World Economic and Financial Surveys

Global Financial Stability Report

Is Growth at Risk?

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. . . 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, 2016–17 or January–June) to indicate the years or months covered, including the beginning and ending years or months;

/ between years or months (for example, 2016/17) 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 ¼ 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.

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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) and on the IMF website (www.imf.org). All substantive changes are listed in detail in the online tables of contents.

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

Individual contributors to the report are Ali Al-Eyd, Zohair Alam, Adrian Alter, Sergei Antoshin, Magally Bernal, André Leitão Botelho, Luis Brandão-Marques, Jeroen Brinkhoff, John Caparusso, Sally Chen, Shiyuan Chen, Yingyuan Chen, Charles Cohen, Claudia Cohen, Fabio Cortes, Dimitris Drakopoulos, Kelly Eckhold, Martin Edmonds, Jesse Eiseman, Jennifer Elliott, Aquiles Farias, Alan Xiaochen Feng, Caio Ferreira, Tamas Gaidosch, Rohit Goel, Hideo Hashimoto, Sanjay Hazarika, Dong He, Geoffrey Heenan, Dyna Heng, Paul Hiebert, Henry Hoyle, Nigel Jenkinson, David Jones, Mitsuru Katagiri, Will Kerry, Jad Khallouf, Robin Koepke, Romain Lafarguette, Tak Yan Daniel Law, Feng Li, Yang Li, Peter Lindner, Xiaomeng Lu, Sheheryar Malik, Rebecca McCaughrin, Kei Moriya, Aditya Narain, Machiko Narita, Vladimir Pillonca, Thomas Piontek, Breanne Rajkumar, Mamoon Saeed, Luca Sanfilippo, Jochen Schmittmann, Yves Schüler, Dulani Seneviratne, Juan Solé, Ilan Solot, Yasushi Sugayama, Jay Surti, Narayan Suryakumar, Nico Valckx, Francis Vitek, Changchun Wang, Jeffrey Williams, Christopher Wilson, and Xinze Yao. Magally Bernal, Breanne Rajkumar, and Claudia Cohen were responsible for word processing.

Gemma Diaz from the Communications Department led the editorial team and managed the report's production with support from Linda Kean and editorial assistance from Sherrie Brown, Lorraine Coffey, Susan Graham, Lucy Scott Morales, Nancy Morrison, Katy Whipple, AGS, and Vector.

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

This GFSR reflects information available as of September 22, 2017. 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 September 21, 2017. However, the analysis and policy considerations are those of the IMF staff and should not be attributed to Executive Directors or their national authorities.

FOREWORD

Twice a year, the *Global Financial Stability Report* (GFSR) assesses the degree to which developments in the financial sector may affect future economic conditions by analyzing macro-financial linkages and then identifies policies to mitigate risks to growth from the financial sector. At the current juncture, investor risk appetite is buoyant globally: since the last report in April, funding conditions have continued to improve, asset return volatility has receded to multiyear lows across markets, and global capital flows have surged. This easing of financial conditions has supported global growth and financial inclusion, with credit being allocated to benefit a broad range of borrowers. These favorable conditions create a window of opportunity to strengthen the financial system that should be seized, since experience has taught us that it is during times of easy financial conditions that vulnerabilities build.

Chapter 1 of this GFSR documents how the continuation of monetary accommodation in advanced economies—necessary to support activity and boost inflation—is associated with rising asset valuations and higher leverage, and how this environment makes the system more vulnerable to future shocks. Chapter 2 focuses on household leverage, showing that ample credit growth portends benign conditions in the near term but larger downside risks in the medium term—and thus creates an intertemporal tradeoff. Chapter 3 takes this logic a step further and directly links the easing of financial conditions to downside risks to GDP growth. Easy financial conditions fuel growth in the shorter term, but when those conditions are coupled with a buildup in leverage, risks to growth rise in the medium term. In fact, we propose to measure financial stability by a measure of Growth at Risk, defined as the value at risk of future GDP growth as a function of financial vulnerability.

The analysis in all three chapters underscores that some of the factors that have contributed to recent gains in financial stability could put growth at risk in the medium term in the absence of appropriate policies to address rising financial vulnerabilities. Macroprudential policies, such as those that address underwriting standards, are the primary tool for guarding against future risks to growth from the global financial system. Now is the time to further strengthen that system, particularly by focusing on nonbank institutions, whose vulnerabilities are rising. Macroprudential policies that mitigate the buildup of medium-term risks can also help to better balance monetary policy tradeoffs.

Whereas vulnerabilities are rising in the nonbank financial system, the safety of the global systemically important banks (GSIBs) has improved significantly. Those banks have more capital and more liquidity and are subject to tighter supervision, thanks to the pivotal reforms undertaken after the 2008 global financial crisis. Yet some GSIBs still struggle to adapt their business models to ensure their continued health and profitability, which is critical if they are to fulfill their primary mandate: lending to the real economy. A review of the unintended consequences of the postcrisis regulatory reforms will likely lead to some streamlining in the implementation of banking regulations, but it is essential that the overall high level of capital and liquidity be preserved, regulatory uncertainty be avoided, and the global financial regulatory reform agenda be completed. Equally essential is continuing international regulatory cooperation.

Tobias Adrian
Financial Counsellor

EXECUTIVE SUMMARY

Near-Term Risks Are Lower

The global financial system continues to strengthen in response to extraordinary policy support, regulatory enhancements, and the cyclical upturn in growth. The health of banks in many advanced economies continues to improve, as progress has been made in resolving some weaker banks, while a majority of systemic institutions are adjusting business models and restoring profitability. The upswing in global economic activity, discussed in the October 2017 *World Economic Outlook* (WEO), has boosted market confidence while reducing near-term threats to financial stability.

But beyond these recent improvements, the environment of continuing monetary accommodation—necessary to support activity and boost inflation—is also leading to rising asset valuations and higher leverage. Financial stability risks are shifting from the banking system toward nonbank and market sectors of the financial system. These developments and risks call for delicately balancing the eventual normalization of monetary policies, while avoiding a further buildup of financial risks outside the banking sector and addressing remaining legacy problems.

The Two Sides of Monetary Policy Normalization

The baseline path for the global economy, envisaged by central banks and financial markets, foresees continued support from accommodative monetary policies, as inflation rates are expected to recover only slowly. Thus, the gradual process of normalizing monetary policies is likely to take several years. Too fast a pace of normalization would remove needed support for sustained recovery and desired increases in core inflation across major economies. Unconventional monetary policies and quantitative easing have forced substantial portfolio adjustments in the private sector and across borders, making the adjustment of financial markets much less predictable than in previous cycles. Abrupt or ill-timed shifts could cause unwanted turbulence in financial markets and reverberate across borders and markets. Yet the prolonged monetary support envisaged for the major economies may lead to the buildup of further financial excesses. As the search for yield intensifies, vulnerabilities are shifting to the nonbank sector, and market risks are rising. There is too much money chasing too few yielding assets: less than 5 percent ($1.8 trillion) of the current stock of global investment-grade fixed-income assets yields over 4 percent, compared with 80 percent ($15.8 trillion) before the crisis. Asset valuations are becoming stretched in some markets as investors are pushed out of their natural risk habitats, and accept higher credit and liquidity risk to boost returns.

At the same time, indebtedness among the major global economies is increasing. Leverage in the nonfinancial sector is now higher than before the global financial crisis in the Group of Twenty economies as a whole. While this has helped facilitate the economic recovery, it has left the nonfinancial sector more vulnerable to changes in interest rates. The rise in leverage has led to a rise in private sector debt service ratios in several of the major economies, despite the low level of interest rates. This is stretching the debt servicing capacity of weaker borrowers in some countries and sectors. Debt servicing pressures and debt levels in the private nonfinancial sector are already high in several major economies (Australia, Canada, China, Korea), increasing their sensitivity to tighter financial conditions and weaker economic activity.

The key challenge confronting policymakers is to ensure that the buildup of financial vulnerabilities is contained while monetary policy remains supportive of the global recovery. Otherwise, rising debt loads and overstretched asset valuations could undermine market confidence in the future, with repercussions that could put global growth at risk. This report examines such a downside scenario, in which a repricing of risks leads to sharp increases in credit costs, falling asset prices, and a pullback from emerging markets. The economic impact of this tightening of global financial conditions would be significant (about one-third as severe as the global financial crisis) and more broad-based (global output would fall 1.7 percent relative to the WEO baseline with varying cross-country effects). Monetary normalization would go into

reverse in the United States and would stall elsewhere. Emerging market economies would be disproportionately affected, resulting in an estimated $100 billion reduction in portfolio flows over four quarters. Bank capital would take the biggest hit where leverage is highest and where banks are most exposed to the housing and corporate sectors.

Deleveraging in China: Challenges Ahead

Steady growth in China and financial policy tightening in recent quarters have eased concerns about a near-term slowdown and negative spillovers to the global economy. However, the size, complexity, and pace of growth in China's financial system point to elevated financial stability risks. Banking sector assets, at 310 percent of GDP, have risen from 240 percent of GDP at the end of 2012. Furthermore, the growing use of short-term wholesale funding and "shadow credit" to firms has increased vulnerabilities at banks. Authorities face a delicate balance between tightening financial sector policies and slowing economic growth. Reducing the growth of shadow credit even modestly would weigh on the profitability and broader provision of credit by small and medium-sized banks.

Global Banks' Health Is Improving

The health of global systemically important banks (GSIBs) continues to improve. Balance sheets are stronger because of improved capital and liquidity buffers, amid tighter regulation and heightened market scrutiny. Considerable progress has been made in addressing legacy issues and restructuring challenges. At the same time, while many banks have strengthened their profitability by reorienting business models, several continue to grapple with legacy issues and business model challenges. Banks representing about $17 trillion in assets, or about one-third of the GSIB total, may continue to generate unsustainable returns, even in 2019. As problems in even a single GSIB could generate systemic stress, supervisory actions should remain focused on business model risks and sustainable profitability. Life insurers have also been adapting their business strategies in the low-yield environment following the global financial crisis. They have done this by reducing legacy exposures, steering the product mix away from high guaranteed returns, and seeking higher yields in investment portfolios. Meanwhile, supervisors need to monitor rising exposure to market and credit risks.

Policymakers Must Take Proactive Measures

Policymakers must take advantage of the improving global outlook and avoid complacency by addressing rising medium-term vulnerabilities.

- Policymakers and regulators should fully address crisis legacy problems and require banks and insurance companies to strengthen their balance sheets in advanced economies. This includes putting a resolution framework for international banks into operation, focusing on risks from weak bank business models to ensure sustainable profitability, and finalizing Basel III. Regulatory frameworks for life insurers should be enhanced to increase reporting transparency and incentives to build resilience. A global and coordinated policy response is needed for resilience to cyberattacks (see Box 1.2).
- Major central banks should ensure a smooth normalization of monetary policy through well-communicated plans on unwinding their holdings of securities and guidance on prospective changes to policy frameworks. Providing clear paths for policy changes will help anchor market expectations and ward off undue market dislocations or volatility.
- Financial authorities should deploy macroprudential measures, and consider extending the boundary of such tools, to curb rising leverage and contain growing risks to stability. For instance, borrower-based measures should be introduced and/or tightened to slow fast-growing overvalued segments, and bank stress tests must assume more stressed asset valuations. Capital requirements should be increased for banks that are more exposed to vulnerable borrowers to act as a cushion for already accumulated exposures and incentivize banks to grant new loans to less risky sectors.
- Regulation of the nonbank financial sector should be strengthened to limit risk migration and excessive capital market financing. Transition to risk-based supervision should be accelerated, and harmonized regulation of insurance companies—with emphasis on capital—should be introduced. Tighter microprudential requirements should be implemented in highly leveraged segments.
- Debt overhangs—especially among the largest borrowers as potential originators of shocks—must be addressed. Discouraging further debt buildup through measures that encourage business investment and discourage debt financing will help curb financial risk taking.

- Emerging market economies should continue to take advantage of supportive external conditions to enhance their resilience, including by continuing to strengthen external positions where needed, and reduce corporate leverage where it is high. This would put these economies in a better position to withstand a reduction in capital inflows as a result of monetary normalization in advanced economies or waning global risk appetite. Similarly, frontier market and low-income-country borrowers should develop the institutional capacity to deal with risks from the issuance of marketable securities, including formulating comprehensive medium-term debt management strategies. This will enable them to take advantage of broader financial market development and access, while containing the associated risks.
- In China, the authorities have taken welcome steps to address risks in the financial system, but there is still work to do. Vulnerabilities will be difficult to address without slower credit growth. Recent policies to improve the risk management and transparency of the banking system and reduce the buildup of maturity and liquidity transformation risks in banks' shadow credit activities are essential and must continue. However, policies should also target balance sheet vulnerabilities at weak banks. The government's commitment to reducing corporate leverage is welcome and should remain a priority as part of a broader effort to insulate the economy against slower credit growth.
- Although significant progress has been made in developing the postcrisis policy response, progress remains uneven across the various sectors, with several design and implementation issues remaining outstanding. Ensuring that the reform measures are completed and implemented is essential to minimize the likelihood of another disruptive crisis. Completing the reform agenda will also allow policymakers to conduct a comprehensive evaluation of the impact of the reforms and fine-tune the agreed measures. This will allow them to address any material unintended effects their cumulative implementation might have on the provision of key financial services. This is critical to provide continued assurance that reforms have delivered on their objectives and to stave off emerging pressures to roll back these measures, which would only make the financial system more vulnerable.
- Finally, implementation of structural reforms and supportive fiscal policies (as examined in Scenario Box 1 of the October 2017 *World Economic Outlook*) would lift global growth and generate positive economic spillovers, reinforcing financial policy efforts.

Household Debt and Economic Growth

Chapter 2 examines the short- and medium-term implications for economic growth and financial stability of the past decades' rise in household debt. The chapter documents large differences in household debt-to-GDP ratios across countries but a common increasing trajectory that was moderated but not reversed by the global financial crisis. In advanced economies, with notable exceptions, household debt to GDP increased gradually, from 35 percent in 1980 to about 65 percent in 2016, and has kept growing since the global financial crisis, albeit more slowly. In emerging market economies, the same ratio is still much lower, but increased relatively faster over a shorter period, from 5 percent in 1995 to about 20 percent in 2016. Moreover, the rise has been largely unabated in recent years. The chapter finds a trade-off between a short-term boost to growth from higher household debt and a medium-term risk to macroeconomic and financial stability that may result in lower growth, consumption, and employment and a greater risk of banking crises. This trade-off is stronger when household debt is higher and can be attenuated by a combination of good policies, institutions, and regulations. These include appropriate macroprudential and financial sector policies, better financial supervision, less dependence on external financing, flexible exchange rates, and lower income inequality.

Financial Conditions Can Predict Growth

The global financial crisis showed policymakers that financial conditions offer valuable information about risks to future growth and provide a basis for targeted preemptive action. Chapter 3 develops a new macroeconomic measure of financial stability by linking financial conditions to the *probability distribution* of future GDP growth and applies it to a set of 21 major advanced and emerging market economies. The chapter shows that changes in financial conditions shift the whole distribution of future GDP growth. Wider risk spreads, rising asset price volatility, and waning global risk appetite are significant predictors of increased downside risks to growth in the near term, and higher leverage and credit growth provide

relevant signals of such risks in the medium term. Today's prevailing low funding costs and financial market volatility support a sanguine view of risks to the global economy in the near term. But increasing leverage signals potential risks down the road, and a scenario of a rapid decompression in spreads and volatility could significantly worsen the risk outlook for global growth. A retrospective real-time analysis of the global financial crisis shows that forecasting models augmented with financial conditions would have assigned a considerably higher likelihood to the economic contraction that followed than those based on recent growth alone. This confirms that the analytical approach developed in the chapter can be a significant addition to policymakers' macro-financial surveillance toolkit.

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 September 21, 2017.*

Executive Directors broadly shared the assessment of global economic prospects and risks. They observed that global activity has strengthened further and is expected to rise steadily into next year. The pickup is broad based across countries, driven by investment and trade. Nevertheless, the recovery is not complete, with medium-term global growth remaining modest, especially in advanced economies and fuel exporters. In most advanced economies, inflation remains subdued amid weak wage growth, while slow productivity growth and worsening demographic profiles weigh on medium-term prospects. Meanwhile, several emerging markets and developing economies continue to adjust to a range of factors, including lower commodity revenues.

Directors noted that, while risks are broadly balanced in the near term, medium-term risks remain skewed to the downside, with rising financial vulnerabilities. These include the possibility of a sudden tightening of global financial conditions, a rapid increase in private sector debt in key emerging market economies, low bank profitability and pockets of still-elevated nonperforming loan ratios, and policy uncertainty about financial deregulation. Directors also pointed to risks associated with inward-looking policies, rising geopolitical tensions, and weather-related factors.

Given this landscape, Directors underscored the continued importance of employing a range of policy tools, in a comprehensive, consistent, and well-communicated manner, to secure the recovery and improve medium-term prospects. They recognized that major central banks have made every effort to communicate their monetary normalization policies to markets. The cyclical upturn in economic activity provides a window of opportunity to accelerate critical structural reforms, increase resilience, and promote inclusiveness.

Directors stressed that a cooperative multilateral framework remains vital for amplifying the mutual benefits of national policies and minimizing any cross-border spillovers. Common challenges include maintaining the rules-based, open trading system; preserving the resilience of the global financial system; avoiding competitive races to the bottom in taxation and financial regulation; and further strengthening the global financial safety net. Multilateral cooperation is also essential to tackle various noneconomic challenges, among which are refugee flows, cyberthreats and, as most Directors highlighted, mitigating and adapting to climate change. Concerted effort is also needed to reduce excess global imbalances, through a recalibration of policies with a view to achieving their domestic objectives as well as strengthening prospects for strong, sustainable, and balanced global growth. In this context, as a few Directors emphasized, the IMF also has a role to play by continuing to strengthen its multilateral analysis of external imbalances and exchange rates.

Directors agreed that continued accommodative monetary policy is still needed in countries with low core inflation, consistent with central banks' mandates. Fiscal policy should gear toward long-term sustainability, avoid procyclicality, and promote inclusive growth. At the same time, fiscal policy should be as growth friendly as possible, using space, where available, to support productivity and growth-enhancing structural reforms. In many cases, policymakers should prioritize rebuilding buffers, improving medium-term debt dynamics, and enhancing resilience. Efforts to raise potential output should be prioritized based on country-specific circumstances, including increasing the supply of labor, upgrading skills and human capital, investing in infrastructure, and lowering product and labor market distortions. Social safety nets remain important to protect those adversely affected by technological progress and other structural transformation.

Directors noted that income disparities among countries have narrowed, but inequality has increased in some economies. They saw a role that well-designed fiscal policies can play in achieving redistributive

objectives without necessarily undermining growth and incentives to work. Directors generally concurred that there may be scope for strengthening means-testing of transfers in many countries and for increasing the progressivity of taxation in some others. Most Directors noted that any consideration of a universal basic income would have to be weighed carefully against a host of country-specific factors—including existing social safety schemes, financing modalities, fiscal cost, and social preferences, as well as its impact on incentives to work—which, in the view of many Directors, raised questions about its attractiveness and practicality. Directors emphasized that improving education and health care is key to reducing inequality and enhancing social mobility over time.

Directors underlined the continued need for emerging market and developing economies to bolster economic and financial resilience to external shocks, including through enhanced macroprudential policy frameworks and exchange rate flexibility. They noted that a common challenge across these economies is how to speed up their convergence toward living standards in advanced economies. While priorities differ across countries, many need to improve governance, infrastructure, education, and access to health care. In several countries, policies should also facilitate greater labor force participation, reduce barriers to entry into product markets, and enhance the efficiency of credit allocation.

Directors observed that the global financial system continues to strengthen, and market confidence has improved generally. They recognized the substantial progress made in resolving weak banks in many advanced economies, while a majority of systemic institutions are adjusting business models and restoring profitability. However, a prolonged period of monetary accommodation could lead to further increases in asset valuations and a buildup of leverage in the nonfinancial sector that could signal higher risks to financial stability. These developments call for continued vigilance about household debt ratios and investors' exposure to market and credit risks. In this context, Directors stressed the need to calibrate the path of normalization of monetary policies carefully, implement macro- and microprudential measures as needed, and address remaining legacy problems.

Directors noted a generally subdued outlook for commodity prices. They encouraged low-income developing countries that are commodity exporters to continue improving revenue mobilization and strengthening debt management, while safeguarding social outlays and capital expenditures. Countries with more diversified export bases should further strengthen fiscal positions and foreign exchange buffers. Across all low-income developing countries, an overarching challenge is to maintain progress toward their Sustainable Development Goals.

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CHAPTER 1

IS GROWTH AT RISK?

Financial Stability Overview

Near-term financial stability risks have declined with the strengthening global recovery, but medium-term vulnerabilities are building as the search for yield intensifies. Risks are rotating from banks to financial markets as spreads and volatility compress while private sector indebtedness rises.

The Global Recovery Is Improving the Near-Term Outlook for Financial Stability

Near-term risks to financial stability continue to decline. *Macroeconomic risks* are lower (Figures 1.1 and 1.2) amid the global upswing in economic activity, discussed in the October 2017 *World Economic Outlook* (WEO). *Emerging market risks* have also declined, underpinned by the pickup in global activity and benign external conditions. This environment of benign macroeconomic conditions and continued easy *monetary and financial conditions*—but still sluggish inflation—is fueling a marked increase in *risk appetite*, broadening investors' search for yield.

Systemically Important Banks and Insurers Continue to Enhance Resilience

Global systemically important banks (GSIBs) and insurers have strengthened their balance sheets by raising capital and liquidity but are still grappling with remaining legacy issues and business model challenges.

Prepared by staff from the Monetary and Capital Markets Department (in consultation with other departments): Peter Dattels (*Deputy Director*), Matthew Jones (*Division Chief*), Paul Hiebert (*Advisor*), Ali Al-Eyd (*Deputy Division Chief*), Will Kerry (*Deputy Division Chief*), Zohair Alam, Sergei Antoshin, Magally Bernal, Luis Brandão-Marques, Jeroen Brinkhoff, John Caparusso, Sally Chen, Shiyuan Chen, Yingyuan Chen, Charles Cohen, Fabio Cortes, Dimitris Drakopoulos, Kelly Eckhold, Martin Edmonds, Jesse Eiseman, Jennifer Elliott, Caio Ferreira, Tamas Gaidosch, Rohit Goel, Hideo Hashimoto, Sanjay Hazarika, Geoffrey Heenan, Dyna Heng, Henry Hoyle, Nigel Jenkinson, David Jones, Jad Khallouf, Robin Koepke, Tak Yan Daniel Law, Yang Li, Peter Lindner, Rebecca McCaughrin, Aditya Narain, Machiko Narita, Vladimir Pillonca, Thomas Piontek, Mamoon Saeed, Luca Sanfilippo, Jochen Schmittmann, Juan Solé, Ilan Solot, Yasushi Sugayama, Narayan Suryakumar, Francis Vitek, Jeffrey Williams, and Christopher Wilson.

After a painful period of restructuring and absorption of elevated charges for past misconduct in the form of fines and private litigation, the outlook for sustainable profitability is improving, but strategic reorientation remains incomplete. The next section assesses risks from large global banks and life insurance companies.

Medium-Term Vulnerabilities Are Rising and Rotating to Nonbanks

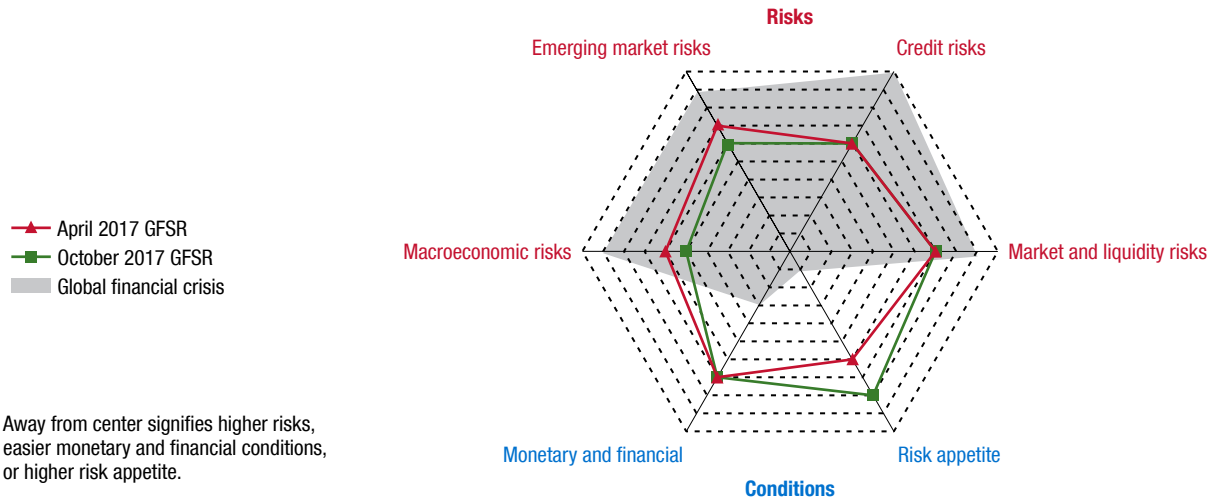
Many asset valuations have continued to rise in response to the improved economic outlook and the search for yield (Figure 1.3, panel 1), driving down a broad range of risk premiums (Figure 1.3, panel 2). While increased risk appetite and the search for yield are a welcome and intended consequence of unconventional monetary policy measures, helping to support the economic recovery, there are risks if these trends extend too far. Compensation for inflation risks (term premiums) and credit risks (for example, spreads on corporate bonds) are close to historic lows, while volatility across asset markets is now highly compressed (Figure 1.3, panel 3). Some measures of equity valuation are elevated, but relative to yields on safe assets (that is, the equity risk premium) they do not appear overly stretched. This prolonged search for yield has raised the sensitivity of the financial system to *market and liquidity risks*, keeping those risks elevated. The widening divergence between economic and financial cycles within and across the major economies is discussed in Box 1.1.

A key stability challenge is the rebalancing of central bank and private sector portfolios against a backdrop of monetary policy cycles that are not synchronized across countries. Too quick an adjustment in monetary policies could cause unwanted turbulence in financial markets and set back progress toward inflation targets. Too long a period of low interest rates could foster a further buildup of market and credit risks and increase medium-term vulnerabilities.

Credit risks are already elevated, given the deterioration in underlying leverage in the nonfinancial sector—households and firms—of many Group of Twenty (G20) economies. Despite low interest rates,

Figure 1.1. Global Financial Stability Map: Risks and Conditions

Risk appetite has grown markedly as near-term stability risks have declined.



Source: IMF staff estimates.
Note: The shaded region shows the global financial crisis as reflected in the stability map of the April 2009 *Global Financial Stability Report* (GFSR).

private sector debt service ratios in many major economies have increased to high levels because of rising debt. Weaker households and companies in several countries have become more sensitive to financial and economic conditions as a result.

The Global Recovery Could Be Derailed

Prolonged low volatility, further compression of spreads, and rising asset prices could facilitate additional risk taking and raise vulnerabilities further. Investors' concern about debt sustainability could eventually materialize and prompt a reappraisal of risks. In such a downside scenario, a shock to individual credit and financial markets well within historical norms could decompress risk premiums and reverberate worldwide, as explored later in this chapter. This could stall and reverse the normalization of monetary policies and put growth at risk.

Large Systemic Banks and Insurers: Adapting to the New Environment

The large internationally active banks at the core of the financial system—so-called global systemically important banks (GSIBs)—have become more resilient since the crisis, with stronger capital and liquidity. Banks have made substantial progress in addressing legacy issues and restructuring challenges—while adapting their business models to the new regulatory and market landscape. Strategic reorientation has led to a pullback from market-related business. Banks have, however, retained a presence in international business and cross-border loans. These strategic realignments have come amid changing group structures, as activity is increasingly channeled through subsidiaries. Despite ongoing improvement, progress is uneven and adaptation remains incomplete. About a third of banks by assets may struggle to achieve sustainable profitability, underscoring ongoing challenges and medium-term vulnerabilities.

Life insurers were hit by the global financial crisis, but have since rebuilt their capital buffers. However, they are now facing the challenge of a low-interest-rate environment. In response, insurers have adapted their business models by changing their product mix and asset allocations. But in doing so, they have been increasingly forced out of their natural risk habitat in a search for yield, making them more vulnerable to market and credit risks. Investors still worry about the viability of some insurers' business models and find it difficult to assess risks, resulting in weak equity market valuations. Policymakers should seek to strengthen regulatory frameworks and increase reporting transparency.

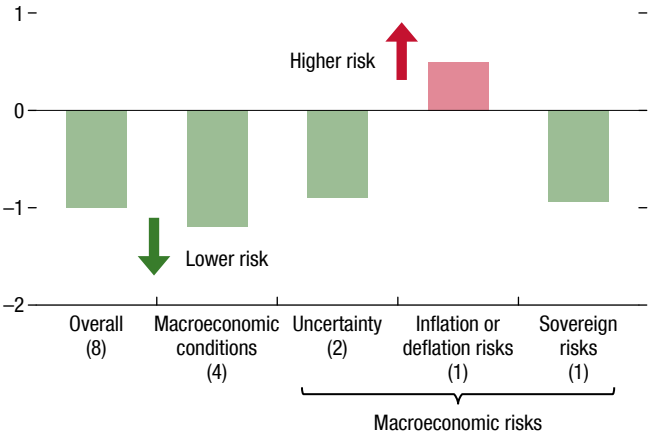
Global Systemically Important Banks

Global banks remain critical pillars of international financial intermediation. These GSIBs provide a wide range of financial services for companies, institutions,

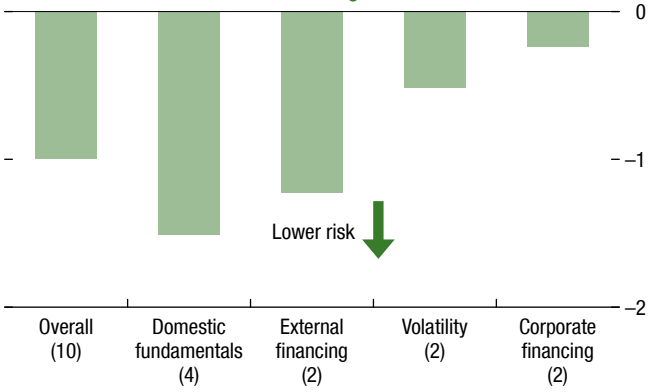
Figure 1.2. Global Financial Stability Map: Assessment of Risks and Conditions

(Notch changes since the April 2017 Global Financial Stability Report*)*

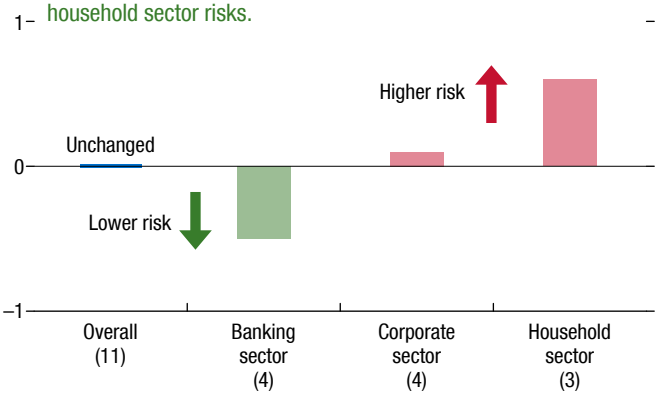
1. Macroeconomic risks have fallen, and macroeconomic conditions have improved.



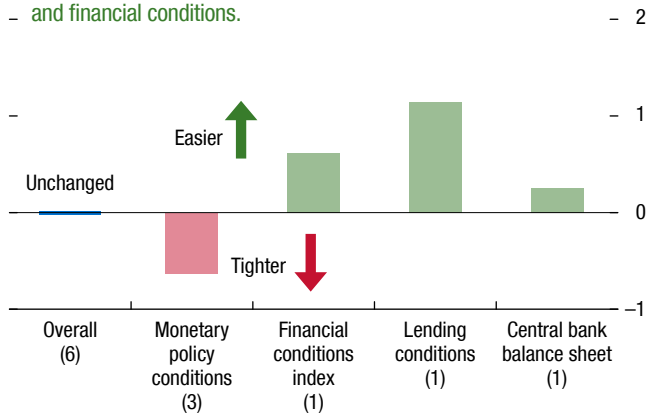
2. Emerging market risks are lower, driven by improved fundamentals and external financing conditions.



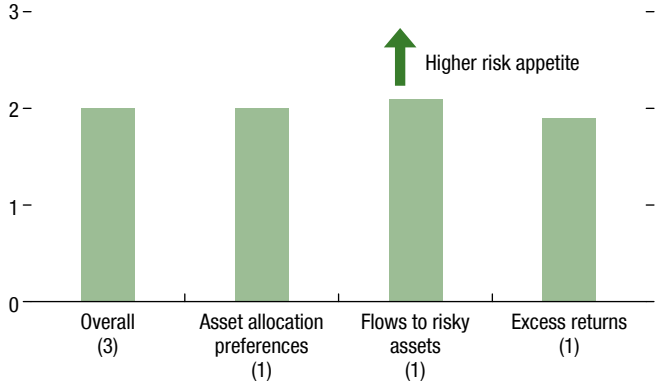
3. Credit risks are unchanged, with improvements in the banking sector contrasting with increasing corporate and household sector risks.



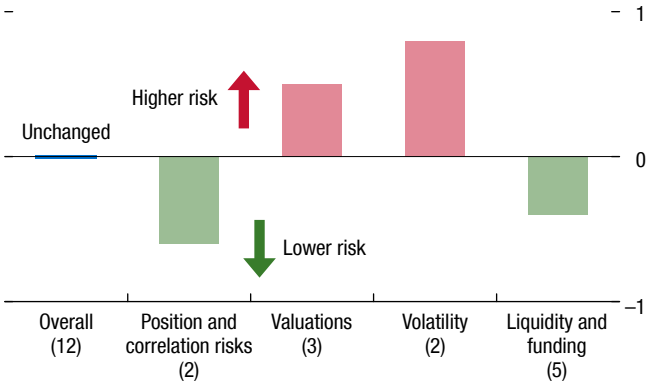
4. Monetary and financial conditions remain accommodative, as slightly higher real rates are offset by easier lending conditions and financial conditions.



5. Risk appetite continues to increase, as reflected in robust capital flows to emerging markets and increased performance and allocations to risk assets.



6. Market and liquidity risks are unchanged, as compressed risk premiums and low volatility offset less-extended market positioning and improved trading liquidity conditions.



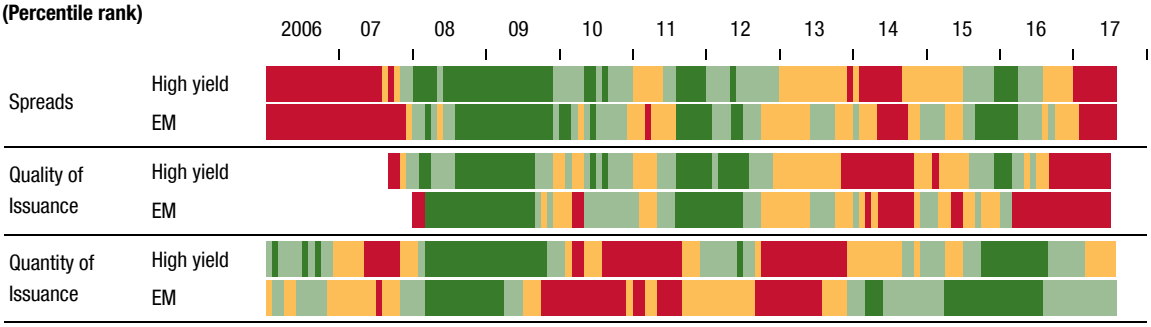
Source: IMF staff estimates.

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 in parentheses next to each category on the *x*-axis indicates the number of individual indicators within each subcategory of risks and conditions. For lending conditions, positive values represent a slower pace of tightening or faster easing.

Figure 1.3. Search for Yield, Asset Valuations, and Volatility

The global search for yield has compressed risk premiums across some assets ...

1. Search for Yield (Percentile rank)

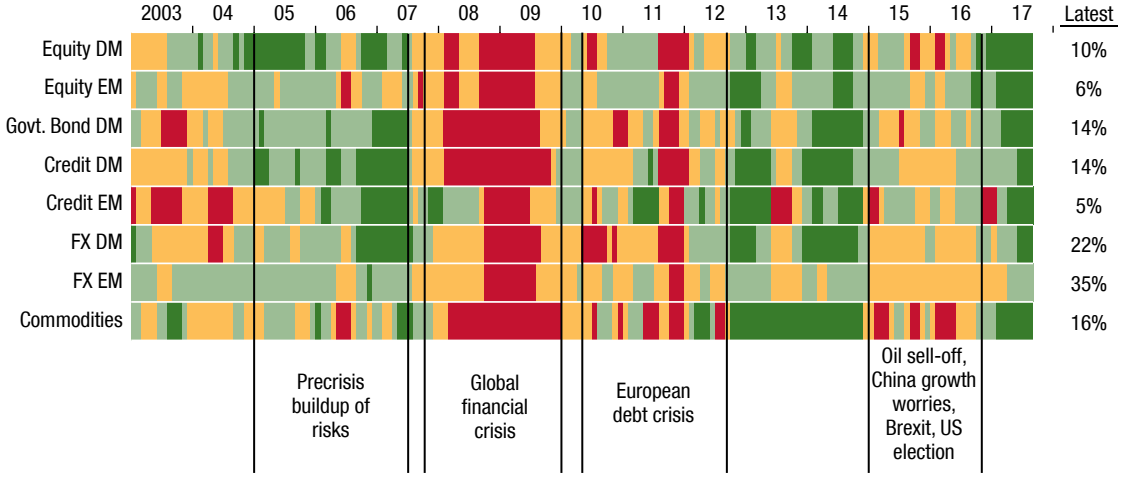


2. Cross-Asset Valuations (Percentile rank)

	CAPE	Forward P/E	Equity Risk Premiums	Term Premiums (10-year)	Corporate Spreads	House Prices to Income
United States	83	79	85	7	6	74
Germany	62	33	86	9	14	39
Japan	28	17	87	5	65	8
United Kingdom	85	60	96	8	8	92
Emerging Markets	25	58	84	19	5	44

... while volatility remains near precrisis lows.

3. Realized Volatility (Percentile rank)



Sources: Bank of America Merrill Lynch; Bloomberg Finance L.P.; Dealogic; Haver Analytics; Organisation for Economic Co-operation and Development; Thomson Reuters; and IMF staff estimates.
Note: The color shading is based on valuation quartiles. Red (dark green) denotes low (high) premiums, spreads, volatility, and issuance quality, as well as high (low) issuance and house price to income. In panel 1, quality of issuance shows spreads per turn of leverage. Quantity of issuance is 12-month trailing gross issuance as percent of the outstanding amount. In panel 2, CAPE is the trailing 12-month price-to-earnings ratio adjusted for inflation and the 10-year earnings cycle. Forward P/E is the 12-month forward price-to-earnings ratio. Equity risk premiums are estimated using a three-stage dividend discount model on major stock indices. Term premium estimates follow the methodology in Wright 2011. Corporate spreads are proxied using spreads per turn of leverage. For house-price-to-income ratio, income is proxied using nominal GDP per capita. The percentile is calculated from 1990 for CAPE, forward P/E, equity risk premiums and term premiums, from 1999 for EM term premiums, from 2000 for house-price-to-income ratio, and from 2007 for corporate spreads. In panel 3, the heatmap shows the percentile of three-month realized volatility since 2003 at a monthly frequency. CAPE = cyclically adjusted price-to-earnings ratio; DM = developed market; EM = emerging market; FX = foreign exchange; Govt = government; P/E = price to earnings.

and individuals across many countries.[1] Together, these 30 banks hold more than $47 trillion in assets and more than one-third of the total assets and loans of thousands of banks globally. They have an even greater role in certain key global financial functions: collectively they comprise 70 percent or more of certain international credit markets (for example, syndicated trade finance), market services, and the international financial infrastructure. GSIBs are central to the international financial system (Figure 1.4, panel 1).

All GSIBs share systemic importance. At the same time, they are a diverse group, with differences in business mix and geographic positions. The 30 GSIBs encompass business models ranging from those that are market focused to those that are consumer focused and from highly specific transaction banking models to all-embracing universal banks (Figure 1.4, panels 3 and 4). About half of GSIBs, by assets, are universal banks, offering a mix of services. Unsurprisingly, most operate on more than one continent. But almost a third of these banks, by assets, are largely domestic businesses (mostly in China and the United States).

GSIBs Are Undergoing Business Model Transitions

In the aftermath of the crisis. GSIBs have been reorienting their business models in three overlapping phases (Figure 1.4, panel 2). First, a process of legacy cleanup has been ongoing for most banks. As these legacy challenges recede, banks have entered a phase of strategic reorientation, which continues to affect both their lines of business and geographic scope. As banks have progressed in these first two phases, the focus is shifting to resolution regimes and the associated need to reconfigure international group structures for some banks. These multiyear adjustments—still ongoing—have been necessary to support resilience and achieve more sustainable profitability in the new environment. Progress on these fronts has been positive, but uneven, and challenges remain.

Global Banks Have Fortified Balance Sheets and Continue to Address Crisis Legacies

The resilience of GSIBs has improved over the past decade as they have adapted to enhanced prudential standards. They have significantly strengthened their balance sheets with an additional $1 trillion in capital since 2009 while reducing assets. Adjusted capital ratios (incorporating reserves against expected losses) have in aggregate risen steadily since the undercapitalized precrisis period (Figure 1.5, panel 1). GSIB liquidity has also improved: loan-to-deposit ratios are down from the elevated levels a decade ago, and reliance on short-term wholesale funding has fallen (Figure 1.5, panel 2).

In tandem with higher capital and more liquidity, GSIBs have also made significant progress in dealing with legacy challenges from the 2008–09 financial crisis and its aftermath.

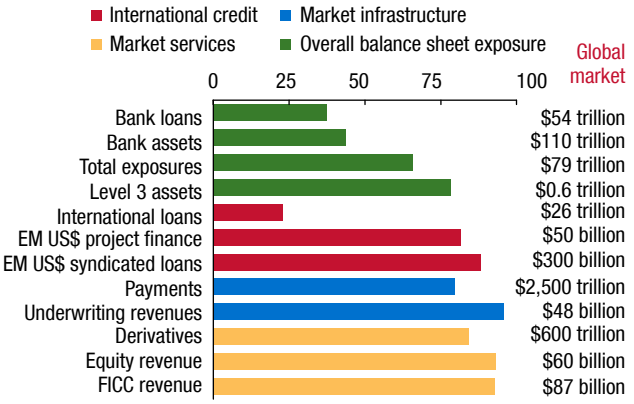
- Banks have made progress in cleaning up legacy assets, facilitated by carving out noncore portfolios (mainly legacy impaired loans and bonds) for aggressive disposal and runoff (Figure 1.5, panel 3). About two-thirds of GSIB noncore assets have been disposed of; US GSIBs are the most advanced in this process. In contrast, several European banks continue to take high charges to provide for and write off legacy bad debts.
- Second, charges for past misconduct in the form of fines and private litigation have eased from a high level. These charges totaled an estimated $220 billion between 2011 and 2016, equivalent to 27 percent of underlying net income for European banks over the period and 19 percent for US banks. Although some of these charges were the result of misbehavior in personal financial services (insurance products in the United Kingdom, consumer protection in the United States, private banking tax evasion at the global level), most stemmed from market businesses (US residential mortgage-backed securities, fixing of the London interbank offered rate) and international transactions (anti–money laundering measures) in which GSIBs dominate. From a financial stability point of view, the litigation charges should strengthen incentives for more prudent future business practices.

Despite progress in disposing of *legacy assets* and dealing with past misconduct, GSIBs continue to cope

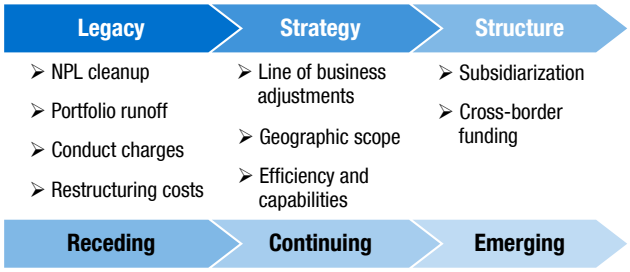
[1]Global systemically important banks (GSIBs) are identified based on size, interconnectedness, cross-jurisdictional activity, impact on financial institution infrastructure (for example, the payments system), and complexity (Basel Committee on Banking Supervision 2014). GSIBs included in the analysis are based on the list published in November 2016, the latest available at the time of this report, and include the following: *China* (4)—Agricultural Bank of China (ABC), Bank of China (BOC), China Construction Bank (CCB), Industrial and Commercial Bank of China (ICBC); *Japan* (3)—Mitsubishi UFJ Financial Group (MUFG), Mizuho Financial Group (MFG), Sumitomo Mitsui Financial Group (SMFG); *Continental Europe* (11)—Banco Santander (SAN), BNP Paribas (BNP), Crédit Agricole (CA), Credit Suisse (CS), Deutsche Bank (DB), Groupe BPCE (BPCE), ING Groep (ING), Nordea Bank (NDA), Société Générale (SG), UBS Group (UBS), Unicredit Group (UCG); *United Kingdom* (4)—Barclays (BARC), HSBC Holdings (HSBC), Royal Bank of Scotland (RBS), Standard Chartered (STAN); *United States* (8)—Bank of America (BOA), Bank of New York Mellon (BNY), Citigroup (C), Goldman Sachs (GS), JP Morgan Chase (JPM), Morgan Stanley (MS), State Street (STT), Wells Fargo (WFC).

Figure 1.4. Global Systemically Important Banks: Significance and Business Model Snapshot

1. GSIBs' Global Market Share by Asset or Activity, 2016 (or latest)
(Percent; US dollars)



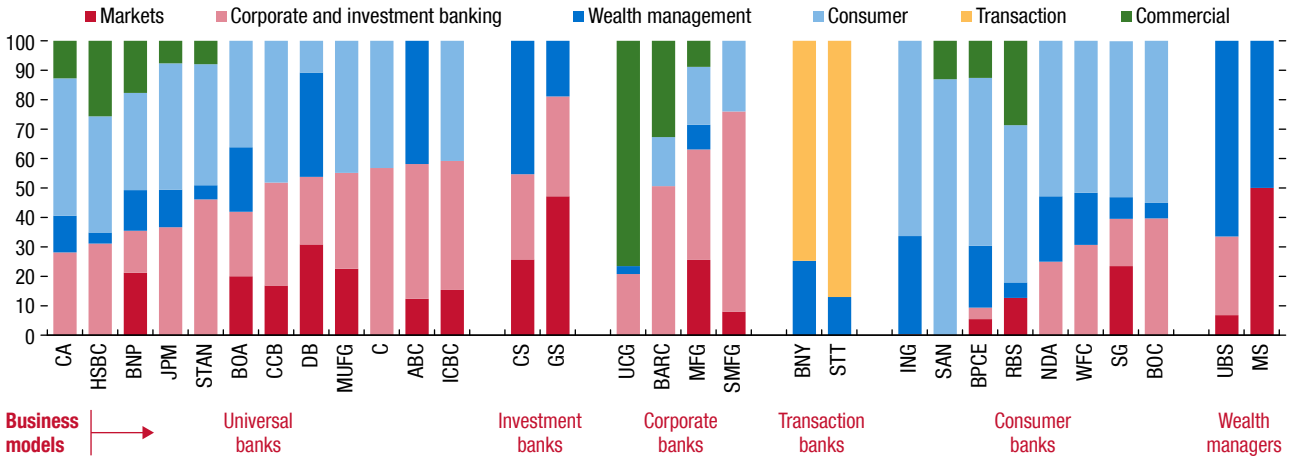
2. Bank Business Model Challenges



3. GSIB Business Models and Geographic Strategies

Business Model	Description	Geographic Reach			Percent of GSIB Assets
		Global	Regional	Local	
Universal Bank	Balance of household and business services	C, JPM, HSBC, DB, STAN, BNP, MUFG	CA	BOA, ABC, CCB, ICBC	56
Corporate Bank	Lending to businesses	BARC, SMFG	UCG, MFG		12
Investment Bank	Capital markets services, advisory, mergers, and secondary market sales and trading	GS, CS			3
Transaction Bank	Corporate transaction services (including payments) and institutional services (settlement, clearing, custody)	BNY, STT			1
Consumer Bank	Retail banking including lending (mortgages, credit cards, other unsecured credit), savings products, and retail payment services	ING, SAN, SG	NDA, BOC, RBS	BPCE, WFC	23
Wealth Manager	Asset management, private banking, and insurance	MS, UBS			4
Percent of GSIB Assets		52	18	31	100

4. GSIBs: Revenue Mix by Line of Business, 2016
(Percent of revenue)

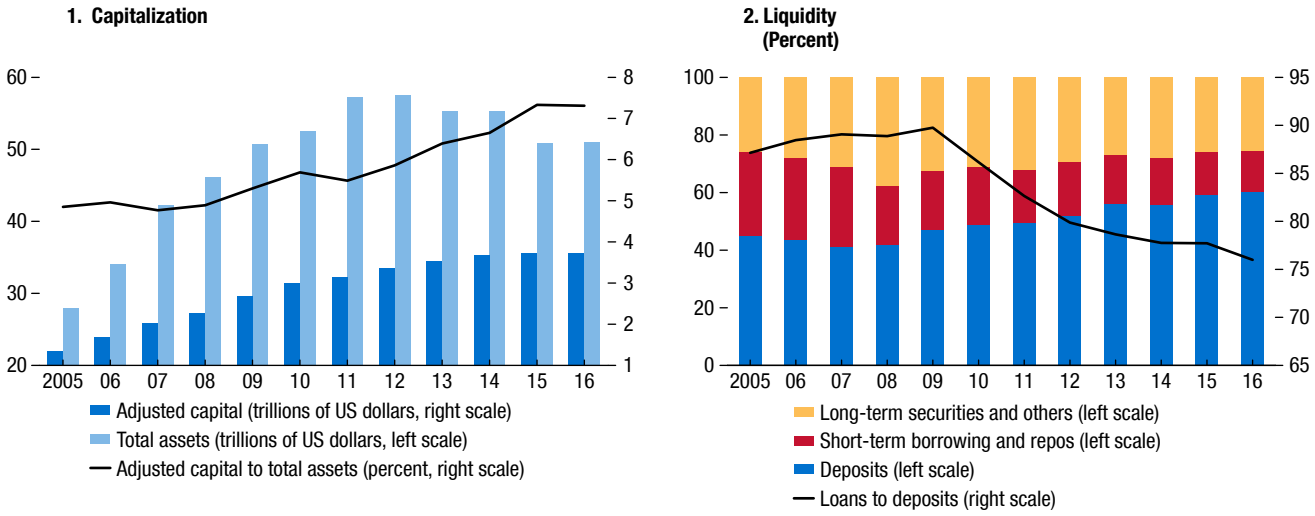


Sources: Bank financial statements; Bank for International Settlements; Basel Committee on Banking Supervision; Bloomberg Finance L.P.; Dealogic; Haver Analytics; Office of Financial Research; S&P Capital IQ; SNL Financial; and IMF staff estimates.
Note: In panel 1, global market size for total exposures, level 3 assets, payments, and over-the-counter derivatives are calculated using the GSIB indicator metrics. "Total exposure" is a proxy for banks' total asset exposures, which includes total consolidated assets, derivatives exposures, and certain off-balance-sheet exposures. This is the same as the denominator used for the Basel III ratio. EM US$ project finance includes syndicated loans only. GSIBs' apparently low share of international loans reflects the nearly pure domestic focus of the local category banks as shown in panel 3. In panel 1, global banking loans and assets are calculated using a sample of 3,500+ banks. See footnote 1 in the text for an explanation of the abbreviations in panels 3 and 4. EM = emerging market; FICC = fixed income, currencies, and commodities; GSIB = global systemically important bank; NPL = nonperforming loan.

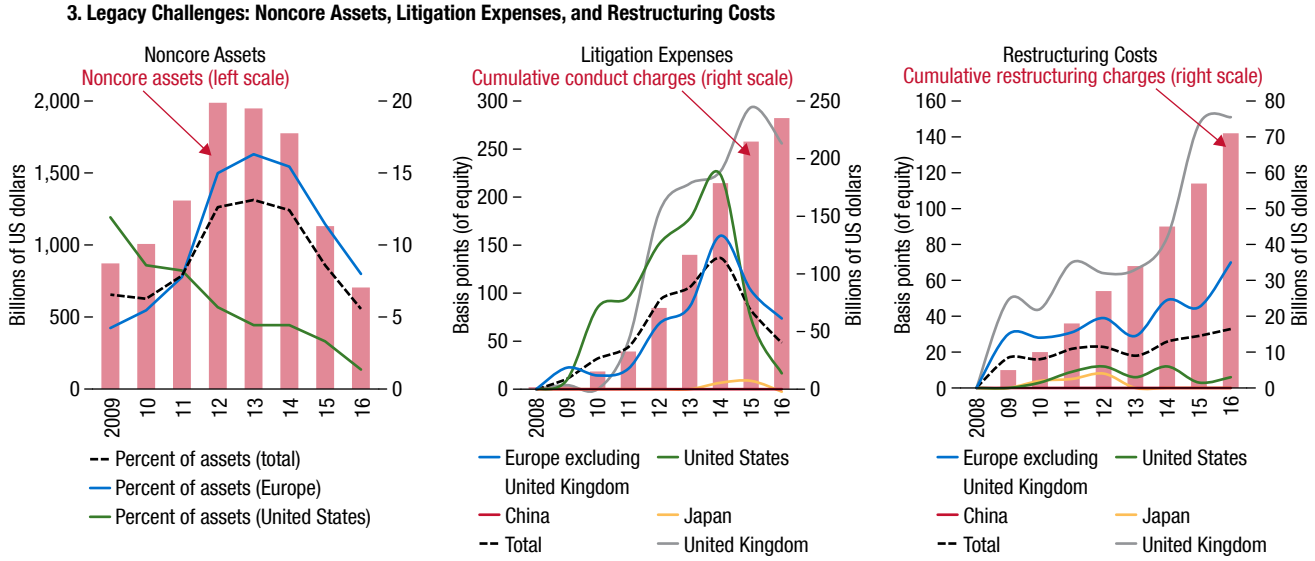
Figure 1.5. Global Systemically Important Banks: Capital, Liquidity, and Legacy Challenges

Global banks are better capitalized ...

... and hold higher liquidity ...



... and have made good progress in addressing legacy challenges.



Sources: Bank financial statements; Bloomberg Finance L.P.; Dealogic; S&P Capital IQ; SNL Financial; and IMF staff estimates and analysis.
Note: Adjusted Tier 1 capital equals shareholders' equity, minus 45 percent (an estimate of average gross loss given default) of reported nonperforming loans, plus loan-loss reserves. In panel 1, total assets are adjusted for the netted derivatives. In panel 3, conduct and restructuring charges (in basis points of equity) are on an estimated posttax basis, assuming charges adjusted by effective tax rates.

with restructuring charges. Most of these are severance and other charges stemming from branch and staff reductions motivated by banks' efforts to reduce their operating cost structures. Continental European and UK banks are most affected; their restructuring charges in 2016 amounted to $13 billion, equivalent to 25 percent of their underlying net income. Although some GSIBs have made substantial progress in reducing staff, others (particularly some European GSIBs) still report large restructuring charges.

Global Banks Have Reduced Market-Related Business

Strategically, GSIBs have reduced their market-related functions—investment banks have made some of the biggest cutbacks (Figure 1.6, panel 1). This move came as earlier overexpansion and excess capacity collided with regulatory changes that increased risk-asset weighting and capital charges and drove a sharp decline in profitability of banks' other lines of business (Figure 1.6, panel 2). Fixed income, currency, and commodity (FICC) businesses, in particular, have become less attractive to all but a few high-volume or high-margin players, which have taken a greater share of a shrinking revenue pie (Figure 1.6, panels 2 and 3). In this environment, US banks have gained market share, and activity is now concentrated in fewer players.

While GSIBs' declining exposure to financial markets will reduce their risk, there may be associated costs to market liquidity. Evidence that this change affects market liquidity in normal times is mixed, and greater participation by nonbank market intermediaries could help address the fragmentation of market liquidity. What is less clear is whether global banks' reduced capacity to intermediate in financial markets could affect the resilience of liquidity in periods of stress. Similarly, the supply of risk management services that require GSIB balance sheet space and capital could be reduced or provided to fewer clients. The balance between reduced GSIB riskiness and potential costs to liquidity during stress is an issue deserving of careful ongoing consideration.[2]

[2]Work is underway at the Financial Stability Board, in collaboration with standard-setting bodies, to evaluate the impact of the regulatory reform agenda. But it will likely take some time to realize the full impact of changes in bank business models on financial activity. Adrian and others (2017) also document the stagnation of broker-dealer balance sheets associated with deleveraging.

Global Banks Overall Continue to Operate Internationally

In contrast to declining market intensity, GSIBs overall have remained central to the provision of international credit and services (including total loans and specific product markets, such as syndicated lending, trade finance, and project finance). International balance sheet commitments and revenue mix have remained quite stable across almost all GSIBs (Figure 1.7, panel 1). Even as non-GSIB banks shrank international loans aggressively during 2009–13 (owing to balance sheet pressures), GSIBs as a group maintained their international lending volume (Figure 1.7, panel 2).

Those GSIBs less impacted by the financial crisis have maintained or expanded their international role. This may in part be motivated by the relative profitability of international operations. Across a sample of 724 banking subsidiaries, foreign banking operations have been more profitable than domestic business for Japanese and continental European and UK GSIBs (Figure 1.7, panel 3). Japanese banks, whose international loans have contributed to raising profitability, have continued to pivot aggressively toward international markets—maintaining their reliance on potentially volatile wholesale foreign currency funding—accompanied by a general expansion of corporate loans and foreign securities investments. Shifts in international exposures of continental European and UK banks reflects three main crosscurrents. A few—mainly UK banks—have emphatically cut exposures in an international arena where they suffered large losses. Some (mainly French) banks were forced by balance sheet constraints to retrench. For many others, international lending remains an attractive business to which they have demonstrated commitment within the constraints of their balance sheet capacity and exposure limits.[3] In contrast, US GSIBs, whose domestic operations are highly profitable, have maintained or slightly pulled back the international proportion of their loan portfolios.

Subsidiarization Presents a Structural Challenge for Some Banks

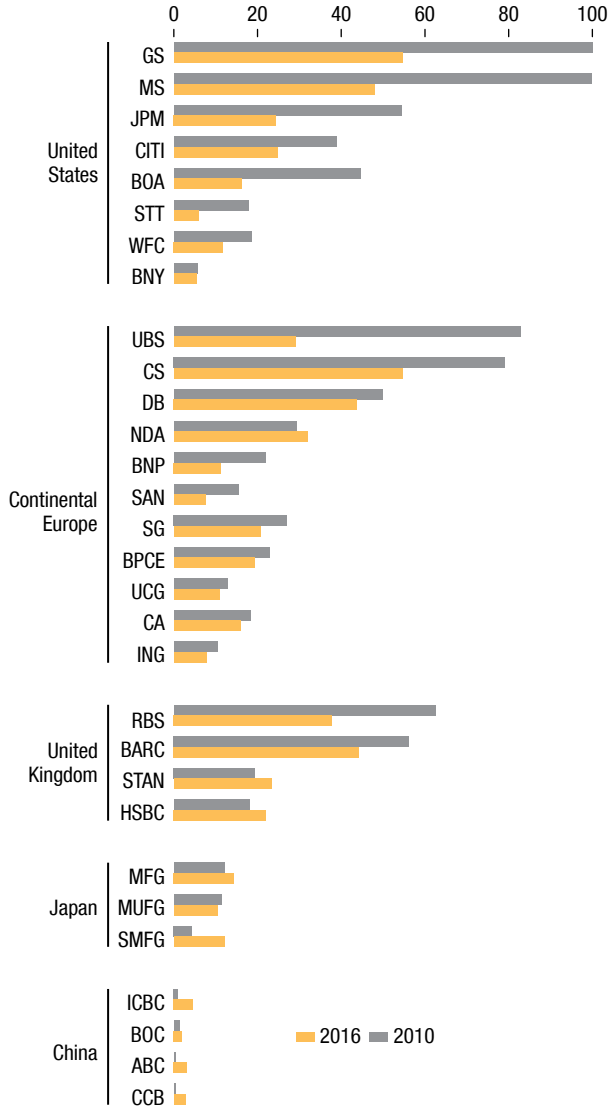
Largely in response to national regulatory pressures, several GSIBs more reliant on branching have begun gradually shifting their international lending from a direct cross-border model to one based on lending via

[3]This could suggest that reduced international exposure may be more a cyclical than a structural phenomenon for GSIBs, as suggested for the broader banking sector by McCauley and others 2017. See also Caruana 2017.

Figure 1.6. Global Systemically Important Banks: Market Activity

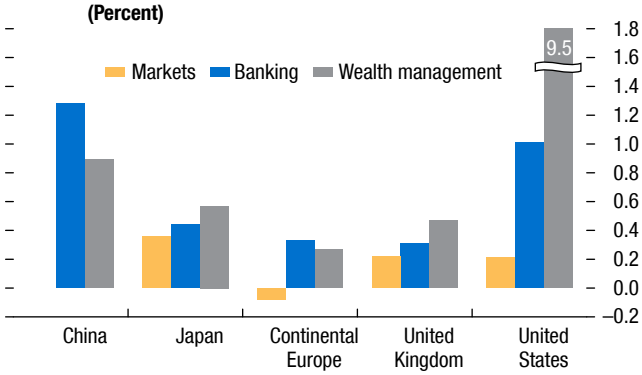
Market intensity has declined sharply ...

1. Market Intensity, 2010 and 2016
(Index, maximum intensity = 100)



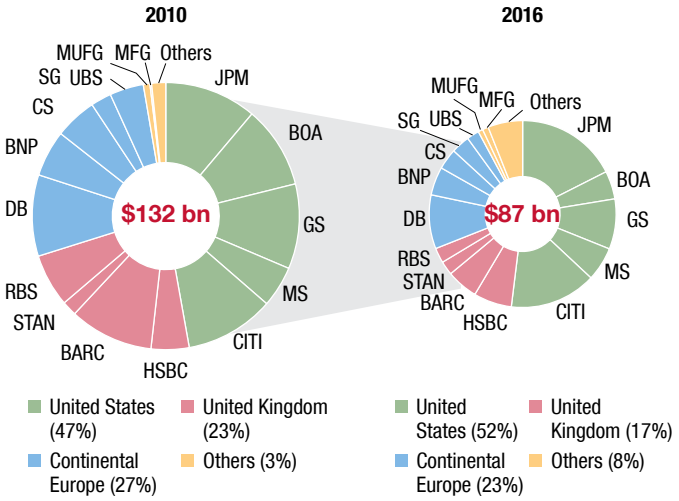
... as banks avoid relatively unprofitable markets businesses.

2. GSIBs by Home Region: Average Return on Assets, by Business Type, 2014–16 Average
(Percent)



FICC revenue pool has shrunk with a shift in market share toward US banks.

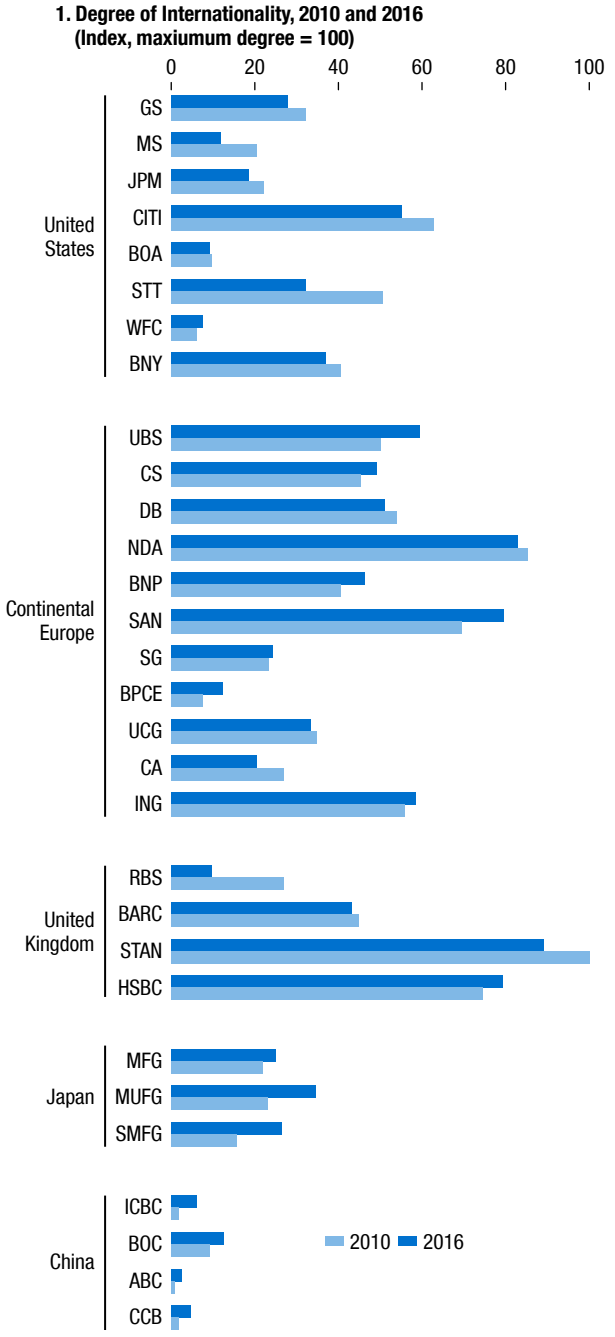
3. FICC Trading Revenues, 2010 and 2016



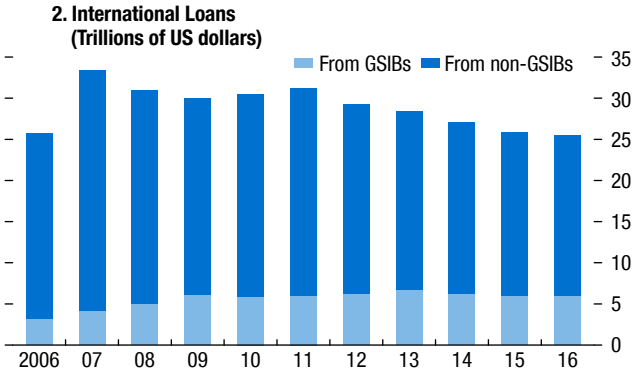
Sources: Bank financial statements; Basel Committee for Banking Supervision; Bloomberg Finance L.P.; equity research reports; European Central Bank; Federal Reserve Board; S&P Capital IQ; SNL Financial; and IMF staff estimates and analysis.
Note: In panel 1, market intensity is an index scaled (1 to 100) of relative exposures across the 30 GSIBs over 2010 to 2016. Each exposure is based on an average of (1) market-risk-weighted assets divided by total risk-weighted assets; (2) Level 3 assets divided by total assets; (3) notional derivatives relative to total assets; and (4) average value at risk relative to risk-weighted assets. In panel 2, business type is identified for each subsidiary entity based on a sample of 934 foreign and domestic subsidiaries of the 30 GSIBs. Banking (724 subsidiaries) includes corporate, commercial, and consumer banking, and the advisory part of investment banking. Markets (156 subsidiaries) include underwriting, secondary market trading in securities, currencies and commodities, and dealings in derivative contracts. Wealth management (46 subsidiaries) includes asset management, private banking, and insurance. See footnote 1 in the text for an explanation of the abbreviations in panels 1 and 3. FICC = fixed income, currencies, and commodities.

Figure 1.7. Global Systemically Important Banks' International Activity

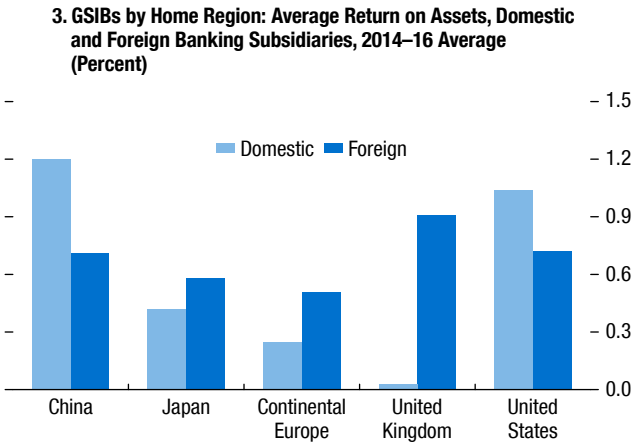
GSIBs' international activity has remained stable overall.



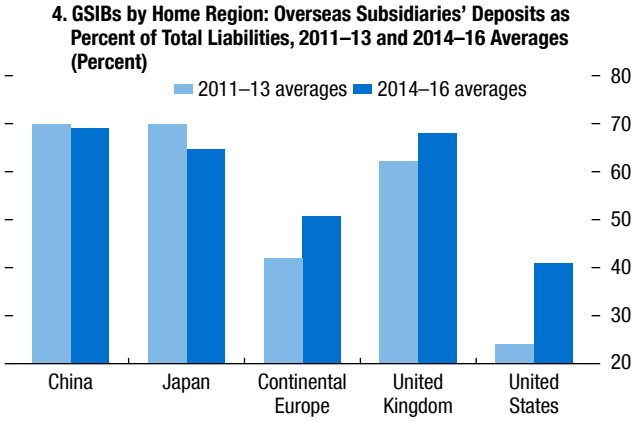
GSIBs are increasing their share in international lending despite an overall reduction.



Foreign banking operations are more profitable than domestic entities for many banks.



Subsidiaries of European and US GSIBs have increased their funding through local deposits.



Sources: Bank financial statements; Basel Committee for Banking Supervision; Bloomberg Finance L.P.; European Central Bank; Federal Reserve Board; S&P Capital IQ; SNL Financial; and IMF staff estimates and analysis.
Note: Degree of internationality is an index scaled (1 to 100) of relative exposures across the 30 GSIBs over 2010 to 2016. Each exposure is based on an average of (1) percent of revenue from nonhome regions; (2) international loans divided by total loans (or international assets divided by total assets); and (3) foreign deposits divided by total deposits. For panel 2, see notes in Figure 1.6 for sample descriptions. In panel 3, subsidiary return on assets are based on reported earnings. The reported earnings of subsidiaries in the United Kingdom and the United States may be understated due to the booking of conduct charges in those jurisdictions. See footnote 1 in the text for an explanation of the abbreviations in panel 1. GSIBs = global systemically important banks.

foreign subsidiaries ("subsidiarization"). The aggregate share of GSIB lending extended through foreign subsidiaries has risen from 40 percent to 60 percent of international lending since 2009 and may continue to increase gradually as banks respond to regulatory pressure to house their activities in each international jurisdiction within local legal entities with adequate local capital and liquidity. This has motivated banks to shift funding from cross-border (interbank and intragroup) funding toward local deposits (Figure 1.7, panel 4).

These structural adjustments have helped improve the resolvability and funding resilience of large, highly interconnected global banks, which strengthens financial stability. Healthy subsidiaries may also be better able to withstand pressure on their parents or other affiliates, which may have a positive effect on the stability of host countries. These considerable benefits come with some possible unintended costs. Keeping individual pools of capital in subsidiaries across a group may lower returns on equity as banks maintain higher levels of capital than before subsidiarization. Lower mobility of capital and liquidity might also compromise GSIBs' capacity to respond to solvency or liquidity shocks.[4] This may be more significant for banks that have a globally integrated capital and liquidity model (most investment banks) than for consumer banks. Moreover, regulatory impediments to the flow of liquidity, risk management, and funds deployment within the euro area contribute to higher costs and reduced activity, adding to business model and economic challenges. Again, officials will need to consider the balance of costs and benefits of these structural adjustments.

Progress toward Sustainable Profitability Is Uneven

Uneven progress in tackling legacy charges, business model adaptations, and group structure has led to varied profitability, as well as a mixed outlook across GSIBs (Figure 1.8, panel 1). In part, this owes to the vigor and timeliness in addressing legacy and capital challenges from the global financial crisis. Responding early has paid off. US bank profitability, for example, has reached levels in line with or exceeding 8 percent cost of equity, a conservative estimate of investors' required returns, and approach management-stated targets for their returns. European banks' 2016 profitability, in contrast, was more mixed, with several banks generating low returns, in part because of their slower progress in addressing legacy issues. Overall, about half of GSIBs by asset size remain below an 8 percent return on equity.

The outlook for sustained profitability is becoming more favorable as legacy issues are more fully addressed, business model improvements are implemented, and the global recovery strengthens.[5] Following a period of strong cyclical and structural profitability headwinds over the past five years, profitability drivers are turning up (Figure 1.8, panel 2). After restructuring, weak and challenged banks' assets are set to increase again. This is expected to arrest their revenue declines and to improve their reported cost-ratio dynamics. Along with an expected cyclical improvement in net interest margins, these developments should help increase return on assets.

However, even with these improvements and better outlook, analysts expect one-third of the GSIB assets (about $17 trillion) to generate below-sustainable returns in 2019 (Figure 1.8, panel 3). For these banks, profitability has been restrained by structural forces such as high operating costs, low operating efficiency, and highly competitive home markets, exacerbated in several cases by weak information technology systems. Banks that exhibit both thin capital buffers relative to future regulatory requirements and relatively weak profitability to build those buffers over the next few years warrant heightened attention (see Figure 1.8, panel 4). Some banks continue to grapple with legacy issues, while others, particularly European investment banks, still face the fundamental problem of defining and executing profitable business models. An environment of low domestic interest rates also affects the profitability of Japanese GSIBs. These banks seek continued international expansion to offset compressed domestic profitability, and supervisors must bear in mind that such expansion increases currency and maturity mismatch risks (see IMF 2017d). Problems in even a single GSIB could generate systemic stress, so supervisory action clearly needs to remain focused on business model risks and sustainable profitability.

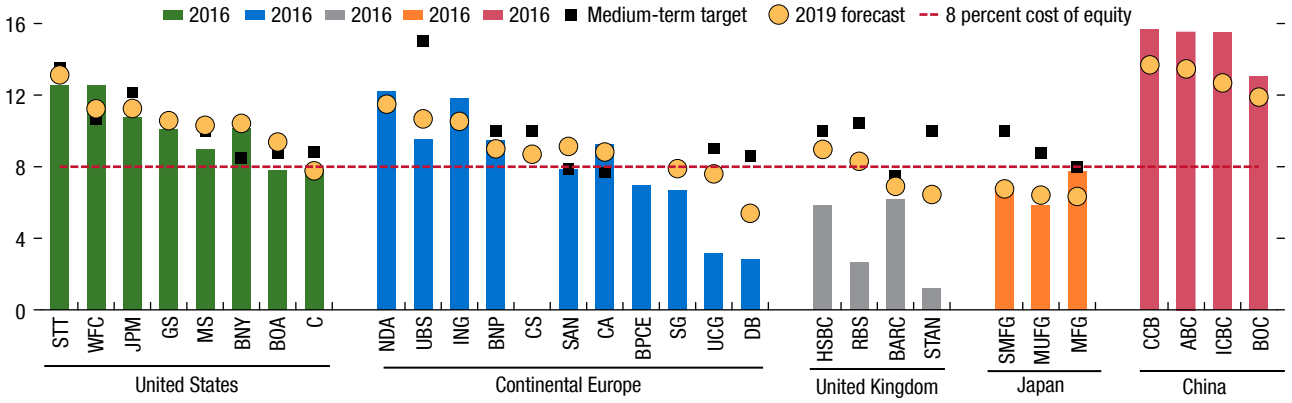
[4]Chapter 2 of the April 2015 *Global Financial Stability Report* (GFSR) discusses these issues further; see also Cetorelli and Goldberg 2012; Reinhardt and Riddiough 2015; and Fiechter and others 2011.

[5]This report defines banks as "weak" if they are expected to generate return on equity below 8 percent in 2019, "challenged" if the expectation is between 8 and 10 percent, and "healthy" if more than 10 percent is expected. Investor surveys, cited in the October 2016 GFSR, suggest that the cost of equity is at least 8 percent. The current cost of equity—inferred from current market prices using a Gordon Growth model—is almost 11 percent for GSIBs as a whole; individual bank estimates for the cost of equity range from 8 to 15 percent. Bank management medium-term profitability targets are consistent with this view: the target for 11 out of 21 GSIBs is a return on equity above 10 percent; for the remaining 10 banks, it is between 8 and 10 percent.

Figure 1.8. Global Systemically Important Banks: Financial Performance Gaps

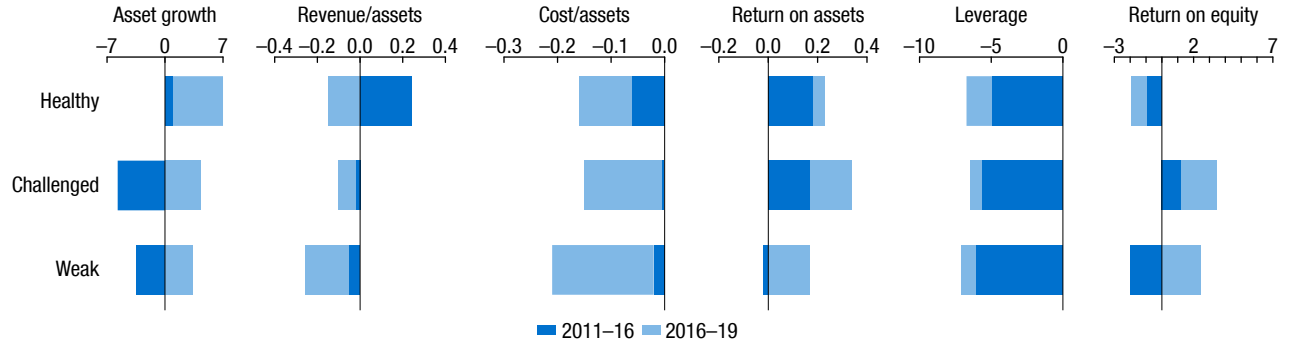
Most US GSIBs should reach profitability targets, but European and Japanese GSIBs face significant gaps.

1. GSIB Return on Equity: 2016 Underlying, 2019 Consensus Forecasts, and Management Medium-Term Target (Percent)



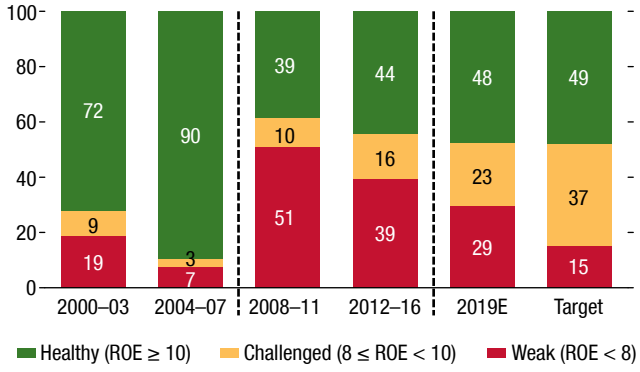
Balance sheet reflation and cost improvement are expected to help profitability ...

2. GSIBs: Annualized Asset Growth in Percent and Changes in Profitability Drivers and Metrics (Percentage points)



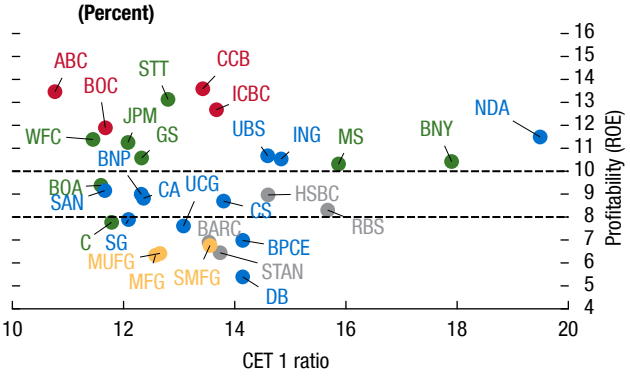
... whereas global banks, representing about one-third of GSIB assets, are still expected to have weak profits.

3. Percent of GSIB Assets by Return-on-Equity Thresholds, 2019 Consensus Forecasts



Some banks have thin capital buffers and weaker profitability prospects.

4. GSIBs: Profitability and Capital Position, 2019 Consensus Forecasts (Percent)



Sources: Bank financial filings; Bloomberg Finance L.P.; SNL Financial; and IMF staff analysis.
Note: Underlying profit is reported net income excluding conduct and litigation charges, restructuring costs, and noncash valuation adjustments. In panel 1, CS has an ROE of –0.3 percent in 2016. Management's ROE targets, where not available directly, are estimated from their stated return on tangible equity targets, assuming a constant ratio of current tangible equity to total equity. In panel 2, asset growth is on an annualized basis. In panels 2 and 3, future asset forecasts are estimated using consensus RWA forecasts and assuming constant RWA density. In panel 3, a balanced sample of the current 30 GSIBs are considered for the entire duration. In all panels, 2016 numbers are used for BPCE due to lack of analyst forecasts. Forward-looking analyst forecasts consensus is gathered from Bloomberg. In panel 4, the colors correspond to those in panel 1. See footnote 1 in the text for an explanation of the abbreviations in panels 1 and 4. CET 1 = common equity Tier 1 capital; GSIB = global systemically important bank; ROE = return on equity; RWA = risk-weighted asset.

Further Policies Are Needed

Regulation and supervision of global systemically important banks have been considerably tightened in recent years, with detailed frameworks governing capital and liquidity and much more vigorous and regular monitoring. There has been less progress in making a resolution framework for international banks operational. Challenges include the need for further strengthening national resolution regimes, the development of cross-border resolution plans with adequate loss-absorbing capacity to make them effective, and close coordination between home and host-country regulators and resolution authorities, providing sufficient comfort for host countries that a centralized resolution strategy would protect their interests. Only with such a framework in place will it be possible to avoid the potential negative consequences that can flow from the imposition of capital and liquidity requirements for GSIBs on a market-by-market basis.

In addition, regulators should have a strong focus on risks from weak business models to ensure that weaker banks are able to achieve sustainable profitability. As discussed in previous GFSR reports, this applies beyond the global banks that are the focus here. In particular, although euro area banks have made further progress in cleaning up their balance sheets, nonperforming loan ratios remain high in some countries, and profitability is still a challenge. Without a more concerted effort to reduce nonperforming assets and improve business models, financial stability concerns could be reignited in the euro area. More generally, continued progress toward completing banking union remains essential to strengthening the financial stability foundations of the euro area banking sector.

Finally, it will be important to finalize Basel III to further strengthen the financial sector and create a more level international playing field. At a minimum, any proposals by national regulators to substantially ease capital, liquidity, or prudential standards should be considered carefully in light of their potential to damage the agenda of global regulatory harmonization.

Insurers

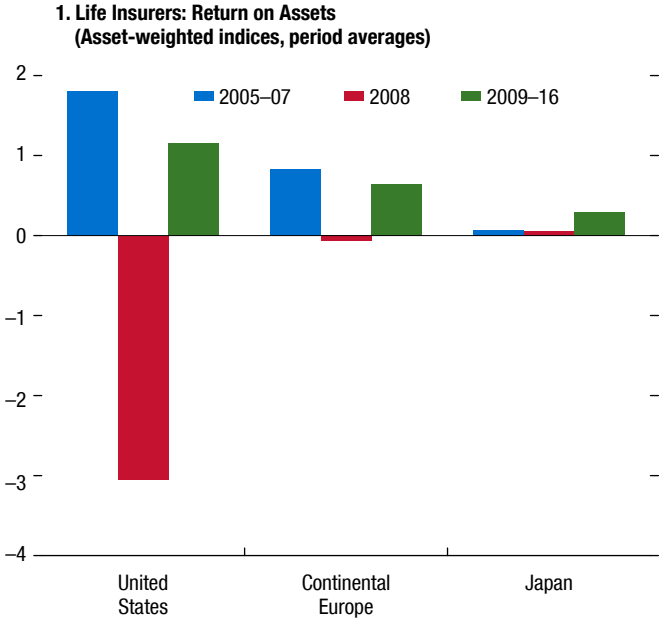
Life Insurers Have Rebuilt Capital Buffers since the Crisis

Life insurers were hit hard by the global financial crisis. Profits tumbled, particularly in the United States (Figure 1.9, panel 1), and capital buffers fell.[6]

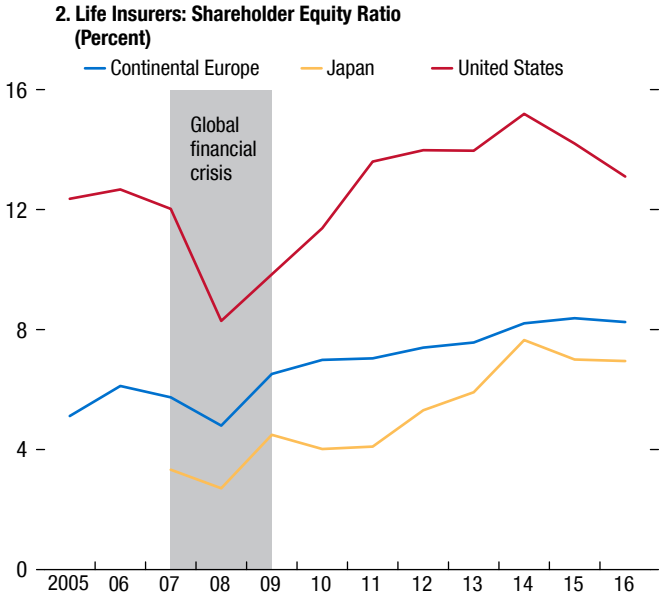
[6]This analysis is based on a sample of more than 80 life insurers from Belgium, France, Germany, Italy, Japan, the Netherlands, Norway, Spain, Sweden, the United Kingdom, and the United States. The sample covers almost two-thirds of total assets of life insurers in Europe, Japan, and the United States.

Figure 1.9. Life Insurance Companies' Profitability and Capital

Amid falling yields and bullish asset markets, life insurers have managed to restore profits ...



... allowing them to retain earnings and lift capital buffers.

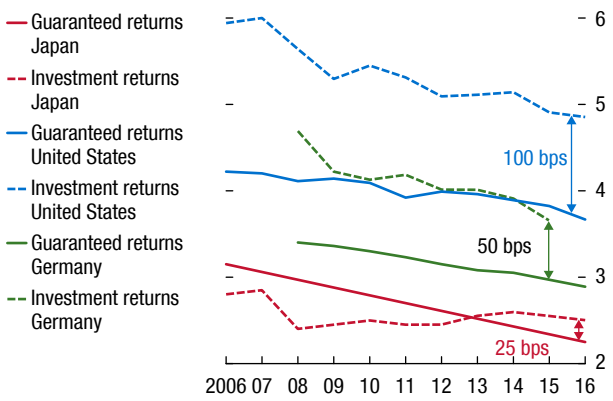


Sources: Bloomberg Finance L.P.; and IMF staff estimates.
Note: In panel 1, return on assets is calculated by dividing net income by total tangible assets minus separate accounts. In panel 2, the shareholder equity ratio is calculated by dividing the sum of common equity plus retained earnings by tangible assets minus separate accounts. In both panels, for Japan, separate accounts were not deducted in the denominator due to lack of data.

Figure 1.10. Changes in Life Insurance Companies' Business Models

Facing investment spread compression, life insurers in Germany, Japan, and the United States have reduced guaranteed returns ...

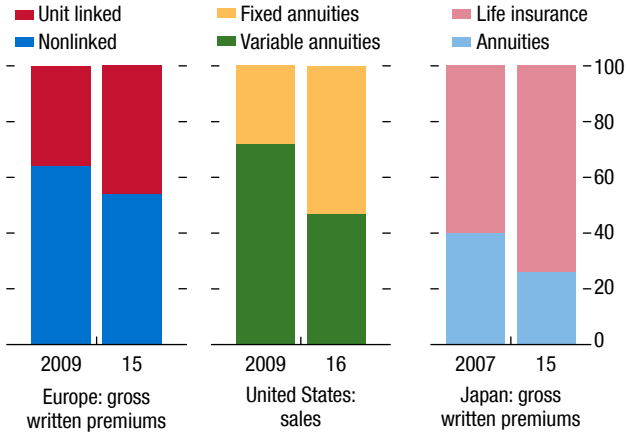
1. Average Investment Returns and Guaranteed Returns (Percent, on existing portfolios)



Sources: Bundesbank; NLI Research Institute; and Office of Financial Research.
Note: bps = basis points.

... and have been gradually changing their product mix.

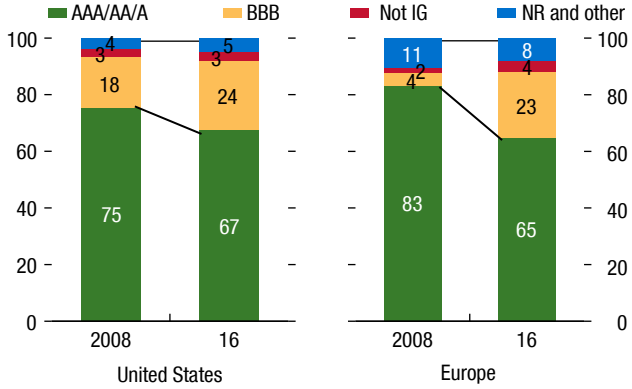
2. Changes in Insurance Product Mix (Percent)



Sources: European Insurance and Occupational Pension Authority; Life Insurance Association of Japan; and Life Insurance and Market Research Association.

Searching for yield, US and European life insurers have invested more in lower-rated bonds ...

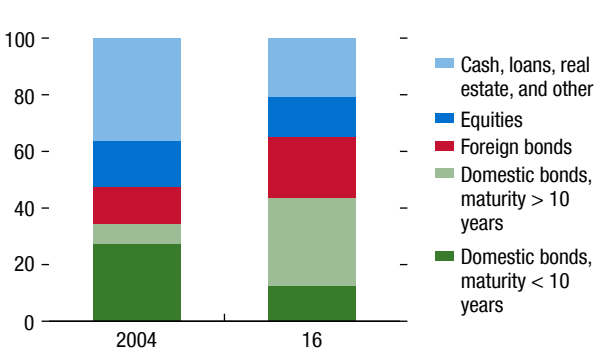
3. European and US Life Insurers: Bond Asset Allocation (Percent)



Sources: SNL Financial; and IMF staff estimates.
Note: Not IG = noninvestment grade: bonds with ratings lower than BBB–; NR = not rated. NR and other may include some loans.

... and Japanese life insurers have increased duration and holdings of foreign bonds.

4. Japanese Life Insurers' Investment Portfolio (Percent)



Source: Bank of Japan.

But insurers have been able to build capital since then (Figure 1.9, panel 2). Bullish equity and bond markets have raised the value of the portion of insurers' assets that are marked to market, helping boost earnings, dividend payouts, and capital.

Life Insurers Have Been Adapting Their Business Models to Cope with Historically Low Returns

While building capital levels, life insurance companies have also been adapting their business models in response to the low-yield environment. Several changes have been made in the face of lower investment spreads. First, insurers have reduced the guaranteed returns on new policies (Figure 1.10, panel 1). Second, they have adjusted their product mix (Figure 1.10, panel 2). European insurers have gradually sold more unit-linked policies. These policies sell units similar to those in a mutual fund and shift market risk to policyholders. US insurers have moved from variable to fixed annuities, which are easier to hedge. Japanese insurers have favored the sale of

insurance products over saving products. However, these changes have been slow to affect balance sheets given the large amount of legacy policies that remain.

In addition, insurers have been adjusting their asset mix to higher-yielding and less liquid assets, moving out of their natural investment habitat in search of yield.

- Insurers have taken on more *credit risk*. Despite risk-sensitive capital requirements, at least one-third of US and European insurers' bond portfolios now have a BBB rating or lower (Figure 1.10, panel 3).[7] Additional risk taking has also been taking place in the United States—for example, using unregulated subsidiaries, which do not face the same capital requirements as insurers.
- Insurers have taken on more *market risk*. Japanese and US insurers have extended the maturity of domestic bond holdings to better match the duration of their liabilities and enhance yields. Over the past five years, portfolio durations in the United States have increased from about five to eight years overall. Japanese life insurers have also invested in higher-yielding foreign bonds, partly exposing them to currency risk (Figure 1.10, panel 4).
- Insurers have taken on more *liquidity risk*. Examples include commercial property, infrastructure financing, private placements, structured securities, and mortgage loans. In the United Kingdom, about 25 percent of annuities are currently backed by illiquid investments, and insurers have plans to increase that proportion to 40 percent by 2020.[8]

Market Concerns about Insurers Persist

Despite these changes, insurers continue to face profitability pressure (Figure 1.11, panel 1), and investors remain concerned about life insurers' business models, as reflected in market valuations. Half of the US and European insurers in the sample, by assets, now have a price-to-book ratio both below precrisis levels and below one (Figure 1.11, panel 2), reflecting concerns over future profitability in a low-rate environment, as well as difficulties in assessing risks.

- *Profitability:* Despite efforts to change business models, insurers in a significant group of countries continue to face both high guaranteed returns and high duration mismatches (Figure 1.11, panel 3).[9] If low interest rates persist, investment returns could continue to decrease for the next decade, a situation that would leave life insurers in the Netherlands, Germany, Sweden, and Norway facing negative spreads within a few years. Even if interest rates were to increase by 100 basis points, many insurers would still face this risk (Figure 1.11, panel 4).
- *Risk assessment:* Investors continue to have difficulties adequately assessing risk in the sector because regulatory regimes are evolving and disclosure is inadequate. For example, discount rates used to value future liabilities differ between insurers and are often higher than market risk-free rates, resulting in an underestimation of liabilities. Regulatory gaps (discussed later in this chapter) make it hard to compare risks in insurers across countries. Options embedded in some insurance contracts are also hard to value, making it difficult to assess balance sheet risks.

Life Insurers Are More Vulnerable to Market and Credit Risks

Business model adjustments on the asset side have made insurers more vulnerable to a decompression of risk premiums and falls in asset prices. A sharp decline in equity and real estate markets, combined with an increase in credit spreads and a flight to high-quality sovereign bonds, would amount to a double hit on insurers' balance sheets in this scenario. Asset values would fall, while liabilities would increase as risk-free rates used to discount future liabilities decline. Figure 1.12 shows a simulation of such a scenario, in which assets and liabilities are fully marked to market. However, current accounting and regulatory rules exempt insurers from marking all their liabilities to market and allow them to dampen market shocks through adjustments to liabilities. In the simulation, life insurers in Italy, Spain, and the United States would be affected by their lower-rated sovereign and corporate bond holdings. Insurers in Germany, the Netherlands, Norway, and Sweden would be affected by the relatively long duration of their liabilities.

If such a shock were to occur, it could mean that life insurers would be unable to fulfill their role as financial intermediaries, precisely when other parts of the finan-

[7]Part of this change can be attributed to downgrades of bonds that were already in the bond portfolios of insurers.

[8]See Bank of England 2017.

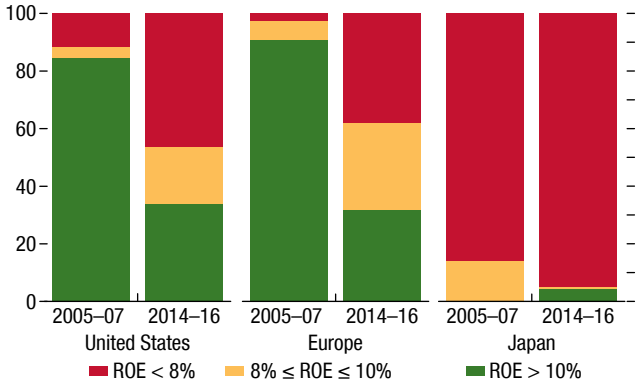
[9]See Chapter 2 of the April 2017 GFSR.

Figure 1.11. Life Insurers' Market Valuations and Risk Outlook

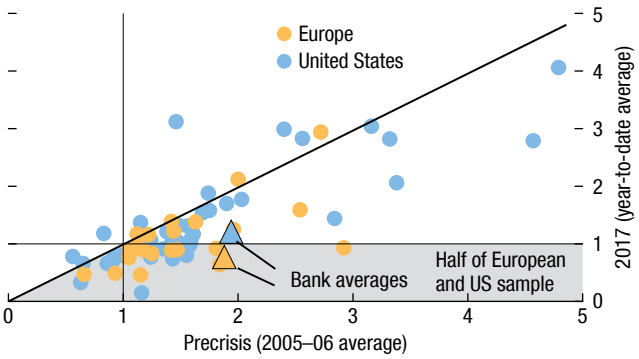
Legacy liabilities are a drag on their profitability ...

... such that half of European and US insurers are valued below their book values and below precrisis levels.

1. Life Insurers: Return on Equity
(Period average, percent of sector assets per category)



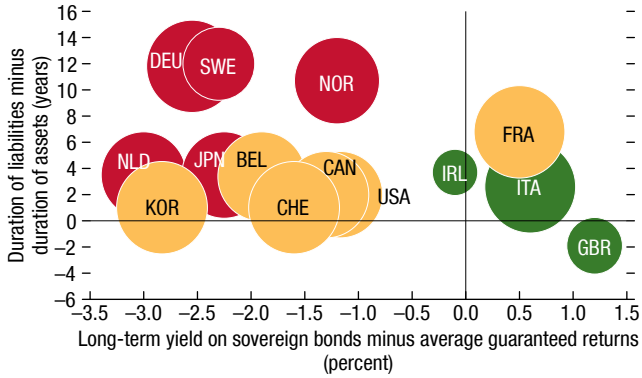
2. Life Insurers' Price-to-Book Ratios



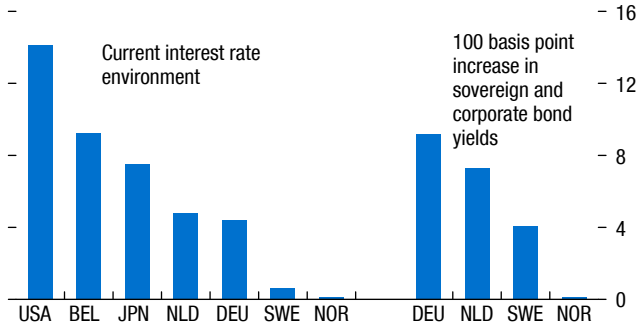
Guarantees and duration mismatches remain high for a large part of the sector.

Some insurers may soon face negative investment spreads.

3. Duration Mismatch and Guaranteed Return Spreads



4. Projected Number of Years until Bond Yields Fall below Guaranteed Returns



Sources: Annual reports; Autorité de Contrôle Prudentiel et de Résolution; Bloomberg Finance L.P.; Bundesbank; De Nederlandsche Bank; European Insurance and Occupational Pensions Authority; Moody's Investors Service; National Association of Insurance Commissioners; Nationale Bank van België; NLI Research Institute; Office of Financial Research; Organisation for Economic Co-operation and Development; SNL Financial; and IMF staff estimates.
Note: In panel 1, the implied cost of capital was about 10 percent before and after the global financial crisis. In panel 3, the size of the bubble relates to the share of liabilities with guaranteed returns to total life insurance liabilities. Green = countries with insurance sectors that have low guaranteed returns and low or negative duration mismatch. Yellow = countries with insurance sectors that have either high guaranteed returns or a high duration mismatch. Red = countries with insurance sectors that have both high guaranteed returns and high duration mismatch. In both cases in panel 4, guaranteed returns continue to decline. In the case of a 100 basis point increase in bond yields, Belgian, Japanese, and US investment yields are not expected to fall below guaranteed returns. Data labels in the figure use International Organization for Standardization (ISO) country codes. ROE = return on equity.

cial system are also failing to do so.[10] This highlights the importance of guarding against complacency and the need for additional policy focus on nonbank financial institutions and financing markets and the extension of macroprudential tools.

Policies Are Needed to Ensure Greater Insurer Resilience

Life insurers face growing vulnerabilities in the continued low-interest-rate environment. Policymakers should ensure that as insurers adapt to this environment they do not take excessive risks. Risk assessment in the insurance sector suffers from opaque and heterogeneous financial disclosure and deficiencies in the accounting and regulatory regimes. Policymakers must continue to strengthen regulatory frameworks and increase reporting transparency.

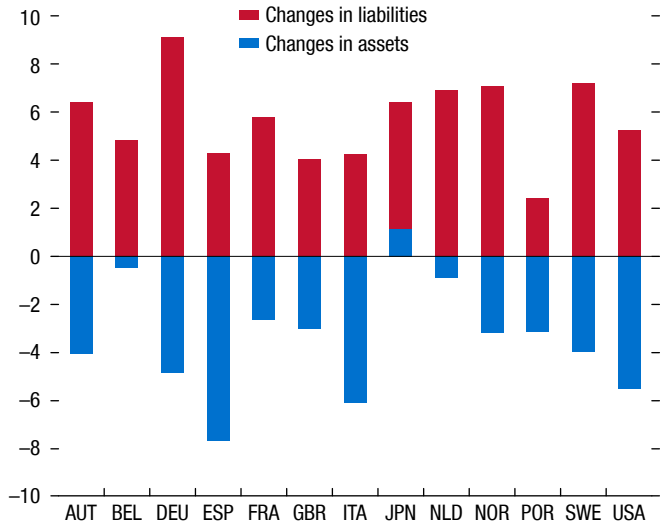
Greater public disclosure of timely information on key metrics to assess interest rate risk (namely, guaranteed returns and duration mismatches) would motivate insurers to further adapt their business models and build additional capital buffers. Liabilities are often not valued using current market prices (Japan, United States) or are understated by country- and firm-specific adjustments (Europe), hampering comparability. In the United States, there is no consolidated capital requirement, and sector-wide stress tests are not regularly undertaken, which leaves the potential for firms to mask risks. In Europe, the lack of loss-absorbing capacity in some instruments eligible as regulatory capital harms the credibility of reported solvency positions. Regulators are encouraged to close these regulatory gaps. In particular, the International Association of Insurance Supervisors should accelerate its efforts to establish a global insurance capital standard that adequately addresses these underlying vulnerabilities.

Monetary Policy Normalization: A Two-Sided Risk

Central bank balance sheets have grown considerably due to large-scale asset purchase programs. This has forced substantial portfolio adjustments in the private sector and across borders, reducing government bond yields, term premiums, and credit spreads while boosting equity valuations. As the global recovery progresses, a key stability challenge is to gradually rebalance central bank and private sector portfolios against the backdrop of monetary policy cycles that are not synchronized across countries.

[10]See also Chapter 3 of the April 2016 GFSR.

Figure 1.12. Simulated Mark-to-Market Shocks to Assets and Liabilities
(Percent)



Sources: Bank of Japan; European Insurance and Occupational Pensions Authority; Life Insurance Association of Japan; Moody's Investors Service; National Association of Insurance Commissioners; and IMF staff estimates.
Note: Cash flows are fixed. Derivative positions and loss absorption by policyholders and by taxes and regulatory adjustments are not taken into account. This implies that results should be considered an upper-bound impact. Shocks are applied to aggregate sector balance sheets of solo life insurers as of 2016:Q3 (Europe), 2016:Q1 (Japan), and 2015:Q4 (United States). The following shocks are applied: equity (–10 percent); real estate (–6 percent); sovereign debt yield AAA–A (–50 bps), BBB (+100 bps), < BBB (+100 bps); corporate bond yields AAA–A (+50 bps), BBB (+150 bps), < BBB (+200 bps); risk-free rates (–50 bps). Data labels in the figure use International Organization for Standardization (ISO) country codes. bps = basis points.

Too quick an adjustment could cause unwanted turbulence in financial markets and international spillovers. However, the expected process of normalization is likely to be gradual, with continued easy monetary conditions and low volatility that could foster a further buildup of financial excesses and medium-term vulnerabilities.

Managing the gradual normalization of monetary policies presents a delicate balancing act. The pace of normalization cannot be too fast or it will remove needed support for sustained recovery and desired increases in core inflation across major economies. The substantial rebalancing of private portfolios that has occurred also makes the adjustment of financial market prices much less predictable than in previous cycles. On the other hand, the likely prolonged period of low interest rates could further deepen financial stability risks as investors take on more risk in their search for yield.

Uncertainty around Central Bank Balance Sheet Adjustments

Large-scale asset purchase programs by the major central banks have led to a considerable shift in portfolios by domestic and foreign investors (Figure 1.13, panels 1 and 2). Central banks in Japan, the United Kingdom, the United States, and the euro area have increased their holdings of outstanding government securities to 37 percent of GDP, up from 10 percent before the global financial crisis. These purchases have produced marked shifts in asset allocations across major advanced economies during their respective periods of quantitative easing (QE).

- The Bank of Japan's QE program, the most aggressive of those of major advanced economy central banks, led domestic banks and pension funds to reduce their Japanese government bond holdings. The European Central Bank's QE program also had a large impact in altering the composition of portfolios: foreigners significantly reduced their holdings of government debt, followed by domestic banks and pension funds. In the United States, the Federal Reserve's QE programs led to a more muted shift: foreigners reduced their holdings of Treasuries as the accumulation of foreign exchange reserves slowed, as did insurance companies and pension funds, but other investors increased their holdings, including banks (to satisfy liquidity requirements), households, and mutual funds. The extent of the QE programs across central banks largely reflected the severity of the deflationary pressures experienced since the crisis began.
- Some 100 percent or more of the supply of government bonds has been absorbed by central bank purchases in the euro area and Japan. Official demand for Japanese government bonds exceeded net issuance in early 2013, while official purchases of euro area government debt eclipsed net issuance in 2016 as the growth in government deficits slowed (Figure 1.13, panel 3). But even though the Federal Reserve's QE programs were large in absolute terms, they were more modest relative to net issuance, which explains their more muted impact on investor portfolio rebalancing.[11]
- By reducing the stock of fixed income instruments available to the private sector, central banks crowded out traditional investors, such as banks, insurance companies, and asset managers, to differing degrees (Figure 1.13, panel 4). This prompted some private investors to reach for duration, credit, and liquidity risk to increase returns—an intended and beneficial consequence of asset purchase programs.

Going forward, portfolio rebalancing will have an impact on term premiums and broader risk premiums through two main channels. First, by releasing particular assets, central bank balance sheet normalization will increase their net supply to the public and may increase their term and risk premiums (the portfolio balance channel) (Figure 1.13, panel 4). Second, normalization will be associated and consistent with higher future short rates (the signaling channel).

There is significant uncertainty as to the magnitude of the adjustment in term premiums, given the unique set of conditions—large central bank balance sheets, a prolonged period of accommodation, diverging monetary policy cycles, and uncertain effects of postcrisis reforms and portfolio substitution. The magnitude holds great import: sovereign bond yields are the benchmark rate for a wide range of other assets, and term premiums are an input for broader risk premiums.

Historically, policy rates and term premiums have not always moved in unison; indeed, they diverge quite often (Figure 1.14, panel 1). Once the central bank starts increasing policy rates, it also provides forward guidance, reducing uncertainty (over interest rates and inflation). Consequently, bond risk and term premiums decline. Indeed, term premiums actually declined during the two most recent US tightening cycles; even previous monetary tightening cycles draw at best a mixed picture.[12]

But historical precedent may not be a helpful guide, given the large size of central bank balance sheets and compressed term premiums (Figure 1.14, panel 2). In the case of the United States, the Federal Reserve estimates that market expectations of a gradual unwinding and fall in the maturity of its securities holdings would increase the term premium by about 15 basis points by the end of 2017, at which point QE would still be holding down term premiums by a total of about

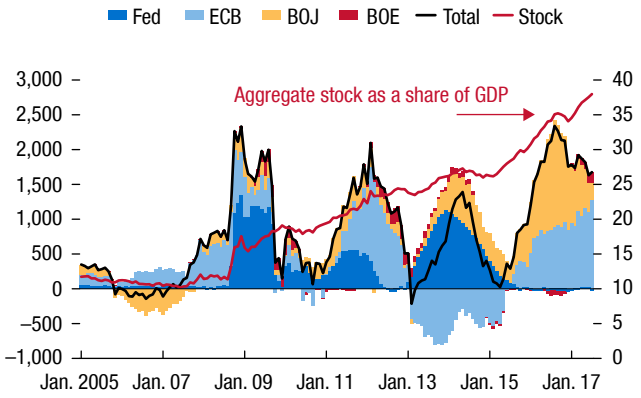
[11]Federal Reserve asset purchases accounted for a lower share of net issuance of US Treasuries, but a much greater share of quasi-agency mortgage-backed securities (net issuance in excess of 100 percent).

[12]Adrian, Crump, and Moench 2013.

Figure 1.13. Central Bank Balance Sheets and the Sovereign Sector

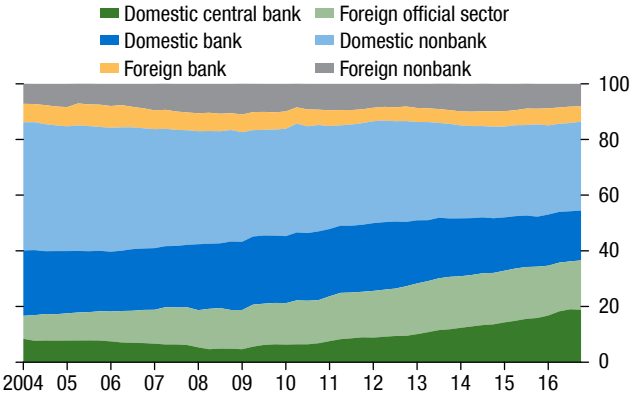
Central bank balance sheets have expanded because of large-scale asset purchases ...

1. Change in Central Bank Balance Sheet Assets (Billions of US dollars, 12-month rolling sum, left scale; percent of GDP, right scale)



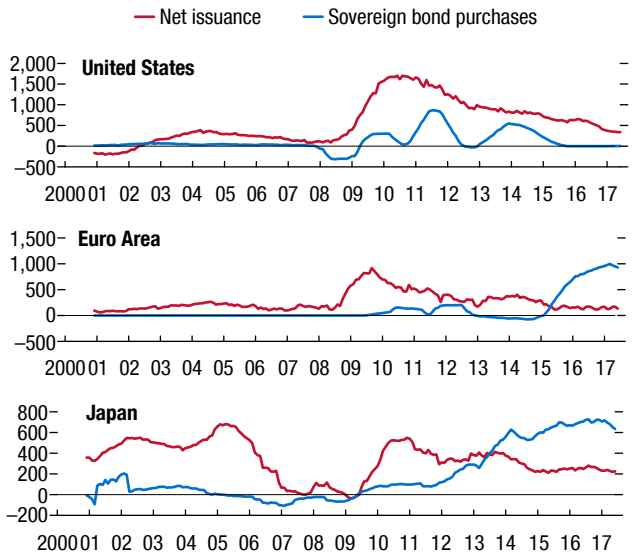
... leading domestic and foreign central banks to capture a sizable share of sovereign debt.

2. Advanced Economy Sovereign Bond Holdings by Investor Type (Percent)



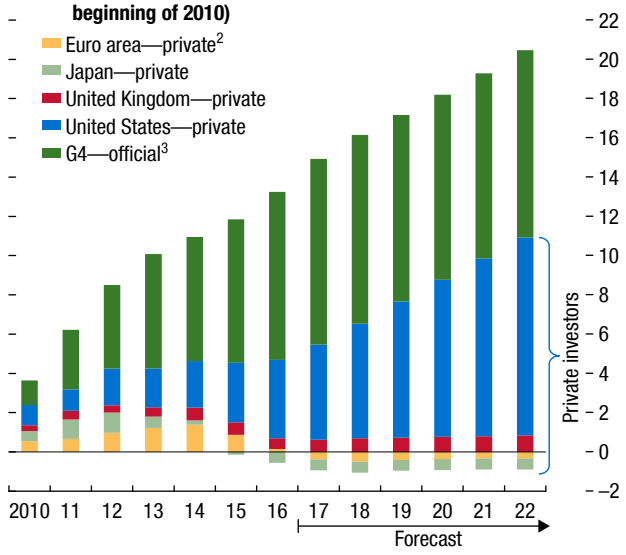
Large official purchases have outstripped net issuance in the euro area and Japan ...

3. Government Bond Issuance and Official Demand (Billions of US dollars, 12-month moving sum)



... but going forward, the private sector will need to absorb additional supply.

4. Change in Stock of Advanced Economy Sovereign Debt, by Region of Issuance and Holder[1] (Trillions of US dollars, cumulative change since beginning of 2010)

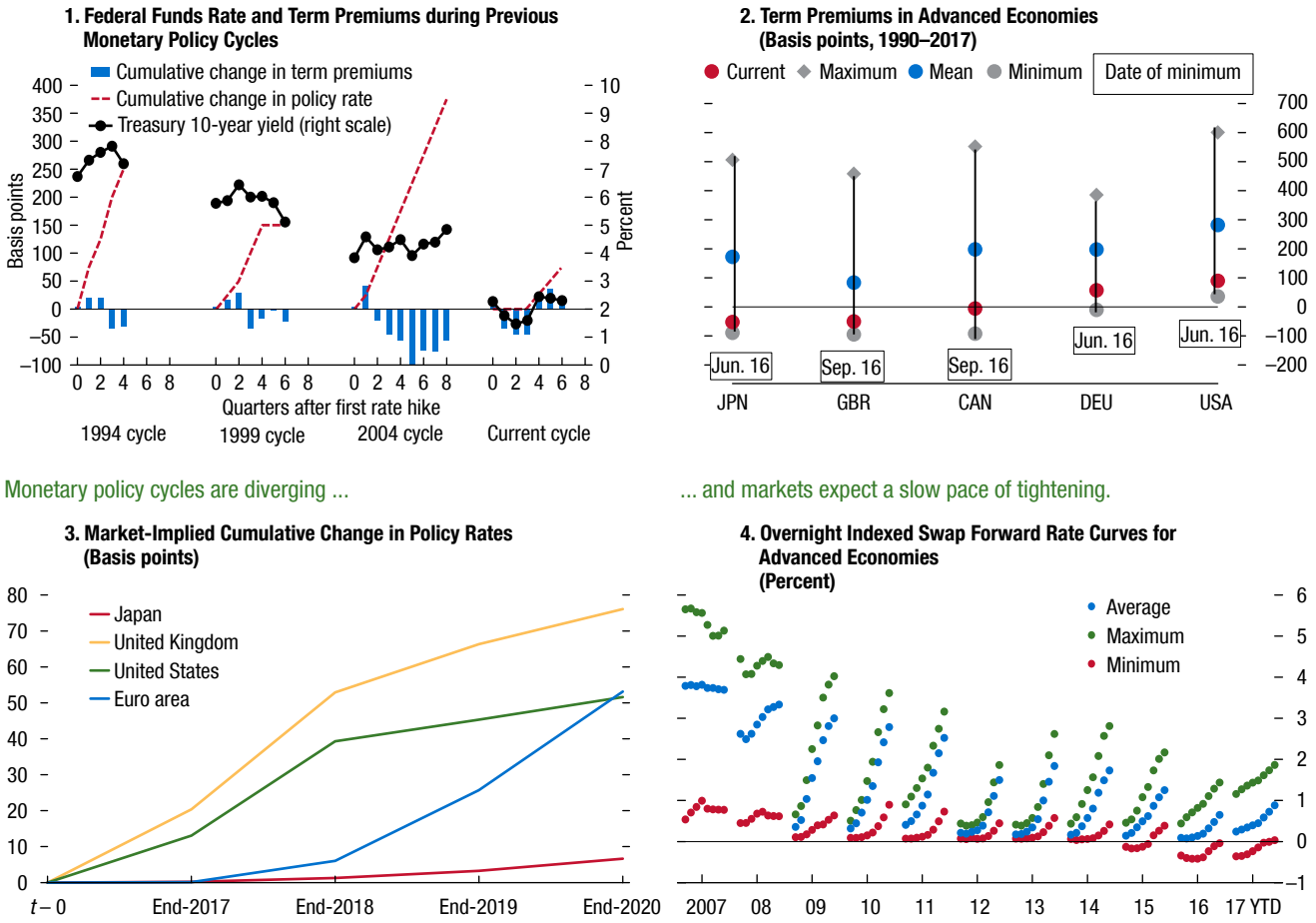


Sources: Bank of England; Bank of Japan; European Central Bank; Federal Reserve; government sources; Morgan Stanley; World Bank; Arslanalp and Tsuda 2012, updated; and IMF staff estimates.
Note: Panels 2–4 exclude agency debt securities. In panel 4, debt stocks are converted to US dollars using end of quarter exchange rates; ECB net purchases are assumed to decline to a reduced pace and the asset purchase program extended to June 2018; Fed net purchases are assumed to follow the path outlined by the Fed starting in 2017:Q4; BOJ net purchases are assumed to equal forecast net supply; BOE net purchases are assumed to equal zero from 2017:Q1 onward. BOE = Bank of England; BOJ = Bank of Japan; ECB = European Central Bank; Fed = US Federal Reserve; G4 = euro area, Japan, United Kingdom, United States; QE = quantitative easing.
[1]Forecasts use forecasted central government net lending/borrowing.
[2]The following member countries of the euro area are included: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, and Spain.
[3]Until end-2016, debt absorbed by central banks and foreign and supranational institutions; from 2017 onward, aggregated central bank purchases.

Figure 1.14. Policy Rates, 10-Year Government Bond Yields, and Term Premiums

Policy rates and term premiums have diverged during recent monetary policy tightening cycles ...

... but term premiums are near historical lows in several major economies.



Monetary policy cycles are diverging ...

... and markets expect a slow pace of tightening.

Sources: Bloomberg Finance L.P.; and IMF staff estimates based on Wright 2011.
Notes: Panel 4 shows annual average three-month overnight indexed swap (OIS) rates on forward contracts for tenors from six months to five years. The OIS forward curves are constructed from the US dollar, euro, Japanese yen, and British pound, and the average, maximum, and minimum are computed for each tenor across the four jurisdictions. Data labels in the figure use International Organization for Standardization (ISO) country codes. YTD = year to date.

85 basis points, with the portfolio balance channels accounting for two-thirds of the impact.[13] An inflation surprise on the upside could also lead to a sharp jump in term premiums.

Potential International Spillovers Pose Additional Challenges and Risks

Because of the different starting points and time paths for both economic recovery and the state of financial repair, the international aspects of balance sheet normalization and spillovers are significant for two reasons:

- The domestic effects of balance sheet normalization may be transmitted to other economies because global financial markets are highly integrated. Balance sheet normalization in major advanced economies could tighten financial conditions in other countries, raising long-term rates and inducing capital outflows from those countries. This is because term premiums exhibit a high degree of comovement, particularly if they originate from shocks from the largest global bond markets,

[13]Bonis, Ihrig, and Wei 2017.

such as the United States, Germany, and Japan (see the October 2016 GFSR). These heightened cross-border dynamics could potentially trigger a large simultaneous increase in global rates. This poses challenges because of diverging monetary policies (Figure 1.14, panel 3) and paths for normalization (Figure 1.14, panel 4).

- Differences in balance sheet repair across countries could create additional sources of financial stress as monetary policy normalizes. For example, euro area sovereign term spreads could increase further as the prospect of reduced monetary accommodation moves closer. Although this could partly reflect rising inflation expectations, it could also signal increased credit risks in countries with high debt burdens given the prospect of further reductions in European Central Bank (ECB) net asset purchases.

How Will Emerging Market Economies Fare amid Reduced Central Bank Support?

Large-scale monetary accommodation has underpinned a significant portion of portfolio flows to emerging market economies. Model estimates indicate that about $260 billion in portfolio inflows since 2010 can be attributed to the *push* of unconventional policies by the Federal Reserve (Figure 1.15, panel 1).[14]

These estimates suggest that the expected steady pace of Federal Reserve policy normalization over the next two years (as described in the baseline of the October 2017 WEO) could reduce portfolio flows by about $35 billion a year (Figure 1.15, panel 2). Countries that benefited the most during the boom period could see the largest moderation in inflows. If so, Chile, Mexico, and South Africa would be expected to experience the greatest decline in inflows relative to the size of their economies, estimated at a cumulative 1.0 to 1.5 percent of annual GDP over the next two years (Figure 1.15, panel 3). It is worth noting, however, that emerging market economies with previously large inflows are generally those with deeper and more liquid markets that are able to withstand outflows better. Countries that have benefited the most from inflows owe some of this benefit to strong domestic factors, such as improving growth and external positions and declining corporate vulnerability. To the extent that such favorable conditions are maintained, the impact of a less favorable external environment would be mitigated, including via other types of foreign capital inflows, such as foreign domestic investment.

Emerging market economies should be able to handle this reduction in inflows in a relatively smooth manner, given their enhanced resilience and stronger growth outlook. However, a rapid increase in investor risk aversion would have a more severe impact on portfolio inflows and prove more challenging, particularly for countries with greater dependence on external financing. For example, Malaysia, Poland, South Africa, and Turkey are projected to have sizable external financing needs through 2020 (Figure 1.15, panel 4). However, pressures from external shocks can be mitigated by large external asset holdings of domestic investors and banks.

Monetary Policy Changes Should Be Well Communicated to Prevent Excessive Market Volatility

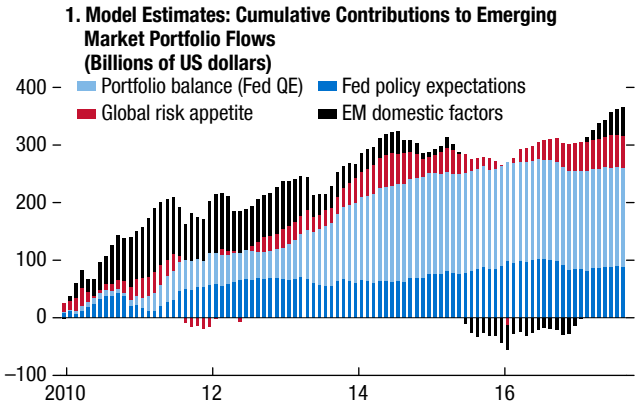
The baseline path for the global economy foresees continued support from accommodative monetary policies, as inflation rates are expected to recover only slowly. Too quick an adjustment could cause unwanted turbulence in financial markets while removing needed support for the recovery. To ensure a smooth normalization of monetary policy, monetary authorities should provide and follow well-communicated plans on unwinding their holdings of securities and, if needed, provide guidance on prospective changes to the framework. At the same time, authorities need to be mindful of potential global spillovers as normalization proceeds. These efforts will help anchor market expectations and avoid undue market dislocations or excessive volatility.

Central banks with still-expanding balance sheets will need to take appropriate measures to alleviate col-

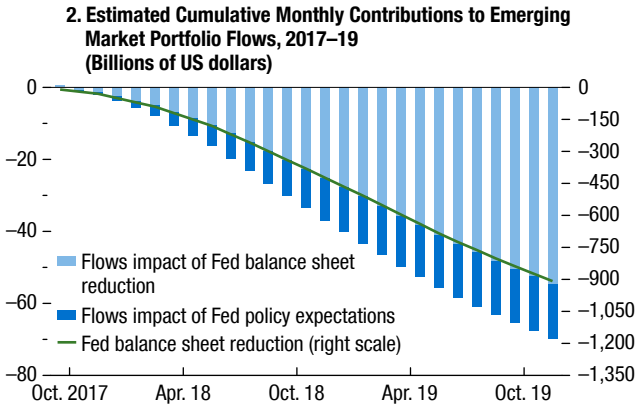
[14]Estimates for portfolio flows are obtained using a model adapted from Koepke 2014. The model estimates the impact of external "push" and domestic "pull" variables on portfolio flows to emerging markets, consistent with the capital flows literature. The dependent variable is monthly data from the Institute of International Finance on nonresident portfolio flows to emerging market economies (that is, foreign purchases of emerging market stocks and bonds). Independent variables include push factors, pull factors, and a constant term. Push variables include a proxy for global risk aversion (the US corporate BBB spread over Treasuries), three-year-ahead expectations for the federal funds effective rate, and the change in assets on the Federal Reserve's balance sheet. Pull variables include an emerging market economic surprise index compiled by Citigroup and the Morgan Stanley Capital International Emerging Markets Index. The (positive) constant term captures the sizable passive component of portfolio flows, which is due to portfolio growth and passive reallocation (and thus unrelated to push or pull factors).

Figure 1.15. Emerging Market Economy Capital Flows

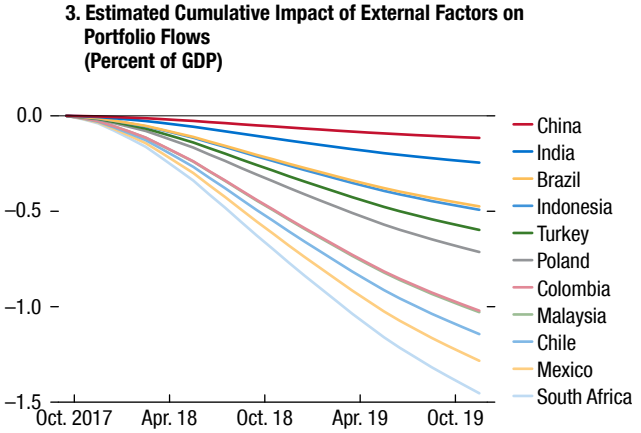
A large portion of portfolio flows has been driven by US monetary policy accommodation.



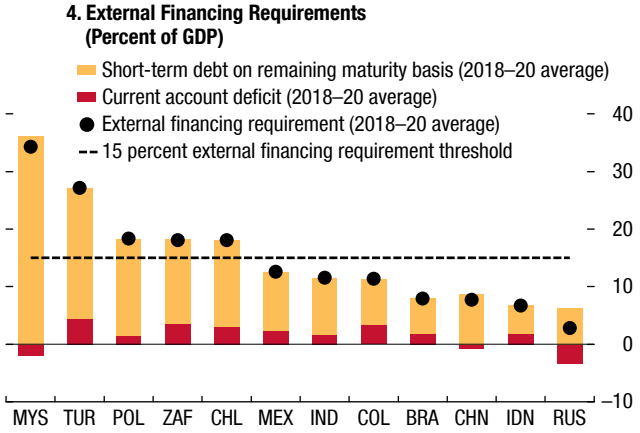
Estimates point to a substantial reduction in portfolio flows due to US monetary policy normalization ...



... with some countries likely to experience reduced inflows of 1–1.5 percent of annual GDP over the next two years.



This could prove challenging for those with large external financing needs.



Sources: Federal Reserve; and IMF staff estimates.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. EM = emerging market; Fed = Federal Reserve; QE = quantitative easing.

lateral scarcity pressures in order to support liquidity resilience and efficient market functioning.

- For the European Central Bank, subdued inflation points to the need for monetary policy to remain accommodative for an extended period.[15] To this end, the ECB has committed to keeping policy rates at their current levels until well past the horizon of net asset purchases. It will be important to adhere to this commitment, thus ensuring the credibility of forward guidance and maintaining accommodation even if supply constraints necessitate scaling back net asset purchases next year. Moreover, reinvesting the proceeds from maturing assets would keep the central bank balance sheet from shrinking.
- For the Bank of Japan, stubbornly low inflation underscores the importance of maintaining sustained accommodation through its "quantitative and qualitative easing with yield curve control" framework.[16] The Bank of Japan should carefully calibrate its yield curve policy in the event of downside risks, including by considering lowering

[15]See IMF 2017c.

[16]See IMF 2017d and IMF 2017e.

the yield curve—in coordination with appropriate fiscal support and with consideration to the profitability of financial institutions and the functioning of the Japanese government bond market—should deflation pressure persist. Moreover, it is important for the Bank of Japan to continue to monitor the market liquidity and functioning of the Japanese government bond market and to consider appropriate measures to alleviate shortages in the event of liquidity stress.

Has the Search for Yield Gone Too Far?

The low-interest-rate environment has stimulated a search for yield in markets, pushing investors beyond their traditional risk mandates. This has compressed spreads, reduced the compensation for credit and market risk in bond markets, contributed to low volatility, and facilitated the use of financial leverage. While these supportive financial conditions have helped boost growth, as intended, they have also raised the sensitivity of the financial system to market risks. Prolonged normalization of monetary policy could extend these trends. Unless well managed, these rising medium-term vulnerabilities could lead to significant market disruptions if risk premiums and volatility decompress rapidly.

Too Much Money Chasing Too Few Yielding Assets Has Created a Search for Yield

After nearly 10 years of extraordinary monetary accommodation, as well as changing structural factors such as demographics and slower growth, the universe of global fixed income looks very different than before the global financial crisis. While the size of the fixed income market has exploded—one of the major investment-grade benchmark indices has increased from about $19.5 trillion in 2007 to $45.7 trillion in 2017—the portion of bonds with yields that meet investor targets has shrunk dramatically. In 2007, about 80 percent of the fixed income index ($15.8 trillion) yielded over 4 percent—the approximate required return for many absolute return investors such as pension funds and insurance companies (Figure 1.16, panel 1).[17] But this proportion has now shrunk to less than 5 percent ($1.8 trillion) (Figure 1.16, panel 2).[18]

In the United States, this dearth of higher-yielding securities combined with the portfolio rebalancing effects of QE has resulted in a search for yield. There has been a marked shift of foreign investors out of their traditional positions in US Treasury bonds and agency securities and into higher-yielding US corporate bonds (Figure 1.16, panels 3 and 4). Non-US investors now rank among the largest holders of US corporate bonds, at nearly 30 percent of outstanding debt, up from 12 percent in 1990 and one quarter before the start of quantitative easing policies. Marginal demand has been especially pronounced among Asian investors, with flows from insurance and pension funds from Japan and Taiwan Province of China accounting for almost two-thirds of all foreign institutional flows into US investment-grade credit over the past three years.

The Search for Yield Has Also Led to Greater Capital Flows and More Borrowing by Low-Income Countries

In emerging market economies, the search for yield—combined with stronger growth and lower corporate vulnerabilities—has supported a notable rebound in portfolio inflows. Nonresident inflows of portfolio capital reached an estimated $205 billion in the year through August and are on track to reach $300 billion for 2017, more than twice the total observed during 2015–16 and on par with the strong pace of inflows from 2010–14 (Figure 1.17, panel 1). The primary beneficiaries of portfolio inflows have been large emerging market economies, including Colombia, Mexico, South Africa, and Turkey. Some have used this period to enhance policy buffers in the form of higher international reserves (Figure 1.17, panel 2). This has helped compress yields and spreads for sovereigns and firms, lifting asset valuations and external bond issuance (Figure 1.17, panels 3 and 4).

Low-income countries have also benefited from the search for yield by expanding their access to international bond markets. Bond issuance has risen sharply since the start of 2017, with the total volume $7.4 billion close to the record level in 2014 (Figure 1.18, panel 1). Despite strong global demand for yield,

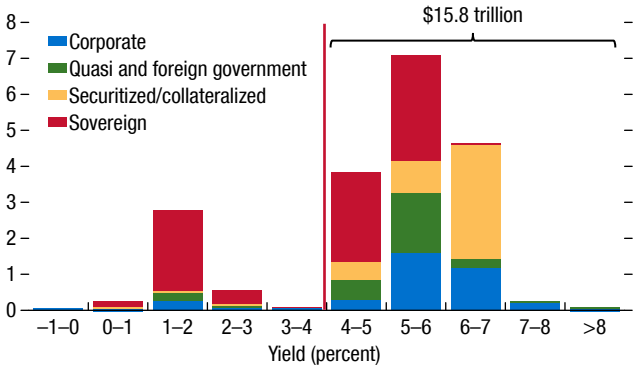
[17]For example, the required return on investment for insurance companies = the guaranteed returns promised to policyholders + the cost of their equity * leverage. These numbers differ between markets. For the United States, this is 3.6 percent + 10 percent * 0.10 = 4.6 percent. For Europe, this is 2.3 percent + 10 percent * 0.07 = 3.0 percent. This assumes no additional sources of profit, such as underwriting margins, so the required return should be seen as an upper bound. Nevertheless, absolute return investors require historically high real rates. For pension funds, the required return is the discount rate applied to liabilities.

[18]Bank of America Global Broad Market Index.

Figure 1.16. Global Fixed Income Markets and US Corporate Credit Investor Base

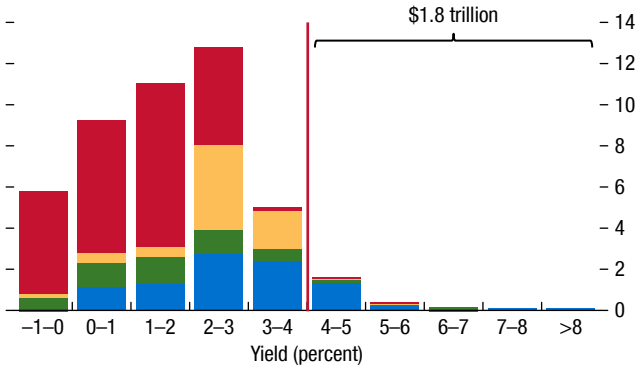
In 2007, a variety of asset classes generated returns in excess of 4 percent.

1. Global Investment-Grade Fixed Income Instruments, 2007 (Trillions of US dollars)



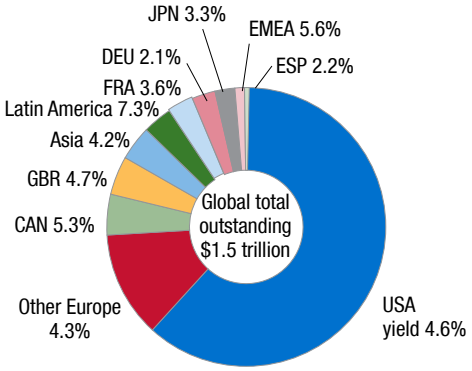
In 2017, corporate debt is the only significant asset class that provides a comparable return.

2. Global Investment-Grade Fixed Income Instruments, 2017 (Trillions of US dollars)



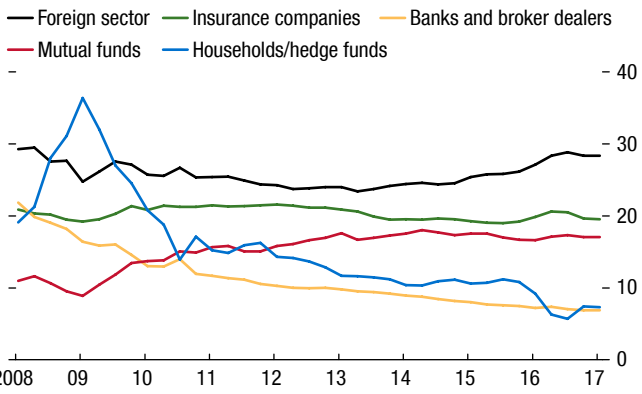
US corporate bonds make up the majority of the US dollar corporate bond universe ...

3. Yields of US Dollar Corporate Bonds Outstanding



... drawing foreign investors beyond their traditional risk habitats.

4. Holdings of US Corporate Bonds and Loans, by Investor Type (Percent)



Sources: Bank of America Merrill Lynch; Bloomberg Finance L.P.; Federal Reserve; Haver Analytics; and IMF staff estimates.
Note: Panels 1 and 2 are based on the Bank of America Global Bond Market Index. Data labels in the figure use International Organization for Standardization (ISO) country codes. EMEA = Europe, Middle East, and Africa.

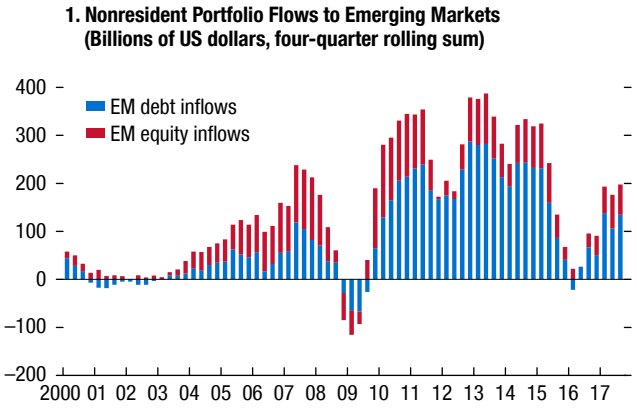
low-income countries face less favorable borrowing conditions, reflecting less liquid markets, weaker credit profiles, and the lack of an issuance track record (Figure 1.18, panel 2). Borrowing has generally been used to fund infrastructure projects, refinance debt, repay arrears, and increase budgetary flexibility.[19] However, this borrowing has been accompanied by an underlying deterioration in debt burdens (Figure 1.18, panel 3).

[19]See IMF 2017a.

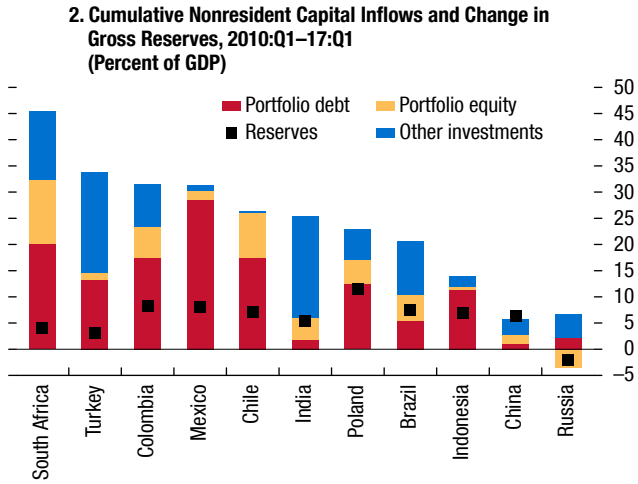
In low-income countries, greater reliance on foreign borrowing leaves them vulnerable to a decompression of global risk premiums. This vulnerability reflects several factors, including higher total debt stocks and greater debt servicing needs and high exposure to flight-prone foreign asset managers and hedge funds. Low-income countries would be most at risk if adverse external conditions coincided with spikes in their external refinancing needs. Although near-term debt rollover needs are small, many low-income-country

Figure 1.17. Emerging Market Economies: Debt Issuance, Portfolio Flows, and Asset Prices

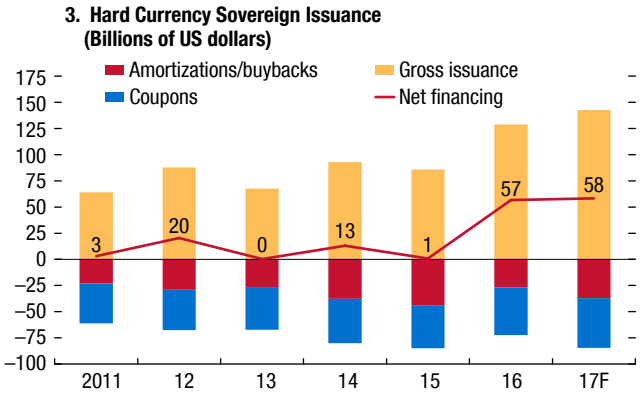
Portfolio flows to emerging markets have rebounded in recent quarters.



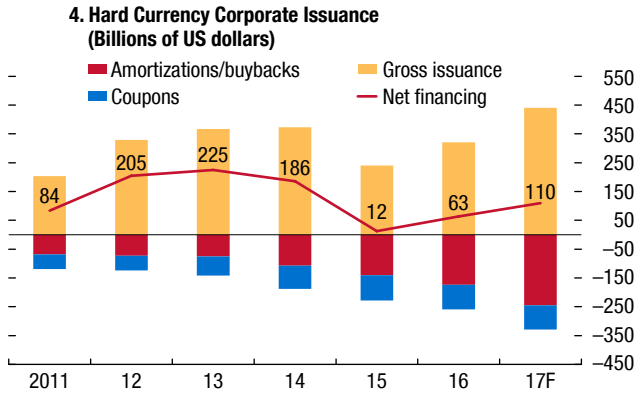
Some emerging markets have used foreign inflows to build reserve buffers.



Emerging market sovereign gross and net issuance is at record levels.



Corporate gross issuance is back to 2013–14 levels, but net issuance remains subdued.



Sources: Haver Analytics; Institute of International Finance; JPMorgan Chase & Co.; and IMF staff estimates.
Note: Panel 2 uses four-quarter sum of GDP to 2017:Q1. Panels 3 and 4 are JP Morgan estimates. Panel 4 omits direct investment and financial derivative liabilities.
EM = emerging market; F = forecast.

issuers face a significant repayment hump after 2021 (Figure 1.18, panel 4). Indeed, annual principal and interest repayments (as a percent of GDP or international reserves) have risen above levels observed in regular emerging market economy borrowers.

Credit and Market Risks Are Increasingly Being Mispriced

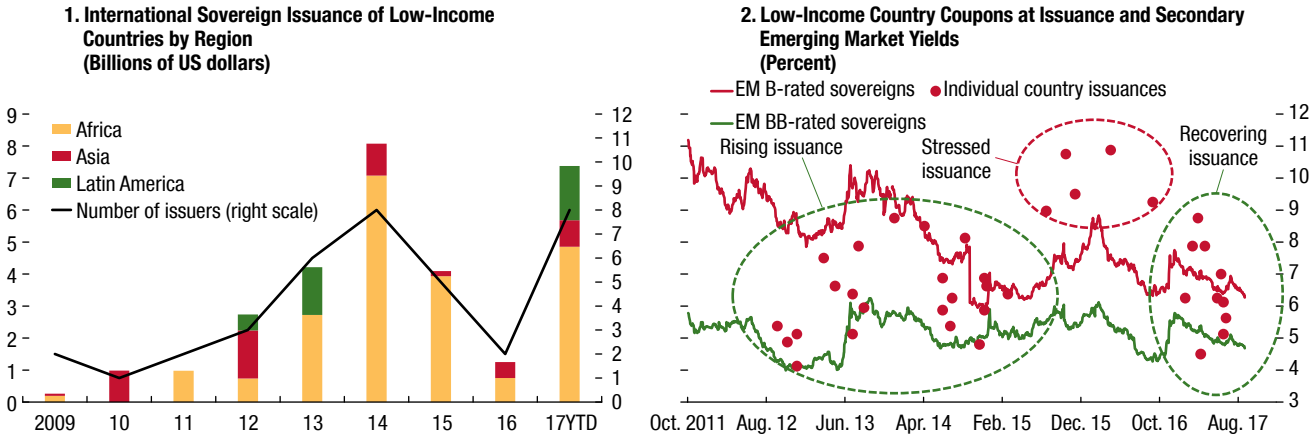
Low yields, compressed spreads, abundant financing, and the relatively high cost of equity capital have encouraged a buildup of financial balance sheet leverage as corporations have bought back their equity and raised debt levels (as discussed in the April 2017 GFSR). This means that the share of lower-rated companies in major US, European, and global bond indices has increased (Figure 1.19, panel 1). This trend of worsening credit quality also means that the estimated default risk for high-yield and emerging market bonds has remained elevated (Figure 1.19, panels 4 and 5).

Despite declining credit quality, the compensation for credit risk in key corporate bond markets has

Figure 1.18. Low-Income Country External Borrowing and Vulnerabilities

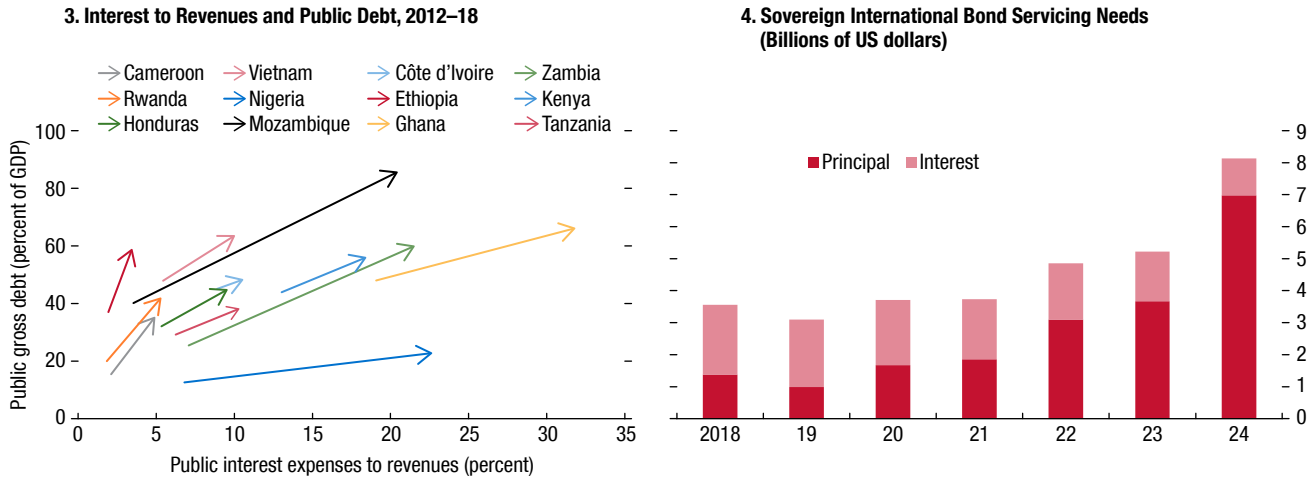
Low-income sovereign bond issuance has risen sharply in 2017, nearing previous peaks.

Market access conditions improved recently, but remain less favorable compared with other issuers.



Debt burden indicators have deteriorated.

Tighter external financial conditions would affect those with large rollover needs.



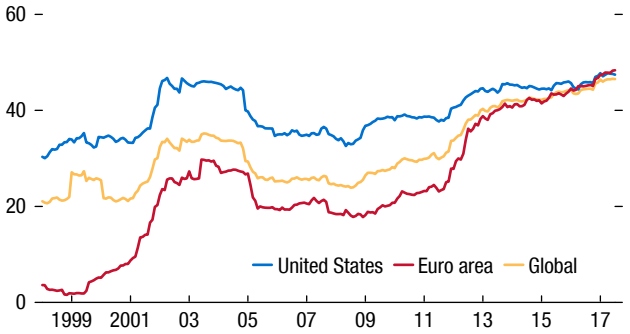
Sources: Bloomberg Finance L.P.; Bond Radar; and IMF staff estimates.
Note: Sample includes 74 low-income countries that were both International Development Association and IMF Poverty Reduction and Growth Trust (PRGT) eligible as of end-2014. Four countries (Bolivia, Mongolia, Nigeria, Vietnam) have graduated from the list of PRGT-eligible countries. Data labels use International Organization for Standardization (ISO) country codes. EM = emerging market; YTD = year to date.

actually fallen. One way to gauge this is to measure the amount of spread per unit of corporate leverage paid to investors. For every increase in the leverage multiple (measured by debt to earnings before interest, taxes, depreciation, and amortization), the spread received has declined sharply for both US dollar–denominated and emerging market bonds (Figure 1.19, panel 2). A decomposition of bond yields suggests that the amount of spread left for market risk has fallen, particularly for high-yield bonds (Figure 1.19, panels 3–5). Similarly, other estimates of market risk premiums in bond markets suggest that compensation has declined steadily over time (Figure 1.19, panel 6). To reach the average levels from 2000 to 2004, market risk and term premiums would need to rise about 200 basis points for investment-grade bonds and about 450 basis points for high-yield bonds. Market risk and term premiums would need to rise about 375 basis points for emerging market bonds.

Figure 1.19. US and Emerging Market Corporate Bond Spread Decomposition and Leverage

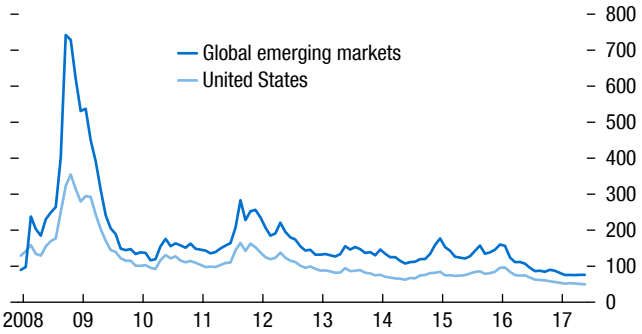
A high proportion of ratings are clustered at the bottom end of the investment-grade rating range.

1. Quality Breakdown of the Investment-Grade Index (Percent of sample with BBB rating)



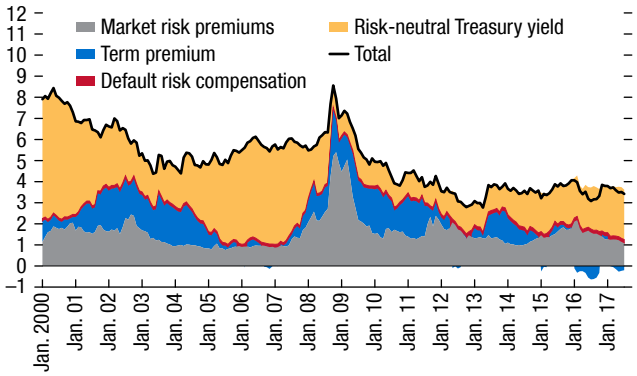
Risk-adjusted spreads have compressed to postcrisis lows.

2. Emerging Market and US Dollar Bond Spreads per Turn of Leverage (Basis points per turn of leverage)



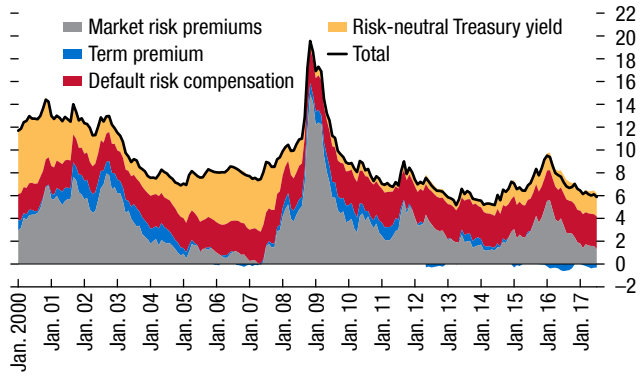
Risk premiums grind tighter for investment ...

3. US Dollar Global Investment-Grade Bond (Excluding Emerging Markets) Yield Decomposition (Percent)



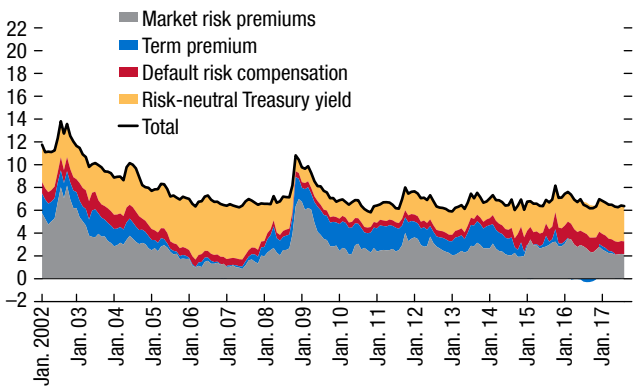
... and high-yield risk premiums fall to near new tights after an energy-related pop in 2016.

4. US Dollar Developed Market High-Yield Bond Yield Decomposition (Percent)



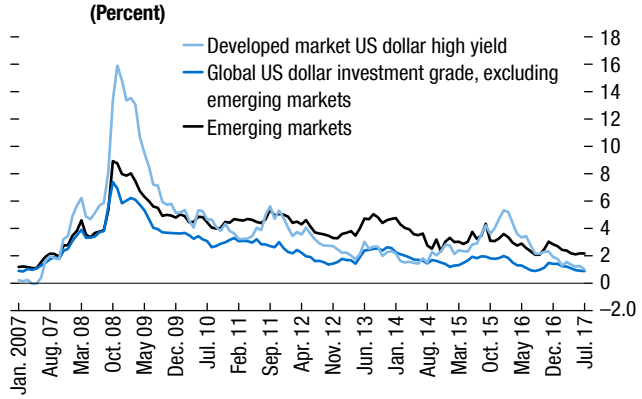
Emerging market bond risk premiums are also grinding lower ...

5. US Dollar Emerging Market Bond Yield Decomposition (Percent)



... driven by declines in term and market risk premiums.

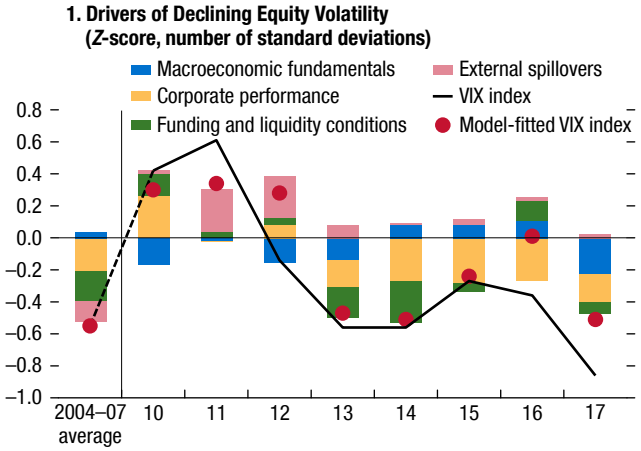
6. Markets Plus Term Premiums for Emerging Market and Developed Market Investment-Grade and High-Yield Bonds (Percent)



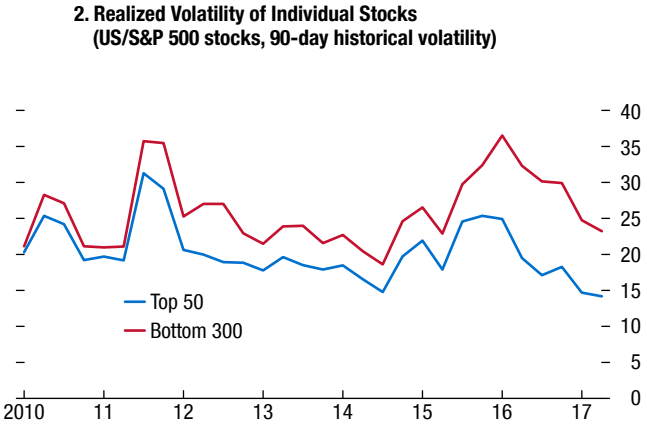
Sources: Bank of America Merrill Lynch; JPMorgan Chase & Co; Standard & Poor's; and IMF staff calculations.
Note: Market risk premium is the difference between the observed monthly bond spread and the estimated default risk compensation. Default risk compensation is estimated monthly by breaking down each index's holdings into Standard & Poor's (S&P) ratings buckets. Then, based on each bucket's rating and average duration, an average cumulative default probability is derived by referencing S&P's ratings transition tables. These results are weighted by the duration and ratings distribution of the corresponding index. Investment-grade spread, duration, and weightings are derived from the JPMorgan JULI ALL ex-EM index. High-yield data are derived from the JPMorgan Developed Market High Yield index. Emerging market data are derived from the JPMorgan EMBI Global index. Loss given default is always assumed to remain constant at 60 percent. Panel 5 includes both investment-grade and high-yield bonds.

Figure 1.20. Long-Term Drivers of the Low-Volatility Regime

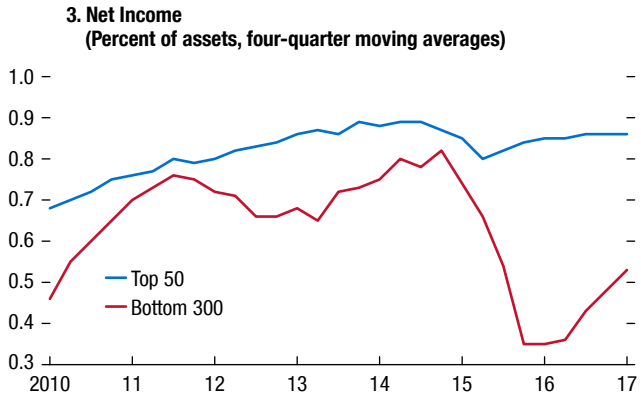
Equity volatility touched record lows in 2017.



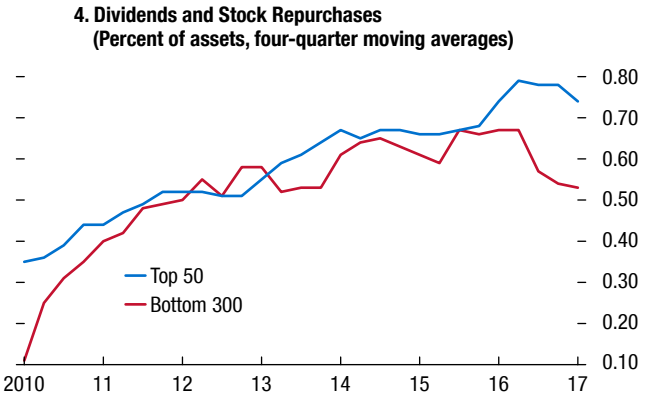
S&P 500 index volatility is suppressed by large firms ...



... whose earnings are stronger and more stable ...



... and whose payouts are more generous.



Sources: Bloomberg Finance L.P.; and IMF staff calculations.
Note: The Chicago Board Options Exchange Volatility Index (VIX) model is an ordinary least squares regression using quarterly data since 2004:Q1. Macroeconomic fundamentals include US GDP growth and the rolling 12-month standard deviation of the Citi US Economic Surprise Index. Corporate performance includes net income to assets and payouts to assets for Standard & Poor's (S&P) 500 firms. Funding and liquidity conditions include the TED spread (the difference between the interest rates on interbank loans and on short-term US government debt, "T-bills"); average euro, Japanese yen, and British pound one-year cross-currency basis swap rate; and supply of US Treasuries net of Federal Reserve purchases. External spillovers include the average of 10-year Greek, Italian, Portuguese, and Spanish yield spreads to the German 10-year yield. The VIX is used as the dependent variable in the volatility model.

Volatility Is Compressed

The bountiful liquidity provided by major central banks through their QE programs, as well as the expectation that central banks will react swiftly to market stress, has further strengthened the link between low risk premiums and low volatility. The impact of economic and financial conditions on US equity volatility is examined through an explanatory model, which offers three main findings (Figure 1.20, panel 1).[20]

- First, *stable macroeconomic fundamentals* have reduced volatility, as captured by the volatility of

[20]The analysis is centered on the United States as the most representative measure of global market volatility, given that the United States accounts for over one-third of the global equity market and dominates trading of implied volatility futures.

economic surprises and the strength of underlying growth. Accommodative monetary policy has helped support this economic environment.
- Second, the a*ccommodative funding and liquidity conditions* provided by monetary policy have left volatility lower than in previous cycles.
- Third, *corporate performance has remained stable* and contributed to steady investor earnings expectations and reduced volatility.

This steady corporate performance—and associated low realized volatility measures—has been driven in part by large-cap companies (Figure 1.20, panel 2). The market performance of large-cap companies has been underpinned by stronger and more resilient earnings (Figure 1.20, panel 3). At the same time, however, cash-rich US corporations have used payouts via dividends and stock repurchases to smooth equity valuations and compress volatility (Figure 1.20, panel 4). With payouts rising to a high percentage of assets, this tool may be less available to smooth earnings. Finally, increased dispersion of returns across sectors, which may reflect potential policy shifts in the United States and abroad, has also contributed to reduced volatility of the overall index.

Low Volatility, Financial Leverage, and Liquidity Mismatches Could Amplify a Market Shock

Low volatility can increase the sensitivity of the financial system to market risk. First, in standard portfolio risk models, low volatility enables investors to increase their exposure to financial assets and so their sensitivity to market risk. Second, low volatility can create incentives for investors to increase financial leverage, which collectively can amplify market shocks. An example of this effect is the increased popularity of so-called volatility-targeting investment strategies (Figure 1.21, panel 1). These strategies seek to keep expected portfolio volatility to a specific targeted level. Lower market volatility (in both global equity and bond markets) then means that greater financial leverage is needed to meet volatility targets (Figure 1.21, panel 2).[21]

However, during volatility spikes, these strategies can lead to significant asset sales to pare back leverage. Such an episode took place in August 2015,[22] when a representative volatility-targeting investment strategy cut its global equity exposure drastically (Figure 1.21, panel 3).[23] The size of US equity holdings held by volatility-targeting investment strategies may be larger than $0.5 trillion today.[24] Although this is less than 2.5 percent of the market capitalization of all US publicly traded equities, the trading volume related to deleveraging from these trading strategies could be much larger, particularly at times of equity market stress.[25]

The low-interest-rate environment has also raised bond market risk. Low interest rates have reduced coupons of newly issued bonds. While this has been a boon for issuers, helping to reduce debt servicing costs, it has come at the price of higher market risk for investors. The prices of those bonds are more sensitive to changes in interest rates (increasing their duration). This market risk is illustrated in Figure 1.22, panel 1, which simulates the impact of an immediate 100 basis point shock on long-term interest rates. The analysis shows that this impact has increased over time as duration has increased. Losses in bond funds might lead to outflows from asset managers. Indeed, the sensitivity of outflows appears to have increased in relation to periods of large negative returns in US high-yield bond funds (Figure 1.22, panel 2). A significant outflow might trigger sales of riskier and less liquid assets held by open-end mutual funds, which could lead to substantial changes in the price of these instruments and

[21]Derivatives such as equity index futures are commonly used to achieve greater financial leverage by volatility-targeting investment strategies.

[22]The Chicago Board Options Exchange Volatility Index (VIX) increased sharply to 40.7 percent on August 24, 2015, its highest level since September 2011, from 13.0 a week earlier. While rising concerns about a hard landing in China amid a significant decline in oil prices were major drivers of the increase in market volatility, market participants' concern about a perceived end to the Federal Open Market Committee quantitative easing policy may have also played a major role in the equity market sell-off.

[23]The Standard & Poor's (S&P's) 500 index exposure for a representative volatility-targeting investment strategy uses the AQR Risk Parity Fund mutual fund as its proxy portfolio.

[24]This estimate assumes that the universe of volatility-targeting investment strategies holds on average a portfolio in which global US equities account for 60 percent of the exposure and bonds account for 40 percent. The result is also adjusted by an estimated leverage number based on the volatility targets of different volatility-targeting investors. US equity exposure is assumed to be about half of the exposure to global equities. This is similar to the average geographic breakdown of equity investments in the AQR Risk Parity Fund over the past two years.

[25]Chandumont 2016 estimates that selling from volatility-targeting funds accounted for between 9 and 16 percent of all trading volume in S&P 500 futures during August 24–26, 2015.

Figure 1.21. Leveraged and Volatility-Targeting Strategies

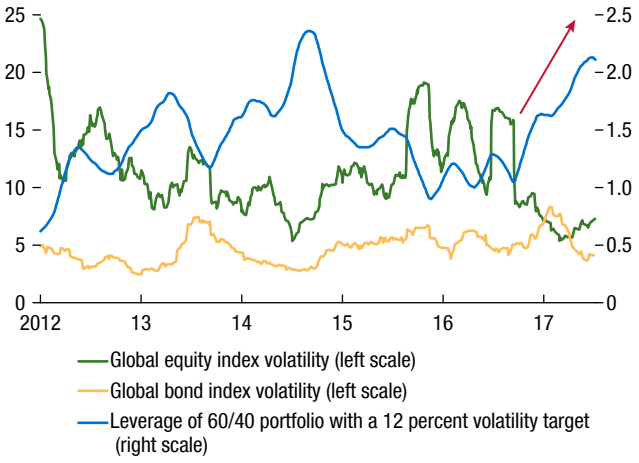
1. The Growth of Volatility-Targeting Investors

Investment Strategy	Volatility Target (percent)	Flexibility to Deviate from Volatility Target	AUM Mid-2017	Growth in AUM Past Three Years (percent)
Variable Annuities	8–12	Low	$440 billion	69
CTA/Systematic Trading	15	Medium	$220 billion	19
Risk Parity Funds	10–15	Medium–high	$150–$175 billion	...

Sources: Annuity Insights; Barclays Capital; BarclayHedge; and IMF staff calculations.

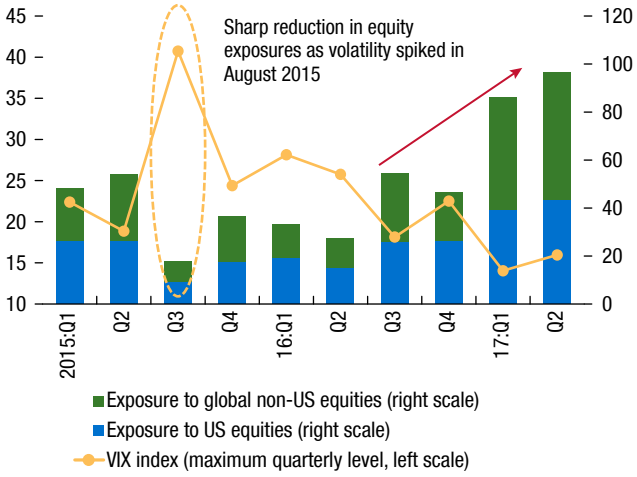
Lower volatility drives investors to increase financial leverage to meet their return and volatility targets ...

2. Leverage for a Theoretical Volatility-Targeting Investment Portfolio[1] (Sixty-day moving average)



... leading to rising equity exposures that are prone to sell-offs during volatility spikes.

3. Global Equity Exposure for a Representative Volatility-Targeting Investment Portfolio[2] (Percent/net asset value)



Sources: Bloomberg Finance L.P.; Federal Reserve; Investment Company Institute; and IMF staff calculations.
Note: AUM = assets under management; CTA = Commodity Trading Advisor; VIX = Chicago Board Options Exchange Volatility Index.
[1]The leverage calculation for a theoretical volatility-targeting investment strategy assumes a theoretical investment portfolio consisting of 60 percent global equities/40 percent bonds and an annual return volatility target of 12 percent. Leverage is defined as total investment exposure divided by the net asset value of the portfolio. The calculation uses a 60-day realized volatility moving window on the returns of equity and bond investments. The MSCI World Index is used as the proxy for equity investments; the Bloomberg Barclays Global Aggregate Total Return Value Unhedged index is used as the proxy for bond investments.
[2]The S&P 500 index exposure for a representative volatility-targeting investment strategy uses the AQR Risk Parity mutual fund as its proxy portfolio. The exposure data are obtained using Bloomberg's port function and reflect the percentage exposure of the fund's portfolio to equity index futures as a percentage of market value.

affect the value of these assets held by other investors. Figure 1.22, panel 3 shows that mutual funds hold a greater share of the high-yield bond market than in the past.

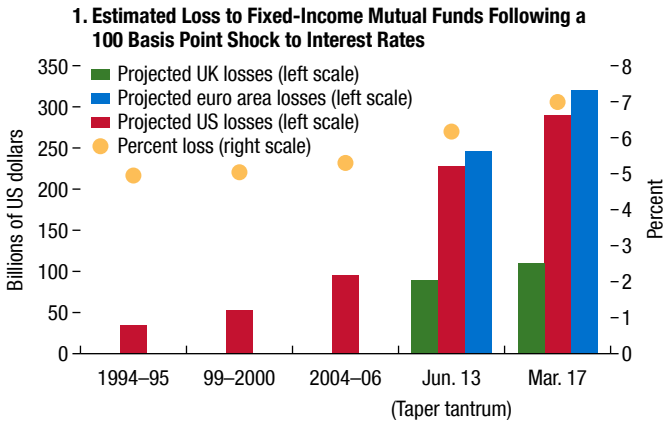
Prolonged normalization of monetary policy could mean continued low volatility and a further buildup of exposures, duration, and financial leverage. This would make the financial system even more sensitive to market risk, storing up medium-term vulnerability.

Efforts Are Needed to Help Lessen Stability Risks

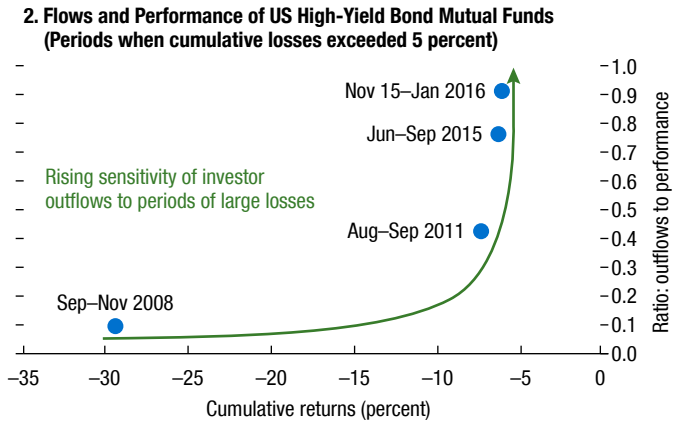
Regulators should be attentive to the potential for a substantial increase in asset market volatility to contribute to destabilizing feedback effects such as asset fire sales and adverse liquidity and leverage spirals. To lessen these risks, financial regulators should continue working to ensure that financial institutions maintain robust risk management standards at all points in the credit, business, and interest rate cycles. In addition,

Figure 1.22. Vulnerability of the US Corporate Credit Investor Base to Shocks

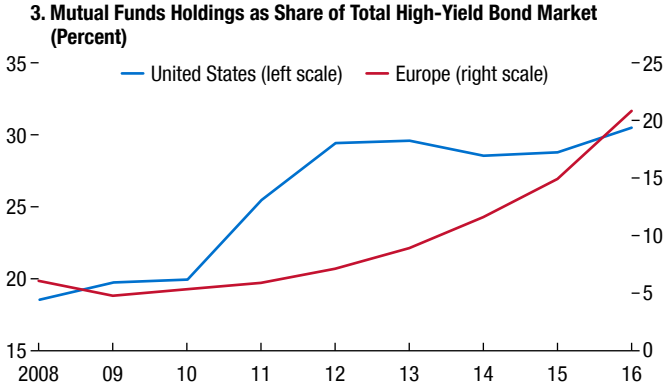
Higher duration leaves investors more vulnerable to interest rate risk ...



... at a time when there is greater sensitivity of investor outflows.



Liquidity mismatch risk is also a concern amid the rise in illiquid assets held by mutual funds globally.



Sources: Bloomberg Finance L.P.; EPFR Global; Federal Reserve; Investment Company Institute; and IMF staff estimates.
Note: In panel 1, data are based on prior periods of US monetary policy tightening starting in February 1994, July 1999, July 2004, and December 2015 and periods of large interest rate moves since the global financial crisis. The Barclays Capital Global Aggregate index is used as a proxy for duration of an average fixed-income portfolio. Total fixed-income mutual fund assets are used to calculate the dollar losses from a parallel 100 basis point increase in interest rates. Panel 2 shows periods when cumulative losses have exceeded 5 percent. There have been only four periods over the past decade when cumulative monthly losses on US high-yield bond benchmarks have exceeded 5 percent—a typical threshold used by investors when implementing stop-loss strategies. These risk management strategies are commonly used by investors to reduce their holdings in risky assets if prices breach certain prespecified loss limits. By closing out the position, the investor is hoping to avoid further losses.

supervisors, regulators, and firm management should closely monitor and assess financial institutions' exposure to asset classes where there are indications that the search for yield has contributed to valuation pressure.

There is also a need for regulators to endorse a clear and common definition of financial leverage in investment funds and to improve data transparency, particularly with respect to derivatives. Lack of progress on regulation on the use of derivatives is a concern given that the use of financial leverage through derivatives appears to be on the rise as fund managers seek to enhance low yields, particularly in strategies that target a specified level of price volatility.

Policymakers should continue to strengthen supervisory frameworks relating to liquidity risk management. This could be done by building on recent initiatives and recommendations to include greater flexibility in redemption and dealing frequency,[26] marking illiquid

[26]See US SEC (October 2016), FSB (January 2017), IOSCO (July 2017), and UK FCA (February 2017).

assets to market, and the treatment of institutional investors, as well as through better guidance on the use of particular risk management tools and enhanced disclosure requirements.

For borrowers in frontier markets and low-income countries, authorities should develop institutional capacity to deal with the risk that accompanies increased issuance of marketable debt securities. Authorities should formulate a comprehensive debt management strategy that incorporates exchange rate, interest rate, and liquidity risks associated with the issuance of external debt and explore liability management operations to mitigate refinancing risk.[27] Authorities should ensure efficient use of the borrowed funds by strengthening public investment management. They should also enhance investor relations programs to better understand and inform the international investment community regarding their debt issuance strategy.

The Rise in Leverage

Leverage in the nonfinancial sector has increased since 2006 in many G20 economies amid easy financing conditions. While this has helped facilitate the recovery in aggregate demand, it has also made the nonfinancial sector more sensitive to changes in interest rates. Private sector debt service burdens have increased in several major economies as leverage has risen, despite declining borrowing costs. Debt servicing pressure could mount further if leverage continues to grow and could lead to greater credit risk in the financial system. China has seen a rapid buildup in leverage, so the recent derisking measures are a welcome step. Yet continued rapid credit growth and accumulated vulnerabilities at smaller banks make it challenging to fully address systemic risks.

Group of Twenty Nonfinancial Sector Leverage

Aggregate G20 Debt-to-GDP Ratios Are Higher than before the Global Financial Crisis

Among G20 economies, total nonfinancial sector debt—borrowing by governments, nonfinancial companies, and households from both banks and bond markets—has risen to more than $135 trillion, or about 235 percent of aggregate GDP (Figure 1.23, panel 1).[28] This partly reflects economic developments since the global financial crisis. The rise in sovereign debt is largely due to the downturn in GDP, but is also due in part to the necessary actions taken by governments to stabilize economies and financial sectors. Private sector credit growth has helped facilitate the subsequent recovery in aggregate demand, and so has cushioned economic growth against further downside risks. But higher debt has made the nonfinancial sector more sensitive to changes in interest rates.

In G20 advanced economies, the debt-to-GDP ratio has grown steadily over the past decade and now amounts to more than 260 percent of GDP. In G20 emerging market economies, leverage growth has accelerated in recent years. This was driven largely by a huge increase in Chinese debt since 2007, though debt-to-GDP levels also increased modestly in other G20 emerging market economies (Figure 1.23, panel 2).

Overall, about 80 percent of the $60 trillion increase in G20 nonfinancial sector debt since 2006 has been in the sovereign and nonfinancial corporate sectors (Figure 1.23, panel 3). Much of this increase has been in China (largely in nonfinancial companies) and the United States (mostly from the rise in general government debt). Each country accounts for about one-third of the G20's increase. Average debt-to-GDP ratios across G20 economies have increased in all three parts of the nonfinancial sector (Figure 1.23, panel 4).

There has also been a broad increase in nonfinancial debt-to-GDP ratios across individual G20 economies since 2006; only Argentina and Germany have experienced a decline in total nonfinancial sector debt to GDP (Table 1.1). In some economies, individual sectors have deleveraged. For example, household debt to GDP fell in Germany and the United States, in particular. Nonfinancial corporate leverage declined the most in Argentina, Japan, and the United Kingdom. But in the majority of cases in the G20, nonfinancial debt-to-GDP ratios have risen.

While gross liabilities have risen, the development of net debt—gross debt minus financial assets—has varied across the nonfinancial sector in G20 advanced economies (Figure 1.23, panel 5). General government net debt rose along with gross debt over the decade since 2006. Nonfinancial private sector net debt, however, fell as savings and higher asset prices helped build up financial assets more quickly than liabilities. This, in turn, has helped support the recovery in spending

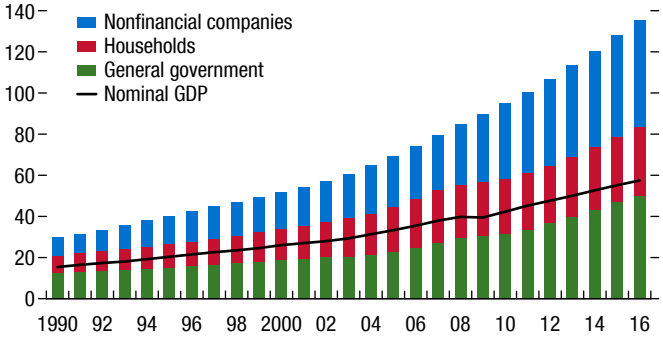
[27]See IMF 2017b.

[28]G20 aggregates are based on the 19 individual economies in the group (the 20th member is the European Union).

Figure 1.23. Group of Twenty Nonfinancial Sector Credit Trends

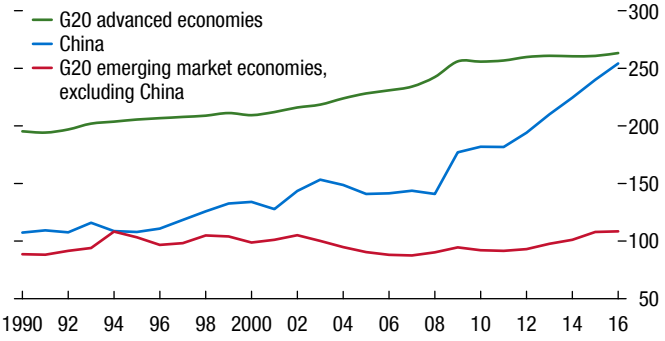
Debt has been rising more quickly than GDP ...

1. Gross Debt and GDP
(Trillions of US dollars)



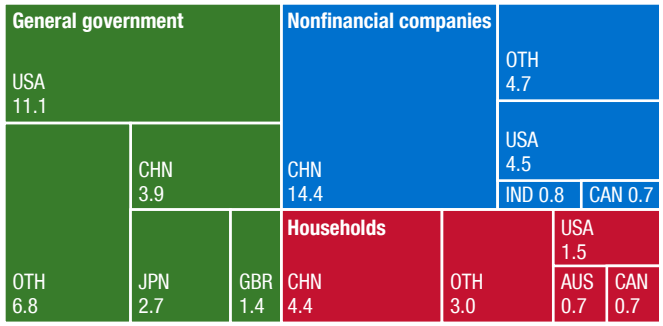
... largely in advanced economies and China ...

2. Gross Debt-to-GDP Ratios by Region
(Percent)



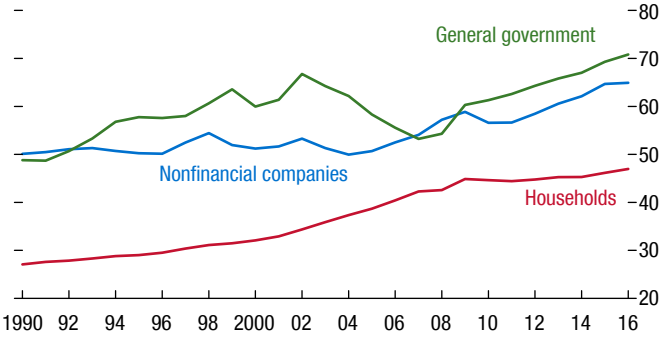
... and in sovereigns and firms ...

3. Change in Gross Debt, 2006–16
(Trillions of US dollars)



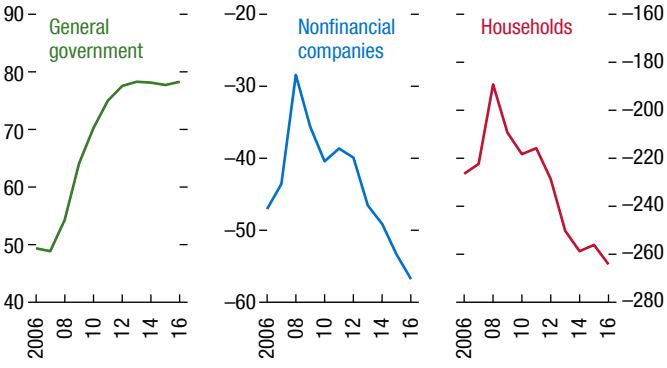
... with debt-to-GDP ratios above precrisis levels.

4. Average Gross Debt-to-GDP Ratios by Sector
(Percent)



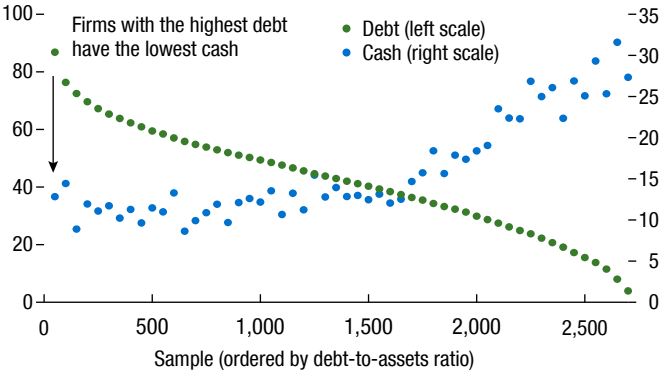
Private sector financial assets have risen ...

5. Advanced Economy Net Debt-to-GDP Ratios by Sector
(Percent)



... but cash is unevenly distributed among firms.

6. Advanced Economy Nonfinancial Corporate Debt and Cash
(Percent of assets)



Sources: Bank for International Settlements; Bloomberg Finance L.P.; Haver Analytics; IMF, World Economic Outlook database; and IMF staff calculations.
Note: Data are adjusted for foreign exchange movements by converting to US dollars at the end-2016 exchange rate. Advanced economy nonfinancial corporate debt is shown net of estimated intercompany loans. In panel 3, OTH = other Group of Twenty (G20) economies. Panel 4 shows the average debt-to-GDP ratio across the G20 economies, by sector. Panel 5 shows debt minus financial assets as a percent of GDP. Panel 6 is based on a sample of more than 2,600 nonfinancial companies in continental Europe, Japan, the United Kingdom, and the United States. Each dot shows average debt and cash to assets for the same 50 firms. Data labels in the figure use International Organization for Standardization (ISO) country codes.

Table 1.1. Sovereign and Nonfinancial Private Sector Debt-to-GDP Ratios
(Percent)

		Advanced Economies									Emerging Market Economies									
		JPN	CAN	USA	GBR	ITA	AUS	KOR	FRA	DEU	CHN	BRA	IND	ZAF	TUR	MEX	RUS	SAU	ARG	IDN
General Government	2006	184	70	64	41	103	10	29	64	66	25	66	77	31	45	38	10	26	70	36
	2016	239	92	107	89	133	41	38	96	68	44	78	70	52	28	58	16	13	54	28
Households	2006	59	74	96	90	36	105	70	44	65	11	14	10	39	9	12	8	12	4	11
	2016	57	101	79	88	42	123	93	57	53	44	23	10	35	18	16	16	15	6	17
Nonfinancial Corporations	2006	100	76	65	79	67	73	83	56	49	105	39	38	33	27	14	32	28	20	14
	2016	92	102	72	73	71	79	100	72	46	165	44	45	37	67	28	52	50	12	23
Total	**2006**	**343**	**221**	**225**	**210**	**205**	**187**	**183**	**164**	**180**	**142**	**118**	**125**	**104**	**81**	**64**	**49**	**66**	**93**	**61**
	2016	**388**	**295**	**259**	**250**	**246**	**243**	**232**	**226**	**168**	**254**	**145**	**125**	**124**	**113**	**103**	**84**	**78**	**73**	**68**

Sources: Bank for International Settlements; Haver Analytics; IMF, World Economic Outlook database; and IMF staff calculations.
Note: Dark shading denotes a higher debt-to-GDP ratio in 2016 than in 2006. The table shows debt at market values. Advanced economy nonfinancial corporate debt is shown net of estimated intercompany loans where data are available. Data labels in the table use International Standardization Organization (ISO) codes.

and GDP. But it is important not to draw too much comfort from this development. While debt accumulation is not necessarily a problem, one lesson from the global financial crisis is that excessive debt that creates debt servicing problems can lead to financial strains. Another lesson is that gross liabilities matter. First, in a period of stress, it is unlikely that the whole stock of financial assets can be sold at current market values—and some assets may be unsellable in illiquid conditions. Second, the aggregate data used here do not account for differences in the distribution of assets and liabilities. For example, the younger population might have a greater proportion of debt in the household sector, while the older population might have a greater proportion of financial assets.

A similar argument can be made about cash holdings in nonfinancial companies. Although cash holdings may be netted from gross debt at an individual company—because that firm has the option to pay back debt from its stock of cash—it could be misleading to do so in the aggregate data generally used in this section. This is because the distribution of debt and cash holdings differs between companies. Figure 1.23, panel 6, which is based on debt and cash stocks held by a sample of more than 2,600 European, Japanese, and US companies, shows that those with higher debt also tend to have lower cash holdings and vice versa.

Although G20 gross private nonfinancial debt has increased in the aggregate, the reasons for higher leverage differ across sectors. For example, changes in household leverage appear to be broadly associated with lower borrowing costs and house price movements (Figure 1.24, panel 1). Higher house prices, driven up by buoyant market conditions and risk appetite, mean that not only is more borrowing needed to purchase properties but also that more collateral is available to support the increased borrowing. Lower interest rates make new borrowing more attractive for households. Chapter 2 examines household indebtedness in more detail. It finds that household debt has continued to grow over the past decade across a broad set of countries. It also concludes that high growth in household debt in the medium term is associated with a greater probability of a banking crisis.

The increase in corporate debt has taken place during loose financing conditions, just as during the period before the global financial crisis (Figure 1.24, panel 2). Low interest rates probably stimulated greater demand for credit from companies as larger debt became more affordable, leading to changes in capital structures. Easy financing conditions—a combination of low interest rates, buoyant market valuations, and low volatility—have reduced the probability of default as measured by credit models, which is likely to have increased the willingness of lenders to supply credit to companies.[29]

However, this contemporaneous default probability is based on current market conditions, which might not last. If there are adverse shocks, a feedback

[29]Growth in private sector debt in some emerging market economies may also be linked to improvements in credit infrastructure (such as increased use of credit registries and improvements in credit risk evaluation) as well as policies to foster lending to small and medium enterprises and financial inclusion.

loop could develop, which would tighten financial conditions and increase the probability of default, as happened during the global financial crisis. Thus the low contemporaneous default probability could mask risks associated with the buildup of corporate leverage, a phenomenon that has been called the "volatility paradox."[30]

Higher Private Sector Debt Has Raised Servicing Costs and Could Increase Vulnerabilities

While debt has generally increased relative to GDP, it happened in a period of falling and low interest rates. So what happened to debt affordability over this period? This question is important because measures of debt affordability tend to be good vulnerability signals, particularly when debt levels are high.[31] Although lower interest rates have helped lower sovereign borrowing costs, in most of the G20 economies where companies and households increased leverage, nonfinancial private sector debt service ratios—defined as annualized interest payments plus income amortization—also increased (Figure 1.25, panel 1).

Moreover, there are now several economies where debt service ratios for the private nonfinancial sectors are higher than average and where debt levels are also high. Figure 1.25, panel 2, shows that this is particularly the case for the nonfinancial private sector in Australia, Canada, and China, and for the household sector in Korea (debt service ratios for households and nonfinancial companies are available only for G20 advanced economies).

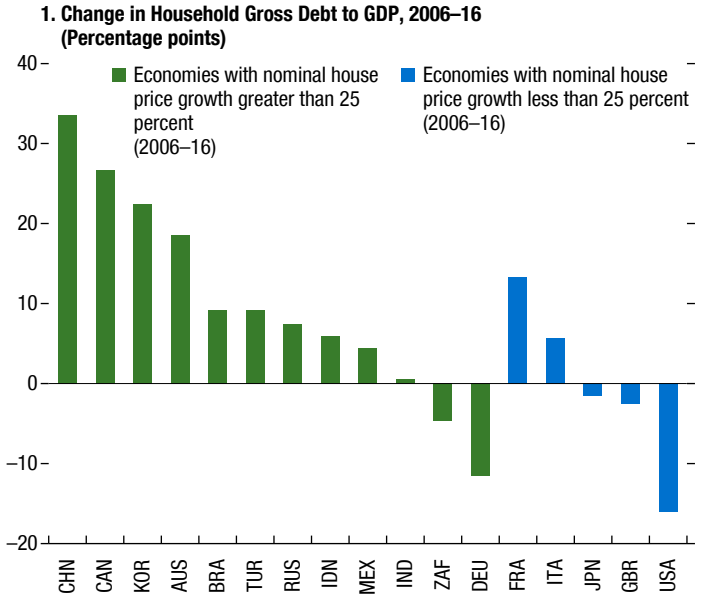
The distribution of debt within an economy's corporate and household sectors is also important in assessing payment pressures. While the aggregate data on debt service ratios used here do not allow an examination of the distribution, other work might shed some light on this question. The April 2017 GFSR found (for companies in the United States) a deterioration in interest coverage ratios for those most indebted, particularly in the energy sector. In emerging market economies, however, commodity companies and industrials made up a significant proportion of firms with weak interest

[30]See Adrian and Shin 2013 and Geanakoplos 2010 for a discussion of the leverage cycle, and Brunnermeier and Sannikov 2014 and Adrian and Brunnermeier 2016 for a discussion of the volatility paradox.

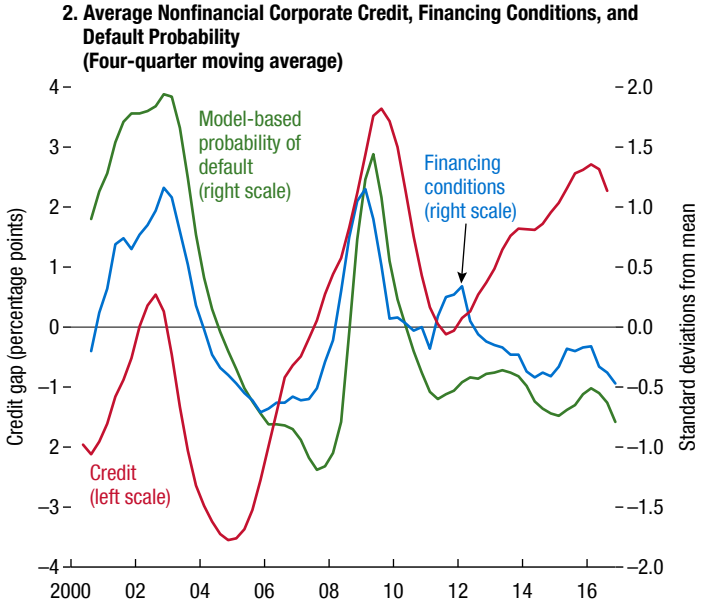
[31]Chapter 2 discusses household debt service capacity as a vulnerability indicator. See also work at the Bank for International Settlements on this issue, including Drehman, Juselius, and Korinek 2017; BIS 2017; and BIS 2012.

Figure 1.24. Group of Twenty Nonfinancial Private Sector Borrowing

Household debt has risen broadly with house prices.



Corporate debt has built up with easy financing conditions.

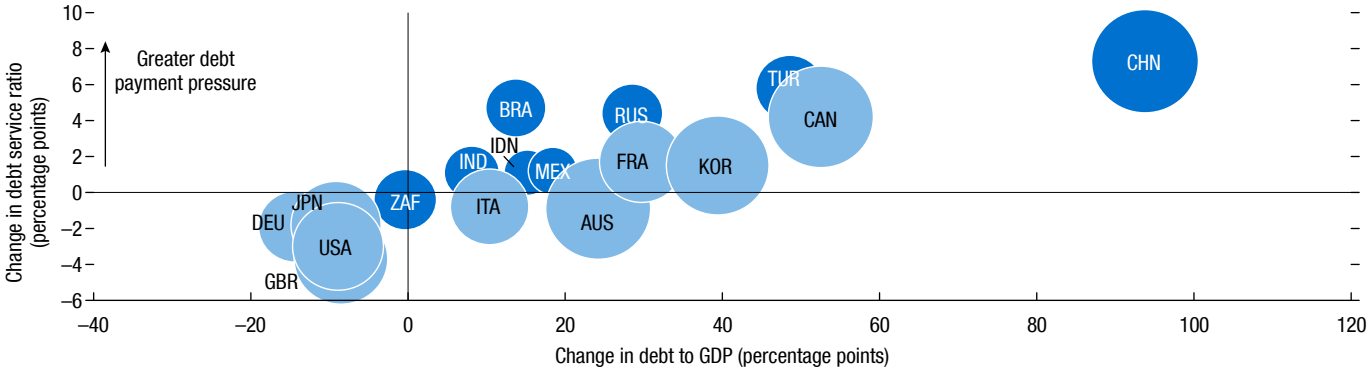


Sources: Bank for International Settlements; Bloomberg Finance L.P.; Haver Analytics; Moody's CreditEdge; Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: In panel 1, house price growth is from 2008 in Brazil; from 2010 in China, India, and Turkey; and is not available for Argentina and Saudi Arabia. Panel 2 shows the average Group of Twenty: corporate debt-to-GDP gap, financing conditions (average of corporate borrowing rates, book-to-market ratios, and implied volatility), and probability of default from the Moody's KMV model (based on a sample of more than 41,000 companies). Data labels in the figure use International Organization for Standardization (ISO) country codes.

Figure 1.25. Group of Twenty Nonfinancial Private Sector Credit and Debt Service Ratios

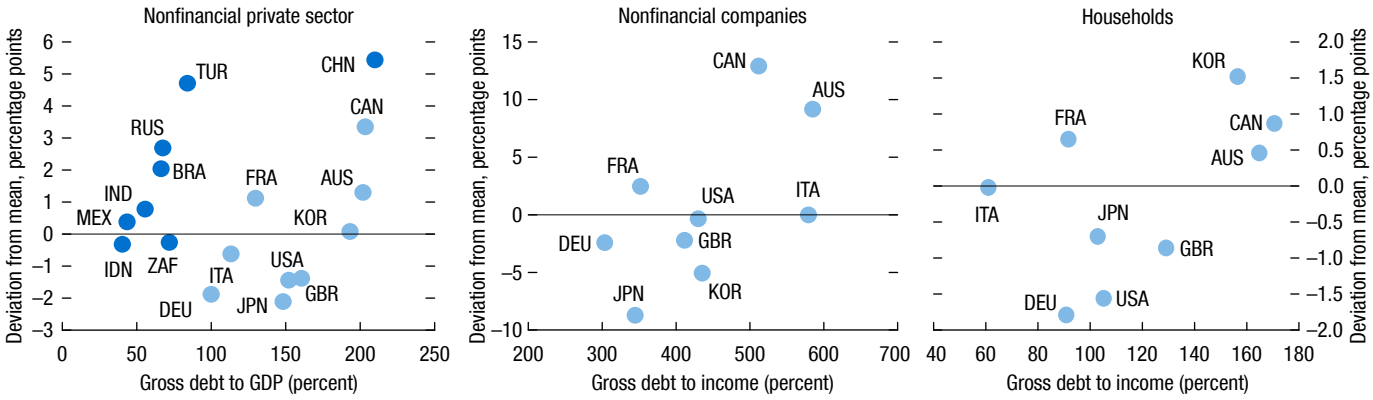
Debt service ratios have increased with higher leverage, despite low interest rates.

1. Change in Private Nonfinancial Sector Debt and Debt Service Ratios, 2006–16



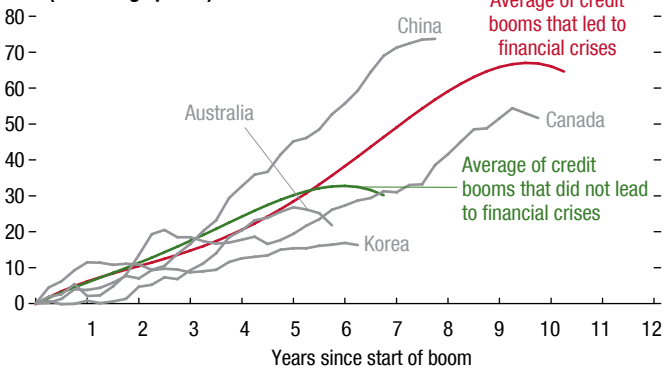
Debt service ratios in some countries are now at high levels ...

2. Debt Service Ratios and Debt, 2016 (Percent)



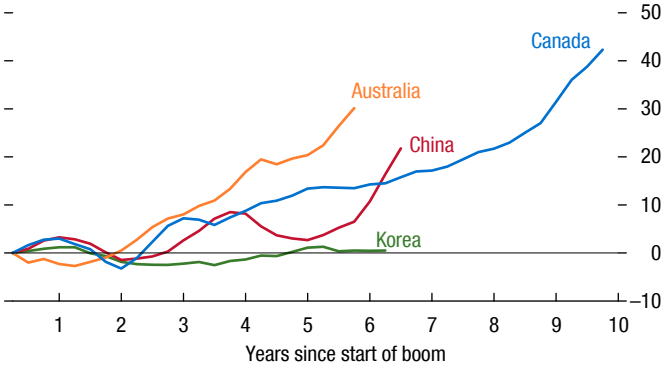
... in economies with credit booms ...

3. Change in Credit-to-GDP Ratio (Percentage points)



... and house price growth.

4. Cumulative Real House Price Growth (Percent)



Sources: Bank for International Settlements; Bloomberg Finance L.P.; national statistical offices; Organisation for Economic Co-operation and Development; and IMF staff calculations.

Note: Debt service ratios are defined as annualized interest payments plus amortizations as a percentage of income, as calculated by the Bank for International Settlements. In panel 1, the size of the circles is proportional to debt to GDP in 2016. In panel 2, income is gross disposable income plus interest payments (plus dividends paid for firms). Panel 3 shows Group of Twenty economies with higher demeaned nonfinancial private sector debt service ratios and debt levels against past booms. Past booms are for a sample of 43 advanced and emerging market economies where the credit-to-GDP gap rose above 10 percent. The start and end dates of the booms are defined as periods when the credit gap was above 6 percent. Financial crisis dates were taken from Laeven and Valencia 2012. Data labels in the figure use International Organization for Standardization (ISO) country codes.

coverage ratios. Similarly, ECB 2017 shows that the distribution of household debt service ratios reveals greater vulnerability among those that had more recently taken out a mortgage to finance a house purchase than was evident from the aggregate figure.

Although not all credit booms lead to recessions, it is interesting to compare the credit booms in economies most likely to face payment pressures with past experience. While the boom in Australia is similar to the average of past credit booms that did not lead to a financial crisis, the boom in Canada has been longer than the average of these benign booms, and the boom in China has been steeper than the average of past credit booms that did coincide with a financial crisis (Figure 1.25, panel 3). In addition, in three of the economies with the highest debt service ratios, there has been a steep increase in real house price valuations (Figure 1.25, panel 4).

Experience has shown that a buildup in leverage associated with a run-up in house price valuations can develop to a point that they create strains in the nonfinancial sector that, in the event of a sharp fall in asset prices, can spill over to the economy. For example, Chapter 2 finds that the relationship between future GDP growth and household debt is driven mostly by mortgage debt. This could be because of the procyclicality of home equity lines of credit, or more generally because of wealth effects that lead households to cut consumption when the value of their housing assets declines.[32]

Overall, there are now several major economies where debt servicing pressure in the private nonfinancial sector is already high. Weaker households and companies in these countries could have trouble repaying their debt if interest rates rise or if incomes fall.

Policies Are Needed to Reduce Vulnerabilities in the Private Nonfinancial Sector

Policymakers should address the risks from continued increases in debt and leverage across sectors by drawing on, and enhancing where needed, an appropriate mix of macroprudential and microprudential policies, preemptive regulatory measures, and close monitoring of balance sheets.

Higher household debt burdens should be reduced where debt servicing pressures are already high and should not grow further where debt servicing is currently manageable but debt levels are elevated. This can be achieved through a combination of measures, including limits on debt-service-to-income and loan-to-value ratios, and measures to restrict loan contracts. Some countries have undertaken measures to address high house price valuations and deter further buildup of household debt. Policy measures, however, must carefully balance minimizing the medium-term risks to financial stability while not harming the potential long-term benefits of financial inclusion and development.

Policymakers should vigilantly monitor nonfinancial corporate leverage. Macroprudential measures extended through banks (such as sectoral capital requirements or risk weights on foreign currency credit) could also be considered to reduce or prevent a further buildup in corporate debt. In addition, tax reforms that reduce incentives for debt financing could help attenuate the risk of a further buildup in leverage and may even encourage firms to lower existing tax-advantaged leverage. More broadly, measures to foster smooth corporate deleveraging should be deployed where needed, including by strengthening corporate restructuring mechanisms.

China: From Derisking to Deleveraging—Challenges Ahead

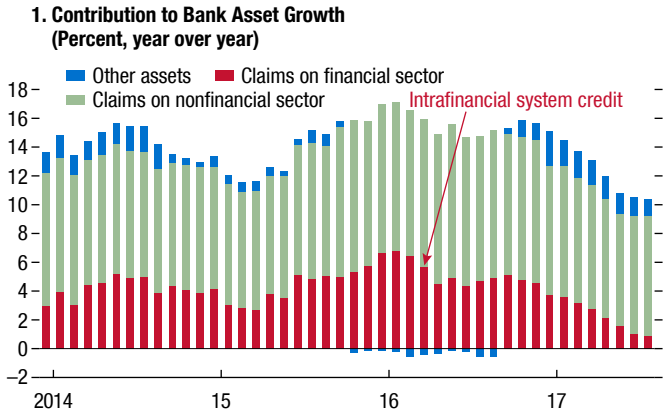
The rapid rise in nonfinancial sector leverage in China in recent years, along with the size, complexity, and pace of growth of its financial system, point to continued financial stability risks. Banking sector assets are now 310 percent of GDP, nearly three times the emerging market average and up from 240 percent at the end of 2012. Rapid increases in intrafinancial-system credit have been an important factor in this growth (see Figure 1.26, panel 1). This reflects both the growing use of short-term wholesale funding to boost leverage and profits (Figure 1.26, panel 2) and shadow credit to firms and other nonfinancial borrowers (Figure 1.26, panels 3 and 4), particularly by small and medium-sized banks.[33] This

[32]See also Mian and Sufi 2011 and Schularick and Taylor 2012.

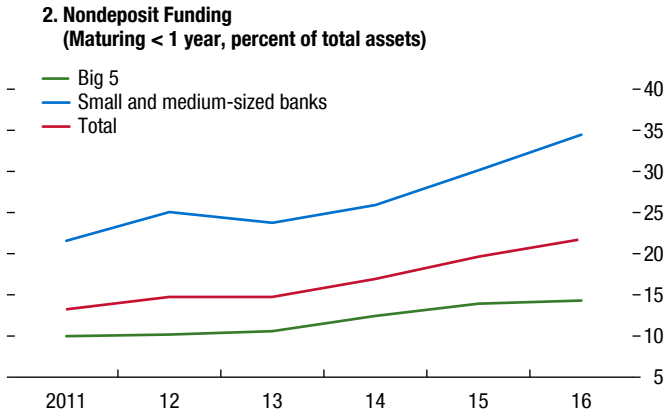
[33]Shadow credit refers to banks' nonloan, nonbond credit to nonfinancial borrowers. This includes assets that are on balance sheet (trust beneficiary rights, specialized asset management plans, and other structured assets) and off balance sheet (bank-sponsored wealth management plans). Estimates of off-balance-sheet bank credit are calculated as 65 percent of outstanding wealth management plans, which deduct the portion of underlying plan assets that are claims on financial or public sector counterparties, as reported in *China Bank Wealth Management Market Annual Report 2016*.

Figure 1.26. Chinese Banking System Developments

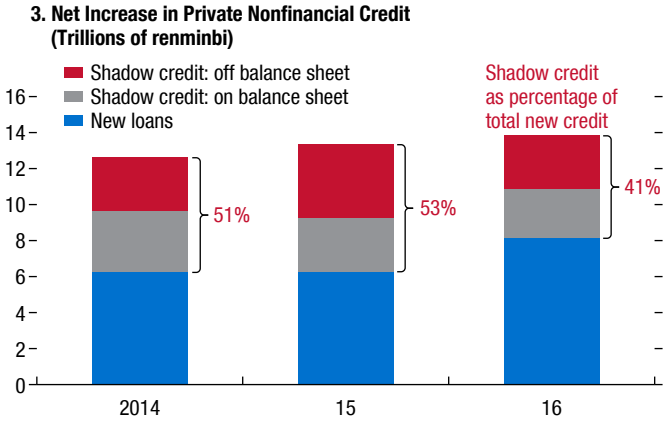
Intrafinancial system credit has driven bank growth ...



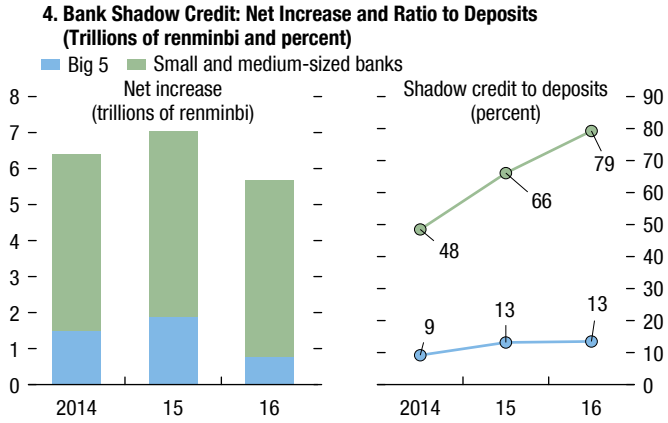
... increasing reliance on risky funding ...



... but also reflecting significant shadow credit ...



... particularly from small and medium-sized banks.



Sources: Haver Analytics; People's Bank of China; SNL Financial; and IMF staff calculations.
Note: Shadow credit refers to banks' nonloan, nonbond credit to nonfinancial private borrowers, both on and off balance sheet. For a complete definition, please see footnote 33. Panels 2, 3, and 4 are based on publicly available financial statement data for 32 of China's largest banking groups.

has increased the opacity of intermediation, increased the use of unstable short-term funding, and raised sensitivity to liquidity stress.

China recently introduced a range of prudential and administrative measures to contain these vulnerabilities. Efforts to derisk the financial system using better-designed regulatory tools (such as the Macroprudential Assessment, or MPA) aim to slow growth in banks' supply of shadow credit, reduce dependence on interbank funding, and contain regulatory arbitrage.[34]

[34]Among examples of such measures are the People's Bank of China's inclusion of wealth management products in its MPA framework, counting negotiable certificates of deposit toward the prudential limit on interbank liabilities, and tightening corporate bond collateral requirements for exchange-traded repurchase agreements.

On-balance-sheet shadow credit products at small and medium-sized banks declined sharply in late 2016 and early 2017. Growth in off-balance-sheet shadow credit, in the form of wealth management products, has also recently reversed by the largest amount in the post-crisis period (Figure 1.27). This coincided with rising interbank and bond market interest rates and stalling corporate bond issuance.

Authorities Face a Delicate Balance between Tightening Financial Sector Policies and Slowing Credit Growth

Curbing shadow credit could have an outsize impact on banks' capacity to increase credit. Bank-level data show that roughly half of lenders'

estimated credit in recent years was extended via such products.[35] As shadow credit typically requires less capital and provisioning than regular loans, reducing its growth would free up only enough capital to support a smaller increase in lending, leading to a net slowdown in the flow of total credit. For instance, if banks expanded shadow credit by 27 percent—the pace in 2016—their projected retained earnings would support total credit growth (loans and shadow credit) of 17 percent year over year, just above the actual growth rate in 2016. If banks instead kept shadow credit constant, increasing only loans, the same amount of retained earnings would support credit growth of 11 percent, in line with nominal GDP growth in the second quarter of 2017 (Figure 1.28, panel 1).

Banks face a trade-off between using retained earnings to address vulnerabilities or support credit growth.[36] If some retained earnings are used to increase the pace of loss recognition, or increase capital and provisions against a modest portion of existing shadow products, credit capacity would decline further (Figure 1.28, panel 2). Balance sheet vulnerabilities from shadow credit would also recede only gradually at smaller banks, remaining elevated relative to the biggest banks (Figure 1.28, panel 3).

Derisking Will Weigh on Some Banks' Profitability and Business Models

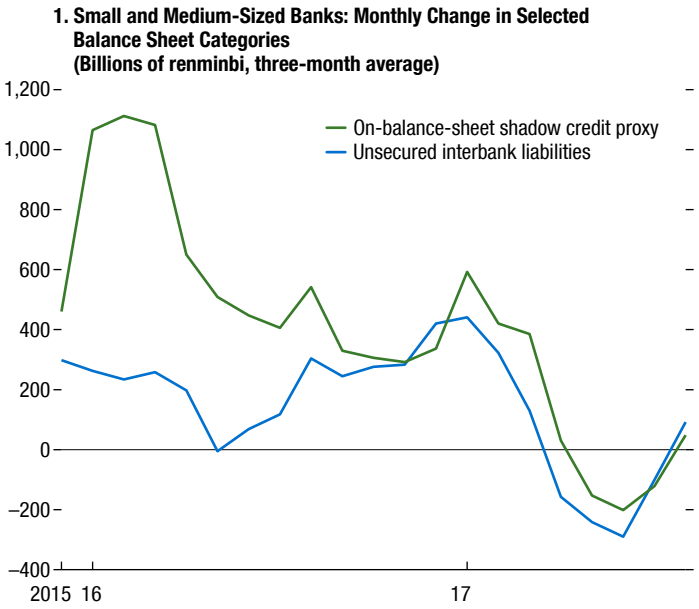
Shifting away from shadow credit products and interbank funding will improve bank balance sheets over time, but in the short term could also decrease bank profitability, weakening buffers at already vulnerable banks and reducing capacity to expand credit. Bank earnings in China have fallen in recent years, driven by an uptick in provision expenses and lower net interest margins (Figure 1.29, panel 1). Small and medium-sized banks have sustained profitability in

[35]Based on publicly reported data for a sample of 32 of China's largest banking groups. This calculation excludes corporate bonds held in banks' securities portfolios. The total credit provision from these banks depicted is equivalent to roughly 90 percent of the total increase in nonfinancial credit in 2015 and 2016 (as measured by Total Social Financing flows).

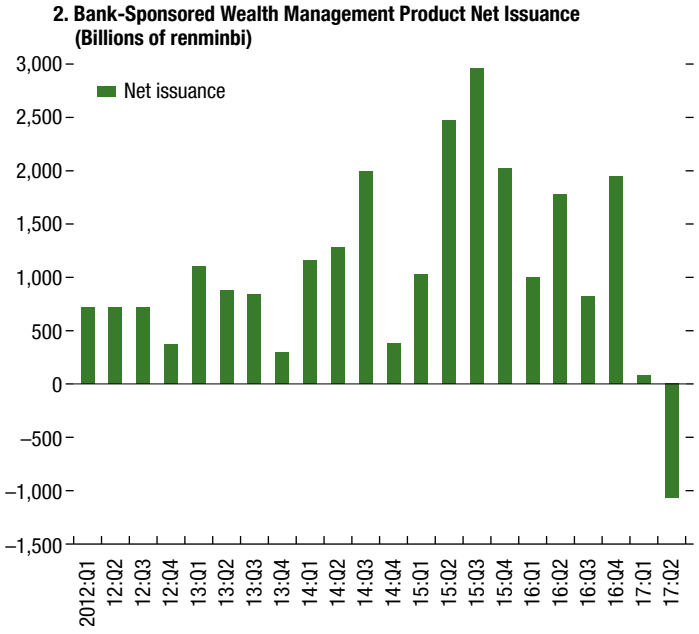
[36]Banks can avoid this trade-off through recapitalization. Chinese banks have announced planned increases of RMB 66 billion in new common equity for 2017, or about 2 percent of end-2016 common equity at small and medium-sized banks. Raising capital in public markets is complicated, however, by rules against raising capital when price-to-book ratios are below 1.

Figure 1.27. China: Regulatory Tightening Has Helped Contain Financial Sector Risks

Interbank lending and shadow credit dipped sharply in 2017 ...



... and so did off-balance-sheet shadow credit.



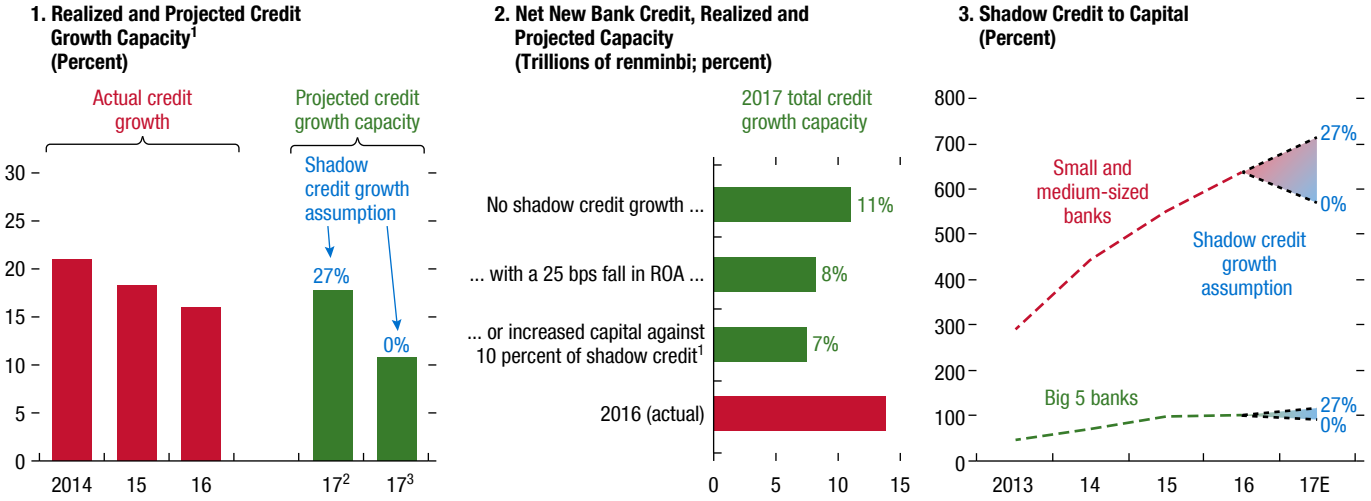
Sources: CEIC Data Co. Ltd.; China Banking Regulatory Commission; Haver Analytics; media reports; People's Bank of China; Wind data; and IMF staff calculations.

Figure 1.28. Chinese Banks: Financial Policy Tightening and Credit Growth Capacity

Curbing shadow credit slows overall credit ...

... especially if other weaknesses are also addressed ...

... and would reduce vulnerabilities only gradually.



Sources: Company annual reports; SNL Financial; and IMF staff calculations.
Note: Shadow credit refers to nonbond, nonloan credit to nonfinancial private borrowers, both on and off balance sheet. For a complete definition, please see footnote 33. bps = basis points; E = estimated; ROA = return on assets.
[1]Credit growth capacity is calculated at the bank level for 32 firms as the maximum net new credit possible given assumptions for growth in shadow credit (on and off balance sheet) and common equity Tier 1 (CET1) capital. Changes in shadow credit affects the CET1 available to support credit growth. New shadow credit is assumed to carry regulatory capital risk weightings of 25 percent, whereas off-balance-sheet shadow credit carries a risk weighting of zero. Assumes firm-level profitability, dividend payout ratio, CET1 ratio, and loan mix from 2016 stay constant.
[2]Projected credit growth capacity assuming shadow credit growth of 27 percent year over year.
[3]Projected credit growth capacity assuming shadow credit growth of 0 percent year over year.

part by shifting their business model toward shadow credit activities, which account for a growing share of revenue (Figure 1.29, panel 2) and balance sheets, with shadow products surpassing loan growth over the past three years by a wide margin.

A return to traditional lending would strain profits at smaller banks via several channels. Net interest income from loans and deposits fell from 1.7 percent of assets in 2011 to just 1.0 percent in 2016, reflecting the changing asset mix but also the higher (and relatively liberalized) interest rates in the shadow credit market (Figure 1.29, panel 2).[37] Profitability could suffer if more credit flows through the formal loan market, which is subject to more conservative provisioning rules and macroprudential controls on sector allocation. Any tightening in shadow credit activities would likely crimp net fees and commissions, which have doubled since 2011 at smaller banks on the back of higher off-balance-sheet income related to shadow products.

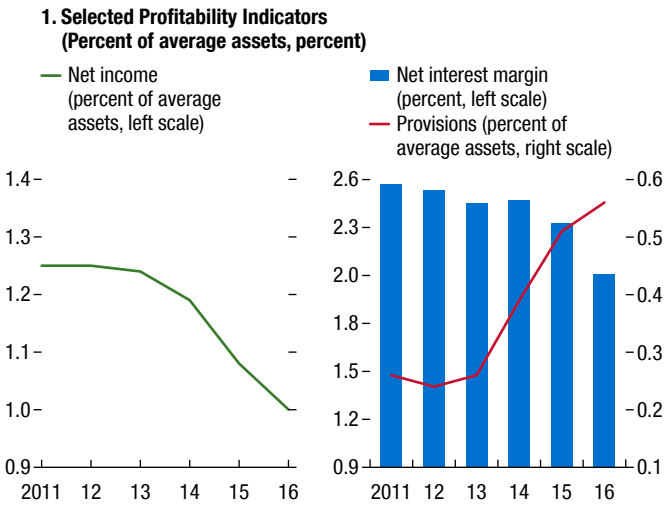
Reducing wholesale funding will also weigh on credit growth, particularly at small and medium lenders. These banks have funded much of their growth via nondeposit-funding sources with shorter maturities. Nondeposit funding maturing in less than one year has risen to about 34 percent of assets, from 22 percent in 2011, with over half maturing in less than three months (Figure 1.29, panel 3). The result has been a sharp increase in short-term borrowing to finance long-maturity assets, with short-term nondeposit funding exceeding similar-maturity nonloan assets by about 6 percent of assets, or RMB 2.8 trillion (see Figure 1.29, panel 4). Any meaningful reduction in short-term market funding would require liquidating longer-term assets.

To be successful, regulatory tightening on lenders must be accompanied by reforms that reduce

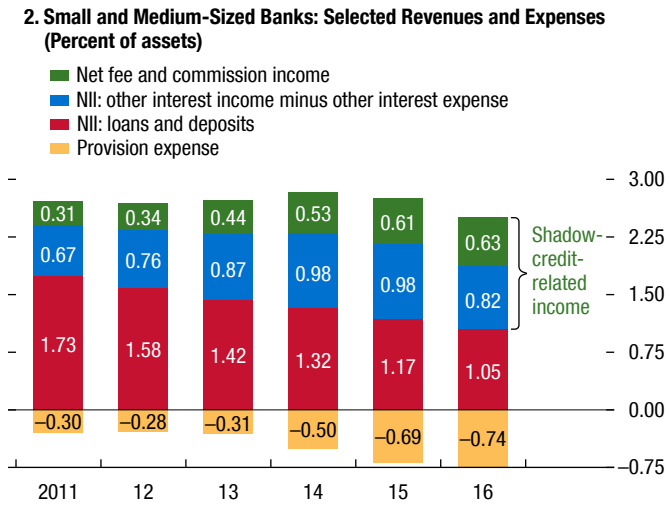
[37]The deterioration in net interest margins is mostly attributable to the traditional lending and deposit-taking business, whereas shadow investment and funding activities have had a neutral or positive contribution on a net basis, particularly at smaller lenders.

Figure 1.29. Bank Profitability and Liquidity Indicators

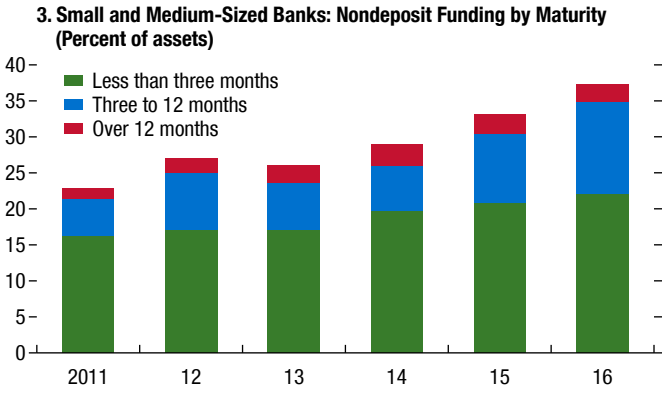
Bank earnings are lower due to narrower margins and rising provisions ...



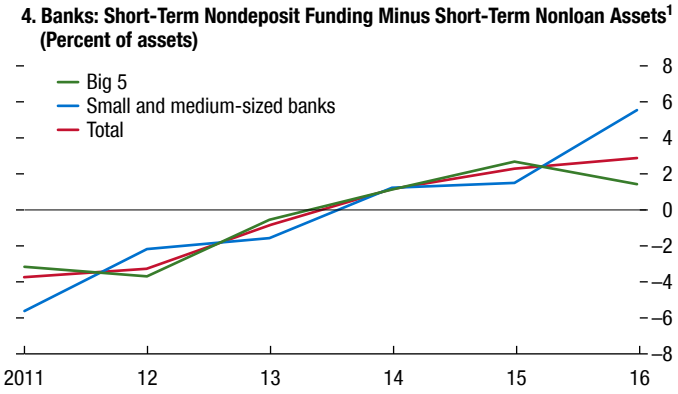
... but would be worse without shadow-related income.



Growing use of risky short-term funding ...



... has led to worsening maturity mismatches.



Sources: SNL Financial; and IMF staff calculations.
Note: Shadow credit refers to banks' nonloan, nonbond credit to nonfinancial private borrowers, both on and off balance sheet. For a complete definition, see footnote 33.
NII = net interest income.
[1]Assets and liabilities available on demand or maturing in three months or less.

the economy's vulnerability to slower credit growth. Authorities' recent efforts to improve banks' risk management and reduce maturity and liquidity transformation risks in shadow credit activities are necessary and must be deepened. Stability risks will nonetheless remain elevated, however, if banks support continued rapid credit growth: they will have fewer buffers to recognize losses, profitability could compress further at weaker lenders, and incentives for regulatory arbitrage will remain strong. Raising new equity would allow banks to raise provisions and capital without slowing credit growth, but must be accompanied by reforms to strengthen bank risk management and governance.

A broader reform package could help mitigate the economic impact of slower credit growth and tighter regulations while addressing vulnerabilities. On the borrower side, authorities must build on their commitment to reduce corporate leverage, resolve nonviable firms, and improve credit efficiency.[38] With lenders, regulation to reduce shadow credit risks and

[38]IMF 2016b, 2016c, and 2017f discuss progress and recommendations on these topics in more detail.

regulatory arbitrage should be further strengthened. Policies should target reducing balance sheet vulnerabilities at weak banks, including through restricting dividend payouts. Restructuring or resolving nonviable financial institutions would also support corporate debt restructuring and strengthen risk management and governance incentives. The forthcoming IMF–World Bank Financial Sector Assessment Program report on China will discuss financial sector stability issues in China in more detail and provide specific recommendations.

Could Rising Medium-Term Vulnerabilities Derail the Global Recovery?

Concerns about a continuing buildup in debt loads and overstretched asset valuations could have global economic repercussions. This section uses a scenario analysis to illustrate how a repricing of risks could lead to a rise in credit spreads and a fall in capital market and housing prices, derailing the economic recovery and undermining financial stability.

This section illustrates how shocks to individual credit and financial markets well within historical norms can propagate and lead to larger global impacts because of knock-on effects, a dearth of policy buffers, and extreme starting points in debt levels and asset valuations. A sudden uncoiling of compressed risk premiums, declines in asset prices, and rises in volatility would lead to a global financial downturn. With monetary policy in several advanced economies at or close to the effective lower bound, the economic consequences would be magnified by the limited scope for monetary stimulus. Indeed, monetary policy normalization would be stalled in its tracks and reversed in some cases.

The Global Macrofinancial Model documented in Vitek 2017 is used to assess the consequences of a continued buildup in debt and an extended rise in risky asset prices, from already elevated levels in some cases. This dynamic stochastic general equilibrium model covers 40 economies and features extensive macro-financial linkages—with both bank- and capital-market-based financial intermediation—as well as diverse spillover channels.

This scenario has two phases. The first phase features a continuation of low volatility and compressed spreads. Equity and housing prices continue to climb in overheated markets. As collateral values rise, bank lending conditions adjust to maintain steady loan-to-value ratios, facilitating favorable bank lending rates and more credit growth. As discussed, leverage in the nonfinancial private sector has already increased over the past decade across major advanced and emerging market economies. In the scenario, a further loosening in lending conditions, combined with low default rates and low volatility, leads investors to drift beyond their traditional risk limits as the search for yield intensifies despite increases in policy rates.

As presented earlier, market and credit risk premiums are close to decade-low levels—leaving markets exposed to a decompression of risk premiums. Thus, the second phase begins with a rapid decompression of credit spreads and declines of up to 15 and 9 percent in equity and house prices, respectively, starting at the beginning of 2020. This shift reflects debt levels breaching critical thresholds, prompting markets to grow concerned about debt sustainability, while risk premiums jump, aggravating deleveraging pressures. As risk premiums rise, debt servicing pressures are revealed as high debt-to-income ratios make borrowers more vulnerable to shocks. The asset repricing is moderate in magnitude, but is broad-based across jurisdictions and leads to a tightening of financial conditions. Flight to quality flows reduce long-term bond yields in safe havens and raise them in the rest of the world. Segments with higher leverage and extended valuations are hit particularly hard, leading to higher funding costs and debt servicing strains.

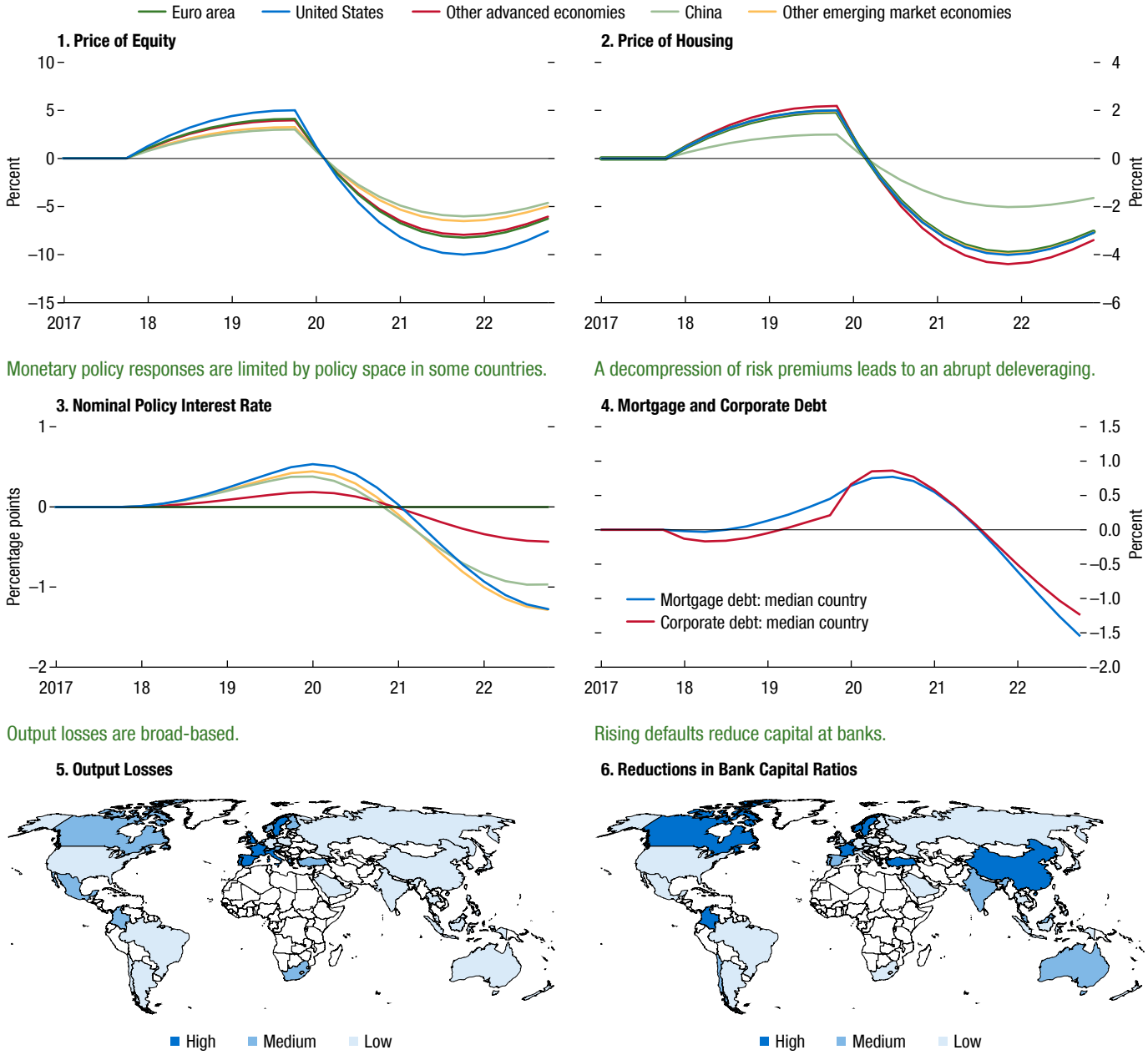
Underlying vulnerabilities are exposed, and the global recovery is interrupted. Figure 1.30 summarizes the main impacts and spillovers:

- The global economic impact of this scenario is broad-based and significant, about one-third as severe as the global financial crisis.[39] The level of global output falls by 1.7 percent by 2022 relative to the WEO baseline, with varying cross-country impacts.
- The severity of the economic impact on the United States is cushioned by stronger bank buffers, milder house price declines, and more monetary policy

[39]The results are broadly consistent with Chapter 2, which finds that increases in household debt from already elevated levels signal high economic risks, and with Chapter 3, which concludes that rising private sector leverage signals higher downside risks to growth over the medium term.

Figure 1.30. Global Financial Dislocation Scenario

Financial stability risks build up for two more years, as equity and house prices continue to rise amid low volatility and narrow spreads, followed by an eventual sharp repricing.



Source: IMF staff estimates.
Note: The variables in all panels are expressed as deviations from baseline. In panel 5, countries are shaded according to the following magnitudes of output losses: (1) smaller than 1.8 percent of GDP ("low impact"), (2) between 1.8 percent and 2.3 percent of GDP ("medium impact"), and (3) greater than 2.3 percent of GDP ("high impact"). In panel 6, the thresholds for reductions in bank capital ratios are (1) smaller than 0.625 percentage points ("low impact"), (2) between 0.625 and 0.675 percentage points ("medium impact"), and (3) greater than 0.675 percentage points ("high impact").

space compared with other advanced economies, despite relatively high equity valuations. The Federal Reserve reverses interest rate hikes during the second phase of the scenario, cutting the policy rate by 150 basis points to 1.75 percent by 2022.
- The euro area suffers a larger output loss because the policy rate is at the effective lower bound and—as a result of renewed financial fragmentation—term premiums rise in high-spread euro area economies. Government debt ratios climb because nominal output is lower and debt service costs are higher for these economies.
- Emerging market economies are disproportionately affected by the correction in global risk assets. The flight to quality prompts outflows from their equity and bond markets, putting pressure on currencies and challenging countries with large external financing needs.
- Corporate and household defaults rise on the back of higher interest costs, lower earnings, and weaker growth. Default rates do not breach global financial crisis levels but return to levels consistent with prior cyclical peaks. Firms in some euro area countries and China with excessive debt overhangs are more sensitive to the increase in credit costs. Household leverage and high house prices in Australia and Canada make these economies more susceptible to risk premium shocks.
- Higher credit and trading losses, in turn, reduce bank capital ratios to varying degrees worldwide. Banking systems in advanced economies are healthier compared with the precrisis period, while leverage is less of a potential amplifier. Chinese banks suffer outsize declines in capital, but strong policy buffers could be used to mitigate the financial and economic impacts.

Emerging Markets Would Suffer a Retrenchment in Foreign Capital Inflows

Drawing on the above scenario, the potential for emerging market stress due to pressures on portfolio inflows is examined in more detail, including by taking into account the likely reduction in these flows from Federal Reserve balance sheet normalization (as discussed earlier).
- During the first phase of the scenario, portfolio flows to emerging market economies are supported by rising investor risk appetite. This partially offsets the drag on portfolio inflows from US monetary policy normalization observed during 2017–19. As a result, there is a (net) reduction in portfolio inflows to emerging market economies of about $25 billion a year, compared with $35 billion under the baseline (Figure 1.31, panel 1).
- During the second phase of the scenario, the asset market correction triggers a more rapid retrenchment in capital inflows to emerging market economies of about $65 billion over the first four quarters, in addition to the projected reduction of $35 billion in inflows associated with continued Federal Reserve balance sheet normalization. The combined effect results in a reduction of portfolio inflows of some $100 billion during the first four quarters of the correction (and about $65 billion during the subsequent four quarters).
- At the country level, the associated portfolio inflow reduction during the first two years of the shock to global risk premiums ranges from 1.6 to 2.3 percent of GDP for the most affected countries (Figure 1.31, panel 2). Such a reduction is likely to lead to an outright reversal of portfolio flows, at least during some quarters, considering that the decompression of risk premiums is likely to be more rapid in some periods than in others (rather than unfolding at a steady pace as depicted in this exercise).

The buildup in external financing pressures could be particularly challenging for countries with large and rising projected current account deficits. For example, Colombia, South Africa, and Turkey have projected current account deficits in the range of 3 to 4½ percent of GDP in 2019 (Figure 1.31, panel 3). Moreover, emerging market currencies would come under pressure, limiting space for monetary policy to ease. In turn, higher domestic interest rates would affect firms' debt servicing capacity, hitting those with still high levels of corporate leverage and increasing risks to weaker banking systems (as explored in the April 2017 GFSR) (Figure 1.31, panel 4).

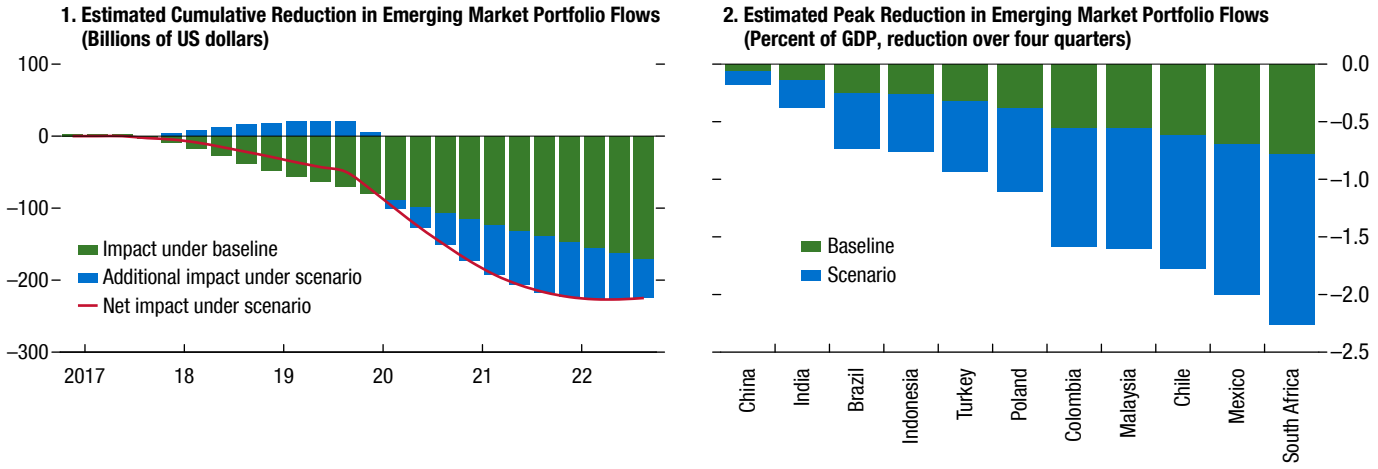
Emerging Market Policies

In emerging market economies, policymakers should take advantage of current favorable external conditions to further enhance their resilience, including by continuing to strengthen external positions where needed and reduce corporate leverage where it is high. Deploying policy buffers and exchange rate flexibility would help buffer external shocks, while

Figure 1.31. Emerging Market Economy External Vulnerabilities and Corporate Leverage

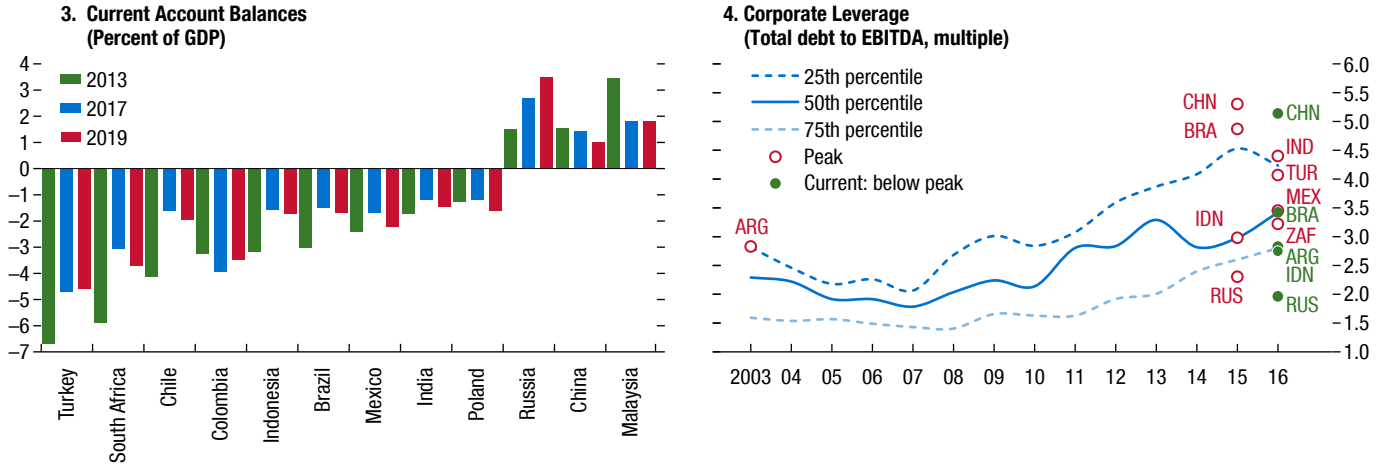
US monetary normalization and a global asset market correction would increase capital outflow pressures.

Countries that previously received large inflows may see sizable outflows.



Outflows could be challenging for countries with large current account deficits ...

... and put pressure on those with high levels of corporate leverage.



Sources: Bank of America Merrill Lynch; Bloomberg Finance L.P.; Capital IQ; Haver Analytics; and IMF staff calculations.
Note: Data labels in the figure use International Organization for Standardization (ISO) country codes. EBITDA = earnings before interest, taxes, depreciation, and amortization.

improving corporate debt-restructuring mechanisms and monitoring firms' foreign exchange exposures would lower corporate vulnerabilities. Advances in these areas would leave these economies better placed to cushion any reduction in capital inflows that may occur from monetary policy normalization in advanced economies.

However, capital outflow pressures could become more significant if there is a severe retrenchment in global risk appetite, as in the scenario described earlier. Such pressures should usually be handled primarily with macroeconomic, structural, and financial policies, although the appropriate response will differ across countries depending on available policy space (see IMF 2012, 2015, 2016a). Where appropriate, exchange rate flexibility should be a key shock absorber, but in countries with sufficient international reserves, foreign exchange intervention can be useful to prevent disorderly market conditions. In periods of stress, liquidity provision may also be needed to support the orderly

functioning of financial markets. Capital flow management measures should be implemented only in crisis situations, or when a crisis is considered imminent, and should not substitute for any needed macroeconomic adjustment. When circumstances warrant the use of such measures on outflows, they should be transparent, temporary, and nondiscriminatory and should be lifted once crisis conditions abate.

Box 1.1. A Widening Divergence between Financial and Economic Cycles

Prolonged monetary accommodation—and a continuing need to sustain economic momentum—has contributed to a widening divergence between financial and economic cycles. Rapid inflation of asset prices has ensued as large output gaps necessitate an unusually protracted period of low interest rates. This asset price growth has been accompanied by gathering strength in credit growth and rising leverage, the combination of which has facilitated strong financial expansion across several economies. Such financial expansions have generally been accompanied by less remarkable economic recoveries, leading to only slowly dissipating negative output gaps. This divergence creates a challenge for monetary and financial policies to support economic recovery while ensuring that medium-term risks do not build.

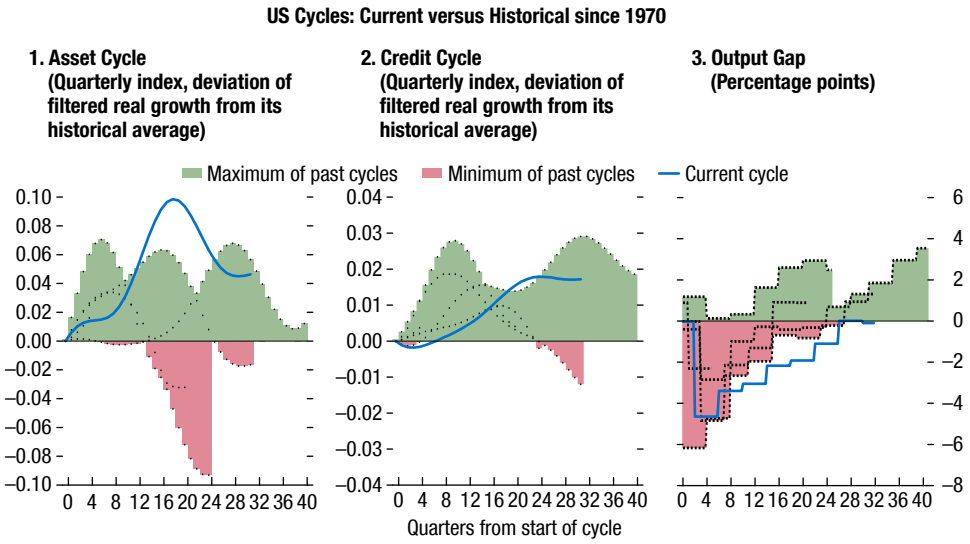
- In the United States, a maturing financial cycle expansion has combined with a slowly closing output gap. The combined growth of asset prices (equity, bond, property) since the recent recession has seen one of the longest and largest cyclical expansions since 1970, albeit from a relatively weak starting point (Figure 1.1.1, panel 1). This growth across asset markets has only moderated a little from its peaks, while credit growth has been gathering momentum. At the same time, an unusually large negative output gap has been slow to close, suggesting a need for complementary macroeconomic and financial sector policies to support the economic recovery while attenuating the financial cycle upswing as needed.
- In the euro area, the divergence between financial and economic cycles is also growing. A strong asset price boom is only slightly off recent peaks, while credit growth is slowly recovering (Figure 1.1.1, panel 2). This contrasts with a persistently large negative output gap—also suggesting a need for continued accommodative macroeconomic policies and tighter financial sector policies, as warranted in particular euro area member countries.
- The financial cycle in Japan, in contrast, has been more muted in tandem with a weak economic recovery, while asset price inflation has been volatile and oscillating around long-term trends in recent years. Recently, however, stronger credit growth has emerged along with a narrowing of the negative output gap.
- In other economies where debt service ratios for the private nonfinancial sectors have risen to high levels—such as Australia, Brazil, Canada, China, and Korea—there is a particularly strong need for financial sector policy vigilance to guard against any further buildup of imbalances.

This box was prepared by Paul Hiebert, Yingyuan Chen, and Yves Schüler (Deutsche Bundesbank).

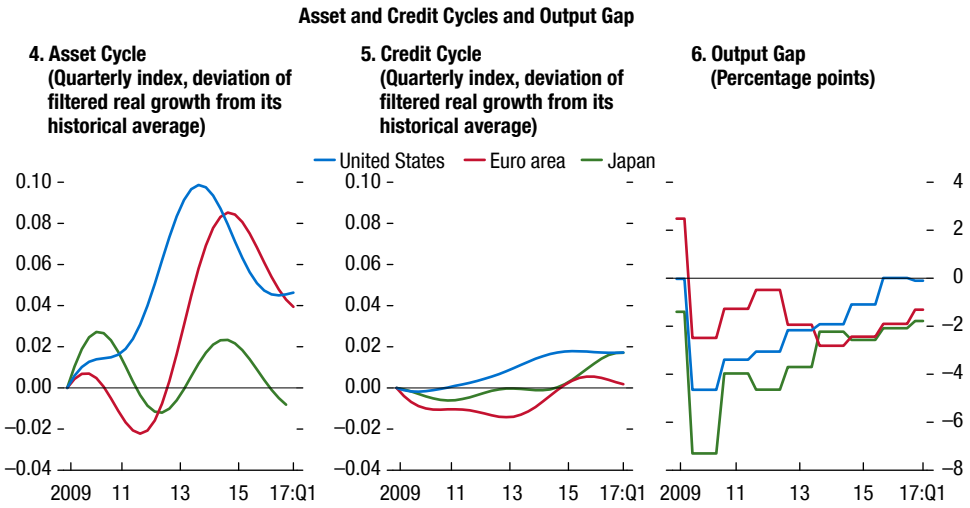
Box 1.1 *(continued)*

Figure 1.1.1. Financial and Economic Cycles

The US financial expansion and output gap are noteworthy by historical standards ...



... as a cumulative gap grows between financial and economic cycles across major advanced economies.



Sources: Bank for International Settlements; IMF, World Economic Outlook database; national sources; and IMF staff estimates.
Note: Cycles are dated using National Bureau of Economic Research recession dates. Cycles capture low-frequency movements around long-term rates. Real asset price cycles combine momentum common to equity, corporate bond, and house price indices—deflated using national consumer price indices. The credit cycle is real total nonfinancial sector credit. For more information on the underlying methodology, see Schüler, Hiebert, and Peltonen 2017.

Box 1.2. Cyberthreats as a Financial Stability Risk

Cyberthreats to financial institutions are growing, and events in 2016 and 2017 have altered the threat landscape substantially. There has been a sizable increase in the impact and sophistication of financially motivated cyberattacks on financial institutions.[1] Cyberthreats can be related to financial gain—including malware attacks—or can aim to destroy information technology systems. Some estimates place the economic losses of a hypothetical major global cyberattack as high as $53 billion (Lloyds 2017). While the magnitude and frequency of attacks have grown, their nature has evolved as perpetrators have adopted operational models that replicate legitimate businesses, such as the use of vertically integrated software packages and cloud-based operations. This evolution renders the technology both more potent and easier to access. Moreover, because cyberthreats are international and can become systemic, private sector institutions are not well positioned to respond effectively on their own. A coordinated regulatory approach is needed, which would result in a consistent risk mitigation framework to support financial stability.

The systemic risk ramifications of a cyberattack could be substantial. There are several channels through which cybersecurity events could threaten financial stability: (1) data breach, (2) disruption of business, (3) integrity attack (modifications to internal data), and (4) malicious activities (financial gain). Greater reliance on technology, combined with the interconnection of the global financial system, means that many, if not all, participants in the system are at risk. Banks and financial market infrastructures, in particular, harbor the potential for contagious cyberrisk, given their interconnection—so that attacks on individual financial institutions can quickly fan out across national financial systems and beyond. A recent example concerns the June 2017 "NotPetya" attack, disguised as ransomware, which among others severely hit bank operations in Ukraine. Information technology systems in the country, including automatic teller machines, were rendered unusable. Problems spilled across borders[2] at a total global cost of some $850 million. Other interconnected financial institutions, such as financial infrastructures (for example, payment, clearing, and settlement systems), are also at risk. Insurance companies are less exposed through connectedness; however, their indirect exposure through their cyberinsurance risk underwriting can be significant and is not fully understood.[3]

A global and coordinated policy response is needed to ensure *resilience* to cyberattacks and combat cybercrime. Regulators have begun introducing cybersecurity regulations. Among recent initiatives, the European Parliament—following up on the EU-wide Cybersecurity Strategy—adopted the directive on security of network and information systems; the European Banking Authority issued guidelines on information and communications technology risk assessment; the Bank of England launched a vulnerability testing framework and set out a supervisory statement on cyberinsurance underwriting risk; the Board of Governors of the Federal Reserve System, the Office of the Comptroller of the Currency, and the Federal Deposit Insurance Corporation jointly published a notice of proposed rulemaking regarding enhanced cyberrisk management standards; the Committee on Payments and Market Infrastructures and the Board of the International Organization of Securities Commissions issued cyberguidance for financial market infrastructures; and the New York State Department of Financial Services issued Cybersecurity Requirements for Financial Services Companies. The EU-wide General Data Protection Regulation, effective May 2018, although not specific to the financial sector, will nevertheless have a significant global impact on the system, given its extraterritorial applicability and potentially drastic fines for data breaches.[4] While regulations converge on common themes, their sectoral applicability and level of detail vary, which presents compliance difficulties for international operations. Tackling cybercrime effectively means attacking its business model. The risks of being engaged in cybercrime must be raised significantly, underpinned by stronger international coordination.

Beyond ensuring resilience, regulation has increasingly focused on *prevention*. Frameworks are being designed for the identification and prevention of cyberincidents, as well as for timely recovery and information sharing. Ongoing initiatives by financial

This box was prepared by Tamas Gaidosch and Chris Wilson.

[1]For example, the number of stolen identities rose 95 percent year over year in 2016, according to Symantec.

[2]For example, two multinational companies estimated losses from NotPetya exceeding $130 million each.

[3]As evidenced by the recent supervisory statement of the Bank of England on cyberinsurance underwriting risk.

[4]Fines can be up to 4 percent of yearly turnover or €20 million, whichever is greater.

Box 1.2 *(continued)*

regulators typically include practical countermeasures such as requirements on penetration and resilience tests (for example, testing how far into an organization's system hackers can go and how well the system defends itself and recovers). As these regulations take hold, harmonization of minimum standards is needed to help smooth implementation, especially for institutions operating across borders and sectors. More international coordination would be helpful to share good practice, identify emerging risks, and raise standards across the entire global system—including, as needed, broader cross-border cooperation and information sharing with intelligence and other agencies outside the financial sector, among others.

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CHAPTER 2

HOUSEHOLD DEBT AND FINANCIAL STABILITY

Summary

Although finance is generally believed to contribute to long-term economic growth, recent studies have shown that the growth benefits start declining when aggregate leverage is high. At business cycle frequencies, new empirical studies—as well as the recent experience from the global financial crisis—have shown that increases in private sector credit, including household debt, may raise the likelihood of a financial crisis and could lead to lower growth.

Globally, household debt has continued to grow in the past decade. This chapter takes a comprehensive look at the relationship between household debt, growth, and financial stability across a sample of 80 advanced and emerging market economies. Besides aggregate macro-level analysis, the chapter also delves into micro-level data on individual household borrowing to shed additional light on how household indebtedness affects growth and stability at the aggregate level.

The chapter finds that there is a trade-off between the short-term benefits of rising household debt to growth and its medium-term costs to macroeconomic and financial stability. In the short term, an increase in the household debt-to-GDP ratio is typically associated with higher economic growth and lower unemployment, but the effects are reversed in three to five years. Moreover, higher growth in household debt is associated with a greater probability of banking crises. These adverse effects are stronger when household debt is higher and are therefore more pronounced for advanced than for emerging market economies, where household debt and credit market participation are lower.

However, country characteristics and institutions can mitigate the risks associated with rising household debt. Even in countries where household debt is high, the growth-stability trade-off can be significantly mitigated through a combination of sound institutions, regulations, and policies. For example, better financial regulation and supervision, less dependence on external financing, flexible exchange rates, and lower income inequality would attenuate the impact of rising household debt on risks to growth.

Overall, policymakers should carefully balance the benefits and risks of household debt over various time horizons while harnessing the benefits of financial inclusion and development.

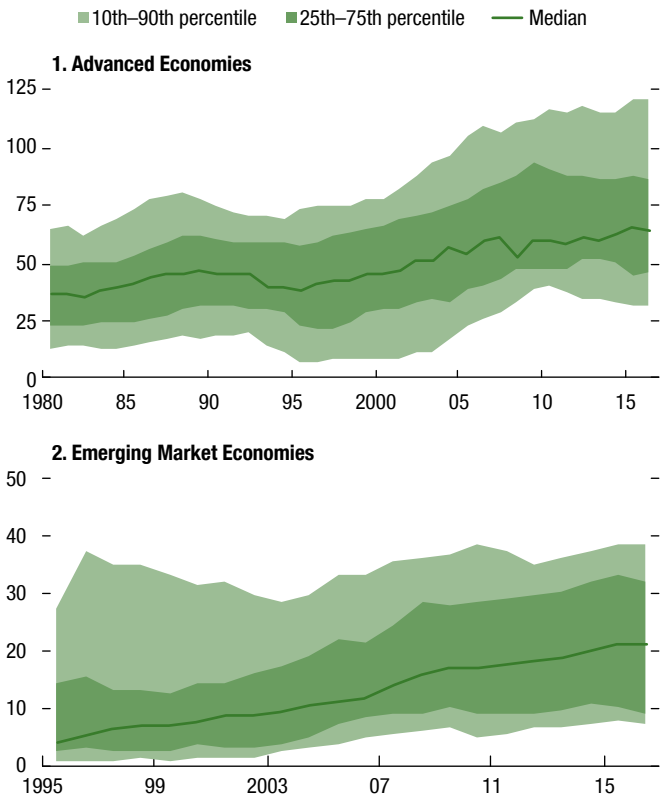
Introduction

Considerable attention has been paid to household debt since the global financial crisis as it has continued to grow in a wide range of countries (Figure 2.1). The median household debt-to-GDP ratio among emerging market economies increased from 15 percent in 2008 to 21 percent in 2016, and among advanced economies it increased from 52 percent to 63 percent over the same period. At the same time, in the highest quartile, the household debt-to-GDP ratio fell only slightly from 88 percent to 86 percent in advanced economies and continued to rise from 28 percent to 32 percent in emerging market economies. While this increase reflects to some extent the intended effects of expansionary monetary policy, central banks in various advanced and emerging market economies have recently warned against the financial stability risks of high household debt and high debt-to-income ratios when inflation and wage growth are low (see, for example, Reserve Bank of Australia 2017, Bank of Canada 2017, Bank of England 2017, South African Reserve Bank 2017, and Banco Central de Chile 2017).

Household debt and access to credit can help boost demand and build personal wealth, but high indebtedness can also be a source of financial vulnerability. According to the permanent income hypothesis, higher debt indicates higher expected income. It also allows households to make large investments in housing and education and helps smooth consumption over time. In other words, debt allows households to acquire goods and services now and repay gradually, through higher (anticipated) income. In the long term, higher private sector credit supports economic growth (Beck, Levine, and Loayza 2000) although the precise link between growth and household debt is more elusive (Beck and others 2012). Nonetheless, even if positive in the long term, high household indebtedness can cause significant debt overhang problems when a country unexpectedly faces extreme negative shocks. The experience of the global financial crisis suggests that high household debt can be a source of financial vulnerability and lead to prolonged recessions (Mian and Sufi 2011). Broader cross-country studies also indicate that increases in household debt may predict lower future income growth and financial crises in the medium term (Mian, Sufi, and Verner, forthcoming; Jordà, Schularick, and Taylor 2016). As household borrowing increases the economy grows quickly in the short term but becomes highly leveraged. In this situation, a macroeconomic shock may increase unemployment and reduce output in the medium term because of financial disruptions or nominal rigidities (for example, downward wage rigidity, a zero lower bound on interest rates, or fixed exchange rates) that may prevent full adjustment to the shock.

The macroeconomic and financial risks arising from increasing household debt may not be equally important across countries at different stages of development and with different financial and institutional characteristics. Emerging market economies may be less prepared to deal with the consequences of a household deleveraging process because of limited institutional capacity. For exam-

Figure 2.1. Household Debt-to-GDP Ratio in Advanced and Emerging Market Economies
(Percent)



Source: IMF staff calculations.
Note: Panels show the cross-country dispersion of household debt-to-GDP ratios. See Annex 2.1 for sample coverage.

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ple, lack of effective personal bankruptcy regimes may prevent households and lenders from efficiently dealing with debt overhang. On the other hand, household debt is lower in emerging market economies than in advanced economies reflecting a higher prevalence of financial frictions that reduce households' access to debt. The balance between more financially and institutionally developed economies' ability to deal with the consequences of higher household debt and the higher debt resulting from those very characteristics will likely determine the effect of household debt on economic growth and financial stability immediately and over the medium term.

This chapter takes a comprehensive look at the relationship between household debt, macroeconomic performance, and financial stability across a broad sample of countries. It largely abstracts from the long-term considerations related to financial inclusion and financial access and focuses instead on the short- to medium-term consequences of household debt increases. It does so using a larger sample of advanced and emerging market economies than hitherto investigated to shed new light on the conditions under which household debt increases are more likely to predict subpar macroeconomic performance, large economic downturns, and financial crises.[1] Furthermore, it also explores micro-level data based on national surveys for selected countries to document a series of stylized facts and the underlying mechanisms behind the aggregate results. Specifically, the chapter aims to answer the following questions:

- How strongly is household debt aligned with future GDP growth and consumption? Does the pattern differ between advanced and emerging market economies? Does the relationship depend on the institutional context, such as the terms of household debt contracts and various institutional factors?
- At the individual household level, what role do income differences play in household borrowing and consumption decisions? Is the household debt-to-income ratio very different across income groups and countries?
- How strongly is an increase in household debt associated with the probability of financial crises? Does household debt represent a neglected crash risk?
- What are the implications for macroprudential and other policies?

[1]See Chapter 3 of the April 2012 *World Economic Outlook* for an earlier analysis of household debt, Chapter 3 of the April 2011 *Global Financial Stability Report* for an analysis of housing finance and financial stability, and the October 2016 *Fiscal Monitor* for an analysis of private versus public sector debt.

The main findings are as follows:

- *On average, an increase in household debt boosts growth in the short term but may give rise to macroeconomic and financial stability risks in the medium term.* Real GDP initially reacts positively to increases in household debt, as do consumption, employment, and house and bank equity prices. However, after one or two years, the dynamic relationship between debt, GDP, consumption, employment, housing, and bank equity prices turns negative. Higher household debt is associated with a greater probability of a banking crisis, especially when debt is already high, and with greater risk of declines in bank equity prices.
- *But the negative medium-term consequences of increases in household debt are more pronounced for advanced than for emerging market economies.* In the latter, the short-term positive relationships between household debt and GDP growth, consumption, and employment are stronger and the negative medium-term association with these variables is weaker. These relationships are explained by the lower average household debt and credit market participation in emerging markets, which may mean narrower and less costly deleveraging from a macro perspective. Or it may imply less room for overborrowing at the aggregate level in countries where other financial frictions constrain access to debt for a larger share of the population.
- *Country characteristics and the institutional setting play an important role*. These negative medium-term effects are reinforced when household debt is high in countries with more open capital accounts and fixed exchange rates, whose financial systems are less developed, and where transparency and consumer financial protection regulation is absent, quality of supervision is lower, and income inequality is larger. While these characteristics are more prevalent in emerging market economies, the lower initial levels of household debt in this group compensate for their amplifying effect for the average emerging market economy in the sample. Nonetheless, these results show that the overall consequences of household debt increases may vary importantly across countries and can be beneficial, even at high levels of debt, when the right mix of policies and institutions is in place.
- *Lower-income groups tend to be more vulnerable.* Household surveys confirm that, within countries, the share of lower-income households in total debt has grown. These households typically have higher

debt-to-income, higher debt-service-to-income, and higher debt-to-assets ratios, which makes them more vulnerable to adverse shocks than higher-income households.
- *Macroprudential tools are useful.* Macroprudential tools that target credit demand, such as restrictions on loan-to-value and debt-to-income ratios, seem to help constrain the growth in household credit.

The remainder of the chapter is organized as follows: The chapter first lays out a conceptual framework for household debt and macro-financial stability. It then describes some general developments in household debt, both from a macro and a micro (disaggregated) perspective. Next, it turns to empirical analysis of financial stability risks posed by household debt and the comovement between household debt, income, and consumption for both advanced and emerging market economies. The findings of the chapter lead to questions about the regulatory framework that influences household debt decisions and risk taking, which are addressed subsequently. The last section concludes and presents relevant policy implications.

How Does Household Debt Affect Macroeconomic and Financial Stability?

This section discusses some of the key models and mechanisms through which changes in household debt affect the macroeconomy and financial stability. First, it reviews some long-term relationships between household debt and growth. Next, it discusses the permanent income theory and some alternative models that yield different effects.

Higher financial inclusion and financial development can have positive effects on long-term growth, but the relationship between household debt and long-term growth is more elusive. Extensive literature has documented that financial development and the corresponding increase in private credit by both firms and households lead to higher growth (Levine 1998; Beck and Levine 2004, among others). However, the link between household debt and long-term growth has been more elusive, with earlier papers arguing that the growth consequences of household debt depend on the use of borrowed resources, and more recent evidence finding a weak relationship between household debt and GDP growth.[2] More recently, Arcand, Berkes, and Panizza (2015) and Sahay and others (2015b) find that when private sector debt reaches a certain level, the positive effects on per capita growth start to decline, which they relate to the diversion of resources from productive sectors and to rising financial stability risks when the economy becomes highly leveraged (see Box 2.1 for further discussion and a direct analysis of the long-term relationship between household debt and growth).

At the business cycle frequency, the permanent income theory argues that household debt has beneficial effects on the macroeconomy and on financial stability. Households that anticipate an increase in future income will increase their debt to smooth their consumption or make large investments in nonfinancial assets or education (Friedman 1957; Hall 1978).[3] A smoother intertemporal consumption pattern improves household welfare and contributes to macroeconomic stability, while credit and asset markets accommodate the financing needs of households (Uribe and Schmitt-Grohé 2017). As such, household debt also enhances financial stability.

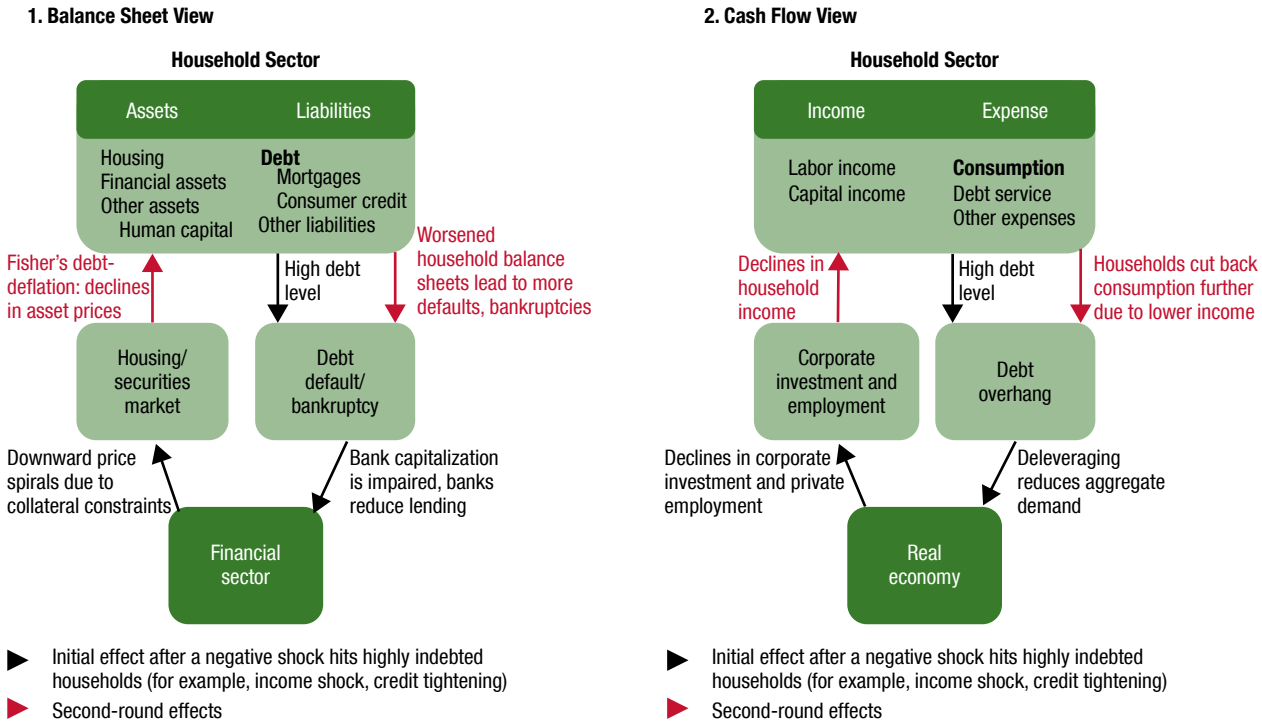
But newer theories and empirical evidence show that the relationship between household debt and macro-financial stability can also be negative. More recent consumption and debt theories relax some of the assumptions of the permanent income model and consider the consequences of borrowing constraints, negative externalities, and behavioral biases.[4] These

[2]For the earlier papers on the conditional relationship between some proxies of household debt and growth, see Jappelli and Pagano 1994 and De Gregorio 1996. For recent analyses that directly consider measures of household debt finding statistically insignificant relationships to long-term growth, see Beck and others 2012; Angeles 2015; and Sahay and others 2015a.

[3]In this context, demographics and the distribution of income and debt matter. Younger households that anticipate future income growth would borrow more against their future income (Blundell, Browning, and Meghir 1994). Rajan (2010) and Kumhof, Rancière, and Winant (2015) have argued that increased income and wealth inequality led to the rapid growth of household debt in the United States and eventually to the financial crisis in 2008. Coibion and others (2017) find that, over the period 2001–12, income inequality may have indirectly operated as a screening device for banks, given that they lend less to low-income households in high-inequality regions in the United States.

[4]Market incompleteness may also play a role in households' borrowing and saving decisions. Sheedy (2014) argues that financial contracts are typically not contingent on all possible future events. Because households do not have access to insurance against future risks that could affect their ability to repay debt, the bundling together of borrowing and a transfer of risk are inefficient. In the same vein, Deaton (1991), Carroll (1992), and Aiyagari (1994) argue that households may maintain a "buffer stock" of precautionary savings to smooth out future consumption. This suggests that debt may have a more limited role for macro-financial stability.

Figure 2.2. First- and Second-Round Effects of the Buildup of Household Debt on Financial Stability



Source: IMF staff.
Note: This figure depicts the interactions between household debt, the financial sector, and the real economy. The balance sheet view (panel 1) shows assets and liabilities (debt) at the household level, whereas the cash flow view (panel 2) shows household income and expenses in the form of consumption and debt service. The two main channels through which household debt and consumption interact are deleveraging and debt overhang. Debt overhang may adversely affect aggregate demand through deleveraging or a crowding out of consumption by the debt service burden. Deleveraging can occur through forced or accelerated repayment of debt, reduction in new credit, and increased defaults or personal bankruptcies. From a legal standpoint, default follows from a situation in which assets and income are insufficient to cover debt-servicing costs, and bankruptcy from lack of sufficient assets and income to repay the debt. There may be second-round effects, such as Fisher-type debt-deflation dynamics, that may be caused by downward asset price spirals.

market imperfections may result in household debt becoming a source of vulnerability, with consequent risks for macro-financial stability. Some of the effects are illustrated in Figure 2.2. More specifically:

- *Borrowing constraints, leverage, and aggregate demand:* If aggregate demand determines the level of output, a contraction in demand by highly indebted households will not always be compensated for by an increase in demand by those that are less indebted, which may lead to a recession (Eggertsson and Krugman 2012; Korinek and Simsek 2016). In this type of model, adverse shocks to highly indebted households, such as a reduction in the value of collateral, trigger borrowing constraints that lead to a deleveraging process that may further reduce the value of collateral. The presence of nominal rigidities, such as a zero lower bound for nominal interest rates or nominal wages that cannot adjust downward, amplifies the consequences of these shocks.[5] For instance, adverse shocks to house prices (or stock prices) reduce homeowners' equity in their housing assets (or households' net wealth, respectively). If sufficiently large, this reduction could trigger large debt defaults and impose further downward pressure on house prices (or stock prices, respectively), leading to a debt deflation spiral (Fisher 1933), as illustrated in Figure 2.2.[6] This sequence

[5]A broad set of macroeconomic models with financial frictions predict that high leverage reduces borrowing capacity and amplifies the impact of negative macroeconomic shocks (Kiyotaki and Moore 1997; Bernanke, Gertler, and Gilchrist 1999; Brunnermeier and Sannikov 2014, among others). Although these models focus on firms instead of household debt, the mechanism applies more broadly and is incorporated into newer studies described in this section.

[6]Note, however, that household debt defaults can also facilitate adjustment to lower debt levels, because it increases the resources

generates negative spillovers. It can cause stress to bank capital and balance sheets and thereby harm the rest of the economy and compromise financial stability. Since, when taking on debt, households do not internalize the potential impact of their decisions on aggregate demand and other households, they borrow too much from a social perspective. Hence, better outcomes could be achieved by ex ante policies that reduce the debt level, or constrain its increases (Korinek and Simsek 2016).

- *Behavioral biases:* Short-sighted households may strongly prefer current consumption over future consumption, or neglect crash risk. Households that value too much current consumption (hyperbolic discounting) tend to postpone saving decisions indefinitely and to contract an excessive amount of revolving debt (Laibson 1997). Overoptimism may also lead households to borrow too much, resulting, for instance, in higher credit card debt (Meier and Sprenger 2010). Consistent with the idea of overoptimism, not only among households but also among market participants, recent evidence shows that credit expansions forecast equity crashes (Baron and Xiong 2017). Households that base their expectations solely on extrapolations from past events, when house prices have been growing, may increase their borrowing during housing booms because they expect their home equity to continue growing (Fuster, Laibson, and Mendel 2010; Shiller 2005).[7] Alternatively, households may neglect certain low-probability risks, such as potentially large defaults on mortgages affecting AAA-rated securities exposed to these defaults (Gennaioli, Shleifer, and Vishny 2012). Or they may vary in their optimism about returns on risky assets (Geanakoplos 2010), with optimistic agents borrowing from pessimistic ones to purchase assets that serve as collateral. This process may amplify asset prices and leverage cycles and impair financial stability. Finally, tax treatment (interest deductibility) may also play a role in explaining a bias toward debt financing for households, much as it does for firms (IMF 2016b).

To summarize, the exact nature of the relationship between household debt and future growth and financial stability may depend on several factors. The relationship may be positive if agents behave in a rational, forward-looking manner and contract debt solely with an eye on future income growth and returns to capital in the absence of financial frictions and binding borrowing constraints. However, the relationship between household debt and macro-financial stability may turn negative for the reasons described above. The negative relationship may be more likely when households borrow primarily for nonproductive purposes or experience inadequate returns on their investment. High debt may bring about sharp adjustments in their consumption pattern—through deleveraging—and affect other parts of the economy. Depending on how well a country can absorb macro-financial stress or on the policies and institutions in place—such as the monetary stance, fiscal space, quality of regulation and supervision, capital account openness, and the degree of foreign-currency-denominated loans—some episodes of debt overhang and deleveraging may be absorbed more easily than others, in response to exogenous shocks affecting households.

Developments in Household Debt around the World

This section shows that household debt levels are higher in advanced economies than in emerging market economies and mainly comprise mortgage debt, while household debt has grown substantially in emerging market economies. Micro-level evidence indicates that lower-income households are less likely to borrow, but those that do tend to have riskier borrowing profiles.

Household debt to GDP is higher in advanced economies than in emerging market economies, but there is considerable heterogeneity within each group. On average, in 2016, the household debt-to-GDP ratio reached 63 percent in advanced economies and 21 percent in emerging market economies, reflecting differences in financial depth and inclusion across these groups of countries.[8] But even in advanced economies, it ranges from about 30 percent of GDP in Latvia to more than 100 percent of GDP in Australia, Cyprus, Denmark, Switzerland, and the Netherlands (Figure 2.3, panel 1). In some emerging market economies, house-

households have at their disposal to cover non-debt-related expenses and maintain their consumption levels (Elul 2008). Such a financial decelerator mechanism may explain why debt overhang is more costly (as measured by consumption loss) in countries where the cost of debt default is very high.

[7]Cheng, Raina, and Xiong (2014) find that even real estate professionals (midlevel managers in securitized finance) had overly optimistic beliefs about house prices.

[8]In this chapter, household debt comprises loans by households from banks and other financial institutions. In some countries, this also includes nonprofit institutions serving households.

hold debt remained very low, at less than 10 percent of GDP in 2016, in Argentina, Bangladesh, Egypt, Ghana, Pakistan, the Philippines, and Ukraine, while in others, such as Malaysia, South Africa, and Thailand, it exceeded 50 percent of GDP. More broadly, the cross-country distribution of the household debt-to-GDP ratio is positively correlated with differences in financial development (Figure 2.3, panel 2).

Mortgage debt makes up the bulk of household debt in advanced economies, but less so in emerging market economies. It accounts for more than 50 percent of total household debt in most advanced economies, whereas among emerging market economies it captures one-third or less of total household debt (Figure 2.3, panel 3). Indeed, differences in mortgage debt explain a large fraction of the difference in household debt between emerging market and advanced economies. Although the characteristics of mortgages vary widely across countries and jurisdictions, a survey of IMF country desks finds that most mortgages are recourse loans: after a default the lender can try to seize additional household assets to cover the debt if the market value of the house is insufficient (see Annex Figure 2.1.1). Other debt consists primarily of consumer credit, which is typically used to smooth out short-term fluctuations in consumption and income but can also be used to finance microenterprises.[9]

Household debt has grown substantially in many countries over the past decade and has kept growing in recent years, especially among emerging market economies. Household debt-to-GDP levels fell in the United States and the United Kingdom after the global financial crisis of 2007–08 and in various European countries—most notably, Iceland, Ireland, Portugal, Spain, and the Baltics—in the wake of the European sovereign debt crisis (Figure 2.3, panel 1). In Germany, household debt has fallen as a percentage of GDP since 2000. Notwithstanding these recent declines, the level of household debt to GDP remains high by historical standards in most of these countries and has kept growing in other advanced economies, such as Australia and Canada (Figure 2.3, panel 5). In a number of emerging market economies—most notably Chile, China, Malaysia, Thailand, Paraguay, Poland, and some central and southeastern European countries, household debt to GDP expanded rapidly over a short time, from as low as 10 percent of GDP in 2005 to more than 60 percent of GDP in some cases. This is also reflected in the rapid rise of median household debt-to-GDP ratios in emerging market regions: from between 5 percent and 10 percent in 2000 to between 17 percent and 22 percent in 2016 (Figure 2.3, panels 5 and 6).

Changes in household debt ratios are driven mainly by debt increases rather than low or negative income growth. In theory, the household debt-to-GDP ratio may go up if debt increases more, or declines less, than GDP does. The rapid rise in the household debt-to-GDP ratio from 1990 to 2007 is due mainly to rapid increases in inflation-adjusted household debt, in both advanced and emerging market economies, amounting to 6.7 percent and 13.4 percent a year, respectively—far exceeding the growth of real GDP and real disposable income (Figure 2.3, panel 4). This rise was facilitated by the sharp decline in interest rates and easier and more widespread access to credit. Hence, debt servicing may not have risen that much. During this period, net wealth also rose on account of strong real house price increases. After 2008, the growth in household debt slowed to 2 percent a year in advanced economies, reflecting a retrenchment of households in the wake of the global financial crisis, and to 6.6 percent a year in emerging market economies. In both cases, debt continued to exceed the rate of GDP growth, leading to increases in the ratio of household debt to GDP.

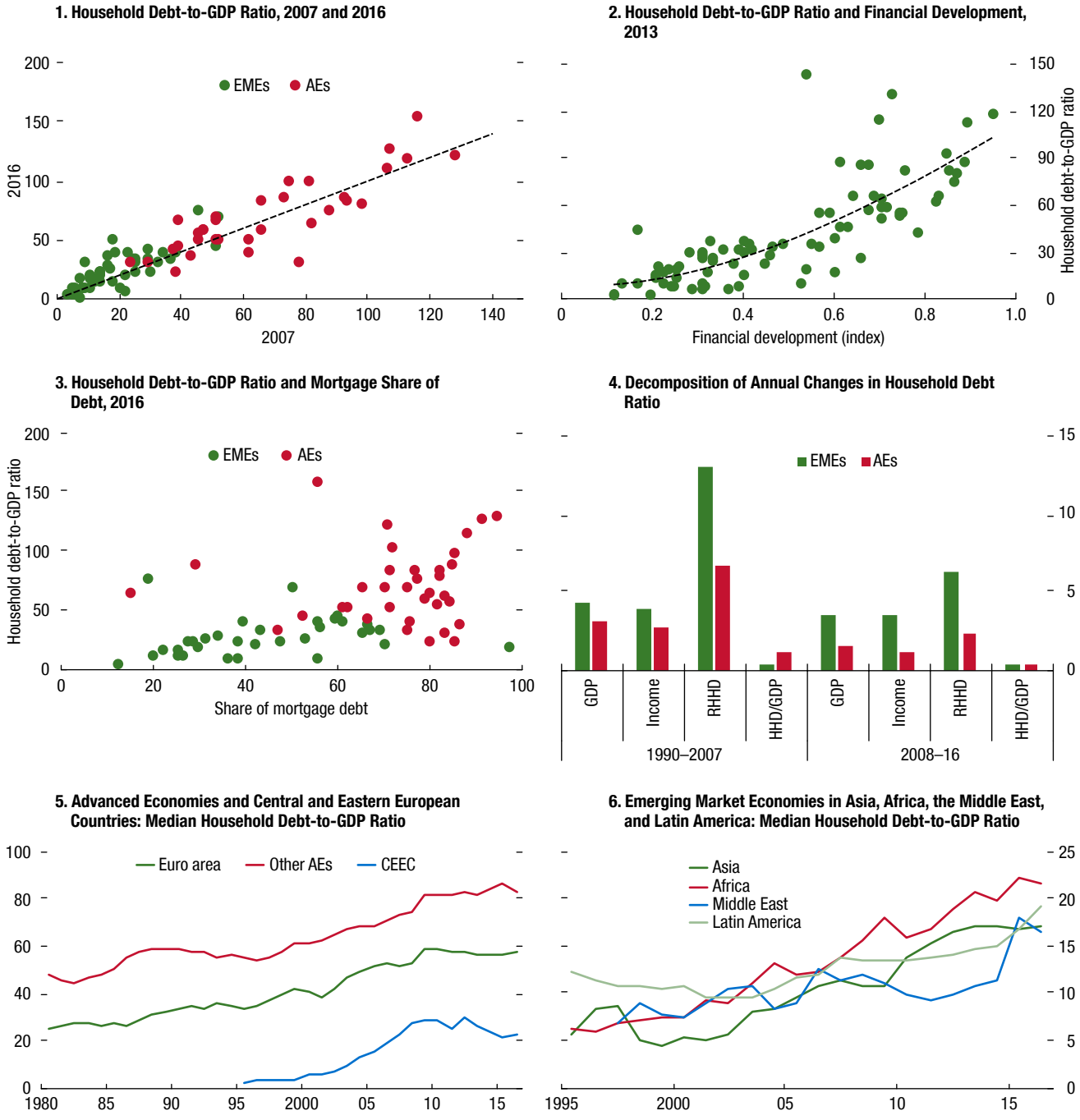
The overall trend in household debt to GDP is very similar to that of the debt-to-assets ratio. For a subsample of 18 Organisation for Economic Co-operation and Development countries, increases in household debt to assets are highly correlated with household debt-to-GDP ratios (Figure 2.4, panel 6). Thus, increases in debt are usually accompanied by rising leverage, meaning that a focus on net wealth may mask underlying vulnerabilities that arise from procyclical asset values. The trend is most notable for mortgage debt—which constitutes the bulk of household debt in many countries—for which there is large comovement with the housing market cycle. As a result, households are less able to tap into their housing wealth to smooth consumption after a shock. Therefore, following the recent empirical literature and without losing much generality, the rest of the empirical analysis focuses on the debt-to-GDP ratio.[10]

[9]For instance, urban Indian households report about one-fifth of their debt to be for business-related purposes. In addition, rural households use two-fifths of their debt for productive purposes, with the highest share among the wealthier households (see Badarinza, Balasubramaniam, and Ramadorai 2016).

[10]In the ensuing analysis, using the debt-to-assets ratio instead of the debt-to-GDP ratio for a subset of 26 Organisation for Economic Co-operation and Development countries for which such data are available yields qualitatively the same results (see Figure 2.6, panel 2).

Figure 2.3. Growth and Composition of Household Debt by Region

(Percent)

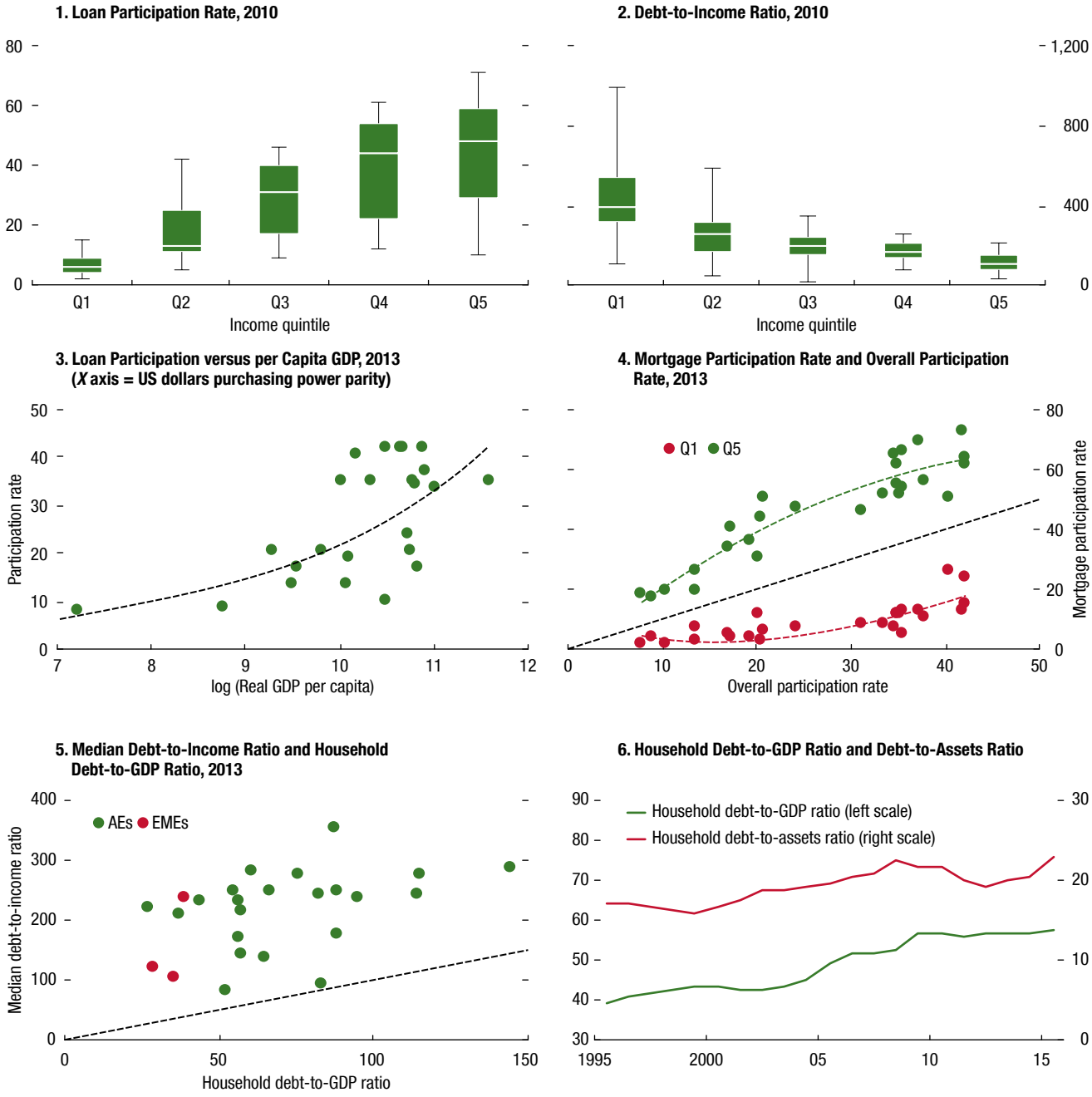


Sources: Bank for International Settlements; CEIC Data Co. Ltd.; Economic Cycle Research Institute; Haver Analytics; IMF, International Financial Statistics, Monetary and Financial Statistics, and World Economic Outlook databases; Jordà-Schularick-Taylor Macrohistory Database; Svirydzenka 2016; Thomson Reuters Datastream; and IMF staff calculations.

Note: For countries included in regional breakdowns, see Annex 2.1. In panel 2, financial development is the index taken from Svirydzenka 2016. Panel 4 reports median annual growth rates for each country group and period for real GDP, real disposable household income, real household debt (RHHD), and household debt-to-GDP ratio (HHD/GDP). Dashed line in panel 1 denotes the 45-degree line. AEs = advanced economies; CEEC = Central and Eastern European countries; EMEs = emerging market economies; income = real disposable household income.

Figure 2.4. Household Debt: Evidence from Cross-Country Panel Data

(Percent, unless noted otherwise)



Sources: Bank for International Settlements; country panel surveys; Euro Area Housing Finance Network; Luxembourg Wealth Study; Organisation for Economic Co-operation and Development (OECD); US Survey of Consumer Finance; and IMF staff calculations.
Note: Panels 1 and 2 show the cross-country dispersion across income quintiles, evaluated at the median for mortgage borrowers (quintile 1 to quintile 5, from lowest to highest income). Dashed lines in panels 4 and 5 denote the 45-degree line. For country coverage, see Annex 2.1. Panel 6 shows debt, asset, and wealth ratios for a subsample of 18 OECD countries for which such data are available since 1995. AEs = advanced economies; EMEs = emerging market economies.

Lower-income groups typically participate less in credit markets, and their credit profiles are weaker. Household survey data from 25 countries show that households in the lowest income quintiles participate much less in mortgage (and overall) credit markets (Figure 2.4, panel 1). Those that do, however, have, on average, higher risk profiles, with higher debt-to-assets and debt-to-income ratios as well as higher debt service ratios (defined as total debt repayment as a percentage of total income) (Figure 2.4, panel 2). This suggests that lower-income households are most vulnerable to cyclical fluctuations in income and are less likely to benefit from positive wealth effects, given their relatively low net asset holdings. From a bank's perspective, these customers generally represent a higher credit risk, which, in turn, may explain the relatively low participation rate, indicating the presence of credit constraints.

Differences in participation across countries explain part of the differences in debt ratios between advanced and emerging market economies. As with other measures of financial inclusion, household credit participation increases with economic development, as measured by real GDP per capita (Figure 2.4, panel 3).[11] As credit participation increases, it initially covers mainly high-income families and then moves more aggressively toward easing access for lower-income families, as reflected by the curvature of the respective income groups' lines (Figure 2.4, panel 4). Thus, high credit participation by low-income families is mainly an advanced economy phenomenon; lower-income countries grant access to credit mainly to higher-income households. Since not all households have debt and since debt-to-income ratios vary significantly across households, macro-level measures of household debt (such as debt-to-GDP and debt-to-net-wealth ratios) underestimate the true burden of indebted households (Figure 2.4, panel 5).[12] This underestimation could be especially relevant for emerging market economies where participation rates are low and where low macro-level indebtedness may coexist with significant micro-level household indebtedness (see Box 2.2 for an analysis of Chinese households).

[11]See also Demirgüç-Kunt and Klapper (2012), who find that account penetration is higher in economies with higher national income, as measured by GDP per capita.

[12]The aggregate measures of household indebtedness correspond to an income-weighted average of individual household debt ratios. Households with no debt but positive income, as well as differences in indebtedness across households, lead to differences between aggregate and micro-level measures.

The dynamics of household debt are linked to the evolution of house prices. For example, household debt in Canada and the United States evolved very similarly until the global financial crisis (Box 2.3). After the crisis, household debt continued to rise in Canada but fell in the United States as house prices followed different paths: declining in the United States while continuing to appreciate in Canada. As a result, US households' leverage for mortgage holders, reflected in the debt-to-income ratio, remained broadly constant, while Canadian mortgage borrowers' debt to income increased across all income groups and is now much higher than for US households. These patterns suggest that household debt and housing prices have common dynamics (Box 2.4). Similarly, in China, where house prices rose by 16 percent in real terms, the debt-to-income ratio increased across most income groups between 2011 and 2015, and especially for lower-income households (Box 2.2).

Financial Stability Risks of Household Debt: Empirical Analysis

Increases in household debt have a positive short-term but a negative medium-term relationship to macroeconomic aggregates such as GDP growth, consumption, and employment. They also predict downside risks to GDP growth and a higher probability of a banking crisis. However, the strength of the negative association depends on the level of household debt to GDP, getting stronger when this level exceeds certain thresholds. The short-term positive effects are generally stronger and the medium-term negative effects are consistently weaker for emerging market economies.

Household Debt and Growth, Consumption, and Employment

When household debt increases, future GDP growth and consumption decline and unemployment rises relative to their average values. Changes in household debt have a positive contemporaneous relationship to real GDP growth and a negative association with future real GDP growth, in line with various recent empirical studies.[13] Specifically, a 5 percent increase in household debt to GDP over a three-year period forecasts a 1¼ percent decline in real GDP growth three years ahead (Figure 2.5, panel 1).[14] These results do not seem to be

[13]See, for instance, Mian, Sufi, and Verner, forthcoming; Jordà, Schularick, and Taylor 2016; and Lombardi, Mohanty, and Shim 2017.

[14]The empirical model includes country fixed effects, so that all variables can be interpreted as deviations from their sample averages.

driven by potential endogeneity concerns.[15] A further breakdown shows that household debt is correlated with future declines in private consumption (Figure 2.5, panel 2) but less so with government consumption and investment. It is also negatively correlated with the current account deficit. These findings suggests that household debt booms finance consumption expansions, often through current account deficits that revert later when consumption and GDP growth also decline. Increases in household debt are also associated with significantly higher unemployment up to four years in the future (Figure 2.5, panel 3).

The short-term positive association between changes in household debt and GDP growth is stronger and the medium-term negative relationship weaker for emerging market economies than for advanced economies (Figure 2.5, panel 1). On the other hand, consumption expands less in the short term and declines less in the medium term after household debt increases in emerging market economies (Figure 2.5, panel 2), while the results for unemployment follow a similar pattern as those for GDP (Figure 2.5, panel 3). This suggests that the trade-off between the benefits of increased household participation in credit markets and the risks to macroeconomic stability is less striking for these countries, most likely because of lower average household debt, although institutions and policies may also play an important role, as discussed later. Moreover, the evidence on long-term growth reviewed in Box 2.1 suggests that, in the long term, increases in household debt appear positively related to growth up to a certain level.[16]

Increases in household debt are associated with heightened downside risks to future GDP growth for all countries, but in emerging market economies they also predict higher upside risks. Quantile regression results show that changes in household debt have important implications for movements in the distribution of future GDP growth (Figure 2.5, panel 4). Initially, household debt is associated with strong positive output growth (the right tail of the distribution), especially among emerging market economies. But three to five years ahead, increases in household debt seem to have a clearer association with below-average movements of future growth (the left tail of the distribution of future real GDP growth).[17] This pattern is consistent with the deleveraging and aggregate demand externalities that arise after a period of rapid growth in household debt, resulting in a volume of borrowing above the socially optimal level that leads to important corrections after a shock. It is interesting to note that, among emerging market economies, increases in household debt are associated with worse negative and stronger positive future growth outcomes compared with advanced economies. This finding may reflect the more extreme historical experiences in this group of countries; they benefit more from financial development and improved access to finance but also suffer more strongly during episodes of debt overhang and financial crises.

Supply-driven increases in household debt are more damaging to future growth. Using changes in financial conditions to identify supply- and demand-driven increases in household debt, similar to Mian, Sufi, and Verner, forthcoming, shows that the supply-driven component of household debt has a stronger impact on future GDP growth than the demand component (Figure 2.5, panel 5). Similarly, a monetary policy loosening (negative Taylor rule residuals) reinforces the negative relationship between household debt and future economic activity.

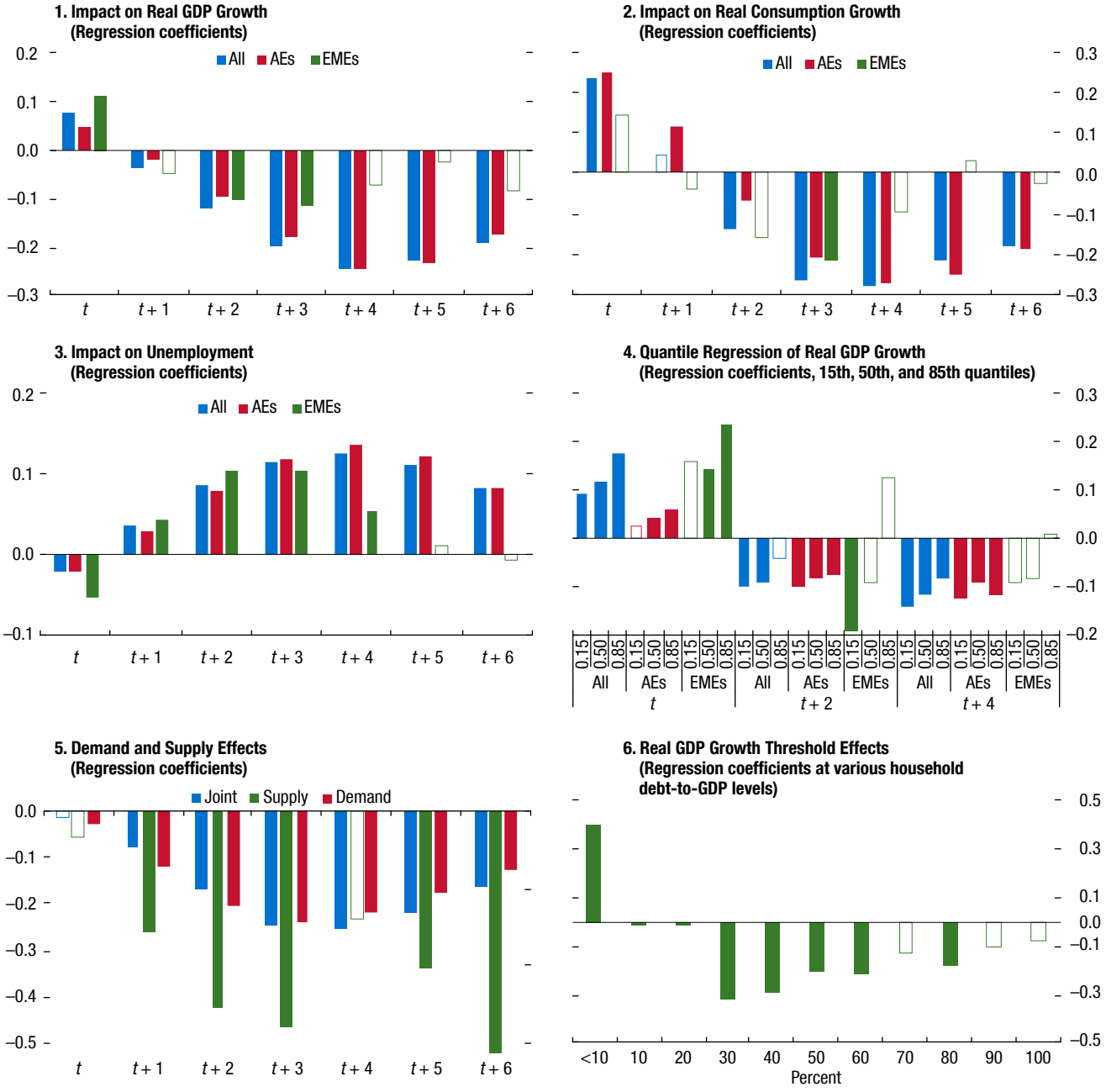
The negative medium-term association between GDP growth and growing household debt is largely absent at low levels of debt to GDP. At very low levels of household debt to GDP, below 10 percent, the association between increases in debt and future real GDP growth is positive; it turns negative when household indebtedness exceeds 30 percent of GDP (Figure 2.5, panel 6). Beyond that point, the correlation declines slightly, but it maintains its negative sign. The presence of this nonlinearity is consistent with recent findings of a bell-shaped

[15]Results obtained using instrumental variables yield qualitatively similar and quantitatively larger estimates than those obtained through ordinary least squares. In these estimations, changes in household and firm debt-to-GDP ratios were instrumented by the interaction between a country's degree of capital account openness and US financial conditions and global liquidity (broad money). Micro-level regressions discussed below—which are much less likely to be affected by potential endogeneity—provide additional support for the causal interpretation of these results.

[16]The cumulative effect of an increase in household debt on growth, consumption, and employment, inferred from Figure 2.5, is negative in advanced economies and neutral to marginally negative in emerging market economies. However, such an exercise implicitly relates changes in household debt to longer-term growth outcomes, which is more adequately addressed in the framework reviewed in Box 2.1. According to those results, an increase in the household debt-to-GDP ratio raises long-term growth as long as the final ratio is below a threshold between 36 and 70 percent of GDP (corresponding to a 90 percent confidence interval).

[17]In advanced economies, an increase in household debt is negative for medium-term GDP growth across the entire distribution of future GDP growth (all quantiles), whereas in emerging market economies, the impact of household debt on future GDP growth is negative only in the left tail of the distribution (when future growth is below average).

Figure 2.5. Effects of Household Debt on GDP Growth and Consumption



Sources: Bank for International Settlements; CEIC Data Co. Ltd.; Economic Cycle Research Institute; Haver Analytics; IMF, World Economic Outlook database; Jordà-Schularick-Taylor Macrohistory Database; Penn World Table; and IMF staff calculations.
Note: Panels 1, 2, and 3 are from panel regressions of rolling three-year real GDP growth (consumption and unemployment, respectively) up to six years ahead, on lagged changes in household and corporate debt-to-GDP ratios (over a three-year period), controlling for lags of the dependent variable, and country and time fixed effects. Panel 4 shows quantile regression coefficient estimates for changes in the household debt ratio, using the same specification as the panel regression model. Panel 5 breaks down changes in household debt-to-GDP ratios into supply and demand factors, where local financial conditions are assumed to signal supply-side factors, and the residual to reflect other (demand) factors. Panel 6 shows coefficient estimates from a panel regression estimation, conditioning the effect on changes in household debt, and interacted with various debt thresholds. Colored bars indicate that the effects are statistically significant at the 10 percent level or higher. See Annex 2.2 for details of the estimation methodology. AEs = advanced economies; EMEs = emerging market economies.

relationship between financial deepening and long-term growth (Sahay and others 2015b) and studies relating this to increased financial risks (see also Box 2.1). While the threshold above which increases in household debt more strongly signal risks to real activity is low, it is generally above the levels reached by emerging markets in this sample. This finding may partly explain the milder association estimated for this group of countries.

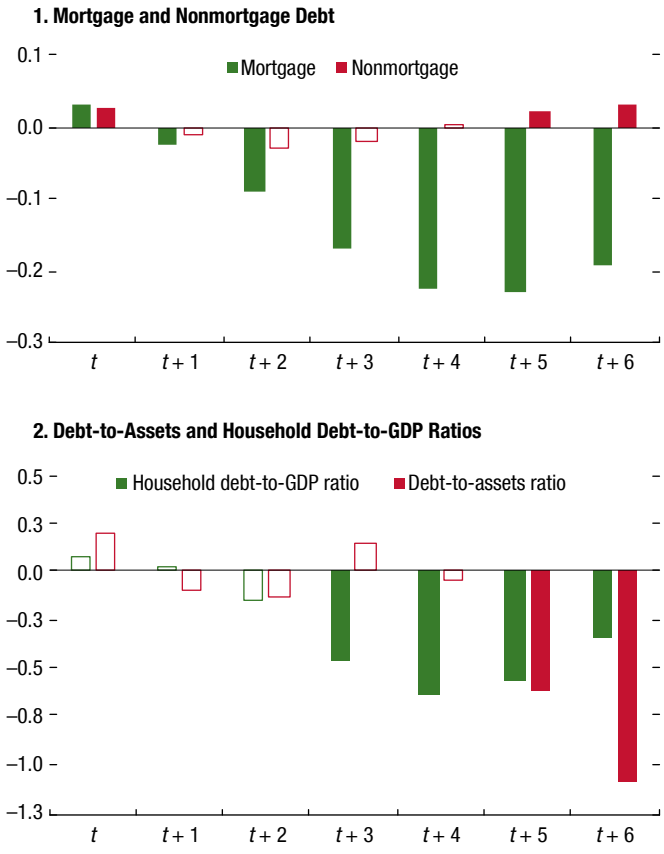
The relationship between future GDP growth and household debt is driven mostly by mortgage debt. The finding that the mortgage debt component is statistically significant and the nonmortgage component is not (Figure 2.6, panel 1) goes somewhat against the argument that increases in debt accompanied by a simultaneous accumulation of assets are less risky, because households may be able to tap into these assets when facing shocks. This could be due to the procyclicality of home equity lines or—more generally—to wealth effects that lead households to cut consumption when the value of their housing assets decline.[18] Further evidence confirms that the accumulation of assets does not dampen the consequences of increased indebtedness. Changes in the household debt-to-total-assets ratio are associated with growth declines only at horizons beyond five years ahead, with increases in household debt to GDP remaining significant at shorter horizons (Figure 2.6, panel 2). These results suggest that, at business cycle frequencies, it is primarily households' debt service capacity, approximated by a higher debt-to-GDP ratio, that signals vulnerabilities rather than their solvency position.

Similar results are found in micro-level data: high debt-to-income ratios make households more vulnerable to income shocks. Micro longitudinal data for five euro area countries show that high household indebtedness in 2010, right before the European sovereign debt crisis, caused a significant reduction in consumption between 2010 and 2014 (Figure 2.7, panel 1).[19] Furthermore, consumption declined more for the most indebted

[18]Boom-bust cycles in housing prices that accompany increases in household debt could be driving the results reported above, but further analysis shows that lagged house price growth is not very significant in growth forecasting regressions. Additional evidence from dynamic panel vector autoregression techniques shows that house price shocks are associated with a gradual rise in household debt, whereas household debt shocks lead to significant increases in house prices in the short term, up to two to three years, but are followed by a fall in house prices afterward (Box 2.5).

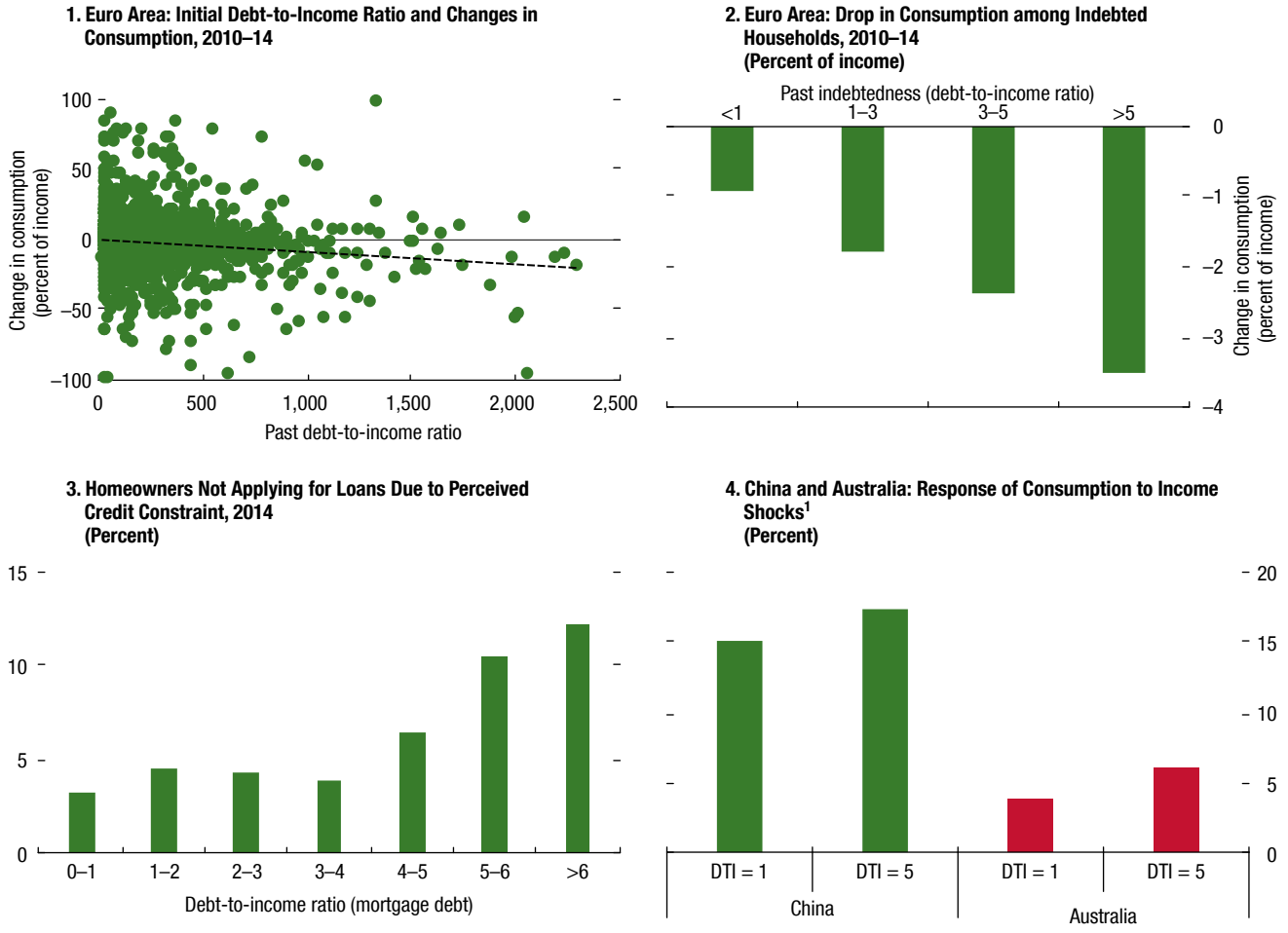
[19]The macroeconomic and unexpected nature of the shock makes it unlikely that the results are driven by the reverse causality argument that individual households borrowed preemptively to hoard liquidity and smooth consumption.

Figure 2.6. Effects of Household Debt on GDP Growth: Robustness Tests
(Regression coefficients)



Sources: Bank for International Settlements; CEIC Data Co. Ltd.; Economic Cycle Research Institute; Haver Analytics; IMF, World Economic Outlook database; Jordà-Schularick-Taylor Macrohistory Database; Penn World Table; and IMF staff calculations.
Note: This figure shows coefficients of household debt variables in panel regressions of real GDP growth, one to six years ahead, on lagged changes in household and corporate debt-to-GDP ratios (over a three-year period), controlling for lags of the dependent variable, and country and time fixed effects. Panel 1 splits household debt into mortgage and nonmortgage debt-to-GDP ratio. Panel 2 includes changes in the household debt-to-GDP ratio and changes in the household debt-to-assets ratio in the panel regression. Estimations are performed over subsamples for which data are available compared with analysis in Figure 2.5. Colored bars indicate that the effects are statistically significant at the 10 percent level or higher.

Figure 2.7. Micro-Level Evidence Corroborating the Macro Impact



Sources: European Central Bank Household Finance and Consumption Survey; Household, Income and Labour Dynamics in Australia Survey; China Household Finance Survey; and IMF staff calculations.
Note: Panels 1–3 present data from euro area countries with a panel dimension (Belgium, Cyprus, Germany, Malta, Netherlands). The change in consumption-to-income ratio is computed over 2010–14. For panel 4, see Boxes 2.2 and 2.4 for additional information. DTI = debt-to-income ratio.
[1]In panel 4, results are based on data for households tracked between 2013 and 2015 for China, and between 2006 and 2015 for Australia.

households (Figure 2.7, panel 2), which also perceived themselves to be the most financially constrained (Figure 2.7, panel 3). The larger reduction in consumption by highly indebted households at the micro level and the corresponding decline in aggregate consumption observed in macro data are consistent with the effects of aggregate demand externalities arising from deleveraging. Evidence for China also shows that consumption of households with high debt-to-income ratios responds more strongly to income shocks (Figure 2.7, panel 4 and Box 2.2). Hence, highly indebted households' higher marginal propensity to consume may amplify the effect of negative income or credit shocks on China's economy, in line with evidence in advanced economies (for example, Mian, Rao, and Sufi 2013). Similar results are found for advanced economies, such as Australia, although they are less pronounced.

Financial Stability Risks and Neglected Crash Risk

Increases in household debt are also good early warning indicators for banking crises.[20] A simple look at the data shows that increases in household debt peak about three years before the onset of a banking crisis (Figure 2.8, panel 1). Formal evidence from a logit

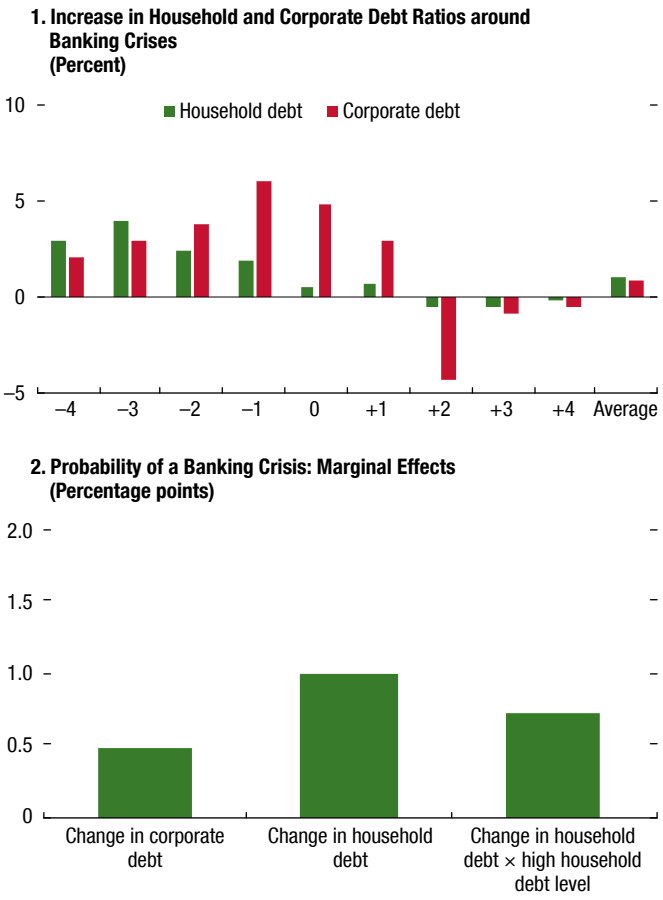
[20]Previous research documenting similar findings includes Gourinchas and Obstfeld 2012; Drehmann and Tsatsaronis 2014; and Jordà, Schularick, and Taylor 2016.

panel data model shows that a rise in the household debt-to-GDP ratio contributes to a greater probability of banking crises three years ahead (Figure 2.8, panel 2). The marginal effect, at about 1 percent, is economically significant, since the unconditional crisis probability is about 3.5 percent for the countries under examination. The relationship between increasing household debt and financial crises is more pronounced when household debt is high (65 percent of GDP). This is broadly consistent with the nonlinear effects found for the relationship between household debt and GDP growth, with the higher threshold resulting from the extreme nature of crises as compared with episodes of growth declines. The existence of nonlinear effects suggests that debt increases in already highly indebted households may be hard to sustain when facing a negative income shock, leading them to drastically reduce consumption and default on their debts.

Increases in the household debt ratio predict negative equity excess returns (over the risk-free rate), especially for the banking sector. Such predictability is present for both the banking sector and the overall stock market index (Figure 2.9, panel 1). This negative correlation may reflect investor overoptimism and a systematic neglect of the risk of equity crashes (so-called neglected crash risk) during periods of high growth in household debt (Figure 2.9, panel 2). Further analysis with quantile regressions shows that the negative association between increases in household debt and future equity returns is stronger in the lower tail of the return distribution than in the upper tail, confirming that investors appear to systematically neglect the risk of equity crashes. Although the neglected crash risk affects all sectors, predictability is stronger for bank stock returns, suggesting that rising household debt is often associated with neglected banking sector vulnerabilities.[21] As discussed later in the chapter and shown earlier, these vulnerabilities may arise both from the ensuing decline in growth associated with the deleveraging process or from higher debt defaults from overindebted households. The predicted decline in overall stock market returns suggests that growth contractions explain part of these results. But consistent with a simultaneous role for

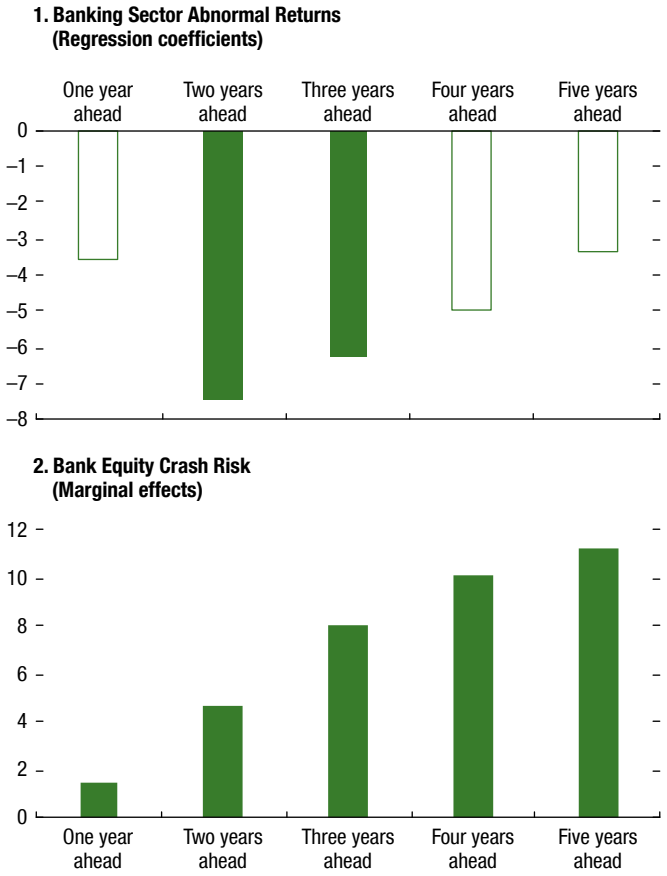
[21]Risk-adjusted abnormal returns of the banking sector are computed to measure the performance of bank stocks relative to market returns. Abnormal returns are defined as the capital asset pricing model regression residuals with quarterly data. For each country, the coefficient on market excess return, that is, the market beta, is estimated in each year based on past return data to avoid using future information that is unknown in that year.

Figure 2.8. Banking Crises and the Role of Household Debt



Sources: Bank for International Settlements; CEIC Data Co. Ltd.; Economic Cycle Research Institute; Haver Analytics; IMF, International Financial Statistics, and Monetary and Financial Statistics databases; Jordà-Schularick-Taylor Macrohistory Database; Laeven and Valencia 2013; Thomson Reuters Datastream; and IMF staff calculations.
Note: Panel 1 shows the average growth in ratios of household and nonfinancial corporate debt to GDP before and after a banking crisis, as well as the unconditional average growth rate. Panel 2 shows the marginal effects of a panel logit model for banking crises for 34 countries, with country fixed effects, levels, and changes in ratios of household and nonfinancial corporate debt to GDP. It also shows the interaction effect with a high household debt dummy variable, set at 65 percent of GDP, representing the top quintile of the distribution. The effects are significant at the 10 percent confidence level. Banking crises are taken from the updated database by Laeven and Valencia (2013).

Figure 2.9. Bank Equity Returns and Household Debt



Source: IMF staff calculations.
Note: Panel 1 shows coefficients from regressions of future bank equity risk-adjusted abnormal returns, one to five years ahead, using past three-year changes in the household debt-to-GDP ratio as independent variables. Panel 2 shows the marginal effect of the change in the household debt ratio (normalized by the standard deviation) on the probability of equity crashes in the next one to five years. Bank equity crashes are defined as annual bank equity returns lower than one standard deviation below the mean, as in Cheng, Raina, and Xiong 2014; and Baron and Xiong 2017. Solid bars mean that the response is statistically significant using 95 percent confidence intervals.

rising defaults, increases in the household debt ratio are often associated with higher growth of nonperforming loans in the country's banking sector three years later, confirming that rapid growth in household debt is associated with greater banking stress in the future.

When Is Household Debt More Likely to Predict Low GDP Growth?

The consequences of an increase in household debt for future growth differ substantially across countries. The estimated debt-to-GDP-growth relationship exhibits substantial heterogeneity within both advanced and emerging market economies (Figure 2.10, panel 1). The median coefficient for the three-year-ahead impact of an increase in debt on GDP growth is –0.5 for advanced economies and –0.13 for emerging market economies. Within each group of countries, the dispersion of the estimated coefficients is large, although more so for emerging market economies, which also have a larger share of positive country-level coefficients. This dispersion suggests that, in addition to the initial level of household debt documented earlier, country-specific and institutional factors may play a role in mediating the relationship between rising household debt and future economic activity. To investigate the role of various leading factors, separate panel regressions add interactions between household debt and a number of institutional and country-specific characteristics to the panel regression between changes in household debt and three-year-ahead GDP growth (Figure 2.10, panel 2).[22]

Having an open capital account and a fixed exchange rate regime increases the risks associated with rising household debt. An open capital account has multiple benefits for financial integration and access to foreign capital (Mussa and others 1998; Stulz 1999), but it also exposes countries experiencing large capital inflows to sudden stops (Calvo and Reinhart 2000). In this sample, a more open capital account results in a stronger negative association between increases in household debt and future GDP growth.[23] This result might arise from the accumulation of foreign-currency-denominated debt, similar to findings by Mian, Sufi, and Verner (forthcoming). As noted in the literature, capital flows that sustain episodes of foreign debt accumulation are frequently followed by sudden stops that force strong corrections in consumption, particularly in emerging markets. This pattern is consistent with a larger differential effect of capital account openness in this group of economies. Along similar lines, having a fixed exchange rate regime reduces an economy's flexibility to accommodate external shocks, resulting in a larger contraction in aggregate demand, especially in the presence of nominal wage rigidities (Schmitt-Grohé and Uribe 2016). Interestingly,

[22]Additional analysis also attempted to relate the effect of household debt on banking crises documented earlier to institutional and country-specific variables, but no significant interaction effects were detected, probably because of the relatively smaller coverage, over time, and number of countries and crises observations, relative to the panel data growth regression analysis.

[23]In this analysis, capital account openness is measured as de jure openness. The results do not change when using de facto measures such as capital flows as a percentage of GDP.

this analysis shows that it is the combination of a fixed exchange rate regime and capital account openness that magnifies the risks associated with increasing household debt. This finding is consistent with the limitations that such a regime poses for accommodating the consequences of large changes in capital inflows (IMF 2016a).

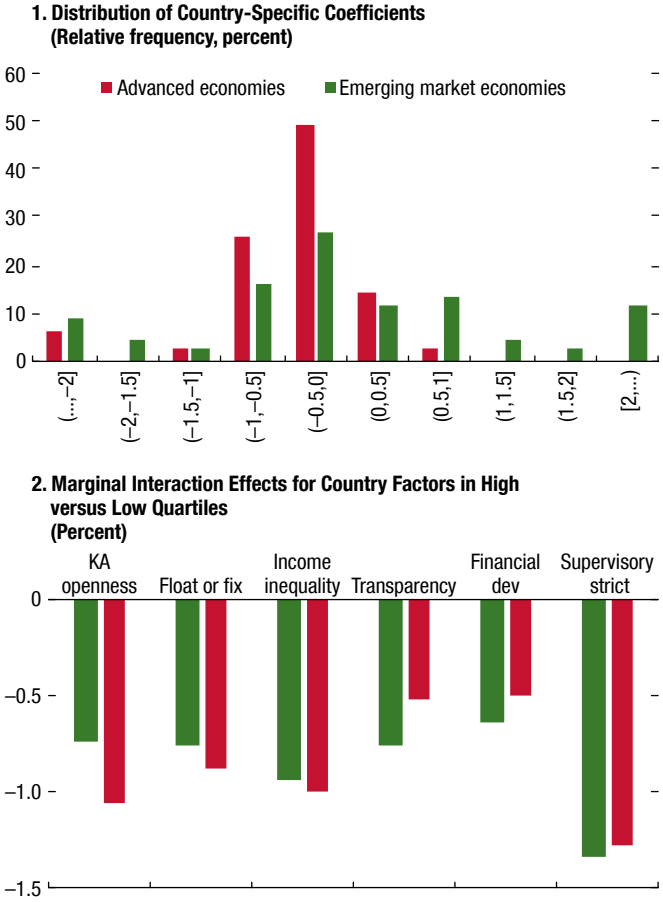
Financial development and the quality of bank supervision seem to mitigate the medium-term negative relationship between increases in household debt and GDP growth. Credit expansion in a more financially developed environment entails lower risks because the financial system is better able to assess credit risk and allocate credit and is better prepared to deal with their consequences. Moreover, countries where banking supervision is more stringent and capital requirements are stricter appear able to reduce the negative effect of household debt on GDP growth. The same effect is found for banking systems that have higher capital ratios or a larger distance to default. All these measures directly or indirectly reflect the quality and conservatism of the banking supervision—supervisors may stop banks from paying out high dividends to shareholders and instead require them to retain higher capital buffers, thereby limiting, to some extent, the bank lending channel.

Among institutional variables, the existence of credit registries significantly reduces the risks signaled by rising household debt. Having access to broad information on individuals' levels of debt and payment histories (both positive and negative) reduces the possibility of overborrowing, improves origination standards, and reduces borrowing costs for good creditors. In addition, characteristics of the debt frameworks—such as protection against predatory lending—temper the negative association with future GDP growth, but are not robustly significant. Other aspects of the institutional framework, such as various characteristics of the household credit market obtained through a survey of country desks, do not appear to have a significant effect in reducing the risks signaled by household credit expansion.[24]

The effect of household debt on GDP is somewhat larger in more unequal societies. The role of inequality is not obvious because of two countervailing forces (Figure 2.10). On one hand, richer households tend to have lower debt-to-income (DTI) ratios and higher participation (Figure 2.4). A higher level of inequality

[24]For the list of housing market characteristics see Annex Figure 2.1.1. The lack of significance for several of these and other institutional measures may result from the reduced samples for which they are available or the limited time variation of the data (some being available for a single year).

Figure 2.10. The Impact of Household Debt by Country and Institutional Factors



Source: IMF staff calculations.
Note: Panel 1 shows country-level coefficients of changes in household debt in ordinary least squares regressions of three-year-ahead real GDP growth on changes in household and firm debt. Panel 2 shows the marginal effect of changes in household debt on GDP growth three years ahead, from panel regressions with institutional factors, evaluated at the 25th and 75th percentiles. Effects are statistically significant at the 10 percent level or higher. See also Figure 2.8 and Annex 2.2. Financial dev = financial development index from Svirydzenka 2016; Float or fix = exchange rate regime (floating, the green bar, versus fixed, the red bar); Income inequality = income inequality measures, the difference between the income share of the top 20 and bottom 20 percent income groups; KA openness = capital account openness index from the Chinn-Ito Index; Supervisory strict = measure of overall bank capital stringency from Barth, Caprio, and Levine 2013; Transparency = dummy variable indicating whether a credit registry or other form of borrower information data transparency exists.

means that the share of income of the richest households increases and the macro-level DTI ratio declines.[25] On the other hand, higher-income households may decide to borrow more as a response to their relatively higher income, leading to an increase in macro-level DTI. Thus, the relationship between macro-level household debt and inequality is ambiguous. In this sample, higher inequality is associated with a slightly higher impact of changes in household debt on future growth.[26] Other explanations center on behavior, arguing that higher inequality results in more people with less financial education who are more vulnerable to overlending and predatory practices.[27]

These results suggest that the level of household debt at which further increases are detrimental is country specific and higher for countries with better institutions. The negative effects of increases in the household debt-to-GDP ratio on future GDP growth differ by country and depend on the initial level of indebtedness and country characteristics, as outlined earlier. This means that countries can attenuate the negative effects of increased household debt that arise at high initial levels of indebtedness if they are more financially developed and have higher standards of financial information transparency (credit registries) and consumer finance protection, better regulation and supervision, less inequality, and more flexible exchange rate regimes.[28] In effect, the impact on growth of a rising household debt-to-GDP ratio appears to be positive in the medium term when institutions and policies are the most effective, and appears to be negative when institutions and policies are the least effective, regardless of the initial level of household debt.

Conclusions and Policy Implications

The econometric analysis clearly shows that household debt has different effects on economic growth and financial stability depending on the horizon. At business cycle frequency, high growth in household lending appears to foster above-average growth and employment at first, but tends to be followed by a period of instability and subpar GDP growth and employment. This finding is consistent with the presence of a policy trade-off between short-term and medium-term growth and financial instability. While this forecasting trade-off is a robust pattern of the data, it is stronger for advanced economies than for emerging market economies, with increases in household debt consistently signaling higher risks when initial debt levels are already high. Nonetheless, the results indicate that the threshold levels for household debt increases being associated with negative macro outcomes start relatively low, at about 30 percent of GDP. Therefore, although emerging market economies have some space to take advantage of the positive effects of expanding households' access to credit—in both the short and long term—with low medium-term risks, such space may be limited. Furthermore, even in countries with low macro levels of household debt, a rapid expansion in credit may lead to an increasing fraction of highly leveraged households that may be vulnerable to shocks. Finally, existing studies suggest that household debt appears positive for growth across medium- to long-term horizons, although the relationship weakens at high levels of indebtedness.

A country's characteristics, institutions, and policies can mitigate the risks associated with increasing household debt. The negative effects are weaker in countries with less external financing and floating exchange rates, that are financially more developed, that have better financial sector regulations and policies, and that have lower income inequality. Thus, even in countries where the level of household debt to GDP is high, the stability-growth trade-off can be attenuated by a combination of good policies, institutions, and regulations. On the other hand, in countries where the low initial level of household debt mitigates some of the risks, the wrong combination of institutional characteristics and policies may offset the effect of a low debt level. This indicates that the point at which further increases in household debt pose risks to future economic performance is country specific; various factors should be evaluated by country authorities to assess vulnerabilities arising from household leverage.

Policy action will need to calibrate the short-, medium-, and long-term benefits and risks. Policies need to carefully balance minimizing the medium-term risks of growth in household credit for financial stability without harming the potential long-term benefits of inclusion and development. Moreover, policy

[25]The macro-level DTI is the weighted average of household-level DTIs, with weights by income share.

[26]However, the significance of this effect varies, depending on the exact model specification.

[27]Along these lines, Rajan (2010) argues that household debt among lower-income households was encouraged by the political system in the United States as an easier (but riskier) way to deal with income inequality.

[28]While capital openness may also strengthen the association between household debt and future growth decelerations, it does so mainly in combination with less flexible exchange rate regimes.

action must overcome the inaction bias and political pressure generated by the very short-term positive impact of household credit on GDP growth versus the medium-term negative impact.

In any event, certain policy changes can help reduce the impact of aggregate demand externalities and behavioral biases. Some of the drag household debt places on GDP can be reduced by moving away from fixed exchange rates; introducing financial sector policies that promote financial institutions and market depth, access, and efficiency; and advancing policies that help reduce income inequality. For the most part, these policy changes may also have long-term positive effects on growth. For example, as noted by Coibion and others (2017), lower inequality may enhance lower-income households' access to credit and their ability to smooth consumption and make long-term investments (for example, sending children to college and retraining for different careers) that benefit society. Furthermore, the reliance on foreign debt and the role of capital flows may need further attention because they expose countries to sudden stops or destabilizing capital outflows (see also IMF 2014).

Macroprudential policy can help curb household leverage. Macroprudential policies can help internalize the externality that the borrowing by each household imposes on the rest of the financial system, given that large increases in household debt are associated with a greater likelihood of financial crises and recessions. The design of targeted macroprudential measures may need to take distributional aspects into account, since certain characteristics of households are associated with a greater misalignment of debt and future income. Detailed panel regression analysis shows that various macroprudential measures can significantly reduce real household credit growth, both in advanced economies and in emerging market economies (Box 2.5). Demand-side measures, such as limits on the debt-service-to-income ratio and loan-to-value ratio, seem highly effective. Supply-side measures targeted at loans, such as limits on bank credit growth, loan contract restrictions, and loan loss provisions, are equally effective. However, these policies would require careful calibration to maintain the balance between the short-, medium-, and long-term effects discussed.

There is also a role for policymakers to further strengthen the protection of consumer finance. The empirical analysis found that credit registries reduce the negative effects on growth in the medium term. The development of credit registries will help improve the welfare of households vulnerable to overborrowing. Consumer financial protection not only helps unsophisticated consumers make wiser finance decisions, it also helps enhance overall financial stability, as shown in the empirical analysis. Measures could include increasing the transparency of financial contracts, financial education, prohibition of predatory lending, and regulation of certain financial innovation products.

Similarly, good microprudential supervision can mitigate the negative effects of household debt. As amply demonstrated during the global financial crisis, differences in the quality and depth of banking supervision helped explain why some countries escaped the negative externalities associated with the large increase in household debt during the preceding decade. This may reflect stronger supervisory powers or more stringent capital regulation frameworks that allowed supervisors to diminish the negative effect of household debt increases on future GDP.

Market solutions may also help mitigate the economic consequences of household debt in financial recessions. For example, risk sharing between mortgage lenders and borrowers could be increased, which is the aim of the shared appreciation design of mortgage contracts advocated by Shiller (2014) and Mian and Sufi (2014). In this more equity-like design of mortgage contracts, the principal is automatically written down if the local house price index falls below a specified threshold; increases in property value are shared between the homeowner and the lender. This type of mortgage loan can help price in the associated crash risk before lenders extend credit and reduce the debt overhang problem of households when house prices fall. In theory, this approach would reduce the blow to the macroeconomy of housing busts during episodes of household deleveraging. It would thus enhance financial stability much as nonfinancial firms or banks benefit from bail-in debt with loss-absorbing capacity vis-à-vis bondholders (see Chapter 3 of the October 2013 *Global Financial Stability Report*). However, more work is needed on the conditions and pricing that would entice banks to offer such contracts and to get a full understanding of the potential effects on financial stability (including banks' ability to absorb associated losses).

Box 2.1. Long-Term Growth and Household Debt

In the long term, higher levels of credit to GDP are generally associated with higher economic growth. Financial development, including better institutions and easier access to credit by households, has been shown to be beneficial to economic growth in the long term (Levine 1998; Beck and Levine 2004). As the financial sector develops, growth-enhancing investments can be more easily financed. Nonetheless, the relationship between household debt and growth is more elusive (Jappelli and Pagano 1994; De Gregorio 1996; Beck and others 2012; Sahay and others 2015a).

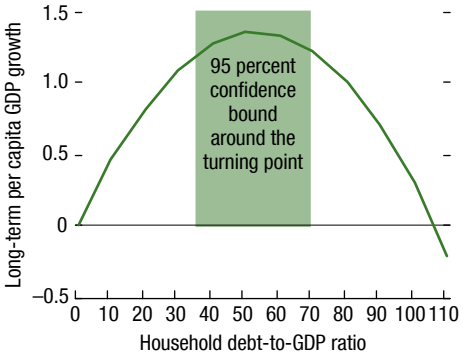
Recent studies have found that economies may reach a point of "too much finance." Arcand, Berkes, and Panizza (2015) and Sahay and others (2015b) found that financial depth begins to dampen output growth when credit to the private sector reaches between 80 percent and 100 percent of GDP. Too much finance may increase the frequency of booms and busts because of greater risk taking and leverage, and may leave countries ultimately worse off and with lower real GDP growth. Another argument is that too much finance leads to a diversion of talent and human capital away from productive sectors and toward the financial sector (Shiller 2005).

A more detailed analysis with household credit suggests the existence of a tipping point. An empirical exercise conducted for the countries covered in the chapter finds that household debt increases long-term real GDP per capita growth, but the effects weaken at higher levels of household debt and eventually become negative. The maximum positive impact in this exercise is found when household debt is between 36 percent and 70 percent of GDP (Figure 2.1.1, panel 1). In addition, there does not appear to be an effect specific to emerging market economies, but a financial crisis seems to result in permanently lower per capita GDP growth (Figure 2.1.1, panel 2).

Box prepared by Adrian Alter and Nico Valckx.

Figure 2.1.1. Long-Term per Capita GDP Growth and Household Debt

1. Effect of Household Debt on per Capita GDP Growth (Percent)



2. Panel Regression of per Capita GDP Growth and Household Debt, 1970–2010[1]

Variables	(1) Per Capita GDP Growth	(2) Per Capita GDP Growth	(3) Per Capita GDP Growth
HHD	0.051*	0.007	0.021
	(1.726)	(0.346)	(0.762)
HHD^2	–0.048**	–0.024	–0.051**
	(–1.980)	(–1.494)	(–2.057)
Crisis		–0.017***	–0.015***
		(–6.319)	(–4.688)
EME × HHD			–0.000
			(–0.015)
Education	0.028	0.018*	0.017
	(1.117)	(1.818)	(1.576)
Initial per capita GDP	–0.012**	–0.004	–0.000
	(–1.973)	(–1.227)	(–0.078)
Constant	–0.035	–0.038	–0.066
	(–0.353)	(–0.933)	(–1.507)
Observations	278	278	278
Number of countries	73	73	73
AR^2	0.0186	0.137	0.185
Hansen	0.253	0.797	0.361
Instruments	55	73	68

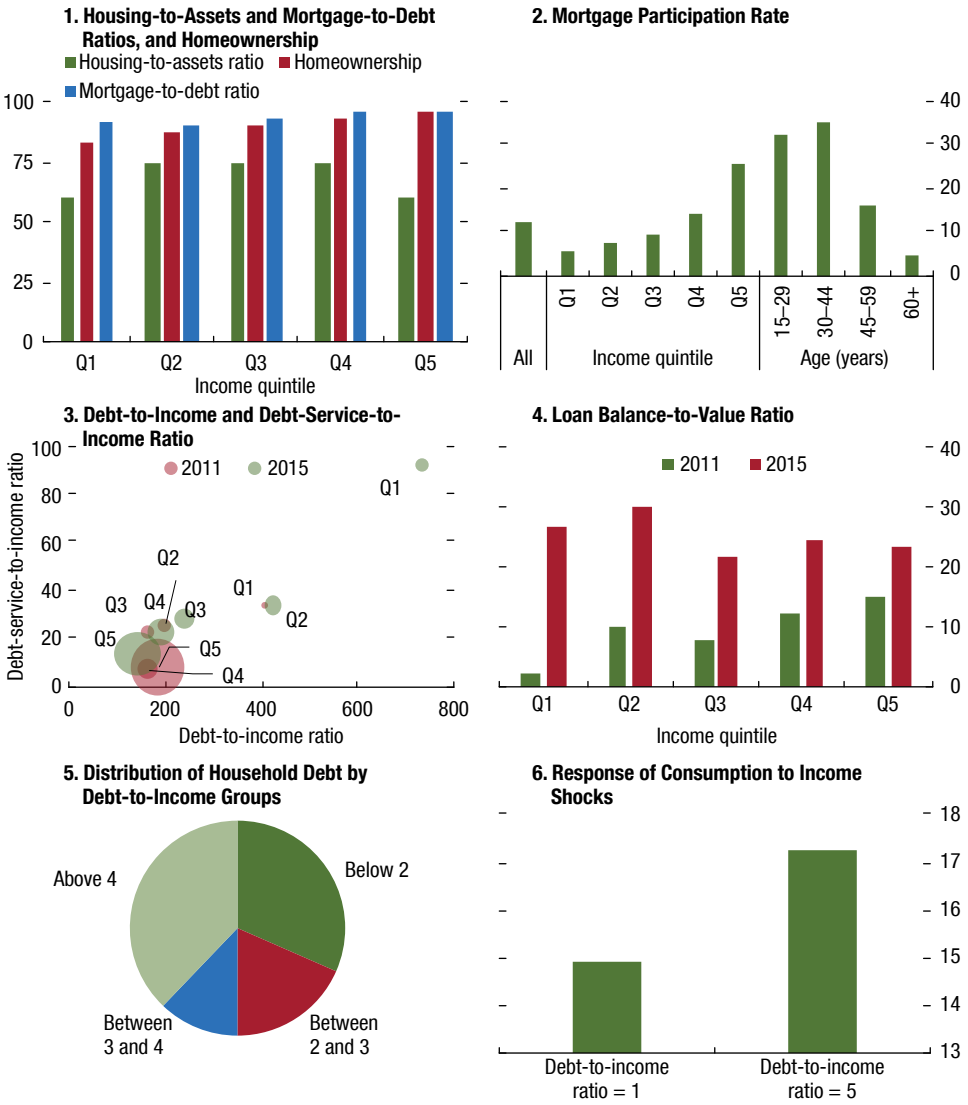
Source: IMF staff calculations.
Note: Figure shows nonlinear effect of household debt on long-term per capita GDP growth at various levels of household debt, based on a long-term panel regression. It uses the Arellano-Bover general method of moments estimator of five-year average per capita GDP growth (shown in panel 2) on household debt to GDP (HHD), the squared ratio of household debt to GDP (HHD^2), initial per capita GDP, secondary education enrollment, dummies for banking crises (Crisis), and emerging market economies' household debt-to-GDP ratio (EME × HHD).
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.
[1]Z-statistics in parentheses.

Box 2.2. Distributional Aspects of Household Debt in China

Housing assets and mortgages are important components of the balance sheets of Chinese households. High levels of ownership (about 90 percent of the population own a property) make housing the largest asset of Chinese households: more than two-thirds of their total assets (Figure 2.2.1, panels 1 and 2). On the liability side, urban households in China have increased their borrowing. Mortgage loans from banks account for the largest share of their debt. Consistent with the life-cycle theory of debt, participation rates among urban Chinese households across age groups follow a hump shape and are highest for younger

Figure 2.2.1. Characteristics of China's Household Debt

(Percent)



Sources: IMF staff calculations, based on China Household Finance Survey; see Gan and others 2013 for details.
Note: Data shown are mainly for urban households from different income quintiles (Q1 to Q5, lowest to highest). The housing-to-assets ratio is defined as the ratio of housing assets to total assets. The mortgage-to-debt ratio is defined as the ratio of mortgage debt to total debt. The mortgage debt participation rate is computed across age groups. Debt-to-income (multiple) and debt-service-to-income (percentage) ratios by income quintiles are scaled by the share of each household quintile in total debt. The response of consumption-to-income shocks is the coefficient in the cross-sectional regressions of the percentage change in consumption on the percentage change in income between 2013 and 2015 among households that were tracked in the survey. In panel 2, "age" refers to the age of the head of household. For panel 5, a ratio above 4 indicates a highly indebted household.

Box 2.2 *(continued)*

households.[1] Household debt has become an increasingly important component of credit in China. As the household debt-to-GDP ratio rose from 18.7 percent to about 38 percent from 2007 to 2016, loans to households as a percentage of total loans issued by financial institutions increased from 19.4 percent to 31.3 percent over the same period.[2]

The debt burden of mortgage borrowers in urban areas has increased in recent years, although mortgage participation rates are still relatively low compared with advanced economies. The debt-to-income ratio increased across most income groups, especially for lower-income households. The debt service ratio, defined as total debt repayment as a percentage of total income, also increased for all income groups but especially for lower-income households (Figure 2.2.1, panel 3). The loan balance-to-value ratio, defined as the remaining loan balance as a percentage of self-reported housing value, also increased over time (Figure 2.2.1, panel 4). On the other hand, mortgage loan participation rates, especially for low-income households, are still low, which is consistent with China's economic and financial development level.

The increased household debt could amplify the macroeconomic consequences of negative shocks. Although household debt is about 38 percent of GDP in China, more than one-third of it is held by highly indebted households, defined as those with a debt-to-income ratio greater than 4 (Figure 2.2.1, panel 5). This means that deterioration in the balance sheets of these households could have an amplified negative impact on the banking sector as well as on the macroeconomy, even though loans to households, including home mortgages, in China are still a smaller fraction of banks' total assets than in advanced economies. In addition, empirical evidence based on tracked samples of Chinese households between 2013 and 2015 shows that consumption of households with high debt to income responds more strongly to income shocks (Figure 2.2.1, panel 6). This suggests that negative shocks to household balance sheets may amplify the effect on China's economy because of highly indebted households' higher marginal propensity to consume—a pattern consistent with evidence in advanced economies (for example, Mian, Rao, and Sufi 2013).

[1]Note that not many households of those ages 45–59 borrow for mortgages because a large share of today's housing stock still originates from the planned-economy period during which the government or state-owned enterprises distributed housing.

[2]Only domestic-currency (renminbi) loans are included. Data on total loans and loans to households are based on *Sources and Uses of Funds of Financial Institutions* published by the People's Bank of China.

Box prepared by Alan Xiaochen Feng, in collaboration with Feng Li and Xiaomeng Lu from the Survey and Research Center for China Household Finance at Southwestern University of Finance and Economics.

Box 2.3. A Comparison of US and Canadian Household Debt

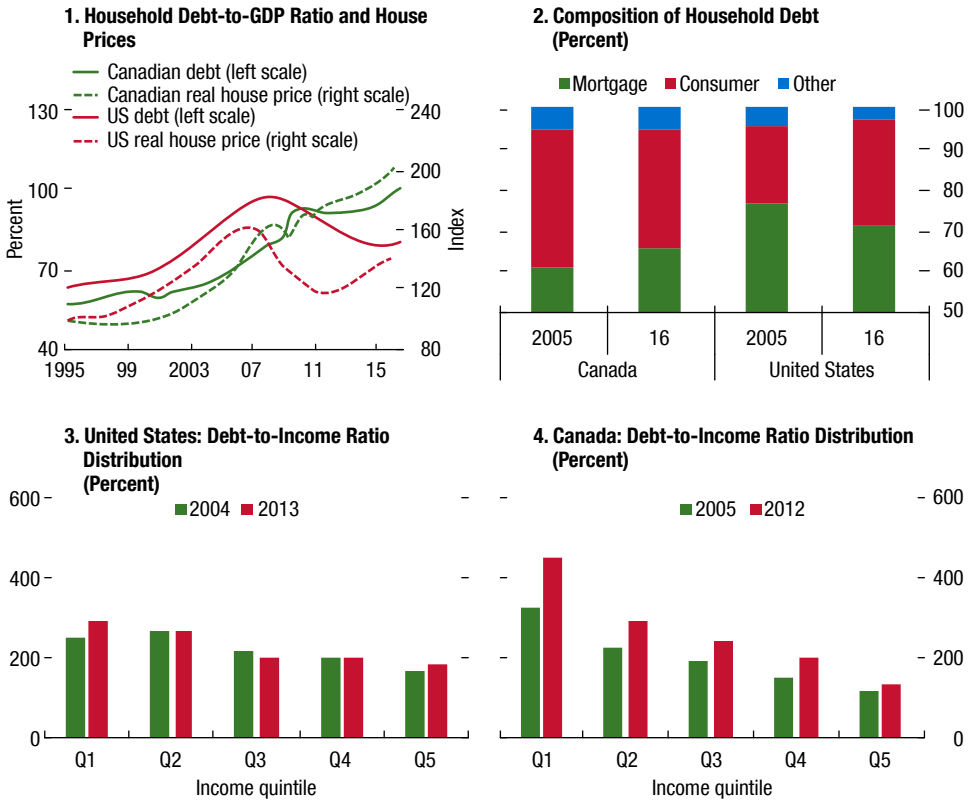
Until the global financial crisis, household debt levels evolved very similarly in the United States and Canada. US household debt increased from 56 percent in 1995 to nearly 100 percent of GDP in the first quarter of 2008 and from 62 percent to 80 percent in Canada (Figure 2.3.1, panel 1). Afterward, US household debt fell to below 80 percent by early 2017, whereas in Canada, it continued to rise to more than 100 percent. This reflects different house price and unemployment trends, as well as difference in the evolution of net wealth, which left Canadian households relatively better off than their US counterparts.

Box prepared by Adrian Alter, Alan Xiaochen Feng, and Nico Valckx.

The composition of household debt has changed in both countries. In response to continuously rising house prices, Canadian household debt became more tilted toward mortgage debt, which increased from 61 percent of total debt in 2005 to 66 percent of total debt in 2016 (Figure 2.3.1, panel 2). In the United States, where house prices fell by 40 percent from their peak in 2008, households' share of mortgage debt decreased, while consumer debt increased substantially, mainly because of increased student loan debt.

Leverage is very different across households. US households' leverage (as given by the debt-to-income ratio) remained broadly constant, except for the poorest income group, whose leverage increased slightly. In Canada, on the other hand, debt-to-income

Figure 2.3.1. US and Canadian Household Debt Developments and Characteristics



Source: IMF staff calculations, based on the Luxembourg Wealth Study, US Survey of Consumer Finances, and the Canadian Survey of Financial Security.
Note: Panels 3 and 4 refer to the median debt-to-income levels by income quintiles for mortgage borrowers.

Box 2.3 *(continued)*

ratios increased across all income groups, resulting in an average ratio almost 50 percent higher than in the United States (Figure 2.3.1, panels 3 and 4). Moreover, highly indebted households (those with debt-to-income ratios above 350 percent) held more than Can$400 billion, or 21 percent of the total household debt in Canada at the end of 2014, up from 13 percent before the crisis (Bank of Canada 2015).

High leverage may expose households to potentially adverse income shocks. The past recession in the United States showed that highly indebted households substantially reduced spending, which contributed to a significant decline in aggregate demand (Mian and Sufi 2011). Results reported in this chapter are in line with analysis by the Bank of Canada, which in its latest Financial System Review highlighted high household indebtedness and imbalances in the Canadian housing market as its two most important vulnerabilities; accordingly, it has implemented several macroprudential measures to mitigate these problems (IMF 2017).

Box 2.4. The Nexus between Household Debt, House Prices, and Output

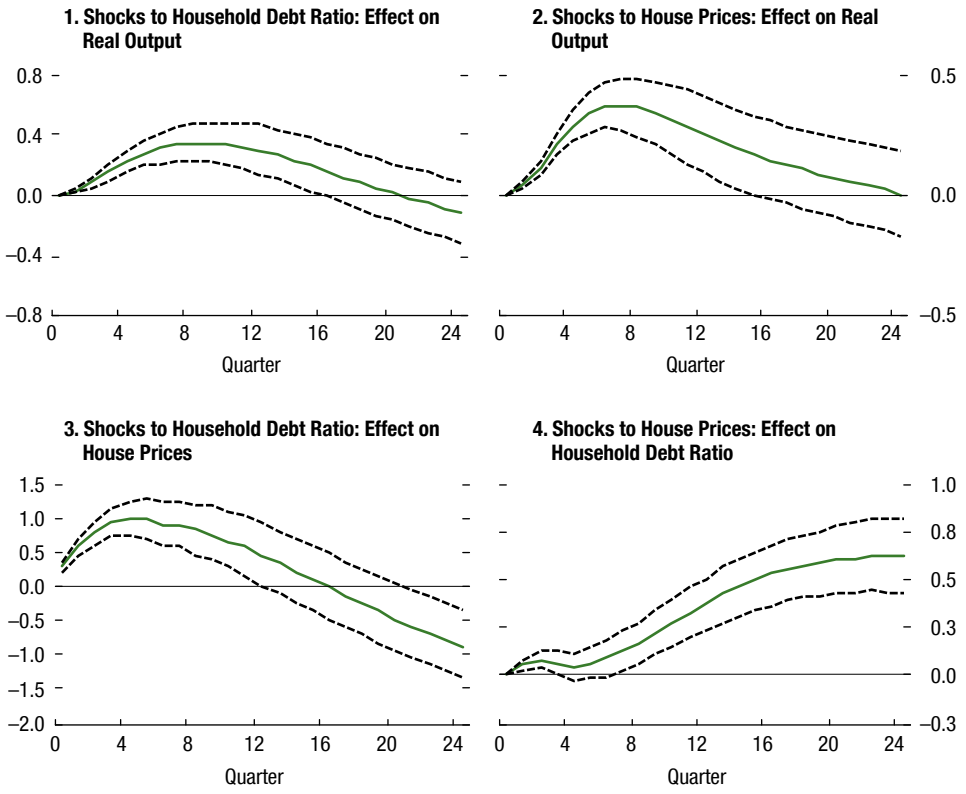
Household debt leads to higher house prices and more debt in the future, likely through reinforcing feedback effects. Dynamic panel vector autoregression analysis confirms that household debt has a short-term positive effect on real house prices and output.[1] A one standard deviation shock to household debt initially leads to higher real house prices and output, but over the medium term (after about three to five years) results in a decline (Figure 2.4.1, panels 1 and 3).[2] Higher house prices are positively associated with output in the short and medium term, but negatively in the long term (Figure 2.4.2). In response to a positive shock to house prices, household debt increases steadily over the short and medium term, while reverting to its long-term mean thereafter (Figure 2.4.1, panel 4).

Box prepared by Adrian Alter and Alan Xiaochen Feng.

[1]The panel vector autoregression model was conducted with a set of 27 countries with quarterly data available starting in 1998.

[2]These findings are consistent with Lombardi, Mohanty, and Shim 2017. See also Mian, Sufi, and Verner, forthcoming; Calza, Monacelli, and Stracca 2013; and Brunnermeier and others 2017.

Figure 2.4.1. Panel Vector Autoregression Dynamic Analysis
(Percentage points)

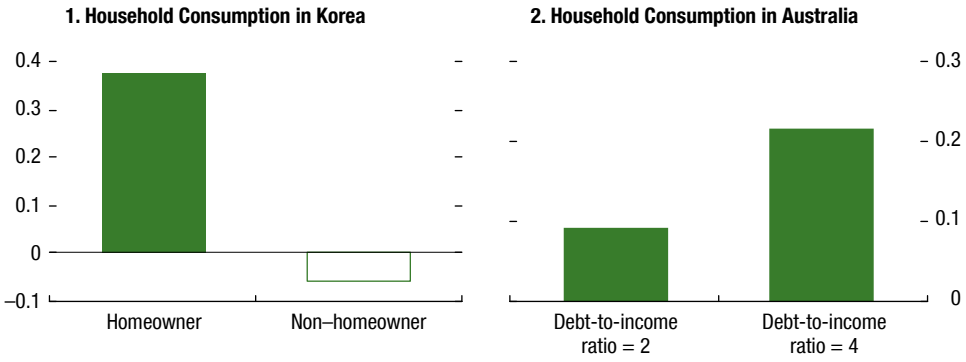


Source: IMF staff calculations.
Note: The figure presents impulse responses from a five-variable recursive panel vector autoregression with eight lags using quarterly data from 1998:Q1 to 2015:Q4, which includes country and time fixed effects. Shocks are identified using a Cholesky decomposition with the following order: log real GDP, corporate debt, household debt, log real house prices, and short-term interest rates. Household debt and corporate debt were scaled by GDP. The results are robust to a Nickell bias correction (using panel general method of moments techniques) and other specifications (for example, ordering, number of lags, changes instead of levels). Dashed lines represent 90 percent confidence intervals, computed using 500 Monte Carlo simulations.

Box 2.4 *(continued)*

Figure 2.4.2. Consumption Response to House Prices

(Percent)



Sources: Australian Bureau of Statistics; Household, Income and Labour Dynamics in Australia; Korean Labor and Income Panel Study; Statistics Korea; and IMF staff calculations.
Note: For households in Korea, regression coefficients are obtained by regressing the percentage change in consumption on changes in the local house price index between 2008 and 2014. For households in Australia, regression coefficients are obtained by regressing the percentage change in consumption on changes in the local house price index between 2012 and 2015. In both analyses, controls include the percentage change in household income, debt, and other demographic information, as well as state-level changes in income over the same period. Samples of households in both countries are restricted to those tracked over the period covered. Low leverage corresponds to a debt-to-income ratio of 2 and high leverage corresponds to a debt-to-income ratio of 4. Standard errors are clustered at the state or province level.

Micro-level panel survey data analysis confirms the impact of house prices on consumption and the role of debt. In Korea, the rise in the local house price index between 2008 and 2014 had a positive effect on household consumption, which is consistent with the initial positive response of GDP to house price shocks shown in the panel vector autoregression analysis.[3]

[3]This empirical exercise uses tracked samples of households between 2008 and 2014 and controls for changes in household income, demographic information, and city-level aggregates.

Such an effect is present only for homeowners, suggesting that the increase in house prices raises collateral value as well as perceived wealth for these households (Figure 2.4.2, panel 1). Similarly, in Australia, homeowners increased consumption in response to higher local house prices between 2012 and 2015, and the effect was stronger for households with high financial leverage. This finding indicates that higher household debt reinforces the impact of house prices on the real economy (Figure 2.4.2, panel 2).

Box 2.5. The Impact of Macroprudential Policies on Household Credit

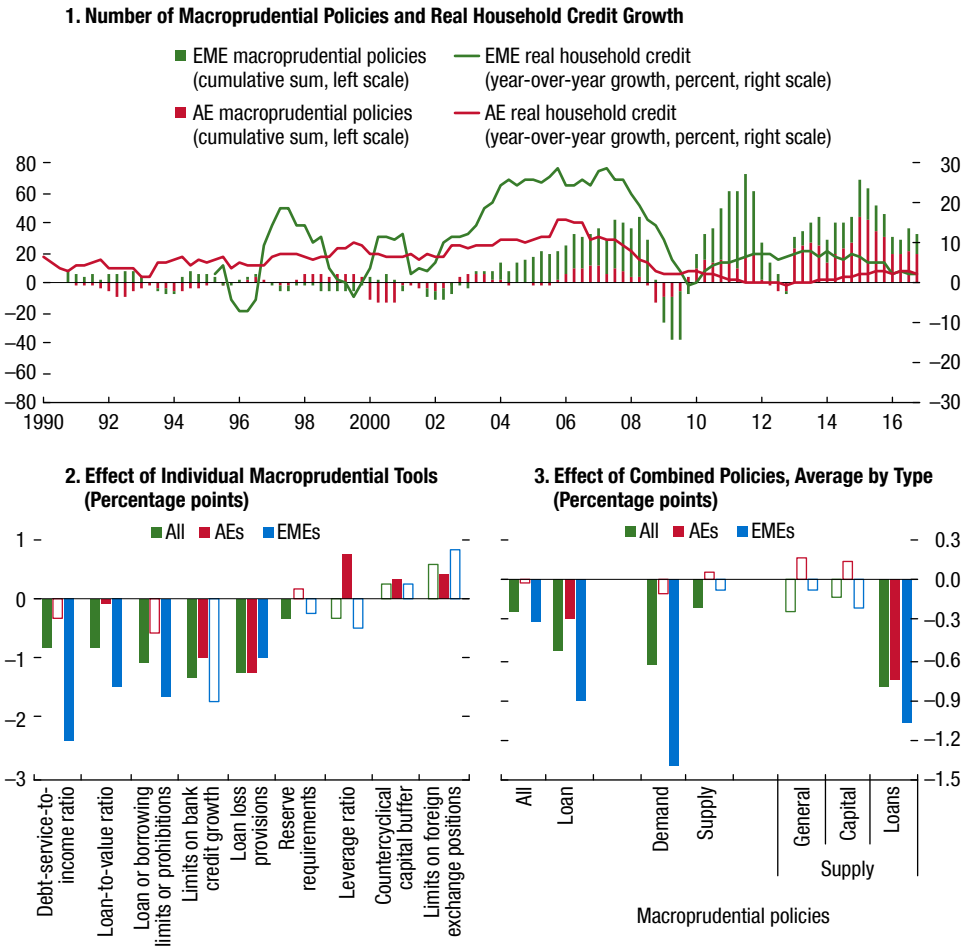
This box finds that macroprudential loan-targeted measures successfully reduce the growth of real household credit in both advanced economies and emerging market economies.

Many countries introduced or tightened macroprudential policy measures to limit systemic risk in the aftermath of the large credit boom that preceded the global financial crisis (Figure 2.5.1, panel 1). In theory, macroprudential policies reduce systemic risk by correcting externalities operating through the financial system. Such externalities include aggregate demand externalities and strategic complementarities among financial institutions, which amplify credit and asset price cycles.[1]

Box prepared by Adrian Alter and Machiko Narita.

[1]See, for example, Hanson, Kashyap, and Stein 2011; De Nicolò, Favara, and Ratnovski 2012; and IMF 2013.

Figure 2.5.1. Macroprudential Policy Tools and Household Credit Growth



Source: IMF staff calculations.
Note: In panel 1, the macroprudential policies show the cumulative sum of tightening (+) and loosening (–) policies. Panel 2 shows the estimated average effects on real household credit growth of one tightening event for each macroprudential measure, one at a time, in a panel regression of 62 countries (32 advanced economies and 30 emerging market economies). In panel 3, All comprises all 14 measures considered. Loan consists of demand-side and supply-side loans. Demand includes debt-service-to-income ratios and loan-to-value ratios. Supply measures are classified into General, Capital, and Loans. Supply (General) consists of reserve requirements, liquidity requirements, limits on foreign exchange positions, and taxes on financial institutions. Supply (Capital) consists of capital requirements, conservation buffers, the leverage ratio, and the countercyclical capital buffer. Supply (Loans) consists of limits on bank credit growth, loan loss provisions, loan restrictions, and limits on foreign currency loans. Shaded bars depict significant effects at the 10 percent confidence levels. See Annex 2.2 for estimation details. AEs = advanced economies; EMEs = emerging market economies.

Box 2.5 *(continued)*

In both advanced and emerging market economies, targeted macroprudential measures successfully reduce real household credit growth. From a set of 14 measures, 5 measures related to credit have robust negative effects (Figure 2.5.1, panel 2). These measures are limits on the debt-service-to-income (DSTI) ratio, limits on the loan-to-value (LTV) ratio, loan contract restrictions, limits on bank credit growth, and loan loss provisions. On average, a tightening of these measures leads to a 1 to 3 percentage point decline in real household credit growth, similar to Kuttner and Shim's (2016) results for LTV and DSTI ratio limits.[2] The effects are generally stronger in emerging market economies, corroborating the findings of Cerutti and others (2017).[3]

On the other hand, measures that are not targeted to loans do not exhibit strong effects in contracting household credit. Reserve requirements also tend to have negative effects, but they are smaller and less significant than targeted measures.[4] Leverage limits, conservation buffers, and limits on foreign exchange positions are positively associated with subsequent growth in household credit. Other measures, such as capital requirements and taxes on financial intermediaries, do not have significant effects. However, a tightening of general supply measures should increase the resilience of the financial system to aggregate shocks by building buffers. Previous studies also find weaker effects of nontargeted and capital measures and may explain their lack of effectiveness, including leakages. For example, tightening capital requirements may have little effect when banks hold ample capital. When examining the effects of measures by type, demand-side measures (DSTI and LTV) as well as loan-targeted supply-side measures (on domestic credit growth and loan loss provisions) are found to be effective (Figure 2.5.1, panel 3).[5]

[2]Other studies, using different data and methodologies, also show that tighter LTV and DSTI ratios reduce household credit growth. See Lim and others 2011; Arregui and others 2013; Crowe and others 2013; Krznar and Morsink 2014; and Jácome and Mitra 2015.

[3]Loan restrictions and limits on credit growth also appear to effectively contain corporate credit growth, to the tune of 2 to 3 percentage points, while other measures have a weak or insignificant impact. The latter could reflect firms' better access to (international) debt markets than households.

[4]See Arregui and others 2013; Crowe and others 2013; Vandenbussche, Vogel, and Detragiache 2015; and Kuttner and Shim 2016.

[5]Combining same-type measures allows the effects of multiple measures adjusted at the same time to be controlled for. For example, Kuttner and Shim (2016) report that changes in DSTI and LTV ratio limits are often coordinated.

Annex 2.1. Data Sources

Annex Table 2.1.1. Countries Included in the Sample for Household Debt and Data Sources

Country	Source	Start Year	Country	Source	Start Year
Advanced Economies			**Emerging Market Economies**		
Australia	BIS; JST	1952	Argentina	BIS	1994
Austria	BIS	1995	Bangladesh	Haver	2004
Belgium	BIS; JST	1950	Bolivia	Central Bank of Bolivia	1992
Canada	BIS; JST	1956	Botswana	IMF, MFS	2001
Cyprus	CEIC	1995	Brazil	BIS	1994
Czech Republic	BIS	1995	Bulgaria	ECRI	1995
Denmark	BIS; JST	1951	Chile	BIS; Central Bank of Chile	1983
Estonia	Haver; Bank of Estonia	1993	China	BIS	2006
Finland	BIS; JST	1950	Colombia	BIS	1996
France	BIS; JST	1958	Costa Rica	Central Bank of Costa Rica	1997
Germany	BIS; JST	1950	Croatia	Croatian National Bank	1993
Greece	Haver	1980	Egypt	Central Bank of Egypt	2002
Hong Kong SAR	CEIC	1982	FYR Macedonia	National Bank of the Republic of Macedonia	1995
Iceland	Haver; IMF, MFS	1995	Georgia	IMF, MFS	2001
Ireland	ECRI	1998	Ghana	IMF Bridge Data; IMF, MFS	2001
Israel	BIS	1992	Hungary	BIS	1989
Italy	BIS	1950	India	CEIC	1998
Japan	BIS; JST	1950	Indonesia	BIS	2001
Korea	BIS	1962	Jordan	Central Bank of Jordan	1993
Latvia	Haver	2003	Kazakhstan	Haver	1996
Lithuania	Haver	1993	Kenya	IMF, MFS	2001
Luxembourg	Haver	1992	Kuwait	CEIC	1997
Malta	ECRI	1995	Malaysia	IMF, MFS	2001
Netherlands	BIS	1990	Mauritius	IMF, MFS	2001
New Zealand	BIS	1990	Mexico	BIS	1994
Norway	BIS	1975	Mongolia	IMF, MFS	2001
Portugal	BIS	1979	Montenegro	ECRI	1995
Singapore	BIS	1991	Morocco	IMF, MFS	2001
Slovak Republic	National Bank of Slovakia	1993	Namibia	IMF, MFS	2001
Slovenia	Haver; IMF, MFS	2004	Nigeria	IMF, MFS	2001
Spain	BIS; JST	1950	Pakistan	IMF, MFS	2006
Sweden	BIS; JST	1975	Panama	IMF, MFS	2002
Switzerland	BIS; JST	1950	Paraguay	Central Bank of Paraguay; IMF, MFS	1990
United Kingdom	BIS; JST	1950	Philippines	Central Bank of the Philippines	1999
United States	BIS; JST; CEIC	1950	Poland	BIS	1995
			Romania	ECRI	1996
			Russia	BIS	1995
			Saudi Arabia	BIS; CEIC	1995
			Serbia	IMF, MFS	2003
			South Africa	Haver	1969
			Thailand	BIS	1991
			Turkey	BIS	1986
			Ukraine	IMF, MFS	2001
			Uruguay	BIS	2001
			Venezuela	BIS	2001

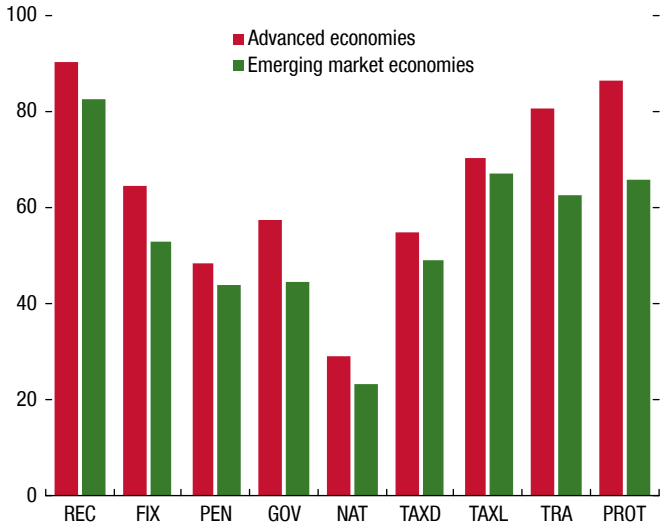
Sources: IMF staff.
Note: BIS = Bank for International Settlements; CEIC = CEIC Data Co. Ltd.; ECRI = Economic Cycle Research Institute; Haver = Haver Analytics; IMF, MFS = Monetary and Financial Statistics database; JST = Jordà-Schularick-Taylor Macrohistory Database.

Annex Table 2.1.2. Household Survey Data Sources

Country	Name of Survey
Advanced Economies	
Australia	Household, Income and Labour Dynamics in Australia Survey
Canada	Luxembourg Wealth Study, Survey of Financial Security
Euro Area	European Central Bank's Household Finance and Consumption Survey; Luxembourg Income Study (LIS); Luxembourg Wealth Study (LWS)
Japan	Keio Household Panel Survey
Korea	Korean Labor and Income Panel Study; Korean Statistical Information Service
Netherlands	DNB Household Survey
United Kingdom	British Household Panel Survey
United States	Luxembourg Wealth Study, Survey of Consumer Finances
Emerging Market Economies	
China	China Household Finance Survey

Source: IMF staff.

Annex Figure 2.1.1. Loan Characteristics, Rules, and Regulations



Source: IMF staff calculations.
Note: Figure is based on an IMF desk survey of the prevalence of certain debt characteristics in 80 countries. The desk survey reveals that a majority of countries have financial protection regulations (against predatory lending practices) and loan transparency rules and regulations (through credit registries or credit bureaus). In 80 percent of the sample, recourse is commonplace in loan agreements, whereas early prepayment restrictions feature in about 40 percent of the countries surveyed. Tax deductibility is common in half of the sample, with limitations on how much debt (or interest payments) households can deduct from their taxes. Fixed-rate mortgages (with the initial rate fixed for 10 or more years) are offered in most countries. Administrative restrictions on land supply are more prevalent in advanced economies (about 60 percent) than in emerging market economies (44 percent), whereas natural restrictions exist in about 30 percent of the countries surveyed (related to size of the country, livable land area, population density, and the like). FIX = fixed rates are offered; GOV = administrative restrictions on land supply; NAT= natural restrictions on density of development, such as topography and geography; PEN = restrictions on early payment; PROT = consumer financial protection legislation in place; REC = mortgage loans are full recourse; TAXD = debt or interest payments are tax deductible; TAXL = limits on TAXD exist; TRA = credit registry.

Annex Table 2.1.3. Description of Explanatory Variables Used in the Chapter

Variables	Description	Source
Macro-level Variables		
Nominal GDP	Gross domestic product, current prices, national currency	Jordà-Schularick-Taylor Macrohistory database; Penn World Table; IMF, World Economic Outlook database
Real GDP	Gross domestic product, constant prices, national currency	IMF, World Economic Outlook database
Real Private Consumption	Private final consumption, constant prices, national currency	IMF, World Economic Outlook database
Consumer Price Index	Consumer prices, period average, index	IMF, International Financial Statistics database
Population	Population, in millions of persons	IMF, World Economic Outlook database
Unemployment	Unemployment rate (percent)	IMF, World Economic Outlook database
Interest Rate	Three-month Treasury bill rate, money market rate, interbank market rate (percent)	Bloomberg Finance L.P.; IMF, International Financial Statistics database; Thomson Reuters Datastream
Bank Equity Index	Equity price index of the banking sector (or financial sector if banking sector price index not available)	Bloomberg Finance L.P.; Thomson Reuters Datastream
Stock Market Index	Overall stock price index	Bloomberg Finance L.P.; IMF, Global Data Source database; Thomson Reuters Datastream
Banking Crisis	Systemic banking crisis defined as (1) significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, and/or bank liquidations); (2) significant banking policy intervention measures in response to significant losses in the banking system	Laeven and Valencia 2013
Real House Price Index	House price index deflated by consumer price index	Jordà-Schularick-Taylor Macrohistory database; OECD, Global Property Guide; and IMF staff calculations
Exchange Rate	National currency units per US dollar, period average	Thomson Reuters Datastream
Real Effective Exchange Rate	Real effective exchange rate, based on consumer price index	IMF, Monetary and Financial Statistics database
Exchange Rate Regime	De facto exchange rate arrangement of the country	Ilzetzki, Reinhart, and Rogoff 2017 data set
Institutional Variables		
Financial Risk Index	Measure of a country's ability to pay its way by financing its official, commercial, and trade debt obligations; index ranges from 50 (least risk) to a low of 0 (highest risk)	International Country Risk Guide, PRS Group
Financial Development Index	Overall financial development index	Svirydzenka 2016
Capital Account Openness Index (Chinn-Ito Index)	An index measuring a country's degree of capital account openness	Chinn and Ito 2006 data set (updated)
Official Supervisory Power	Whether the supervisory authorities have the authority to take specific actions to prevent and correct problems; index ranges from 0 (no powers) to 14 (most powers)	Barth, Caprio, and Levine 2013
Overall Capital Stringency	Whether the capital requirement reflects certain risk elements and deducts certain market value losses from capital before minimum capital adequacy is determined; index ranges from 0 (least stringent) to 7 (most stringent)	Barth, Caprio, and Levine 2013
Income Share Held by Highest 20 Percent	Percentage share of income or consumption is the share that accrues to subgroups of the population indicated by deciles or quintiles	World Bank, World Development Indicators
Income Share Held by Lowest 20 Percent	Percentage share of income or consumption is the share that accrues to subgroups of the population indicated by deciles or quintiles	World Bank, World Development Indicators

Source: IMF staff.
Note: OECD = Organisation for Economic Co-operation and Development.

Annex 2.2. Methodology

This annex provides a general overview of the methodologies behind the various econometric exercises performed in this chapter.

Logit Analysis

The logit model analyzes how levels and changes in household debt affect financial stability. The model is given by

$$log\frac{P[S_{it} = 1|X_{it}]}{P[S_{it} = 0|X_{it}]} = \Psi_{0i} + \Psi_1 X_{it} + \Psi_2 X_{it} \mathrm{I}(\mathrm{HiDebt})_{it} + \epsilon_{it}, \quad \text{(A2.2.1)}$$

in which X_{it} refers to a vector of lagged changes and levels of household and corporate debt-to-GDP ratios, while the third term refers to interactions with an indicator I (HiDebt). The latter takes the value of one if country *i* experiences household debt exceeding 65 percent of GDP. Country fixed effects (Ψ_{0i}) were included in the estimation. The main metric to compare model performance is the area under curve. Annex Table 2.2.1 contains the underlying estimates.

Household Debt and Bank Equity Returns

This exercise provides an alternative measure of banking stress and assesses the role of household debt for future bank equity returns. According to the efficient market hypothesis, past household credit growth should not be correlated with future bank stock returns if investors correctly price the risks associated with the rise in household debt to the banking sector. However, downside risks may be neglected by investors during credit booms when market sentiments are high (for example, Cheng, Raina, and Xiong 2014; Baron and Xiong 2017), leading to systematic predictability of bank stock declines following increases in household debt. Following Baron and Xiong (2017), the empirical specification is given by

$$r_{c,t+k} - r^f_{c,t+k} = \alpha_c + \gamma_t + \beta_h \Delta\left(\frac{HHD}{GDP}\right)_{c,t} + \beta_f \Delta\left(\frac{NFCD}{GDP}\right)_{c,t} + \beta_d \times DivYld_{c,t} + X_{c,t}\delta + \epsilon_{c,t}, \quad \text{(A2.2.2)}$$

in which $r_{c,t+k}$ is the return in year *k* of the banking sector index in country *c;* is government bond

Annex Table 2.2.1. Logit Analysis: Probability of Systemic Banking Crisis

	(1)	(2)	(3)	(4)	(5)
Variables	**Dependent Variable: Systemic Banking Crises**				
Household Debt	4.037***		2.501***	1.270	2.091
	(0.783)		(0.925)	(1.276)	(1.716)
Δ Household Debt		40.05***	35.01***	35.60***	30.86***
		(6.482)	(6.334)	(7.161)	(8.451)
Corporate Debt				0.879	0.536
				(0.761)	(0.743)
Δ Corporate Debt				13.13***	15.62***
				(3.954)	(4.220)
Δ Household Debt × High HH Debt					24.41*
					(14.11)
High HH Debt					–1.355
					(0.896)
Constant	–5.949***	–3.741***	–5.465***	–5.224***	–5.253***
	(0.594)	(0.150)	(0.681)	(0.732)	(0.902)
Observations	1,223	1,033	1,033	1,020	1,020
Country Cluster	Yes	Yes	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes	Yes	Yes
Area under Curve	0.700	0.791	0.806	0.840	0.850
Number of Crises	46	37	37	37	37
Number of Clusters	40	34	34	34	34
Pseudo R^2	0.0612	0.142	0.153	0.204	0.218

Source: IMF staff calculations.
Note: Robust standard errors in parentheses. All regressors are lagged. The third lag of household debt change was used based on significance. High household debt (High HH Debt) dummy variable is set at 65 percent of GDP, representing the top quintile of the distribution. Banking crises are taken from the updated database by Laeven and Valencia (2013).
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

yield, and $DivYld_{c,t}$ is the dividend yield of the banking sector,

$$\Delta\left(\frac{HHD}{GDP}\right)_{c,t} = \left(\frac{HHD}{GDP}\right)_{c,t} - \left(\frac{HHD}{GDP}\right)_{c,t-1}$$

and

$$\Delta\left(\frac{NFCD}{GDP}\right)_{c,t} = \left(\frac{NFCD}{GDP}\right)_{c,t} - \left(\frac{NFCD}{GDP}\right)_{c,t-1} \quad \text{(A2.2.3)}$$

normalized by the standard deviation of each variable for each country, and $X_{c,t}$ includes control variables such as the past levels of household debt and corporate debt ratios.

The baseline model is estimated using the specification above. Two similar models are also estimated using probit analysis and quantile regressions. The probit analysis examines the relationship between past increases in the household debt ratio and the probability of bank equity crashes occurring in the next one to five years. Bank equity crashes are defined as having an annual stock return below the mean return by at least one standard deviation. In the quantile regressions, the relationship between past increases in the household debt ratio and future bank equity returns at different quantiles is examined.

Time Series Analysis of Household Debt, Income, and Consumption

Panel regressions are estimated following Mian, Sufi, and Verner, forthcoming, estimating future real GDP growth on changes in household debt and corporate debt ratios and lagged GDP growth rates. Different specifications are estimated, with changes in the debt ratio calculated over the past three years. In addition, level effects, thresholds, and nonlinearities are tested. Regression estimates are further differentiated by various groupings: advanced and emerging market economies, various institutional factors, and loan terms. Estimations are also performed over different time periods (before and after the global financial crisis) and were qualitatively very similar.

Specifically, the following general equation was estimated:

$$\Delta_h y_{i,t+h} = \alpha_i^h + \beta_{HH}^h \Delta_3 d_{i,t-1}^{HH} + \beta_F^h \Delta_3 d_{i,t-1}^F + X_{i,t-1}\Gamma^h + \epsilon_{it}^h \quad \text{(A2.2.4)}$$

in which α_i^h are country fixed effects, Δ_3 refers to three-year differences, $d_{i,t}^{HH}$ and $d_{i,t}^F$ are the household debt-to-GDP ratio and nonfinancial firm debt-to-GDP ratio, and $h = 0, \ldots, 6$ is the forecast horizon. The matrix X_{it} includes higher-order lags of the dependent variable as additional controls. Right-hand variables are lagged by one year. Annex Table 2.2.2. provides a summary of the major panel regression estimates.

Micro Data Analysis

Euro area panel data allow the effects of household leverage on consumption, using a longitudinal household panel, to be tested. Specifically, from a broader euro area household finance and consumption survey of 15 to 20 countries for 2010 and 2014, data for Belgium, Cyprus, Germany, Malta, and the Netherlands allow testing for the effects of initial household debt-to-income and loan-to-value ratios on changes in the consumption-to-income ratio.

The following cross-sectional regression is estimated, at the household level, with change in household food consumption (percent of income) as the dependent variable:

$$\Delta C_{i,2014} = \alpha_c + \beta_1 DTI_{i,2010} + \gamma Controls + \epsilon_i, \quad \text{(A2.2.5)}$$

in which debt-to-income ratio ($DTI_{i,2010}$) is a proxy for past household indebtedness; household characteristics (such as employment, education, age of the household head, household's net wealth and size) are considered *Controls*. In addition, the model includes country fixed effects (α_c).

Macroprudential Policies and Household Credit Growth

Analysis in Box 2.5 gauged the effectiveness of macroprudential tools for reducing household credit growth. More specifically, the following panel regression equation was estimated:

$$C_{i,t} = \rho C_{i,t-1} + \beta \text{MaPP}_{i,t-1} + \gamma X_{i,t-1} + \alpha_i + \mu_t + \epsilon_{i,t}, \quad \text{(A2.2.6)}$$

in which α_i and μ_t denote country and year fixed effects, i denotes country, and t the time period (quarter). The dependent variable, $C_{i,t}$, refers to year-over-year growth rate of real household credit. The main independent variable, MaPP, is the policy change indicator (that is, tightening or loosening) compiled by IMF staff for each of the 14 macroprudential tools (that is, limits on the debt-service-to-income ratio, loan-to-value ratio, loan restrictions, limits on bank

Annex Table 2.2.2. Panel Regression Estimates for Three-Year-Ahead Growth Regression on Household Debt and Policy Interaction Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Change HHD/GDP	0.104	0.141***	−0.588*	−0.062	−0.241*	−0.109	0.015	−0.758**	−0.796*
Change FirmD/GDP	−0.036*	−0.037*	−0.028*	−0.034*	−0.037*	−0.035*	−0.012*	−0.032*	−0.031*
HHD30 × ΔHHD	−0.261*	−0.367*	−0.373*	−0.360*	−0.280*	−0.435*	−0.080*	−0.310*	−0.304*
Financial Openness Index × ΔHHD	−0.120*							−0.123*	−0.093*
Fixed FX × ΔHHD		−0.301*						−0.113***	0.032
Financial Risk Index × ΔHHD			0.016*					0.020*	0.019*
Income Inequality × ΔHHD				0.002				−0.006***	−0.004*
Transparency × ΔHHD					0.285*			0.246*	0.202*
Financial Development Index × ΔHHD						0.369*		0.394***	0.445**
Financial Openness Index × Fixed FX							0.03		−0.588
Financial Openness Index × Fixed FX × ΔHHD							−0.058*		−0.090**
R^2 Adjusted	0.581	0.572	0.575	0.56	0.57	0.568	0.585	0.616	0.618
Observations	1,002	1,002	1,002	1,002	1,002	1,002	1,002	1,002	1,002
Number of Countries	57	57	57	57	57	57	57	57	57
Akaike Information Criterion	6.16	6.18	6.17	6.2	6.18	6.19	3.95	6.08	6.07
F-statistic	16.1	15.6	15.7	14.8	15.4	15.3	16.4	16.7	16.6
Log Likelihood	−2,991	−3,001	−2,998	−3,015	−3,004	−3,006	−1,885	−2,942	−2,938

Source: IMF staff estimates.

Note: All panel estimations include country fixed effects, time fixed effects, and base effects. Estimations are performed over a constant sample (for which data on all variables are available). Standard errors are robust estimators. Fixed FX = fixed exchange rate regime dummy; HHD = household debt; HHD30 = dummy if household debt-to-GDP ratio exceeds 30 percent; income inequality = difference between income share of top 20 percent and the bottom 20 percent income groups; transparency = a dummy variable, whether a credit registry or other form of borrower information data transparency exists.

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

credit growth, loan loss provisions, reserve requirements, liquidity requirements, limits on foreign exchange positions, capital requirements, conservation buffers, leverage ratio, countercyclical capital buffer, limits on foreign currency loans, and taxes on financial institutions) or macroprudential group indices (that is, all MaPPs, loan MaPPs, demand, supply, supply [general], supply [capital], and supply loans). MaPPs are the cumulative sum of the number of policy changes over the past year (that is, the past four quarters) to reflect the potential delayed effects. A vector of control variables, $X_{i,t}$, such as real output growth and domestic interest rates, is also included. The model is estimated with quarterly data from 62 countries (32 advanced economies and 30 emerging market economies) from the first quarter of 1990 to the fourth quarter of 2015, using both panel fixed effects and the system generalized method of moments technique as outlined by Arellano and Bover (1995).

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CHAPTER 3

FINANCIAL CONDITIONS AND GROWTH AT RISK

Summary

Changes in the state of the financial system can provide powerful signals about risks to future economic activity. As in the run-up to the global financial crisis, financial vulnerabilities, understood as the extent to which the adverse impact of shocks on economic activity may be amplified by financial frictions, often increase in buoyant economic conditions when funding is widely available and risks appear subdued. Once these vulnerabilities are sufficiently elevated, they entail significant downside risks for the economy. Thus, tracking the evolution of financial conditions can provide valuable information for policymakers regarding risks to future growth and, hence, a basis for targeted preemptive action.

This chapter develops a new, macroeconomic measure of financial stability by linking financial conditions to the probability distribution of future GDP growth and applying it to a set of major advanced and emerging market economies.

The analytical approach developed in the chapter can be a significant addition to policymakers' toolkit for macro-financial surveillance. The chapter shows that changes in financial conditions shift the distribution of future GDP growth. While a widening of risk spreads, rising asset price volatility, and waning global risk appetite are significant predictors of large macroeconomic downturns in the near term, higher leverage and credit growth provide a more significant signal of increased downside risks to GDP growth over the medium term.

Thus, at the present juncture, low funding costs and financial market volatility support a sanguine view of risks to the global economy in the near term. But the increasing leverage signals potential risks down the road. A scenario of rapid decompression in spreads and an increase in financial market volatility could significantly worsen the risk outlook for global growth. These findings underscore the importance of policymakers maintaining heightened vigilance regarding risks to growth during periods of benign financial conditions that may provide a fertile breeding ground for the accumulation of financial vulnerabilities.

A retrospective, real-time analysis of the global financial crisis shows that forecasting models augmented with financial conditions would have assigned a considerably higher likelihood to the economic contraction that followed than those based on recent growth performance alone.

Improvements in predictive ability of severe economic contractions, even over short horizons, can be important for timely monetary and crisis-management policies. The ability to harness longer-horizon information from asset prices and credit aggregates can also help in the design of policy rules to address financial vulnerabilities as they develop. The richness of the results obtained across countries suggests that there is significant scope for policymakers to further adapt the approach used in this chapter to specific country conditions including, importantly, to reflect structural changes in financial markets and the real economy.

Introduction

The global financial crisis was a powerful reminder that financial vulnerabilities can increase both the duration and severity of economic recessions. Financial vulnerabilities, understood as the extent to which the adverse impact of shocks on economic activity may be amplified by financial frictions, usually grow in buoyant economic conditions when investment opportunities seem ample, funding conditions are easy, and risk appetite is high. Once these vulnerabilities are sufficiently high, they can entail significant downside risks for the economy.

This interplay between shocks, financial vulnerabilities, and growth suggests that financial indicators can provide important intelligence regarding risks to the economic outlook. Policymakers have devoted considerable attention to translating the information content of financial indicators into an assessment of financial vulnerability. Approaches that have been used include expert judgment, stress tests, and heatmaps based on multiple early-warning indicators and broad financial conditions indices. These approaches all assess financial vulnerability by linking the state of the financial system to the probability of a financial crisis or bank capital shortage.

Because policymakers care about the whole distribution of future GDP growth, linking the state of the financial system to such a distribution would enhance macro-financial surveillance. Policymakers would then be able to specify bad outcomes in terms of their risk preferences. For example, it would be possible to calculate the likelihood of output growth being below a given level and to identify thresholds for financial indicators, such as leverage, that signal heightened tail risks to growth.

This chapter develops a new analytical tool that maps financial conditions into the probability distribution of future GDP growth. In this chapter, financial conditions correspond to combinations of key domestic financial market asset returns, funding spreads, and volatility; domestic credit aggregates; and external conditions such as measures of global risk sentiment. The methodological approach extends a nascent literature that derives a direct empirical link between financial conditions and risks to the real economy and applies it to 21 major advanced and emerging market economies over the near and medium term.

The chapter examines how financial conditions provide information regarding risks to future economic growth across countries and time horizons. In advanced economies, there may be a stronger association between financial variables and future economic activity than in emerging market economies because more economic risks are traded in deeper financial markets. But, in both cases, asset prices may remain buoyant until shortly before risks materialize, as the run-up to the global financial crisis showed. Thus, incorporating information on credit aggregates such as leverage into measures of financial conditions may improve forecasts of risks to growth, especially over the medium term.

The chapter addresses the following specific questions:

- Do changes in financial conditions signal risks to future GDP growth? Are they equally informative for advanced and emerging market economies, about the intensity of recessions and the strength of booms, and over different time horizons?
- What types of financial variables are more informative regarding the risks to growth at different time horizons and in different countries?
- Could we have used financial conditions to shed light on the likelihood of extremely negative growth outcomes of the past, such as the global recession following the bankruptcy of Lehman Brothers?
- How can policymakers make use of this new tool of macro-financial surveillance?

The main findings are as follows:

- Changes in a country's financial conditions shift the distribution of future GDP growth in both advanced and emerging market economies. A tightening of financial conditions, reflected in a decompression in spreads or an increase in asset price volatility, is a significant predictor of large macroeconomic downturns within a one-year horizon. Moreover, in emerging market economies, tighter financial conditions could also portend stronger booms over the subsequent four quarters, possibly because of procyclical capital flows.

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- Asset prices are most informative about risks to growth in the short term, whereas credit aggregates provide more information over longer time horizons. A rising cost of funding and falling asset prices signal a greater threat of severe recession at time horizons of up to four quarters. Higher leverage signals increased downside risk to growth at horizons between one and three years.
- Movements in commodity prices and exchange rates affect the real economy in a significant, albeit complex, manner, making a simple economic interpretation of their predictive content challenging. On the other hand, a souring of global risk sentiment increases downside risks to growth at short time horizons of one quarter.
- In addition to these common patterns, there is heterogeneity in the information content of financial conditions for growth risks across countries. For example, while asset prices are no longer informative over horizons longer than a year for advanced economies, they remain so for emerging markets.
- A retrospective real-time analysis of the global financial crisis shows that forecasting models augmented by financial conditions would have assigned a much higher likelihood to the economic contraction that followed than those based on recent growth performance alone.

The chapter's approach to linking financial conditions and risks to growth can help policymakers in numerous ways. The findings underscore the importance of policymakers maintaining heightened vigilance regarding risks to growth during periods of benign financial conditions that may provide a fertile breeding ground for the accumulation of financial vulnerabilities. Policymakers may respond to signals of an imminent near-term dire economic outcome with crisis-management-type discretionary policy actions that encompass a range of monetary and macroprudential tools. More broadly, this also helps in the design of policy rules to address financial vulnerabilities as they develop through the introduction of appropriate countercyclical macroprudential tools. In this regard, the output of the forecasting models could be used to calibrate parameters of structural macro-financial models used to guide such policy.[1] The richness of the results obtained across countries suggests that there is significant scope for authorities to further adapt the broad approach used in this chapter to specific country conditions, including, importantly, to reflect structural changes in financial markets and the real economy.

The rest of this chapter is organized as follows. The next section discusses conceptual issues related to the links between macro-financial conditions, financial vulnerabilities, and risks to the outlook for economic growth. The subsequent section looks at how asset prices and financial aggregates combine to signal short- to medium-term risks to future GDP growth. The section after that provides an empirical assessment of the degree to which the information contained in measures of financial conditions can help forecast risks to economic growth in major advanced and emerging market economies over horizons up to one year. The final section discusses policy implications. Annexes explain the potential policy applications, construction of financial conditions, and modeling of risks to growth in more detail.

Financial Conditions and Risks to Growth: Conceptual Issues

Economic growth has a complex and nonlinear relationship with shocks and financial vulnerabilities. Theory and recent experience both support the view that financial vulnerabilities increase risks to growth.[2] When investment opportunities seem abundant and the means of financing them are easily and cheaply available, financial vulnerabilities tend to increase. Once such vulnerabilities are sufficiently high, they can amplify and prolong the impact of shocks on economic activity. GDP growth responds nonlinearly to shocks in the presence of financial vulnerabilities, which increases the likelihood of severely negative economic outcomes.[3] Under such circumstances, assessments of both the baseline growth outlook and the risks to such an outlook are informed not only by the span and severity of relevant risk factors that are the source of shocks, but also by the intelligence provided by the interplay of factors that increase financial vulnerability.

[1]Just as estimated vector autoregression models have been used to calibrate the parameters of linear dynamic general equilibrium models used to pin down optimal monetary policy rules (for example, Christiano, Eichenbaum, and Evans 2005; Del Negro and Schorfheide 2009).

[2]Empirical evidence shows that recessions accompanied by financial crises are typically much more severe and protracted than ordinary recessions (Claessens, Kose, and Terrones 2011a, 2011b).

[3]Annex 3.1 provides a framework for understanding the joint dynamics of financial vulnerabilities and growth risks in a structural macro model.

Several factors cause financial vulnerabilities to grow in a buoyant macro-financial environment. Ease of borrowing and high asset prices reduce the incentives to manage liquidity and solvency risks. Perceptions of high investment returns relative to the cost of funding and of the improved quality of collateral incentivize households and firms to increase their leverage without taking into account the potential negative externalities resulting from their collective borrowing decisions (Bianchi 2011; Korinek and Simsek 2016; Bianchi and Mendoza, forthcoming). Booming asset prices also boost the capital adequacy, lending capacity, and risk appetite of financial intermediaries (Brunnermeier and Pedersen 2009; Adrian, Moench, and Shin 2010; Adrian and Shin 2014). As intermediaries respond by increasing short-term wholesale funding to finance long-term credit exposures, maturity mismatches and other balance sheet weaknesses accumulate in the financial sector. For example, lenders' incentives to invest in costly underwriting are reduced, which can result in significant mispricing of credit risk (Gorton and Ordoñez 2014).

The need to lower significant debt and correct balance sheet mismatches can clog financial intermediation, investment, and growth for a long time once the credit cycle turns. With vulnerabilities substantially elevated, even small negative shocks can cause significant reversals because they force lenders to face up to the true quality of exposures and collateral. This results in a significant tightening in credit conditions. Some firms and households may be forced into default, while others may have to liquidate assets. The ensuing pressure on lenders' profits and collateral values can then generate further rounds of contraction in credit, investment, and growth. In addition to the direct negative impact of these events on lenders' profits, rising volatility and risk spreads constrain lenders' capacity to bear risk by increasing the capital required as a buffer against existing exposures (He and Krishnamurthy 2013; Brunnermeier and Sannikov 2014). In such circumstances, risk-bearing capacity will be affected not only by capital constraints but also by funding liquidity concerns (Gertler, Kiyotaki, and Prestipino 2017).

A large body of empirical work has examined the information content of asset prices in forecasting the *baseline* growth outlook.[4] Various asset prices have been found to be useful predictors of future output growth in some countries and in some periods. Combining forecasts obtained from models with individual asset prices appears to result in more consistent, higher-quality forecasts. Short-term yields on risk-free securities and term spreads capture the stance of monetary policy and therefore contain useful information about future economic activity (Laurent 1988; Estrella and Hardouvelis 1991; Bernanke and Blinder 1992; Estrella and Mishkin 1998; Ang, Piazzesi, and Wei 2006). Corporate bond spreads signal changes in the default-adjusted marginal return on business fixed investment (Philippon 2009) and shocks to the profitability and creditworthiness of financial intermediaries (Gilchrist and Zakrajšek 2012).[5] There is some evidence that elevated stock-return volatility can be a useful predictor of output contraction over short horizons (Campbell and others 2001), although empirical evidence for the predictive content of stock returns is weak (Campbell 1999; Stock and Watson 2003).

The key departure of this chapter is to focus on the information content of financial indicators in forecasting *risks* to growth. In addition to asset prices, credit aggregates can also be expected to provide information on the risks to growth in the short, medium, and long term. For example, a combination of low leverage and buoyant asset prices is likely to correspond, over the short term, to high expected growth (an optimistic *baseline* outlook) and a low likelihood of adverse outcomes (sanguine *risk* outlook as represented, potentially, by a probability density of short-term growth with relatively low variance). On the other hand, theory suggests that such an environment might be ideal for a buildup of vulnerabilities over the medium term, ultimately increasing the likelihood of low growth outcomes. As such a possibility becomes more certain, spreads and market volatility would rise and asset prices would fall.[6] Other financial variables can

[4]Stock and Watson (2003) produce a comprehensive survey of the literature up to the early 2000s.

[5]Gilchrist and Zakrajšek (2012) demonstrate the superiority of their constructed bond spread over alternative proxies for the default spread investigated in the earlier literature; for example, the Baa-Aaa bond spread (Bernanke 1983), the commercial paper–Treasury bill spread (Stock and Watson 1989; Friedman and Kuttner 1998), and the so-called junk bond spread (Gertler and Lown 1999).

[6]Financial indicators can be classified into two types. Fast-moving asset prices tend to signal risks to growth over the near term, whereas balance sheet aggregates change gradually over time and may indicate risks over longer horizons. The evolution of aggregates and prices is not by any means independent. For example, the growth in aggregates may, beyond a point, change market expectations of risks. This would be reflected in tightening spreads, which then signal risks to growth in the near term. For a discussion, see Adrian and Liang 2016 and Krishnamurthy and Muir 2016.

also be very informative in the context of small open advanced economies and emerging market economies. These variables include the nominal exchange rate and commodity prices, which may affect the cost of external funding and the availability of international collateral (Caballero and Krishnamurthy 2006).

This chapter refers to such a combination of financial indicators, or an index constituted of them, as financial conditions. The term "financial conditions" often refers to the ease of funding (Chapter 3 of the April 2017 *Global Financial Stability Report* [GFSR]), but here it is used to refer to the combination of a broad set of financial variables that influence economic behavior and thereby the future of the economy.[7]

This chapter examines two alternative approaches to constructing measures of financial conditions from the information contained in several financial indicators. One attractive option is a single financial conditions index (FCI). An important advantage of such a univariate FCI is the parsimony with which it aggregates the information content of multiple financial indicators. Parsimony is highly desirable for forecasting because it reduces parameter uncertainty, but it may lead to suppressing the information provided by certain variables by commingling them with other, more volatile indicators in a single index. For example, the higher variability of asset prices and risk spreads may lead them to dominate univariate FCIs, with credit aggregates being assigned small factor loadings (as is indeed the case in the application described below). Since credit aggregates may carry significant information about risks to growth at longer horizons, the chapter pursues a second approach wherein financial indicators are partitioned into three separate groups based on economic similarity. The three subindices are the *domestic price of risk* (risk spreads, asset returns, and price volatility), *credit aggregates* (leverage and credit growth), and *external conditions* (global risk sentiment, commodity prices, and exchange rates). The separation of a large set of financial indicators into these three predetermined categories is a reasonable compromise between maintaining parsimony, allowing various classes of indicators to provide separate signals about risks to growth at different horizons, and being able to provide a more direct economic interpretation of the various subindices.

[7]This notion of financial conditions is similar to the definition proposed by Hatzius and others (2010). See Annex 3.2 for details on the construction of financial conditions used in this chapter.

The chapter's empirical framework is centered on forecasts of the probability distribution of future growth outcomes based on financial conditions in a way that allows for nonlinearity and state dependence. Building on the literature on conditional density forecasting and recent research on forecasting the distribution of growth in the United States, the chapter uses financial conditions to forecast the probability distribution of future GDP growth in major advanced and emerging market economies for horizons of up to three years through quantile projections.[8] The flexibility of this approach captures the rich nonlinear interaction between shocks, financial vulnerabilities, and economic outcomes predicted by theory. For instance, consider two combinations of financial indicators that forecast the same future median growth rate. The first combination forecasts much greater downside growth risk (that is, a probability density with a significantly fatter left tail) than the second. This indicates that for a constant distribution of fundamental shocks, the economy is more likely to experience a very bad economic outcome in the future under the first configuration than under the second. In this sense, the first combination signals a financial system that is more vulnerable. These density forecasts can subsequently be exploited to construct measures of risks to economic growth associated with the state of the financial system.

Such an approach provides a natural way of assessing financial vulnerability that has several distinct advantages. First, the estimated link between financial conditions and the distribution of future economic activity would provide a close measure of financial vulnerability, understood as the extent to which the financial system amplifies shocks. Second, to the extent that policymakers care about the whole distribution of future GDP growth, it provides a complete depiction of the risks to economic activity associated with the state of the financial system. Third, it allows policymakers to define risk tolerance in terms of GDP growth, which is more general than in terms of the probability of a financial crisis as defined under specific criteria or another ad hoc metric. For instance, this approach gives precise answers to questions such as the probabil-

[8]See Annex 3.3 for details on the empirical framework. Conditional density forecasting is surveyed by Tay and Wallis (2000); Corradi and Swanson (2006); and Komunjer (2013). The chapter's methodology builds on some recent studies (Adrian, Boyarchenko, and Giannone 2016; De Nicolò and Lucchetta 2017) that establish a direct empirical link between financial conditions and risks to economic growth.

ity of GDP growth being less than –3 percent one year ahead given the current—or any hypothetical—state of the financial system.

How Do Changes in Financial Conditions Indicate Risks to Growth?

Over a horizon of one to four quarters, tighter financial conditions—as reflected in higher univariate FCIs—predict increased downside risks to GDP growth in most advanced economies and a more uncertain growth outlook in several emerging market economies. An increasing domestic price of risk signals an elevated threat of imminent, severe recession in advanced and emerging market economies. Rising leverage is a significant predictor of elevated downside risk over the medium term. Country-specific results vary considerably, suggesting a rich interplay of the drivers of growth risk.

What Underpins Economies' Financial Conditions Indices?[9]

The drivers of economies' FCIs vary considerably across a sample of major advanced and emerging market economies.[10] An increase in the FCI corresponds to tighter financial conditions, that is, higher spreads and volatility, lower asset prices, worsening risk sentiment, exchange rate depreciation, and unfavorable commodity price movements. Beyond this common finding, the relative importance of these factors in determining the evolution of FCIs varies considerably across countries. Higher corporate funding costs and worsening global risk sentiment (as captured by rising levels of the Chicago Board Options Exchange Volatility Index [VIX] and Merrill Lynch Option Volatility Estimate [MOVE] Index) tighten financial conditions across the board. But while sovereign spreads are clearly important in emerging market economies, they are rarely so in advanced economies. And while increasing commodity prices loosen financial conditions in exporters such as Australia, Brazil, Canada, Chile, and Russia, they tighten them in commodity-importing countries. Exchange rate appreciation uniformly loosens financial conditions.[11] In the case of emerging market and small open economies, this may reflect the correspondence of an appreciating exchange rate with strong capital inflows. In general, asset price shocks appear to be more important in driving changes in FCIs than credit aggregates. This pattern, however, may reflect the slower speed at which credit adjusts relative to changes in GDP at turning points in the economic cycle, especially at the end of economic booms preceding financial crises.

What Information Do Univariate FCIs Convey about Future Growth?

An increase in the FCI would signal higher downside risks in both advanced and emerging market economies. An increase in the global FCI signals heightened downside risk to world GDP growth (Figure 3.1).[12] Movements in the FCI are especially powerful signals of changes in downside tail risk to the global economy but are less informative about the baseline growth outlook and the strength of economic booms. This is reflected in the fact that the forecast of the left tail of the distribution of global GDP growth decreases significantly in response to an increase in the FCI both one quarter and four quarters ahead. In contrast, the forecasts of the central tendency of GDP growth (as captured by the median growth rate) and of the strength of booms (at the right tail of the growth distribution forecasts) are considerably less responsive to changes in the FCI, and their movement is apparent only for large changes in the FCI such as those observed in the global financial crisis. This is also the case for individual countries—the forecasts of the worst-case outcomes (at the 5th percentile of the future GDP growth distribution) are between 3 times (United States) and more than 10 times (Australia) more sensi-

[9]In this subsection, financial conditions reference the univariate FCIs described in the preceding section.

[10]The financial indicators that constitute a country's FCIs may evolve over time for many reasons, including changes in risk appetite or investor risk sentiment. The methodology used to construct the FCIs, the list of financial indicators, and the sample of countries are described in detail in Annex 3.2.

[11]Exchange rate movements may reflect a complex combination of factors. With respect to a country's FCI, changes in the exchange rate are most likely to be associated with changes in the ease of external financing conditions, which may relate either to evolving global funding conditions and risk sentiment or changes in the market's perception of the country's creditworthiness or both. Exchange rate depreciations are, in such an association, a reflection of a worsening of global conditions or in market perceptions of a country's risk profile. Empirically, such an association appears to apply to most countries covered in the chapter, although the link has been noted in the literature as relevant primarily for emerging market economies.

[12]The global FCI is defined as the first principal component of the country-level FCIs.

tive to changes in FCIs than the forecasts of the central tendency of economic growth.

Easing of global financial conditions through 2016 signaled reduced tail risk to global growth for 2017. This is evident in the upward movement in the bottom tail of the GDP growth density forecast (5th percentile) for the world economy (Figure 3.1) and a similar movement in several countries, including Australia, Brazil, South Africa, Turkey, and the United States (Figure 3.2).[13]

Nonetheless, FCIs do carry significant information regarding upside risks to future economic growth for emerging markets (Figure 3.3). In Brazil, Korea, and Mexico, higher levels of the FCI portend a more uncertain growth outlook at a one-year horizon, as reflected in coefficients of opposite signs at the lowest and highest quantiles (which imply fatter and longer tails at both ends of the distribution of future GDP growth). In some commodity-exporting countries, such as Chile, tightening FCIs appear to signal risk of stronger recessions as well as economic booms of lower intensity (Figure 3.3, panel 2).

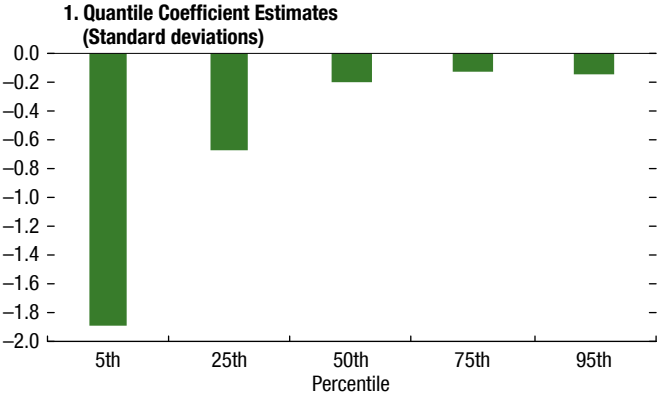
Different properties of advanced and emerging market economy business cycles may account for the differing significance of the information provided by changing FCIs across countries. Some emerging market economies and commodity exporters may have a more pronounced and symmetrical boom-bust cycle that is closely tied to export-commodity prices and global risk sentiment. Positive developments in either factor can motivate significant capital inflows, relaxing domestic financial constraints on growth.[14] When the risk environment reverses, capital flows may retrench, exchange rates can depreciate, and investment and growth can decline (Aguiar and Gopinath 2007). This may explain why a tightening of financial conditions can move the density of GDP growth to the left (Figure 3.3, panel 2). More broadly, increases in FCIs in emerging market economies may reflect domestic interest rate hikes targeted at attenuating overheating due to high domestic demand. But the higher interest rates may attract

[13]The exact magnitude of the movements can be improved by further country-specific calibration that, for instance, increases the number of financial indicators used in FCI construction, but the direction of the movements indicated by the model is quite robust and showcases the potential of this methodology.

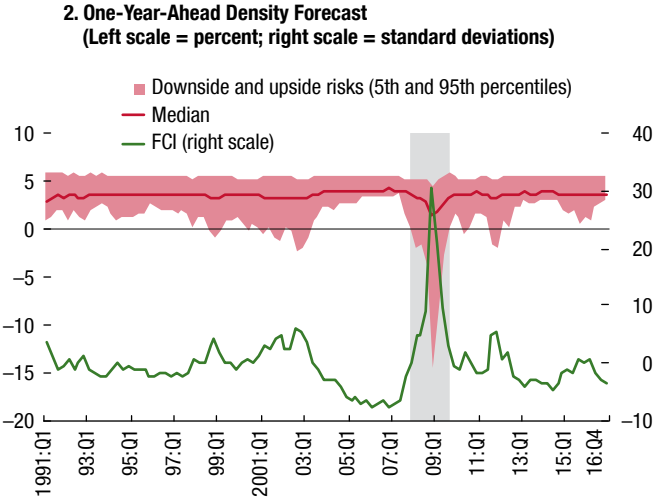
[14]For the role of commodity prices in explaining the cyclical movements of capital flows to emerging market economies, see, for example, Chapter 4 of the April 2017 *Regional Economic Outlook* for the Western Hemisphere.

Figure 3.1. Tighter Financial Conditions Forecast Greater Downside Tail Risk to Global Growth

As financial conditions tighten, the probability of a large economic contraction increases ...



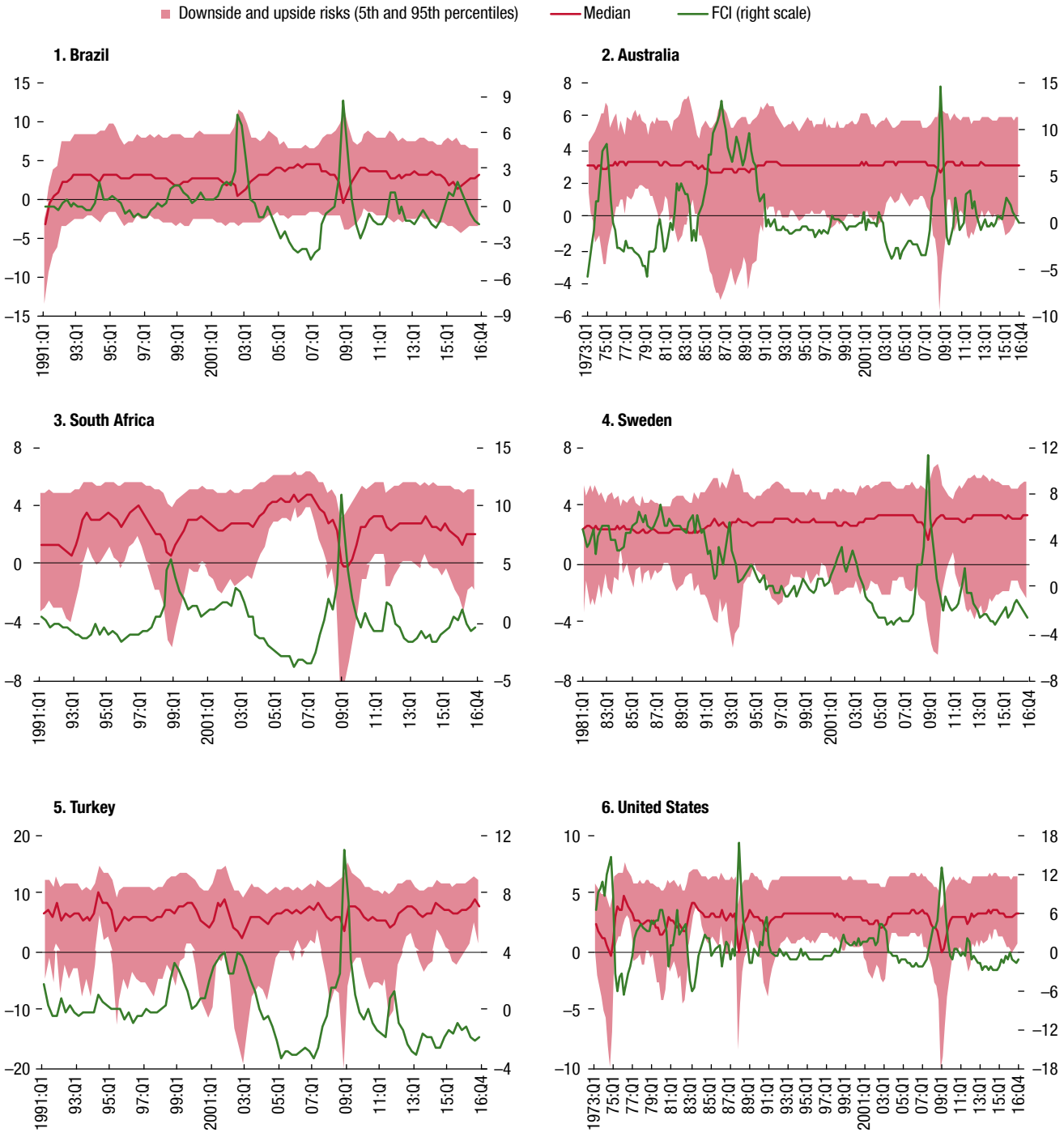
... as was seen in the recent global financial and euro area sovereign debt crises.



Sources: Bloomberg Finance L.P.; Haver Analytics; IMF, Global Data Source and World Economic Outlook databases; Thomson Reuters Datastream; and IMF staff estimates.
Note: Panel 1 depicts the estimated coefficients on the current quarter FCI in a quantile regression of four-quarters-ahead GDP growth on current quarter FCI and GDP growth. Panel 2 depicts the time series of estimated, conditional 5th, 50th, and 95th quantiles of four-quarters-ahead GDP growth. The median (red) line denotes the forecast of the 50th quantile of GDP growth made four quarters earlier using the methodology described in Annex 3.3. The shaded area is bound at the top and bottom by, respectively, the forecasts of the 95th and 5th quantiles of GDP growth made four quarters earlier. FCI = financial conditions index.

Figure 3.2. Risk of Severe Recessions Is Especially Sensitive to a Tightening of Financial Conditions in Major Advanced and Emerging Market Economies

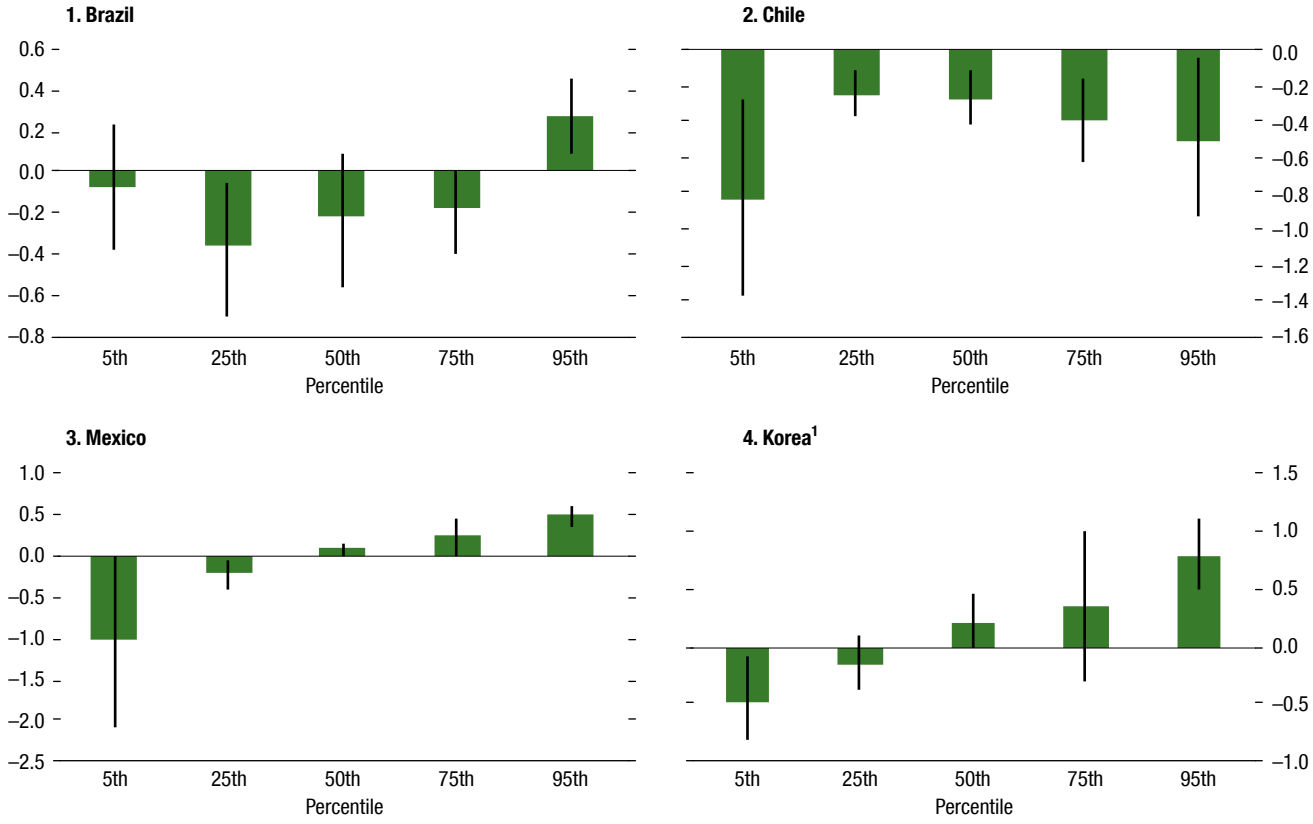
(One-year-ahead density forecasts; left scale = percent; right scale = standard deviations)



Sources: Bloomberg Finance L.P.; Haver Analytics; IMF, Global Data Source and World Economic Outlook databases; Thomson Reuters Datastream; and IMF staff estimates.

Note: The country-specific financial conditions indices (FCIs) are constructed using the methodology described in Annex 3.2. The median (red) line at each point in time denotes the forecast of the 50th quantile of GDP growth made four quarters earlier using the methodology described in Annex 3.3. The shaded area is bound at the top and bottom by, respectively, the forecasts of the 95th and 5th quantiles of GDP growth made four quarters earlier.

Figure 3.3. In Emerging Market Economies, Changes in Financial Conditions Also Affect Upside Risks
(Quantile regression estimates for selected emerging market economies: four quarters ahead)



Sources: Bloomberg Finance L.P.; Haver Analytics; IMF, Global Data Source and World Economic Outlook databases; Thomson Reuters Datastream; and IMF staff estimates.
Note: The panels depict estimated coefficients on the current quarter financial conditions index (FCI) from quantile regressions of four-quarters-ahead GDP growth on current quarter FCI and GDP growth. The coefficients are standardized to depict the impact of a one standard deviation increase in current quarter FCIs on four-quarters-ahead GDP growth (also expressed in standard deviations).
[1]In line with Morgan Stanley Capital International (MSCI) markets classification criteria, Korea is classified as an emerging market economy in panel 4.

capital inflows and thereby extend ongoing credit and economic booms. This may explain why tightening of financial conditions appears to be a good indicator of growing positive and negative risks around the baseline (Figure 3.3, panels 1, 3–4).

Which Asset Prices and Aggregates Best Signal Growth Risks at Various Time Horizons?

Asset prices are differentially informative regarding the domestic price of risk across countries. Term and interbank spreads, followed by corporate and sovereign spreads, are the most important risk indicators for the investment and growth outlook across advanced economies. The dynamics of house prices are particularly important in countries where either the share of homeownership and floating-rate mortgages is high (such as the United Kingdom) or the mortgage market is a key node that underpins pricing and activity in systemic funding markets (as in the United States). The evidence for emerging market economies is more challenging to interpret for two reasons. First, data are much more limited and are available only for more recent years. Second, in many countries, financial market activity is often focused on equity and government bond markets. Unsurprisingly, therefore, analysis of available data suggests that for these countries, sovereign spreads and equity returns are most significant.

Domestic asset prices are the dominant driver of growth risks in the short term, while credit aggregates

are the dominant drivers in the medium term. Results from a panel quantile regression with country fixed effects, estimated separately for advanced and emerging market economies, highlight some common patterns in the relationship between these FCI components and risks to growth.

- *Domestic price of risk:* Tightening of financial conditions caused by a rising price of risk is a significant predictor of downside growth risks over horizons of up to one year. This inverse relationship between the price of risk and the growth forecast is stronger in the left tail of the distribution of future growth and is more significant for advanced economies (Figure 3.4, panels 1–4). The price of risk becomes uninformative over longer horizons in advanced economies. In emerging market economies, an interesting pattern arises—a higher price of risk signals lower downside (tail) risks at two- to three-year horizons. One possible explanation is the negative impact of tighter domestic financial conditions on leverage and balance sheet expansion, which appears to be associated with lower risks to growth in both the short and medium term (Figure 3.4, panels 5–6).
- *Leverage:* Higher credit growth and credit to GDP signal greater downside risk to growth at horizons of one year and longer. The relationship is economically more significant at the lower quantiles of GDP growth and in advanced economies than in emerging market economies (Figure 3.5, panels 1–2). Over shorter time horizons (one quarter), however, the information content differs across countries, with rising leverage continuing to signal higher downside risks in emerging market and large advanced economies but signaling lower downside risks in small open advanced economies.
- *External conditions:* While changing external conditions convey statistically significant information regarding risks to future growth, their information content represents a complex combination of forces. For example, movements in exchange rates can reflect different risk implications through real and financial channels, each of which may be more potent at different horizons. And the impact of changes in commodity prices on risks to growth will differ depending on whether a country is a commodity exporter or importer. Consequently, the signal given by changes in external conditions proved difficult to interpret in a straightforward manner. Nonetheless, a clearer interpretation arises when isolating changes in global risk sentiment from the other external variables.[15] Higher global risk aversion, reflected in a higher VIX, signals greater downside risks to growth in the short term, including a larger threat of an imminent recession (Figure 3.6). However, increases in the VIX also signal lower downside risks to growth at longer horizons of one to two years, possibly because, in most cases, tighter global financial conditions slow the growth of leverage and balance sheet mismatches, which may lessen medium-term growth risks.

The view that emerges from these results is that the prevailing low funding costs and financial market volatility support a positive view of risks to the global economy in the short term, but increasing leverage signals potential risks down the road. In such circumstances, a scenario of a rapid decompression in spreads and increase in financial market volatility could significantly worsen the risk outlook for global growth.

How Well Do Changes in Financial Conditions Forecast Downside Risks to Growth?

Severely adverse growth performance during the global financial crisis is used to demonstrate the potential use of measures of financial conditions in improving forecasts of risks to growth at horizons of up to one year. Augmenting growth forecast models based on past growth performance with financial conditions significantly improves forecasting ability. This is reflected in the greater likelihood that is assigned to the actual negative growth outcomes during that period.

Applying the univariate FCIs to historical episodes highlights the index's power to help predict future economic downturns over short horizons. Notably, the model was used to predict the distribution of growth for the first quarter of 2009, broadly corresponding to the peak of the global financial crisis.

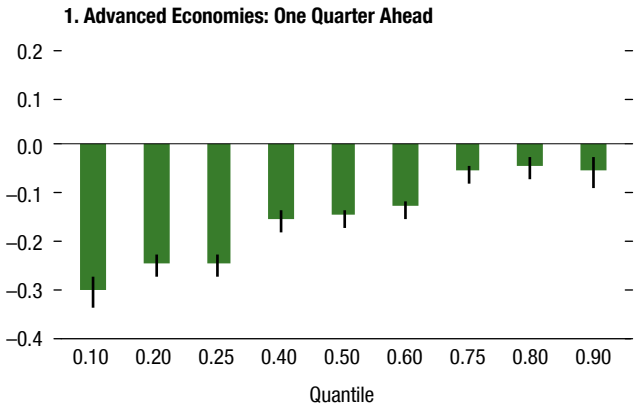
- At a one-quarter horizon (that is, in the fourth quarter of 2008), conditioning the risk forecast of future growth on financial conditions (besides economic growth) adds significantly to capturing

[15]Formally, a separate model of the kind described in Annex 3.2 was examined with the external conditions subindex defined as a global risk sentiment index (equal to the change in the VIX).

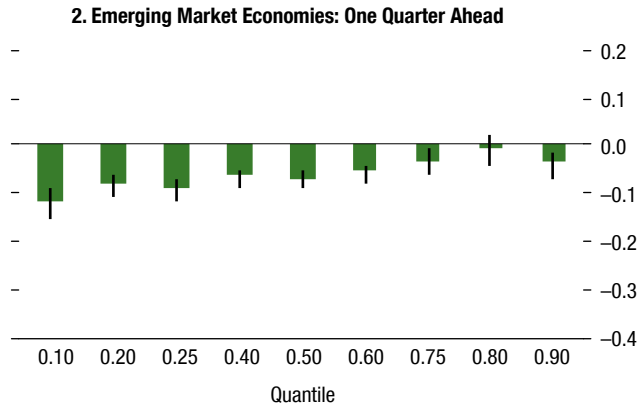
Figure 3.4. Higher Price of Risk Is a Significant Predictor of Downside Growth Risks within One Year

(Quantile regression coefficients)

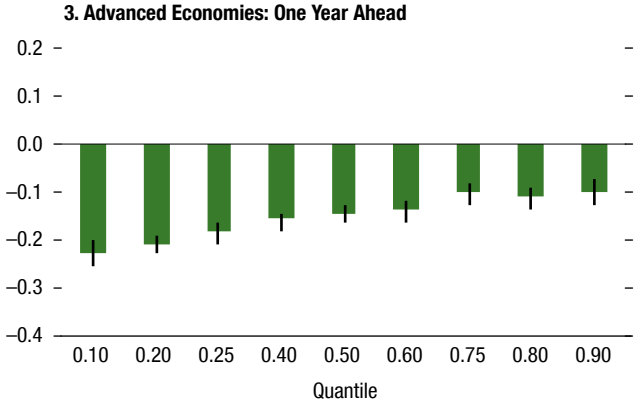
Economic significance is highest over one quarter ...



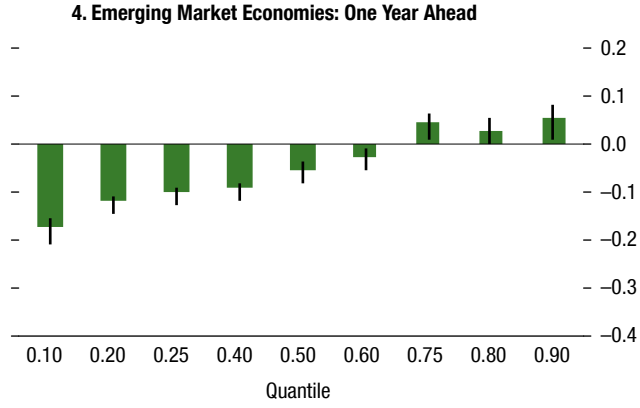
... albeit less so in emerging market economies.



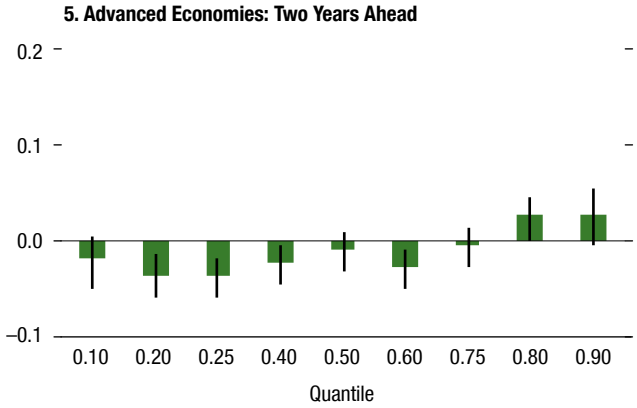
It remains so over one year in advanced economies ...



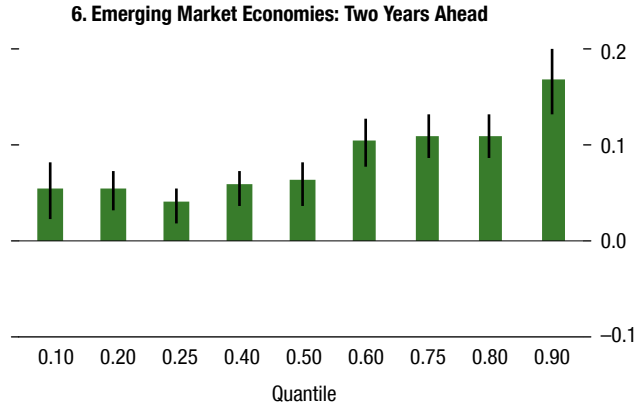
... and in emerging market economies.



Price of risk becomes uninformative over longer horizons in advanced economies ...



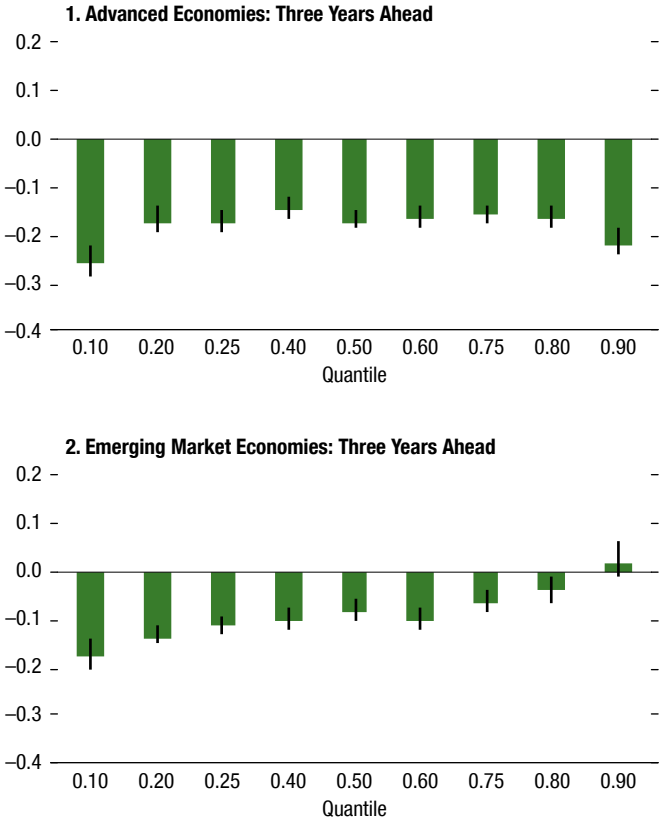
... but, in emerging market economies, higher funding costs signal lower risk over longer horizons.



Sources: Bloomberg Finance L.P.; Haver Analytics; IMF, Global Data Source and World Economic Outlook databases; Thomson Reuters Datastream; and IMF staff estimates.

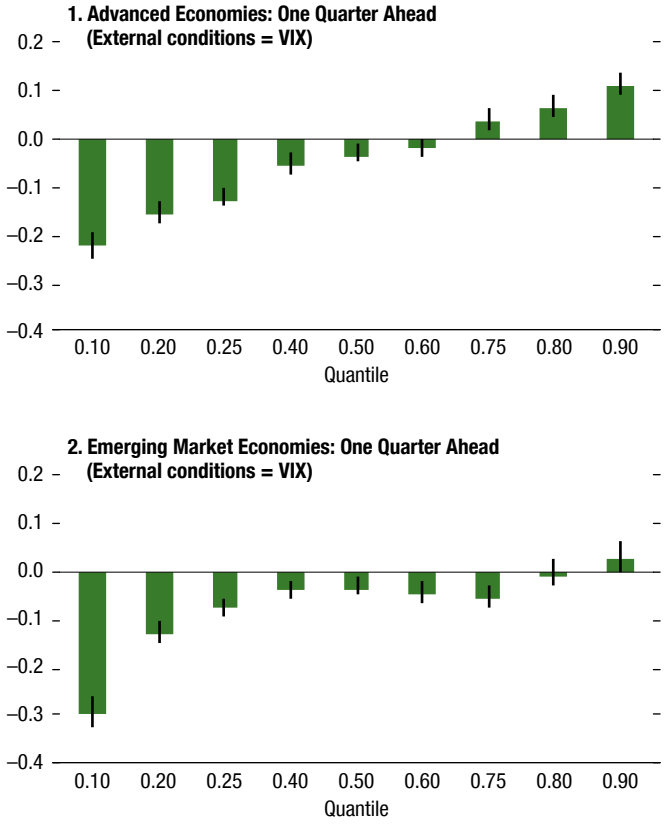
Note: The panels depict coefficient estimates on the price of risk index in pooled quantile regressions of one-quarter-ahead, four-quarters-ahead, and eight-quarters-ahead GDP growth for advanced economies (left column) and emerging market economies (right column). The coefficients are standardized by centering and reducing (zero mean, unit variance) both the dependent variable and the regressors to enable comparison across quantiles, across time horizons, and between advanced and emerging market economies. The coefficient estimate for a given quantile should be read as the impact of a one standard deviation change in the price of risk on the future quantile of GDP growth also expressed in terms of standard deviations. The vertical lines in the green bars denote confidence intervals at 10 percent and, where they cross the *x*-axis, correspond to absence of statistical significance of the regressor.

Figure 3.5. Rising Leverage Signals Higher Downside Growth Risks at Longer Time Horizons
(Quantile regression coefficients)



Sources: Bloomberg Finance L.P.; Haver Analytics; IMF, Global Data Source and World Economic Outlook databases; Thomson Reuters Datastream; and IMF staff estimates.
Note: The panels depict coefficient estimates on the credit aggregates index in pooled quantile regressions of three-years-ahead GDP growth for advanced and emerging market economies. The coefficients are standardized by centering and reducing (zero mean, unit variance) both the dependent variable and the regressors to enable comparison across quantiles, across time horizons, and between advanced and emerging market economies. The coefficient estimate for a given quantile should be read as the impact of a one standard deviation change in leverage on the future quantile of GDP growth also expressed in terms of standard deviations. The vertical lines in the green bars denote confidence intervals at 10 percent and, where they cross the *x*-axis, correspond to absence of statistical significance of the regressor.

Figure 3.6. Waning Global Risk Appetite Signals Imminent Downside Risks to Growth
(Quantile regression coefficients)



Sources: Bloomberg Finance L.P.; Haver Analytics; IMF, Global Data Source and World Economic Outlook databases; Thomson Reuters Datastream; and IMF staff estimates.
Note: The panels depict coefficient estimates on the VIX index in pooled quantile regressions of one-quarter-ahead GDP growth for advanced and emerging market economies. The coefficients are standardized by centering and reducing (zero mean, unit variance) both the dependent variable and the regressors to enable comparison across quantiles, across time horizons, and between advanced and emerging market economies. The coefficient estimate for a given quantile should be read as the impact of a one standard deviation change in the VIX on the future quantile of GDP growth also expressed in terms of standard deviations. The vertical lines in the green bars denote confidence intervals at 10 percent and, where they cross the *x*-axis, correspond to absence of statistical significance of the regressor. VIX = Chicago Board Options Exchange Volatility Index.

imminent tail risks to growth, both at the epicenter of the crisis (that is, the United States) and in a commodity-exporting emerging market economy (Chile). Notably, the likelihood attached to poor growth outcomes around the actual realization is significantly higher if rapidly tightening financial conditions are incorporated into the growth forecast (the density in red) as opposed to a model whose only information for forecasting is the growth outcome (the density in blue) in the fourth quarter of 2008 (Figure 3.7).[16]

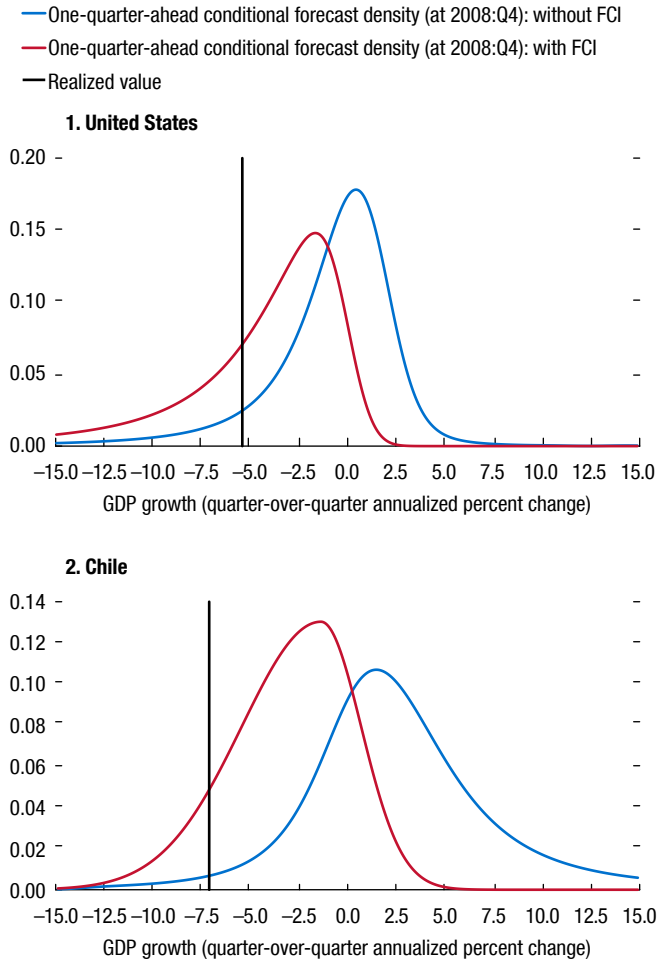
[16]GDP growth exhibits a high degree of persistence in the sample of advanced and emerging market economies covered by this chapter's analysis. Consequently, from a forecasting perspective, a quantile autoregression model of GDP growth represents a conservative and hard-to-beat benchmark against which to assess the marginal conditioning information content of financial conditions. The quantile autoregression model is unlikely to forecast rare (severe) recessions

- These results remain robust in a broader cross section of countries. Among countries that experienced a significant growth downturn during the crisis, adding FCIs to an autoregressive growth forecasting model significantly increases the conditional likelihood of a GDP growth outcome less than or equal to the actual growth outturn one quarter ahead (Table 3.1).[17] In addition to predicting a fatter left tail for the growth distribution, the average growth forecasts including FCIs are closer to the actual severe economic contraction experienced by these countries in the first quarter of 2009, and well below the market consensus, which remained relatively optimistic even after the collapse of Lehman Brothers (Table 3.2).

The exercise also shows that conditioning on univariate FCIs may not work as well at longer horizons. This possibility is evident when comparing the relative predictive ability of the autoregressive growth model with the model augmented with FCIs at one- and four-quarter horizons for the first quarter of 2009. In the case of the global financial crisis, examining the behavior of sampled countries' FCIs through 2008 is revealing. Close examination shows why the forecasting gain differs once the information set is augmented with FCIs at different time horizons. In the first quarter of 2009, GDP growth for most countries was among the worst in their recent economic history. The Lehman Brothers bankruptcy, at the beginning of the fourth quarter of 2008, was the bellwether for a swift and severe deterioration in financial conditions. Risk spreads and market volatility increased steeply, and asset values crashed. The information emanating from FCIs throughout the fourth quarter of 2008 clearly signaled potential negative fallout for economic activity. By contrast, economic indicators took additional time to catch up to the actual magnitude of the decline.

Figure 3.7. Probability Densities of GDP Growth for the Depths of the Global Financial Crisis
(Probability)

Accounting for financial conditions generates a more pessimistic outlook for risks to growth one quarter before 2009:Q1.



Sources: Bloomberg Finance L.P.; Haver Analytics; IMF, Global Data Source and World Economic Outlook databases; Thomson Reuters Datastream; and IMF staff estimates.
Note: The figure displays conditional probability distributions of one-quarter-ahead GDP growth based on a parametric, T-skew density, fitted over quantile regression estimates as described in Annex 3.3. In particular, it includes two conditional distributions of growth based on two forecasting models that use either growth or growth and financial conditions indices (FCIs) to predict future growth (in 2009:Q1). The figure also includes the realized values of GDP growth (black vertical line). Blue density = model with single regressor (one-quarter-lagged GDP growth); red density = model with two regressors (one-quarter-lagged GDP growth and one-quarter-lagged FCI).

and macroeconomic crises well. A good test of the predictive contribution of financial indicators *for such growth episodes* would be to examine how their addition to the conditioning information set would change the likelihood assigned to the realized (bad) growth outcome at various horizons.

[17]Results are presented for a selection of advanced and emerging market economies in Tables 3.1–3.3, even though similar results are obtained for other sampled countries that experienced a recession at the time of the global financial crisis. Results for countries that did not experience an economic contraction suggest that the model augmented with FCIs does not generate false alarms—that is, significantly lower conditional probability of a recession at one- and four-quarter forecast horizons.

Table 3.1. Forecast of GDP Growth Distribution for the Global Financial Crisis with and without Financial Conditions Indices

(Cumulative probability of actual 2009:Q1 growth outturn, percent)

	Selected Advanced Economies				Selected Emerging Market Economies			
	Real-time FCI Augmented	FCI Augmented	Autoregressive		Real-time FCI Augmented	FCI Augmented	Autoregressive
Germany				**Brazil**			
One quarter ahead for 2009:Q1	5.4	2.4	0.0	One quarter ahead for 2009:Q1	35.5	39.6	7.5
Four quarters ahead for 2009:Q1	0.1	0.4	0.0	Four quarters ahead for 2009:Q1	4.2	5.0	5.5
Sweden				**Chile**			
One quarter ahead for 2009:Q1	6.5	5.9	4.8	One quarter ahead for 2009:Q1	6.4	8.0	2.6
Four quarters ahead for 2009:Q1	0.0	0.8	0.5	Four quarters ahead for 2009:Q1	4.0	1.7	2.0
United Kingdom				**South Africa**			
One quarter ahead for 2009:Q1	29.8	29.5	5.8	One quarter ahead for 2009:Q1	7.2	4.6	0.8
Four quarters ahead for 2009:Q1	0.8	2.8	1.5	Four quarters ahead for 2009:Q1	5.3	6.2	1.6
United States				**Turkey**			
One quarter ahead for 2009:Q1	46.7	30.3	8.5	One quarter ahead for 2009:Q1	31.5	27.1	5.3
Four quarters ahead for 2009:Q1	2.6	4.0	4.2	Four quarters ahead for 2009:Q1	3.5	2.3	2.8

Sources: Bloomberg Finance L.P.; Haver Analytics; IMF, Global Data Source and World Economic Outlook databases; Thomson Reuters Datastream; and IMF staff estimates.

Note: The table depicts the cumulative probabilities of a growth outcome in 2009:Q1 of less than or equal to the actual growth outturn (quarter over quarter, annualized) in that period drawn from conditional density forecasts of GDP growth made four quarters earlier (that is, in 2008:Q1). The left column depicts probabilities from the model with financial conditions indices (FCIs) estimated with information available in real time. The middle column depicts probabilities from the model with FCIs estimated with full in-sample information. The right column depicts probabilities from the autoregressive model of GDP growth. Autoregressive = quantile regression of one-year-ahead GDP growth on current quarter GDP growth; FCI augmented = quantile regression of one-year-ahead GDP growth on current quarter GDP growth and FCI.

Table 3.2. Market Consensus Forecasts for the Global Financial Crisis Were Considerably More Optimistic Than Forecasts Based on Financial Conditions

	Growth Forecasts Conditional on Lagged GDP and FCI		Consensus Growth Forecasts		Growth Outturn in 2009:Q1[1]
	2008:Q1	2008:Q4	2008:Q1	2008:Q4	
Brazil	3.1	–4.3	4.6	2.1	–6.9
Canada	1.7	–5.3	1.7	–0.1	–8.8
France	1.9	–1.2	1.6	–0.6	–6.4
Mexico	2.6	–3.6	2.8	–0.1	–14.7
South Africa	2.7	–2.0	4.7	2.7	–6.1
Switzerland	1.9	–2.0	2.8	–1.6	–5.5
Turkey	3.4	–7.4	4.8	0.8	–15.2
United States	1.9	–3.8	1.6	–1.3	–5.4

Sources: Bloomberg Finance L.P.; Consensus Economics; Haver Analytics; IMF, Global Data Source and World Economic Outlook databases; Thomson Reuters Datastream; and IMF staff estimates.

Note: Columns 2 and 3 of the table denote, respectively, the conditional mean forecasts for (quarter over quarter, annualized) GDP growth in 2009:Q1 made one quarter and one year earlier based on an ordinary least squares regression of future GDP growth on current quarter FCI and GDP growth. Columns 4 and 5 denote market consensus forecasts for 2009:Q1 made one quarter and four quarters earlier, respectively. Column 6 depicts the actual growth outturn. FCI = financial conditions index.

[1]Based on data available as of August 3, 2017.

Table 3.3. Forecast of GDP Growth Distribution for the Global Financial Crisis: Comparing Partitioned and Univariate Financial Conditions Indices with Autoregressions
(Cumulative probability of actual 2009:Q1 growth outturn, percent)

Selected Advanced Economies					Selected Emerging Market Economies				
	Real-time Partitioned Financial Variables	Partitioned Financial Variables	FCI Augmented	Autoregressive		Real-time Partitioned Financial Variables	Partitioned Financial Variables	FCI Augmented	Autoregressive
Germany					**Brazil**				
Four quarters ahead for 2009:Q1	0.8	0.7	0.4	0.0	Four quarters ahead for 2009:Q1	14.0	6.7	5.0	5.5
Sweden					**Chile**				
Four quarters ahead for 2009:Q1	7.1	5.7	0.8	0.5	Four quarters ahead for 2009:Q1	12.7	10.4	1.7	2.0
United Kingdom					**South Africa**				
Four quarters ahead for 2009:Q1	6.4	5.0	2.8	1.5	Four quarters ahead for 2009:Q1	5.4	7.3	6.2	1.6
United States					**Turkey**				
Four quarters ahead for 2009:Q1	24.7	19.1	4.0	4.2	Four quarters ahead for 2009:Q1	7.4	4.4	2.3	2.8

Sources: Bloomberg Finance L.P.; Haver Analytics; IMF, Global Data Source and World Economic Outlook databases; Thomson Reuters Datastream; and IMF staff estimates.
Note: The table depicts the cumulative probabilities of a growth outcome in 2009:Q1 of less than or equal to the actual growth outturn (quarter over quarter, annualized) in that period drawn from conditional density forecasts of GDP growth made four quarters earlier (that is, in 2008:Q1) according to the four alternative methodologies. Autoregressive = quantile regression of one-year-ahead GDP growth on current quarter GDP growth; FCI = financial conditions index; FCI augmented = quantile regression of one-year-ahead GDP growth on current quarter GDP growth and FCI; partitioned financial variables = quantile regression of one-year-ahead GDP growth on current quarter GDP growth and subindices of financial indicators.

This explains why autoregressive-conditional quantile forecasts were behind the curve, even at the end of 2008. A few quarters earlier, in early 2008, FCIs had risen from their boom-time lows but were only at their historical averages (for emerging market economies) or at levels corresponding to recessions significantly milder than the outturn of the first quarter of 2009 (for advanced economies). Consequently, one year ahead, conditioning on FCIs does not result in significantly different predictions of growth during the global financial crisis relative to either consensus forecasts or autoregressive-conditional quantile forecasts.

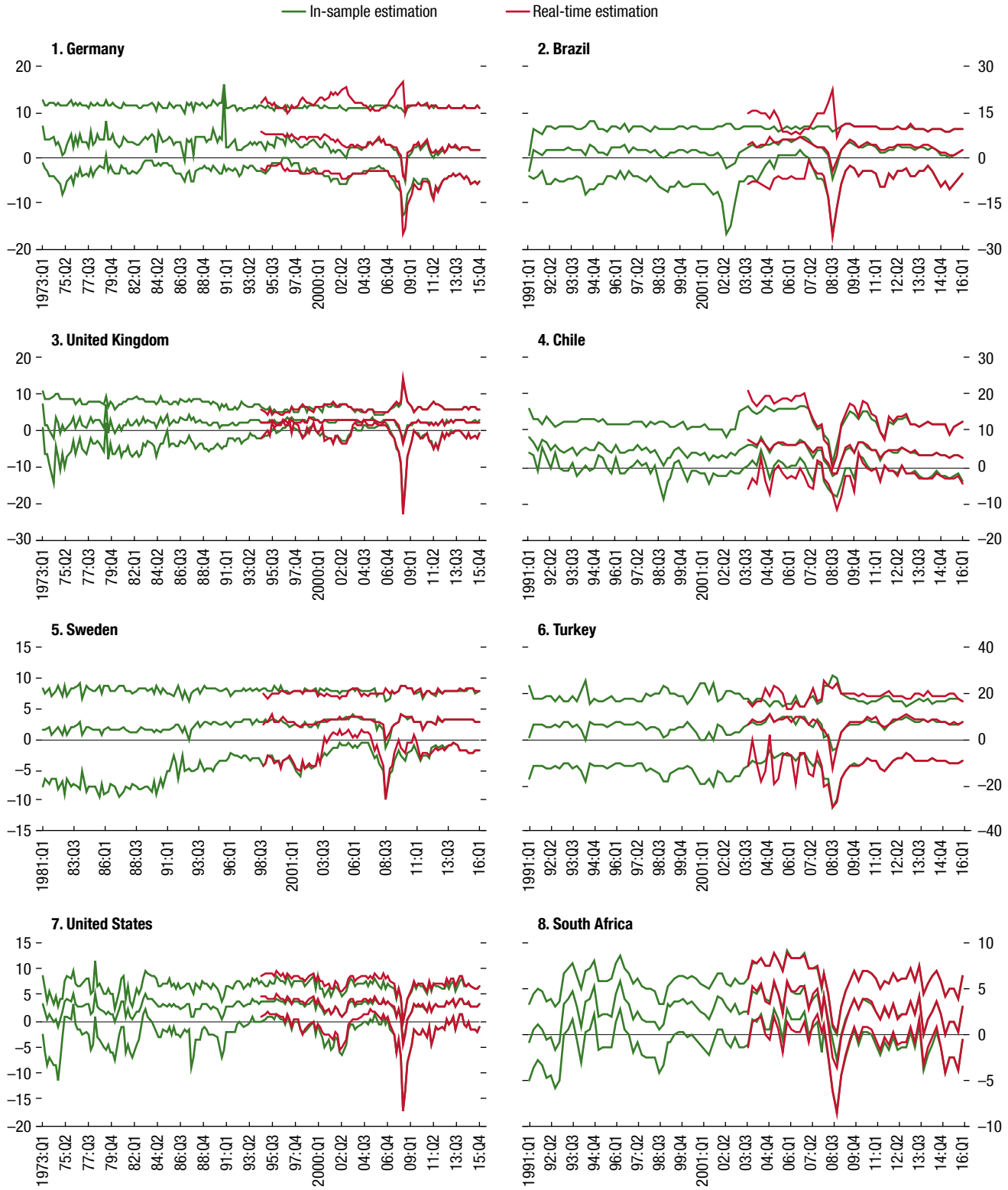
Partitioning the FCI constituents into subindices enables the forecasts conditioned on financial indicators to regain relative predictive gains over longer time horizons in several countries (Table 3.3).[18] One-year-ahead conditional forecasts for annual growth assign significantly higher likelihood to growth outcomes less than or equal to the outturn of the first quarter of 2009 when the forecasts are based on information in financial indicators than when based only on lagged GDP growth. This is the likely consequence of separating credit aggregates from asset prices, thereby allowing their information to gain greater weight at horizons beyond one quarter.

Real-time conditional density forecasts of economic growth are almost identical to those reported above for in-sample forecasts (Figures 3.8 and 3.9). Hence, using information in FCIs and in partitioned financial indicators available only up to one to four quarters earlier than the first quarter of 2009 would result in conditional likelihoods being assigned to the actual growth outcomes that are very similar to those obtained through in-sample forecasts using financial indicators (Tables 3.1 and 3.3).[19]

[18]The contribution of each financial indicator to its group subindex is determined according to a methodology designed to improve forecast performance as discussed in Annex 3.2.

[19]This is implied by the fact that real-time forecasts of the quantiles of future GDP growth obtained through recursive estimation are almost identical to (or, below the median quantile, often lower than) those obtained through the in-sample forecasts. The fact that a majority of financial indicators are available only from the mid-1990s to the mid-2000s, especially for emerging market economies, prevents backtesting of the model's forecasting ability relative to earlier crisis-related recessions, for example, in Sweden (1990–92), Mexico (1994), east Asia (1997), and Turkey (2000–01), among others. More generally, low-frequency and limited time series data on real and financial variables preclude implementation with sufficient power of appropriate out-of-sample forecast evaluation tests described in Corradi and Swanson 2006 and Komunjer 2013.

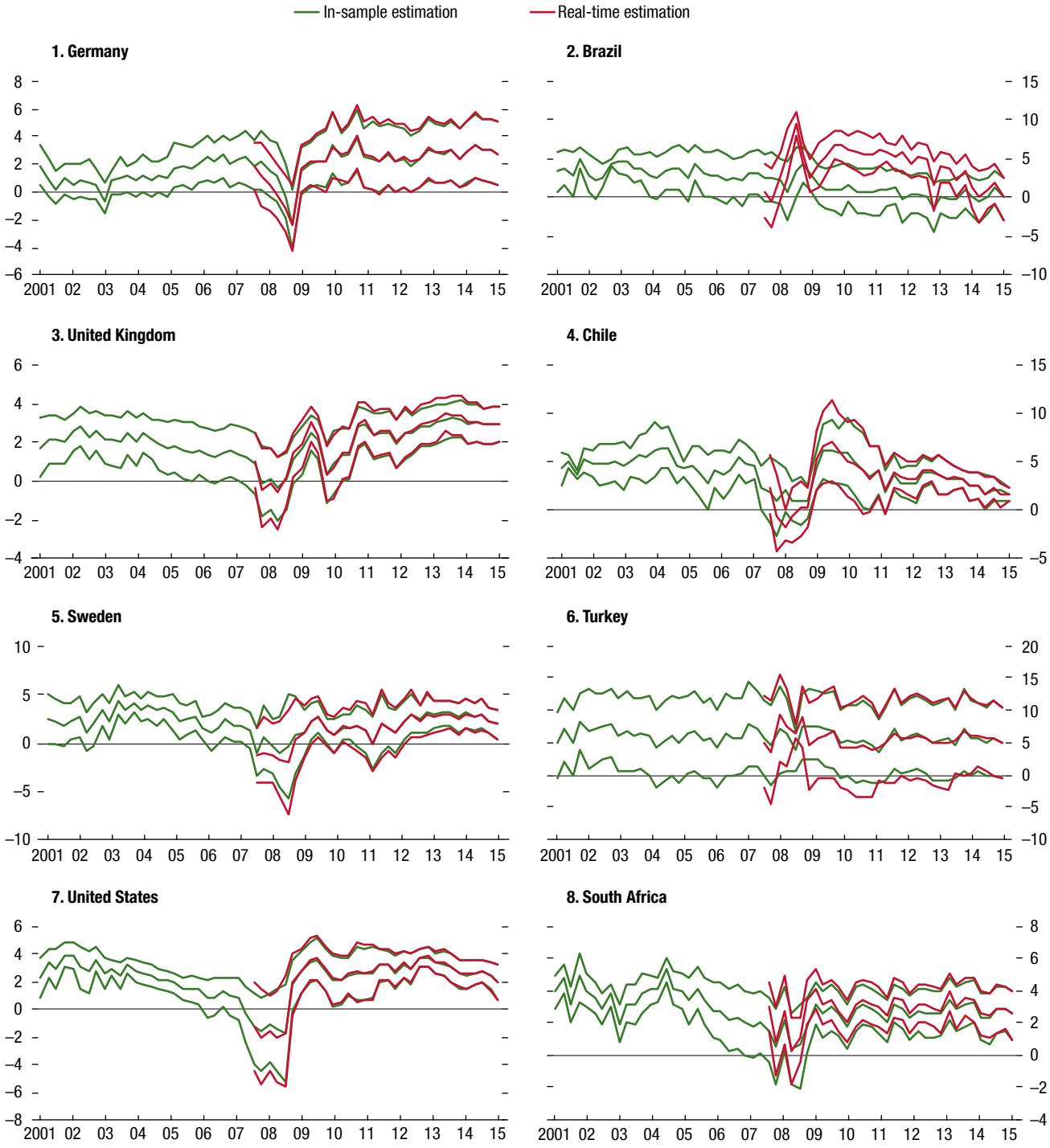
Figure 3.8. In-Sample and Recursive Out-of-Sample Quantile Forecasts: One Quarter Ahead
(Percent)



Sources: Bloomberg Finance L.P.; Haver Analytics; IMF, Global Data Source and World Economic Outlook databases; Thomson Reuters Datastream; and IMF staff estimates.
Note: This figure shows the estimates of the 5th (bottom), 50th (middle), and 95th (top) quantiles of GDP growth based on the quantile regression model where one-quarter-ahead GDP growth is regressed on current date financial conditions index and GDP growth.

Figure 3.9. In-Sample and Recursive Out-of-Sample Quantile Forecasts: Four Quarters Ahead

(Percent)



Sources: Bloomberg Finance L.P.; Haver Analytics; IMF, Global Data Source and World Economic Outlook databases; Thomson Reuters Datastream; and IMF staff estimates.

Note: This figure shows the estimates of the 25th (bottom), 50th (middle), and 75th (top) quantiles of GDP growth based on the quantile regression model with partitioned financial indicators replacing the univariate financial conditions index.

This augurs well for the parameter stability of the chapter's forecast model, demonstrating that its forecasts and relative predictive ability are not an artifact of incorporating events such as the global financial crisis into estimates of its parameters.

Policy Implications

The chapter's findings underscore the importance of policymakers maintaining heightened vigilance regarding risks to growth during periods of benign financial conditions that may provide a fertile breeding ground for the accumulation of financial vulnerabilities. Changes in the domestic price of risk appear to be potent signals of imminent threats to growth and can be useful for swift deployment of monetary easing and crisis-management policy actions. Incorporating information in slower-moving indicators could help better calibrate countercyclical policies, even though doing so systematically would require combining the information derived from the models described in this chapter with appropriate structural models.

This chapter develops a new macroeconomic measure of financial stability by linking financial conditions to the probability distribution of future GDP growth. Since policymakers care about the whole distribution of future GDP growth, linking the state of the financial system to such a distribution would enhance macro-financial surveillance. Policymakers would be able to specify bad outcomes in terms of their risk preference or tolerance and undertake appropriate action based on the information provided by financial conditions. Thus, the new modeling approach can be a powerful tool for forecasting and policy development.

Financial conditions contain useful information with which to help forecast risks to economic growth at short- and medium-term horizons. Thus, the tools used and developed in this chapter can help policymakers assess the risks to the real economy associated with various states of the financial system. For example, at the current juncture, elevated leverage signals downside risks to growth in the medium term, although in the short term, this risk is mitigated by the low price of risk. However, a scenario of rapid decompression in spreads and an increase in financial market volatility would add to the risks arising from leverage, significantly worsening the growth outlook.

Policymakers could use the information provided by such a surveillance framework to identify imminent threats and take swift countervailing action over very short horizons. If a rapid increase in the price of risk at a time of elevated leverage or balance sheet mismatches indicates an imminent threat to the economy, policymakers can quickly ease monetary policy and deploy a wide range of crisis-management and -prevention measures to prevent tail events or reduce their magnitude. During the global financial crisis, bilateral and multilateral swap lines, general creditor guarantees, asset purchase programs, and emergency liquidity facilities, among others, were marshalled by a number of countries at relatively short notice.

The framework developed in this chapter could potentially help policymakers design policy actions to respond in a timely manner to threats to financial stability indicated by changes in financial conditions. It is natural to think of calibrating policy actions on the state of financial conditions—much as monetary policy action is calibrated to information on inflation and output under standard Taylor rules. For example, countercyclical macroprudential tools, such as bank capital buffers and limits on loan-to-value ratios, could be designed and calibrated to contain the growth of financial vulnerabilities in the presence of loose financial conditions. In this regard, the estimated forecast relationships from the GDP growth-at-risk model of this chapter can also be used to calibrate structural models that are amenable to counterfactual analysis and policy development.[20]

Practical implementation of forecasting of risks to growth based on financial conditions will require data gaps to be closed. This need strengthens the case for greater data-gathering efforts. It also points to a need for continuous calibration of these types of models as data gaps gradually close and for incorporation of country-level information that may substitute for the lack of standard financial indicators. In this way, policymakers and others could significantly improve on the forecasting power of the models presented here by incorporating rich country-level information to complement the models' broad financial indicators. As local financial markets undergo structural developments, and authorities consider certain financial indicators to

[20]One option could be to use the conditional density forecasts of GDP growth to calibrate the higher moments (for example, conditional volatility or skewness) of structural models that embed financial accelerator mechanisms such as the one described in Annex 3.1.

be increasingly relevant, these could also be gradually incorporated into the analysis.[21]

Annex 3.1. Financial Vulnerabilities and Growth Hysteresis in Structural Models[22]

An Illustrative Simulation

A simulation exercise of a structural model is conducted to illustrate the nonlinear response of output growth to shocks depending on the level of financial vulnerabilities. The exercise shows that embedding an occasionally binding funding constraint on borrowers in an otherwise standard New Keynesian (NK) open economy structural model is sufficient to generate two key stylized facts. These are, first, that the steady-state probability distribution of GDP growth is negatively skewed and, second, that asset prices and credit aggregates are leading indicators of risks to GDP growth.

In the presence of financial frictions, the response of output growth to shocks is highly nonlinear. Recent advances in macroeconomic theory have clarified the importance of financing constraints on borrowers and intermediaries in generating this response. In their seminal contributions, Bernanke and Gertler (1989); Kiyotaki and Moore (1997); and Bernanke, Gertler, and Gilchrist (1999) clarified the role of credit market frictions in determining fluctuations in real economic activity. Their linear real business cycle models embed a *financial accelerator* mechanism in which endogenous developments in credit markets propagate and amplify shocks to the real economy. Although these models explain how financial frictions increase the amplitude of real business cycles, they do not shed light on how and when they can increase the duration of those cycles or generate extreme, unlikely negative outcomes (asymmetry, or *tail risk*). The key insight of recent advances in business cycle theory is that this outcome depends on individual financial decisions of banks, firms, and households that fail to take into consideration dynamic credit supply externalities implied by their decisions. That is, individual borrowers fail to take into account the fact that once aggregate leverage is sufficiently high, shocks can activate *occasionally binding collateral constraints* (OBCCs). This, in turn, can generate a vicious cycle of deleveraging and negative asset price spirals that clog credit intermediation, consumption, investment, and growth.[23]

The simulation exercise embeds an OBCC into an NK open economy dynamic general equilibrium model. The OBCC is modeled as in Kiyotaki and Moore 1997. To tease out implications for optimal policy, nominal frictions based on an open economy NK model are incorporated in the spirit of Galí and Monacelli 2005. The main features of the model are as follows: Households are endowed with tradable goods as in Bianchi 2011, while they produce nontradables using capital and labor. Households maximize their lifetime utility by choosing an intertemporal portfolio of tradable and nontradable goods for consumption and supplying labor to the production process. Their borrowing must be lower than a fixed fraction of their capital value (that is, there is a collateral constraint). The nontradables sector is monopolistically competitive, and price setting is subject to nominal frictions. Asset prices are determined under a fixed supply of capital. Nominal interest rates are set under a standard Taylor rule responding to inflation and output. The exchange rate is pinned down by the uncovered interest parity condition. The parameters are calibrated based on standard values in the literature of an OBCC model and an open economy NK model, including Bianchi 2011 and Galí and Monacelli 2005.

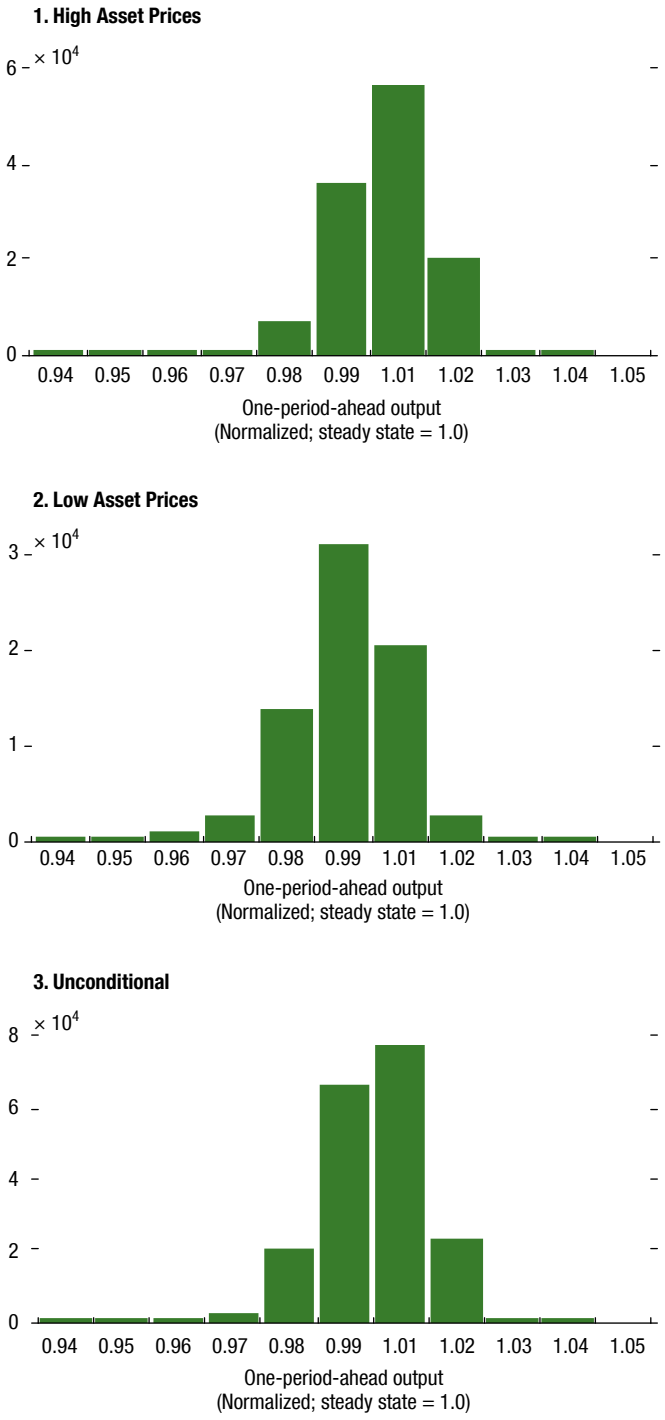
The simulated density of future output is shown to be negatively skewed; that is, it has a fat left tail, indicating a greater risk of severe recession. The unconditional distribution of future output (Annex Figure 3.1.1, panel 3) is negatively skewed—the skewness measure, at –1.51, is statistically significant. In the simulation, as in reality, the collateral constraint does not typically bind. Thus, the evolution of all economic variables, including output, is standard for the most part. However, when the OBCC binds (a rare event), output and asset prices decline significantly because

[21]The methodology developed in this chapter is used to model the impact of financial vulnerabilities on GDP growth. It is flexible in the inputs it can receive. In countries where risks to the real economy posed by amplifiers, whether real or fiscal, are not traded in deep financial markets, corresponding nonfinancial indicators could also be used as inputs.

[22]Prepared by Mitsuru Katagiri. (This annex is a summary of Katagiri, forthcoming.)

[23]For models embedding OBCCs on end-borrowers, see Bianchi 2011; Korinek and Simsek 2016; and Bianchi and Mendoza, forthcoming. For OBCCs or value-at-risk constraints on intermediaries, see He and Krishnamurthy 2013 and Brunnermeier and Sannikov 2014.

Annex Figure 3.1.1. Conditional Densities of Growth with High and Low Asset Prices—One-Period-Ahead Forecasts
(Frequency)



Source: IMF staff estimates.

of the vicious cycle of asset fire sales and tighter credit conditions, and output suffers.

The simulation exercise clearly indicates the utility of conditioning the growth outlook on asset prices. Risk premiums in the simulation exercise are defined as the return on capital minus the inverse of the stochastic discount factor, as is standard.[24] Annex Figure 3.1.1 shows the conditional density of output in period t, given that the risk premium in period $t - 1$ is less than 30 basis points (the case of high asset prices depicted in panel 1) and more than 30 basis points (the case of low asset prices depicted in panel 2). Those two panels indicate that when risk premiums rise (equivalently, when asset prices fall), the conditional density of one-period-ahead output shifts to the left and becomes negatively skewed. Higher risk premiums predict a lower average value of one-period-ahead output and a more pessimistic risk outlook (fatter left tail).

Asset prices and credit aggregates can also be useful leading indicators of recessions or financial crises. The relationship between one-period-ahead output and risk premiums (Annex Figure 3.1.2, panel 1) indicates that the lower quantile of output declines significantly with rising risk premiums, whereas its upper quantile is significantly less sensitive. The relationship between one-period-ahead output and the credit-to-GDP ratio shows that a financial crisis occurs only when the ratio is at a historically high level (Annex Figure 3.1.2, panel 2). Finally, risk premiums and credit-to-output ratios are significantly higher than their steady-state values for several periods before a crisis (Annex Figure 3.1.3).

Calibrating Policy Rules to Attenuate Risks to Growth from Financial Vulnerability

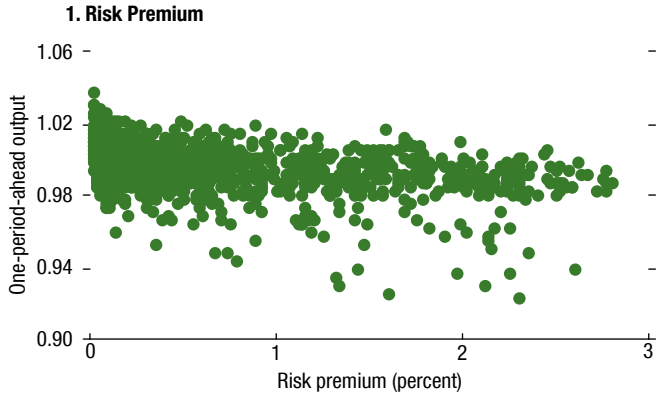
Macroprudential policy contingent on the state of financial conditions can mitigate the adverse real effects of financial crises. The decentralized equilibrium described in the previous section of this annex is *not* socially optimal because agents fail to take into consideration the negative systemic externalities of their leverage choices on asset prices. Borrowers' resulting excess leverage increases the frequency of financial crises.

[24]Note that risk premiums based on this definition are not directly observable in the data, but are conceptually close to the excess return of risk assets as defined in Gilchrist and Zakrajšek 2012 and hence can be calculated from financial market data.

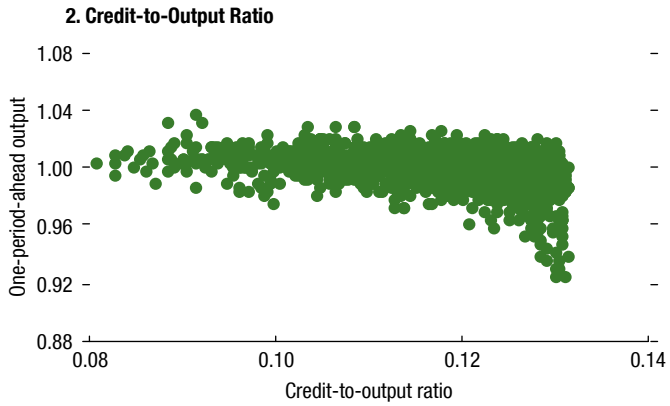
Annex Figure 3.1.2. One-Period-Ahead GDP and Financial Conditions

(Normalized; steady state = 1.0)

Increasing risk premiums signal a more pessimistic growth outlook ...



... as does elevated leverage.



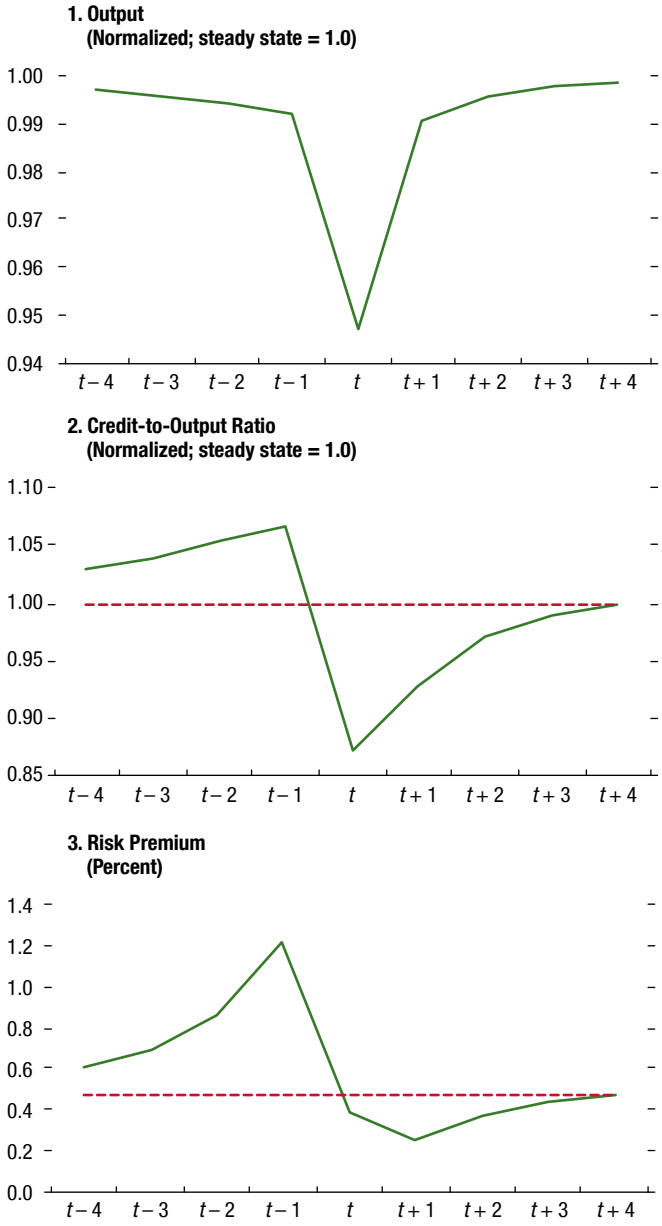
Source: IMF staff estimates.

Bianchi (2011) and Bianchi and Mendoza (forthcoming) show that a macroprudential tax (that is, a tax on debt before the crisis) that is contingent on the state of financial conditions can prevent excess leverage and implement the socially optimal outcome as a decentralized equilibrium. This socially optimal outcome can also be implemented by a regulation on loan-to-value (LTV) ratios.

Once the optimal state-contingent macroprudential policy (taxes on debt or LTV regulation) is introduced, vulnerability to a recession (as measured by the negative skewness of the output distribution) is significantly mitigated. In the *baseline simulation* of the equilibrium without optimal macroprudential policy,

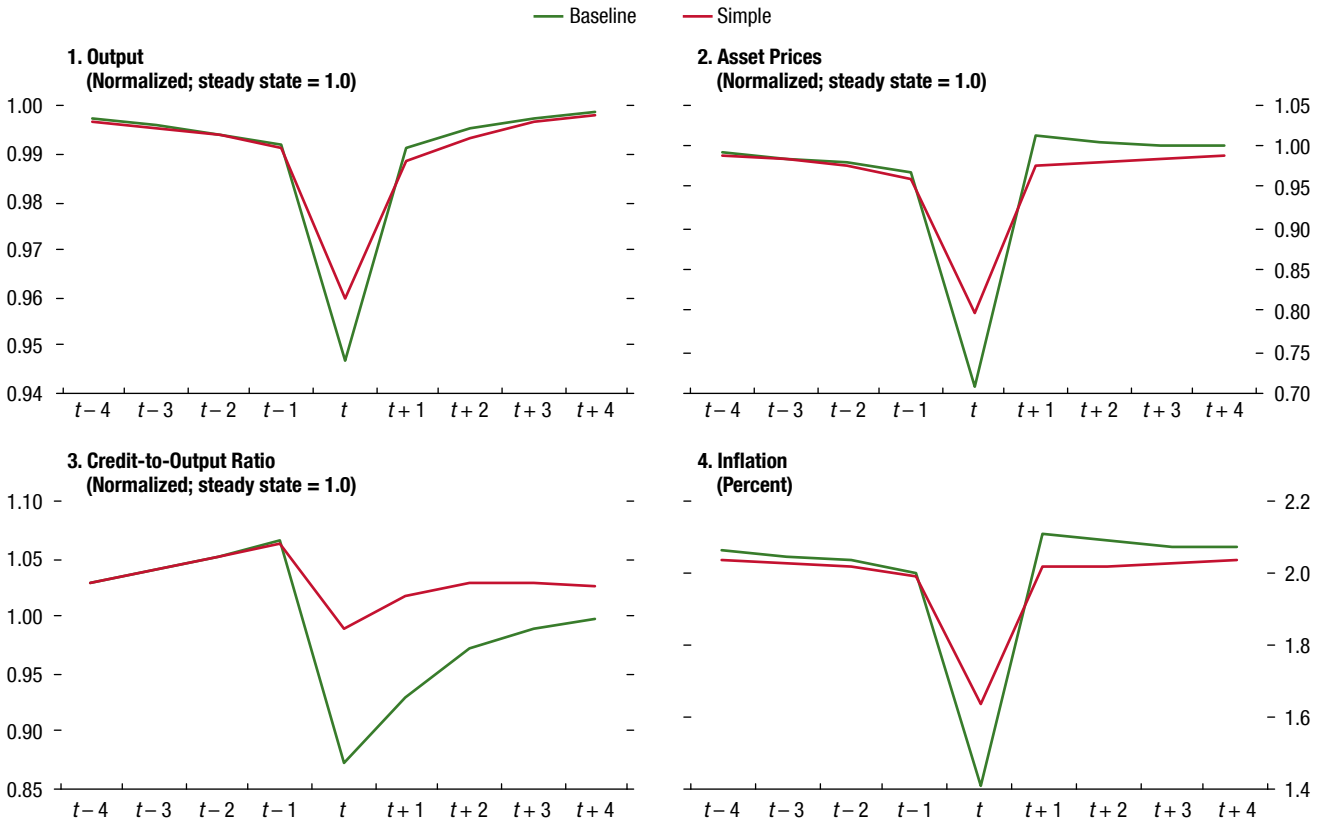
Annex Figure 3.1.3. Asset Prices and Credit Aggregates before and after a Financial Crisis

Severe economic contractions are preceded by several periods of excessive leverage and, shortly before the crisis, by sharply rising risk premiums.



Source: IMF staff estimates.
Note: The crisis happens in period 5 (t) in the figures. The crisis is defined as a period in which output declines by more than 3 percent. The red dashed lines denote steady-state values.

Annex Figure 3.1.4. Simple Debt Tax Ameliorates Risk of Leverage-Induced Recessions



Source: IMF staff estimates.

the probability of a recession driven by a financial crisis is 1.3 percent, and the skewness of the density of future GDP growth at –1.51 is statistically significant. Implementation of the state-contingent debt tax or state-contingent LTV regulation reduces these values to, respectively, 0.5 percent and –0.66.

A simple policy rule conditioned on financial indicators comes close to implementing the optimal macroprudential policy. The optimal policy itself is a complex nonlinear function of state variables and is probably too complicated to implement in practice.[25] Fortuitously, a simple rules-based macroprudential policy responding to vulnerability measures does a good job of mitigating the harmful effects of financial crises. Risk premiums are used to improve the performance of a simple rules-based macroprudential policy because they have predictive power for the crisis. Annex Figure 3.1.4 compares the evolution of real and financial indicators under a simple policy rule whereby debt taxes are a linear function of risk premiums to the baseline equilibrium. Policy based on a simple linear rule delivers almost the same performance as the optimal policy, implying that financial conditions such as risk premiums are useful for conducting macroprudential policies in practice.[26]

[25]The nonlinearity stems from the fact that policymakers should raise borrowing costs through taxes or LTV regulations *only* when a crisis is predicted.

[26]There are two caveats. First, all crises in the OBCC model are caused by a simple collateral constraint, whereas many other factors can contribute to financial crises. Second, the model assumes that policymakers can immediately respond to vulnerabilities. If there is a delay in policy reactions or their transmission to the real economy, the policy implications may be different.

Annex Table 3.2.1. Country Coverage

Australia	Germany	Mexico	Turkey
Brazil	India	Russia	United Kingdom
Canada	Indonesia	South Africa	United States
Chile	Italy	Spain	
China	Japan	Sweden	
France	Korea	Switzerland	

Source: IMF staff.

Annex 3.2. Estimating Financial Conditions Indices[27]

Univariate Financial Conditions Indices

A simple way to build a summary measure of financial conditions is to construct univariate financial conditions indices (FCIs) following the approach in the April 2017 GFSR, although with some important modifications. The main change is that the coverage of financial indicators is expanded to include additional information relevant to assessing domestic financial vulnerabilities. FCIs will therefore also include variables that summarize global risk sentiment (Chicago Board Options Exchange Volatility Index [VIX], Merrill Lynch Option Volatility Estimate [MOVE] Index), credit aggregates that directly indicate the level of financial vulnerability in the economy, and commodity prices and exchange rates that may influence and reflect the ease of funding and financial constraints—for example, by altering borrowers' net worth.[28]

Following the methodology presented in Annex 3.1 of the April 2017 GFSR, FCIs are reestimated for 11 advanced economies starting in 1973 and for 10 emerging market economies starting in 1991. A set of 19 financial indicators is used to capture both domestic and global developments influencing a country's financial conditions (see Annex Table 3.2.1 for country coverage and Annex Table 3.2.2 for variables included and data sources). The FCIs are estimated based on Koop and Korobilis 2014 and build on the estimation of the time-varying parameter vector autoregression model of Primiceri (2005) and dynamic factor models of Doz, Giannone, and Reichlin (2011).[29] This approach has two advantages. First, it can control for current macroeconomic conditions. Second, it allows for dynamic interaction between the FCIs and macroeconomic conditions, which can also evolve over time. The model takes the following form:

$$x_t = \lambda_t^y Y_t + \lambda_t^f f_t + u_t,$$
$$\begin{bmatrix} Y_t \\ f_t \end{bmatrix} = B_{1,t}\begin{bmatrix} Y_{t-1} \\ f_{t-1} \end{bmatrix} + B_{2,t}\begin{bmatrix} Y_{t-2} \\ f_{t-2} \end{bmatrix} + \ldots + \varepsilon_t, \qquad \text{(A3.2.1)}$$

in which x is a vector of financial indicators, Y is a vector of macroeconomic variables of interest (including real GDP growth and inflation), λ_t^y are regression coefficients, λ_t^f are the factor loadings, and f_t is the latent factor, interpreted as the FCI.

Univariate FCIs offer a parsimonious way of summarizing the information in several financial indicators, which could be advantageous from a forecasting perspective because it can help reduce parameter uncertainty. However, the weight of each variable is not necessarily driven by economic considerations of relative importance as suggested either by theory or by country-specific characteristics. For example, movements in asset prices may be effective in pinpointing risks at short horizons, but slower-moving credit aggregates are likelier to yield more information at longer time horizons. Moreover, while asset prices are likely to be an adequate summary of financial vulnerabilities in some advanced economies, credit aggregates may possess significantly greater information content in emerging market economies. Consequently, financial indicators need not receive the same weight across different time horizons and countries; therefore, as described in the second section of this annex, the chapter also uses an approach that seeks to exploit the information content of

[27]Prepared by Romain Lafarguette and Dulani Seneviratne.

[28]An important reason to expand coverage to aggregates is that beyond a few advanced economies, it is unlikely that developments in asset prices provide an adequately encompassing and timely summary of the information regarding vulnerabilities that is contained in these financial aggregates. Thus, conditioning directly on the information content of the aggregates may improve the accuracy of forecasts of the risk outlook for growth.

[29]The FCIs are estimated using Koop and Korobilis' (2014) code (https://sites.google.com/site/dimitriskorobilis/matlab).

Annex Table 3.2.2. Data Sources

Variables	Description	Source
Domestic-Level Variables		
Term Spreads	Yield on 10-year government bonds minus yield on three-month Treasury bills	Bloomberg Finance L.P.; IMF staff
Interbank Spreads	Interbank interest rate minus yield on three-month Treasury bills	Bloomberg Finance L.P.; IMF staff
Change in Long-Term Real Interest Rate	Percentage point change in the 10-year government bond yield, adjusted for inflation	Bloomberg Finance L.P.; IMF staff
Corporate Spreads	Corporate yield of the country minus yield of the benchmark country; JPMorgan CEMBI Broad is used for emerging market economies where available	Bloomberg Finance L.P.; Thomson Reuters Datastream
Equity Returns (local currency)	Log difference of the equity indices	Bloomberg Finance L.P.
House Price Returns	Log difference of the house price index	Bank for International Settlements; Haver Analytics; IMF staff
Equity Return Volatility	Exponential weighted moving average of equity price returns	Bloomberg Finance L.P.; IMF staff
Change in Financial Sector Share	Log difference of the market capitalization of the financial sector to total market capitalization	Bloomberg Finance L.P.
Credit Growth	Percent change in the depository corporations' claims on private sector	Bank for International Settlements; Haver Analytics; IMF, International Financial Statistics database
Sovereign Spreads	Yield on 10-year government bonds minus the benchmark country's yield on 10-year government bonds	Bloomberg Finance L.P.; IMF staff
Banking Sector Vulnerability	Expected default frequency of the banking sector	Moody's Analytics, CreditEdge; IMF staff
Exchange Rate Movements	Change in US dollar per national currency exchange rate; for the United States, Bloomberg Finance L.P.'s DXY index is used	Bloomberg Finance L.P.; IMF, Global Data Sources and International Financial Statistics databases
Domestic Commodity Price Inflation	A country-specific commodity export price index constructed following Gruss 2014, which combines international commodity prices and country-level data on exports and imports for individual commodities; change in the estimated country-specific commodity export price index is used	Bloomberg Finance L.P.; IMF, Global Data Sources database; United Nations, COMTRADE database; IMF staff
Trading Volume (equities)	Equity markets' trading volume, calculated as level to 12-month moving average	Bloomberg Finance L.P.
Market Capitalization (equities)	Market capitalization of the equity markets, calculated as level to 12-month moving average	Bloomberg Finance L.P.; Thomson Reuters Datastream
Market Capitalization (bonds)	Bonds outstanding, calculated as level to 12-month moving average	Dealogic; IMF staff
Change in Credit to GDP	Change in credit provided by domestic banks, all other sectors of the economy, and nonresidents (in percent of GDP)	Bank for International Settlements; Haver Analytics; IMF staff
Real GDP Growth	Percent change in GDP at constant prices	IMF, World Economic Outlook database
Inflation	Percent change in the consumer price index	Haver Analytics; IMF, International Financial Statistics database
Global-Level Variables		
VIX	Chicago Board Options Exchange Market Volatility Index	Bloomberg Finance L.P.; Haver Analytics
MOVE	Merrill Lynch Option Volatility Estimate Index	Bloomberg Finance L.P.

Source: IMF staff.
Note: CEMBI = Corporate Emerging Markets Bond Index; DXY = Dollar Index Spot; MOVE = Merrill Lynch Option Volatility Estimate Index; VIX = Chicago Board Options Exchange Volatility Index.

Annex Table 3.2.3. Partitioning of Financial Indicators into Groups

	Price of Risk	Leverage	Foreign Shocks	Persistence
Financial and Real Indicators (when available)	Term spread Corporate spread Short-term rate Real long-term rate Sovereign spread Interbank spread Equity returns Equity historical volatility House price returns	Credit to GDP Credit growth (quarterly)	Bilateral exchange rate (US dollar to local currency) Commodity prices VIX[1]	GDP growth

Source: IMF staff.
[1] Except for the United States, for which VIX enters as a price-of-risk variable. VIX = Chicago Board Options Exchange Volatility Index.

financial indicators in a manner that is more sensitive to countries and time horizons.

Data Partitioning Based on Linear Discriminant Analysis

The individual financial indicators are aggregated into groups using linear discriminant analysis (LDA), a data-reduction technique (Annex Table 3.2.3). LDA aims to project a data set onto a lower-dimensional space while ensuring adequate separation of data into categories. LDA is similar to principal components analysis (PCA) in the sense that it maximizes the common variance among a set of variables, but it diverges from PCA by also ensuring that the linear combination of the variables discriminates across the classes of another categorical variable of interest. In the framework of the chapter, this categorical variable is a dummy variable, defined at the country level, equal to one when future GDP growth at a one-year horizon is below the 20th percentile of historical outcomes and equal to zero otherwise. Consequently, the loading on each individual financial indicator in the LDA is determined in a way that maximizes its contribution to discriminating between periods of low GDP growth and periods of normal GDP growth. This is convenient from the chapter's perspective because it allows for a link between financial indicators and GDP growth in the data-reduction process. By contrast, the PCA approach aggregates only information about the common trend among financial indicators.[30]

[30]LDA assumes independence of normally distributed data and homoscedastic variance among each class, although LDA is considered robust when these assumptions are violated. See Duda, Hart, and Stork 2001. See Izenman 2013 for a thorough exposition of the LDA technique.

Annex 3.3. The Conditional Density of Future GDP Growth[31]

Quantile Regressions

The estimation of the conditional density forecast is conducted through quantile projections.[32] This approach starts by using quantile regressions to directly estimate the conditional quantiles (q) of the forecast distribution of GDP growth (y) h quarters ahead, as a function of both its current level and current financial conditions (FC):

$$y_{t+h,q} = \beta^{h}_{f,q} FC_t + \beta^{h}_{y,q} y_t + \epsilon^{h}_{t,q}. \quad \text{(A3.3.1)}$$

In the baseline approach, FC corresponds to a predetermined univariate financial conditions index (FCI) constructed in the manner described in Annex 3.2.

The empirical model is subsequently modified to investigate the relative significance of asset prices, credit aggregates, and global or foreign factors in signaling risks to GDP growth in the near to medium term:

$$y_{t+h,q} = \alpha^{h}_{p,q} p_t + \beta^{h}_{a,q} Agg_t + \gamma^{h}_{y,q} y_t + \phi^{h}_{f,q} f_t + \epsilon^{h}_{t,q}, \quad \text{(A3.3.2)}$$

in which p, Agg, and f correspond to the principal components of the price of risk (asset prices and risk spreads),

[31]Prepared by Sheheryar Malik and Romain Lafarguette.

[32]For an introduction to quantile regression, see Koenker 2005. As highlighted by Komunjer (2013), quantile regressions rely on specific functional form assumptions and have some important advantages in forecasting the conditional distribution of the variable of interest. These include the desirability of the conditional quantile estimator as a predictor of the true future quantile; robustness of the estimation to extreme outliers and violations of normality and homoscedasticity of the errors; flexibility, allowing for time-varying structural parameters and the optimal weighting of predictors depending on country, horizon, and the relevant portion of the distribution; and the ability to avoid overfitting (compared with more complex models such as copulas and extreme value theory).

credit aggregates, and global or foreign variables (commodity prices, exchange rates, and global risk sentiment). This approach disentangles the contribution of changes in the price of risk from evolving credit aggregates and shocks to the external environment when it comes to forecasting risks to GDP growth. It thereby provides insight into which variables signal growth tail risks over various time horizons. This can help policymakers and others design a surveillance framework that seeks to embed information flowing in at different frequencies.

Deriving the Density Forecast

The quantile regression in equation (A3.3.1) delivers an estimate for the conditional quantile function (or inverse cumulative distribution function) h quarters ahead—that is, $\hat{y}_{t+h,q}\left(= \hat{\beta}^h_{f,q} FC_t + \hat{\beta}^h_{y,q} y_t\right)$. Given the noisiness of such estimates in practice, recovering the corresponding predictive probability density function will inevitably require smoothing of the quantile function. In this chapter, this is accomplished via fitting a parametric form skewed t distribution.[33]

For each quarter, the analysis attempts to pin down four parameters of the predictive density $\{\mu_{t+h}, s_{t+h}, v_{t+h}, \xi_{t+h}\}$ by minimizing the squared distance between the estimated quantile function, $\hat{y}_{t+h,q}$, and (theoretical) quantile function $y^f_q\left(\mu_{t+h}, s_{t+h}, v_{t+h}, \xi_{t+h}\right)$ corresponding to the above skewed t distribution (see Giot and Laurent 2003). The four parameters (μ, s, v, ξ) are, respectively, the location, scale, degrees of freedom, and the shape of skewed t distribution. Specifically, the 5th, 25th, 50th, 75th, and 95th percentiles are matched via

$$\{\mu_{t+h}, s_{t+h}, v_{t+h}, \xi_{t+h}\} = \underset{\mu_{t+h}, s_{t+h}, v_{t+h}, \xi_{t+h}}{\operatorname{argmin}} \sum_q \left\{\hat{y}_{t+h,q} - y^f_q\left(\mu_{t+h}, s_{t+h}, v_{t+h}, \xi_{t+h}\right)\right\}^2,$$

in which $\mu_{t+h} \in \mathbb{R}$, $s_{t+h} > 0$, $v_{t+h} \geq 2$, and $\xi_{t+h} > 0$. Notwithstanding the skewness property, choice of a skewed t functional form is advantageous from the perspective of flexibility. For example, $v \to \infty$, $f(y; \mu, s, v, \xi)$ is characterized by tail properties resembling a Gaussian distribution. Moreover, the density is symmetric for $\xi = 1$.

[33]There are many choices for fitting a conditional density on the set of conditional quantiles. Adrian, Boyarchenko, and Giannone (2016) adopt a parametric approach focusing on a distribution family chosen a priori (t skewed), whereas De Nicolò and Lucchetta (2017) use a nonparametric approach. The functional form for the skewed t distribution is motivated by Fernandez and Steel (1998) and further explored and refined in Giot and Laurent 2003 and Lambert and Laurent 2002; see also Boudt, Peterson, and Croux 2008. Alternative specifications for the skewed t distribution are present in literature—for example, as put forth by Hansen (1994) and Azzalini and Capitanio (2003). These are essentially equivalent given a nonlinear transformation of the skewness parameter.

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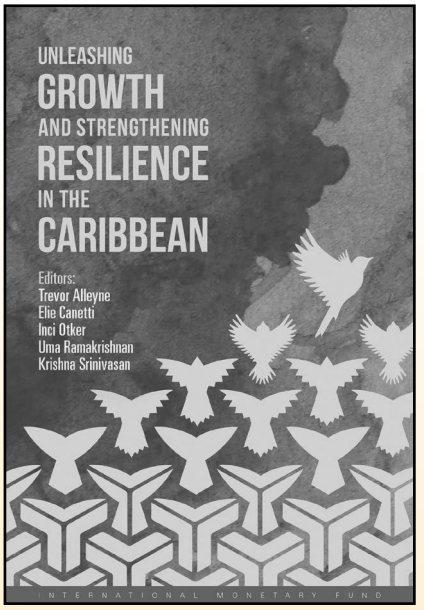

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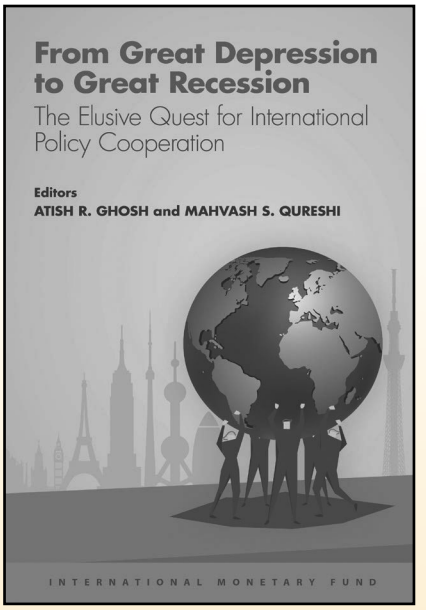

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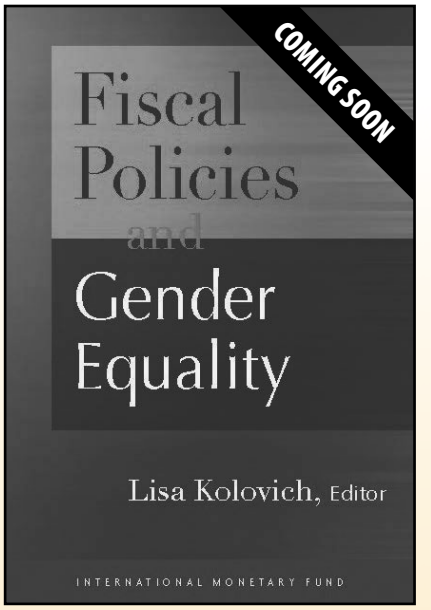

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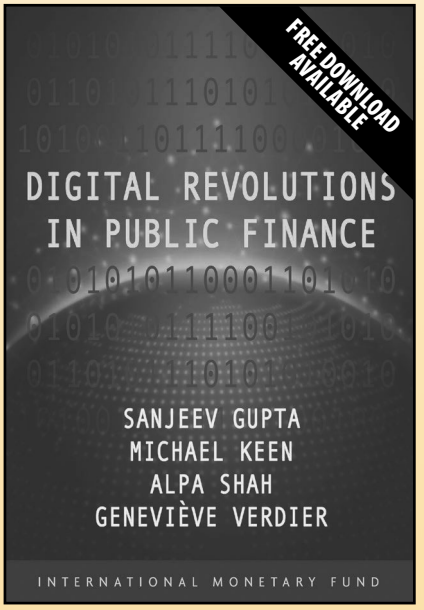

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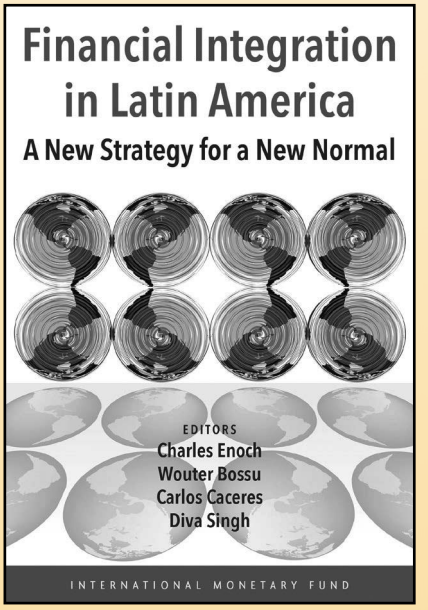

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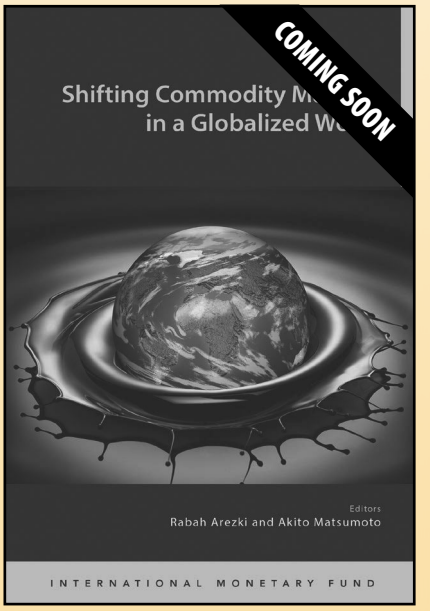

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