameworks for dealing with debt restructuring and insolvency had lower macroeconomic costs associated with any given level of deleveraging (see the April 2015 GFSR, Chapter 1, pp. 9–12).

- *Swift recognition of nonperforming assets and transparency in how they are managed will be central to future banking system health.* Evergreening and poor credit classification can compound concerns about asset quality and degrade policymakers' credibility.

### Advanced Economies: Banks' Legacy Problems and New Challenges

*Banks in advanced economies face substantial challenges in adapting to the new regulatory and market environment. Regulation has improved capital and liquidity buffers at most banks and instituted better protections for taxpayers in systemic events. However, legacy problems of excess capacity, high levels of NPLs, and poorly adapted business models continue to depress bank profitability, which could erode bank resilience over time. These legacy problems became more apparent in late 2015 and early 2016 as sharp downward pressures on bank equity and debt prices drove valuations down to levels that could impair their ability to tap capital markets. Actions taken by the European Central Bank in March have supported a rebound in valuations. But policies are urgently needed to address long-standing structural issues to prevent the return of systemic stress and enhance monetary transmission.*

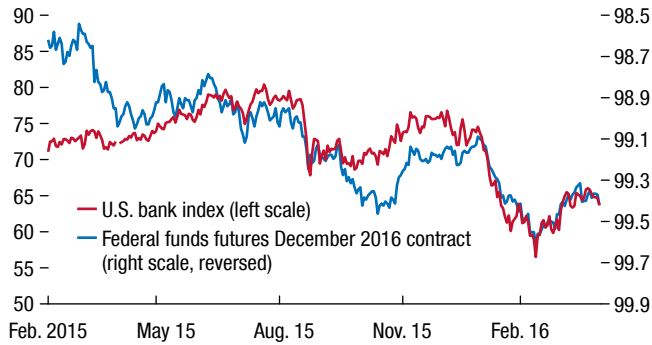
#### Banks Are Safer, so Why Did Their Valuations Come Under Stress?

Banks in advanced economies are more resilient to credit and liquidity shocks thanks to regulatory efforts to increase the amount and quality of capital, raise liquidity buffers, and reduce funding mismatches. Despite these improvements, bank equity prices plunged and funding stresses emerged in late 2015 and early 2016. Notwithstanding some recovery following additional policy action by the European Central Bank in March, this episode reflects continued cyclical economic weakness, as well as long-standing structural problems. Structural challenges include poorly adapted business models that continue to depress bank profitability and, par-

**Figure 1.20. Falling Bank Valuations Reflect Weakening Outlook**

Fears of stalled normalization led to declines in bank equity prices in the United States.

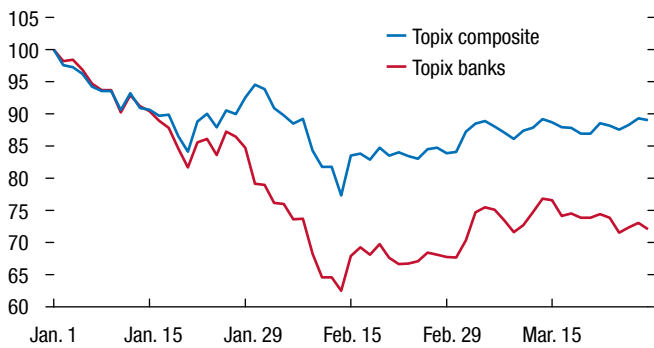
**1. U.S. Bank Equity Prices and Federal Funds December 2016 Contract**



Source: Bloomberg, L.P.

... and Japanese banks came under pressure as the Bank of Japan went to negative rates.

**3. Japanese Equities (January 1, 2016 = 100)**



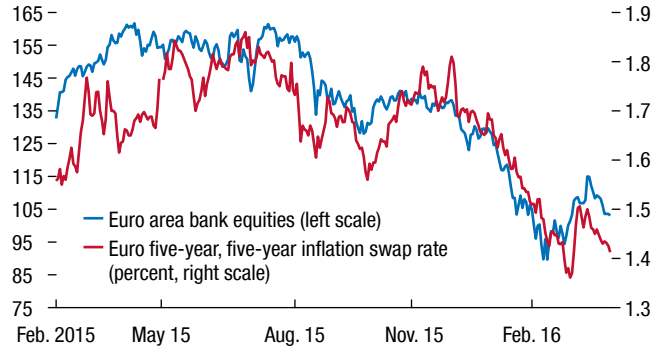
Source: Bloomberg, L.P.

ticularly in the euro area, excess bank capacity and nonperforming loans. Over time, this could work to erode bank soundness and increase systemic risk if left unaddressed.

Cyclical pressures have hurt the outlook for bank earnings generation. Low inflation and low growth act to reduce loan demand and therefore the outlook for future bank earnings (Figure 1.20, panels 1 and 2). In the United States, expectations of a steepening yield curve weakened along with delayed prospects of monetary policy normalization. In the euro area, rising risks of low inflation and low growth pushed bank valuations down, and weak sentiment was reinforced

European bank equities fell in line with the worsening inflation outlook ...

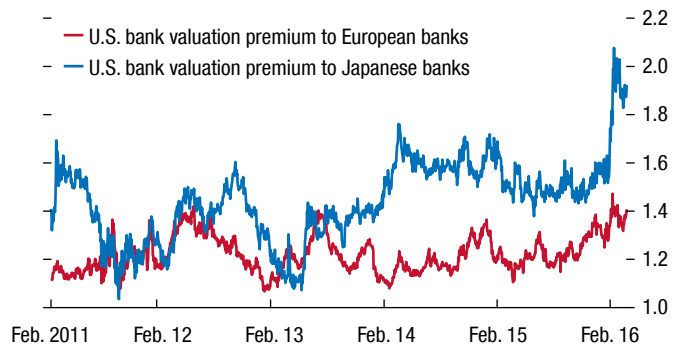
**2. European Bank Equity Prices and Five-Year, Five-Year Inflation Forwards**



Source: Bloomberg, L.P.

Valuations on European and Japanese banks fell to a deep discount to U.S. banks.

**4. Relative Bank Valuations (Times)**



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

Note: The valuation premium is defined as the price-to-book ratio of the KBW index (U.S. banks) divided by that of the Stoxx 600 banks index (for European banks) or Topix banks index (for Japanese banks).

by poor earnings results from some banks. A further cyclical challenge to bank profitability comes as more central banks push rates into negative territory, notwithstanding the macroeconomic benefits of increased monetary easing, discussed below (Figure 1.20, panel 3, and Box 1.3).

**Long-Standing Legacy Issues and New Policy Challenges**

*Japanese banks*

In response to the decline in bond yields since the introduction of quantitative and qualitative easing, major banks have reduced their holdings of

yen-denominated bonds by about 25 percent, and sought to bolster profitability by increasing their foreign income through a mix of acquisitions, direct lending, and securities purchases. This trend is likely to accelerate under negative rates, but could raise concerns about increased credit risks, especially given the weak global outlook.

The Bank of Japan's introduction of a negative interest rate on marginal bank reserve balances is important for sustaining price stability and growth.<sup>25</sup> A side effect, however, could be additional downward pressure on the profitability of Japanese banks, which is already low relative to global peers (Table 1.3). Since the adoption of negative rates, Japanese banks' equity prices have fallen substantially, reflecting market fears about their impact on bank profitability (Figure 1.20, panel 3). In addition, yields on Japanese government bonds have fallen sharply, with yields now negative for tenors out to 10 years. This broader compression of interest income could have significant impact on regional and *shinkin* (regional cooperative) banks, which have less business model flexibility and hence remain more reliant on domestic interest income.

### U.S. banks

U.S. banks face rising risks from the weakening baseline outlook. The postcrisis repair and regulatory cycle was quicker in the United States than in Europe, and banks are more profitable and have low levels of nonperforming assets. The slowdown in emerging market economies is likely to have a limited impact on banks—data from the Federal Financial Institutions Examination Council show that loans to emerging market economies constitute only 5.4 percent of the loan exposure of the largest U.S. banks (Federal Financial Institutions Examination Council 2015). Assuming an average recovery rate of 60 percent, emerging market economy loans would need to suffer a 33 percent default rate to wipe out U.S. banks' loan loss provisions.

U.S. banks have limited direct exposure to energy-related credits, with little evidence so far of a strong uptick in delinquencies even as the cycle slows. According to dis-

closures in fourth quarter financial statements, the “Big 6” banks<sup>26</sup> have about \$200 billion in lending commitments to energy firms, of which only up to one-half is currently funded. The majority of the lending has been to investment-grade borrowers, many of the loans are secured by collateral, and banks have increased provisioning. Smaller regional banks with operations in oil-producing states have larger exposures and lower loan-loss provisions, and their indirect exposures could rise if energy prices remain low. However, even these higher exposures are seen as manageable. Although Federal Reserve data do not break down the performance of commercial and industrial loan by industry group, there has been little evidence to date of increased distress in commercial and industrial loans as a whole. Delinquency and nonaccrual rates remain near cycle lows for bank holding companies with assets in excess of \$10 billion. While defaults are expected to rise in high-yield energy bonds, market prices reflect this rise and bank exposures are limited.

### European banks

European bank equity prices declined along with global bank equities, pushing valuations to a record discount to U.S. banks (Figure 1.20, panel 4). The hardest hit banking systems within the euro area in February have been those of Greece, Italy, and to a lesser extent, Portugal, along with some large German banks, reflecting some or all of the following factors: structural problems of excess bank capacity, high levels of NPLs, and poorly adapted business models:

- *Legacy issues.* Weak euro area bank profitability increases the difficulty of dealing with NPLs by reducing banks' capacity to build capital buffers through retained earnings. For many banking systems, elevated NPLs comprise a major structural weakness. Euro area banks still have €900 billion in NPLs (as of end-June 2015). Figure 1.21, panel 1, and Table 1.3 show that banking systems with higher NPLs have generally seen a greater decline in equity prices, especially in Greece and Italy.
- *Business model challenges.* Difficulties in business model transitions and legal costs have led to extraordinarily weak earnings results at several large European banks, while market turbulence has also affected other revenue streams, especially trading revenues and even wealth management. The return on assets for Euro-

<sup>25</sup>The Bank of Japan has also adopted a three-tier system in which a positive interest rate or a zero interest rate will be applied to current account balances up to certain thresholds in order to make sure that financial institutions' functions as financial intermediaries would not be impaired due to undue decreases in financial institutions' earnings.

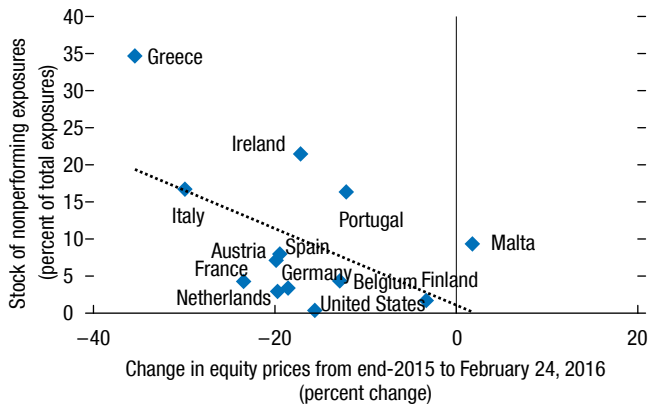
<sup>26</sup>JPMorgan, Citigroup, Wells Fargo, Bank of America Merrill Lynch, Goldman Sachs, and Morgan Stanley.



**Figure 1.21. Valuations Reflect Legacy and Business Model Challenges**

Euro area banks with high stocks of nonperforming loans ...

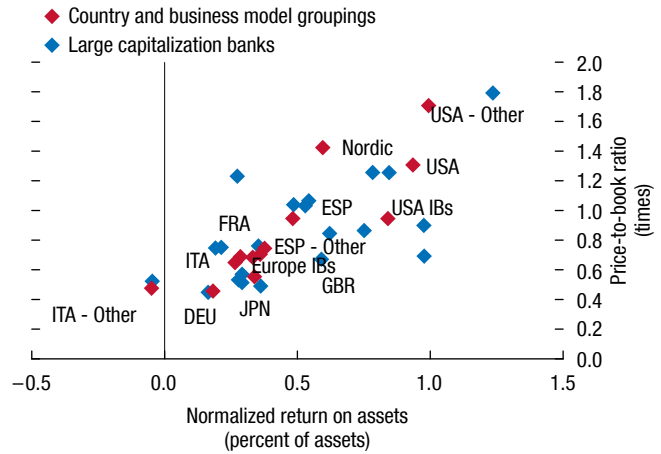
**1. Change in Bank Equity Prices and Stock of Impaired Assets, Year to Date**



Sources: Bloomberg, L.P.; European Banking Authority Transparency Exercise 2015; and IMF staff calculations.  
 Note: Nonperforming exposures as of end-June 2015 for European banks; U.S. data are latest available ratio of nonperforming assets to total assets.

... and low profitability were hit the hardest.

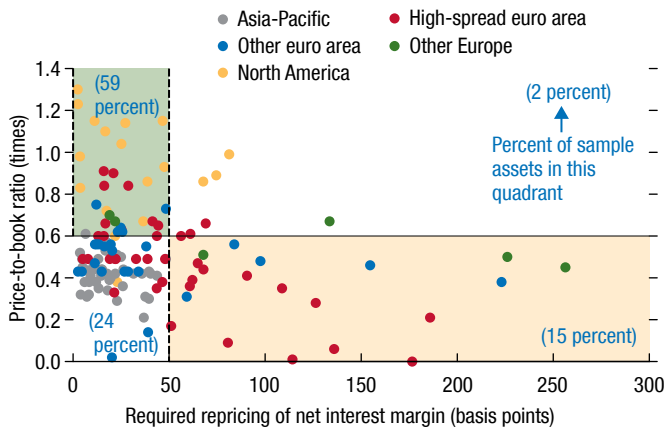
**2. Advanced Economy Bank Profitability and Valuations**



Sources: Bloomberg, L.P.; and IMF staff calculations.  
 Note: Data labels in the figure use International Organization for Standardization country codes. IB = investment bank; Other = listed banks with under \$500 billion in assets.

Business models are under strain in a low-for-long environment ...

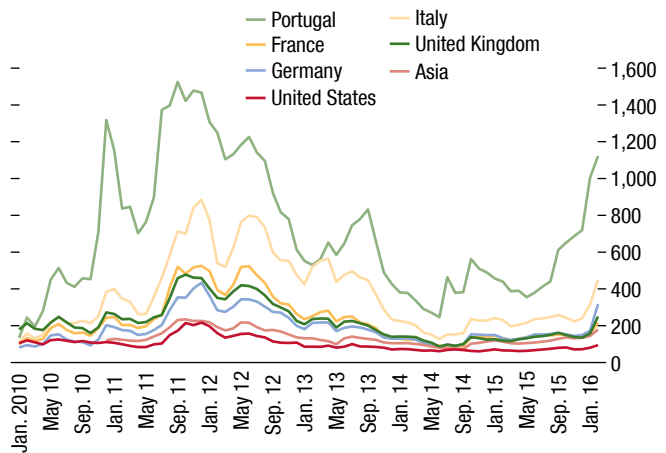
**3. Bank Valuations and Margin Increase Required to Reach 10 Percent Return on Equity**



Sources: Bloomberg, L.P.; SNL Financial; and IMF staff calculations.  
 Note: Banks with required net interest margin repricing of zero are omitted from the chart for clarity. Repricing needs are based on 2015:Q3 or latest available data on a sample of more than 300 advanced economy banks. High-spread euro area countries = Cyprus, Greece, Ireland, Italy, Portugal, Slovenia, and Spain. Other euro area = Austria, Belgium, Finland, France, Germany, Luxembourg, Malta, Netherlands, and Slovak Republic. Other Europe = Denmark, Sweden, Switzerland, and United Kingdom. Asia Pacific = Australia, Japan, and Singapore. North America = Canada and United States.

... and funding costs rose sharply in reaction to earnings and bail-out concerns.

**4. Credit Default Swap Spreads for Subordinated Bank Debt (Basis points)**



Sources: Bloomberg, L.P.; and IMF staff calculations.  
 Note: Data depict asset-weighted averages.

Table 1.3. Selected Indicators of Advanced Economy Banks

	Profitability					Capital					Market Pricing <sup>1</sup>			
	Pre-Provision Profit/Tangible Assets <sup>2</sup> (%)	ROE <sup>3</sup> (%)	ROA <sup>3</sup> (%)	NIM (%)	Cost/Revenue (x)	Equity/Assets <sup>4</sup> (%)	CET1/RWA (%)	Texas Ratio <sup>5</sup> (%)	NPL Ratio <sup>6</sup> (%)	RWA/Assets <sup>2</sup> (x)	P/TB Ratio <sup>7</sup> (x)	Equity Chg. YTD (%)	Senior CDS Spread (bps)	Sub CDS Spread (bps)
<b>United States</b>	1.30	9.5	0.93	2.41	0.58	6.6	11.7	5.1	0.7	0.59	1.21	-20		
U.S. Investment Banks	0.95	8.6	0.84	2.01	0.58	5.9	12.3	4.2	0.7	0.49	0.88	-23		
Other U.S. Banks <sup>8</sup>	1.63	9.5	0.99	2.98	0.59	8.2	10.6	5.7	0.7	0.81	1.51	-16		
<i>Goldman Sachs</i>	0.52	11.2	0.98	0.43	0.57	4.6	11.7	n/a	n/a	0.37	0.86	-20	135	...
<i>Morgan Stanley</i>	0.64	7.4	0.62	0.40	0.65	4.8	15.5	n/a	n/a	0.35	0.78	-26	133	...
<i>JPMorgan Chase</i>	0.99	9.6	0.85	2.08	0.58	5.4	11.8	3.8	0.8	0.46	1.19	-16	84	...
<i>Bank of America</i>	0.90	7.0	0.75	2.39	0.61	6.0	10.2	5.7	1.0	0.60	0.79	-29	121	...
<i>Citigroup</i>	1.30	8.6	0.98	2.99	0.50	7.9	14.6	2.8	0.8	0.54	0.63	-27	121	...
<i>Wells Fargo</i>	2.04	12.8	1.24	2.97	0.56	7.7	11.4	8.4	1.2	0.70	1.72	-13	67	...
<b>United Kingdom</b>	0.40	5.6	0.35	1.93	0.66	5.7	12.6	18.3	2.8	0.37	0.72	-23		
<i>HSBC</i>	0.80	7.9	0.59	1.55	0.51	6.9	11.9	13.7	2.5	0.46	0.73	-19	128	251
<i>RBS</i>	-0.39	5.0	0.29	1.61	0.97	5.8	15.5	22.5	3.9	0.30	0.58	-23	136	280
<i>Lloyds</i>	0.25	3.2	0.16	1.59	0.52	4.7	12.8	23.7	2.1	0.28	1.19	-15	106	233
<i>Barclays PLC</i>	0.39	6.9	0.31	2.90	0.82	4.2	11.4	15.3	1.9	0.32	0.57	-29	137	276
<i>Standard Chartered</i>	0.61	-0.7	-0.05	1.90	0.53	6.8	12.6	25.4	4.8	0.48	0.41	-31	219	446
<b>Core Euro Area</b>	0.44	6.5	0.28	1.51	0.55	3.8	12.0	34.0	4.3	0.29	0.61	-25		
Other Europe	0.43	7.4	0.42	1.66	0.60	5.4	14.4	15.8	2.2	0.33	0.87	-21		
Nordic Banks	0.77	12.2	0.60	1.13	0.34	4.7	18.3	16.9	1.6	0.23	1.38	-8		
European Investment Banks	0.07	6.8	0.32	1.91	0.80	4.1	13.9	11.2	1.5	0.29	0.62	-32		
<i>Deutsche Bank</i>	-0.32	4.4	0.17	1.69	0.89	3.2	13.2	14.1	1.9	0.25	0.39	-34	242	493
<i>Credit Agricole</i>	0.32	7.4	0.23	...	0.57	2.3	10.7	35.1	4.7	0.20	0.68	-18	115	234
<i>BNP Paribas</i>	0.67	8.4	0.35	1.47	0.43	3.8	11.0	40.8	5.6	0.32	0.66	-24	113	229
<i>Societe Generale</i>	0.66	6.7	0.29	...	0.66	4.0	10.9	34.8	5.6	0.27	0.45	-30	114	259
<i>UBS Group</i>	0.55	13.2	0.70	0.98	0.65	5.2	19.0	3.3	0.5	0.23	1.12	-25	88	188
<i>Credit Suisse Group</i>	-0.27	4.1	0.21	1.46	0.72	4.8	14.3	5.6	0.7	0.37	0.63	-41	154	244
<b>Italy</b>	1.09	5.8	0.39	1.57	0.57	6.0	11.8	58.7	11.2	0.48	0.55	-35		
<i>Unicredit</i>	1.04	6.3	0.36	1.50	0.62	5.2	10.7	58.3	10.8	0.46	0.46	-36	227	441
<i>Intesa</i>	1.06	6.9	0.49	1.18	0.55	5.9	13.0	52.2	10.7	0.44	0.79	-27	163	339
Other Italian Banks <sup>8</sup>	1.17	4.1	0.35	2.11	0.54	7.1	12.0	65.6	12.2	0.54	0.43	-43		
<b>Spain</b>	1.70	7.5	0.50	2.51	0.51	5.1	12.5	60.4	6.7	0.47	0.81	-25		
<i>Santander</i>	2.38	8.2	0.53	3.03	0.51	4.5	12.6	43.6	4.5	0.45	0.85	-25	174	363
<i>BBVA</i>	1.52	7.9	0.55	2.84	0.55	5.0	12.1	48.4	6.1	0.54	0.92	-22	172	360
Other Spanish Banks <sup>8</sup>	0.93	6.3	0.41	1.57	0.49	6.0	12.7	91.3	10.1	0.43	0.67	-26		
<b>Japan</b>	0.59	6.9	0.34	1.02	0.54	4.8	...	16.2	...	0.39	0.51	-32		
Mega Banks	0.62	7.3	0.34	0.96	0.54	4.5	...	11.8	...	0.37	0.51	-34		
Next Biggest 10 Banks	0.54	6.5	0.32	1.02	0.48	4.9	...	21.2	...	0.36	0.61	-27		
Other Japanese Banks	0.53	5.9	0.34	1.20	0.58	5.9	...	25.8	...	0.47	0.45	-29		

Sources: Bloomberg, L.P.; SNL Financial; and IMF staff calculations.

Note: Table is based on sample of 214 listed advanced economy banks. Yellow highlighting indicates a bank is at or below the 30th percentile in the table for a given indicator. Orange highlighting indicates a bank grouping is among the two weakest in the table. bps = basis points; CDS = credit default swap; CET1 = common equity tier 1; IFRS = International Financial Reporting Standards; NIM = net interest margin; NPL = nonperforming loan; ROA = return on assets; ROE = return on equity; P/TB = price-to-book ratio; RWA = risk-weighted assets; YTD = year to date.

<sup>1</sup>Market pricing based on data from February 24, 2016.

<sup>2</sup>Denominator is tangible assets including gross derivatives. Data is for 2015 except for several European banks where 2015 data was unavailable and 2014 data was used instead.

<sup>3</sup>Return on equity and assets are calculated using net income adjusted for extraordinary items.

<sup>4</sup>Tangible common equity/total tangible assets including gross derivatives.

<sup>5</sup>The Texas ratio is NPL/(Tangible Common Equity + Loan Loss Provisions).

<sup>6</sup>NPLs for Italian banks are loans classified "sofferenze," or nonaccrual loans according to IFRS.

<sup>7</sup>Price to tangible book value per share. Select banks from Denmark, Italy, Sweden, and the United Kingdom show price to book value per share.

<sup>8</sup>Other banks here include listed banks with assets below \$500 billion.

pean banks is structurally low at 0.25 to 0.50 percent, compared with about 1 percent at U.S. banks (Table 1.3); those banks with the lowest returns on assets also have a large discount to book value pointing to business model challenges (Figure 1.21, panel 2).

- *Regulatory challenges.* Banks face structural demands for more capital as a result of ongoing regulatory actions, but some may have difficulties meeting these requirements. Under the Basel III timetable, banks will be subject to simple leverage ratio requirements starting 2018. Many European banks will also need to raise bail-inable liabilities for higher regulatory requirements to meet total loss-absorbing capacity (TLAC) and minimum requirements for own funds and eligible liabilities (MREL). In general, European investment banks have higher leverage and more compressed risk weightings on assets than their U.S. counterparts, suggesting they must travel a more challenging adjustment path (Table 1.3).

Taken together, a large share of European banks (by assets) face a combination of the above challenges. Figure 1.21, panel 3, measures the increase in net interest margins each bank requires to reach a return on equity of 10 percent.<sup>27</sup> Roughly one-third of listed European banks (by assets) are in the bottom right quadrant, which suggests significant challenges to attaining sustainable profitability without reform (that is, require margin repricing of greater than 50 basis points). Deteriorating profitability and unresolved legacy challenges raise the risk that external capital and funding could become more expensive, particularly for weaker banks with very low equity valuations (price-to-tangible-book valuations of less than 60 percent), pointing to weak future prospects. Italian banks face a particular challenge in this regard, as market pricing has reflected investor concerns that some banks may face difficulties in growing out of their substantial NPL overhang, despite constructive steps taken by Italian authorities to facilitate balance sheet repair.

One manifestation of this challenge is the sharp repricing in January and February in the market for

subordinated and convertible debt-equity hybrid securities—on which some European banks have relied heavily. Banks and their investors now face a tighter bank resolution regime with bail-ins, and the surge in the cost of protection for junior debt holders (via subordinated credit default swaps) early this year suggests that there was indeed a higher perception of risk (see Figure 1.21, panel 4). The bail-in of the subordinated debt of four small Italian banks late last year raised concerns among investors, and the treatment of select senior debt holders of Novo Banco (Portugal) has led to a perception of uneven handedness and increased uncertainty that has dented confidence.

### Systemic Risk Is Contained but Could Reemerge

In February, market indicators in some high-spread countries in Europe indicated a greater likelihood of the reemergence of systemic risk from the confluence of high unresolved NPLs and funding strains, as the possibility of bail-in was fully internalized by liability holders. A widening in the spreads of the liabilities of high-spread banks in particular could unwind some of the progress in reducing fragmentation. There were also tentative signs of spillovers to some sovereigns. However, the feedback effect to market-implied sovereign risk was much weaker than during the sovereign debt crisis in 2012.

The expansion of European Central Bank quantitative easing and other powerful credit and funding easing measures announced in March will help address and contain systemic concerns, but it is not a full solution. The measures announced will help stimulate growth through credit easing and will support achieving inflation targets. At the same time, it provides banking system funding through refinancing. It also mitigates the impact of net interest margin compression. This has supported a strong recovery in bank equities and funding markets from their mid-February lows. However, while these actions bolster growth momentum and reduce the likelihood of near-term systemic stress, they do not (and were not intended to) address the legacy issues that are weighing on euro area banks.

### Raising the Urgency of Strengthening the Banking Sector in Japan and the Euro Area

Policies are urgently needed to address long-standing structural issues, otherwise systemic issues can reemerge and monetary transmission will remain impaired.

<sup>27</sup>See Chapter 1 of the October 2014 GFSR for methodology; each bank is assumed to increase (or shrink) lending until hitting target capital and leverage ratio constraints; the required repricing from that point shows the extent to which net interest margins would need to increase to bring net income to 10 percent of capital. While this exercise results in a measure of profitability adjusted for capital strength, it does not attempt to differentiate between cyclical or structural factors, nor does it explicitly account for potential changes in non-interest income and expenses.

In Japan, the large global banks are well-capitalized and meet Basel III capital and liquidity requirements, but implementing TLAC could be challenging amid low profitability. Supervisors should review profitability stresses on these banks as well as risks arising from overseas commitments. Profitability strains for regional banks may be more acute and should be carefully monitored. Consideration should also be given to formalizing and improving the effectiveness of the macroprudential framework.

Renewed market turmoil indicates the need for a more complete solution to euro area bank legacy problems:

- *Elevated NPLs* urgently need to be tackled, using a comprehensive strategy combining assertive supervision, reforms to insolvency regimes, and developing distressed debt markets, including through asset management companies.
- *Excess capacity* in the European banking system will have to be steadily addressed over time. In many countries, a consolidation and downsizing of the system might be required so that the remaining banks can enjoy pricing power and sufficient demand to increase the system's capital generation capacity of the system.
- The Bank Recovery and Resolution Directive (BRRD) is an important step forward in strengthening the *resolution regime* and better aligning incentives for banks and investors with the risks they are taking, but challenges may arise in utilizing the new framework in a transition period (Box 1.4). With large legacy stocks of NPLs and weak profitability across a number of banks, issuing adequate loss-absorbing capacity (TLAC- and MREL-eligible instruments) will take time and may prove difficult for some banks. The European Union State Aid rules (which place constraints on the use of public funds in bank restructurings) and the BRRD are important checks on market distortions and moral hazard, but they should be implemented carefully, as public support may still be needed in a crisis. In such a situation existing options under the BRRD could be considered, such as excluding some creditors from bail-in if there are financial stability risks; but this may be difficult while still achieving the required bail-in and ensuring other creditors are not worse off than in liquidation. An assessment of the degree of flexibility afforded under the BRRD should be undertaken as part of the next review of imple-

mentation of the Directive, expected by June 2018. Consideration should also be given to reducing the thresholds for “direct recapitalization” of European banks by the European Stability Mechanism (which go beyond the 8 percent bail-in requirement).

Addressing legacy issues and strengthening the banking system will enhance the transmission of monetary policy through the banking system, increase confidence, and mitigate any adverse side effects of, and the need for, more negative rates.

### U.S. Reforms

In the United States, reform of the government-sponsored enterprises (GSEs) remains the largest piece of unfinished business in the U.S. mortgage market reform initiated after the financial crisis. U.S. mortgage markets were at the center of the crisis, and the mortgage market, at \$10 trillion, remains globally systemic. The government maintains a strong role in mortgage guarantees (80 percent of originated single family loans; IMF 2015a), and the Federal Housing Administration insures a significant portion, creating distortions and moral hazard concerns. Continued reform of the GSEs is needed, and the path to their exit from conservatorship is uncertain.

The IMF Financial Sector Assessment Program for the United States in 2010 and in 2015 called for reforms of the U.S. mortgage system, including a rebalancing of the public and private roles in the market (IMF 2010, 2015a). Without reforms, including winding down GSE portfolios, standardizing and modernizing data reporting, reducing the public backstop, and introducing appropriate supervision, the U.S. mortgage system remains unnecessarily risky and complex.

### Scenarios and Policies

*A broad-based policy response is needed to strengthen financial stability and growth, and lead the world to a successful normalization of economic and financial conditions. The stakes are high: First, rising risks of weakening growth and more instability must be avoided. Then, growth must be strengthened and financial stability improved beyond the baseline. An ambitious policy agenda is required, comprising a more balanced and*

*potent policy mix, including stronger financial reforms, with continuing monetary accommodation and measures to support growth. Increased confidence in the policy framework would help reduce vulnerabilities, remove policy uncertainties, and touch off a virtuous feedback loop between financial markets and the real economy. Under such a scenario, world output could be 1.7 percent above the baseline by 2018, while reflation would accelerate smooth normalization of monetary policy and financial market conditions.*

### **Ambitious Policy Action Is Needed to Reduce Downside Risks and Boost Global Financial Stability and Growth**

The policy framework for global financial stability outlined in this report calls for the following key elements:

- *Addressing legacy issues in advanced economies.* Global banks came under renewed stress at the start of the year, bringing to the fore structural challenges in adapting business models and long-standing legacy issues in the euro area. This new stress is a sign that a more complete solution to European banks' problems cannot be further postponed. Elevated NPLs urgently need to be tackled using a comprehensive strategy, and excess capacity in the European banking system will have to be addressed over time. Mortgage markets in the United States—which were at the epicenter of the 2008–09 crisis—continue to benefit from significant government support. Authorities should reinvigorate efforts to reduce the dominance of Fannie Mae and Freddie Mac in the U.S. mortgage market and continue with reforms of these institutions (IMF 2010, 2015a).
- *Strengthening the resilience of emerging market economies.* Emerging market economies are adjusting to the reversal of a number of booms experienced during the past decade. Rapid credit growth and surging commodity prices helped boost capital expenditure, capital inflows, and currencies. Countries should use their buffers and policy space and strengthen policy frameworks to smooth adjustments and ensure the strength of sovereign and banking balance sheets while making the transition to a post-commodity boom world, including by rebalancing financing flows that have been heavily skewed toward commodity sectors.
- *Achieving successful financial and economic rebalancing in China.* Commitment to a more ambitious

and broader policy agenda is urgently needed, including (1) a comprehensive plan to address the corporate debt overhang, including through the development of a sound legal and institutional framework for debt-workout processes; (2) the strengthening of bank balance sheets and a restructuring program to deal with bad assets and recapitalize banks; and (3) an upgraded supervisory framework to meet the needs of an increasingly complex financial system.

- *Enhancing the resilience of market liquidity.* As discussed in previous GFSRs, a comprehensive approach to reducing risks of liquidity runs on mutual funds, and strengthening the provision of market liquidity services is needed to prevent market shocks from being amplified.

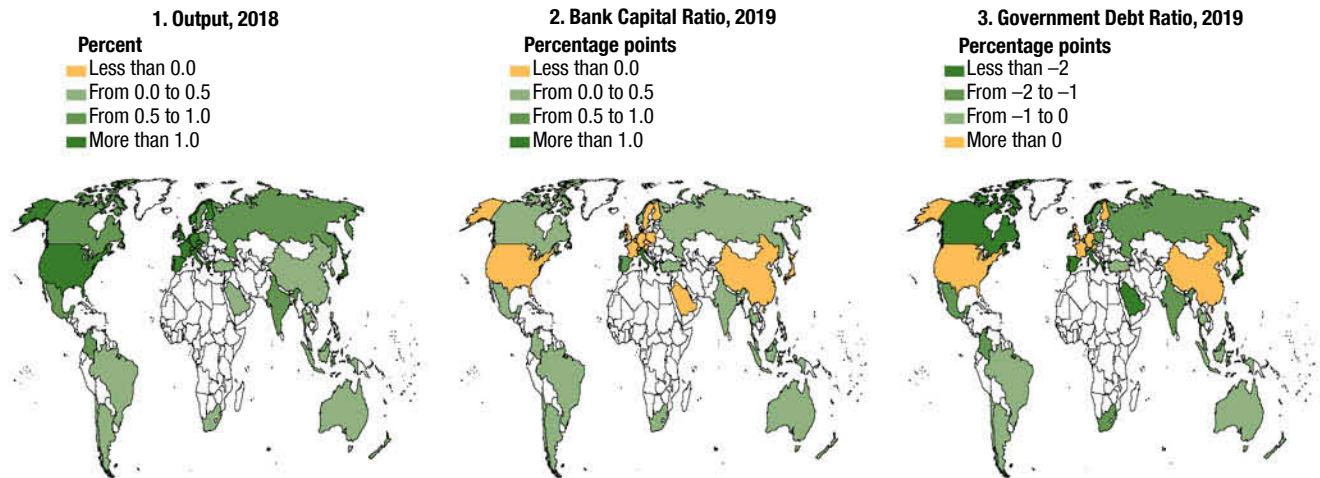
These policy actions will strengthen the resilience of the global financial system and enhance confidence in financial policy frameworks. Some of these reforms will be contractionary in the short term, at a time when monetary policy is at or near the effective zero bound. Therefore, as called for in the WEO, supportive fiscal policies, including structural fiscal reforms, effective debt-management strategies, and active fiscal-risk-management strategies (see also the April 2016 *Fiscal Monitor*, Chapter 1), will be needed alongside continuing monetary accommodation where required to avoid the downside and to boost growth beyond the baseline in the medium term.

### **The Successful Normalization**

The successful normalization would be powered by balance sheet repair, increased confidence in economic risk taking, much reduced risks emanating from global financial markets, and demand support from monetary and fiscal policies. What does the successful normalization scenario look like in the global macrofinancial model used to evaluate its impact?

- *Economic risk taking in the systemic advanced economies rebounds,* supported by balance sheet repair and fiscal stimulus. Private investment increases by 4 percent while private consumption rises by 1 percent in all of the systemic advanced economies over two years.
- *The vitality of the corporate and banking systems rises in the euro area.* Credit cycle upturns follow nonfinancial corporate debt-restructuring initiatives, with the

Figure 1.22. Simulated Peak Effects under Successful Normalization Scenario



Source: IMF staff calculations.

default rate on bank loans to nonfinancial corporations falling by 2 percentage points over two years.

- *Smooth rebalancing in China is supported by fiscal stimulus.* The default rate on bank loans rises gradually, with an orderly deleveraging and a rebalancing of private demand from investment to consumption.
- *Bank capitalization and government debt sustainability changes.* Bank capital ratios rise by 1 to 1.3 percentage points across high-spread euro area countries by 2019, largely reflecting lower credit loss rates. There is a moderate deterioration in bank capital ratios in China given the realization of defaults on nonfinancial corporate loans, and minor changes in the rest of the world. For government debt sustainability, there are mild deteriorations in the systemic economies given the assumed fiscal stimulus measures,

versus mild to moderate improvements in the rest of the world due in part to positive spillovers from the systemic advanced economies.

- *World output increases* by 1.7 percent above the baseline by 2018, while energy and non-energy commodity prices rise by 13.6 and 6.8 percent, respectively (see Figure 1.22).
- *Reflation accelerates smooth normalization of monetary policy.* Reflation toward price stability objectives is accompanied by gradual upward shifts of yield curves, with the long-term government bond yield rising by 50 basis points in all of the systemic advanced economies over two years. Stock prices also increase gradually and moderately, with the real equity price rising by 10 percent in all of the systemic advanced economies over two years.

### Box 1.1. Developments in Financial Conditions

The *Global Financial Stability Report* relies on a range of indicators to assess financial conditions and the availability and cost of credit across economies. The overall assessment is that financial conditions have become less accommodative since last October, following adverse developments in January and February that pushed credit spreads and volatility up, and equity prices and issuance down. The recent recovery in asset prices has unwound much of this tightening in financial markets, but so far the net impact has not been sufficient to offset earlier tightening.

The report relies on a variety of indicators for overall financial conditions. The monetary and financial conditions indicator of the Global Financial Stability Map is designed to capture movements in monetary conditions across mature markets. It includes different sub-indicators such as the cost of central bank liquidity—measured as the average level of real short rates—or the amount of excess liquidity—defined as the difference between broad money growth and estimates for money demand. Realizing that the transmission of monetary policy to the overall economy is tightly intertwined with conditions in financial markets, this indicator also incorporates movements in exchange rates, interest rates, credit spreads, and asset market returns to arrive at a summary indicator of global conditions.

For the United States, the chapter relies on additional indicators based on the methodology developed in Swiston (2008). This indicator includes a broad range of variables covering major financial markets in the United States—such as money markets, and investment grade and high-yield bond markets—as well as a measure of credit availability from the Federal Reserve’s Senior Loan Officer’s Opinion Survey on Lending Standards (Figure 1.1.1, panel 1). The index also allows for a disaggregated assessment of the relative contribution of each variable to the overall index (Figure 1.1.1, panel 2).

Financial Conditions Indices from Bloomberg track the overall level of financial stress in money, bond, and equity markets (Figure 1.1.1, panel 3). The indicators measure the number of standard deviations by which current financial conditions deviate from normal (precrisis) levels. A positive value of the index indicates accommodative financial conditions, while a negative value indicates tighter financial conditions relative to precrisis norms.

While there is no single preferred indicator summarizing the overall situation in financial markets, taken together these measures provide a broad-based assess-

The authors of this box are Juan Sole and Martin Edmonds.

ment of whether monetary and financial conditions are becoming tighter or looser.

So what are these different indicators telling us about financial conditions?

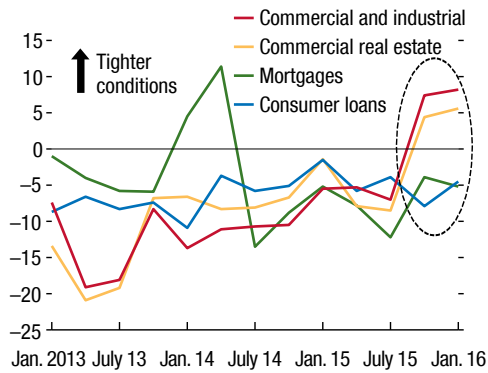
- The global indicators in the Global Financial Stability Map suggest an overall tightening of monetary and financial conditions since the last report. This is largely the result of tighter lending standards in the United States, and a lesser degree of easing in lending standards in Japan. In the United States, banks have progressively tightened lending standards across a range of loan types, but especially in “commercial and industrial” and “commercial real estate” loans (Figure 1.1.1, panel 1). This tightening in lending conditions may reflect some rising corporate credit risks and deterioration in energy-related exposures. A contraction in these two categories is telling: they account for more than 40 percent of total U.S. bank loans, and developments in the commercial real estate sector are seen as a leading indicator of economic activity.
- Developments in lending standards have resulted in a modest tightening of the (Swiston 2008) financial conditions index for the United States since mid-2014, but still leaving overall conditions accommodative as measured by this indicator (Figure 1.1.1, panel 2).
- An alternative gauge of financial conditions is provided by Bloomberg’s high-frequency index of market indicators. Although more volatile, this index also shows tightening conditions since June 2014. In the past month, however, the index has largely reversed the tightening seen in December to February (Figure 1.1.1, panel 3).
- Given the importance of U.S. dollar funding conditions for global markets, tighter conditions in the United States can have wide-ranging implications for global markets. Moreover, since the impact of changes in financial variables lasts for a few quarters in the Swiston (2008) financial conditions index, the historically high spreads for high-yield bonds seen in January and February may weigh on this measure of financial conditions going forward, even though spreads have fallen sharply since reaching historically high levels in mid-February. Equity market performance, which was the largest individual contributor to easy financial conditions in this index over the past several quarters, will also bear down on financial conditions given the recent equity market correction that has only recently been unwound.

Box 1.1. (continued)

Figure 1.1.1. Financial Conditions

Lending standards have been tightening across the board since mid-2015.

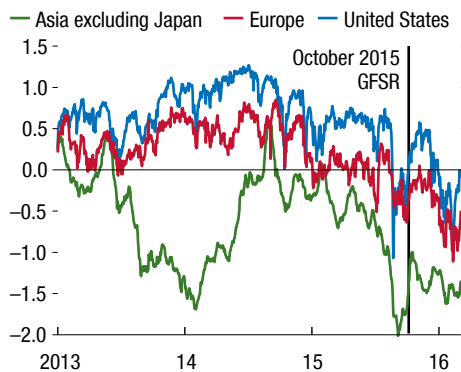
1. Senior Loan Officer Opinion Survey: Tightening Bank Lending Standards (Net percent of respondents)



Sources: Federal Reserve; and Haver Analytics.

Financial conditions in Europe and Asia have also tightened ...

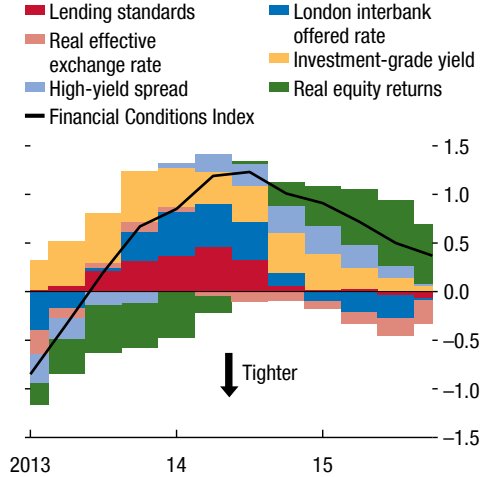
3. Financial Conditions Indices



Source: Bloomberg, L.P.  
Note: GFSR = Global Financial Stability Report.

The U.S. financial conditions index progressively tightened since mid-2014.

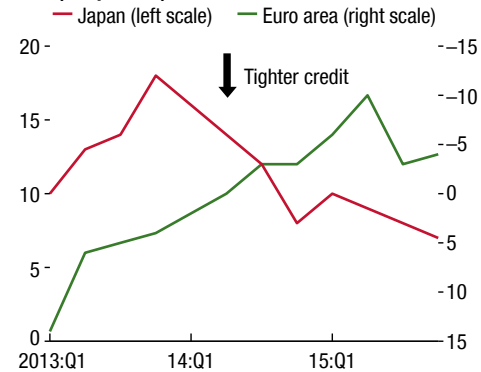
2. U.S. Financial Conditions Index and Component Contributions (Change in percentage points of year-over-year real GDP growth)



Sources: Bank of America Merrill Lynch; Bloomberg, L.P.; Haver Analytics; and IMF staff calculations.

... even as Japanese banks tightened credit standards.

4. Central Bank Credit Standards Surveys (Net percent)



Sources: Bank of Japan; European Central Bank; and Haver Analytics.

- The tightening of overall financial conditions in the United States has been exacerbated by oil sector stress and rising liquidity premiums, and has added to the impact of the first increase in policy rates in over nine years. The latest data on lending standards in the euro area and Japan suggest a lesser degree of easing in bank

lending standards in Japan, but modestly accommodative in euro area lending to enterprises (Figure 1.1.1, panel 4). It remains to be seen whether the market turmoil and subsequent recovery in market prices will translate into tighter lending standards for bank loans going forward, or were just a temporary setback.



### Box 1.2. Brazil: Financial System Risks

*Vulnerabilities threaten to worsen amid the prolonged domestic recession, weak commodity prices, and tightening market conditions. The health of Brazilian nonfinancial corporations has deteriorated across various measures, as signs of strain begin to appear in the country's relatively healthy banking system.*

Brazilian nonfinancial firms have accumulated vulnerabilities in recent years. Corporate leverage across Latin America has increased during the past five years as in other emerging market economies. Regionally, however, Brazilian firms stand out for their higher leverage and higher interest costs; the decline in their profitability has been more pronounced as well, especially among weaker firms (Figure 1.2.1).

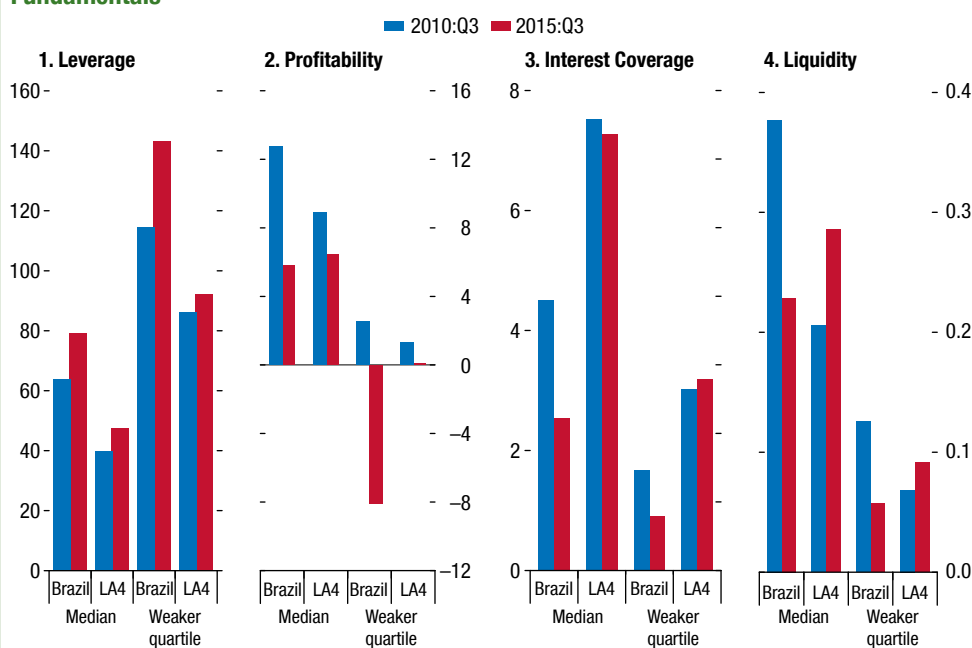
The banking system's soundness indicators appear healthy. Credit growth has decelerated from high rates in the period from 2010 to 2014 to 6.6 percent year over year in 2015, reflecting both supply and demand factors. Bank profitability indicators are still relatively

high despite higher funding costs and higher provisions for loan losses. Capital ratios remain well above the regulatory minimum in 2015. Banks are also well provisioned (150 percent of nonperforming loans [NPLs]), and liquidity risk for the system as a whole appears to be low. Banks continue to rely mainly on domestic funding sources, with the ratio of foreign funding to total funding at about 10 percent.

However, a protracted slump together with higher interest rates, rising unemployment, and falling corporate profits will likely put strains on banks' balance sheets (Figure 1.2.2). Although the overall NPL ratio remains low at about 3.5 percent, an uptick in NPLs has been recorded in some segments of nonfarm consumer and corporate loans, such as agriculture loans, overdraft loans, and credit cards. There are also nascent signs of broader asset quality issues, particularly in the corporate sector, including a notable increase in firm bankruptcy protection applications alongside a general spike in the unemployment rate. Markets have been pricing assets accordingly, with higher financing costs and implied default rates for banks rising to their highest levels since the global financial crisis.

This box was prepared by Ivo Krznar, Fabiano Rodrigues Bastos, and Christian Saborowski.

**Figure 1.2.1. Brazil versus Chile, Colombia, Mexico, and Peru: Nonfinancial Corporate Fundamentals**

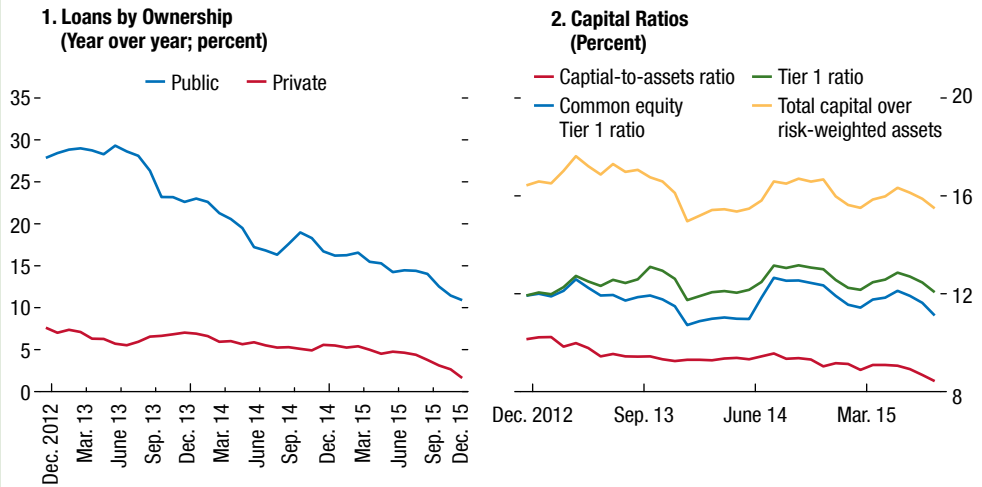


Sources: S&P Capital IQ; and IMF staff calculations.

Note: Approximately 800 firms for Brazil and 900 firms for LA4. Interest coverage = earnings before interest, taxes, depreciation, and amortization/total interest (ratio, four-quarter average); LA4 = Chile, Colombia, Mexico, and Peru; leverage = total debt to total equity (percent); liquidity = cash ratio (cash and equivalents over current liabilities, four-quarter average); profitability = return on equity (percent, four-quarter average).

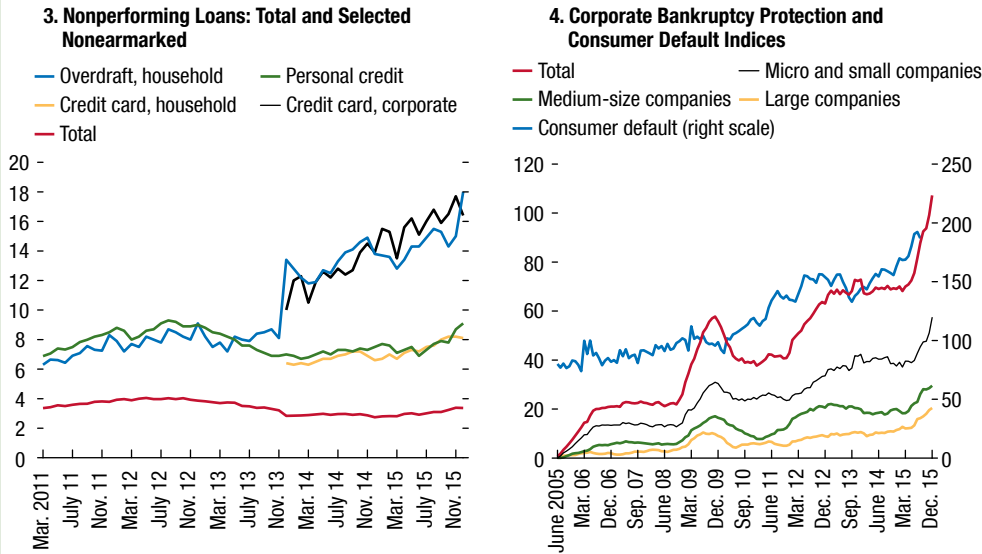
Box 1.2. (continued)

Figure 1.2.2. Performance of the Banking System in Brazil



Source: Banco Central do Brasil.

Source: Banco Central do Brasil.



Source: Banco Central do Brasil.

Source: Serasa.

### Box 1.3. Impact of Low and Negative Rates on Banks

#### *Impact of low and negative rates varies across banking systems*

Unconventional monetary policies, including quantitative easing and negative policy rates, continue to be crucial to address the weak macroeconomic environment. Banks are key beneficiaries of these policies overall, as improved price stability and growth lead to stronger borrower creditworthiness, a decline in nonperforming assets, reduced provisioning costs, capital gains on bond holdings, as well as declining wholesale funding costs.

Markets and policymakers have little historical basis for understanding the full benefits and costs that may arise over a prolonged period of low or of negative rates. The interests of banks and the broader economy may diverge in some respects. Credit easing, driven by low or negative rates, may lower costs to households and firms, support asset prices, and boost growth—good news for the real economy. But there may be some adverse side effects for banks. By driving down costs of borrowing for the real economy, unconventional monetary policy appears to compress banks' net interest margins, a key source of bank income. Negative interest rates may be unique in accelerating this margin compression over time, as banks have so far proven unwilling or are legally unable to pass on negative rates to retail depositors. As negative policy rates bring asset yields lower, *deposit* funding costs may get “stuck” at zero, squeezing the margin between the two.

The extent of the pressure on profitability is difficult to estimate, but certain types of banks will be more vulnerable than others. The impact will depend on banks' capacity to pass on costs through the repricing of loans and deposits and other liabilities, the relative importance of net interest income to profitability, and the ability to generate other income.

- *Liability repricing.* One key benefit of low rates for banks is the repricing of nondeposit liabilities—lowering the cost of funding. Repricing of wholesale funding provides a quick pass-through to banks, providing cost relief. Repricing of deposits is less straightforward. A zero lower bound on deposits will have the largest negative impact on those banks with the largest household and corporate deposit bases, as more of their funding base will get stuck at zero interest rates. It may also have more impact in countries with lower household and corporate time deposit

The authors of this box are Jennifer Elliott, Henry Hoyle, and Andreas Jobst.

interest rates, which implies the zero lower bound will become binding sooner. At the country level, there is widespread variation in both of these metrics, suggesting some banking systems may be more vulnerable than others (Figure 1.3.1, panel 1). Germany, Italy, Portugal, and Spain stand out as relatively more vulnerable than the euro area average on both these issues, whereas banks in France, the Netherlands, and even the United Kingdom may be better positioned in this regard. Nordic banks benefit from a uniquely low share of deposits in total liabilities, which may be one reason why banks there have not been acutely affected by negative interest rates so far.

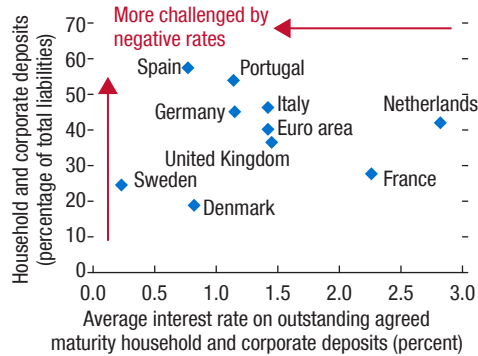
- *Asset repricing.* Profitability pressure from negative interest rates is likely to be more pronounced in countries where loan books reprice the quickest. For instance, the aggregate interest rate on bank loans in Italy, Portugal, and Spain exhibit elevated sensitivity to changes in the benchmark interbank rate (Figure 1.3.1, panel 2), suggesting asset yields will drop quickest in these markets, partially reflecting the high level of variable rate mortgages (Figure 1.3.1, panel 3), but also shorter loan maturities or high levels of competition between banks. By contrast, banks in Sweden and Switzerland have been able to maintain sufficient asset yields during periods of negative interest rates, protecting lending margins (Figure 1.3.1, panel 4). Corporate loan books generally reprice toward the interbank rate more quickly, reflecting heightened competition with capital market finance for larger corporations.
- *Net interest margin and profit profile.* Equal amounts of net interest margin compression may also have different effects on overall profitability given the wide variation in profit margins. Germany, Italy, and Japan may be relatively more sensitive to low or negative rates because of a weaker starting point for profitability. Figure 1.3.1, panel 5, shows the impact of a 10-basis-point decline in net interest margins on banks across the world. The decline in net interest income is roughly similar for most countries on a weighted average basis. However, the impact on overall pretax profits, shown in the blue bars, would be much higher for European banks, and to a lesser extent Japanese banks, as thin overall profit margins amplify the impact of lost net interest income.
- *Ability to generate other income.* Replacing income lost through shrinking margins will be challenging. Analysis suggests, for example, that euro area banks are unlikely to be able to generate the volumes of

Box 1.3. (continued)

**Figure 1.3.1. The Impact of “Low-for-Long” May Vary across Countries**

Continued low rates could bring pressure on other financial institutions ...

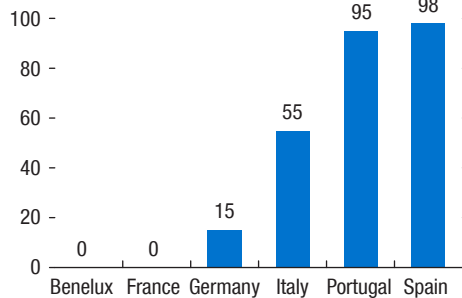
**1. Household and Corporate Deposits as a Share of Total Monetary Financial Institution Liabilities and Interest Rates on Outstanding Agreed Maturity Deposits, January 2016**



Sources: European Central Bank; Haver Analytics; and IMF staff calculations.

Banks with a large proportion of mortgages priced to reference rates cannot raise mortgage rates ...

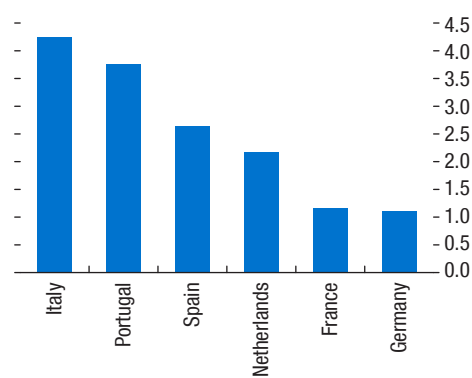
**3. Tracker Mortgage Loans (Percent of total mortgages)**



Source: Morgan Stanley.  
Note: Tracker mortgages are variable-rate mortgages following a reference rate. Benelux = Belgium, Netherlands, and Luxembourg.

... and some will have less ability to reprice loans to make up earnings.

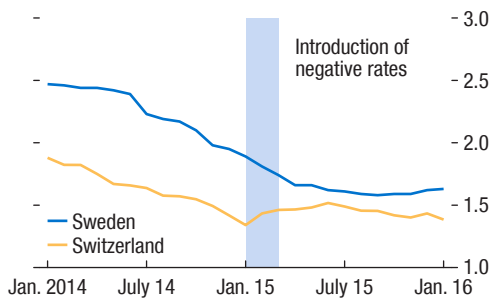
**2. Estimated Changes in Outstanding Loan Book Interest Rates for a 10-Basis-Point Change in the Interbank Rate, by Country (Basis points)**



Sources: Haver Analytics; and IMF staff calculations.

... but some banks have been better able to maintain asset yields and protect lending margins.

**4. Sweden and Switzerland: Bank Mortgage Rates (Percent)**



Source: Haver Analytics.  
Note: Introduction of negative rates and in Denmark denotes cut to certificate of deposit rate from -5 basis points to -50 basis points. Swiss data is a simple average of rates on new 1- to 10-year fixed rate mortgages, whereas Swedish data reflects the weighted average interest rate on new fixed rate mortgages of all tenors.

lending required to offset margin compression (see Figure 1.3.1, panel 6) in the context of the tepid pace of new credit creation in recent years and regulatory pressures to raise capital. There is room to boost fee and commission income. Large European banks only earn half to three-quarters of what their American peers do relative to their asset base. This

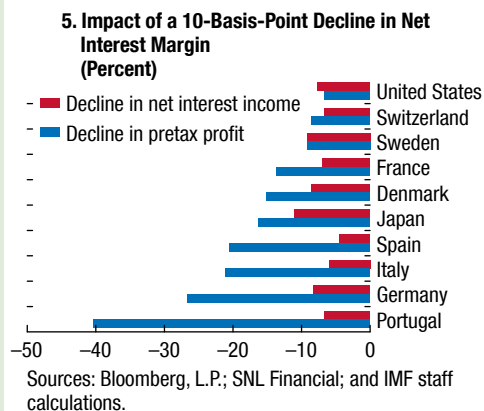
process will likely be slow, however, particularly in many euro area markets where competition dynamics limit banks' ability to charge fees.

Reflecting these concerns, and to mitigate costs while enhancing the benefits, the European Central Bank added a number of measures when it reduced

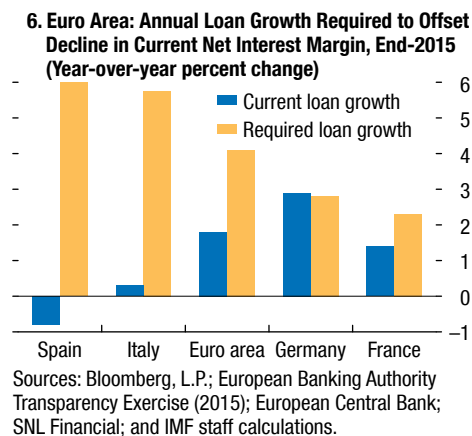
**Box 1.3. (continued)**

**Figure 1.3.1. (continued)**

Declining net interest margins will hit profits of European banks more strongly.



Substantial loan growth would be required to make up loss of net interest income.



rates further into negative territory in March. These included providing long-term funding to support credit easing at low costs, along with other measures. In Japan, the Bank of Japan announced a system of tiered reserves so only a limited portion of excess reserves would be at negative rates.

*Continued low rates could put pressure on other financial institutions*

The weakening of the baseline and implied market pricing of very low inflation suggests central banks will maintain and even deepen monetary support. Low and negative rates will, therefore, be a feature of the landscape, with a negative impact on return on savings. If prolonged, this could undermine the viability of life insurers, pensions, and savings vehicles. Low rates mean low returns, making it difficult for insurers to meet guaranteed returns, and with substantial duration mismatches this will eventually force losses on life insurance policyholders (see Chapter 3). According to the European Insurance and Occupational Pensions Authority (EIOPA), more than half of European life insurers are guaranteeing an investment return to policyholders that exceeds the yield on the local 10-year government bond, thereby incurring undesirable negative investment spreads (EIOPA 2013). Countries that

suffer both from large duration mismatches and from negative investment spreads are particularly vulnerable to a prolonged low interest rate environment. According to EIOPA, Germany and Sweden suffer from duration mismatches of more than 10 years and negative investment spreads. Even where these concerns are not present, profitability remains a significant challenge and could prompt excess risk-taking, including in portfolios and by taking on nontraditional activities. As described in the April 2015 *Global Financial Stability Report*, this excess risk taking already appears to be happening in the U.K. and U.S. markets.

Defined benefit pension plans, already challenged by the longevity of their beneficiaries, would be severely damaged in a sustained low interest rate environment. Recent EIOPA tests showed sizable shortfalls in plans in some European countries. A similar study in the United States also revealed serious underfunding (Pension Benefit Guaranty Corporation Data Book 2012). But in a stress scenario of continuing low rates in a recession, sponsors may become insolvent, in which case losses would be shared with pension recipients and other defined benefit schemes covered by insurance companies, further raising the need for precautionary savings by firms and households.

### Box 1.4. Euro Area Financial Architecture—Progress, but Gaps Remain

There has been substantial progress toward filling the gaps in the European Union's financial architecture. The successful completion of the first year of the Single Supervisory Mechanism, the transition to a fully operational Single Resolution Mechanism, and the full entry into force of the bail-in provisions of the European Commission's Bank Recovery and Resolution Directive are important milestones in the construction of the Banking Union. The European Commission has also issued an action plan for building a capital markets union.

The banking union architecture, however, remains incomplete without a common deposit insurance scheme. The European Commission's proposal for a common European Deposit Insurance Scheme will go a long way toward lowering the risk of deposit flight, help weaken the link between local sovereign and banking sector risks, and unify deposit insurance across banking union member states. Risk sharing through the common deposit insurance scheme should go hand in hand with other measures to reduce banking sector risks.

The new mandatory bail-in regime under the Bank Recovery and Resolution Directive could raise implementation challenges. Building sufficient institution-specific buffers will take time, and in the meantime the new legal framework limits the use of public funds without creditor bail-in at a time when

pockets of weakness are still to be found in banks. Moreover, national discretion remains in key areas that affect loss allocation, such as the hierarchy of creditors in insolvency, which could affect creditors differently across European Union countries.

A common fiscal backstop is missing from the Single Resolution Fund and the proposed common European Deposit Insurance Scheme. In the absence of such a backstop, there is a risk that in a crisis, national authorities themselves would have to support banks established in their jurisdictions, leading to the reemergence of the sovereign-bank risk nexus and financial fragmentation.

Whether the macroprudential framework will allow for strong action when risks rotate to nonbanks is not clear. Greater clarity on responsibilities for system-wide financial stability is needed. National frameworks to contain systemic risk are now largely in place, and a framework for cooperation through reciprocity across the union of national measures is being established. Furthermore, the European Central Bank has the mandate to top up some macroprudential measures taken by Single Supervisory Mechanism members, but these measures apply only to banks. At the euro area level, there is no truly effective coordinating framework for macroprudential policy relating to nonbank financial institutions. The European Systemic Risk Board—which has European Union-wide mandate—has only warning and recommendation powers to influence the approach to nonbank activities and institutions. Addressing this gap should be an important priority.

The authors of this box are Shekhar Aliyar, John Bluedorn, Michaela Erbenova, Marina Moretti, Aditya Narain, and Erlend Nier.

**Annex Table 1.1.1. Chinese Nonfinancial Firms in Sample: Companies, Borrowing, and Debt-at-Risk**

Industry	Number of Companies	Total Borrowing (US\$ millions)	Number of Companies at Risk	Debt-at-Risk (US\$ millions)	Debt-at-Risk over Total Borrowings (percent)
Information Technology	377	147,229	71	12,576	9
Retail and Wholesale	321	157,113	73	55,145	35
Manufacturing	1,231	501,659	240	88,525	18
Leasing/Commercial	43	5,342	6	142	3
Utilities	109	369,881	9	3,086	1
Steel	72	115,484	28	45,396	39
Construction Materials	43	59,841	9	11,625	19
Transportation	104	152,096	10	27,548	18
Mining	52	135,163	15	47,598	35
Energy	43	224,845	15	2,357	1
Real Estate	407	850,737	100	96,412	11
Others	69	55,558	14	1,642	3
Total	2,871	2,774,948	590	392,053	14

Sources: S&P Capital IQ; and IMF staff estimates.

Note: Debt-at-risk is defined as the debt of corporates with interest coverage ratio of below 1. Interest coverage ratio is EBITDA/interest expense of the corporate. EBITDA = earnings before interest, taxes, depreciation, and amortization.

### Annex 1.1. China: Corporate Loans Potentially at Risk

This report considers the potential for debt at risk in the corporate sector to result in bank losses. It uses a bottom-up approach to identify stress at the individual firm level to form an aggregate view of associated debt at risk.<sup>28</sup>

The approach begins by isolating a population of companies for which accounting information is available. Companies are drawn from the S&P Capital IQ database, covering the universe of all publicly listed companies. For China, the data set includes 2,871 companies, including 2,607 listed firms and 264 unlisted firms, which together

account for \$2,775 billion of total borrowing (see Annex Table 1.1.1).

A company is then defined as “at risk” if in 2015<sup>29</sup> it generated insufficient earnings before interest, taxes, depreciation, and amortization to cover its reported interest expense. Such firms have an interest coverage ratio (ICR) of < 1. The debt-at-risk ratio across a sample is therefore

$$\frac{\sum \text{Borrowings of companies with ICR} < 1}{\sum \text{Borrowings of all companies in the sample}}$$

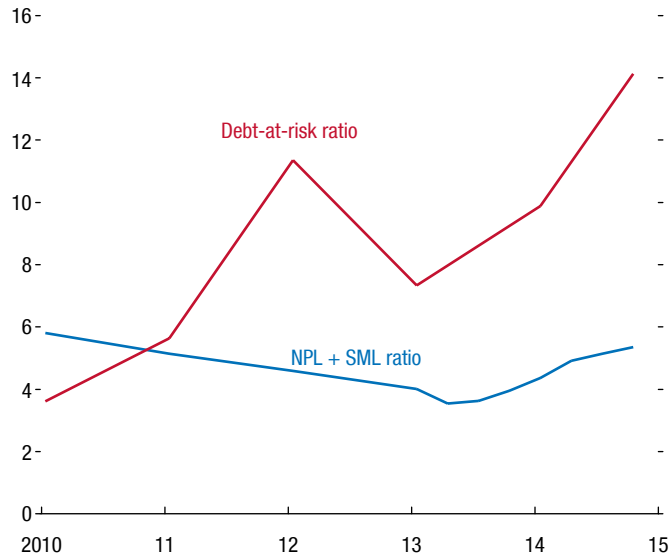
On this basis, the debt-at-risk ratio is computed for the listed universe sample, as shown in Annex Figure 1.1.1.

Judgment is required for setting the threshold conditions for identifying a borrower as being at risk. Some have argued that ICR < 1 is too narrow a standard and misses identifying companies that could fail to meet obligations if conditions deteriorate. The April 2014 GFSR uses a threshold of ICR < 2, and Chivakul and Lam (2015) use ICR < 1.5. Here, ICR < 1 is used for its explanatory simplicity, insofar as the inability to cover interest expense from operating cash flow indicates distress. But it is acknowledged that this approach is narrow and may understate debt at risk.

<sup>29</sup>All 2015 figures are for the latest 12 months available.

<sup>28</sup>A number of other approaches to estimating problem loans could be used. Top-down analyses (see, for example, Dell’Ariccia and others, 2012) examine the relationship between a country’s credit growth and subsequent nonperforming loans. In bottom-up analyses, credit stress in a lending portfolio is identified by tracking median leverage (either debt to equity or median debt to earnings before interest, taxes, depreciation, and amortization), or the population mean (or “weak tail”) typically defined as the weakest quintile or decile. However, in these latter approaches there is no definite relationship between leverage and borrower default, that is, no threshold criterion for default or trigger for nonpayment on obligations because appropriate levels of debt to equity and debt to earnings before interest, taxes, depreciation, and amortization differ across firms. Moreover, these approaches address system averages (even if the average is within deciles).

**Annex Figure 1.1.1. China: Reported NPL + SML Ratio, and Debt-at-Risk Ratio**



Sources: People’s Bank of China; S&P Capital IQ; and IMF staff estimates.  
 Note: 2015 debt-at-risk ratio is last 12 months. NPL = nonperforming loan; SML = special mention loan.

Conversely, insufficient cash generation during a single period may overstate risks since a single year of negative earnings before interest, taxes, depreciation, and amortization, for example, might simply indicate a cyclical problem, an investment loss, or some other singular issue. To address this concern, the consecutive periods over which a cash flow test is applied is varied, and the impact on identified borrowers at risk and credit is quantified. Annex Figure 1.1.2 shows the sensitivity of at-risk debt by varying both ICR and number of periods.

Industry-level debt-at-risk ratios from the listed universe are applied to the industry loan mix from the entire banking system. This step is performed primarily for completeness, specifically to forestall concerns about the listed companies’ industry mix being unrepresentative of the broader banking system even though the data do not make for a perfect one-to-one mapping.<sup>30</sup> This step assumes that the debt-at-risk ratio calculated for listed firms applies to all firms (listed and unlisted) in that sector. This procedure raises the overall average ratio of loans

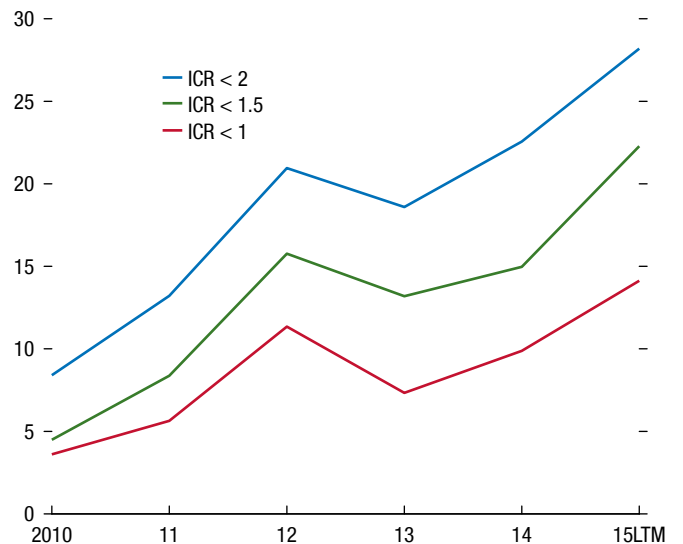
<sup>30</sup>There is not perfect matching across industries partly because the People’s Bank of China’s industry loan mix data on which the analysis relies are available only up to 2013, and also because the People’s Bank of China’s loan categories are somewhat broader and do not map perfectly to the industry categories used in this analysis.

**Annex Figure 1.1.2. Sensitivity of Variations in Interest Coverage Threshold**

**1. Sensitivity to Variation in Interest Coverage Threshold and Consecutive Periods of ICR Insufficiency**

Consecutive Periods	Interest Coverage Threshold			
	0.5	1.0	1.5	2.0
One Year	8.9	14.1	22.3	28.2
Two Years	4.8	8.6	14.4	21.4

**2. Debt-at-Risk History under Alternative Threshold Conditions (Percent of debt)**



Sources: S&P Capital IQ; and IMF staff estimates.  
 Note: ICR = interest coverage ratio; LTM = last 12 months.

potentially at risk from 14.1 percent across the listed universe to 15.5 percent across the RMB 52.6 trillion (\$8.1 trillion) of commercial banks’ total corporate loans. On this basis, total loans potentially at risk on commercial banks’ balance sheets at the end of 2015 are estimated to be RMB 8.2 trillion (\$1.3 trillion).

The estimates for bank loans potentially at risk to the corporate sector are partial in several respects. First, the analysis does not cover all bank lending because only bank loans to the corporate sector are considered, nor does the analysis cover the impact of corporate stress on nonbank lending. Lending by policy banks and lending by commercial banks to local government financing vehicles is not included, because policy banks are wholly government owned, while a large portion of the debt of local government financing vehicles are explicitly backed or guaranteed by the government. Furthermore,



it is assumed that the asset quality of both listed and nonlisted firms is equivalent, despite evidence of greater repayment stress for nonlisted firms (see footnote 11).

The base case assumes a loss of 60 percent on loans potentially at risk, leading to an estimated loss of \$756 billion (approximately 6.9 percent of GDP). A plus or minus 15 percentage point deviation from the assumed 60 percent loss rate changes losses by \$189 billion, in either direction. In addition, a number of bank exposures to the corporate sector were omitted from the estimates (Annex Figure 1.1.3):

- *Policy banks.* Applying the average ratio of loans potentially at risk to the \$1.6 trillion of corporate loans by policy banks and an estimated \$1.5 trillion of bank loans to local government financing vehicles boosts estimated losses on loans potentially at risk by about \$150 billion and \$144 billion, respectively.
- *Shadow products.* Applying the average ratio of loans potentially at risk from banks' corporate loan books to their shadow credit product exposures (trusts' beneficiary rights, directional asset management plans, and others) results in additional losses of \$98 billion.

### Annex 1.2. Successful Normalization and Global Market Disruption Scenarios<sup>31</sup>

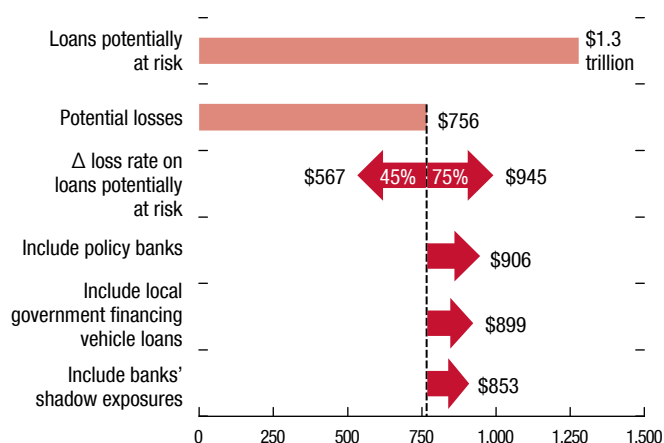
This annex provides further information on the successful normalization and global market disruption scenarios. These scenarios are simulated using the Global Macrofinancial Model, a structural macroeconomic model of the world economy, disaggregated into 40 national economies, documented in Vitek (2015). This estimated panel dynamic stochastic general equilibrium model features a range of nominal and real rigidities, extensive macrofinancial linkages with both bank- and capital market-based financial intermediation, and diverse spillover transmission channels.

#### The Successful Normalization Scenario

The successful normalization scenario features a rebound in economic risk taking and confidence in the systemic advanced economies supported by balance sheet repair and fiscal stimulus. It assumes confidence gains by nonfinancial firms and households, which reduce their saving rates and bring forward

<sup>31</sup>Annex 1.2 prepared by Francis Vitek.

**Annex Figure 1.1.3. Corporate Sector Loans Potentially at Risk**  
(Billions of U.S. dollars)



Sources: Bank financial statements; CEIC; People's Bank of China; S&P Capital IQ; and IMF staff estimates and analysis.

their expenditures. In particular, private investment increases by 4 percent while private consumption rises by 1 percent in all of the systemic advanced economies over two years. The reflation this generates accelerates smooth exits of monetary policy from the effective lower bound, inducing gradual policy interest rate increases in the United States immediately, and in the euro area, Japan, and the United Kingdom after one year. This asynchronous monetary normalization is accompanied by gradual upward shifts of yield curves, with the long-term government bond yield rising by 50 basis points in all of the systemic advanced economies, residually induced by term premium decompression. There are also gradual and moderate stock price increases, with the real equity price rising by 10 percent in all of the systemic advanced economies, residually driven by higher risk appetite. This rebound in economic and financial risk taking in the systemic advanced economies is supported by balance sheet repair in high-spread euro area economies, and by fiscal stimulus elsewhere. In high-spread euro area economies, credit cycle upturns follow nonfinancial corporate debt restructuring initiatives, with the default rate on bank loans to nonfinancial corporations falling by 2 percentage points. In the systemic advanced economies less the high-spread euro area economies, expenditure-based fiscal stimulus measures lower the primary fiscal balance ratio by 2 percentage points.

**Annex Table 1.2.1. Successful Normalization Scenario Assumptions**

<i>Layer 1: Rebound in Economic Risk Taking and Confidence in Systemic Advanced Economies, 2016:Q3–18:Q2</i>	
Private Investment, Investment Demand Shocks	+4 percent
Private Consumption, Consumption Demand Shocks	+1 percent
Long-Term Government Bond Yield, Duration Risk Premium Shocks	+50 basis points
Real Equity Price, Equity Risk Premium Shocks	+10 percent
Loan Default Rate, Loan Default Shocks	
High-Spread Euro Area	–2 percentage points
Primary Fiscal Balance Ratio, Fiscal Expenditure Shocks	
Low-Spread Euro Area, Japan, United Kingdom, United States	–2 percentage points
<i>Layer 2: Smooth Financial Liberalization and Orderly Deleveraging, 2016:Q3–18:Q2</i>	
Money Market Interest Rate Spread, Credit Risk Premium Shocks	+50 basis points
Real Equity Price, Equity Risk Premium Shocks	–10 percent
Primary Fiscal Balance Ratio, Fiscal Expenditure Shocks	–2 percentage points

Source: IMF staff.

Note: All scenario assumptions are expressed as deviations from the April 2016 *World Economic Outlook* baseline. All endogenous variable adjustments peak in 2018:Q2 and dissipate by 2021:Q4. The high-spread euro area economies are Greece, Ireland, Italy, Portugal, and Spain. The low-spread euro area economies are Austria, Belgium, Finland, France, Germany, and the Netherlands.

This scenario also features a smooth financial liberalization and orderly deleveraging in China supported by fiscal stimulus. Financial liberalization gradually widens the spreads of the deposit and money market interest rates over the policy interest rate by 50 basis points over two years. A moderation in risk appetite gradually lowers the real equity price by 10 percent. This smooth financial liberalization and equity risk premium decompression induces a gradual increase in the default rate on bank loans to nonfinancial corporations, as well as an orderly reduction in the ratio of bank credit to nominal output, reducing the likelihood and severity of a financial crisis. This gradual deleveraging is accompanied by an orderly rebalancing of private domestic demand from investment to consumption. This smooth financial liberalization and orderly deleveraging in China is supported by expenditure-based fiscal stimulus measures that lower the primary fiscal balance ratio by 2 percentage points (Annex Table 1.2.1).

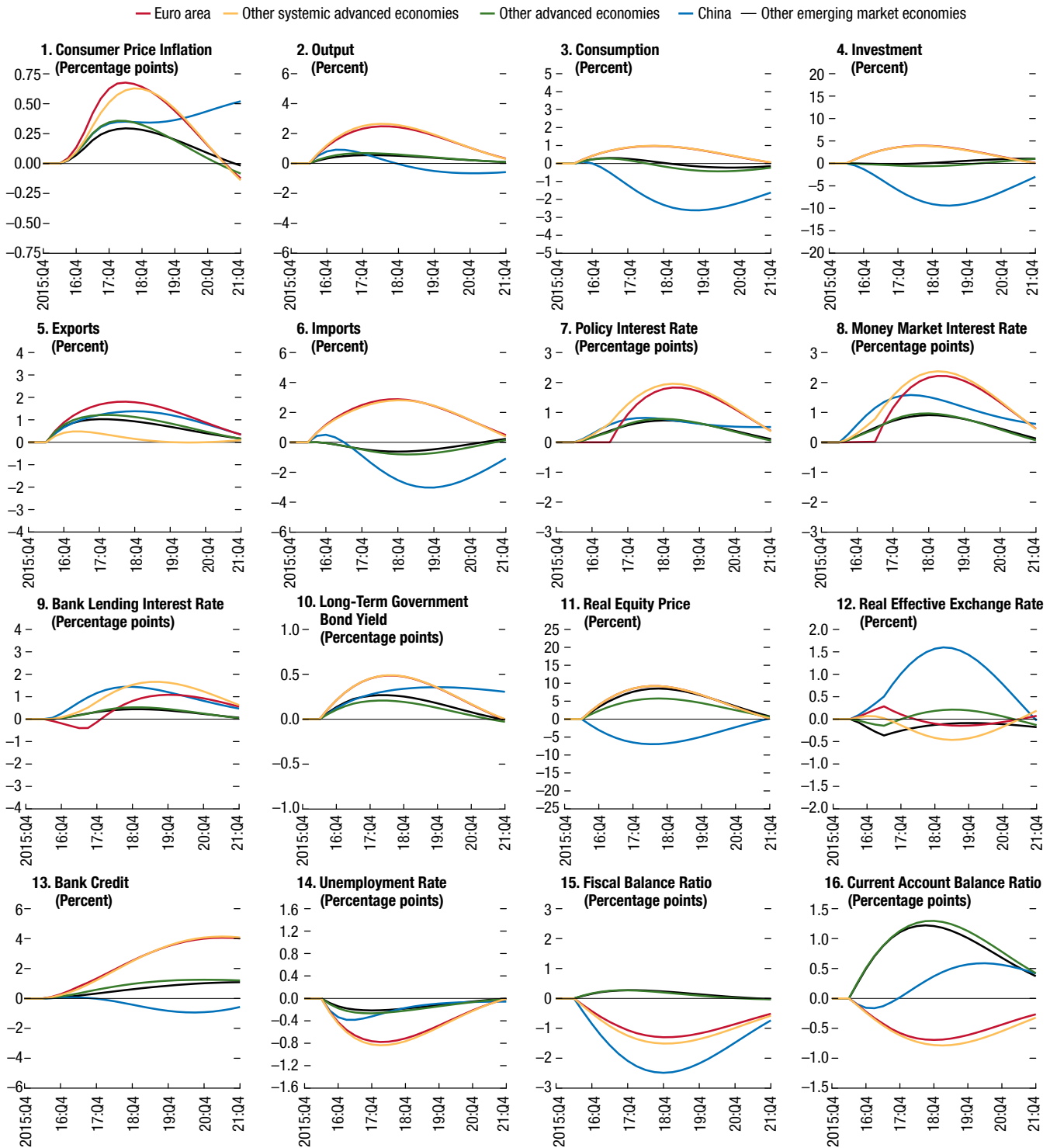
This scenario is generally positive for banking sector capitalization and government debt sustainability worldwide. Largely reflecting higher economic risk taking, stronger credit supply, and reduced costs of equity, output increases by 0.1 to 3.3 percent relative to the baseline across economies by 2018, while consumer price inflation rises by 0.1 to 0.8 percentage points, and the unemployment rate falls by 0.1 to 1 percentage points. These inflationary macroeconomic expansions are concentrated in the systemic

advanced economies, where the rebound in economic and financial risk taking occurs. Accordingly, they induce policy interest rate hikes of 0.3 to 2.1 percentage points across economies by 2018, concentrated in the systemic advanced economies. The banking sector accommodates and contributes to increases in private investment with 0.6 to 4.6 percent rises in bank credit by 2020, except in China, where bank credit falls by 0.9 percent. Bank capital ratios rise by 1 to 1.3 percentage points across high-spread euro area economies by 2019, given lower credit loss rates following nonfinancial corporate debt restructuring initiatives. Government debt ratios rise by up to 2.5 percentage points by 2019 in the systemic advanced economies less the high-spread euro area economies given fiscal stimulus, but fall by up to 5 percentage points in other economies less China given higher nominal output. In aggregate, world output increases by 1.7 percent by 2018, while energy and non-energy commodity prices rise by 13.6 and 6.8 percent, respectively (Annex Figure 1.2.1).

**The Global Market Disruption Scenario**

The global market disruption scenario is initiated by a loss of market confidence that causes an increase in asset risk premiums in systemic economy stock markets, a rise in credit stress in the banking sectors of high-spread euro area economies with some spillovers

Annex Figure 1.2.1. Successful Normalization Scenario Simulation Results



Source: IMF staff estimates.

Note: Depicts variable paths expressed as output-weighted average deviations from baseline. Real effective exchange rate increases represent currency depreciations in real effective terms.

**Annex Table 1.2.2. Global Market Disruption Scenario Assumptions**

<i>Layer 1: Rising Risk Premia and Credit Spreads in Systemic Economies, 2016:Q3–18:Q2</i>	
Real Equity Price, Equity Risk Premium Shocks	
China, Euro Area, Japan, United Kingdom, United States	–20 percent
Money Market Interest Rate Spread, Credit Risk Premium Shocks	
China, High-Spread Euro Area	+100 basis points
Low-Spread Euro Area	+50 basis points
Long-Term Government Bond Yield, Duration Risk Premium Shocks	
High-Spread Euro Area	+50 basis points
Low-Spread Euro Area	–25 basis points
<i>Layer 2: Balance Sheet Vulnerabilities in Euro Area and Emerging Market Economies, 2016:Q3–19:Q2</i>	
Regulatory Bank Capital Ratio, Capital Requirement Shocks	
Euro Area	+2 percentage points
Loan Default Rate, Loan Default Shocks	
Emerging Market Economies	+0.3 to +4.7 percentage points
<i>Layer 3: Secular stagnation worldwide, 2016:Q3–21:Q4</i>	
Private Investment, Investment Demand Shocks	–8 percent
Private Consumption, Consumption Demand Shocks	–2 percent

Source: IMF staff.

Note: All scenario assumptions are expressed as deviations from the April 2016 *World Economic Outlook* baseline. Endogenous variable adjustments peak in 2018:Q2 or 2019:Q2 where indicated and one-quarter dissipate by 2021:Q4. The high-spread euro area economies are Greece, Ireland, Italy, Portugal, and Spain. The low-spread euro area economies are Austria, Belgium, Finland, France, Germany, and the Netherlands.

to their sovereign debt markets, and a disorderly deleveraging by the corporate sector in China. A weakening in stock markets sees real equity prices fall by 20 percent in China, the euro area, Japan, the United Kingdom, and the United States over two years. Credit and banking sector stress is represented by a widening of funding spreads on banking counterparties, by 100 basis points in China and high-spread euro area economies, and by 50 basis points in low-spread euro area economies. Finally, the reemergence of sovereign strains in high-spread euro area economies as a result of rising debt burdens is represented by a 50 basis point increase in long-term government bond yields there, versus a 25 basis point decrease in low-spread euro area economies given safe haven capital inflows.

Banking and corporate sector balance sheet legacy vulnerabilities pose challenges to the euro area and emerging market economies under this scenario. This includes regulatory pressure to build bank capital buffers in the euro area, where we assume that regulatory bank capital ratio requirements rise by 2 percentage points over three years. It also includes credit cycle downturns in all emerging market economies to varying degrees, as default rates on bank loans to nonfinancial corporations

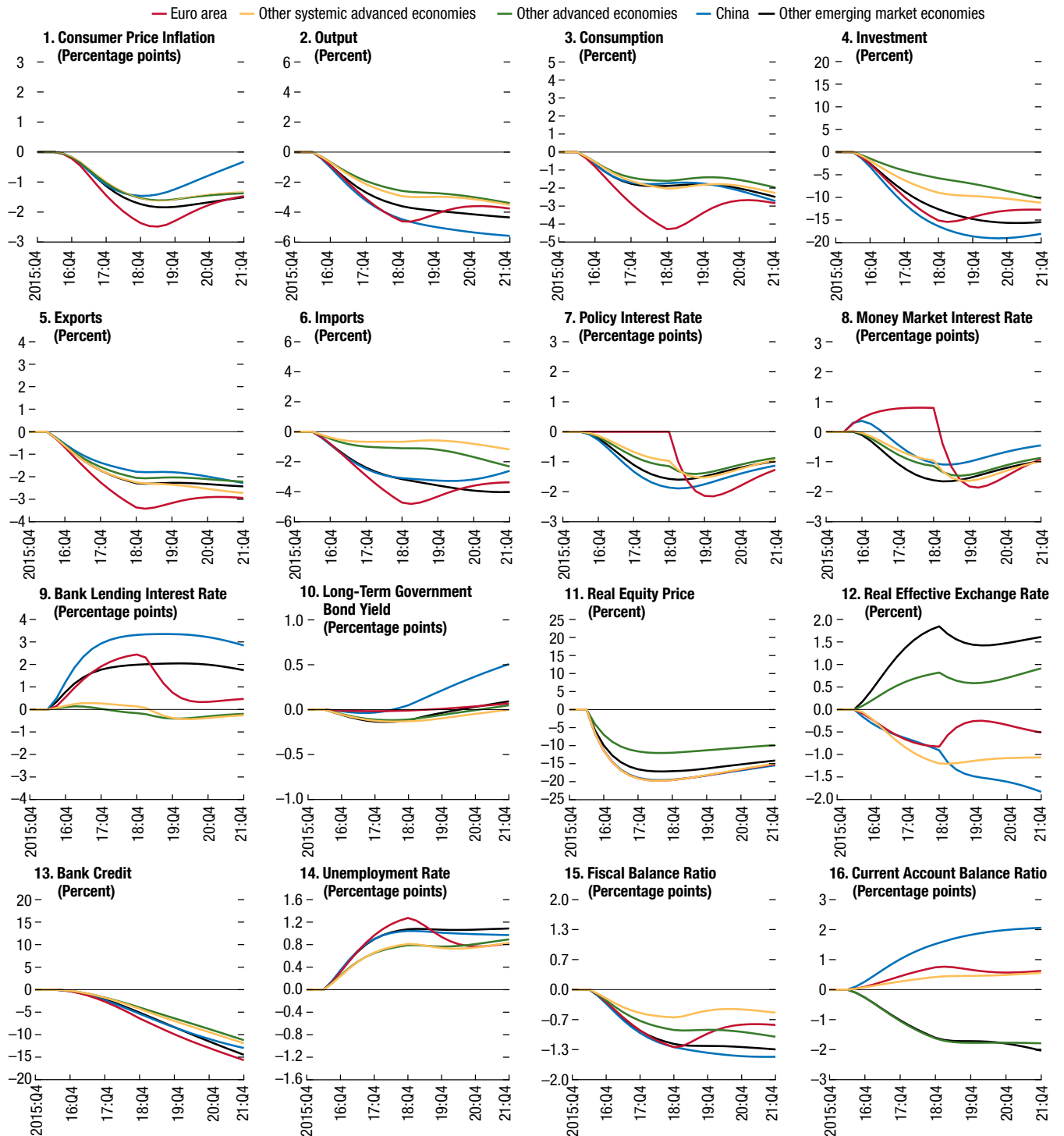
rise above and beyond what is induced by business cycle downturns (exogenous default rate increases average 2 percentage points across emerging market economies and are proportional to their estimated share of corporate debt at risk).

The global market disruption scenario entrenches secular stagnation worldwide, given constrained macroeconomic policy responses as outlined in the WEO. This is generated by suppressed economic risk taking worldwide, represented by confidence losses by nonfinancial corporations and households that raise their saving rates and delay their expenditures. In particular, we assume that private investment falls by an additional 8 percent while private consumption declines by a further 2 percent in all economies over five years. Under this scenario, conventional monetary policy remains at or near the effective lower bound in the systemic advanced economies, while we interpret the calibration of global financial market adjustments as net of the effects of unconventional monetary policy responses where warranted, in particular in the euro area and Japan. Finally, we allow automatic fiscal stabilizers to operate fully but abstract from discretionary fiscal stimulus measures worldwide (Annex Table 1.2.2).

Largely reflecting lower economic and financial risk taking, under this scenario output falls by 2.4 to 6.8 percent relative to the baseline across economies by 2021. Given these steadily accumulating output losses, consumer price inflation declines by 1.2 to 2.8 percentage points across economies by 2019, and the unemployment rate rises by 0.6 to 1.6 percentage points. These disinflationary macroeconomic contractions induce policy interest rate cuts of 1.1 to 1.9 percentage points across economies by 2019, mitigating inflation reductions and output losses. This scenario negatively affects banking sector capitalization and credit availability. The banking sector accommodates and contributes to reductions in private investment with 8.6 to 16.6 percent decreases in bank credit by 2021. Bank capital ratios fall by 0.4 to 4.5 percentage points across emerging market economies by 2019,

where credit loss rates generally increase more given larger rises in default rates on bank loans to non-financial corporations, versus at most 0.4 percentage points across advanced economies. Government debt sustainability is significantly eroded in some advanced economies. Largely reflecting lower nominal output, government debt ratios rise by 4 to 22.9 percentage points across advanced economies by 2021, where initial government debt ratios are generally higher and conventional monetary policy space constraints are widely binding, versus 3.9 to 15 percentage points across emerging market economies. In aggregate, world output falls by 3.9 percent by 2021, of which 2.5 percent is accounted for by the secular stagnation layer from the WEO, while energy and nonenergy commodity prices fall by 40 and 22.4 percent, respectively (Annex Figure 1.2.2).

Annex Figure 1.2.2. Global Market Disruption Scenario Simulation Results



Source: IMF staff estimates.

Note: Depicts variable paths expressed as output-weighted average deviations from baseline. Real effective exchange rate increases represent currency depreciations in real effective terms.

## References

- Chivakul, Mali, and W. Raphael Lam. 2015. "Assessing China's Corporate Sector Vulnerabilities." Working Paper No. 15/72, International Monetary Fund, Washington.
- Dastidar, Siddhartha, and Bruce Phelps. 2009. "Liquidity Cost Scores for U.S. Credit Bonds." Barclays Capital, October 6. Web page.
- Dattels, Peter, Rebecca McCaughrin, Ken Miyajima, and Jaime Puig Forne. 2010. "Can You Map Financial Stability?" Working Paper 10/145, International Monetary Fund, Washington.
- Dell'Ariccia, Giovanni, Deniz Igan, Luc Laeven, Hui Tong, Bas Bakker, and Jerome Vandenbussche. 2012. "Policies for Macrofinancial Stability: How to Deal with Credit Booms." Staff Discussion Note No. 12/06, International Monetary Fund, Washington.
- European Banking Authority. 2015. "2015 EU-Wide Transparency Exercise: Aggregate Report." November 25. London: European Banking Authority.
- European Insurance and Occupational Pensions Authority. 2013. "Pension Benefit Guaranty Corporation Data Book." European Insurance and Occupational Pensions Authority, Frankfurt.
- Federal Financial Institutions Examination Council. 2015. "E.16 Country Exposure Lending Survey and Country Exposure Information Report." September 30. Virginia: Federal Financial Institutions Examination Council.
- International Monetary Fund. 2010. "Financial Sector Stability Assessment Report, United States." Country Report 10/247, International Monetary Fund, Washington.
- . 2015a. "Financial Sector Stability Assessment Report, United States." Country Report 15/170, International Monetary Fund, Washington.
- . 2015b. "The Fund's Lending Framework and Sovereign Debt—Further Considerations." Policy Paper, International Monetary Fund, Washington.
- . 2015c. "People's Republic of China Article IV Consultation Report." Country Report 15/234, International Monetary Fund, Washington.
- Lukonga, Inutu, Moez Souissi, Kusay Alkhunaizi, Rafik Selim, Nombulelo Duma, Kay Chung, Nkunde Mwase, Jonah Rosenthal, Amir Sadeghi Emamgholi, and Brian Hilland. Forthcoming. "Low Oil Prices, Macro Financial Linkages and Financial Stability in the CCA and MENA." International Monetary Fund, Washington.
- Panigirtzoglou, Nikolaos, and Robert Scammell. 2002. "Analysts' Earnings Forecasts and Equity Valuations." *Bank of England Quarterly Bulletin*, Spring, London.
- Sahay, Ratna, Martin Čihák, Papa N'Diaye, Adolfo Barajas, Bi Ran, Diana Ayala, Yuan Gao, Annette Kyobe, Lam Nguyen, Christian Saborowski, Katsiaryna Svirydzhenka, and Seyed Reza Yousefi. 2015. "Rethinking Financial Deepening: Stability and Growth in Emerging Markets." Staff Discussion Note No. 15/08, International Monetary Fund, Washington.
- Swiston, Andrew. 2008. "A US Financial Conditions Index: Putting Credit Where Credit Is Due." Working Paper No. 161, International Monetary Fund, Washington.
- Vitek, Francis. 2015. "Macrofinancial Analysis in the World Economy: A Panel Dynamic Stochastic General Equilibrium Approach." Working Paper No. 15/227, International Monetary Fund, Washington.
- Wright, Jonathan. 2011. "Term Premia and Inflation Uncertainty: Empirical Evidence from an International Panel Dataset." *American Economic Review* 101 (4): 1513–44.

## Summary

**T**rade and financial integration of emerging market economies into the global economy and financial system has increased significantly over the past two decades. As a result, spillovers of emerging market shocks to equity prices and exchange rates in advanced and emerging market economies have risen substantially and now explain over a third of the variation in asset returns in these countries. Bond market spillovers, however, do not display a corresponding trend, since they continue to be driven largely by global factors.

In recent years, the importance of financial factors in explaining spillovers has grown relative to that of trade linkages. The rise in financial market integration has strengthened spillovers across countries. More than its economic size, the degree of financial integration matters for a country's importance as a receiver and transmitter of spillovers.

Spillovers tend to occur more between countries with similar macro-financial fundamentals. Cross-country spillovers are strongest within sectors. Sectors that are more dependent on external finance are more subject to spillovers, as are firms with lower liquidity and higher borrowing. Purely financial contagion effects remain less significant in the case of China. However, the impact of shocks to economic fundamentals, such as news about China's growth, on equity returns in both emerging market and advanced economies has been rising. China's spillovers to global financial markets will likely increase considerably in the next few years.

Finally, structural changes in financial markets, notably the growth in mutual fund intermediation of capital flows, appear to have increased the importance of the portfolio channel of contagion from emerging markets.

These findings suggest that when assessing macro-financial conditions, policymakers may increasingly need to take into account economic and policy developments in emerging market economies. In particular, as China's role in the global financial system continues to grow, clear and timely communication of its policy decisions, transparency about its policy goals, and strategies consistent with their achievement will be ever more crucial. Finally, given the evident importance of corporate borrowing and mutual fund flows in amplifying spillover of shocks, it will be essential to shape macroprudential surveillance and policies to contain systemic risks arising from these channels.



## Introduction

*Financial spillovers occur when fluctuations in the price of an asset trigger changes in the prices of other assets. This chapter studies the evolution of such spillovers from emerging market economies to financial markets of other countries. Growing integration of emerging market economies into the global financial system can be expected to raise international financial spillovers—both in its desirable (better incorporation of news) and less desirable (transmission of excess volatility due to financial friction) forms.*

Crises in emerging market economies have often had financial repercussions in other countries.<sup>1</sup> The Latin American debt crisis of the 1980s, Mexico's economic crisis of 1994–95, and the east Asian and Russian financial crises of the late 1990s are prominent examples of high macro-financial volatility in emerging market economies that spilled over significantly to other emerging market economies and to advanced economies.

More recently, however, financial market volatility originating in emerging market economies seems to have been widely transmitted outside of crises or near-crises. For example, the suspension of trading after the drop of the Chinese stock market on January 6, 2016, reverberated across major asset markets globally. Similarly, when Chinese equities fell sharply on August 24, 2015, following the announcement of a change in the exchange rate regime of the renminbi, the subsequent plunge in Asian equity markets was significant, and the U.S. and European stock markets were also adversely affected.

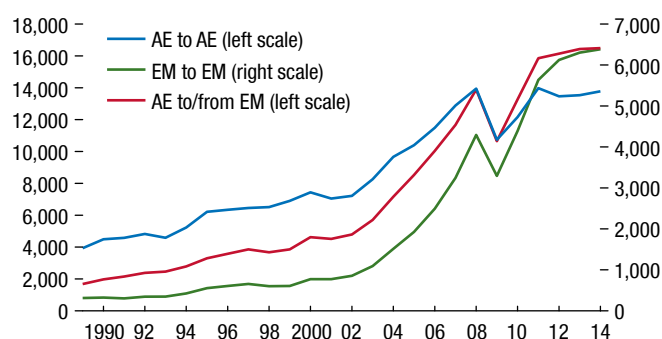
Over the past two decades, the share of emerging market economies in global output, trade, and the financial system has risen substantially. Emerging market economies have contributed more than half of global growth over the past 15 years, and their share in global GDP has risen to 38 percent. Integration of these economies into the global trading network has been rapid during this period,

Prepared by a team consisting of Jay Surti (team leader), Adrian Alter, Luis Brandão-Marques, Qianying Chen, Selim Elekdag, Benjamin Huston, Oksana Khadarina, Hui Miao, Win Monroe, and Ling Zhu, with support from Jesse Eiseman, under the overall leadership of Gaston Gelos and Dong He.

<sup>1</sup>The classification of countries as “advanced” and “emerging market” economies is described in Annex 2.1.

**Figure 2.1. Trade between Advanced and Emerging Market Economies**

(Billions of U.S. dollars; exports plus imports)



Sources: Haver Analytics; IMF, International Financial Statistics database; and IMF staff calculations.

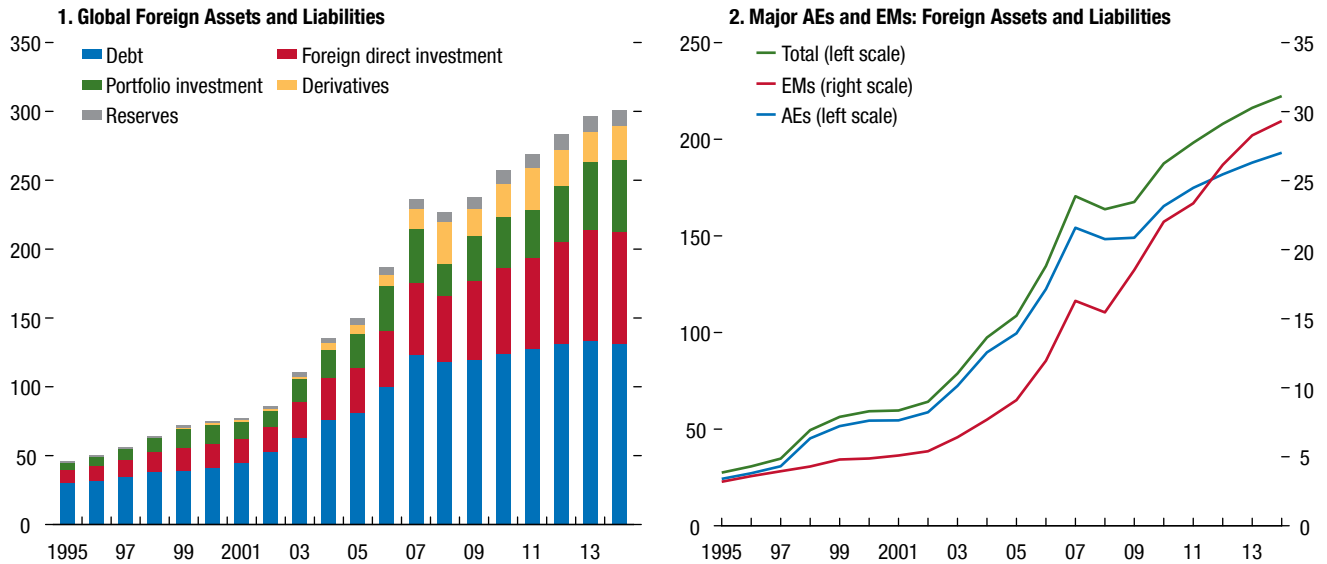
Note: AE = advanced economy; EM = emerging market economy.

with trade between advanced and emerging market economies now exceeding trade between advanced economies. Meanwhile, trade between emerging market economies is 20 times what it was in the early 1990s (Figure 2.1). Financial integration has also grown, albeit at a slower pace and from a lower base (Figure 2.2). Advanced economy banks doubled their exposure to emerging market economies during 2005–13, and bond flows to emerging market economies strengthened continuously. Domestic financial market development in emerging market economies has also proceeded accordingly as their share of global equity market capitalization more than doubled relative to two decades ago and their bond market capitalization increased more than seven times. Importantly, a number of de jure and de facto measures point to declining segmentation during this growth in emerging market economies' financial markets. Increased integration of emerging market economies into the global financial system, in addition to risks, has also likely brought these economies significant benefits.

Financial spillovers from emerging market economies are likely to have risen as the channels of transmission have strengthened, magnifying the reverberation of economic shocks and financial friction.

- *Direct and indirect trade linkages of emerging market economies have grown significantly.* Their bilateral trade and participation in trade networks via supply chains have risen (Figure 2.3; IMF 2011). This

**Figure 2.2. Global Financial Integration**  
(Trillions of U.S. dollars)



Sources: External Wealth of Nations Mark II database; Lane and Milesi-Ferretti 2007; and IMF staff calculations.  
Note: Both panels depict total gross foreign assets and liabilities. AE = advanced economy; EM = emerging market economy.

has important implications for how news about emerging markets’ economic performance affects financial markets elsewhere. For example, stock prices of firms with exports to, or subsidiaries in, these emerging market economies will be affected by changes in the prices of those economies’ assets, insofar as these changes reflect updated expectations of demand for these firms’ products (IMF 2014b, 2015).

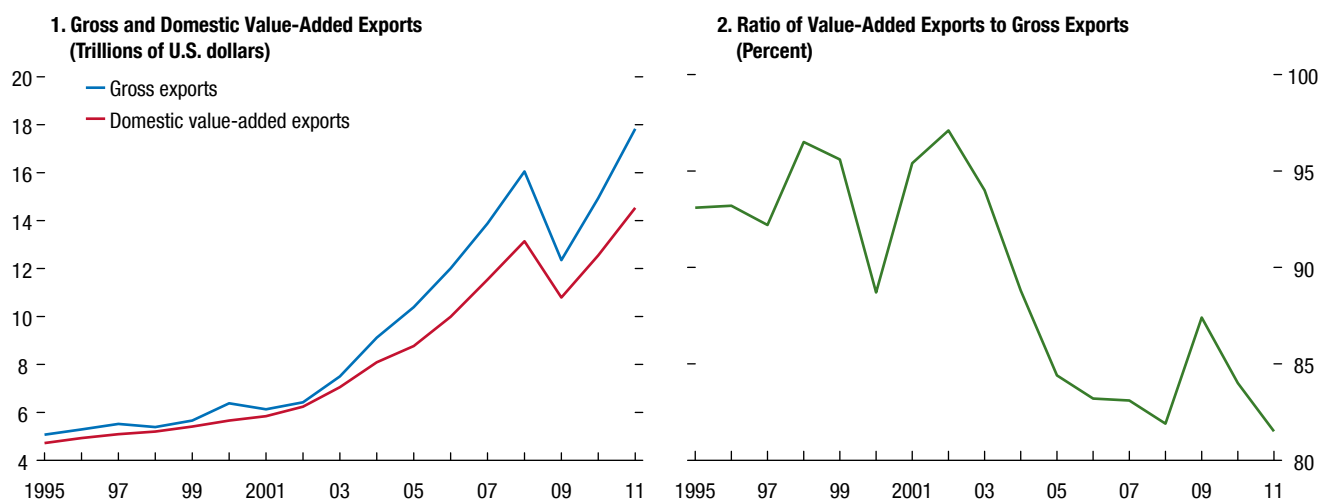
- *Financial mechanisms are likely to have grown as well.* The presence of financial friction may enable or strengthen the cross-border transmission of asset price shocks, even in the absence of direct or indirect trade and economic linkages between countries. This is exemplified by the *portfolio channel of contagion*, through which fund managers can propagate shocks internationally when they rebalance asset holdings across countries in response to losses or gains. The importance of this type of channel is likely to have grown as a result of the increasing presence of advanced economy investors in emerging market economies and vice versa. Similarly, banks that suffer losses in their emerging market operations may be forced to cut lending to other countries.

It is, therefore, natural to hypothesize that emerging markets now transmit shocks in normal times as well as in crisis periods. The continuous increase in correlations in asset prices over the past two decades is suggestive in this regard (see the April 2014 *Global Financial Stability Report*).

In this context, this chapter addresses the following questions:

- How have financial spillovers from emerging market economies evolved during the past two decades? To what degree does news about the real economy in major emerging market economies affect financial markets elsewhere, and how has the strength of this impact changed?
- What are the relative roles played by financial market integration, trade, and direct financial linkages? In which sectors are financial spillovers most prevalent?

The chapter proceeds in four stages. It first defines financial market spillovers and the way they relate to correlation in market returns, common shocks, and contagion. Second, it decomposes the variation in a country’s returns in key markets into contributions from domestic and foreign market shocks. These

**Figure 2.3. Global Gross Exports and Domestic Value-Added Exports**


Sources: Duval and others 2016; Organisation for Economic Co-operation and Development–World Trade Organization Trade in Value-Added database; and IMF staff calculations.

Note: Standard gross exports and value-added exports are shown in panel 1, and the ratio of value added to gross exports (VAX ratio) is shown in panel 2. Although both gross and value-added exports are trending upward, their difference (foreign value added in exports) has also been rising. Likewise, the declining VAX ratio highlights the decline in domestic value added (Johnson and Noguera 2014). As inputs pass through these global supply chains, they typically cross borders multiple times, which implies that commonly used gross trade data can be misleading. Using value-added measures of exports mitigates this bias and helps illustrate the growing prominence of global supply chains.

evolving spillovers are subsequently explained as a function of changing trade and financial linkages between countries, controlling for other relevant factors. This analysis is conducted not only at an aggregate, cross-country level, but also, innovatively, at the sectoral level using firm-level data. Third, the chapter assesses the changing impact of news about fundamentals in major emerging market economies on market returns. Fourth, the analysis shows how the portfolio channel of contagion is a growing source of emerging market spillovers in equities markets.

These are the main findings:

- Equity and foreign exchange market spillovers from emerging markets have risen significantly over the past two decades. More than a third of the variation in advanced economies' stock market returns and in their exchange rates can now be traced to spillovers from emerging market economies. Bond market spillovers do not display a corresponding trend, because bond flows are driven much more strongly by global factors.
- In recent years, the importance of financial factors has grown relative to that of trade linkages. The increase in financial market integration has strengthened spillovers across countries. More than their

economic size, the degree of financial integration matters for a country's importance as receiver and transmitter of spillovers.

- Spillovers tend to occur more between countries with similar macro-financial fundamentals. Cross-country spillovers are strongest within sectors. Firm-level factors matter: sectors that are more dependent on external finance are more susceptible to spillovers, as are firms with lower liquidity and higher leverage ratios. Corporate borrowing appears to be playing a growing role in spillover transmission.
- Structural changes in global financial markets and capital flows are affecting the nature of financial spillovers from emerging market economies. Although still smaller than spillovers from advanced economies, emerging market spillovers through global mutual funds have risen in recent years in line with the increase in asset allocation to these economies.
- Shocks to economic fundamentals, such as news about China's growth, are increasingly driving equity returns in both emerging market and advanced economies. It is likely that China's spillovers to global financial markets will increase considerably

in the next few years. By contrast, purely financial factors (such as contagion effects stemming from portfolio reshuffling by common investors) remain less significant in the case of China.

These findings have the following policy implications:

- The growth in spillovers from emerging market economies to global equities and foreign exchange markets means that when assessing macro-financial conditions, policymakers may need to increasingly consider these countries' economic and policy developments. Financial “spillbacks” from emerging market economies stemming from advanced economies' policy actions are also likely to become more significant, underscoring the importance of enhanced international macroeconomic and macroprudential policy cooperation.
- Policymakers need more comprehensive and granular data on capital flows and their intermediation by banks, large institutional investors, and investment funds to better assess risks and vulnerabilities and identify potential shock triggers and spillover channels.
- Given evidence that financial deepening can attenuate financial spillover of external shocks, governments should promote the development of a local investor base (April 2014 GFSR, Chapter 2).
- As China's role in the global financial system grows, economic and policy developments in that country will have increasing implications for global financial stability. Clear and timely communication of its policy decisions, transparency about its policy goals, and strategies consistent with achieving them will, therefore, be essential to ensure against volatile market reactions, which may have broader repercussions.
- Given evidence of the rising importance of investment funds in generating cross-country contagion, better surveillance of mutual funds' exposures and their resilience in the face of shocks is warranted. Micro- and macroprudential measures to guard against systemic risk from their activities should be considered (April 2015 GFSR, Chapter 3).
- Similarly, given that high levels of corporate indebtedness play a prominent role not only in originating shocks but also in their transmission, countries must guard against financial stability risks. Guarding

against excessive increases in corporate leverage may require macroprudential measures targeted at both bank- and market-based financing by firms (October 2015 GFSR, Chapter 3).

## International Financial Spillovers—Definition and Drivers

International financial market spillovers can be defined as the impact of changes in domestic asset price movements (or their volatility) on asset prices in other economies.<sup>2</sup> The concept excludes comovement across markets that is driven by common factors (say, regional or global shocks that affect many economies similarly). This implies that any empirical analysis faces the challenge of distinguishing such common shocks from truly idiosyncratic ones and establishing directionality.<sup>3</sup>

Financial market spillovers are a broader phenomenon than contagion. Definitions of contagion usually refer to “unusual” comovement of asset prices or their volatility, typically arising during periods of stress (Forbes 2012).<sup>4</sup> Specifically, contagion is usually understood as asset price comovement that cannot be explained by real-economy linkages.<sup>5</sup> Spillovers span shock transmission in this sense of contagion, but are more general. The definition of spillovers is agnostic as to the underlying mechanism and corresponds to directional interdependence across asset markets, including during normal times.

<sup>2</sup>An alternative, less standard definition of financial spillovers can encompass the direct impact of country-specific news on financial markets elsewhere, even if this news is not reflected in domestic markets (spillovers to financial markets). For example, the absence of a well-developed domestic stock market may preclude or inhibit the impact of news on market returns within the country, but this news may have an impact on markets elsewhere.

<sup>3</sup>The concept of spillovers used here is more narrow than that frequently used in relation to real-economy spillovers. The macroeconomic consequences of the evolution of financial spillovers is an important issue that is beyond the scope of the current analysis.

<sup>4</sup>For example, contagion is sometimes statistically defined as an increase in unconditional correlation in asset returns following shocks to a given market or country (Forbes and Rigobon 2002). In order for such contagion to be present, correlations must rise even after adjusting for the higher volatility that often accompanies the occurrence of shocks.

<sup>5</sup>For example, Puy (2016) defines contagion as the mechanism through which a set of common investors (mutual funds) expose all countries or assets in their portfolio to foreign funding or asset return shocks. This is one channel of financial market spillover examined in this chapter, but there are others as well.

Cross-country financial market spillovers may reflect the transmission of news about economic fundamentals or contagion arising from financial friction.

- The presence of *direct and indirect trade linkages* plays an important role in the cross-country financial market transmission of shocks to economic fundamentals. For example, stock prices of firms exporting to a country will be affected by news about economic growth in that market. News about economic fundamentals in major emerging market economies can also convey information about the future demand for commodities, affecting asset prices in commodity-exporting countries, regardless of the strength of their bilateral trade with these emerging market economies. As another example, a devaluation of a country's currency will make that country's exports more competitive, which will likely be reflected in a valuation adjustment of competing firms in other economies (Forbes 2002).<sup>6</sup>
- The presence of *common investors or lenders* in two countries can be sufficient to generate spillovers even in the absence of real-economy linkages (Figure 2.4). For example, as noted previously, funds can propagate shocks by portfolio rebalancing in the face of relative performance concerns and fire sales brought on by end-investor withdrawals (see the April 2015 GFSR, Chapter 3; Boyer, Kumagai, and Yuan 2006; Broner, Gelos, and Reinhart 2006; Coval and Stafford 2007; Jotikasthira, Lundblad, and Ramadorai 2012; Kodres and Pritsker 2002; Kyle and Xiong 2001; Raddatz and Schmukler 2012). Constraints in large institutional investors' mandates may cause those investors to drop assets of countries downgraded to below investment grade (April 2014 GFSR, Chapter 3). The inclusion or exclusion of a country in a benchmark index typically has significant effects on flows and asset prices, since many funds follow these indices either mechanically or closely (Raddatz, Schmukler, and Williams 2015). *Herding* (rational or irrational) by international

<sup>6</sup>Although the efficient markets hypothesis would predict an instantaneous asset price adjustment to news across borders, evidence shows that stock markets do not immediately incorporate all news (see, for example, Lin, Engle, and Ito 2004). Several theoretical explanations have been offered for this phenomenon (Kyle 1985; Fung, Lam, and Lam 2010). See also Dimpfl and Jung 2011.

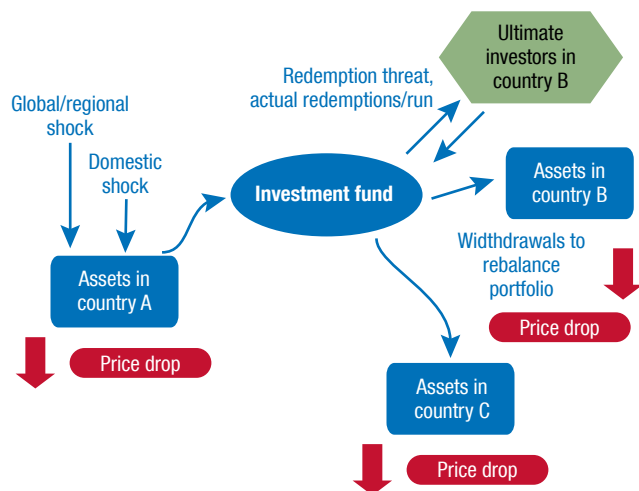
investors may lead to the propagation of shocks beyond what is warranted by fundamentals (Calvo and Mendoza 2000). The wake-up call effect—investors' reassessment of the fundamentals of a whole region or group of countries in response to trouble in one country—is an additional mechanism of shock transmission in the presence of common investors (Ahnert and Bertsch 2015; Goldstein 1998). Common lenders can also transmit shocks—for example, after suffering losses in one country, banks may cut lending in others to meet capital requirements (Cetorelli and Goldberg 2012). To the extent that these types of financial friction amplify shocks, exacerbate volatility, and move prices away from fundamentals, they can do economic harm, even in the absence of a crisis, since they can lead to higher funding costs for firms and misallocation of resources.

The degree of financial market integration can be expected to be crucial in shaping the prevalence and intensity of spillovers. A high degree of financial integration facilitates the rapid adjustment of asset prices to economic news in other markets (for example, by allowing arbitrage to eliminate mispricing), promoting better resource allocation and growth. At the same time, a higher degree of financial integration also enables the operation of the common investor and lender spillover channels described above, potentially yielding excessive cross-border price reactions. Particularly if persistent, such price swings could have financial stability implications and economic costs. Financial integration has been fostered by the dismantling of legal, institutional, and informational barriers (Bekaert and others 2011).<sup>7</sup>

Shock transmission is also likely amplified or attenuated by a range of country-specific factors. These include the size of financial markets (of both the originating and receiving countries), the cyclical position and economic buffers (of the receiving country and its firms), and institutional and policy characteristics of either country. Often, the degree of similarity in country and sector characteristics

<sup>7</sup>On the other hand, it has been argued that lack of country-level transparency (Brandão-Marques, Gelos, and Melgar 2013) can make a market more vulnerable to shocks emanating from financial centers (IMF 2015).

**Figure 2.4. Example of Shock Transmission through Common Lenders**



Source: IMF staff.

is associated with higher spillovers—for example, a policy change in a large economy affecting a certain sector may affect companies with similar financing patterns elsewhere, if they compete for international financing sources (see, for example, Antón and Polk 2013). Moreover, under the wake-up call hypothesis discussed earlier, an adverse shock in one country may lead investors to withdraw from similar countries or companies.<sup>8</sup>

In addition to rising financial integration, various accompanying structural changes in international capital markets are likely to have changed the scope and speed of shock transmission from emerging market economies.

- *First, foreign investors (from both advanced and emerging market economies) have become more important players in emerging market economies' debt markets* (Figure 2.5, panel 1). Since the 2007–09 global financial crisis, both international and domestic factors have combined to make emerging market assets, including local currency sovereign bonds and hard currency corporate debt, attractive

<sup>8</sup>See Dasgupta, Leon-Gonzalez, and Shortland 2011. Since spillovers entail the transmission of both negative and positive shocks, it is also plausible for more *dissimilar* countries or sectors to experience *more* spillovers. For example, in the case of the wake-up call phenomenon, countries that are very dissimilar from the one experiencing an adverse shock may enjoy positive spillovers (for example, flight to quality during a crisis).

to end-investors. The growing preponderance of bond flows relative to equity flows is significant, because bond flows are more fickle and appear to be more reactive to global financial conditions (IMF 2014b). Institutional investors in emerging market economies have grown and have increasingly sought to diversify their assets (Karolyi, Ng, and Prasad 2015).

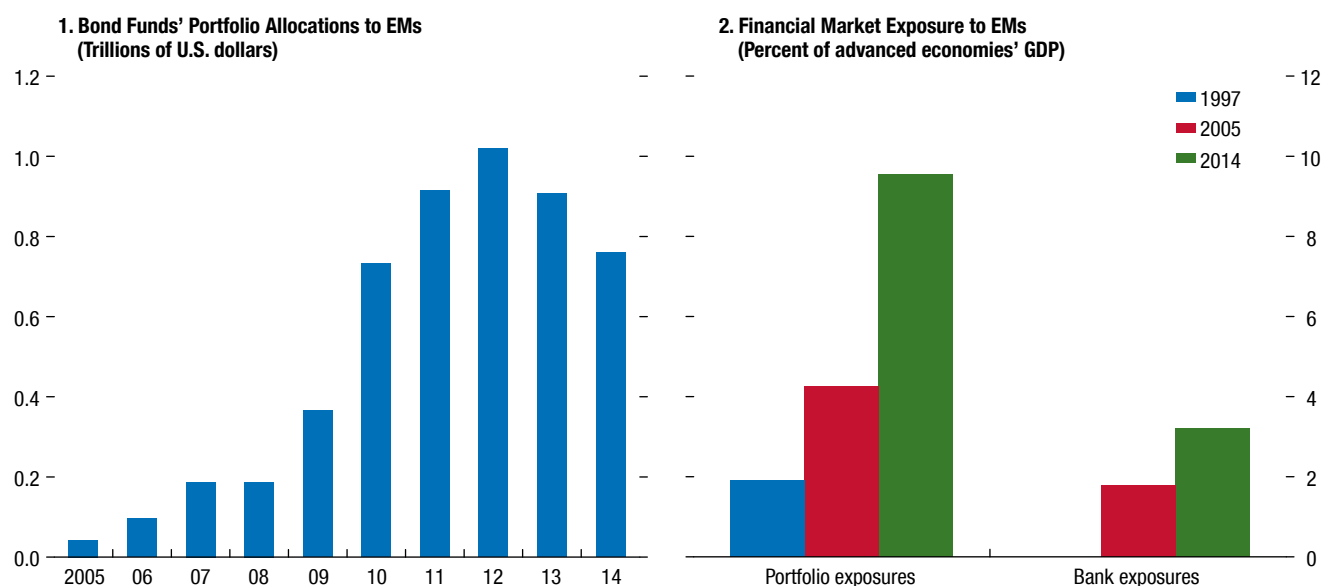
- *Second, the intermediation of global capital flows to emerging market economies has moved from banks to funds* (Figure 2.5, panel 2). Global systemically important banks, traditionally preeminent in this sphere, have lost ground as business models were adjusted following the global financial crisis and regulatory reforms (April 2015 GFSR, Chapter 2). An increasing share of capital to emerging market economies is now intermediated from retail investors through open-end mutual funds. Although cross-border banking flows have traditionally been the most volatile form of capital flows (April 2015 GFSR, Chapter 2), funds are also key transmitters of funding shock spillovers from both end-investor funding withdrawals and losses incurred on investments in other countries.
- *Third, the role of offshore dollar funding markets has grown considerably in recent years.* Close to two-thirds of dollar funding originates outside the United States, increasingly intermediated by investment funds (He and others 2015; McCauley, McGuire, and Sushko 2015). This development is likely to have affected the patterns of financial spillovers.

## Spillovers through Financial Markets

### How Have Financial Market Spillovers Evolved?

The evolution of spillovers from emerging market economies in equities, foreign exchange, and bond markets is first examined through an econometric model. For the empirical estimation, a financial market spillover from country A to country B is broadly defined as the share of the variation in country B's market return shocks that can be attributed to (contemporaneous or preceding) shocks in country A's market returns. Specifically, following the approach of Diebold and Yilmaz (2014), we estimate a vector autoregression (VAR) of daily asset returns incorporating global control

**Figure 2.5. Advanced Economies' Financial Exposures to Emerging Market Economies**



Sources: Bank for International Settlements (BIS), Consolidated Banking Statistics; BIS, Locational Banking Statistics; IMF, Coordinated Portfolio Investment survey; Lipper; and IMF staff calculations.

Note: The sample of countries in panel 1 is larger than that used in subsequent analysis. Please see Annex 2.1 for details on country classifications. Panels show the exposure of economies for which data are available. Panel 1 shows exposures of bond funds domiciled in Austria, France, Germany, offshore financial centers, Spain, Switzerland, United Kingdom, and United States to EMs including Argentina, Bosnia and Herzegovina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Estonia, Ghana, Hungary, India, Indonesia, Jamaica, Korea, Latvia, Malaysia, Mexico, Nigeria, Peru, Philippines, Poland, Qatar, Russia, Serbia, Slovak Republic, Slovenia, South Africa, Thailand, Turkey, Uganda, Ukraine, and Vietnam. In panel 2, AEs are Australia, Canada, Denmark, euro area, Hong Kong SAR, Israel, Japan, Norway, Singapore, Sweden, Switzerland, United Kingdom, and United States; EMs are Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Peru, Philippines, Poland, Russia, South Africa, Thailand, and Turkey. AE = advanced economy; EM = emerging market economy.

variables to remove comovement due to common factors.<sup>9,10</sup> Although the method does not identify the causality of spillovers, it relies on historical patterns to identify directionality. Moreover, the results presented below are quite robust and qualitatively unaffected by alternative methods.<sup>11</sup> In particu-

<sup>9</sup>Results are reported for a VAR of daily local currency nominal asset returns with a rolling window of 250 trading days, incorporating a lag of one day and a forecast error variance decomposition horizon of 12 trading days. The sample covers 33 major advanced and emerging market economies during 1995–2015. A generalized variance decomposition is used. Annex 2.1 provides a detailed exposition of the data and empirical framework.

<sup>10</sup>A challenge in this context is that major news in emerging market economies may affect global variables, such as global commodity prices. For the benchmark case, we therefore report results controlling only for the Chicago Board Options Exchange Standard & Poor's 500 Implied Volatility Index (VIX), which according to separate analysis does not seem to be influenced by shocks to emerging market economies. Results are robust to controlling for a broader range of global factors (Annex 2.1).

<sup>11</sup>Specifically, as noted in Pesaran and Shin 1998, the approach of Diebold and Yilmaz allows for correlated (nonorthogonalized) shocks but accounts for them via a weighting mechanism based

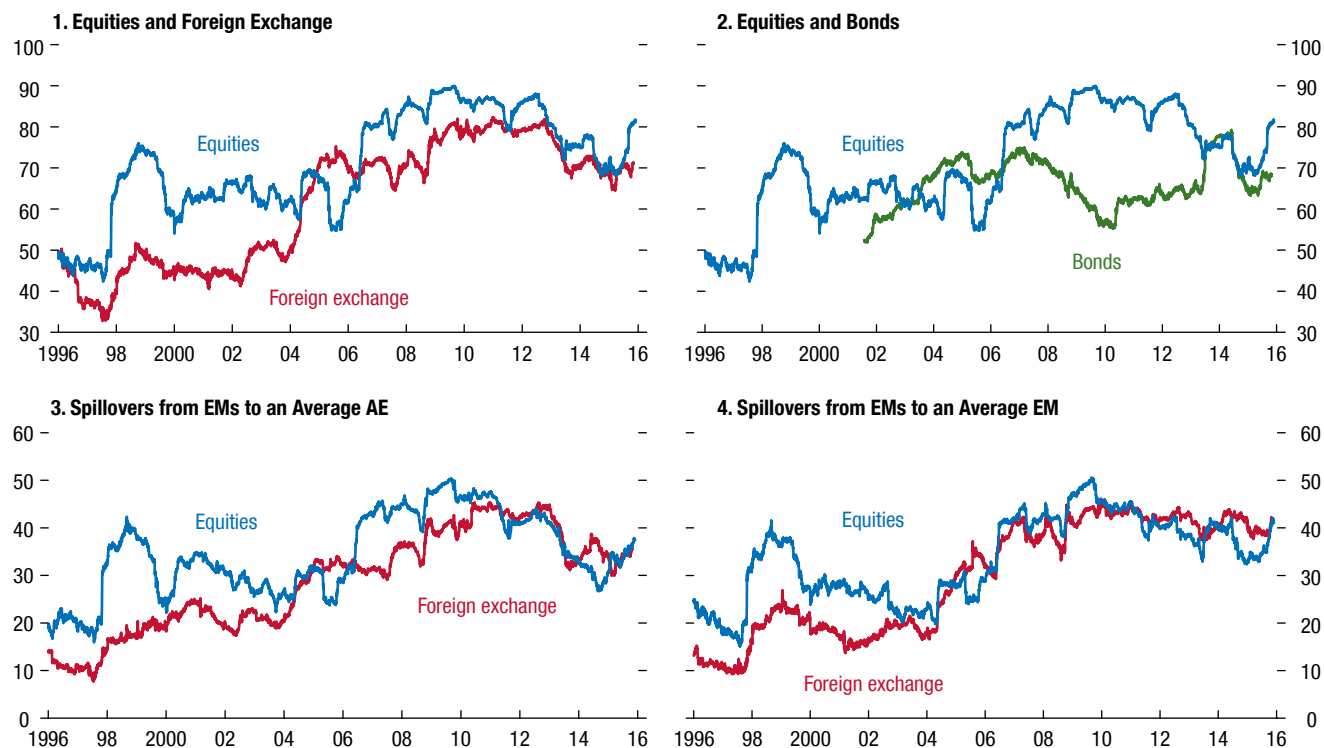
lar, an alternative approach was pursued, based on statistical (Granger) causality—a more stringent criterion that restricts attention to asset price movements in country B that systematically occur *following* shocks in country A. Indices based on this method move in tandem with the spillover patterns documented below.

Cross-country equity and foreign exchange spillovers have risen significantly (Figure 2.6, panel 1). The share of variation in advanced and emerging market economies' equity returns attributable to other countries' equity return variation rose from 50 percent in 1995 to over 80 percent by 2015. For foreign exchange markets, spillovers rose from 50 percent in 1995 to 71 percent in 2015.<sup>12</sup> Further analysis (not

on the variance-covariance matrix of shocks. Annex 2.1 presents details of the robustness checks. In addition, the following section uses a different method to identify directionality more precisely.

<sup>12</sup>Global bond market spillovers, while significant, do not show the trend increase in spillovers evident in equity and foreign exchange markets. Instead they appear to be cyclical, corresponding to U.S. monetary policy in particular, rising during periods of *search*

**Figure 2.6. Spillover Indices for Various Asset Classes and Components**  
(Percentage points)



Sources: Bloomberg, L.P.; Thomson Reuters Datastream; and IMF staff calculations.

Note: Average spillovers to AEs (EMs) were obtained by scaling spillovers by the number of AEs (EMs). Financial market spillovers are defined as the fraction of the 12-day-ahead forecast error variance of a country's local currency nominal equity return that can be accounted for by innovations in another country's equity return. AE = advanced economy; EM = emerging market economy.

shown) reveals that this rise in spillovers stems from a strengthened transmission channel in recent years and not from larger and more frequent emerging market shocks. The pattern for bond markets is less clear, partly because bond prices are significantly influenced by U.S. factors such as the VIX, which is controlled for in these estimations (April 2014 GFSR, Chapter 2). Previous work suggests that financial conditions in advanced economies are significantly more important drivers of bond flows than of equity flows. These factors have been shown to explain as much as half of the variation in bond flows compared with about a fifth of the variation in equity flows (IMF 2014a). Finally, bond spillovers may also be attenuated by the

for yield, as during the Great Moderation before the crisis and during the postcrisis quantitative easing until the taper tantrum in 2013 (Figure 2.6, panel 2). Analysis of emerging market economies' bond market spillovers will be taken up in the context of the common investor channel of contagion.

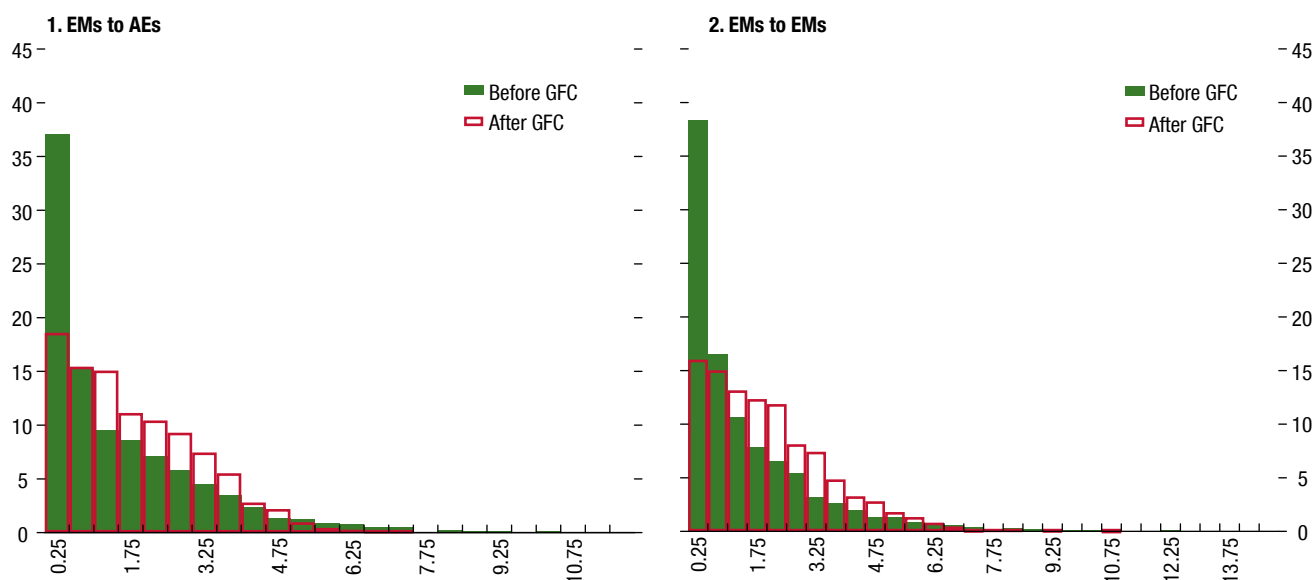
fact that increased advanced economy exposure to emerging market bonds is a recent phenomenon and has occurred during quantitative easing by central banks in major advanced economies, which may have suppressed bond return variation.

Spillovers from emerging market economies now explain a significant proportion of the variation in advanced and emerging market economies' equity and foreign exchange market returns (Figure 2.6, panels 3 and 4). More than a third of the variation in advanced economies' equity and foreign exchange returns and more than 40 percent of the variation in emerging market economies' equity and foreign exchange returns are attributable to spillovers from emerging market economies.<sup>13</sup>

<sup>13</sup>Equity market spillovers in the opposite direction, from advanced to emerging market economies, have grown by a comparable amount over the past two decades and now account for over a third of the variation in emerging market equity returns.



**Figure 2.7. Spillovers before and after the Global Financial Crisis**  
 (Frequency of bilateral outward equity market spillovers in percentage points)



Source: IMF staff calculations.

Note: The figure depicts the relative frequency in percentage points (y-axis) of the intensity of spillovers to other countries' equity returns in percentage points (x-axis). AE = advanced economy; EM = emerging market economy; GFC = global financial crisis.

Financial spillovers from emerging market economies have been significantly stronger since the 2007–09 global financial crisis (Figure 2.7). Average equity return spillovers from emerging market economies to other emerging markets and to advanced economies rose by 28 percent following the crisis—increasing more strongly to emerging market than to advanced economies. Spillovers from some of the largest emerging market economies (Brazil, China, India, Russia, South Africa) have risen by 40 percent. Spillovers from emerging market economies jumped up dramatically between October 2005 and March 2007, stayed elevated through the global financial crisis, and have risen again starting in late 2014 following a dip in between (Figure 2.6). This evolution of financial spillovers from emerging market economies may reflect, in chronological order, increased financial flows between emerging market and advanced economies during 2005–07 followed by the global financial crisis, and soaring advanced economy exposures to emerging market economies through mutual fund flows that have contributed to the recent resurgence of spillovers.<sup>14</sup>

<sup>14</sup>As borne out by the statistical analysis of factors driving the evolution of spillovers in a subsequent part of this chapter.

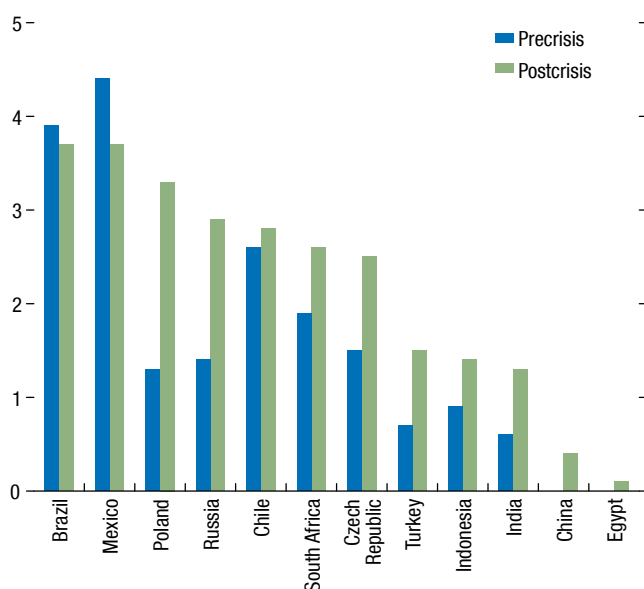
Unsurprisingly, the postcrisis evolution of spillovers mirrors the dynamics of cross-asset price correlations, which have been elevated since 2010, even during periods of low volatility in asset returns (October 2015 GFSR, Chapter 1).

Equity market spillovers are larger from emerging market economies with more integrated financial markets (Figure 2.8). Brazil, Chile, Mexico, Poland, and South Africa transmitted consistently larger equity market spillovers than larger emerging market economies, such as China and India, whose financial markets have been more segmented. The fact that financial spillovers from Chinese A-shares markets have remained low relative to those from other emerging market economies likely reflects the importance of financial integration in shaping spillover intensity.

### What Explains the Rise in Emerging Market Financial Spillovers?

*To what extent can the growth in financial spillovers from emerging market economies be explained by countries' evolving trade and financial linkages, their institutional and policy characteristics, and the financial health and business models of their firms?*

**Figure 2.8. Average Equity Spillovers from Selected Emerging Market Economies**  
(Percentage points)



Sources: Bloomberg, L.P.; Thomson Reuters Datastream; and IMF staff calculations.

*This section links the changing size and pattern of financial spillovers estimated previously to changing trade and financial integration, country-level factors, and corporate sector financial indicators. Overall, the importance of financial factors has increased relative to that of trade linkages in explaining spillovers.*

The analysis examines the role of a variety of country-, sector-, and firm-level factors explaining the strength of financial spillovers. General trade openness and bilateral trade volumes are used to measure trade linkages; foreign direct investment and portfolio flow volumes measure financial linkages.<sup>15</sup> Economic or financial sector characteristics and policy parameters can amplify or attenuate the impact of trade and financial linkages on the intensity of spillovers transmitted or received by countries. To capture factors affecting the degree of segmentation of domestic asset markets from the global financial system (including informational barriers), the analysis considers capital account openness, corporate governance variables, and the transparency of government policies. Countries that have larger financial markets or are home or

<sup>15</sup>Cross-border bank exposures were difficult to incorporate owing to substantially larger gaps in data.

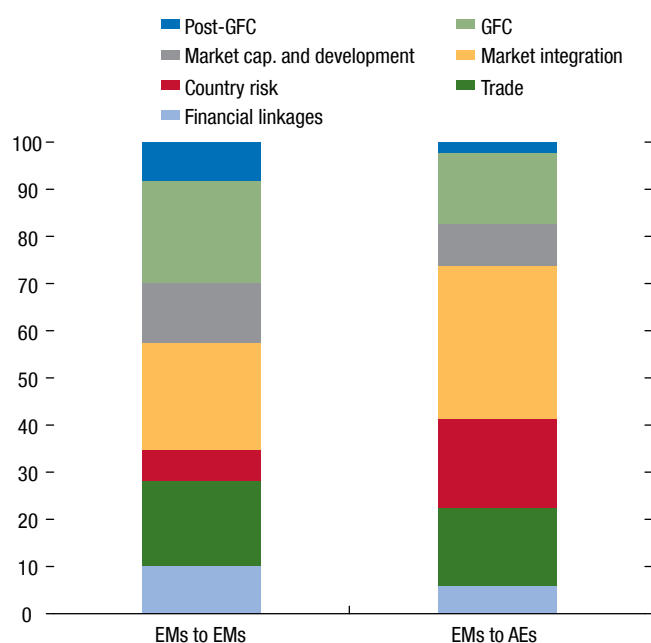
host to more internationally active financial institutions are likely to exert larger spillovers on foreign financial markets. Countries with larger domestic financial markets may also be better able to absorb shocks unrelated to fundamentals (since, for example, local funds may step in if local prices undershoot in response to external developments). This motivates the use of measures of size of both the receiver's and the transmitter's financial systems. Similarities in macro-financial and political risk with the transmitter may play a role in the transmission of shocks, as discussed earlier, and are therefore also considered here. Measures of firms' financial health (profits and cash buffers) and funding strategies (borrowing and dependence on external financing) are also included in the analysis. Given measurement problems and difficulties in disentangling the precise roles of different factors, the results should, however, be taken as indicative and not as precise estimates.

#### *Equity market spillovers at the country level*

An analysis of the contribution of different structural and cyclical factors in explaining spillovers reveals the following (Figure 2.9):

- *Trade linkages* explain, on average, between 10 percent and 20 percent of emerging market economies' equity return spillovers. Their significance is higher in the case of commodity-exporting countries. In the postcrisis period, however, their significance in explaining the evolution of spillovers is lower.
- *Increased market integration* has contributed to the growth in equity market spillovers, particularly from emerging market to advanced economies, and explains 30 percent to 40 percent of spillovers.
- The increase in spillovers in the postcrisis period cannot be fully explained by the variables included. The change seems to be more pronounced among emerging market economies. This may be the result of growth of common investor mechanisms, which may not be fully captured in the analysis (and is reflected in the postcrisis dummy in Figure 2.9).
- Countries with more similar *risk profiles* are more likely to experience spillovers from each other, and this factor is of greater importance for spillovers from emerging market to advanced economies, for which it explains about 20 percent of spillovers.

**Figure 2.9. Contribution to Variation in Emerging Market Economy Equity Spillovers, 1995–2014**  
(Percentage points)



Source: IMF staff calculations.

Note: The figure shows the percent contribution of each variable to the overall regression ( $R^2$ ), using relative weight analysis as described in Nathans, Oswald, and Nimon 2012. AE = advanced economy; Country risk = receiver's International Country Risk Guide rating relative to transmitter; EM = emerging market economy; Financial linkages = receiver's and transmitter's portfolio and foreign direct investment flows; GFC = global financial crisis; Market cap. and development = spillover transmitter's equity market capitalization and financial institution development of spillover receiver, respectively; Market integration = de jure (capital account openness) and de facto (transparency of government policymaking) measures of market segmentation; Trade = transmitter's trade of goods and services with partners. Definition of variables are in Annex Table 2.2.1.

### Equity market spillovers at the sectoral level

The analysis of sectoral cross-country spillovers provides a complementary and more granular perspective on equity market spillovers. Specifically, we examine spillovers using firm-level stock market data, grouping companies according to seven broad sectors. Using such disaggregated data at the sectoral level helps better identify the underlying transmission mechanisms.<sup>16</sup>

<sup>16</sup>Sector-level data also confer greater cross-sectional variation, which refines the precision of statistical estimates. The analysis considers the interplay between equity return spillovers and trade at the sector level. Both sector- and country-specific fundamentals are accounted for. Sector-level equity subindices are paired with bilateral goods and services exports and imports (trade). Consistent with the aggregate analysis above, foreign direct investment flows are used to proxy financial linkages. Sector-level fundamentals account for differences in solvency (interest coverage ratio), profitability (return

For example, it allows us to measure how much the Chinese industrial sector explains stock price movements of other economies' firms in the oil and gas sectors. By linking spillovers at the sectoral level to sector-level trade flows, the analysis also allows for a more precise identification of the relative importance of the trade channel in explaining the size of spillovers.

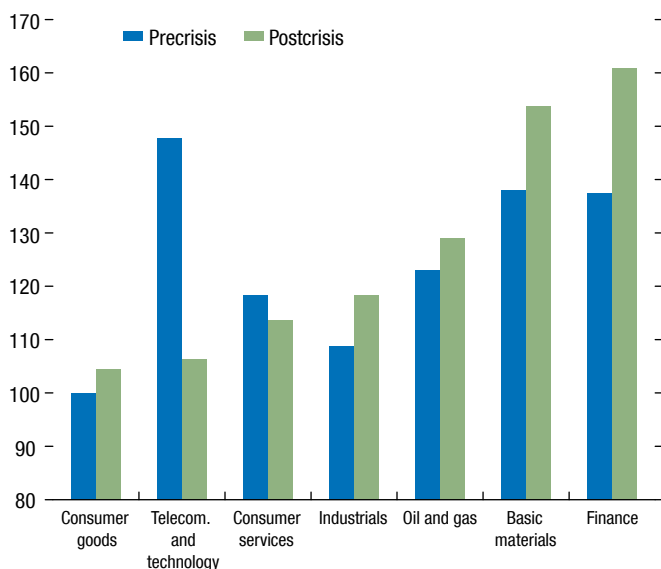
Equity market spillovers from emerging market economies are stronger in tradable goods and globally integrated sectors, and have grown over time (Figure 2.10). Spillovers have been consistently higher in sectors such as finance, basic materials (which includes metals and mining), and oil and gas, and have been lower in retail and nontradables-dominated sectors such as consumer goods and services. For instance, the Chinese industrial sector's stock price fluctuations alone account for close to 5 percent of advanced economies' variation in equity prices in the basic materials sector, up from 1½ percent before the global financial crisis (Figure 2.11).

Intrasectoral spillovers are more significant than cross-sectoral spillovers. Intrasector outward spillovers are on average 7 percent higher than cross-sectoral spillovers. This reflects the tendency of shocks to spill over more to similar firms (because of economic and possibly also herding—or wake-up-call-type effects noted earlier). This may particularly reflect the importance of intraindustry trade, even for emerging market economies. For example, emerging market economies are often suppliers of intermediate goods in increasingly complex supply chains, and advanced economies often export machinery to the industrial sector in emerging market economies.

The financial health of firms is an increasingly important factor affecting the magnitude of emerging market economies' equity return spillovers (Figure 2.12). Investor sensitivity to cross-country differences in corporate fundamentals has increased particularly across emerging market economies. Similar firms are more likely to be affected by spillovers. Stock prices of firms with lower liquidity ratios and higher levels of borrowing tend to be more affected by spillovers. More broadly and consistent with the role played by financial constraints, sectors that are more dependent on market financing experience stronger inward spillovers. Such sectors transmit shocks more easily (possibly because they are more vulnerable to changes in financial conditions, and are therefore more volatile) and are also more affected by international shocks. When

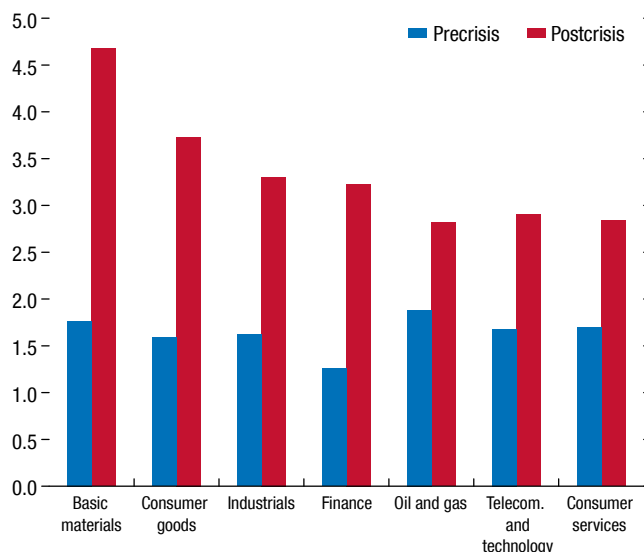
on equity), liquidity (current ratio), and a sector's dependence on external financing (Rajan and Zingales 1995). The remaining determinants are the same as those used in the aggregate analysis.

**Figure 2.10. Emerging Market Economy Outward Equity Spillovers by Sector (Index)**



Sources: Bloomberg, L.P.; Thomson Reuters Datastream; and IMF staff calculations.  
 Note: Spillovers were normalized by the minimum value. Telecom. = telecommunications.

**Figure 2.11. Chinese Industrial Sector: Equity Market Spillovers to Advanced Economy Sectors (Percentage points)**



Source: IMF staff calculations.  
 Note: The figure depicts the annual average precrisis and postcrisis outward equity market return spillovers from the Chinese industrial sector to sectors across all advanced economies. Spillovers measure the fraction of the 12-day-ahead forecast error variance of sector-level equity returns across advanced economies that is attributable to innovations in the equity return in the Chinese industrial sector. Telecom. = telecommunications.

combined with previous analysis (April 2015 GFSR, Chapter 1; October 2015 GFSR, Chapter 3), this underscores the importance of high corporate borrowing—not just as a potentially large originator of shocks, but also as a key channel for their transmission to other advanced and emerging market economies.

Sectoral trade linkages play an important role in underpinning spillovers from emerging market economies to advanced economies. The importance of financial factors has, however, increased relative to trade since the global financial crisis. Similarly, differences in country risk seem to have become less important for spillover transmission to advanced economies.

In recent years, more developed financial systems have helped emerging market economies dampen foreign financial spillovers. A closer look at precrisis and postcrisis patterns of factors underlying the evolution of spillovers suggests that more mature financial sectors, with more developed local institutions, are now attenuating spillovers from other emerging market economies, although this was not the case in the precrisis period.<sup>17</sup>

<sup>17</sup>This is in line with evidence presented in Chapter 2 of the April 2014 GFSR. The postcrisis average of the financial development index for emerging market economies is higher than its precrisis level.

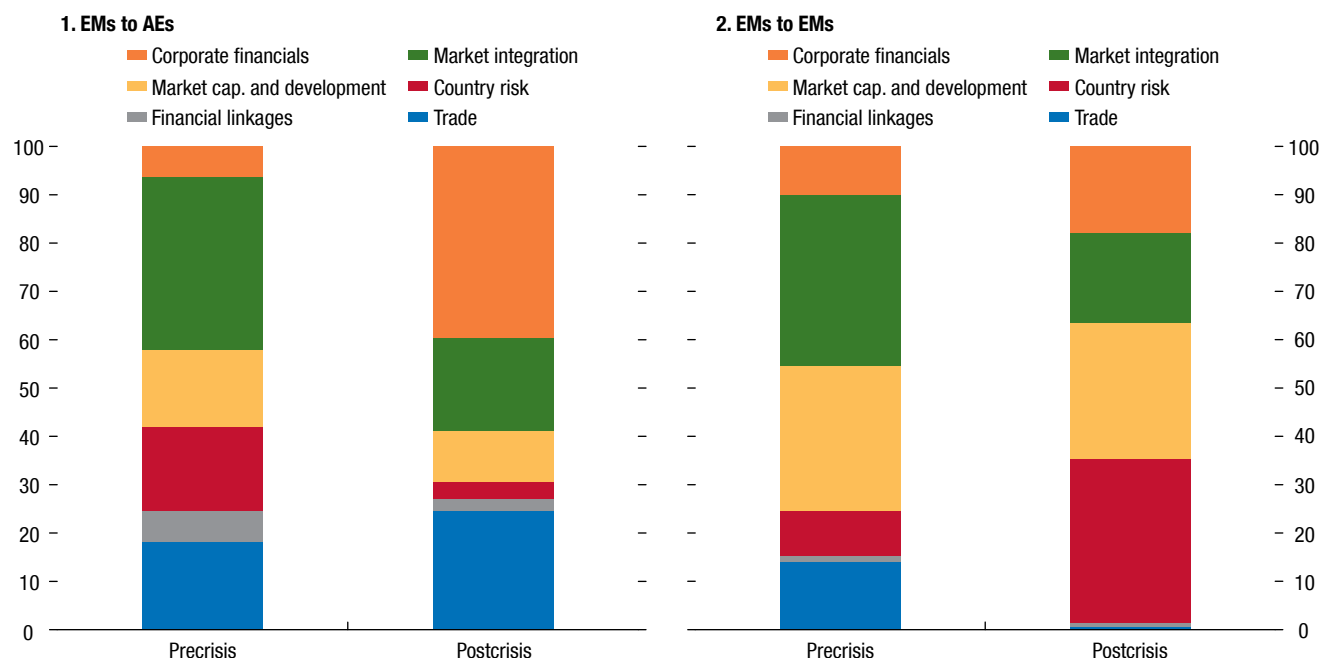
### Spillovers to foreign exchange markets

Trade does not play a major role in explaining spillovers in foreign exchange markets (Figure 2.13). Rather, financial market integration, the size of the shock transmitter’s financial market, and similarities in country risk are important in explaining spillovers to both advanced and emerging market economies’ exchange rates. For emerging market economies, the spillover patterns experienced a significant structural shift following the crisis. Brazil, Mexico, and South Africa are among the largest sources of spillovers to foreign currency markets (Figure 2.14). For example, fluctuations in the Mexican peso explain close to 3 percent of the exchange rate movements of other emerging market economies.

### Cross-Border Financial Market Effect of News about Fundamentals

*This section presents a complementary examination of the changing nature and importance of financial spillovers by focusing on the implications of growth surprises in major*

**Figure 2.12. Emerging Market Economy Equity Market Spillovers: Role of Firm-Level Factors**  
(Percentage points)



Sources: Bloomberg, L.P.; Thomson Reuters Datastream; IMF, International Financial Statistics and World Economic Outlook databases; United Nations statistics; and IMF staff calculations.

Note: The figure shows the percent contribution of each variable to the overall regression ( $R^2$ ), using relative weight analysis as described in Nathans, Oswald, and Nimon 2012. Corporate financials include interest coverage ratio (inverse of leverage), current ratio (liquidity), return on equity (profitability), and external financing dependence. They are measured in absolute differences between transmitter and receiver. AE = advanced economy; Country risk = receiver's International Country Risk Guide rating relative to transmitter; EM = emerging market economy; Financial linkages = spillover receiver's foreign direct investment flows; Market cap. and development = respectively, spillover transmitter's equity market capitalization (sector) and financial institution development of the spillover receiver; Market integration = de facto measures (transparency of government policymaking) of market segmentation; Trade = bilateral trade (sector level). Definitions of variables are in Annex Table 2.2.1.

*emerging market economies. Overall, although growth surprises in Brazil are increasingly important regionally, those stemming from China have a global as well as regional effect.*

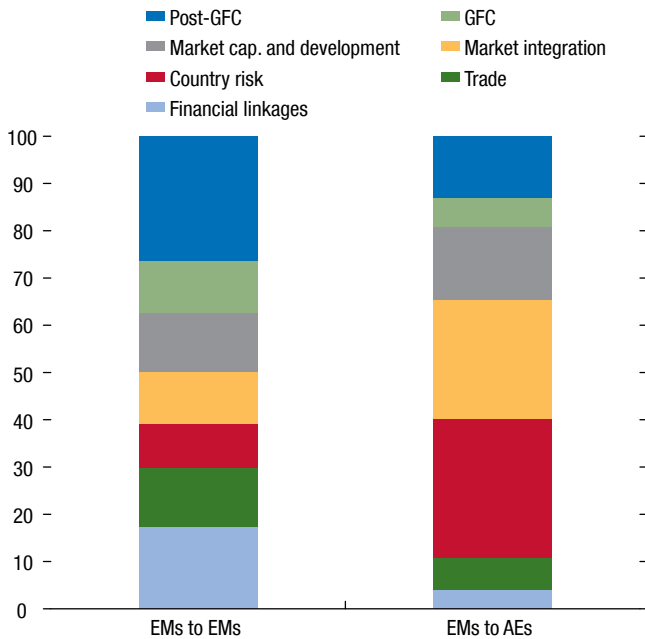
An analysis of *surprises* regarding economic fundamentals allows for a more precise identification of the direction of spillovers. This section assesses the impact of clearly identified news about macroeconomic fundamentals in major emerging market economies on financial markets in other economies, controlling for common global factors. The method serves as a useful complement to the previous analyses, enabling a clear-cut assessment of the cross-border impact of news about fundamentals on financial markets. By design, it excludes spillovers induced purely by financial friction, which may however affect the strength of transmission.

This approach also allows for assessment of spillovers of news that are not well reflected in

less-developed domestic financial markets. Less-developed and segmented markets may not process information efficiently.<sup>18</sup> These considerations are particularly relevant for China over the past two decades, but may also apply to other emerging market economies. Research on Chinese firms that dual-list their stock in the A-shares and B-/H-shares markets has uncovered a very different pattern of variation in returns for identical stocks of the same

<sup>18</sup>A combination of heterogeneous expectations and trading restrictions can result in speculative-trading-generated bubbles and excess volatility in segmented markets. Scheinkman and Xiong (2003) present a conceptual framework and an extensive bibliography on this issue. More generally, the presence of heterogeneous expectations and short-sale constraints may result in a time pattern of asset return volatility in the segmented market that does not mirror what may be expected in a market with access to a better range of arbitrage and hedging options.

**Figure 2.13. Contribution to Variation in Emerging Market Economy Foreign Exchange Spillovers, 1995–2014**  
(Percentage points)

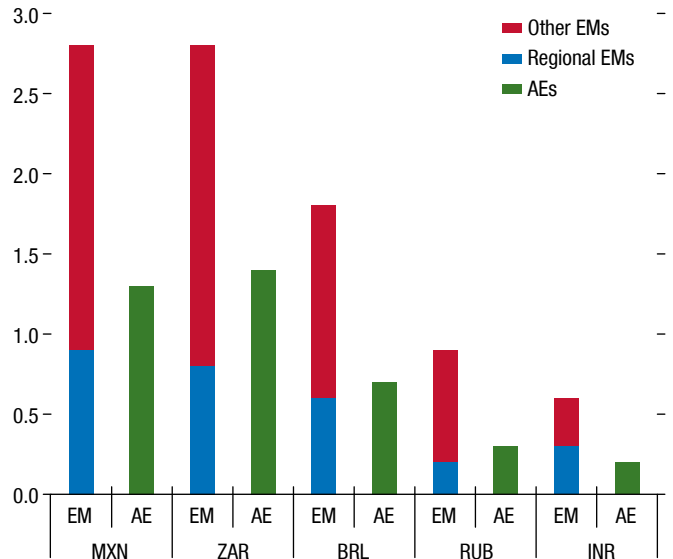


Source: IMF staff calculations.  
 Note: The figure shows the percent contribution of each variable to the overall regression ( $R^2$ ), using relative weight analysis as described in Nathans, Oswald, and Nimon 2012. AE = advanced economy; Country risk = receiver's International Country Risk Guide rating relative to transmitter; EM = emerging market economy; Financial linkages = receiver's and transmitter's portfolio and foreign direct investment flows; GFC = global financial crisis; Market cap. and development = spillover transmitter's equity market capitalization and financial institution development of spillover receiver, respectively; Market integration = de jure (capital account openness) and de facto (transparency of government policymaking) measures of market segmentation; Trade = transmitter's trade of goods and services with partners. Definitions of variables are in Annex Table 2.2.1.

firm in the two markets.<sup>19</sup> The Chinese example is a particularly good case for why, in such circumstances, the previous analysis may understate financial market

<sup>19</sup>Chan and Kwok 2005; Fong, Wong, and Yong 2007; Mei, Scheinkman, and Xiong 2009; and Peng, Miao, and Chow 2007 find that the investor bases for these markets are close to mutually exclusive—the A-shares market is dominated by retail and, through the 1990s at least, inexperienced investors, whereas the B-/H-shares markets have been dominated by foreign institutional investors. The A-shares market has been subject to prohibition against short selling, and until 2010 investors did not have access to equity derivatives instruments, so arbitrage and hedging were severely limited. These factors are directly associated with a tendency toward more speculative behavior in the A-shares market, with a wedge between prices of identical shares of dual-listed firms, and with different return volatility patterns. Differential equity return dynamics cannot, in particular, be ascribed to either liquidity differentials (Pastor and Stambaugh 2003) or asset float (Hong, Scheinkman, and Xiong 2006) across the two sets of markets.

**Figure 2.14. Foreign Exchange Spillovers of Selected Emerging Market Economies, 2011–15**  
(Percentage points)



Source: IMF staff calculations.  
 Note: Regional EMs refer to EMs in emerging Asia, Europe, Latin America, or Middle East and Africa. AE = advanced economy; BRL = Brazilian real; EM = emerging market economy; INR = Indian rupee; MXN = Mexican peso; RUB = Russian ruble; ZAR = South African rand.

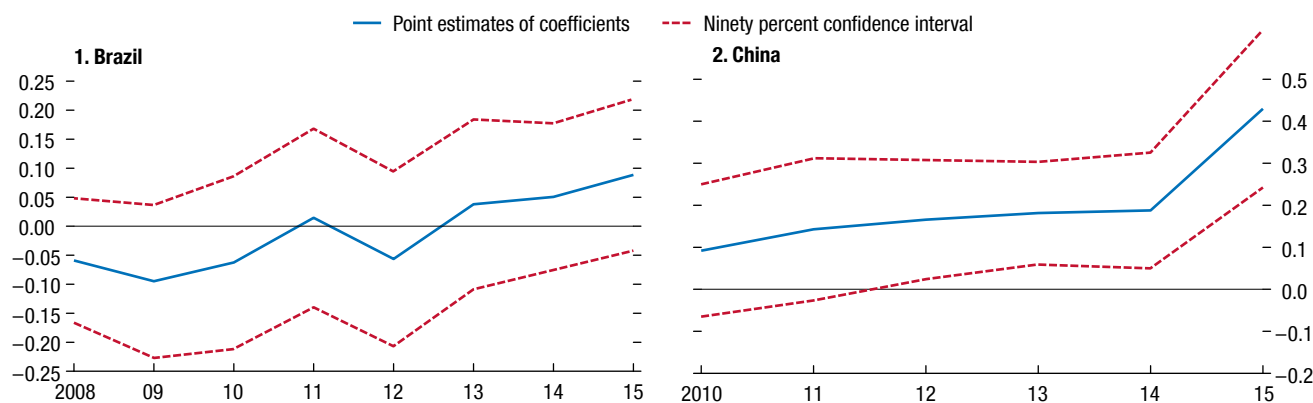
spillovers to other countries from shocks to domestic fundamentals.

Growth surprises in China have had an increasing and, in recent years, significant impact on equity markets in other economies (Figure 2.15). A factor model of equity returns was estimated to study the spillover effects of surprises about growth in three major emerging market economies on financial markets in 13 other emerging market economies and 25 advanced economies.<sup>20</sup> The results reveal a strong and steady increase in the impact of growth surprises from China on emerging market and advanced economy equity returns over the past two decades, with the shock impact turning statistically significant shortly after the global financial crisis (see also Shu and others 2015). This stands in contrast to growth surprises from other major emerging market

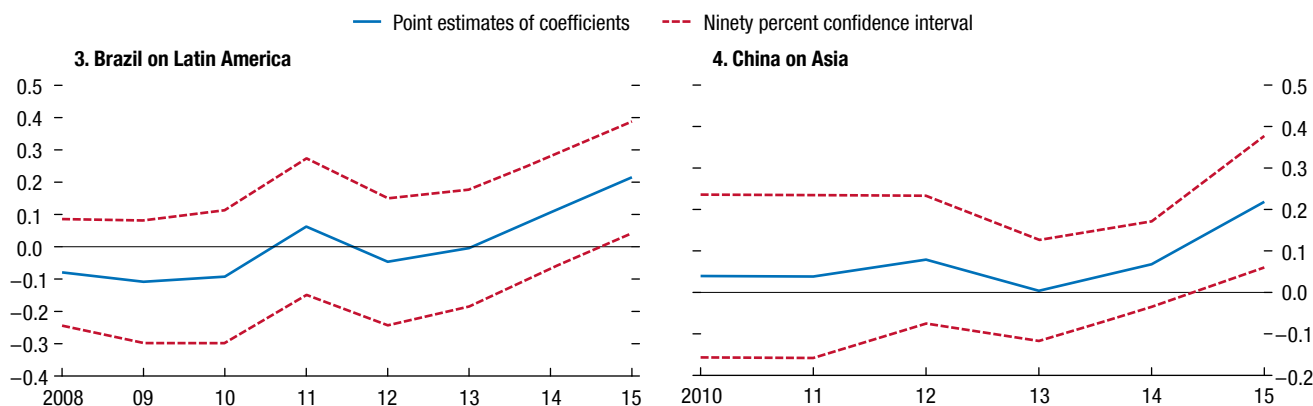
<sup>20</sup>See Annex 2.3 for a detailed exposition and description of the database. Growth surprises are proxied by news about realized changes in industrial production relative to market expectations. The three major emerging market *shock transmitters* are Brazil, China, and Russia. The selection of the shock recipient markets was based on data availability on market returns at a daily frequency and is consistent with the sample of countries included in the preceding section.

**Figure 2.15. Spillover of Growth Surprises in Major Emerging Market Economies**  
(Percentage points)

**Impact of Industrial Production Surprises on Equity Returns across the World**



**Impact of Industrial Production Surprises on Equity Returns across the Region**



Source: IMF staff calculations.

Note: The figure shows the (averaged across full sample of countries) response of equity prices to a 1 percentage point deviation in industrial production relative to median market forecast. The coefficients are estimated from five-year rolling regressions. The horizontal axis reports the last year of corresponding rolling windows.

economies, which do not share the significant nature of China’s impact on global equity prices.

Growth surprises in Brazil and China exert an increasing and significant impact on equity prices in other emerging market economies in their region (Figure 2.15). Brazil’s importance for regional financial markets is larger than its global imprint. In China’s case, however, the regional impact of growth surprises is smaller than on other emerging market and advanced economies.

The results are likely to underestimate the overall impact of news from emerging market economies but should reflect underlying trends well. First, only a very narrow set of news is considered here; that is, specific macroeconomic growth surprises but not, for example,

firm-level news, policy announcements, or political events. Second, *significant* news from these emerging market economies is likely to affect global factors, a channel that is excluded from the estimation. For example, Roache and Rousset (2015) find that news regarding Chinese industrial production has a significant impact on oil and selected metal prices.

The impact of shocks to China’s fundamentals on global financial markets is expected to grow stronger and wider over time (Box 2.1). Beyond the continued growth in importance of the Chinese economy, the size of financial market spillovers is also likely to grow because of the transition to a more market-based financial system and a decline in market segmentation. Moreover, the challenge of engineering a smooth tran-

sition will make global financial markets more sensitive to changes in China's economic and financial conditions and policies. This is consistent with the evidence on the impact of more uncertain Chinese growth prospects on commodity markets and currencies (October 2015 GFSR, Chapter 1). In both equity and bond markets, the inclusion of Chinese securities and indices in emerging market and global benchmark indices will likely have a large global impact. As banking and market linkages rise, the use of the renminbi as a funding currency as well as a reserve currency will grow, which will also increase spillovers through foreign exchange markets.<sup>21</sup>

### A Closer Look at the Portfolio Rebalancing Channel of Spillovers

*This section examines the role of mutual funds in propagating shocks across countries. It uses microlevel data on fund exposures to quantify financial interdependence across countries through the presence of common investors. These common exposures are a significant contributor to equity return spillovers—much more for spillovers across emerging markets than to advanced economies.*

The presence of common investors may be a source of cross-country financial market spillovers. This can occur when losses cause fund managers to become more risk averse and rebalance their portfolios toward those of their peers. In doing so, they will shed assets where they are overexposed relative to their benchmark (Broner, Gelos, and Reinhart 2006). For funds dedicated to investing in emerging market economies, the transmission of shocks can then occur across these emerging market economies; for funds investing in both advanced and emerging market economies, the transmission of shocks can happen between both groups of countries, and in both directions. In this framework, country A will be vulnerable to shocks to country B if it shares with country B funds that are overweight on both A and B (and if the investments of these funds are significant relative to their own domestic market size).<sup>22</sup> This is because if country B's

assets fall in value, it will cause strong losses to funds with heavy investment in country B, driving the funds to reduce their overweight positions across the board, including on country A.

An examination of countries' reliance on investors that are overweight in emerging market economies suggests that *financial interdependence* through the presence of common investors has risen significantly (Figure 2.16). Both emerging market and advanced economies in our sample now rely significantly more (as measured by the share of their equity and bond market capitalization) on globally active equity and bond mutual funds that are overweight on emerging market economies relative to their benchmark weights (see also Box 2.2 for a description of the growth in bilateral cross-border exposures of mutual funds). The common investor channel of spillovers from emerging market economies may, therefore, have risen in importance. It is, however, less important for less financially integrated economies such as China, particularly on the bond market side.

There is evidence that the role of financial interdependence through common investors is a significant contributor to equity return spillovers (Figure 2.17). The empirical approach assesses how much country A's asset returns influence those of country B via trade linkages, relative market size, and financial interdependence through common overweight mutual fund investors.<sup>23</sup> Overall, the role played by financial interdependence both is economically significant and has risen since the global financial crisis, accounting for more than a quarter of the variation in equity returns explained by the model.<sup>24</sup> In particular, financial interdependence via common investors is a statistically significant contributor to financial spillovers from emerging market economies, particularly to advanced economies. The size of this effect on spillovers from advanced to emerging market economies remains, however, about three to four times greater than the other way around. In other words, common investors are still much more likely to transmit shocks from advanced to emerging market economies than vice versa. The role of common investors is weaker,

<sup>21</sup>The inclusion of the renminbi in the IMF's special drawing right basket may have already kick-started the process of its growth as a reserve currency.

<sup>22</sup>The underlying reason for this mechanism is that funds typically get evaluated with respect to a benchmark, and tend to suffer redemptions when they underperform. The effect works both ways (for positive as well as for negative shocks) and may explain momentum trading, as documented elsewhere (Raddatz and Schmukler 2012).

<sup>23</sup>The analysis is based on the model of Broner, Gelos, and Reinhart (2006, section 6). See Annex 2.4 for details.

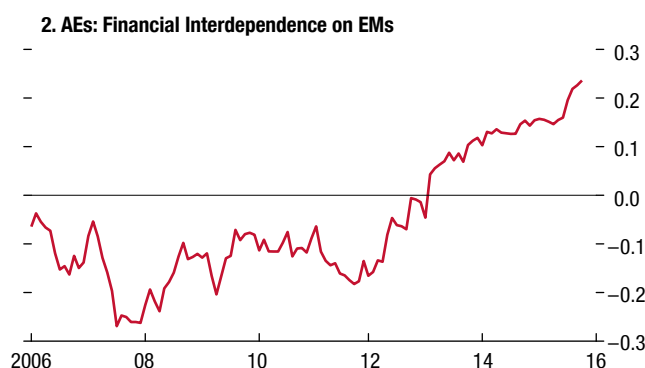
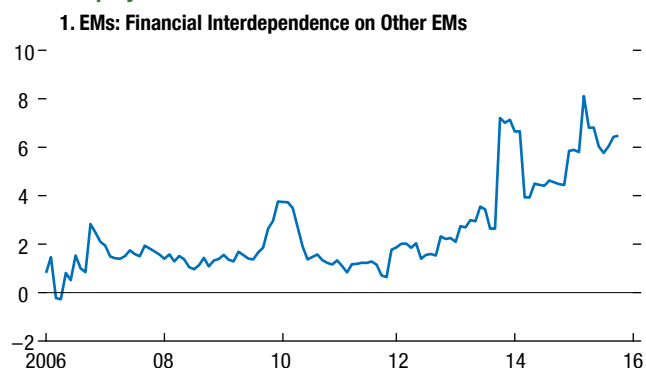
<sup>24</sup>This finding is quite robust to the choice of model specification. While financial interdependence is a statistically significant driver of bond returns in our sample of countries, and its economic significance has doubled since the global financial crisis (Figure 2.17), it grew from a very low base and remains nascent.



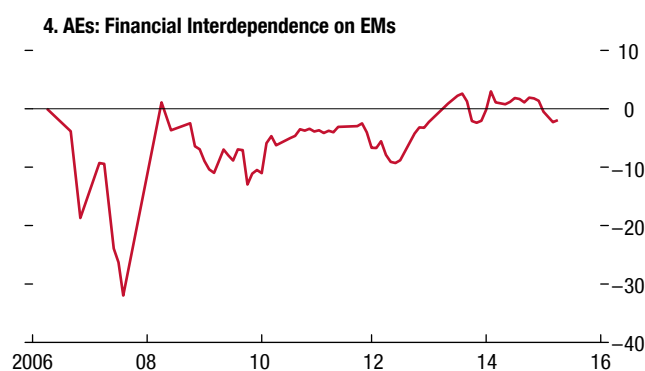
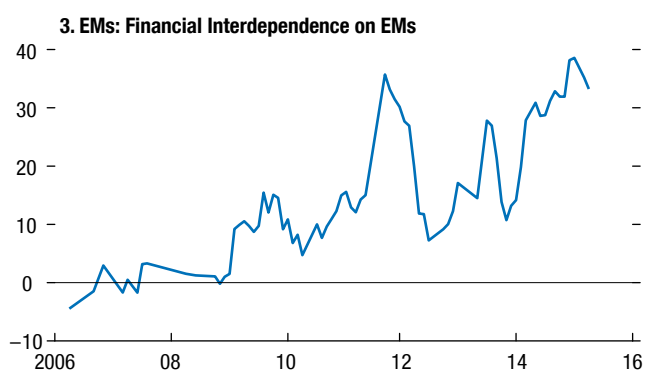
**Figure 2.16. Financial Interdependence on Emerging Market Economies through Global Funds**

(Index value)

**Global Equity**



**Global Bonds**



Source: IMF staff calculations.

Note: Financial interdependence is a measure of one country's reliance on investments by funds that have larger-than-average positions in another country. Here, this measure is averaged across country groups. AE = advanced economy; EM = emerging market economy.

however, in explaining spillovers between emerging market economy stock markets.

**Conclusions**

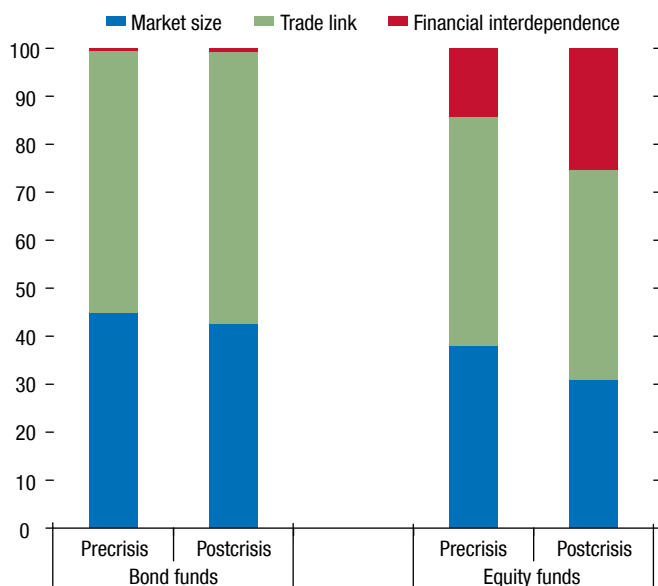
Financial globalization has made asset markets increasingly interdependent. About 70 percent to 80 percent of equity and foreign exchange returns in both advanced and emerging market economies are by now attributable to international factors. In other words, financial spillovers are the norm, not the exception.

In particular, this chapter has found evidence for a growing role of financial spillovers from emerging market equity and foreign exchange markets. Over a third and 40 percent, respectively, of the variation in advanced and emerging market economies' stock returns and exchange rate fluctuations can now be explained by emerging financial markets. Bond

markets do not display a corresponding trend, mainly because their behavior in recent years has mostly been driven by global factors, and the portfolio channel of contagion through financial interdependence on emerging market economies still remains economically insignificant for bonds. Emerging market economies that are more financially integrated transmit larger spillovers, notwithstanding factors such as economic size and trade volumes. Cross-country spillovers are strongest within economic sectors and are most pronounced among tradable goods and globally integrated sectors.

Financial factors are becoming more important relative to trade linkages in explaining the patterns of spillovers. The increase in financial integration, through a decline in both legal and informational barriers, has contributed to the growth in shock transmission. The role of common investor mechanisms has also increased

**Figure 2.17. Contributions to Variation in Bond and Equity Returns in Advanced and Emerging Market Economies (Percent)**



Source: IMF staff calculations.

Note: The figure shows the percent contribution of each variable to the overall regression ( $R^2$ ), using relative weight analysis as described in Nathans, Oswald, and Nimon (2012). The  $R^2$  values are 0.41 and 0.56 for bonds and 0.29 and 0.54 for equities in the pre- and postcrisis periods, respectively.

in importance because investment funds are intermediating a larger share of capital flows. Stocks of firms with higher leverage and that are more dependent on external financing are more susceptible to spillovers.

News about China's growth has become increasingly influential in driving global equity returns, but the role of purely financial mechanisms remains subdued. News about China also has a measurable impact on global oil and commodity prices. By contrast, purely financial factors (such as contagion effects stemming from the portfolio reshuffling of common investors) remain less significant. China's spillovers to global financial markets can be expected to see a significant further increase in the next few years.

The findings suggest the following policy implications:

- The growth in financial spillovers from emerging market economies means that when assessing macro-financial conditions, policymakers may need to increasingly take into account economic and policy developments in emerging market economies. This also includes the need to pay increased attention to possible financial “spillbacks” from emerging market economies stemming from advanced economies’ policy actions. The development also underscores the importance of enhanced international macroeconomic and macroprudential policy cooperation.
- Policymakers need more comprehensive and granular data on capital flows and their intermediation by banks, large institutional investors, and investment funds to better assess risks and vulnerabilities and identify potential shock triggers and spillover channels.
- Given evidence that financial deepening can attenuate financial spillover of external shocks, governments should promote specific forms of financial deepening, for example developing a local investor base (GFSR April 2014, Chapter 2).
- As China's role in the global financial system grows, clear and timely communication of its policy decisions, transparency about its policy goals, and strategies consistent with achieving them will be increasingly important to avoid volatile market reactions with wider reverberations.
- Enhancing surveillance of cross-border financial flows intermediated by asset managers is a priority, as is shaping micro- and macroprudential rules to guard against systemic risks from mutual funds.
- Lastly, it will be important for authorities to deploy appropriate macroprudential measures targeted at bank- and market-based financing to limit excessive increases in corporate leverage that can threaten financial stability (GFSR October 2015, Chapter 3).

### Box 2.1. Spillover Channels from China—From Real to Financial Linkages?

*The main driver of spillovers from China continues to be news about the country’s growth prospects (October 2015 GFSR, Chapter 1). Concerns about weaker Chinese growth and import demand have driven down commodity prices, weighing on exchange rates of emerging market economies with strong trade ties and high commodity dependence. But direct financial linkages have also grown in the past few years, with cross-border bank exposures to China exceeding \$1 trillion and Chinese issuers dominating Asia’s external dollar bond markets. Financial linkages are expected to grow substantially in strength, and financial market spillovers can be expected to expand accordingly.*

#### Trade Integration Has Proceeded Rapidly, but Financial Integration Has Yet to Catch Up

After many years of rapid economic growth since the 1980s, China has emerged as the largest trading nation and the second largest economy in the world. However, the global financial implications of this growth have been relatively muted owing to capital controls and a complex set of rules constraining trading and investment behavior in domestic markets, which have therefore remained segmented. Still, in recent years, capital controls have become

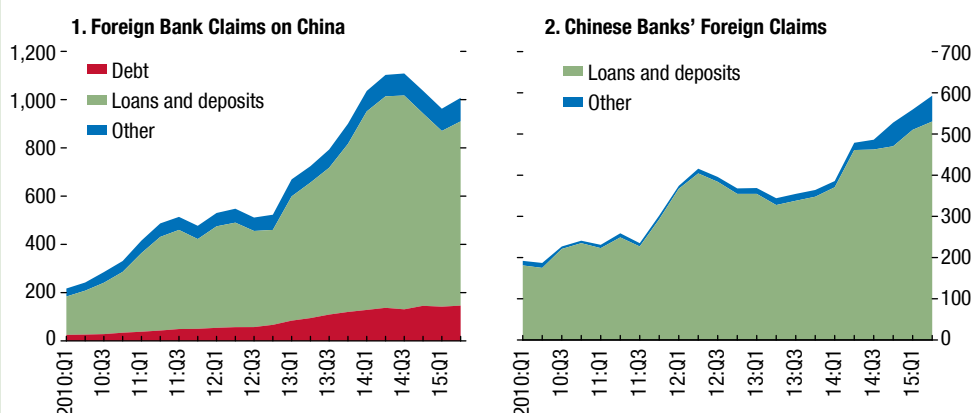
The author of this box is Hui Miao.

more porous, and capital flows sizable. More recently, Chinese authorities have adopted many financial liberalization measures that have paved the way for the renminbi’s inclusion in the IMF’s special drawing right basket. China’s financial integration with the rest of world is expected to accelerate, and its financial influence abroad will likely catch up with its economic prowess (Bayoumi and Ohnsorge, 2013; He and Luk 2013; He and others 2012; Hooley 2013).

Growth in cross-border banking in the past five years has been striking, and if the recent pace keeps up, China will emerge as a major global banking hub in the medium term. Bank lending is the main channel of financial linkages between China and the rest of the world. During 2010–15, cross-border bank lending to Chinese entities rose more than five times, to more than \$1 trillion, and Chinese bank lending abroad increased three times, to about \$600 billion (Figure 2.1.1 and April 2015 GFSR, Chapter 2). As Chinese firms continue their overseas expansion, Chinese banks are likely to follow.

The opening up of Chinese bond and equity markets will have major implications for global asset allocation. The Chinese bond market, which has the third largest market capitalization in the world at \$6.7 trillion, has been growing at an annual average rate of 22 percent over the past five years (Figure 2.1.2). The bond market was largely closed to foreign

**Figure 2.1.1. China: Growth in Cross-Border Banking Claims and Liabilities**  
(Billions of U.S. dollars)



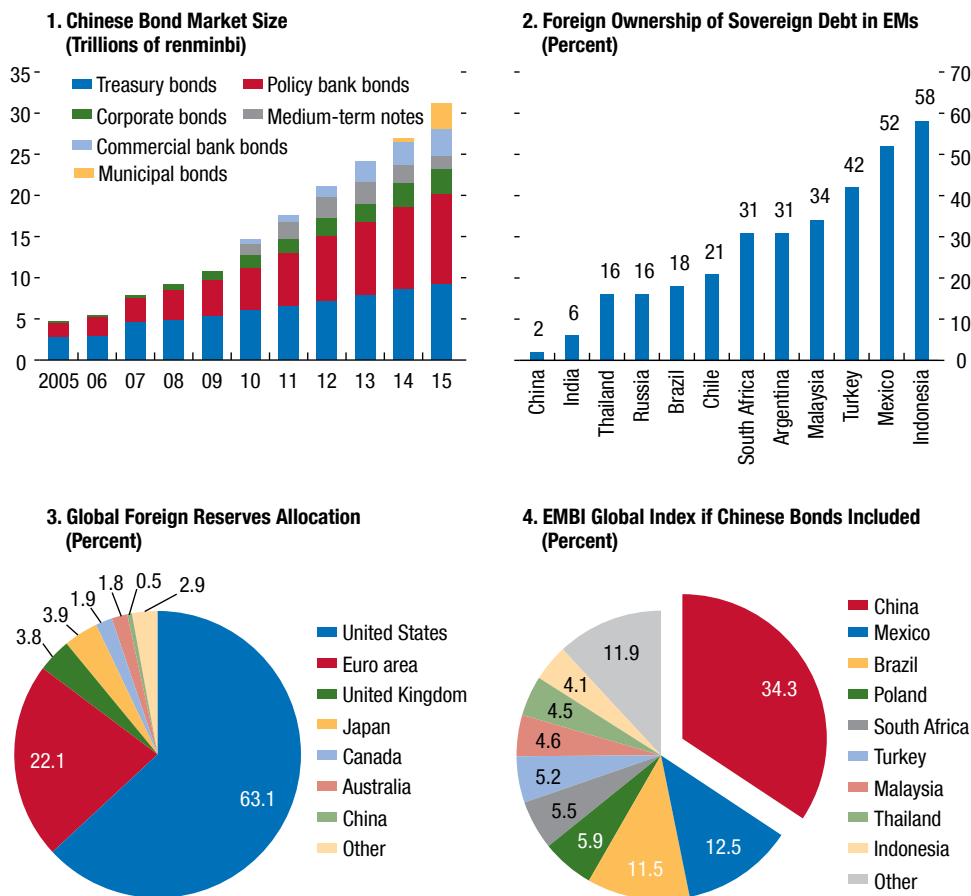
Sources: Bank for International Settlements; and IMF staff calculations.  
Note: Loans include those extended by nonfinancial companies owned by banks. In panel 2, the debt data are too small to be shown.

**Box 2.1. (continued)**

investors until 2015, when foreign central banks and sovereign wealth funds were allowed to invest. Foreign central banks can be expected to allocate more reserves to Chinese bonds, and foreign private investment in renminbi bonds is also likely to rise as the bond market opens up further. This can have significant implications for global asset allocation and emerging market economy financial markets. Whereas Chinese bonds are not included in any global index at present, if included, their index weight would be about one-third in the widely followed J.P. Morgan Emerging Markets Bond Index Global. On the equities side, if A-shares were included in a global equity index, their Morgan Stanley Capital International emerging market index weight would be close to 10 percent.

Outward portfolio investment by Chinese residents in global bond and equity markets is also likely to increase significantly. China's gross international investment position is only 107 percent of GDP, significantly less than that of Japan and the United States, reflecting the fact that Chinese households hold limited foreign assets. As the capital account opens up, Chinese households are likely to increase their investment in foreign financial markets, seeking diversification. The pent-up demand for offshore assets by the Chinese private sector is high, and the liberalization of the capital account would imply a significant development for global asset markets. For example, if foreign assets were to reach 10 percent of household savings deposits, this would imply an additional \$1 trillion invested overseas.

**Figure 2.1.2. Chinese Bond Markets and Global Asset Allocation**



Sources: Bank for International Settlements; and IMF staff calculations.  
 Note: EM = emerging market economy; EMBI Global = J.P. Morgan Emerging Markets Bond Index Global.

## Box 2.2. Bilateral Cross-Border Exposure through Mutual Funds

*This box quantifies and analyzes the significance of cross-border exposure in bonds and equities through mutual funds, and contagion effects brought about by investors residing in countries affected by a shock for a sample of advanced and emerging market economies.<sup>1</sup> Although emerging market economies are now more connected to global markets through mutual fund investments, investors residing in these countries are unlikely to transmit shocks to advanced economies.*

Cross-border exposure of mutual funds domiciled in a selected group of advanced and emerging market economies has increased significantly over the past 15 years (Table 2.2.1). On average, cross-border holdings by equity mutual funds grew from 4.25 percent of the recipient country's GDP in July 2007 to about 5.9 percent by November 2015. For bond funds, the growth in average exposure has been even more significant, quadrupling over the same period, from 0.35 to 1½ percent of GDP. Although emerging market economies have become more central to the global network of mutual fund flows and exposures, they are still considerably behind advanced economies. In November 2015, emerging market economy assets represented 21 percent and 29 percent, respectively, of cross-border mutual funds' bond and equity assets, but the share owned by emerging market bond and equity mutual fund investors was much lower, at only 4 percent and 2 percent, respectively.

A significant body of research has found that financial intermediaries, particularly mutual funds, can play an important role in the transmission of financial shocks and in explaining the observed excess comovement in asset prices across countries (Gelos 2011; April 2015 GFSR, Chapter 3). In fact, the behavior of end-investors is an important driver of mutual fund behavior (Brandão-Marques, Espinosa-Vega, and Solé forthcoming), often leading to fire-sale transactions (Coval and Stafford 2007). Although mutual fund flows caused by fire sales seem to explain a significant portion of emerging market equity

The authors of this box are Luis Brandão-Marques, Marco Espinosa-Vega, and Juan Solé, with research assistance from Diego Wachs.

<sup>1</sup>The analysis categorizes financial markets following the Morgan Stanley Capital International classification. Advanced economies comprise Austria, Belgium, Finland, France, Germany, Italy, Japan, Netherlands, Spain, Switzerland, United Kingdom, and United States. Emerging market economies comprise Brazil, Chile, China (including Hong Kong SAR), Greece, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Peru, Philippines, Poland, Russia, South Africa, Thailand, and Turkey.

prices (Jotikasthira, Lundblad, and Ramadorai 2012), few studies have documented emerging market economy spillovers and contagion through the behavior of *investors domiciled in the affected country* as opposed to international investors in third countries (see, however, Brandão-Marques, Espinosa-Vega, and Solé, forthcoming).

To assess the significance of this mechanism, the identified network of bilateral country exposures through mutual funds was subjected to a simulated shock. The starting point is a significant drop in emerging market economies' stock prices (15 percent, on average), possibly as a result of a global shock, such as a fire sale caused by investors from advanced economies. If, in a given step of the simulation, the drop in prices is greater than a threshold defined as the 5th percentile of historical monthly returns, it is assumed that investors residing in the affected market sell 35 percent of their assets abroad and propagate the shock. For equities, the price response of each market to the sell-off is estimated using the average ratio of monthly returns to volume of trade as a price elasticity.<sup>2</sup> The results of the simulation (see Brandão-Marques, Espinosa-Vega, and Solé, forthcoming) suggest that the dynamics of a shock to advanced economies only are similar to those of a shock to both advanced and emerging market economies. Moreover, shocks to emerging market economies do not spill over to advanced economies through *the sales of investors based in emerging market economies* and only do so modestly to other emerging market economies.<sup>3</sup> That is, *spillbacks* through this particular channel are still likely to be low. However, advanced economy investors' sales in advanced and emerging market economies in response to initial losses in emerging market economies may still be a powerful contagion mechanism, as discussed earlier in this chapter.

<sup>2</sup>The measure of price pressure is similar to Amihud's measure of market illiquidity (Amihud 2002). Since volume data are, in general, not available for bond markets, the simulation assumes that the price response is twice that observed in equity markets, given that these markets are relatively illiquid (October 2015 GFSR, Chapter 2). Although the assumption of a 30 percent drawdown from all advanced economies is extreme but not without precedent, the price elasticities used in the exercise are in general mild, since they do not incorporate the effect of panic sales.

<sup>3</sup>However, a number of factors may increase the likelihood of spillovers from emerging market economies. First, other institutional and retail investors may join the fire sale and amplify the drawdown. Second, price responses may be highly nonlinear, whereas the simulation assumes them to be linear. Finally, the second-round effects may elicit additional responses if they change investors' perceptions about fundamentals or the likelihood of contagion.

## Box 2.2. (continued)

Table 2.2.1. Geographical Distribution of Cross-Border Exposures

In July 2007, there were already significant cross-border exposures through equity mutual funds ... and they continued to increase until November 2015.

Equity Mutual Funds (Percent of recipient country's GDP)					
July 2007	Advanced Europe	Japan	United States	Large EMs	Other EMs
Advanced Europe	—	0.02	4.16	0.03	0.05
Japan	1.84	—	4.71	0.05	0.04
United States	1.04	0.01	—	0.02	0.03
Large EMs	1.96	0.03	2.58	—	0.06
Other EMs	1.81	0.02	2.88	0.03	—
November 2015	Advanced Europe	Japan	United States	Large EMs	Other EMs
Advanced Europe	—	0.16	6.66	0.08	0.07
Japan	2.52	—	7.17	0.09	0.04
United States	2.84	0.39	—	0.08	0.05
Large EMs	1.55	0.12	2.63	—	0.04
Other EMs	1.63	0.12	3.30	0.08	—

While for bond funds, exposures were small in 2007... but have become significantly more important at the end of 2015.

Bond Mutual Funds (Percent of recipient country's GDP)					
July 2007	Advanced Europe	Japan	United States	Large EMs	Other EMs
Advanced Europe	—	0.00	0.14	0.00	0.01
Japan	0.18	—	0.15	0.00	0.01
United States	0.23	0.00	—	0.00	0.01
Large EMs	0.17	0.00	0.14	—	0.01
Other EMs	0.42	0.01	0.27	0.01	—
November 2015	Advanced Europe	Japan	United States	Large EMs	Other EMs
Advanced Europe	—	0.11	1.10	0.07	0.07
Japan	0.31	—	0.38	0.01	0.01
United States	1.83	0.15	—	0.06	0.05
Large EMs	0.32	0.06	0.23	—	0.01
Other EMs	1.33	0.15	1.12	0.05	—

Sources: EPFR Global; IMF, Coordinated Portfolio Investment Survey; and IMF staff calculations.

Note: The table shows cross-border exposures by mutual funds in percent of the recipient country or region's GDP. Each cell shows, by row, the assets in a given country or region owned by mutual funds domiciled in the country or region displayed in the respective column. Data include direct and indirect exposures (through mutual funds domiciled in offshore financial centers, which are apportioned to each country in the sample using the IMF's Coordinated Portfolio Investment Survey, Equity Investments). A darker shade of red indicates larger exposure. For November 2015, GDP figures refer to 2014. EM = emerging market economy.

## Annex 2.1. Estimation of Spillovers and Assessment of the Relative Importance of Spillover Channels

### Defining Spillovers

The approach to measuring financial interconnectiveness and spillovers follows closely the methodology proposed by Diebold and Yilmaz (2014). A VAR-based econometric framework is estimated in order to capture financial spillovers across advanced and emerging market economies. Within this VAR model, a spillover is defined as the fraction of the  $H$ -day-ahead forecast error variance of country  $j$ 's asset return that can be accounted for by innovations in country  $i$ 's asset return.

For equity market spillovers, country-specific equity returns refer to the main stock market index returns in local currency.<sup>25</sup> The sample starts in January 1995 and ends in October 2015. Similar to Diebold and Yilmaz (2014), time-varying spillovers are obtained by employing a rolling-window estimation approach. In the baseline model, the rolling window is based on 250 business days, which covers an entire year. The first estimation point refers to the end of December 1995.<sup>26</sup> A similar framework is used for sovereign bond yields, currencies, and equity sector indices.<sup>27</sup> When the set of variables is very large as in the case of cross-country, cross-sector spillover estimation, the VAR model is estimated using shrinkage techniques (such as elastic net, lasso), which allow for the estima-

tion of large VARs (Demirer and others 2015; Song and Bickel 2011).

A VAR model amended by several exogenous variables (VARX) can be written as

$$Y_t = \alpha + \sum_{i=1}^p \gamma_i Y_{t-i} + \sum_{i=0}^p \beta_i X_{t-i} + u_t$$

$$u_t \sim iid(0, \Sigma_u). \quad (1)$$

The estimation of the VARX model is done recursively, with the number of lags set to one. The set of endogenous ( $Y$ ) variables consists of daily log-returns from 33 countries. To circumvent differences in time zones, two-day average returns are used (Forbes and Rigobon 2002). Several control factors are used to account for common/systematic global factors.

Using the framework proposed by Koop, Pesaran, and Potter (1996) and Pesaran and Shin (1998), we apply the generalized variance decomposition (GVD) identification framework. GVDs, being order invariant by construction, avoid the ad hoc ordering of structural shocks characteristic of recursive identification. This is a distinct advantage given that the sample of countries is large and heterogeneous and identification schemes such as those based on short- and long-term restrictions (Lütkepohl 2005), sign restrictions, and heteroscedasticity (Rigobon 2003) are neither feasible nor practical (Killian 2013). However, GVDs do not orthogonalize structural shocks, so in general it is not possible to attribute the part of the forecast error variation in an endogenous variable  $\{j\}$  that arises from a shock to variable  $i$  directly to structural innovations in  $i$  as opposed to innovations in other variables  $\{j\}$  that are caused by their correlation with structural shocks to  $i$ . Our findings are robust to some alternative approaches to frameworks for VAR identification in which equity return spillovers derived under the baseline GVD identification approach were compared with those estimated by averaging across a very large sample of randomly selected Cholesky orderings. Specifically, spillover indices were estimated using the Cholesky decomposition with random variable sequences (Klößner and Wagner 2014). The baseline results were compared with the average, minimum, and maximum spillover index from a set of 10,000 random orders. Although the estimated level of total cross-country equity market spillovers is lower than under the generalized impulse response function framework, all our baseline results hold in this model as well.

<sup>25</sup>The set of equity indices includes 13 advanced economies (Australia, Canada, Denmark, euro area, Hong Kong SAR, Israel, Japan, Norway, Singapore, Sweden, Switzerland, United Kingdom, United States) and 20 emerging market economies (Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Peru, Philippines, Poland, Russia, South Africa, Thailand, Turkey). Countries are classified as "advanced" and "emerging market" economies as per the taxonomy of Morgan Stanley Capital International as of 2011.

<sup>26</sup>Results are robust to the following: U.S. dollar; excess and real returns; equity return volatilities; foreign exchange returns, bond yields, and returns; other global factors and their combinations (oil and commodity prices); TED, term, and credit spreads; global interest rates, global (and U.S.) policy and shadow rates, global equity returns, and change in the Chicago Board Options Exchange Standard & Poor's 500 Implied Volatility Index; daily versus weekly frequencies and daily windows of 125 and 750 days; lags of two and five; and horizons of one, two, and five days.

<sup>27</sup>Spillovers are also obtained using sector-level equity indices within the framework described in this annex. There are seven sectors for each country: basic materials, consumer goods, consumer services, financial services, industrials, oil and gas, and telecommunications and technology.

### Interconnectedness/Spillover Indices

At each estimation point, the GVD for each variable is further aggregated in a matrix. The non-diagonal elements are referred to as “spillovers.” The average sum of nondiagonal elements defines the main spillover index:

$$SI = \frac{100}{N} \sum_{i=1}^N \sum_{j \neq i}^N d_{ij}. \quad (2)$$

This index can be further decomposed into four spillover subcomponents: among advanced economies, among emerging market economies, from advanced to emerging market economies, and vice versa. For example, the index of spillovers from emerging market to advanced economies can be written as follows:<sup>28</sup>

$$SI_{EM \rightarrow AE} = \frac{100}{N} \sum_{i=M+1}^N \sum_{j=1}^M d_{ij} \quad (3)$$

$$SI_{EM \rightarrow AE} + SI_{AE \rightarrow EM} + SI_{EM \rightarrow EM} + SI_{AE \rightarrow AE} \equiv SI, \quad (4)$$

in which the sum of the subcomponents equals the main spillover index (*SI*).

### Assessing the relative importance of spillover channels and country characteristics

The relative importance of the drivers of cross-country spillovers across equity and foreign exchange markets is assessed through dynamic panel regression models estimated at an annual frequency spanning the period 1995–2014. The spillover indices obtained at both country and sector levels through the VAR model are used as dependent variables in this exercise.

At the country level, for a pair of spillovers from economy *j* (transmitter) to *i* (receiver), at time *t*, the general specification of the regression model can be written as follows:

$$\begin{aligned} spillovers_{i,jt} = & \alpha_1 TRADE\ CHANNEL_{jt} + \beta_1 FINANCIAL\ CHANNEL_{i,jt} \\ & + \delta_1 MACRO_{i,jt} + \delta_2 POLICY_{i,jt} + \delta_3 INST_{i,jt} \\ & + GFC_t + postGFC_t + Other_{i,jt}, \end{aligned} \quad (5)$$

in which the dependent variable *spillovers* is the end-of-year-*t* spillover. *TRADE CHANNEL* denotes the transmitter’s total trade in goods and services with all partners in the sample in percent of its domestic

<sup>28</sup>The system of endogenous variables consists of *N* vectors (e.g., *M* advanced economies and [*N*-*M*] emerging market economies).

GDP; *FINANCIAL CHANNEL* denotes the portfolio and foreign direct investment flows of the transmitter and receiver with the rest of the world in percent of their respective domestic GDP; *MACRO* refers to the similarity, measured as absolute value of the difference, of the spillover receiving country’s composite risk rating (International Country Risk Guide index) relative to the spillover transmitter; *POLICY* includes measures that affect domestic financial market segmentation and include the indices of capital account openness and of the transparency of government policymaking in the receiver and the transmitter; *INST* includes indices of the development of financial institutions of the receiver and of the equity market capitalization of the receiver and transmitter; *GFC* is the time dummy for the global financial crisis (2007–09); and *postGFC* is the dummy for the period from 2010 to 2014. The panel regressions include fixed effects, and the standard errors are clustered at the level of the transmitters and receivers, respectively, as a robustness check.

At the sector level, analysis provides a complementary perspective to that conducted at the country level. Country-level regressors described above are augmented by sector-level bilateral trade and key corporate financial indicators (sector size, solvency, liquidity, profitability, external financial dependence).<sup>29</sup>

### Annex 2.2. Description and Definition of Variables

This annex summarizes the data sources and definitions used in this chapter’s analysis (Annex Table 2.2.1).

### Annex 2.3. Surprise Approach

We use a classical factor model of equity returns to study the spillover of shocks to growth expectations in three major emerging market economies (Brazil, China, Russia) to equity prices in our sample of advanced and other selected emerging market econo-

<sup>29</sup>Corporate financial indicators are proxied by the following sector metrics: interest coverage ratio (solvency), current ratio (liquidity), return on equity (profitability), Rajan-Zingales (1995; external financing dependence), and total assets (size). Sector averages within each country are used.



**Annex Table 2.2.1. Definitions of Variables**

Variable	Description	Source
<b>Trade and Financial Linkages</b>		
Transmitter's Trade of Goods and Services with Partners	The sum of exports and imports of goods and services of a spillover-transmitting country with all partner countries in the sample as percent of world GDP	DOTS
Bilateral Trade (sector level)	The sum of exports and imports of goods and services in percent of domestic GDP	UN Comtrade
Receiver's Portfolio and FDI Flows	The sum of portfolio and FDI flow of spillover-receiving country vis-à-vis the world in percent of domestic GDP	IMF, WEO
Transmitter's Portfolio and FDI Flows	The sum of portfolio and FDI flow of spillover-transmitting country vis-à-vis the world in percent of domestic GDP	IMF, WEO
Receiver's FDI Flows	FDI flow of spillover-receiving country vis-à-vis the world in percent of domestic GDP	IMF, WEO
<b>Macroeconomic, Policy, and Institutional Factors</b>		
<i>Country Risk</i>		
Receiver's ICRG Rating Relative to Transmitter	The absolute value of the difference between the ICRG composite risk rating of a receiver and transmitter	PRS Group
<i>Market Capitalization and Development</i>		
Receiver's Financial Institutional Development	Index that summarizes information regarding financial institutions (banks and non-banks), and financial markets across three dimensions: depth, access, and efficiency	Sahay and others, 2015
Transmitter's Stock Market Capitalization	Transmitter's stock market capitalization divided by world GDP	Datastream; IMF, WEO
Receiver's Stock Market Capitalization Relative to Transmitter	Difference in stock market capitalization in percent of world GDP between receiver and transmitter	Datastream; IMF, WEO
<i>Market Integration</i>		
Capital Account Openness Index	The Chinn-Ito index (KAOPEN), which is an index measuring a country's degree of capital account openness and normalized to a number from 0 to 1	<a href="http://web.pdx.edu/~ito/Chinn-Ito_website.htm">http://web.pdx.edu/~ito/Chinn-Ito_website.htm</a>
Transparency of Government Policymaking	Index of transparency of government policymaking (World Competitiveness Index)	World Economic Forum
<b>Sector Variables</b>		
Return on Equity	Net income divided by total equity, sector average	Worldscope
Interest Coverage Ratio	Earnings before interest, taxes, depreciation and amortization (EBITDA) or earnings before interest and taxes (EBIT) divided by interest expense, sector average	Worldscope
Current Ratio	Current assets to current liabilities, sector average	Worldscope
External Financing Dependence	Rajan and Zingales (1995) index measures dependence on external finance as a firm's capital expenditures minus cash flow from operations divided by capital expenditures, sector average	Worldscope
Size	Total assets, sector average	Worldscope
<b>Global Variables</b>		
VIX	Chicago Board Options Exchange Market Volatility Index	Datastream
Commodity Price Index	S&P Goldman Sachs Commodity Price Index	Datastream
U.S. Term Spread	The difference between short-term (3-month) and long-term (10-year) U.S. interest rates	Datastream
U.S. Credit Spread	The difference in yield between 10-year Treasury note and 10-year BBB corporate bond	Datastream
Global Shadow Rate	Principal component of the shadow rates of United States, euro area, and Japan	RBNZ and authors' calculations
Oil	Crude Oil–West Texas Intermediate Spot	Datastream
Global Stocks	Financial Times Stock Exchange 100 Index	Datastream
<b>News Shocks</b>		
UBS Surprise Indices	UBS Surprise Indices include both growth surprises and inflation surprises; see Annex 2.3 for detailed description	Bloomberg, L.P.
Industrial Production Indices and Forecasts	For each announcement by authorities, Bloomberg records the actual (announced) industrial production growth (year-over-year) as well as its median forecasts by market analysts	Bloomberg, L.P.
<b>Common Investor Variables</b>		
Market Returns	Percentage change in level of country-specific bond (equity) indices	Datastream
Market Size	Market capitalization of country-specific bond (equity) indices interacted with market returns	Datastream
Trade Links	Total trade between partner countries interacted with market returns	DOTS, Datastream
Financial Interdependence	Financial Interdependence Index interacted with market returns	EPFR Global, Datastream

Source: IMF staff.

Note: DOTS = Direction of Trade Statistics; FDI = foreign direct investment; ICRG = International Country Risk Guide; RBNZ = Reserve Bank of New Zealand; WEO = World Economic Outlook database.

mies.<sup>30</sup> The sample period starts between March 2003 (Russia) and April 2005 (China) and ends in November 2015.

Specifically, we expand a classical factor model of equity returns (see, for example, Cuadro-Saez, Fratzscher, and Thimann 2009) by including a set of spillover variables—idiosyncratic country-specific shocks from the three major emerging market economies:

$$r_{i,t} = \alpha_i + \beta_j S_{j,t}^{IP} + \mu G_t + \delta r_{i,t-1} + \varepsilon_{i,t}, \quad (1)$$

in which  $r_{i,t}$  is two-day equity returns in country  $i$  at date  $t$ ,  $S_{j,t}^{IP}$  is the difference between the actual announced industrial production growth rate and the median forecast by market analysts in emerging market economy  $j$  at date  $t$ ,  $G_t$  is a vector of global factors, and  $r_{i,t-1}$  is lagged two-day equity returns. Global factors include world equity returns as measured by the Financial Times Stock Exchange 100, world interest rate as measured by the three-month U.S. Treasury bill rate, global risk aversion as measured by the Chicago Board Options Exchange Standard & Poor's 500 Implied Volatility Index, and crude oil price. Equity returns and oil price are logged for easy interpretation. Because this is an event study analysis, we regress only the specification on announcement dates.<sup>31</sup>

As in Cuadro-Saez, Fratzscher, and Thimann (2009), the estimation uses an ordinary least squares estimator with panel-corrected standard errors.

### Annex 2.4. Common Investor Channel for Financial Spillovers from Emerging Market Economies

#### Data

The fund data come from EPFR Global and consist of observations of cross-country equity and bond portfolio fund investment allocations. Data on country

stock market returns and market capitalization were gathered from Thomson Reuters Datastream. All data are at monthly frequency and span the period 2000–15. See note 25 for the country list.

#### Methodology

A panel regression model with country fixed effects (Broner, Gelos, and Reinhart 2006) was used to measure the impact of investor overlap on portfolio investment recipient countries' stock market dynamics. The specification for this panel regression is<sup>32</sup>

$$r_{c,t} = \alpha_c + \beta_1 \cdot w_{c,t} \cdot r_{c,t} + \beta_2 \cdot t_{c,c',t} \cdot r_{c',t} + \beta_3 \cdot d_{c,c',t-1} \cdot r_{c',t} + \varepsilon_{c,t}, \quad (1)$$

in which, at time  $t$ ,  $r_{c,t}$  is the stock market return for country  $c$ ,  $w_{c,t}$  is the stock market capitalization for country  $c$ , and  $t_{c,c',t}$  is the share of country  $c$ 's total trade between country  $c$  and country  $c'$ .  $d_{c,c',t-1}$  is the value of the financial interdependence index at time  $t - 1$  and denotes country  $c$ 's reliance on investors who are also exposed to country  $c'$ . The model covariates  $w_{c,t} \cdot r_{c',t}$  and  $t_{c,c',t} \cdot r_{c',t}$  effectively serve as controls for the effect of stock market size and trade linkages.

Several steps were taken to mitigate the influence of outliers. First, we winsorized each regression variable at the 0.005th and 99.5th percentiles to remove the most extreme observations.<sup>33</sup> Then we robustly estimated the coefficients of our model using a modern estimation approach known as SMDM.<sup>34</sup> Model standard errors were transformed using the approach of Croux, Dhaene, and Hoorelbeke (2003) and are robust to the influence of both heteroscedasticity and autocorrelation.

#### Financial Interdependence Index

The *financial interdependence index* of Broner, Gelos, and Reinhart (2006) is a measure that can be used to assess the extent to which a given set of countries rely

<sup>30</sup>An alternate measure of growth and inflation surprises, supplied by UBS, was also analyzed to assess the spillover effects from six major emerging market economies: Brazil, China, Mexico, Russia, South Africa, and Turkey. Whereas results obtained were qualitatively similar to those presented in the chapter, an advantage of the surprise measure described here is that it accounts for the intensity/magnitude of the surprise, which is by construction not captured by the UBS measure.

<sup>31</sup>The coefficient on the emerging market economy shock surprise variable may be interpreted as follows. If the point estimate is 0.2 for  $S_{China}^{IP}$ , it means that if the actual industrial production growth rate beats the median forecast by 1 percentage point, the equity markets in other countries would rise by 0.2 percentage point on average.

<sup>32</sup> $\beta_j$ , for  $j \in \{1,2,3\}$ , are estimated regression coefficients,  $\alpha_c$  is the fixed effect attributable to country  $c$ , and  $\varepsilon_{c,t}$  is the portion of country  $c$ 's stock market return that is not explained by the model's covariates at time  $t$ .

<sup>33</sup>Another motivation for this mild use of winsorization was to clean from the regression data obvious data measurement errors, which were identified by IMF staff and confirmed by EPFR Global database experts.

<sup>34</sup>SMDM estimation differs from ordinary least squares estimation in that it seeks to minimize the iterated reweighted sum of squared differences between observed and predicted values of the dependent variable. This means the SMDM estimation procedure assigns less weight to outlying observations than does ordinary least squares estimation and, consequently, that SMDM estimates are more robust to outliers. See Leone, Minutti-Meza, and Wasley 2014.

on a common set of overexposed investors. This index is defined as follows:

$$d_{c_j, c_k, t} = \sum_i re_{c_j, i, t} \times oe_{i, c_k, t}, \quad (2)$$

in which  $d_{c_j, c_k, t}$  denotes country  $c_j$ 's reliance on investors overexposed to country  $c_k$  at time  $t$ .

The subterms  $re_{c_j, i, t}$  and  $oe_{i, c_k, t}$  refer to country  $c_j$ 's relative reliance on investment from fund  $i$  and fund  $i$ 's overexposure to country  $c_k$ , at time  $t$ . Formally, these are defined as

$$re_{c_j, i, t} = \frac{a_{i, c_j, t}}{\sum_{i'} a_{i', c_j, t}}, \text{ and} \quad (3)$$

$$oe_{i, c_k, t} = b_{i, c_k, t} - \bar{b}_{c_k, t}, \quad (4)$$

which, in turn, rely on the following definitions:

$$\bar{b}_{c_k, t} = \frac{a_{i, c_k, t}}{s_{i, t}}, \text{ and} \quad (5)$$

$$s_{i, t} = \sum_{c_k} a_{i, c_k, t}, \text{ for } i \neq i'. \quad (6)$$

The component terms  $\bar{b}_{c_k, t}$ ,  $b_{i, c_k, t}$ ,  $s_{i, t}$ , and  $a_{i, c_k, t}$  represent, respectively, the average fund investment weight for country  $c_k$ , the investment weight of fund  $i$  in country  $c_k$ , the total value of all assets invested by fund  $i$ , and the value of assets invested by fund  $i$  in country  $c_k$ , all at time  $t$ .

## References

- Ahnert, Tony, and Christoph Bertsch. 2015. "A Wake-Up Call Theory of Financial Contagion." Unpublished manuscript.
- Amihud, Yakov. 2002. "Illiquidity and Stock Returns: Cross-Section and Time-Series Effects." *Journal of Finance*, 5 (1): 31–56.
- Antón, Miguel, and Christopher Polk. 2013. "Connected Stocks." *Journal of Finance* LXIX (3): 1099–127.
- Bayoumi, Tamim, and Franziska Ohnsorge. 2013. "Do Inflows or Outflows Dominate? Global Implications of Capital Account Liberalization in China." Working Paper 13/189, International Monetary Fund, Washington.
- Bekaert, Geert, R. Campbell Harvey, Christian T. Lundblad, and Stephan Siegel. 2011. "What Segments Equity Markets." *Review of Financial Studies* 24 (12): 3841–890.
- Boyer, Brian H., Tomomi Kumagai, and Kathy Yuan. 2006. "How Do Crises Spread? Evidence from Accessible and Inaccessible Stock Indices." *Journal of Finance* 61 (2): 957–1003.
- Brandão-Marques, Luis, Marco Espinosa-Vega, and Juan Solé. Forthcoming. "Cross-Border Spillovers from Mutual Fund Activity." Working Paper, International Monetary Fund, Washington.
- Brandão-Marques, Luis, R. Gaston Gelos, and Natalia Melgar. 2013. "Country Transparency and the Global Transmission of Financial Shocks." Working Paper 13/156, International Monetary Fund, Washington.
- Broner, Fernando A., R. 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.
- Calvo, Guillermo, and Enrique Mendoza. 2000. "Rational Contagion and the Globalization of Securities Markets." *Journal of International Economics* 51 (1): 79–113.
- Cetorelli, Nicola, and Linda S. Goldberg. 2012. "Global Banks and International Shock Transmission: Evidence from the Crisis." *IMF Economic Review* 59 (1): 41–76.
- Chan, Kalok, and Johnny K. H. Kwok. 2005. "Market Segmentation and Share Price Premium: Evidence from Chinese Stock Markets." *Journal of Emerging Market Finance* 4 (1): 43–61.
- Coval, Joshua D., and Erik Stafford. 2007. "Asset Fire Sales (and Purchases) in Equity Markets." *Journal of Financial Economics* 86: 479–512.
- Croux, Christoph, Geert Dhaene, and Dirk Hoorelbeke. 2003. "Robust Standard Errors for Robust Estimators." Discussion Paper Series 03.16, KU Leuven, CES.
- Cuadro-Saez, Lucía, Marcel Fratzscher, and Christian Thimann. 2009. "The Transmission of Emerging Market Shocks to Global Equities Markets." *Journal of Empirical Finance* 16 (1): 2–17.
- Dasgupta, Amil, Roberto Leon-Gonzalez, and Anja Shortland. 2011. "Regionality Revisited: An Examination of the Direction of Spread of Currency Crises." *Journal of International Money and Finance* 30: 831–48.
- Demirer, Mert, Francis X. Diebold, Laura Liu, and Kamil Yilmaz. 2015. "Estimating Global Bank Network Connectedness." Working Paper 15/1512, Koc University-TUSIAD Economic Research Forum.
- Diebold, Francis X., and Kamil Yilmaz. 2014. "On the Network Topology of Variance Decompositions: Measuring the Connectedness of Financial Firms." *Journal of Econometrics* 182 (1): 119–34.
- Dimpfl, Thomas, and Robert C. Jung. 2011. "Financial Market Spillovers around the Globe." Global Financial Markets Working Paper Series 20–2011, Friedrich-Schiller University.
- Duval, Romain, Nan Li, Richa Saraf, and Dulani Seneviratne. 2016. "Value Added Trade and Business Cycle Synchronization." *Journal of International Economics* 99: 251–62.
- Fong, Tom, Alfred Wong, and Ivy Yong. 2007. "Share Price Disparity in Chinese Stock Markets." Working Paper 11/2007, Hong Kong Monetary Authority.
- Forbes, Kristin J. 2002. "Are Trade Linkages Important Determinants of Country Vulnerability to Crises?" In *Preventing Currency Crises in Emerging Markets*, edited by Sebastian Edwards and Jeffrey Frankel. Chicago: University of Chicago Press.
- . 2012. "The 'Big C': Identifying Contagion." Working Paper 12/18465, National Bureau of Economic Research, Cambridge, Massachusetts.
- , and Roberto Rigobon. 2002. "No Contagion, Only Interdependence: Measuring Stock Market Co-Movements." *Journal of Finance* 57 (5): 2223–261.
- Fung, Alexander Kwok-Wah, Kin Lam, and Ka-Ming Lam. 2010. "Do the Prices of Stock Index Futures in Asia Overreact to U.S. Market Returns?" *Journal of Empirical Finance* 17 (3): 428–40.
- Gelos, R. Gaston. 2011. "International Mutual Funds, Capital Flow Volatility, and Contagion—A Survey." Working Paper 11/92, International Monetary Fund, Washington.
- Goldstein, Morris. 1998. "The Asian Financial Crisis." Policy Brief PB98-1, Peterson Institute for International Economics, Washington.
- He, Dong, and Paul Luk. 2013. "A Model of Chinese Capital Account Liberalisation." Working Paper 12/2013, Hong Kong Institute for Monetary Research, Hong Kong.
- , Lillian Cheung, Wenlang Zhang, and Tommy Wu. 2012. "How Would Capital Account Liberalization Affect China's Capital Flows and the Renminbi Real Exchange Rates?" *China and the World Economy* 20 (6): 29–54.
- He, Dong, Eric Wong, Andrew Tsang, and Kelvin Ho. 2015. "Asynchronous Monetary Policies and International Dollar Credit." Working Paper 19/2015, Hong Kong Institute for Monetary Research, Hong Kong.
- Hong, Harrison, José A. Scheinkman, and Wei Xiong. 2006. "Asset Float and Speculative Bubbles." *Journal of Finance* 61 (3): 1073–117.
- Hooley, John. 2013. "Bringing down the Great Wall? Global Implications of Capital Account Liberalisation in China." *Bank of England Quarterly Bulletin*.

- International Monetary Fund. 2011. *Changing Patterns of Global Trade*, Policy Paper, Washington.
- . 2014a. *Global Liquidity*, Policy Paper, Washington.
- . 2014b. *Spillover Report*, Washington.
- . 2015. *Spillover Report*, Washington.
- Johnson, Robert C., and Guillermo Noguera. 2014. “A Portrait of Trade in Value Added over Four Decades.” Working Paper, University of Warwick.
- 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.
- Karolyi, G. Andrew, David T. Ng, and Eswar Prasad. 2015. “The Coming Wave: Where Do Emerging Market Investors Put Their Money?” Working Paper 15/21661, National Bureau of Economic Research, Cambridge, Massachusetts.
- Killian, Lutz. 2013. “Structural Vector Autoregressions.” Chapter 22 of *Handbook of Research Methods and Applications in Empirical Macroeconomics*, edited by N. Hashimzade and M.A. Thornton, Edward Elgar.
- Klößner, Stefan, and Sven Wagner. 2014. “Exploring all VAR Orderings for Calculating Spillovers? Yes, We Can!—A Note on Diebold and Yilmaz (2009).” *Journal of Applied Econometrics* 29 (1): 172–79.
- Kodres, Laura, and Matthew Pritsker. 2002. “A Rational Expectations Model of Financial Contagion.” *Journal of Finance* 57 (2): 769–99.
- Koop, Gary, H. Hashem Pesaran, and Simon M. Potter. 1996. “Impulse Response Analysis in Nonlinear Multivariate Models.” *Journal of Econometrics* 74 (1): 119–47.
- Kyle, Albert S. 1985. “Continuous Auctions and Insider Trading.” *Econometrica* 53 (6): 1315–335.
- , and Wei Xiong. 2001. “Contagion as a Wealth Effect.” *Journal of Finance* 56 (4): 1401–440.
- Lane, Philip, and Gian-Maria Milesi-Ferretti. 2007. “The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970–2004.” *Journal of International Economics* 73 (2): 223–50.
- Leone, Andrew J., Miguel Minutti-Meza, and Charles E. Wasley. 2014. “Influential Observations and Inference in Accounting Research.” Working Paper FR 14/06, Simon Business School, Rochester, New York.
- Lin, Wen-Ling, Robert F. Engle, and Takatoshi Ito. 2004. “Do Bulls and Bears Move across Borders? International Transmission of Stock Returns and Volatility as the World Turns.” *Review of Financial Studies* 7 (3): 507–38.
- Lütkepohl, Helmut. 2005. *New Introduction to Multiple Time Series Analysis*. New York: Springer.
- McCauley, Robert N., Patrick McGuire, and Vladyslav Sushko. 2015. “Global Dollar Credit: Links to U.S. Monetary Policy and Leverage.” Working Paper 15/483, Bank for International Settlements, Basel.
- Mei, Jianping, José A. Scheinkman, and Wei Xiong. 2009. “Speculative Trading and Stock Prices: Evidence from Chinese A-B Share Premia.” *Annals of Economics and Finance* 10: 225–55.
- Nathans, Laura L., Frederick L. Oswald, and Kim Nimon. 2012. “Interpreting Multiple Linear Regression: A Guidebook of Variable Importance.” *Practical Assessment, Research & Evaluation* 17 (9): 1–19.
- Pastor, Lubos, and Richard Stambaugh. 2003. “Liquidity Risk and Expected Stock Returns.” *Journal of Political Economy* 111: 642–85.
- Peng, Wensheng, Hui Miao, and Nathan Chow. 2007. “Price Convergence between Dual-Listed A and H Shares.” *China Economic Issues* 6/07.
- Pesaran, H. Hashem, and Yongcheol Shin. 1998. “Generalized Impulse Response Analysis in Linear Multivariate Models.” *Economics Letters* 58: 17–29.
- Puy, Damian. 2016. “Mutual Funds Flows and the Geography of Contagion.” *Journal of International Money and Finance* 60: 73–93.
- Raddatz, Claudio, and Sergio L. Schmukler. 2012. “On the International Transmission of Shocks: Micro-Evidence from Mutual Fund Portfolios.” *Journal of International Economics* 88: 357–74.
- , and Tomás Williams. 2015. “International Asset Allocations and Capital Flows: The Benchmark Effect.” Working Paper 04/2015, Hong Kong Institute for Monetary Research, Hong Kong.
- Rajan, Raghuram, and Luigi Zingales. 1995. “What Do We Know about Capital Structure? Some Evidence from International Data.” *Journal of Finance* 50 (5): 1421–460.
- Rigobon, Roberto. 2003. “Identification through Heteroskedasticity.” *Review of Economics and Statistics* 85: 777–92.
- Roache, Shaun K., and Marina Rousset. 2015. “China: Credit, Collateral and Commodity Prices.” Working Paper 15/27, Hong Kong Institute for Monetary Research, Hong Kong.
- Sahay, Ratna, Martin Čihák, Papa N’Diaye, Adolfo Barajas, Ran Bi, Diana Ayala, Yuan Gao, Annette Kyobe, Lam Nguyen, Christian Saborowski, Katsiaryna Svirydzenka, and Seyed Reza Yousefi. 2015. “Rethinking Financial Deepening: Stability and Growth in Emerging Markets.” Staff Discussion Note 08/2015, International Monetary Fund, Washington.
- Scheinkman, José A., and Wei Xiong. 2003. “Overconfidence and Speculative Bubbles.” *Journal of Political Economy* 111: 1183–219.
- Shu, Chang, Dong He, Honglin Wang, and Jinyue Dong. 2015. “The Influence of Chinese and U.S. Financial Markets on Asia-Pacific.” In *Cross-Border Financial Linkages: Challenges for Monetary Policy and Financial Stability*. BIS Paper 82. Basel: Bank for International Settlements.
- Song, Song, and Peter J. Bickel. 2011. “Large Vector Auto Regressions.” Working Paper SFB649DP2011–048, Humboldt University, Collaborative Research Center 649.

## SUMMARY

**T**his chapter describes major insurance sector developments over the past decade and assesses changes in the systemic importance of insurers. Insurance firms play an important role as providers of protection against financial and economic risks and as financial intermediaries.

The chapter shows that across advanced economies the contribution of life insurers to systemic risk has increased in recent years, although it clearly remains below that of banks. This increase is largely due to growing common exposures to aggregate risk, caused partly by a rise in insurers' interest rate sensitivity. Thus, in the event of an adverse shock, insurers are unlikely to fulfill their role as financial intermediaries precisely when other parts of the financial system are failing to do so as well. The higher common exposures do not seem to be driven by marked changes in insurers' investment portfolios, although smaller and weaker insurers in some countries have taken on more risk.

The findings suggest that supervisors and regulators should take a more macroprudential approach to the sector. Doing so is necessary if supervision is to go beyond guarding against the solvency and contagion risks of individual firms and take on the systemic risk arising from common exposures. Steps that would complement a push for stronger macroprudential policies include the international adoption of capital and transparency standards for the sector. In addition, the different behavior of smaller and weaker insurers warrants attention by supervisors.

## Introduction

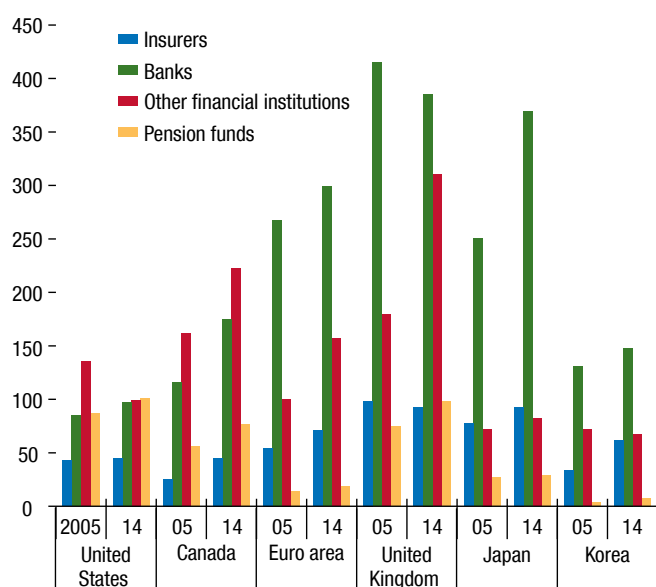
Insurance companies—life insurers as well as providers of property and casualty, health, and financial coverage—perform important economic functions and are big players in financial markets (Figure 3.1). They enable economic agents to diversify idiosyncratic risk, thereby supplying the necessary preconditions for certain business activities (Liedtke 2011; Box 3.1). They are a major source of long-term risk capital to the real economy, and are among the largest institutional investors, holding about 12 percent of global financial assets, or \$24 trillion (of which life insurance accounts for 85 percent). Their long-term investment horizon can in principle enable them to act as a shock absorber in financial markets.

The financial crisis put the insurance sector on the map as a source of systemic financial risk. Before the global financial crisis of 2007–09, insurers were not thought to pose significant systemic risks. Insurers have longer-term liabilities than banks, greater diversification of assets, and less extensive interconnections with the rest of the financial system. It was assumed that the functions of any failed firm would be relatively easily picked up by others (high substitutability). However, the near-collapse of the insurer AIG during the crisis prompted a rethinking of the sector’s systemic risk contribution. A number of insurance firms were subsequently among the financial institutions designated as globally systemically important (International Association of Insurance Supervisors [IAIS] 2013a; Box 3.2).

Various studies have highlighted the changing nature of insurance activities and their contributions to systemic risk (Billio and others 2012). For example, the way in which their product offerings and investments have evolved may be exposing insurers to greater aggregate, nondiversifiable risk (Acharya and others 2009). The rise of such exposures would increase the risk that insurers perform poorly when other parts of the financial sector are hit, potentially inducing correlated trading and fire sales. Studies also point to tightening linkages with banks as insurers have become more active in capital markets (Dungey, Luciani, and Veredas 2014; Peirce 2014). In some countries, insurance com-

The authors of this chapter are Nico Valckx (team leader), Jorge Chan-Lau, Alan Feng, Ben Huston, Gregorio Impavido, Andy Jobst, John Kiff, Frederic Lambert, Nobuyasu Sugimoto, and Kai Yan, under the general guidance of Gaston Gelos and Dong He. Research support was provided by Suchitra Kumarapathy and Xinhao Han. Viral Acharya and Michael Hafeman were consultants for this chapter.

**Figure 3.1. Selected Countries: Relative Size of Financial Intermediaries**  
(Percent of GDP)



Sources: Haver Analytics; European Central Bank Statistical Data Warehouse; and IMF staff calculations.

panies are seen as more vulnerable to runs than in the past (Paulson and others 2014). Finally, higher exposures to nontraditional non-insurance activities (such as derivatives trading) may increase the counterparty risks posed by insurers (Acharya and others 2009).

Low interest rates are an important source of risk for insurers, especially for the life sector. The current prolonged period of low interest rates challenges life insurers’ business model because their promised rates of return on long-term contracts exceed the returns on available “safe” assets (sovereign bonds and high-grade corporate bonds). In the major advanced economies, the resulting lower profits and capital buffers may be prompting a “search for yield.” Such effects are likely to be most pronounced for insurers that offer products with more generous and long-running minimum-return guarantees.<sup>1</sup> For nonlife insurers, pressures are generally less severe because they can reprice existing contracts more easily and have shorter investment horizons.

<sup>1</sup>The April 2015 *Global Financial Stability Report* (GFSR) finds that European life insurers in some countries are particularly vulnerable. See also European Systemic Risk Board (2015).

Global policy initiatives are under way to address vulnerabilities and systemic risks in the insurance sector. The IAIS has made progress by clarifying the role of insurance and reinsurance activities in financial stability analysis (IAIS 2011, 2012b), developing a systemic risk assessment of global systemically important insurers (IAIS 2013a), and developing guidance on macroprudential policy (IAIS 2013b, 2013c). Nevertheless, regulatory regimes differ widely across countries, which may lead to regulatory arbitrage (Financial Stability Board 2013).

This chapter reviews some of the key recent developments in the sector and analyzes the systemic risks they pose.<sup>2</sup> The discussion focuses mainly on the advanced economies, given the challenges associated with unconventional monetary stimulus. The chapter does not aim to conduct stress tests for specific companies, assess their solvency, or conduct scenario analyses for the sector. Neither does it investigate in detail the liability side of insurers, such as changes in the products offered by the industry, which can play an important role in shaping risks. Instead, using novel data and methods, the chapter addresses the following questions:

- *How has the insurance sector's contribution to systemic risk changed since the early 2000s? Are insurers becoming more similar? Are they becoming more exposed to common risk factors?*
- *To what extent can the changes be traced to investment behavior, maturity mismatches, business models, and the broader market? Have low interest rates led to increased investments in additional risky securities? Which types of insurers have been prone to take on asset-side risk, and is there evidence of a search for yield or “gambling for resurrection”? Have insurers become more procyclical in their reaction to shocks? Have they become more sensitive to interest rate movements?*
- *What are the implications for regulating and reforming the global insurance sector?*

The chapter's main findings are as follows:

- *The sector's systemic risk contribution has increased as common exposures within the sector and to the rest of the economy have risen—but it remains below that*

<sup>2</sup>This chapter complements recent analytical GFSR chapters focusing on other segments of the financial sector (international banking [April 2014], shadow banking [October 2014], and asset management [April 2015]), and expands on the analysis of European insurers in the April and October 2015 GFSRs.

*of banks.* Results based on a number of methods suggest that the systemic importance of insurers has grown in the advanced economies since the 2007–09 global financial crisis. This increase has been driven mostly by higher commonalities in exposures and greater exposure to market risk through the combined effect of asset and liability positions. Less important has been a rise in the systemic risk stemming from the default risk of individual institutions.

- *The rise in exposures to aggregate risk means that insurers are more likely to be adversely hit jointly with other segments of the financial sector.* In the event of an adverse shock, insurers are unlikely to fulfill their role as financial intermediaries precisely when other parts of the system are also failing to do so. Given insurers' significance as funding sources (for example, in the corporate bond market in the United States), the effects on the real economy could be important.
- *The higher common exposures seem to be driven partly by duration mismatches and broader market forces.* Portfolio compositions do not appear to have become markedly more similar. However, because of imperfect asset-liability matching (duration mismatches), life insurers have become increasingly sensitive to interest rates as interest rates have fallen.<sup>3</sup> Moreover, the observed broad rise in cross-asset correlations (October 2015 GFSR, Chapter 1) likely reflects both temporary and structural factors.
- *Firms do not seem to have actively shifted their portfolios toward riskier categories of assets, but some insurers have engaged in a search for yield.* However, because insurers have not counteracted market forces in their asset choices, even without an overt shift they have become more exposed to aggregate risk. Moreover, firm-level case studies suggest that, as interest rates decline, particular types of firms—smaller life insurers, those with weaker capital positions, and those with higher shares of guaranteed liabilities—tend to take on relatively more risk. The financial crisis did not reveal

<sup>3</sup>Any existing duration mismatch will worsen with a decline in interest rates since the duration of long-term liabilities rises more than that of shorter-term assets. This effect is more pronounced when the level of interest rates is low—that is, any further fall in interest rates will result in a sharper increase in duration mismatches.



evidence of outright procyclical behavior by U.S. insurers, but overall, the international evidence on this issue is mixed. Developments on insurers' liability side (not studied in detail in this chapter) may also have played a part in the rise in systemic risk contributions.

The findings suggest that supervisors and regulators should take a more macroprudential approach to the sector. Doing so is necessary if supervision is to go beyond the solvency and contagion risks of individual firms and take on the systemic risk arising from common exposures. A step that would complement a push for stronger macroprudential policies would be international adoption of capital and transparency standards for the sector. In addition, attention to smaller and weaker firms is also warranted. They are most likely to take on excessive risks—and the solvency problems of smaller entities may result in cascading effects that become systemic.

The chapter proceeds with a discussion of the different concepts of systemic risk posed by insurers, followed by recent developments in insurers' business models, market structures, and performance. Three subsequent sections provide a comprehensive analysis of systemic risks posed by insurers, examine changes in insurers' investment behavior, and analyze detailed case studies. The final two sections assess the regulatory framework and consider policy implications.

## Insurance and Systemic Risk: Conceptual Issues

*Systemic risk in the financial system arises from the danger that some part of the system will become unable to perform its key economic functions and thereby impair the real economy. Insurance firms can contribute to systemic risk through the possibility that an individual firm will fail, with systemic consequences. Another contribution to systemic risk is through common exposures across firms that may endanger financial intermediation of the system as a whole in the event of an adverse shock. In general, the negative externality comes about when insurance companies that decide to take on more aggregate risk do not internalize the possibility that such actions may hinder intermediation in other parts of the financial system. These two types of systemic risk are discussed here.*

## Risk of Individual Default

Systemic risk analysis traditionally has focused on the risks of failure of individual institutions and their potential knock-on effects. From this contagion, or “domino,” view of systemic risk (Acharya 2015), the insurance sector has generally been considered significantly safer than the banking sector (see, for example, Cummins and Weiss 2014), although this notion has been challenged recently (Acharya and others 2009) (Figure 3.2). The domino perspective considers the following six key characteristics when assessing the systemic risk posed by an individual institution:<sup>4</sup>

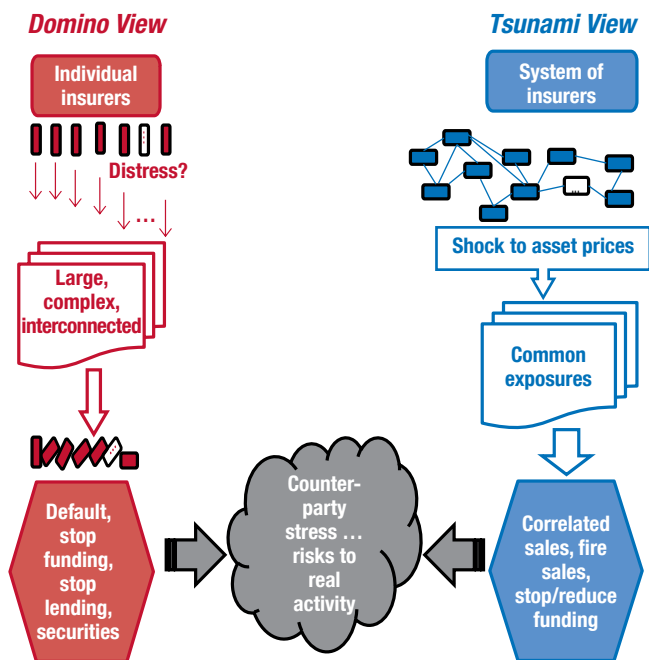
- *Size*—For certain types of insurance businesses, asset size must be large to effectively pool and diversify risks.<sup>5</sup> As a result, however, the asset size of some insurance firms rivals that of the biggest banks and may create too-big-to-fail-type risks.
- *Interconnectedness and integration in financial sector infrastructure*—Although not part of payment or clearing systems, insurers are interconnected through reinsurance relationships and retrocession arrangements (Box 3.3), and with the wider financial sector through various other channels. In many countries, they are important holders of bank debt (Alves and others 2015), and they are often linked to banks through ownership ties or counterparty exposures such as derivatives transactions or securities lending (Cummins and Weiss 2014; Dungey, Luciani, and Veredas 2014; Peirce 2014).<sup>6</sup> This development is likely to be reinforced by the new Total Loss-Absorbing Capacity standard for global systemically important banks, which may induce insurers to buy bail-inable debt. The linkages of the insurance sector with the wider financial system appear to have been

<sup>4</sup>See also Box 3.2, which covers global systemic risk factors for insurers.

<sup>5</sup>Insurers that underwrite large policies with exposures to catastrophes need to be larger than those that underwrite small policies without such exposure. Although reinsurance can reduce the need for large size at the company level, reinsurers themselves require large size.

<sup>6</sup>Life insurers use interest rate derivatives for asset-liability matching, but are not extensive users of other types of derivatives (Bank for International Settlements 2015; Berends and King 2015). Insurers are large players in securities lending markets, accounting for about 10 percent of such activity (Baklanova, Copeland, and McCaughrin 2015). Recent regulatory reform may reduce the availability of cost-effective derivative hedges (Mannix 2014).

Figure 3.2. Systemic Risks in Insurance



Source: IMF staff.

strengthened by its growing participation in capital markets (Baluch, Mutenga, and Parsons 2011).

- **Substitutability**—Typically, insurance companies can cover the gaps left by the failure of any one insurer. Nonetheless, substitutability may be low in market segments in which concentration is very high and thus creates the risk of market frictions in the event of a failure.
- **Leverage**—Too much leverage may pose solvency risks. There is some ambiguity as to how to properly measure leverage among insurers. When considering debt-to-asset ratios, insurance firms' leverage is usually much lower than that of banks (Thimann 2015). However, leverage including insurance liabilities is close to that of banks.
- **Funding liquidity risk**—Insurers are generally less susceptible than banks to the threat of runs because insurers have longer-dated liabilities and stable cash flows. Nevertheless, runs are possible in some markets. Acharya and Richardson (2014) point out that large numbers of life insurance contracts can be “cashed in” (surrendered) by the

insured party. Foley-Fisher, Narajabad, and Verani (2015) find that in 2007, U.S. life insurers became subject to self-fulfilling runs by institutional investors in the agreement-backed securities market.<sup>7</sup> Feodoria and Förstemann (2015) argue that a sharp rise in interest rates could threaten German life insurers with a potentially large increase in early policy cancellations.<sup>8</sup>

- **Complexity**—Insurance companies are typically less complex than banks. In the United States, however, some insurance companies move liabilities to “shadow insurers” in less regulated U.S. states and offshore domiciles, or themselves engage in shadow banking through certain funding agreements and related products (Kojien and Yogo 2013). For property and casualty insurers, the entry into new markets, such as catastrophe bonds, may actually help them mitigate tail risks, which are difficult to model (see Box 3.3).<sup>9,10</sup>

The low-interest-rate environment has raised concerns about the solvency of firms in various insurance markets, and such firms may be induced to take on excessive risks. Vulnerable firms include those that have guaranteed a minimum interest rate on a large proportion of their products or have negative duration gaps (longer maturities for their liabilities than for their assets). European stress tests in 2014 found that insurers in a number of countries were vulnerable to low interest rates because of such gaps (European Insurance and Occupational Pensions Authority 2014). Vulnerable firms have been under pressure to shift risks from

<sup>7</sup>Funding agreement-backed securities are tradable securities backed by funding agreements, that is, guaranteed investment contracts issued by life insurers.

<sup>8</sup>For example, General American Life Insurance Company experienced a run in 1999 (Paulson and others 2014). Rose (2016) discusses the case of the Great Surety Company, which experienced a run during the Great Depression.

<sup>9</sup>In this context, AIG and monoline insurers illustrate the risks from involvement in nontraditional markets, such as guarantee writing on bonds and securitization. Monoline insurers provided financial guarantees (or “wraps”) to bond issuers to enhance the creditworthiness of the issued securities, and later on also for securitization and structured credit markets. A dangerous chain of dependencies developed between the creditworthiness of the monolines and the securities they guaranteed. During the financial crisis, monoline credit ratings were downgraded, which led directly to sharp devaluations and sell-offs of the guaranteed securities (The Geneva Association 2010b).

<sup>10</sup>Climate change is likely to represent a major challenge for non-life insurers and reinsurers (Carney 2015).

their equity holders to their creditors, and possibly gamble for resurrection. Anecdotal evidence points to a search for yield (*Risk Magazine* 2013, 2015), which to some extent has been confirmed by systematic analysis (Becker and Ivashina 2015).

### Beyond Individual Default

The contribution to systemic risk by insurers and other financial firms goes beyond the risks of contagion arising from individual defaults. In the “tsunami” or macroprudential view, even solvent firms may propagate or amplify shocks to the rest of the financial system and the real economy. For example, insurance companies play a critical role in corporate bond markets, and a cessation of funding that may arise from a shock to insurance company balance sheets could have extensive repercussions.<sup>11</sup> Similarly, systemic risk may stem from common exposures of a few large firms or many small ones (Acharya 2015; IMF 2013). If such insurers behave procyclically, they may contribute to price swings on asset markets with possibly detrimental systemic effects (Bank of England 2015).<sup>12</sup>

The insurance sector could be a significant contributor to systemic risk even if no single insurance company were systemically important. In models such as that in Acharya and Richardson (2014), each institution’s contribution to systemic risk can be measured by its propensity to be undercapitalized when the system as a whole is undercapitalized. In such cases, the firm’s systemic importance is based not on its own capital shortfall, but on its contribution to the aggregate capital shortfall.

It is therefore important to assess the degree to which their exposure to aggregate risk has evolved.

- Life insurers should be expected to have a low exposure to aggregate risk because their investments are liability driven, and they aim to closely match the maturities of the cash flows of their assets and liabilities. In other words, their net cash flows should not be highly correlated with the market, and their betas should be low.

<sup>11</sup>Other channels may also play a role. Insurers may, for example, stop lending securities to counterparties (Bank of England 2015).

<sup>12</sup>The tsunami effect could be further compounded by spillovers arising from the network properties of the financial system. More generally, the domino and tsunami views are not mutually exclusive.

- Although insurers are large investors in equities and bonds (see the next section), they can in principle be expected to ride out price fluctuations and even behave in a countercyclical, that is, stabilizing, manner in securities markets.
- However, if firms offer products with nondiversifiable risk, insure against aggregate risk, or become more alike in their asset management, they may develop a common set of net exposures (through their assets and liabilities) to shocks and market risk (Acharya and Richardson 2014; Schwarcz and Schwarcz 2014).<sup>13</sup> Large adverse shocks to these exposures would be reflected in a sharp decline in insurers’ stock prices. Depending on the exact nature of the shock, to restore equity values, regain access to funding, or meet capital requirements (or all three), insurance companies would need to react by, for example, discontinuing their purchases of corporate bonds. Given the correlated nature of these exposures, many companies would want to act in a similar way, which, given the footprint of insurers in this market, could mean a drying up of funding for firms that rely on financing through bonds. More extreme events may prompt correlated sales, and downward price spirals, with disruptive effects (Acharya and others 2009; IMF 2015).
- In sum, a higher correlation of insurers’ stock prices among themselves and with the market implies that more insurers are more likely to be hit by the same shocks at the same time, and they will tend to react more similarly when hit by a shock.

### Trends in Global Insurance Markets

*The role of insurance firms as financial intermediaries in the midst of changing market structures and performance trends provides some preliminary indication of the sector’s systemic importance.*

Insurance firms are important financial intermediaries in the advanced economies and in global financial markets. As measured by premiums written, life and nonlife insurance markets are largest in North America (for the purposes of this chapter, excluding Mexico), Europe, and Japan (Figure 3.3), and they are growing rapidly in emerging market

<sup>13</sup>Regulatory regimes may reinforce such procyclicality.

economies and low-income countries—especially in Argentina, Brazil, China (Box 3.4), and Thailand. In South Africa, life insurance penetration, with premiums written in 2014 reaching 12 percent of GDP, is among the highest in the world. As measured by both premiums written and total assets, the life insurance market is larger than the nonlife market. Life insurers hold large amounts of government and corporate bond debt, and in the United Kingdom and Japan they also hold major stakes in equity markets. Insurers' share in direct lending is small, but it is rising in many countries.

A first look at aggregate figures for size, direct exposures to affiliates and banks, and concentration suggests a relatively benign picture (Figure 3.4). Insurance companies have become larger, but by much less than the largest banks. Investments in affiliates and deposits with banks are a small share—less than 5 percent—of insurers' consolidated balance sheets. On average, insurance sectors have become less concentrated despite continuing mergers and acquisitions. Insurers' debt-equity ratios are generally relatively low; in Europe, where they are the highest, they have slightly decreased.

Liquidity risks are more difficult to assess, but rates of early policy cancellations (lapses) have fallen. In general, lapse rates are contained, and especially so in Europe. In North America, lapse rates have dropped in recent years in line with declining interest rates (because new policies would be concluded at lower rates). On the other hand, anecdotal evidence suggests that lapses on life policies are becoming increasingly likely, as early withdrawal penalties are reduced in some countries.<sup>14</sup>

Insurers have been increasing their nontraditional investments, albeit from a low base. These include investment banking, direct lending, investments via hedge funds, and third-party asset management (IAIS 2011; October 2014 GFSR). In the United States, nontraditional non-insurance assets of nonlife insurers have grown from 3 percent of total assets in 2004 to 8 percent in 2014, and for life insurers from 2.5 percent to 4.5 percent. In Germany, only nonlife insurers

<sup>14</sup>The likelihood of lapsing will vary with economic and market conditions, which help determine the extent to which more attractive alternatives to an existing policy are available. Up to 50 percent of European life insurance policies are estimated to be canceled without penalty (Global Risk Regulator 2016).

have increased their proportion of nontraditional non-insurance assets.

Insurance companies have also been innovating on the liability side. Many insurers are tapping alternative capital markets, such as those for insurance-linked securities, to cover extreme risks or reduce reserve requirements (Box 3.3). A rise in unit-linked products<sup>15</sup> will generally reduce the share of life policies that incorporate guaranteed returns, although variable-rate products with guarantee mechanisms remain popular—including in the United States and some European countries—and may require complex and innovative hedging strategies. Moreover, some unit-linked products may also carry minimum performance guarantees.

### Comovement, Financial Stability, and Systemic Risk

*This section undertakes novel analytical exercises to assess, from various angles, the evolution of commonalities in exposure of the insurance sector and its contribution to systemic risk in advanced Asia, Europe, and North America.*<sup>16</sup>

#### Commonality and Comovement

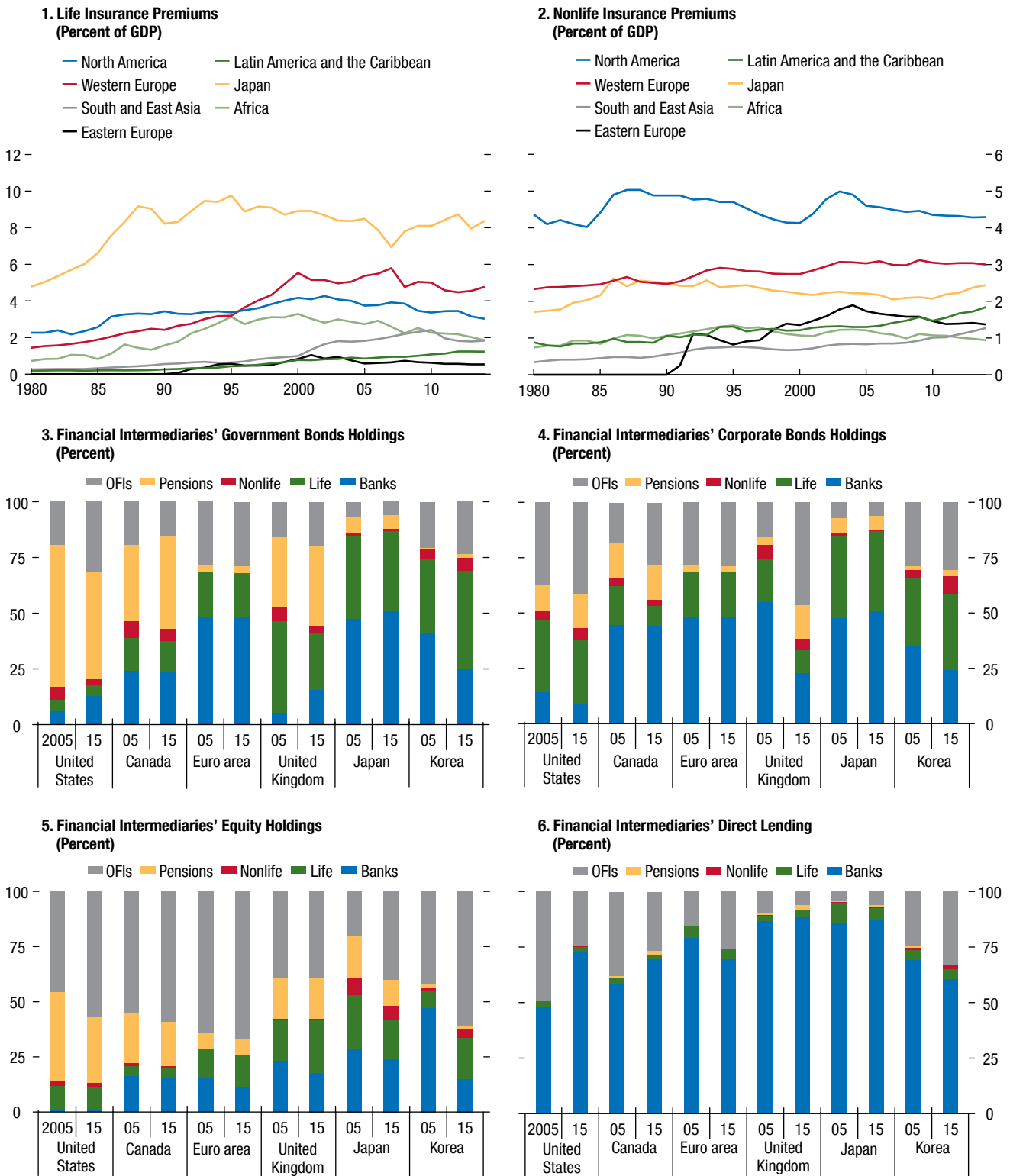
Life insurers' equity price comovements have increased. To assess the degree to which stock returns behave similarly, a dissimilarity index is computed using firm-level equity returns for banks and life and nonlife insurers.<sup>17</sup> The degree of similarity is then measured by the number of clusters, with a lower number of clusters denoting more similarity. The number of clusters among life insurers generally declined from 2006 to mid-2008 (Figure 3.5). In North America and Europe, the global financial crisis reversed this trend in the second half of 2008, but since 2010, life insurance companies have become somewhat more homogeneous again. The development is, however, more marked for the United States. For nonlife insurers and for banks,

<sup>15</sup>Unit-linked products are a form of long-term insurance whereby the policyholder chooses the investment strategy. These products can, but do not necessarily have to, include guarantees.

<sup>16</sup>Among the previous studies are the October 2014 GFSR; Bisias and others (2012); Cummins and Weiss (2014); The Geneva Association (2010a, 2010b, 2011); Houben and Teunissen (2011); Jobst (2014); Jobst, Sugimoto, and Broszeit (2014); Krenn and Oschischnig (2003); and Liedtke (2011).

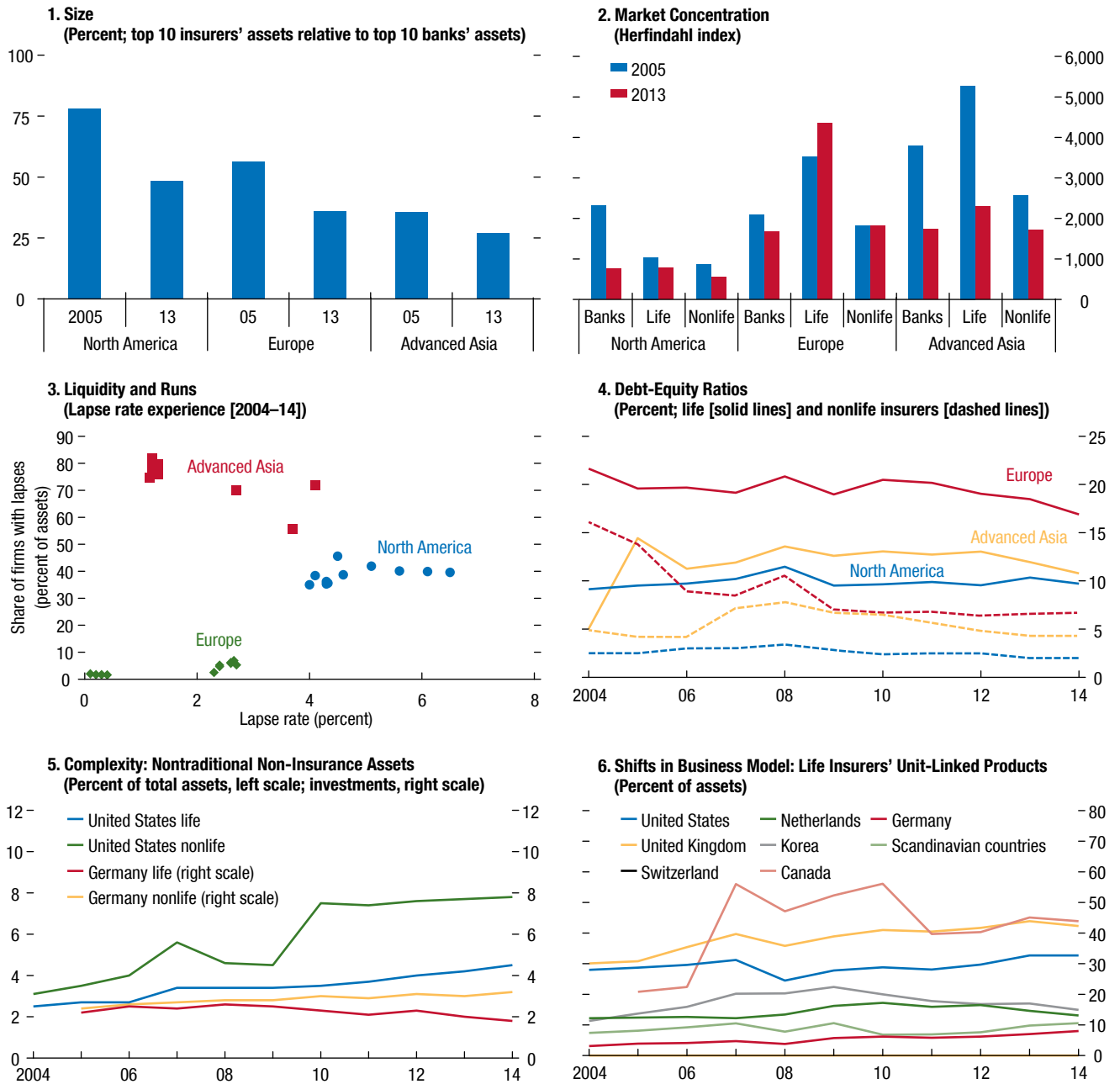
<sup>17</sup>Similarity is based on two dimensions: temporal correlation and proximity (Chouakria and Nagabhushan 2007; Liao 2005).

Figure 3.3. Global Insurance Sector Size and Market Structures



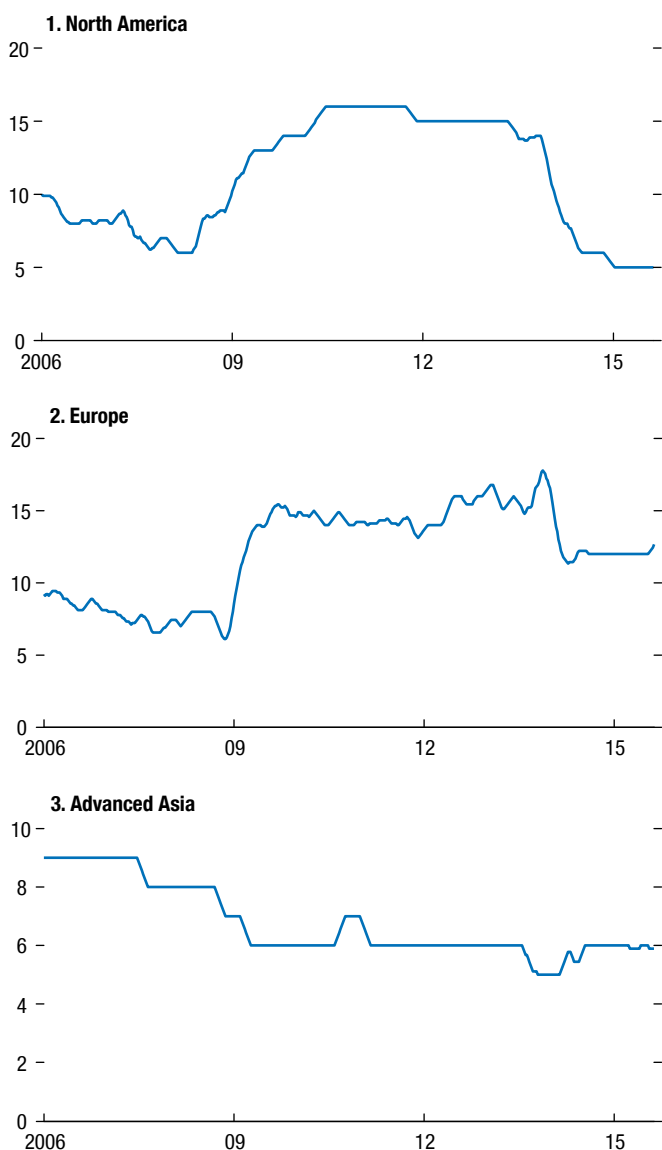
Sources: Flow of Funds via Haver Analytics database; SwissRe, Sigma Database; and IMF staff calculations.  
 Note: OFIs = other financial institutions.

Figure 3.4. Changing Insurance Business Models and Systemic Risk Factors



Sources: A.M. Best, Global Statement File; BVD Bankscope; GDV Statistical Year Books; and IMF staff calculations.  
 Note: Concentration is measured as the median of the Herfindahl indices for countries in North America, Europe, and advanced Asia. A Herfindahl index between 1,500 and 2,500 indicates moderate concentration and an index above 2,500 a high level of concentration. Advanced Asia = Japan, Korea, Hong Kong SAR, Singapore, Taiwan Province of China, Australia, and New Zealand; Europe = Austria, Belgium, Denmark, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, and United Kingdom; North America = United States and Canada; Scandinavian countries = Denmark, Finland, Norway, and Sweden.

**Figure 3.5. Time-Series Clustering of Life Insurers on Equity Returns**  
(Number of clusters)



Sources: Bloomberg, L.P.; and IMF staff calculations.  
Note: Lines show the smoothed number of clusters corresponding to a centered nine-week equal-weighted moving average. The analysis was conducted on five-year rolling windows of insurers' equity returns.

the trend is less pronounced, albeit broadly similar (not reported here).<sup>18</sup>

Similarly, common factors have gained in importance as drivers of life insurers' equity performance, but much less so for nonlife insurers in Europe. On average, the share of the first principal component in insurers' common equity price variations rose from 54 percent to 61 percent in the United States, and from 26 percent to 32 percent for European insurers overall (Figure 3.6). It is less important for nonlife insurers in the United States; in Europe, the first principal component explains a much lower fraction in return variation, and this explanatory power has fallen.<sup>19</sup>

### Contribution to Systemic Risk

Life insurers' contribution to systemic risk, as measured by a comparison of value-at-risk measures ( $\Delta\text{CoVaR}$ ), has tended to increase in Europe and North America.<sup>20</sup> In these regions, indices indicate that the average systemic risk contribution has returned to historically high levels (Figure 3.7). It is two to three times higher than in 2006, especially in the life insurance and banking sectors (absolute levels across the sectors are not comparable).<sup>21</sup> In advanced Asia, the systemic risk contribution has increased primarily in the banking sector, but remains subdued for nonlife insurers. The  $\Delta\text{CoVaR}$  patterns show similarities with the cluster analysis, with the systemic risk contribution increasing as the number of clusters falls. Nonlife insurers' systemic risk indices have risen the least in all three countries considered and have remained broadly at their 2006 levels in North America and advanced Asia.

An alternative gauge (SRISK) also suggests that insurers' contribution to systemic risk has grown,

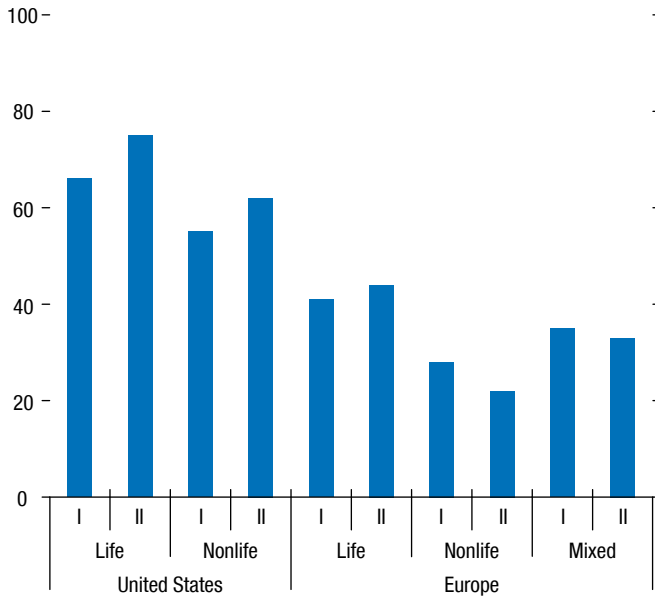
<sup>18</sup>The method implies that number of clusters moves in discrete, sometimes large, jumps.

<sup>19</sup>The contribution of the first principal component does not follow a cyclical pattern, although in Europe it fell somewhat after the global financial crisis.

<sup>20</sup>According to Adrian and Brunnermeier (forthcoming), an institution's CoVaR relative to the system is the value at risk of the whole financial sector conditional on that institution being in a particular state. The difference between the CoVaR conditional on an institution being in distress and the CoVaR conditional on the "normal" state of the institution,  $\Delta\text{CoVaR}$ , captures the contribution of an institution, in a noncausal sense, to overall systemic risk.

<sup>21</sup>One weakness of CoVaR is that it may not necessarily reflect the relative importance of each sector as a potential source of systemic risk, because it depends strongly on the number of firms included in each sector in the estimation. Therefore, Figure 3.7 uses normalized indices, thereby allowing for a comparison of the evolution over time.

**Figure 3.6. Variation of Insurers' Equity Return Due to First Principal Component (Percent)**

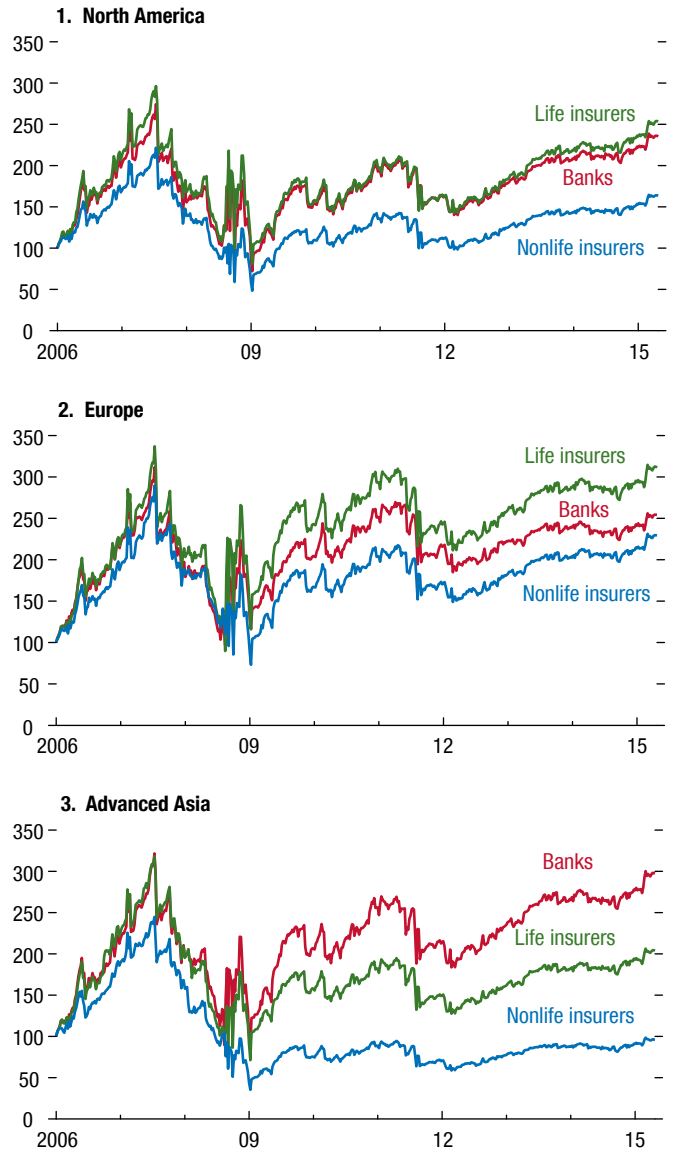


Sources: Bloomberg, L.P.; J.P. Morgan; and IMF staff calculations.  
 Note: Figure shows explanatory power ( $R^2$ ) of first principal component of U.S. and European insurers' equity returns, using daily data (2004 through 2015). Period I is before the crisis, and period II is after the crisis. Crisis is July 2007 through December 2008 for the United States, and July 2009 through December 2011 for Europe.

although remaining smaller than that of banks. The SRISK approach measures systemic risk through a firm's contribution to the aggregate capital shortfall of the financial sector.<sup>22</sup> A capital shortfall occurs if a firm's losses are greater than the excess of its actual capital over its required capital. The capital shortfall is a function of the size of the firm, its leverage, and its expected equity loss, conditional on the market decline. The results show that in general, banks are the most systemic institutions, but in North America, the contribution to systemic risk by life insurers has

<sup>22</sup>Brownlees and Engle (2015), building on Acharya, Engle, and Richardson (2012), propose quantifying the systemic risk of a firm (SRISK) by its expected capital shortfall conditional on a prolonged market decline. A capital shortfall occurs if a firm's losses are greater than its required capital, and consequently, the firm is said to contribute to systemic risk. The capital shortfall is a function of the size of the firm, its leverage, and its expected equity loss. SRISK does not explicitly model the links between firms, as in the network models analyzed later in the section, but imposes comovements in equity returns implicitly through conditioning on a common risk factor using a bivariate generalized autoregressive conditional heteroscedasticity–dynamic conditional correlation model.

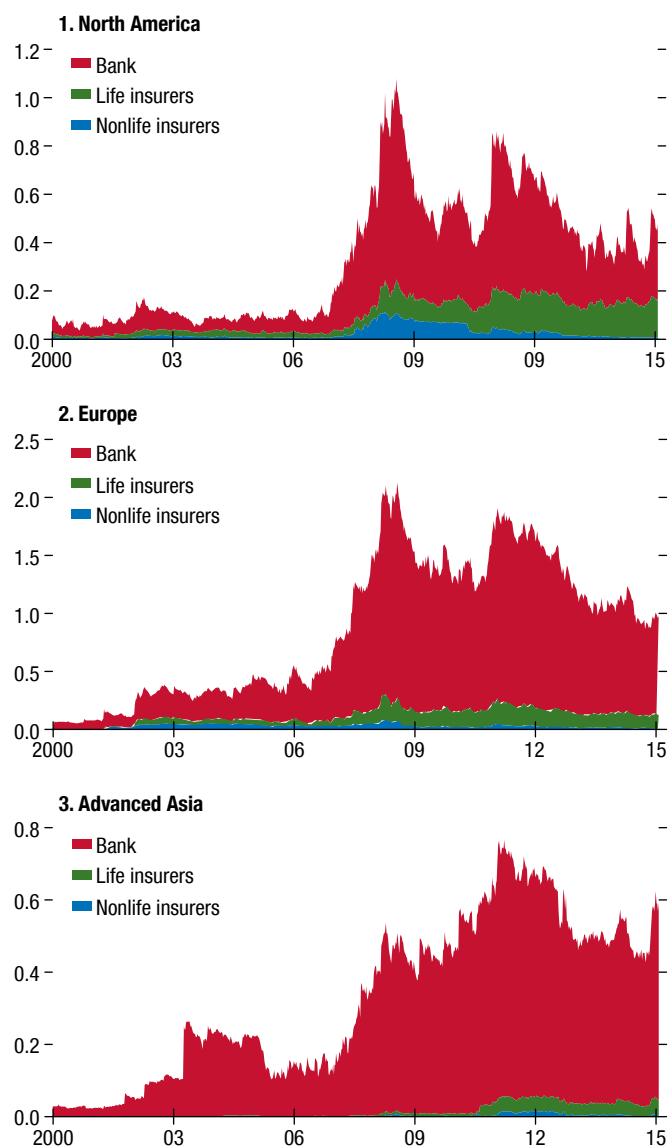
**Figure 3.7. CoVaR Indices (Normalized, 2006 = 100)**



Sources: Bloomberg, L.P.; and IMF staff calculations.  
 Note: Figure shows CoVaR indices constructed by aggregating the average  $\Delta\text{CoVaR}$  of individual firms for all firms in a given sector and region, normalized by their value in the first period. The average  $\Delta\text{CoVaR}$  of an individual firm includes its spillovers to financial firms in advanced economies (238 firms) as well as in emerging market economies (98 firms).  $\Delta\text{CoVaR}$  is estimated from weekly equity returns, for the period from January 1, 2001, to October 23, 2015; the quantile regression was estimated with a window expanding from an initial five-year period. The estimation corrects for the effects of market risk (MSCI World Index) and volatility risk (an average of volatility indices in North America, Europe, and advanced Asia).



**Figure 3.8. Conditional Capital Shortfall**  
(Trillions of U.S. dollars)



Sources: New York University, Stern School of Business, V-Lab; and IMF staff calculations.

Note: Figure shows the contributions to systemic risk of financial institutions on a weekly frequency for the period June 2, 2000, through October 30, 2015, calculated using data from the V-Lab at New York University. The sample comprises 349 firms in advanced and emerging market economies, largely overlapping with the clustering and CoVaR samples.

grown steadily since the global financial crisis (Figure 3.8). This finding is in line with the upward trend of the  $\Delta\text{CoVaR}$  index.<sup>23</sup> Again, nonlife insurers contribute only in a minor way to systemic risk, with no visible increase.

Probability-of-default-based network models complement approaches based solely on equity returns. Focusing on probabilities of default allows the analysis to account explicitly for the effects of capital structure and firm-specific balance sheet characteristics (such as liquidity ratios) on the survival of a firm. In a probability-of-default network, two firms are connected if the partial correlation of their probability of default is nonzero (Chan-Lau and others 2015).<sup>24</sup> Within the network, the most systemic institutions have a higher number of connections.

The results from this model are in line with those of the SRISK analysis. The network was constructed for four different dates (Figure 3.9) to assess the evolution of systemic risk. If all sectors were equally systemic, their relative share among the top systemic institutions would reflect their share in the sample. This is not the case. Banks dominate the systemic risk rankings, but the representation of insurers among the top 100 firms has grown since 2001. In particular, life insurers have tended to be more systemic and nonlife insurers much less systemic than their sample shares suggest.

### Spillovers and Network Centrality

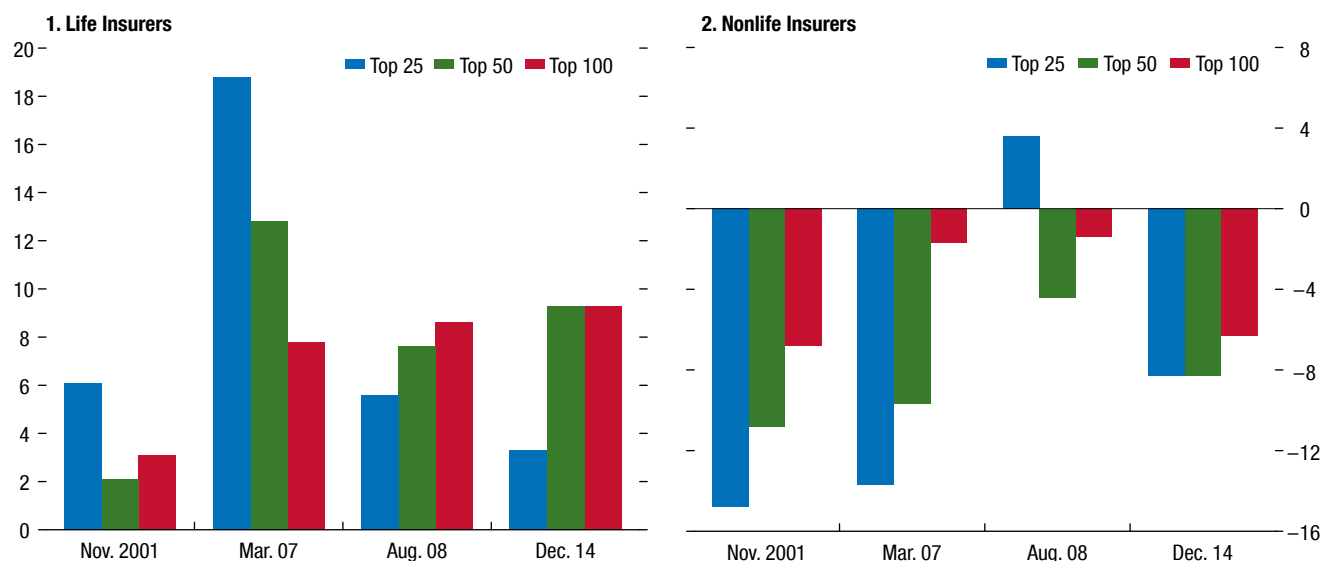
Insurers play an important role as transmitters of spillovers.<sup>25</sup> In Europe and North America, banks and life insurers generally rank highest as transmitters (Figure 3.10). Spillovers from North American nonlife insurers declined substantially after 2010, whereas spillovers from nonlife insurers in Asia increased to a similar degree.

<sup>23</sup>The results for Europe are broadly in line with those reported by Berdin and Sottocornola (2015); Engle, Jondeau, and Rockinger (2015); and European Systemic Risk Board (2015).

<sup>24</sup>Partial correlations remove dependence induced via third parties (Kenett and others 2010).

<sup>25</sup>Spillovers are jointly estimated across regions and measure each region's contribution to the total residual variance of the equity returns of all other regions (Diebold and Yilmaz 2014). To avoid sample selection and survivorship biases, which could arise when using firm-level data with excessive regional or sectoral heterogeneity, the variance decomposition exercise uses regional sector equity index aggregates for North American, Western European, and Asian asset managers, banks, life insurers, nonlife insurers, and reinsurers. See Annex 2.4 in Chapter 2 for a methodological overview.

**Figure 3.9. Forward-Looking Default Correlation Networks**  
(Percent; over- or underrepresentation of insurers)



Sources: Risk Management Institute 2015; and IMF staff calculations.

Note: Figure shows over- or underrepresentation of life and nonlife insurers, in the top 25, top 50, and top 100 firms included in the forward-looking default correlation network. For example, a 5 percent value for the top 100 indicates that there are 5 percent more insurance firms among the top 100 than justified by their sample share. Total sample size ranges between 1,263 and 1,679 firms, including 310 to 410 insurers. Owing to the large number of firms, a regularization adjustment was required to generate fully connected networks, where no firm is an orphan (Oh and others 2014).

The largest cross-region spillovers are those from North American life insurers and asset managers to the European banking and insurance sectors (Figure 3.10). In addition, European banks have a large spillover effect on North American insurers and asset managers, and similarly, European life insurers and reinsurers have a sizable impact on North American life insurers. Significant spillovers transpire from European banks, asset managers, and life insurers to Asian banks, and vice versa, to a lesser extent. A separate analysis for Europe indicates that although insurers were recipients rather than sources of spillovers through the end of the global financial crisis, they have more recently tended to become a source (Box 3.5).

### What Is Behind the Higher Systemic Risk Contributions?

*This section examines potential drivers of the increased systemic importance of life insurers. It first examines their investment behavior using firm-level data from Canada, the United States, Korea, and three European countries. Next, the role of duration mismatches and changed market dynamics are considered.*

### Investment Behavior

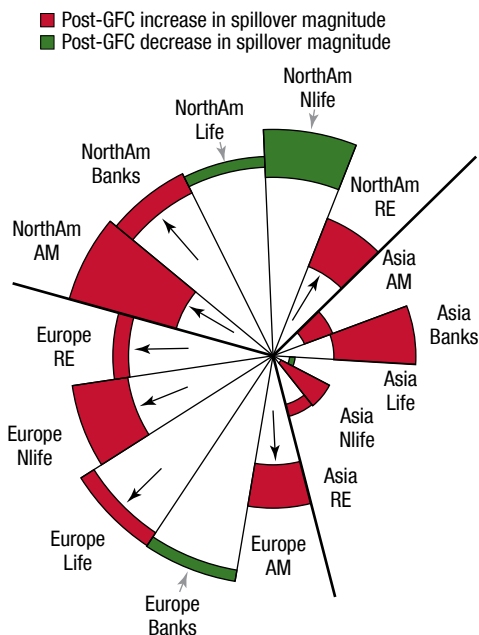
Changes in the investment behavior of insurers may have contributed to higher systemic risk through various channels. First, lower interest rates may have induced firms (particularly weaker ones) to take on relatively more risk in an attempt to shift risk from equity holders to creditors and policyholders, and possibly to gamble for resurrection. That behavior would increase solvency risk (and the risk of domino effects). Second, the asset composition of firms' portfolios may have become more similar, increasing their exposure to common shocks (the tsunami risk). Third, even with a broadly unchanged asset composition, firms' portfolios may have become more similar in their exposures to market risk because their assets feature higher betas or higher correlations with common risk factors. Fourth, the procyclicality in their investment behavior may have risen, increasing insurers' tendency to transmit shocks rather than absorb them.

#### "Riskiness" of portfolios

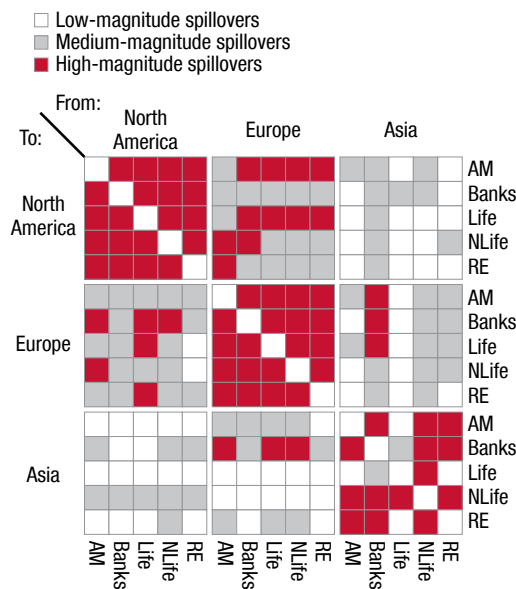
No aggregate risk trend is apparent by asset category for life insurers, but there are differences across firms and

**Figure 3.10. Spillovers between Insurance and Other Financial Sectors**

**1. Change in Spillover Size Pre- and Post-GFC**



**2. Sector-to-Sector Spillovers**



Sources: Datastream; and IMF staff calculations.

Note: Panel 1 shows change in the size of region and sector spillovers between the pre- and post-GFC periods. Segment length corresponds to region/sector spillover index values. Segment width is used to emphasize differences. Panel 2 shows spillover directionality across regions and sectors. AM = asset management; GFC = global financial crisis; Nlife = nonlife; NorthAm = North America; post-GFC = 2010–15; pre-GFC = 2001–08; RE = reinsurance.

countries. For Canada, Germany, Korea, the Netherlands, Norway, and the United States, detailed information on insurers' asset positions could be obtained.<sup>26</sup> Contrary to what may have been expected, on average, insurers have been keeping the overall proportion of higher-risk assets in their portfolios roughly constant or have even reduced it, although returns on investment fell (Figure 3.11, panels 1 and 2).<sup>27</sup> For some European countries, this behavior may be related to the advent of Solvency II, which introduces risk-sensitive capital requirements and market-based valuation. Geographical differences, however, appear to be significant (Figure 3.11, panel 3). In a recent survey, insurers in the United Kingdom and northern Europe reported seeing better opportunities in illiquid assets such as infrastructure and real estate, whereas those in southern Europe were more likely to increase their allo-

cations to equities. Insurers in Germany showed increased interest in exploiting illiquidity premiums.<sup>28,29</sup>

Firm-level data from six advanced economies suggest that less well-capitalized life insurers hold relatively more higher-risk assets, with some increasing such holdings in recent years.<sup>30</sup> Life insurers with capital ratios closer

<sup>26</sup>The degree of granularity varies across countries, but overall, the asset classification is relatively coarse. Since the Norwegian sample consists of only five firms, no formal econometric analysis is undertaken for this market.

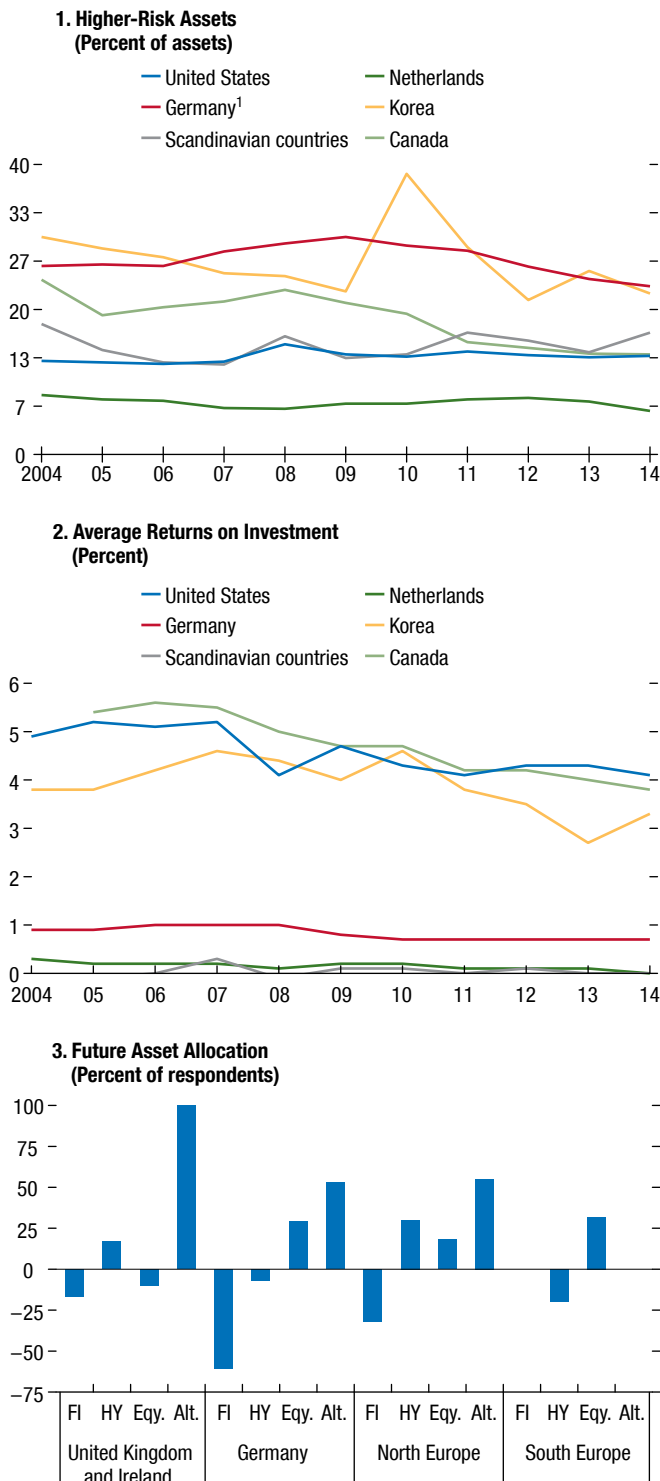
<sup>27</sup>High-yield bonds, shares, mortgages, real estate, affiliate-related investments, loans, and unquoted investments. Under National Association of Insurance Commissioners (NAIC) rules, all these are in the higher-risk (C-1) category.

<sup>28</sup>On average, higher-risk asset holdings are associated with higher exposures to market risk. For U.S. life insurers, and to a lesser extent for European and Asian insurers, changes in higher-risk asset shares (as defined previously) and unlevered market betas (as a measure of insurers' stock price sensitivity to market movements) are positively correlated. This correlation indicates that across insurers, differences in investment risk-taking are reflected in systematic risk exposures through their stock price betas.

<sup>29</sup>Domanski, Shin, and Sushko (2015) document that German insurers engage in a hunt for duration, which reinforces downward pressure on interest rate levels. In our sample, data for the United States and Norway comprise information on maturities; on average, insurers in these countries lengthened the maturity of their bond holdings.

<sup>30</sup>Research finds that insurers tend to reach for yield in the bond market. Risk-shifting incentives and poor corporate governance have been identified as factors that make insurers more willing to take risks (Becker and Ivashina 2015; Ma and Ren 2012). For nonlife insurers, research suggests a trade-off between underwriting risks and investment risks: during periods when underwriting income is low, they tend to reduce their investment in risky assets, and vice versa.

Figure 3.11. Life Insurers' Investments



Sources: A.M. Best Global Statement File; Standard Life 2015; and IMF staff calculations.  
 Note: Alt. = alternative investments; Eqy. = equity; FI = fixed income; HY = high-yield; Scandinavian countries = Denmark, Finland, Norway, and Sweden.  
<sup>1</sup> For Germany, higher-risk assets also include shares in investment funds, which may include bond funds.

to the required minimums allocate significantly more of their investments to higher-risk assets. The low-interest-rate environment has accentuated these differences in Canada, Germany, the Netherlands, and the United States. These findings are consistent with the notion that lower interest rates exacerbate the incentive for weaker insurers to gamble for resurrection (Figure 3.12, panel 1). In addition, granular U.S. data show that life insurers with lower capital buffers also seek higher yields within the highest-rated bond category. Nevertheless, even for these firms, the share of risky asset holdings remains moderate in most cases.

Life insurers with greater proportions of products that guarantee returns engage more in a search for yield. In Germany, such life insurers tend to purchase higher-risk assets (Figure 3.12, panel 2).

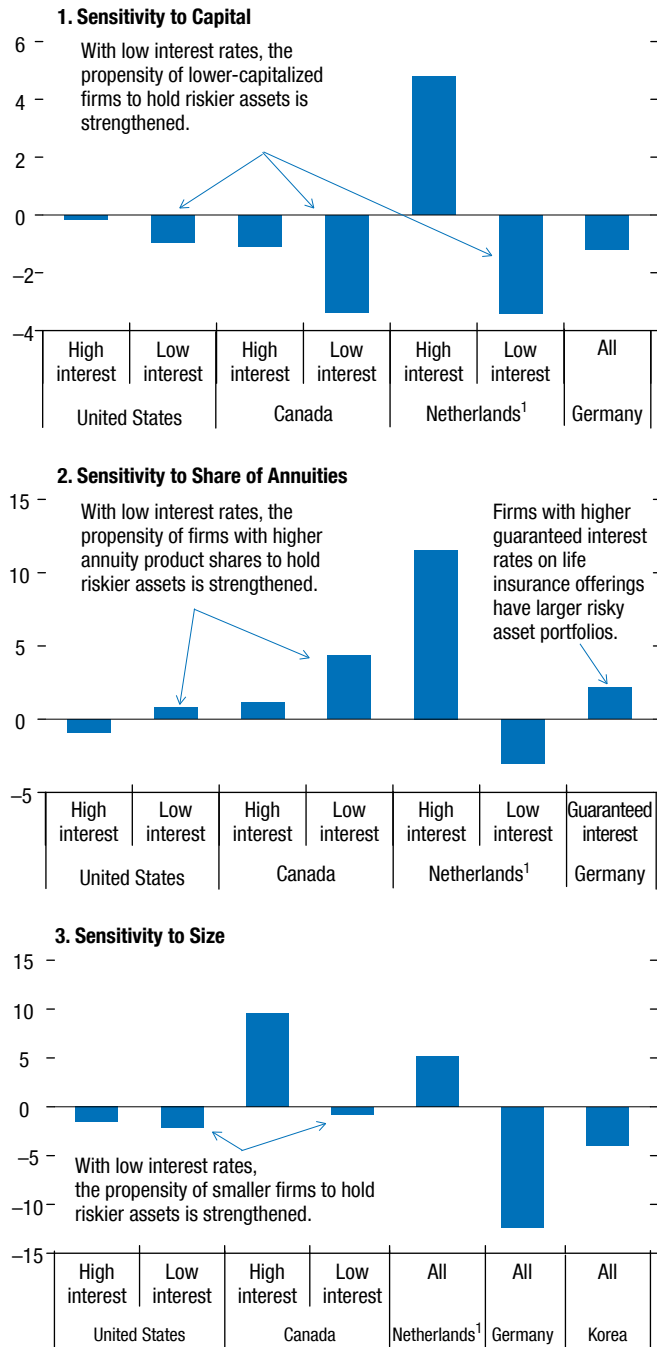
Indirect evidence also comes from North America, where insurers with a higher share of annuity products—which usually offer return guarantees—shift more to riskier assets when interest rates are low. In Norway, firms with larger negative duration gaps (that is, with liabilities that are substantially longer dated than their assets) seem to hold considerably more higher-risk assets, although most have narrowed this gap during the 2012–15 period. Furthermore, detailed U.S. data show that insurers less focused on underwriting and more on investment management (that is, with low net premiums written relative to total liabilities; see Box 3.1) achieved higher average yields within the class of higher-rated bonds (NAIC categories I and II). This finding suggests that they favored higher-yielding securities within the asset class. However, no significant association is found with regard to their investment yield on risky bonds (NAIC categories III–VI).

Smaller life insurers have been behaving differently from larger ones, and in some countries, have increased the share of riskier assets. In four of the five countries analyzed, the relationship between size and risky asset shares is now negative (Figure 3.12, panel 3). In Canada and the United States, smaller insurers in the sample have raised their risky asset holdings in recent years, while larger ones have reduced them (Figure 3.13). In the United States, the difference between the behavior of larger and smaller firms has increased somewhat in the low-interest-rate environment.

*Portfolio similarities by asset category*

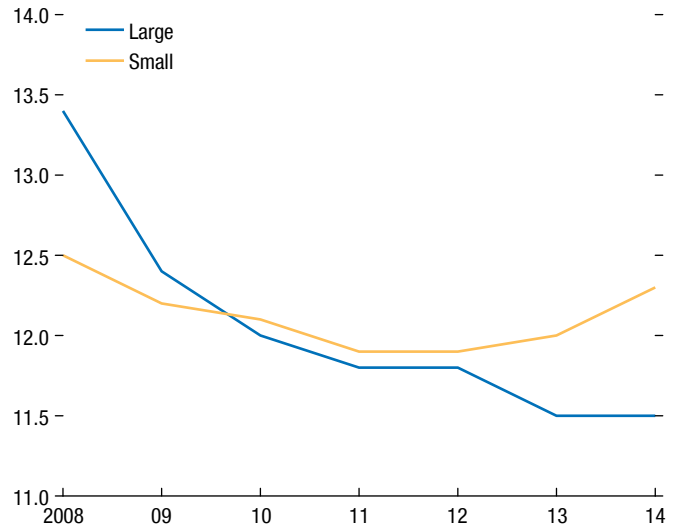
The asset positions of life insurers in Canada, the Netherlands, and the United States do not appear to

**Figure 3.12. Sensitivity of Life Insurers' Risky Assets to Firm-Level Factors**  
(Percent of total assets)



Source: IMF staff calculations.  
Note: Figures show the economic impact of firm factors on the share of higher-risk assets, with differentiation between high- and low-interest-rate environments, where significant.  
<sup>1</sup> For the Netherlands, large insurers (in the high-interest-rate period) are less well capitalized and have more risky assets. They also have less annuities.

**Figure 3.13. U.S. Life Insurers' Higher-Risk Assets**  
(Percent of total assets)



Sources: A.M. Best Global Statement File; National Association of Insurance Commissioners; Standard Life Investments Limited 2015; and IMF staff calculations.  
Note: Large refers to the upper third and small to the lower third of firms ranked by total assets.

have become more similar over time.<sup>31</sup> Hierarchical cluster analysis applied to a cross-section of life insurance companies in each of those countries indicates that the number of clusters appears broadly stable for the period 2002–14 in all three. Hence, at least in these countries, increased similarity in asset holdings does not seem to be the reason for a decline in the number of clusters based on equity returns nor for the associated increased return correlations.

Therefore, the de facto increase in exposures to aggregate risk does not seem to have, in general, been driven by life insurers using similar investment strategies to increase risk. Those higher exposures may instead have been driven by changed market dynamics and structures. Nonetheless, life insurers have not counteracted the increase in aggregate risk exposures. Nonlife insurers, however, appear to have done so over the 2006–15 period, during which their systemic risk contributions have moderated. According to some measures, banks' systemic risk contribution has also declined.

<sup>31</sup>Micro-level data are not available to examine this in detail for other countries.

### Procyclicality

The overall evidence on procyclical behavior is mixed. The analysis for this chapter indicates that U.S. life insurers acted countercyclically in 2008, but lower-capitalized insurers were more prone to sell securities. Between the first and third quarters of 2008, U.S. insurance companies increased their holdings of corporate bonds from 16 percent of their aggregate portfolio to 17.7 percent (Figure 3.14). In contrast, asset holdings at mutual funds and pension funds during this period appear to have either fallen or held steady. Although lower-capitalized insurers tended to sell more bonds during the crisis, the overall contrarian investments by the insurance sector contributed to the stability of the U.S. corporate bond market in that period. This behavior was likely influenced by the relaxation of investment rules in 2009, which alleviated some of the pressure on insurers to sell other assets.<sup>32</sup> Moreover, the data show no clear indication that short-term tactical asset allocation has become more important among U.S. insurers: turnover at the firm level has not increased in recent years.

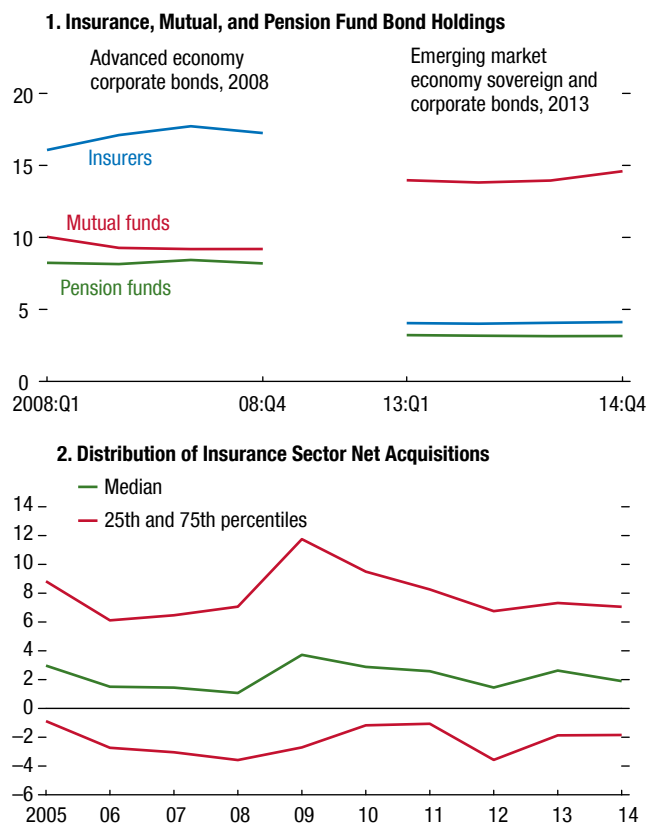
Some previous research finds evidence of procyclicality,<sup>33</sup> although the evidence is not unequivocal.<sup>34</sup> The April 2014 GFSR finds that large institutional investors in emerging market economies, including

<sup>32</sup>Manconi, Massa, and Yasuda (2012) show that in the second half of 2007 the existing rules on commercial mortgage-backed securities (CMBS) forced insurers to compensate for their losses on holdings of securitized CMBS bonds by selling or reducing their buying of lower-rated securitized and corporate bonds. The easing of the rules reduced selling pressure by moderating capital charges applied to losses. Insurers continue to be major investors in CMBS and retail MBS, holding at end-2014 \$208.5 billion in CMBS and \$414.5 billion in retail MBS. See also Becker and Opp (2014) for a critical analysis.

<sup>33</sup>For the United States, see Rudolph (2011); for the Netherlands around the time of the stock market crash of 2002–03, see de Haan and Kakes (2011); for Germany, see Timmer (2016).

<sup>34</sup>For the Netherlands, two studies find evidence of procyclical behavior. Bijlsma and Vermeulen (2015) find that insurers sold distressed euro area sovereign bonds during the 2012 European sovereign debt crisis. Duijm and Steins Bisschop (2015) report similar results for insurers' equity investments during 2006–15, although they attribute the sales in part to the move toward the risk-based Solvency II capital regime. During the stock market crash in 2001, insurers across a range of countries seem to have sold into the falling market (Impavido and Tower 2009; see also the discussion in Papaioannou and others 2013). Manconi, Massa, and Yasuda (2012, p. 516) examine insurers' behavior in 2007 and conclude that they "did not act as strategic liquidity providers at the onset of the crisis." For the United Kingdom, however, the Bank of England (2015) cautioned on evidence of procyclicality, because the observed shift out of equities since 2002 could reflect a structural rather than a cyclical response.

**Figure 3.14. U.S. Insurance Sector Bond Holdings and Turnover (Percent)**



Sources: Lipper Emaxx, National Association of Insurance Commissioners Schedule D; and IMF staff calculations.

Note: Net acquisitions are defined as securities purchased minus sold, relative to last year's outstanding; securities include bonds, common stocks, and preferred stocks.

insurance companies, react less to global shocks around times of "normal" volatility but withdraw more strongly and persistently from a country in response to sovereign downgrades.<sup>35</sup> This may possibly reflect the fact that in liquidity crises, insurers—being less affected by liquidity shocks—take advantage of market conditions to buy underpriced securities, whereas in solvency crises, they do not. However, the October 2015 GFSR reported that securities held in higher concentrations by insur-

<sup>35</sup>In the 2013 market sell-off of emerging market assets, the distress and the increase in U.S. Treasury yields may have been too short-lived to prompt much of a reaction by insurers, whose holdings of emerging market securities remained unchanged; however, the liquidity of bonds held more by insurers fell more strongly (see the April 2015 GFSR).

ance companies suffered a larger decline in liquidity during the global financial crisis and the “taper tantrum” of 2013.

### Other Factors

#### Duration mismatches

The increased stock comovement among life insurers is partly driven by a higher sensitivity to interest rates, which points to the role of duration mismatches. The interest rate on “safe” bonds is one of the factors driving insurers’ stock market returns. Since the global financial crisis, life insurers’ equity prices have become more sensitive to movements in the prices of government bonds, especially in Europe and in the United States. This indicates that markets assess duration gaps to have become more negative (Figure 3.15).<sup>36</sup> When insurers have negative duration gaps (that is, the maturity of liabilities is longer than that of assets) and at least partly guaranteed returns on their liabilities, a decline in interest rates increases their effective leverage.<sup>37</sup> This higher effective leverage can translate into higher market betas.

#### Developments on the liability side

This chapter has not examined insurers’ liabilities in detail, but changes in the mix of products offered and in the degree and types of nontraditional activities may have contributed to their riskiness. For example, credit derivatives exposures have fallen since the crises, but their exact magnitude and nature are difficult to ascertain. Moreover, some markets have seen a rise in the offerings of products with minimum guarantees (investment-oriented life insurance policies and variable annuities), which would increase insurers’ exposures to aggregate risk. As discussed earlier, many insurers are tapping alternative capital markets.

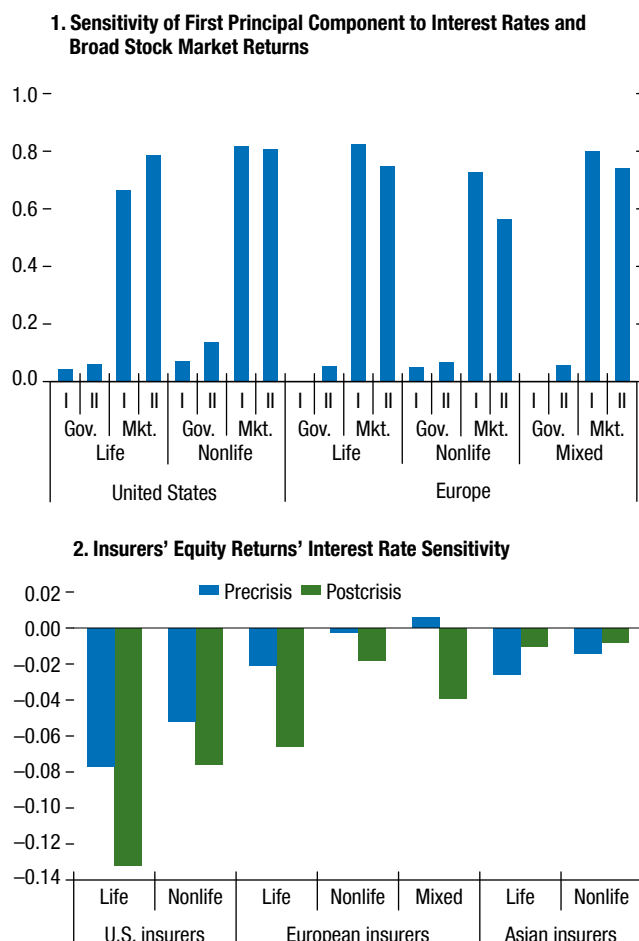
#### Changed market dynamics

The changes in clustering also seem to be associated with broader patterns of cross-asset correlations, representing a combination of temporary and longer-lasting, structural shifts in markets. Cross-asset correlations have been high since the global financial crisis (see April 2015

<sup>36</sup>In earlier work, interest rate sensitivity was found to vary over subperiods between 1975 and 2000 (Brewer and others 2007) as well as since the crisis (Berends and others 2012).

<sup>37</sup>At low interest levels, this effect is accentuated by the convexity of the relationship between duration and interest rates.

**Figure 3.15. Insurers’ Interest Rate and Market Return Sensitivity**



Sources: Bloomberg, L.P.; Datastream; and IMF staff calculations. Note: Panel 1 shows the sensitivity (coefficient) of insurers’ equity returns’ first principal component to government bond yields and the broad stock market return (see also Figure 3.6). Panel 2 shows bond return coefficients, from a regression of insurers’ equity returns on broad stock market and 10-year government bond returns. Gov. = government; Mkt. = market.

GFSR, Chapter 1), but the causes of this phenomenon are not clear. It may reflect a search for yield and, more generally, the lower levels of risk aversion prevalent in recent years (Baker and Wurgler 2007), all of which in turn may be related to the accommodative monetary policies pursued in advanced economies.<sup>38</sup> Arguably, as risk aversion falls, investors become less discriminat-

<sup>38</sup>Guiso, Sapienza, and Zingales (2014) find empirical evidence consistent with a substantial increase in risk aversion following the global financial crisis. Behavioral experiments (Cohn and others 2015) and evidence on the time-varying nature of the equity premium (Campbell, Giglio, and Polk 2013) support this view.

ing about their stock holdings overall, a reaction that translates into higher correlations and higher similarity across equity returns.<sup>39</sup> This situation would be temporary, although likely to persist for some time in many advanced economies. However, structural changes are likely to play a role as well. Market liquidity has become more fragile because of structural changes in the markets and appears to have declined in some market segments (October 2015 GFSR, Chapter 2). Benchmarking and index investing have become more widespread, and the use of derivatives has increased (April 2015 GFSR, Chapter 1). As a consequence, returns across insurers are more likely to be driven by common shocks.

### Insurance Sector Regulation

*This section reviews current insurance regulations and their impact on insurer business models in light of the preceding evidence.*

### Recent Regulatory Developments

Insurance solvency regulations have become more risk based and thereby have affected insurers' investment choices. Risk-based capital and reserve requirements have been introduced in many countries. The trend started with Canada in 1992 and continued with the United States in 1994, Australia in 1995, Japan in 1996, Singapore in 2004, Switzerland in 2006, and Korea in 2011 (Annex 3.1). The use of internal models, combined with a rising degree of confidence in statistical risk measures, has tended to generate more market-sensitive valuations of exposures and insurance liabilities. Greater market sensitivity has reshaped insurers' offerings of credit and equity products and induced insurers to mitigate interest rate risks from asset-liability mismatches.

An additional development—the move toward market-based accounting principles—may contribute to the shortening of investment horizons of risky investments while extending the maturity of safe assets (Annex 3.1). Previously, valuations of investments other than equities were typically based on cost or book values.

<sup>39</sup>This explanation is consistent with the difference between North America and Europe in the pattern of bank clusterings. The economic recovery in the United States reduced the number of bank clusters to below the level preceding the global financial crisis. In contrast, continued economic uncertainty in Europe has kept the number of bank clusters above precrisis levels.

The 2006 Swiss Solvency Test and the 2016 Solvency II Directive of the European Union effectively introduced market-consistent valuation of the total balance sheet.<sup>40</sup> The valuation of liabilities is affected only by the safe interest rate, whereas the valuation of risky assets is also driven by credit spreads (an issue particularly relevant for assets with long maturities). Therefore, insurers have fewer incentives to invest in return-maximizing risky assets so as to avoid large shifts in capital requirements. At the same time, market-consistent valuation encourages investments in longer-term, low-risk assets, such as sovereign debt and high-grade corporate bonds, and these incentives become stronger the higher the market volatility. However, many solvency regimes currently still allow or require the use of cost accounting for insurance liabilities and for many assets (the so-called cost-based valuation standard).

Wide variations in capital requirements and the use of internal models are among the main problems in developing a global capital framework, although progress is being made. The IAIS continues to make progress in establishing its Common Framework for the Supervision of Internationally Active Insurance Groups, which provides more concrete requirements than those in its insurance core principles (ICPs). Also encouraging is the IAIS work on a framework of policy measures for global systemically important insurers (IAIS 2015a) that is consistent with the recommendations of the Financial Stability Board (see Box 3.2).<sup>41,42</sup>

<sup>40</sup>For example, under Solvency II, the discount rates used to derive fair estimates of liabilities are based on prevailing interest rate swap rates, the "ultimate forward rate," plus a matching or volatility adjustment. The matching adjustment depends on the tightness of the asset-liability matching. The volatility adjustment is intended to dampen the procyclicality of credit and liquidity spread volatility. See also European Central Bank 2015.

<sup>41</sup>These policy measures include the higher loss absorbency (HLA) requirement developed in 2015 (IAIS 2015a). As a foundation for the HLA requirement, the IAIS developed the basic capital requirement in October 2014. From 2019, global systemically important insurers will be expected to hold qualifying regulatory capital that is not less than the sum of the required capital amounts from the basic capital requirement and HLA. In December 2014, the IAIS issued the first consultation paper on group-wide, consolidated risk-based insurance capital standards. In June 2015, it published the Ultimate and Interim Goals and main principles for development of insurance capital standards and a so-called delivery process (IAIS 2015b).

<sup>42</sup>Relatively advanced regulatory regimes, such as Switzerland's Solvency Test and the European Union's Solvency II, rely on internal models. Some other regimes, such as those in Canada and Australia, allow internal models only cautiously, whereas the United States and Japan do not allow them except for catastrophe risk and variable annuities (see IMF 2015).



Compliance with the ICPs has improved over time. The ICPs are a globally accepted framework for regulation of the insurance sector and for the conduct of its business strategies. ICPs allow for significant national discretion in their implementation. Since 2003, international compliance seems to have improved, but more for the regulatory aspects than for business strategies. The high noncompliance rates for disclosure point to the importance of addressing remaining data gaps. Moreover, compliance with ICPs is generally greater in advanced economies than in emerging market economies (Figure 3.16).

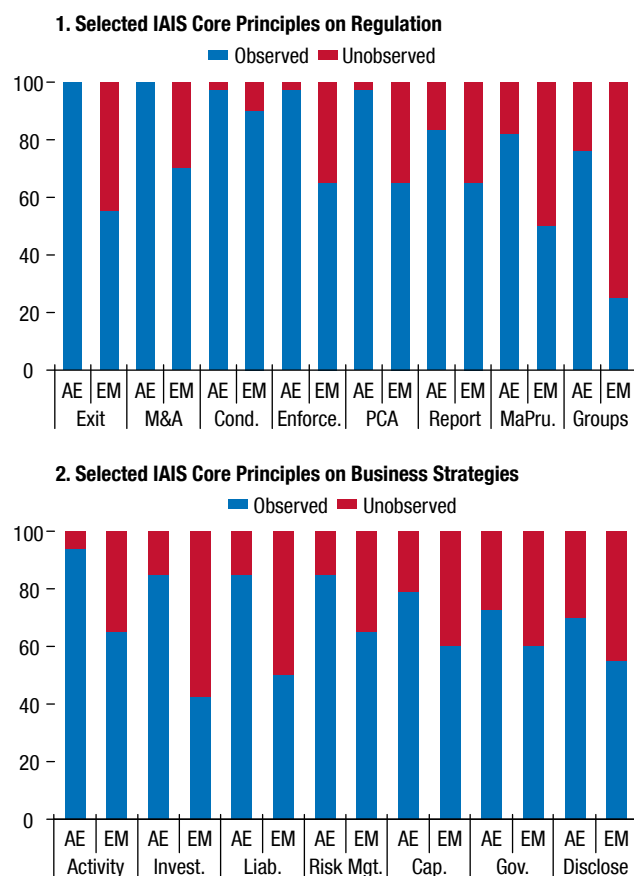
### Looking Forward

#### Macroprudential emphasis

Although progress is being made on the micro-prudential front, the empirical analysis suggests that macroprudential perspectives are needed to address risks related to the sectors' increased common exposures.<sup>43</sup> The analysis underscores the notion that systemic risks not only arise from the potential domino effects created by the insolvency of an individual institution, but also stem, increasingly, from the sector's growing common exposures. This means that supervisors should monitor not only individual firms but also the behavior of the sector as a whole and the interconnections with the rest of the financial system. Enhanced system-wide reporting and disclosure requirements for new and/or less liquid investment products and for duration gaps based on internationally agreed definitions would help supervisors identify greater risk-taking by insurers. Moreover, the IAIS (2013c) work on macroprudential policy measures to strengthen the resilience of the insurance sector should be advanced quickly. One such measure could be countercyclical capital buffers, which—provided they are properly designed—are built up during upswings of the financial cycle and run down during periods of financial market stress. Limits on the use minimum guaranteed interest rates on new life insurance contracts (possibly combined with limits on certain underwriting activities) can also be envisaged. Regular macroprudential stress tests of the sector as a whole would also help identify the sector's resilience to potential vulnerabilities.

<sup>43</sup>This policy recommendation is also elaborated in Monkiewicz and Małeckı (2014).

**Figure 3.16. Compliance with Insurance Core Principles (Percent)**



Sources: IMF, Financial Sector Assessment Programs (FSAP); and IMF staff calculations. Note: Based on FSAP core insurance principles' assessments (33 advanced economies and 20 emerging market economies over the period 2003–15). Insurance core principle compliance is ranked in descending order based on advanced economies. Observed is for fully or largely observed. Unobserved is for partly to fully non-observed. AE = advanced economy; Cap. = solvency; Cond. = supervisory effectiveness (conduct); EM = emerging market economy; Enforce. = enforcement; IAIS = International Association of Insurance Supervisors; Invest. = investments; Liab. = liabilities; MaPru. = macroprudential; M&A = merger and acquisition; PCA = prompt corrective action; Risk Mgt. = risk management.

#### Market-consistent valuation

Full market-consistent valuation increases transparency, and thus helps enhance policyholder protection and provides incentives to address duration mismatches. It is superior to cost-based valuation using book values in reflecting the true economic value of the balance sheet and encouraging greater asset-liability matching. However, this valuation approach tends to make regulatory capital requirements more procyclical, as asset values and capital surpluses change in fairly

lock-step fashion.<sup>44,45</sup> The procyclical implications can be mitigated if insurers hold high-grade bonds whose durations are perfectly matched to their liabilities. Such matching would minimize the cyclical impact of credit and illiquidity premiums of assets on the discounting of long-term liabilities (since liabilities are also discounted at market rates).<sup>46</sup>

Wherever adopted, market-consistent valuation will need to be paired with macroprudential measures that help limit system-wide risks from procyclicality. An example of that accommodation is the European Union's Solvency II regime, which requires market-consistent valuations of both assets and liabilities but includes a "volatility adjustment" that effectively reduces liability values during periods of rising credit spreads in the fixed-income market. To make such countercyclical measures most effective, institutions would need to build capital in the upswing of the financial cycle. In addition, to minimize regulatory arbitrage, authorities should build a consistent international framework for such measures.

#### *Attention to smaller and weaker firms*

Existing international standards focus on larger and stronger firms, but the empirical findings suggest additional policy responses should also target smaller and weaker firms. Weaker firms—those with lower capital ratios, or larger shares of assets with minimum guaranteed returns—and especially smaller companies, seem to be taking relatively more risks. Although the chapter finds that the insurance sector's systemic risk contribution is increasing, international standards are targeted at larger institutions and thus may not apply to the weaker and smaller firms. Insurance supervisors should fill the gap by enhancing both micro- and macroprudential supervision of weaker and smaller firms. Where a large proportion of the insurance sector consists of weaker

and smaller firms, policymakers should consider implementing higher industry-wide capital standards.

#### *Regulatory arbitrage*

Regulatory inconsistencies may trigger significant regulatory arbitrage that boosts systemic risks. Even variations that reflect different business models and risk profiles<sup>47</sup> may trigger it, especially among large insurance groups. For example, in the absence of national U.S. regulatory standards, regulatory arbitrage has been observed via "captive" reinsurance whereby large U.S. insurers established captive reinsurers within the group and transferred significant risks to outside legal entities subject to lower capital requirements (IMF 2015; Kojien and Yogo 2013). Some European internationally active insurance groups reportedly also conduct similar transactions. Proper implementation of group capital requirements may help reduce such arbitrage. The chapter's analysis also shows that weaker insurers seem to adopt more active search-for-yield strategies, which is another form of (ratings-based) regulatory arbitrage. If left unaddressed, such behavior could impair balance sheets if market conditions were to abruptly turn negative.

### Conclusions and Policy Implications

The contribution of the insurance sector—particularly of life insurers—to systemic risk has increased, although not yet to the level of the banking sector. Life insurers' contribution to the aggregate capital shortfall and value at risk of the financial sector has returned to historically high levels and may remain elevated if interest rates continue to be low for long (April 2016 *World Economic Outlook*). Moreover, together with banks, insurers are important transmitters of volatility spillovers across financial sectors and across regions, and they have become more central to the financial systems of North America and advanced Asia.

Life insurers have raised their exposures to aggregate risk, partly as a result of maturity mismatches. Although in the six countries studied in more detail in this chapter, the life insurance sector does not seem to have increased its exposure to assets generally considered "riskier"; life insurers individually seem to have become more sensitive to common shocks and to interest rate

<sup>44</sup>Chapter 3 of the October 2008 GFSR found that the methodological weaknesses of the market-consistent valuation method known as fair value accounting (FVA) may introduce unintended volatility and procyclicality at banks. The study noted that capital buffers, forward-looking reserving, and more refined disclosures can help mitigate FVA procyclicality, and that FVA remains the preferred accounting framework for financial institutions.

<sup>45</sup>The IMF's recent U.S. Financial System Stability Assessment compares two approaches (IMF 2015). It finds a significant effect on the U.S. life insurance sector under a fully market-consistent valuation system, while the effect of cost-based standards appears more benign.

<sup>46</sup>In practice, in recognition of the generally stable nature of insurance liabilities, many jurisdictions allow some adjustments to market-consistent valuation if cash inflows from the assets are expected to meet the projected insurance liability cash outflows.

<sup>47</sup>For example, U.K. and U.S. life insurers have large shares of variable annuities and unit-linked insurance policies, which transfer some or all of the profits and losses on underlying investment portfolios to policyholders. In contrast, in Germany and Japan, life insurers tend to provide guarantees to policyholders.

changes. This is not a completely inevitable outcome. It reflects in part a deliberate choice not to adjust assets or liabilities to a changed environment. The effect of making different choices (likely driven, in part, by regulation) is exemplified by the decline in key systemic risk metrics of nonlife insurers and banks in recent years.

Combating the risks of higher common exposures requires strengthening the macroprudential perspective in regulation and supervision. System-wide risk analysis and enhancements of prudential requirements must be built up to complement the microprudential efforts. In light of the chapter's findings regarding systemic risks, work should be accelerated on macroprudential policy measures and their potential effectiveness in the insurance sector. One such measure could be the adoption of countercyclical capital buffers. Regular macroprudential stress testing of the sector is needed to help identify emerging risks. The approaches used here to measure systemic risk contributions in the insurance sector may prove especially useful in supervisory examinations to highlight insurance trends and identify firms that deserve further scrutiny.

Smaller and weaker firms require more supervisory attention. Their profitability remains under pressure, and they seem to have become more susceptible to a search for yield in the current low-interest-rate environment. Assessing their contribution to systemic risk will require detailed analysis of their investments by type and riskiness, since the failure of one or more midsize insurers could trigger an industry-wide loss of confidence (October 2015 GFSR).

The trends described in the chapter call for increased vigilance over the insurance sector and should encourage further global regulatory reforms. National accounting standards need better alignment with each other to permit international comparisons of capital adequacy to be made. The aim of covering all financial activities within insurance groups should eventually contribute to improve the consistency with the capital regimes of other sectors. Most fundamentally, an international capital standard for insurance companies is needed to counteract their increased contribution to systemic risk and protect against cross-sectoral and regional spillovers. Finally, data gaps (for example, on liability structures) need to be addressed to allow for more complete risk assessments.

### Box 3.1. Insurance Models

Insurance firms have a dual character that is reflected on their balance sheets. They provide protection, an activity that creates liabilities, and they invest, which creates assets.

As protection providers, insurers maintain reserves (their main liabilities) that cover claims and future benefits and provide margins for any unexpected events such as longevity and mortality risks. To supplement the protection obtained from their reserves, insurers may pay out part of the premiums they receive to reinsurers, which cover the insurers for major risks, particularly for property and casualty policies (Box 3.3).

As investment managers, insurers maintain large portfolios, which traditionally are invested primarily in bonds, as well as in equities and loans (Figure 3.1.1). Increasingly, however, insurance companies are acquiring assets from so-called nontraditional non-insurance activities. The following discussion examines the financial structure of life insurance and life annuity plans in more detail.

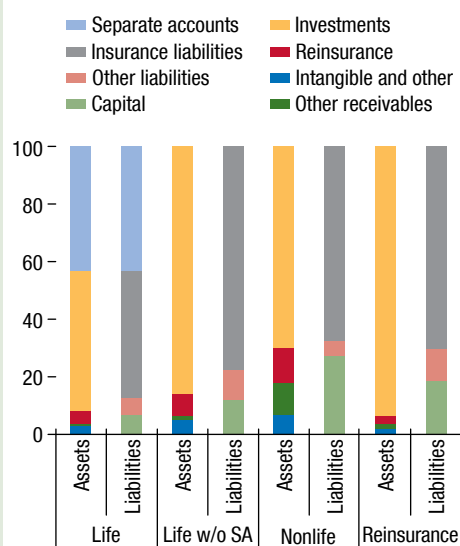
Life insurance is sold in two basic forms: term and whole life. Term life provides coverage for a fixed period, with a level premium guaranteed for its duration; it may be renewable with a premium that may increase with each renewal. If the insured person dies during the term, a death benefit is paid to the policy's beneficiary.<sup>1</sup> Whole life has two components: a defined benefit paid to the beneficiary when the insured person dies, plus an investment component that accumulates a cash value.

Life annuities come in two basic formats: immediate and deferred. Upon making a lump-sum advance payment, the holder of an immediate annuity begins receiving periodic payments that last until the annuitant's death. Deferred annuities delay the start of periodic payments, and the starting principal may be paid for via periodic premiums leading up to the start date. Both immediate and deferred types can have variable accumulation and withdrawal features based on underlying unitized funds and various guaranteed minimum benefits or rates of return. The insurer, which is obliged to continue making payments even after the assets arising from an annuity's premiums are exhausted, sets withdrawal rates at the outset.

This box was prepared by John Kiff and Nico Valckx.

<sup>1</sup>Another form is endowment insurance: term life insurance with a survival benefit paid at the end of the term.

**Figure 3.1.1. Typical Insurance Balance Sheet Structures (Percent)**



Sources: A.M. Best, Global Statement File; Haver Analytics; and IMF staff calculations.

Note: Life w/o SA = life without separate accounts.

Life insurance and annuities have opposite risk profiles. Life insurance policies expose insurers to mortality risk (policyholders die sooner than expected) whereas annuities expose them to longevity risk (policyholders live longer). Therefore, life policies and annuities are in principle natural hedges of each other. However, they are not perfect hedges, in part because life insurance policyholders are usually younger than annuitants. All life products expose insurers to investment risk—the risk that asset portfolios do not perform as well as assumed in pricing and reserving calculations.<sup>2</sup>

<sup>2</sup>For more detail on life annuity risk management, see Chapter 3 in Geneva Association, 2013, *Variable Annuities—An Analysis of Financial Stability*, March; for more on modeling and managing the risk of unit-linked policy guarantees, see Hardy (2003). Nonlife insurance policies are structured like term life policies. Because of the more idiosyncratic nature of nonlife risks, risk management entails investing premiums in high-quality liquid assets and reinsuring tail risks. In addition, nonlife insurers are increasingly turning to alternative risk capital markets.

### Box 3.2. Designation of Global Systemically Important Insurers

The International Association of Insurance Supervisors (IAIS) has created a framework and assessment methodology for identifying firms as global systemically important insurers (GSII). This policy work stems from the fact that insurers contribute to systemic risk, and the distress or disorderly failure of systemic firms threatens financial stability and economic activity. Systemic insurers with a global presence pose such risks on an international scale (IAIS 2012a).

The IAIS assesses global systemic importance along five dimensions. The dimensions are weighted, and each has one or more indicators by which it is measured (Figure 3.2.1). The five categories are size, global activity, interconnectedness, nontraditional non-insurance activities, and substitutability. Using this methodology, the Financial Stability Board, in consultation with IAIS, designated nine primary insurers as GSII and updates this list annually.<sup>1</sup>

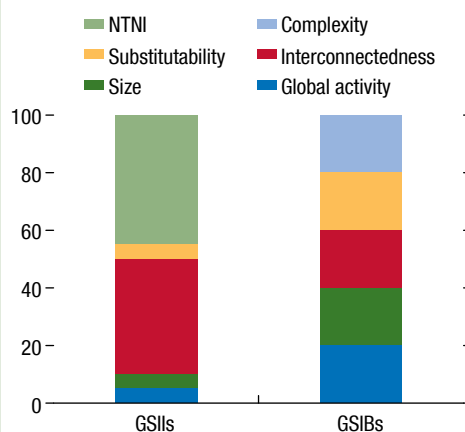
The IAIS has developed policy measures applicable to GSII. These measures include higher loss-absorbency requirements, enhanced group-wide supervision, and national group-wide resolution planning and resolution frameworks. As of 2019, GSII will be expected to hold regulatory capital that is not less than the sum of the requirements for basic capital and higher loss absorbency; the requirements will apply to all group activities, including those of non-insurance subsidiaries.

The framework is comparable to that of the Basel Committee on Banking Supervision (2011) for designating global systemically important banks (GSIB).

This box was prepared by Nico Valckx.

<sup>1</sup>For 2015, these entities were Aegon (the Netherlands), Allianz (Germany), American International Group (United States), Aviva (United Kingdom), Axa (France), MetLife (United States), Ping An Insurance Company of China, Prudential Financial (United States), and Prudential plc (United Kingdom).

**Figure 3.2.1. Systemic Risk Category Weights for Insurers and Banks (Percent)**



Sources: Basel Committee on Banking Supervision 2011; International Association of Insurance Supervisors 2013a; and IMF staff calculations.

Note: GSIBs = global systemically important banks; GSII = global systemically important insurers; NTNI = nontraditional non-insurers.

The specific indicators and weights for the categories differ across the two frameworks, and the GSIB assessment adds a sixth category, complexity (measured with over-the-counter derivatives activity, level 3 assets and the size of the trading book, and the amount of assets available for sale). The GSIB categories all carry equal weights, whereas GSII risk weights vary: low for size, global activity, and substitutability, and high for interconnectedness and nontraditional non-insurance activities.

### Box 3.3. Reinsurance, Retrocession, and Financial Stability

Reinsurance is insurance for insurers. Retrocession is reinsurance for reinsurers. Both provide coverage for (re)insurers that protects them against the cost of payouts for low-probability, high-severity events (tail risks). Reinsurance gives insurers capital relief and expanded underwriting capacity as well as potential opportunities for regulatory arbitrage (IAIS 2012a).<sup>1</sup>

The reinsurance market is small and concentrated. It consists of a relatively few specialist companies plus some primary insurers that sell reinsurance (“assumed reinsurance”). Eight countries account for about 90 percent of reinsurance premiums and the 10 largest

reinsurers account for more than 60 percent of the premiums (Group of Thirty 2006). The rate of use of reinsurance varies widely across countries (Figure 3.3.1).

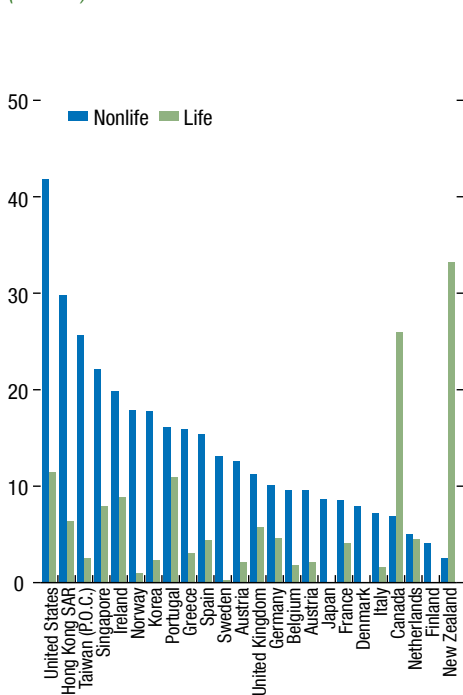
Reinsurers are currently facing pressure from excess capacity, lower demand under a low-loss environment, and competition from alternative sources of capital (European Insurance and Occupational Pensions Authority 2015). Alternative sources of risk capital include catastrophe (CAT) bonds, mortality bonds, and collateralized reinsurance.<sup>2</sup> Alternative risk capital currently comprises about 12 percent of total reinsurance

This box was prepared by John Kiff and Nico Valckx.

<sup>1</sup>Until 2007, there was an active U.S. life insurance securitization market, aimed at arbitraging Regulation XXX and AXXX reserve requirements. Securitization of the so-called redundant reserves required monoline insurance to achieve AAA ratings. However, the postcrisis financial challenges of monoline insurers have virtually closed this market. This regulatory arbitrage is now being achieved with the help of bank letters of credit (Kojien and Yogo 2013).

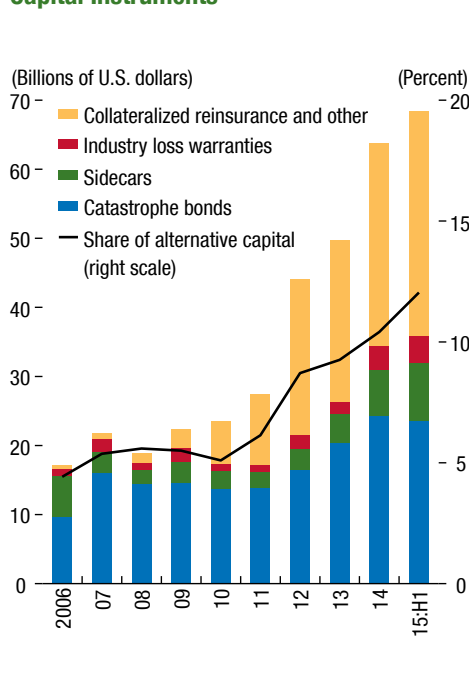
<sup>2</sup>CAT risk is also being transferred via finite-life limited purpose reinsurance vehicles such as “sidecars” and “industry loss warranties,” which are derivative contracts triggered by previously agreed upon levels of industry losses estimated by a third party. Life insurers and defined benefit pension plan sponsors are using insurance risk transfer markets to hedge longevity risk. Longevity swaps provide defined benefit pension plan sponsors with ways of managing longevity risk that go beyond closing or freezing plans; and they provide life insurers with a partial offset to their life insurance mortality risk.

**Figure 3.3.1. Insurers’ Use of Reinsurance (Percent)**



Sources: A.M. Best, Global Statement File; and IMF staff calculations.  
 Note: Reinsurance utilization is defined as reinsurance ceded as a percent of gross premiums written.

**Figure 3.3.2. Alternative Insurance Risk Capital Instruments**



Sources: A.M. Best, Global Statement File; Aon Securities 2015; McKinsey 2013; and IMF staff calculations.

**Box 3.3. (continued)**

capital (Figure 3.3.2). Sophisticated investors are drawn to CAT-linked products as high-yielding uncorrelated assets. CAT products typically provide fully collateralized protection against peak exposures for which traditional reinsurance is unavailable or too expensive.

However, alternative sources of risk capital may pose financial stability concerns. Like the reinsurance market, alternative risk capital markets tend to be highly concentrated. In addition, cash flows on these instruments are often linked to standardized indices, leaving insurers with basis risk. And although most products provide fully collateralized coverage, collateral release terms and conditions may not align with the particulars of insured events (Aon Benfield 2015).<sup>3</sup>

<sup>3</sup>CAT products with indemnity triggers (based on actual losses) provide perfect coverage. In 2015, 62.6 percent of bonds issued were indemnity based (Artemis 2016).

Views about the systemic riskiness of reinsurers and insurance risk transfer markets are mixed. On the one hand, reinsurance liabilities are not redeemable on demand, and claims payments can be spread over many years. Moreover, reinsurer failure and resolution is usually an orderly and lengthy process (Kessler 2013), and alternative risk capital markets can disperse potential losses to diverse ranges of investors. On the other hand, reinsurance creates interconnections within the insurance sector, so that the failure of a major reinsurer might trigger defaults among primary insurers (Park and Xie 2014). Broader potential spillovers depend on the scale and complexity of reinsurers' nontraditional non-insurance activities and, potentially, the change in systemic risk of primary insurers. An additional issue, the possibility of "retrocession spirals," whereby reinsurers inadvertently reinsure their own risk (IAIS 2012b), has become less important in recent years as regulation and supervision have strengthened, including through risk retention.

### Box 3.4. Insurance in China

The insurance industry in China has been growing rapidly. During the five years to 2015, total assets doubled to more than ¥12 trillion (\$1.9 trillion), and premium income also doubled, to more than ¥2 trillion (\$0.3 trillion). Even so, the low level of annual premiums—¥1,479 (\$240) per capita and 3.2 percent of GDP—indicates that growth potential is still strong.<sup>1</sup>

The Chinese insurance market is very concentrated. Of the 75 insurers in 2015, the top five account for more than 40 percent of total assets. One Chinese insurer is currently designated as a global systemically important insurer. Life insurance firms account for more than 80 percent of total insurance industry assets and 60 percent of total industry income from premiums.

In recent years, Chinese insurers have been investing in riskier assets (Figure 3.4.1). During the past two years, insurers invested significantly less in term deposits and bonds (which dropped from 71 percent to 54 percent of aggregate portfolios), and significantly

more in equity and other investments (rising from 29 percent to 46 percent).<sup>2</sup>

The growth in risky assets was more pronounced among smaller, unlisted insurers. On average, the country's five listed insurers increased their risky asset ratio to 28 percent from 17 percent during the past two years, whereas the rise at smaller insurers was to 55 percent from 20 percent.

A key reason for the rapid growth of risky assets is the prevalence of universal life and unit-linked products. Premiums for these products have grown 49 percent annually since 2013. Universal life products offer guaranteed interest rates of 2.5–3.5 percent, with relatively low early withdrawal charges (or even without penalties after one year). This trend is especially strong among smaller and unlisted insurers.

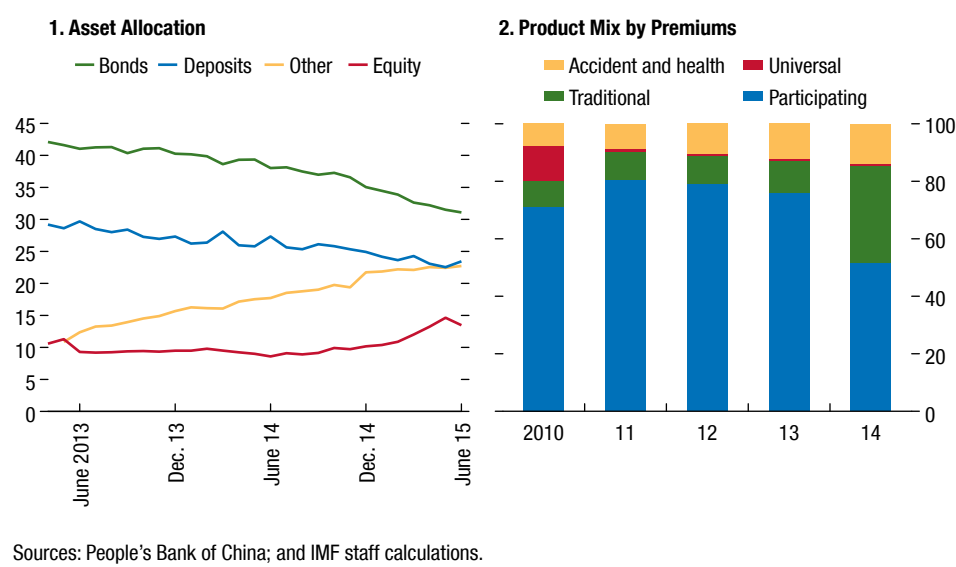
Insurers have strong incentives to concentrate their equity holdings. Insurance regulations stipulate that equity stakes exceeding 20 percent be treated as affiliates, which incur significantly lower capital charges (between 10 percent and 15 percent instead of 31 percent). As a result, the top five equity positions in some insurance firms account for about 30–40 percent of total equity allocations, a concentration that poses significant counterparty risk and thus becomes a financial stability concern.

This box was prepared by Kai Yan.

<sup>1</sup>The State Council has set a goal of achieving a penetration rate for aggregate premiums of 5 percent of GDP and premium density of ¥3,500 per capita by 2020.

<sup>2</sup>Other investments are mostly credit instruments, such as trust loans, infrastructure loans, and wealth management products.

**Figure 3.4.1. Asset Allocations and Product Types for Insurers in China (Percent)**





### Box 3.5. Inward and Outward Spillovers and Centrality of European Insurers

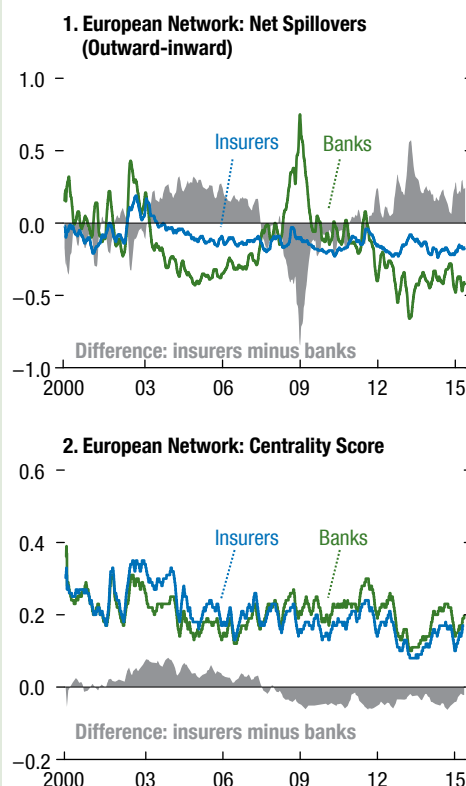
This box uses a conditional of value-at-risk (CoVaR) network approach to quantify systemic risk. The method measures tail dependence and its propagation within a financial network based on the association between very large joint negative equity price changes. This approach permits specification of the degree of outward spillovers (to other firms), inward spillovers (from other firms), and the degree of influence of a firm in the network (the eigenvalue centrality score). As such, the approach is technically closer in spirit to the domino view of systemic risk (for more details, see Ito and Jobst [forthcoming]).

European insurers have been the destination, rather than the source, of spillovers, but the trend suggests that this direction is changing. Banks were the main source of connectedness until the end of the global financial crisis, whereas insurers' net spillover risk has remained largely unchanged since 2008 (Figure 3.5.1, panel 1). In addition, the aggregate results disguise some important time-varying, cross-country differences. The net spillover risks of insurers in Belgium, Denmark, and Spain are generally higher and positive, whereas those of insurers in Finland and Germany are consistently negative. During the financial crisis, spillover risks increased the most for insurers in Belgium and the United Kingdom (and to a lesser extent in the Netherlands), whereas the opposite was true for their peers in Austria, Finland, and France.

With regard to influence on the network (the eigenvalue centrality score), insurers are somewhat less important than banks. Before 2008, the centrality score of European insurers was higher than that of banks (Figure 3.5.1, panel 2). However, the financial crisis led to a decrease in the scores of European insurers and an increase for banks. More recently, the gap between the systemic importance of European banks and insurers has decreased. Moreover, additional analysis suggests that the propagation of negative shocks from insurance companies tends to be smaller and shorter-lived than comparable shocks from banks.

This box was prepared by Andy Jobst.

**Figure 3.5.1. Spillover Effects and Interconnectedness of European Banks and Insurers**



Source: IMF staff calculations based on Ito and Jobst (forthcoming).

Note: Net spillovers defines a network-based measure of “absorption capacity” as the difference between the “to-degree connectedness” and the “from-degree connectedness” conditional on a daily measure of 95 percent CoVaR between two firms. A positive value indicates a higher average probability of being a source of spillover. Estimation uses daily equity log returns between January 1, 2000, and July 20, 2015, are of 114 European Union firms, of which 30 are insurance companies.

## Annex 3.1. Regulatory Standards for Valuations in the Insurance Sector

Annex Table 3.1.1. Regulatory Standards for Valuations in the Insurance Sector

		Valuation Basis	
		Market-Based and/or Consistent Assets and Liabilities	Historical Cost/Book Value
Risk Sensitivity	Risk-Based	European Union ( <i>Solvency II</i> ) Australia Belgium ( <i>pre-Solvency II</i> )* Bermuda Canada Denmark ( <i>pre-Solvency II</i> ) Japan* Korea Mexico Netherlands ( <i>pre-Solvency II</i> ) Norway ( <i>pre-Solvency II</i> )* Switzerland United Kingdom ( <i>pre-Solvency II</i> )	People's Republic of China (C-ROSS) United States
	Non-Risk-Based	Germany ( <i>pre-Solvency II</i> )	Brazil People's Republic of China Solvency I (pre-2016) European Union Solvency I (pre-2016) France ( <i>pre-Solvency II</i> ) India Italy ( <i>pre-Solvency II</i> ) Ireland ( <i>pre-Solvency II</i> ) Luxembourg ( <i>pre-Solvency II</i> ) Spain ( <i>pre-Solvency II</i> ) South Africa Sweden ( <i>pre-Solvency II</i> ) <sup>1</sup>

Sources: IMF staff compilation based on supervisory; and other sources.

Note: This table provides a general comparison of risk measurement and valuation standards. The actual degree of “stringency” of a given solvency regime depends on the confluence of valuation standards, the definition of capital, the level of solvency thresholds, and the implementation of supervisory practices (\*: only assets).

<sup>1</sup>Sweden's Financial Supervisory Authority has used stress tests to make the solvency assessment more risk-sensitive.

## Annex 3.2. Data and Methodology

### Data

Firm-level data for insurers are from A.M. Best, Global Financial Statement File, which provides standardized income and balance sheet information for a large set of firms and countries. In addition, more granular portfolio data are used to analyze life insurers' investments in the United States (Schedule D, provided by the NAIC), Canada (Office of the Superintendent of Financial Institutions), the Netherlands (De Nederlandsche Bank), Germany (Assekurata), Norway (Finanstilsynet), and Korea (Korean Life Insurance Association). Insurers' equity prices and other financial series are taken from Bloomberg, L.P.; Datastream Thomson Reuters; and J.P. Morgan. Insurers' probabilities of default and default correlations are obtained from Risk Management Institute (2015) at the National University of Singapore.

### Time Series Analysis of Investments

The analysis examines how changes in long-term interest rates and firm factors affect the investment decisions of life insurers. The main regression model is given by

$$RiskyShare_{it} = \beta_1 X_{it-1} \cdot LT_t + \beta_2 X_{it-1} + \beta_3 Controls_{it-1} + \alpha_i + \gamma_t + \varepsilon_{it},$$

in which  $RiskyShare_{it}$  is the share of higher-risk assets for insurer  $i$  in year  $t$  (for Korea, the dependent variable is the 2009–13 change in the share of higher-risk assets), and  $LT_t$  is the interest rate of the long-term (10-year) government bond. Firm variables  $X$  include regulatory capital surplus normalized by total assets (for U.S. life insurers), solvency ratio (for Canadian, Dutch, and German life insurers), ratio of annuities to total liabilities, average guaranteed interest rate of insurance policies, and whether the firm is among the upper half ranked by total assets.  $Controls$  include (logged) total assets, leverage, and the ratio of net premiums written to total liabilities. Standard errors are clustered at the group level where applicable (Annex Table 3.2.1).

**Annex Table 3.2.1. Determinants of Life Insurers' Asset Allocation to Higher-Risk Assets**

	United States	Canada	Netherlands	Germany	Korea	
Capital/Solvency Ratio × LT	0.019** (0.008)	0.009** (0.003)	0.211* (0.113)			
Capital/Solvency Ratio	-0.088** (0.036)	-0.049*** (0.013)	-0.541*** (0.187)	-0.285*** (0.079)		
Annuities × LT	-0.032*** (0.011)	-0.198*** (0.063)				
Annuities	0.073* (0.044)	1.021*** (0.234)				
log (Total Assets) × LT	0.002** (0.001)	0.010*** (0.003)				
log (Total Assets)	-0.010** (0.005)	-0.01 (0.018)		-0.084*** (0.031)	-0.048 (0.045)	
Large					-0.047+ (0.030)	
Guaranteed Rate				0.098** (0.043)		
Number of Observations	3,120	256	245	283	19	
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	No
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	No
R <sup>2</sup>	0.86	0.80	0.16	0.14	0.13	0.13

Source: IMF staff calculations.

Note: \*\*\*, \*\*, \*, and + represent statistical significance at 1 percent, 5 percent, 10 percent, and 15 percent levels, respectively. Numbers in parentheses indicate standard errors.

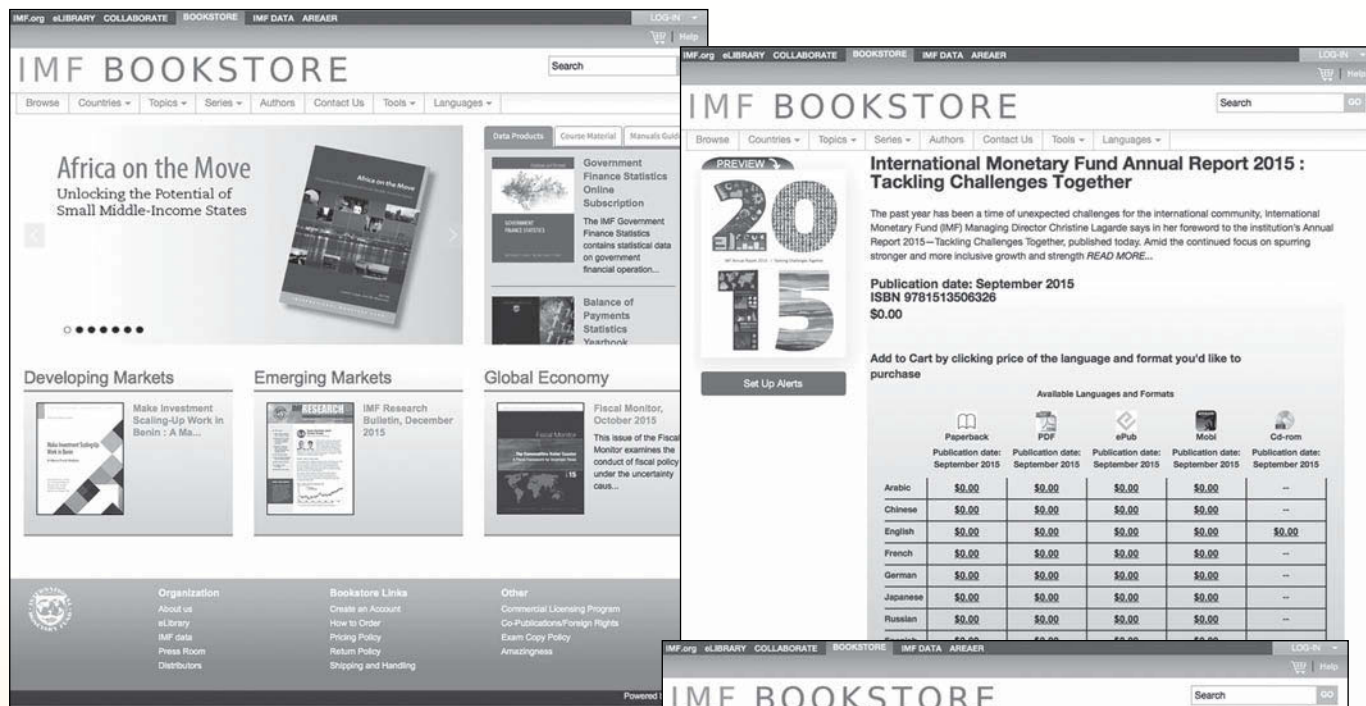
## References

- Acharya, Viral V. 2015. "Are Insurance Firms Systemically Important?" Presentation at Stockholm Institute for Financial Research, August 15.
- , John Biggs, Matthew Richardson, and Stephen Ryan. 2009. "On the Financial Regulation of Insurance Companies." White Paper, Stern School of Business, New York University.
- Acharya, Viral V., Robert Engle, and Matthew Richardson. 2012. "Capital Shortfall: A New Approach to Ranking and Regulating Systemic Risks." *American Economic Review* 102 (3): 59–64.
- Acharya, Viral V., and Matthew Richardson. 2014. "Is the Insurance Industry Systemically Risky?" In *Modernizing Insurance Regulation*, edited by J. H. Biggs and M. Richardson, 151–80. Hoboken, New Jersey: Wiley.
- Adrian, Tobias, and Markus K. Brunnermeier. Forthcoming. "CoVaR." *American Economic Review*.
- Alves, Ivan, Jeroen Brinkhoff, Stanislav Georgiev, Jean-Cyprien Héam, and Iulia Moldovan. 2015. "Network Analysis of the EU Insurance Sector." ESRB Occasional Paper No. 7, European Systemic Risk Board, Frankfurt.
- Aon Benfield. 2015. "Insurance-Linked Securities: Alternative Markets Adapt to Competitive Landscape." September.
- Artemis. 2016. "Catastrophe Bonds and ILS Issuance by Trigger and by Year." [http://www.artemis.bm/deal\\_directory/cat\\_bonds\\_ils\\_by\\_trigger\\_by\\_year.html](http://www.artemis.bm/deal_directory/cat_bonds_ils_by_trigger_by_year.html)
- Baker, Malcolm, and Jeffrey Wurgler. 2007. "Investor Sentiment in the Stock Market." *Journal of Economic Perspectives* 21 (2): 129–51.
- Baklanova, Viktoria, Adam M. Copeland, and Rebecca McCaughrin. 2015. "Reference Guide to U.S. Repo and Securities Lending Markets." Federal Reserve Bank of New York Staff Report No. 740.
- Baluch, Faisal, Stanley Mutenga, and Chris Parsons. 2011. "Insurance, Systemic Risk and the Financial Crisis." *Geneva Papers* 36: 126–63.
- Bank for International Settlements. 2015. "Statistical Release: OTC Derivatives Statistics at End-June 2015." Basel.
- Bank of England. 2015. "Insurance and Financial Stability." *Quarterly Bulletin* 55 (3): 242–58.
- Basel Committee on Banking Supervision. 2011. "Global Systemically Important Banks: Assessment Methodology and the Additional Loss Absorbency Requirement." BCBS Paper 207.
- Becker, Bo, and Victoria Ivashina. 2015. "Reaching for Yield in the Bond Market." *Journal of Finance* 70 (5): 1863–901.
- Becker, Bo, and Marcus M. Opp. 2014. "Regulatory Reform and Risk-Taking: Replacing Ratings." Swedish House of Finance Research Paper No. 13-03.
- Berdin, Elia, and Matteo Sottocornola. 2015. "Assessing Systemic Risk of the European Insurance Industry." European Insurance and Occupational Pensions Authority, Financial Stability Report, December.
- Berends, Kyal, and Thomas King. 2015. "Derivatives and Collateral at U.S. Life Insurers." *Economic Perspectives*. Federal Reserve Bank of Chicago.
- Berends, Kyal, Robert McMenamin, Thanases Plestis, and Richard J. Rosen. 2012. "The Sensitivity of Life Insurance Firms to Interest Rate Changes." Federal Reserve Bank of Chicago, *Economic Perspectives* 37: 47–78.
- Bijlsma, Melle, and Robert Vermeulen. 2015. "Insurance Companies' Trading Behaviour during the European Sovereign Debt Crisis: Flight Home or Flight to Quality?" De Nederlandsche Bank Working Paper No. 468, Amsterdam.

- Billio, Monica, Mila Getmansky, Andrew W. Lo, and Liorana Pelizzon. 2012. “Econometric Measures of Connectedness and Systemic Risk in the Finance and Insurance Sectors.” *Journal of Financial Economics* 104 (3): 535–59.
- Bisias, Dimitrios, Mark Flood, Andrew W. Lo, and Stavros Valavanis. 2012. “A Survey of Systemic Risk Analytics.” *Annual Review of Financial Economics* 4: 255–96.
- Brewer, Elijah III, James M. Carson, Elyas Elyasiani, Iqbal Mansur, and William L. Scott. 2007. “Interest Rate Risk and Equity Values of Life Insurance Companies: A GARCH-M Model.” *Journal of Risk and Insurance* 74 (2): 401–23.
- Brownless, Christian T., and Robert F. Engle. 2015. “SRISK: A Conditional Capital Shortfall Measure of Systemic Risk.” Unpublished, Universitat Pompeu Fabra and New York University.
- Campbell, John Y., Stefano Giglio, and Christopher Polk. 2013. “Hard Times.” *Review of Asset Pricing Studies* 3 (1): 95–132.
- Carney, Mark. 2015. “Breaking the Tragedy of the Horizon—Climate Change and Financial Stability.” Speech given at Lloyd’s of London, September 29.
- Chan-Lau, Jorge A., Chienmin Chuang, Jin-Chuan Duan, and Wei Sun. 2015. “Forward-Looking Default Correlation Financial Networks and Systemic Risk Applications.” Unpublished, International Monetary Fund, Washington, and National University of Singapore.
- Chouakria, Ahlame D., and Panduranga N. Nagabhushan. 2007. “Adaptive Dissimilarity Index for Measuring Time Series Proximity.” *Advances in Data Analysis and Classification* 1 (1): 5–21.
- Cohn, Alain, Jan Engelmann, Ernst Feher, and Michel A. Marechal. 2015. “Evidence for Countercyclical Risk Aversion: An Experiment with Financial Professionals.” *American Economic Review* 105 (2): 860–85.
- Cummins, J. David, and Mary A. Weiss. 2014. “Systemic Risk and the U.S. Insurance Sector.” *Journal of Risk and Insurance* 81 (3): 489–527.
- de Haan, Leo, and Jan Kakes. 2011. “Momentum or Contrarian Investment Strategies: Evidence from Dutch Institutional Investors.” *Journal of Banking and Finance* 35 (9): 2245–51.
- Diebold, Francis X., and Kamil Yilmaz. 2014. “On the Network Topology of Variance Decompositions: Measuring Connectedness of Financial Firms.” *Journal of Econometrics* 182 (1): 119–34.
- Domanski, Dietrich, Hyun Song Shin, and Vladyslav Sushko. 2015. “The Hunt for Duration: Not Waving but Drowning?” BIS Working Paper No. 519, Bank for International Settlements, Basel.
- Duijm, Patty, and Sophie Steins Bisschop. 2015. “Short-Termism of Long-Term Investors? The Investment Behaviour of Dutch Insurance Companies and Pension Funds.” De Nederlandsche Bank Working Paper No. 489, Amsterdam.
- Dungey, Mardi, Matteo Luciani, and David Veredas. 2014. “The Emergence of Systemically Important Insurers.” Unpublished.
- Engle, Robert F., Eric Jondeau, and Michael Rockinger. 2015. “Systemic Risk in Europe.” *Review of Finance* 19 (1): 145–90.
- European Central Bank. 2015. “Financial Stability Review.” November. Frankfurt.
- European Insurance and Occupational Pensions Authority. 2014. “Financial Stability Report.” May. Frankfurt.
- European Systemic Risk Board. 2015. “Report on Systemic Risks in the EU Insurance Sector.” December. Frankfurt.
- Feodorina, Mark, and Till Förstemann. 2015. “Lethal Lapses: How a Positive Interest Rate Shock Might Stress German Life Insurers.” Deutsche Bundesbank Discussion Paper 12, Frankfurt.
- Financial Stability Board. 2013. “Strengthening Oversight and Regulation of Shadow Banking: Policy Framework for Strengthening Oversight and Regulation of Shadow Banking Entities.” Basel.
- Foley-Fisher, Nathan C., Borghan Narajabad, and Stephane H. Verani. 2015. “Self-Fulfilling Runs: Evidence from the U.S. Life Insurance Industry.” Finance and Economics Discussion Series 2015-032, Board of Governors of the Federal Reserve System, Washington.
- The Geneva Association. 2010a. “Key Financial Stability Issues in Insurance: An Account of the Geneva Association Ongoing Dialogue on Systemic Risk with Regulators and Policy-Makers.” July. Geneva: The International Association for the Study of Insurance Economics.
- . 2010b. “Systemic Risk in Insurance: An Analysis of Insurance and Financial Stability.” Special Report of the Geneva Association Systemic Risk Working Group, March. Geneva: The International Association for the Study of Insurance Economics.
- . 2011. “Assessment of Systemic Risk Indicators in the Insurance Sector.” IAIS Technical Committee Observer Hearing, February 17. Geneva: The International Association for the Study of Insurance Economics.
- . 2013. “Variable Annuities—An Analysis of Financial Stability.” March. Geneva: The International Association for the Study of Insurance Economics.
- Global Risk Regulator. 2016. “EU Wades into Insurance Systemic Risk Debate.” February 11.
- Group of Thirty. 2006. “Reinsurance and International Financial Markets.” Washington.
- Guiso, Luigi, Paola Sapienza, and Luigi Zingales. 2014. “Time Varying Risk Aversion.” Unpublished, University of Chicago.
- Hardy, Mary. 2003. *Investment Guarantees, Modeling and Risk Management for Equity-Linked Life Insurance*. Hoboken, NJ: John Wiley & Sons, Inc.
- Houben, Aerdt, and Mark Teunissen. 2011. “The Systemicness of Insurance Companies: Cross-Border Aspects and Policy Implications.” In *The Future of Insurance Regulation and Supervision—A Global Perspective*, edited by Patrick M. Liedtke and Jan Monkiewicz, 246–69. London: Palgrave Macmillan.
- International Association of Insurance Supervisors. 2011. “Insurance and Financial Stability.” November. Bank for International Settlements, Basel.
- . 2012a. “Global Systematically Important Insurers: Proposed Policy Measures.” Public Consultation Document, Bank for International Settlements, Basel.
- . 2012b. “Reinsurance and Financial Stability.” July 19, Bank for International Settlements, Basel.
- . 2013a. “Global Systemically Important Insurers: Final Initial Assessment Methodology.” July 18, Bank for International Settlements, Basel.

- . 2013b. “Global Systematically Important Insurers: Proposed Policy Measures.” July 18, Bank for International Settlements, Basel.
- . 2013c. “Macroprudential Policy and Surveillance in Insurance.” Macroprudential Surveillance and Policy Subcommittee (MPSSC), July 18, Bank for International Settlements, Basel.
- . 2015a. “Capital Requirements for Global Systemically Important Insurers (G-SIIs): Basic Capital Requirements (BCR) and Higher Loss Absorbency (HLA).” October 5, Bank for International Settlements, Basel.
- . 2015b. “The IAIS Risk-Based Global Insurance Capital Standard (ICS): Ultimate and Interim Goals, Principles for Development and Delivery Process.” June 25, Bank for International Settlements, Basel.
- Impavido, Gregorio, and Ian Tower. 2009. “How the Financial Crisis Affects Pensions and Insurance and Why the Impacts Matter.” Working Paper 09/151, International Monetary Fund, Washington.
- International Monetary Fund. 2013. “Key Aspects of Macroprudential Policy.” Washington.
- . 2015. “United States Financial System Stability Assessment.” Washington.
- Ito, Ryoko, and Andreas Jobst. Forthcoming. “Modeling Systemic Risk in the Euro Area.” Working Paper, European Department, International Monetary Fund, Washington.
- Jobst, Andreas. 2014. “Systemic Risk in the Insurance Sector: A Review of Current Assessment Approaches.” *Geneva Papers on Risk and Insurance* 39: 440–70.
- , Nobuyashi Sugimoto, and Timo Broszeit. 2014. “Macroprudential Solvency Stress Testing of the Insurance Sector.” Working Paper 14/133, International Monetary Fund, Washington.
- Kenett, Dror Y., Michele Tumminello, Asaf Madi, Gitit Gur-Gershgoren, Rosario N. Mategna, and Eshel Ben-Jacob. 2010. “Dominating Clasp of the Financial Sector Revealed by Partial Correlation Analysis of the Stock Market.” *PLoS ONE* 5 (12).
- Kessler, Denis. 2013. “Why (Re)Insurance Is Not Systemic.” *Journal of Risk and Insurance* 81 (3): 477–87.
- Koijen, Ralph, and Motohiro Yogo. 2013. “Shadow Insurance.” Working Paper 19568, National Bureau of Economic Research, Cambridge, MA.
- Krenn, Gerald, and Ulrike Oschischnig. 2003. “Systemic Risk Factors in the Insurance Industry and Methods for Risk Assessment.” Oesterreichische Nationalbank, Financial Stability Report, 6: 62–73.
- Liao, Warren T. 2005. “Clustering of Time Series Data—A Survey.” *Pattern Recognition* 38 (11): 1857–74.
- Liedtke, Patrick M. 2011. “Assessment of Systemic Risk Indicators in the Insurance Sector.” Working Paper Series of the Geneva Association, *Etudes et Dossiers* 377.
- Ma, Yu-Luen, and Yayuan Ren. 2012. “Do Publicly Traded Property-Casualty Insurers Cater to the Stock Market?” *Journal of Risk and Insurance* 79 (2): 415–30.
- Manconi, Alberto, Massimo Massa, and Ayako Yasuda. 2012. “The Role of Institutional Investors in Propagating the Crisis of 2007–2008.” *Journal of Financial Economics* 104 (3): 491–518.
- Mannix, Rob. 2014. “Insurance Europe Questions Plans on Uncleared Swaps.” *Risk* 27 (8): 33–39.
- McKinsey & Company. 2013. “Could Third-Party Capital Transform the Reinsurance Markets?” Financial Services Practices. September. Washington.
- Monkiewicz, Jan, and Marian Malecki, eds. 2014. *Macroprudential Supervision in Insurance: Theoretical and Practical Aspects*. London: Palgrave MacMillan.
- Oh, Sang, Onkar Dalal, Kshitij Khare, and Bala Rajaratnam. 2014. “Optimization Methods for Sparse Pseudo-Likelihood Graphical Model Selection.” *Advances in Neural Information Processing Systems* 27 (online edition).
- Papaioannou, Michael G., Joonkyu Park, Jukka Pihlman, and Han van der Hoorn. 2013. “Procyclical Behavior of Institutional Investors during the Recent Financial Crisis: Causes, Impacts, and Challenges.” Working Paper 13/193, International Monetary Fund, Washington.
- Park, S. C., and X. Xie. 2014. “Reinsurance and Systemic Risk: The Impact of Reinsurer Downgrading on Property-Casualty Insurers.” *Journal of Risk and Insurance* 81: 587–622.
- Paulson, Anna, Thanases Plestis, Richard Rosen, Robert McMenamin, and Zain Mohey-Dean. 2014. “Assessing the Vulnerability of the U.S. Life Insurance Industry.” In *Modernizing Insurance Regulation*, edited by J. H. Biggs and M. Richardson. Hoboken, New Jersey: Wiley.
- Peirce, Hester. 2014. “Securities Lending and the Untold Story in the Collapse of AIG.” Working Paper 14-12, Mercatus Center at George Mason University, Fairfax, Virginia.
- Risk Magazine*. 2013. “Re-Risking the Balance Sheet, Allocations to Illiquids Grow.” March.
- . 2015. “Rekindled Affection: Transitional Measures Spur Equity Rethink.” March.
- Risk Management Institute. 2015. “NUS-RMI Credit Research Initiative Technical Report, Version: 2015 Update 1.” *Global Credit Review* 1 (6): 1–91.
- Rose, Jonathan. 2016. “The Resolution of a Systemically Important Insurance Company during the Great Depression.” Finance and Economics Discussion Series Working Paper No. 2016-5, Board of Governors of the Federal Reserve System, Washington.
- Rudolph, M. J. 2011. “U.S. Insurance Company Investment Strategies in an Economic Downturn.” Committee on Financial Research White Paper, Society of Actuaries, Schaumburg, Illinois.
- Schwarcz, Daniel, and Steven L. Schwarcz. 2014. “Regulating Systemic Risk in Insurance.” *University of Chicago Law Review* 81 (4): 1570–640.
- Standard Life Investments Limited. 2015. “European Insurance: Unprecedented Pressure and Change.” November. Edinburgh.
- Thimann, Christian. 2015. “Systemic Features of Insurance and Banking, and the Role of Leverage, Capital and Loss Absorption.” *Geneva Papers*. Geneva: The International Association for the Study of Insurance Economics.
- Timmer, Yannick. 2016. “Cyclical Investment Behavior across Financial Institutions.” Working Paper, Trinity College Dublin, February.

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