

World Economic and Financial Surveys

Global Financial Stability Report

Durable Financial Stability **Getting There from Here**

.....

APR **11**



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

Global Financial Stability Report

Durable Financial Stability

Getting There from Here

April 2011



International Monetary Fund
Washington DC

© 2011 International Monetary Fund

Production: IMF Multimedia Services Division
Cover: Creative Services
Figures: Theodore F. Peters, Jr.
Typesetting: Michelle Martin

Cataloging-in-Publication Data

Global financial stability report – Washington, DC :
International Monetary Fund, 2002-
v. ; cm. – (World economic and financial surveys, 0258-7440)

Semiannual
Some issues also have thematic titles.
ISSN 1729-701X

1. Capital market — Developing countries — Periodicals.
2. International finance — Periodicals. 3. Economic stabilization —
Periodicals. I. International Monetary Fund. II. Series: World
economic and financial surveys.
HG4523.G563

ISBN: 978-1-61635-060-4

Please send orders to:
International Monetary Fund, Publication Services
P.O. Box 92780, Washington, D.C. 20090, U.S.A.
Tel.: (202) 623-7430 Fax: (202) 623-7201
E-mail: publications@imf.org
Internet: www.imfbookstore.org

CONTENTS

Preface	ix
Executive Summary	xi
Chapter 1. Key Risks and Challenges for Sustaining Financial Stability	1
Summary	1
A. What Are the Key Stability Risks and Challenges?	2
B. Living Dangerously—The Legacy of High Debt Burdens in Advanced Economies	10
C. Banking System—Not Enough Has Been Done	12
D. Sovereign Funding Challenges	20
E. Alleviating Pressures on Households and Firms	28
F. Macro and Stability Implications of Capital Inflows into Emerging Markets	35
G. Durable Financial Stability: Getting There from Here	47
Annex 1.1. What Factors Are Driving U.S. Bond Yields Higher?	51
Annex 1.2. Compilation of Investor Base Data for General Government Debt	55
Annex 1.3. Dubai: From Debt Overhang to Restructuring, but Risks Remain	56
Annex 1.4. Projecting Government Funding Costs through 2015	59
Annex 1.5. Strategic Defaults and Housing Prices in the United States	60
Annex 1.6. Recent Measures to Manage Capital Flows in Selected Economies	63
Annex 1.7. Exchange-Traded Funds: Mechanics and Risks	68
References	72
Chapter 2. How to Address the Systemic Part of Liquidity Risk	75
Summary	75
What Is Systemic Liquidity Risk?	77
Will Liquidity Rules under Basel III Lower Systemic Risk?	78
Measures of Systemic Liquidity Risk and Potential Macroprudential Tools to Mitigate It	83
Summary and Policy Considerations	95
Annex 2.1. Methods Used to Compute a Systemic Liquidity Risk Index	99
Annex 2.2. Technical Description of the Systemic Risk-Adjusted Liquidity Model	101
Annex 2.3. Highlights of the Stress-Testing Framework	106
References	109
Chapter 3. Housing Finance and Financial Stability—Back to Basics?	111
Summary	111
Housing Booms and Busts—Theory and Stylized Facts	112
Global Housing Finance Landscape	115
Housing Finance and Financial Stability	133
Conclusions and Policy Implications—Back to Basics	142

Annex 3.1. The Impact of Housing Finance Modes on House Prices and Loan-Loss Growth during the Recent Crisis	146
Annex 3.2. Evidence on House Prices, Credit, and Housing Finance Characteristics in Advanced Economies	150
References	152

Glossary	159
-----------------	------------

Annex: Summing Up by the Acting Chair	169
--	------------

Statistical Appendix

[Available online at www.imf.org/external/pubs/ft/gfstr/2011/01/pdf/statappx.pdf]

Boxes

1.1. The Middle East: Geopolitical Risk to the Financial Stability Outlook	4
1.2. Implications of Japan's Earthquake for Financial Stability	8
1.3. Examining the Ability of U.S. Banks to Absorb Mortgage Principal Reductions	30
1.4. Are Debt Vulnerabilities Building in the Emerging Market Corporate Sector?	43
1.5. Emerging Market Banks: Fueling Growth or Frenzy?	45
1.6. Euro Area Crisis Management and Prevention	50
1.7. Regulatory Reforms: Are We There Yet?	52
2.1. How Well Does the Net Stable Funding Ratio Predict Banks' Liquidity Problems?	82
2.2. How Well Does the Systemic Liquidity Risk Index Explain Banks' Liquidity Problems?	88
3.1. The Danish "Balance Principle" Mortgage Model	118
3.2. Legal Prerequisites for Housing Finance Systems	123
3.3. Experience with Limits on Loan-to-Value Ratios for Residential Mortgages	129
3.4. Housing Finance and the U.S. Housing Crisis	130
3.5. Emerging Market Mortgage Securitization	132
3.6. Empirical Analyses of the Relationships among House Prices, Credit, and Housing Finance Characteristics	137
3.7. Mortgage Finance Unbundling and Incentive Misalignments	140

Tables

1.1. Indebtedness and Leverage in Selected Advanced Economies	11
1.2. Banking Vulnerability Indicators	17
1.3. Sovereign Market and Vulnerability Indicators	21
1.4. Different Scenarios for Return to "Equilibrium" Household Debt-to-GDP Ratios	32
1.5. Macro and Financial Indicators for Selected Emerging Economies	42
1.6. Selected Capital Flow Management Measures in Asian Economies	65
2.1. Factors Used in Calculations	80
2.2. Main Features of the Proposed Methodologies	84
2.3. Indicators for (Systemic) Liquidity Risk Monitoring	85
2.4. Joint Expected Losses from Systemic Liquidity Risk	92
2.5. Capital Charge for Individual Liquidity Risk and Individual Contribution to Systemic Liquidity Risk	92
2.6. Summary Statistics of Individual Contributions to Systemic Liquidity Risk and Associated Fair Value Insurance Premium	93

2.7.	Selected Liquidity Stress-Testing Frameworks	94
2.8.	Withdrawal Rate Assumptions	95
2.9.	Probability of Banks Ending the Simulation with a Liquidity Shortage	95
2.10.	Capital Surcharges	97
2.11.	Selected Regulatory Proposals for Managing Systemic Liquidity Risk	97
3.1.	Crisis Measures	116
3.2.	Housing Finance Features in Advanced Economies, 2008	117
3.3.	Housing Finance Systems in Emerging and Newly Industrialized Economies, 2008	120
3.4.	Mortgage Market Characteristics in Emerging and Newly Industrialized Economies, 2008	122
3.5.	Index of Government Participation in Housing Finance Markets, 2008	126
3.6.	Which Housing Finance Features Help Explain Growth in House Prices, Mortgage Credit, and Nonperforming Loans?	136
3.7.	Joint Determinants of Growth in Real House Prices, Mortgage Credit, and Loan Losses	148
3.8.	Joint Determinants of Growth in Real House Prices and Mortgage Credit, Pre-Crisis Episode, 2004–07	149
3.9.	House Prices and Household Bank Credit	151
3.10.	House Prices, Household Bank Credit, and Macroeconomic Controls	151
3.11.	House Prices and Housing Finance Characteristics	152
3.12.	House Prices and Government Participation	153

Figures

1.1.	Global Financial Stability Map	2
1.2.	Global Financial Stability Map: Assessment of Risks and Conditions	3
1.3.	Changes in Financial Conditions	7
1.4.	Risk Appetite	7
1.5.	Banking Sector Challenges	13
1.6.	Banking System Capital and Reliance on Wholesale Funding	13
1.7.	Global Bank Debt Maturity Profile	14
1.8.	Bank Rollover Requirement, 2011–12	14
1.9.	Bank Debt Yields	15
1.10.	Increase in Bank Deposit Rates	15
1.11.	Change in Bank Net Interest Margin, June 2010	16
1.12.	Policy Solutions to Banking Sector Challenges	18
1.13.	European Union Bank Core Tier 1 Ratios, 2010	19
1.14.	Sovereign Credit Default Swap Spreads	22
1.15.	Euro Area Treasury Bond Spreads over German Bunds, and Volatility	23
1.16.	Risk-Adjusted Yields for Euro-Denominated Bonds	23
1.17.	Change in General Government Debt Holdings	24
1.18.	Average versus Marginal Government Funding Costs	25
1.19.	Sovereign Funding Needs	25
1.20.	Government Funding Costs in 2015	26
1.21.	Funding Cost Thresholds, Debt, and Revenue	27
1.22.	Leverage Ratios: Household Debt as a Percent of GDP	29
1.23.	Various Measures of U.S. Household Leverage	29
1.24.	Shadow Inventory of Houses Potentially for Sale	29
1.25.	Household Balance Sheets	33

1.26.	Federal Reserve Assets and Flows into U.S. Risky Assets	33
1.27.	Nonfinancial Corporate Credit Default Swap Spreads	34
1.28.	Nonfinancial Corporates' Debt-to-Equity Ratios	34
1.29.	Lending Conditions for Small and Medium-Sized Enterprises	35
1.30.	Debt Maturity Profile for the Commercial Real Estate Sector	35
1.31.	Net Capital Inflows to Emerging Markets	36
1.32.	U.S. Investment Flows in Foreign Securities	37
1.33.	Portfolio Debt Inflows and Risk-Adjusted Local Government Yields	38
1.34.	Average Monthly Retail Flows to Emerging Market Debt and Equity Mutual Funds	38
1.35.	Capital Inflows, Real Credit, and Real Equity Prices	39
1.36.	Emerging Market Equities: Foreign Inflows, Issuance, and Returns in 2010	40
1.37.	Emerging Market External Corporate Issuance by Rating	40
1.38.	Median Volatility of Inflation, Currencies, and Capital Flows	41
1.39.	Real Policy Rates in February 2011	48
1.40.	Ten-Year Government Bond Yields	54
1.41.	Macroeconomic Surprise Indices	54
1.42.	Ten-Year Break-Even Rates	54
1.43.	Term Premium on U.S. Treasuries	55
1.44.	Components of 10-Year Nominal Treasury Yield	55
1.45.	Dubai: Foreign Borrowing Surge and Rollover Risk	57
1.46.	Urban Real Estate Prices, CPI-Deflated	57
1.47.	Maturity Profile of Debt of Dubai Government-Related Enterprises	57
1.48.	Dubai: Composition of Debt	58
1.49.	Credit Default Swap Spreads	58
1.50.	United Arab Emirates: Recent Developments in Local Banks	58
1.51.	Nonperforming Loans and Real Estate	58
1.52.	Government Funding Costs and Debt Affordability	61
1.53.	Annualized Transition Probability of a Performing Prime Mortgage to 60-Plus Day Delinquency Conditional on Local Unemployment Rate	62
1.54.	U.S. Mortgage Delinquency Probability and Home Equity Distribution	62
1.55.	Home Equity, Delinquency Rate, and House Price Declines	63
1.56.	Indonesia: Foreign Holdings of Government Bonds and Bank Indonesia Certificates	66
1.57.	Thailand: Weekly Foreign Portfolio Inflows and Reserves	66
1.58.	Asian Residential Property Prices	67
1.59.	Korea: Short-Term External Borrowing	67
1.60.	Exchange-Traded Fund Assets (\$1.2 Trillion), by Type of Exposure	69
1.61.	Exchange-Traded Fund Trading: Synthetic Replication Based on Total Return Swaps	70
1.62.	Counterparty Risks in Exchange-Traded Funds	70
1.63.	Flash Crash: Intraday Prices, May 6, 2010	72
1.64.	Gold Exchange-Traded Funds	72
2.1.	Net Stable Funding Ratio by Region	79
2.2.	Net Stable Funding Ratio by Business Model	79
2.3.	Net Stable Funding Ratio by Bank, 2009	81
2.4.	Systemic Liquidity Risk Index	86
2.5.	Average Sensitivity of Volatility of Banks' Return on Equity to Systemic Liquidity Risk Index	86

2.6.	Sensitivity of Volatility of Banks' Return on Equity Based on Market Capitalization to Systemic Liquidity Risk Index	87
2.7.	Sensitivity of Volatility of Banks' Return on Equity Based on Net Stable Funding Ratio to Systemic Liquidity Risk Index	87
2.8.	Illustration of Individual Expected Losses Arising from Liquidity Risk	90
2.9.	Illustration of Joint and Total Expected Shortfalls Arising from Systemic Liquidity Risk	91
2.10.	Total Loan Reductions	96
2.11.	Principal Component Analysis: Total Variation Explained by Each Factor	99
2.12.	Methodology to Compute Systemic Liquidity under the Systemic Risk-Adjusted Liquidity Model	102
2.13.	Conceptual Relation between the Net Stable Funding Ratio at Market Prices and Expected Losses from Liquidity Risk	103
2.14.	Conceptual Scheme for the Probability Distribution of Joint Expected Shortfall from Liquidity Risk: Two-Firm (Bivariate) Case	104
2.15.	Systemic Liquidity Risk ST Framework	106
3.1.	House Price Indices	113
3.2.	Government Participation in Housing Finance	125
3.3.	Government Participation in Housing Finance: Emerging and Newly Industrialized Economies	125
3.4.	Homeownership Rate and Government Participation in Housing Finance	128
3.5.	Homeownership Rate	128
3.6.	Residential Mortgage-Debt-to-GDP Ratio: Advanced Economies	134
3.7.	Residential Mortgage-Debt-to-GDP Ratio: Emerging Europe	134
3.8.	Nonperforming Residential Mortgage Loans	135
3.9.	Home Foreclosures in the United Kingdom and the United States	139

The following symbols have been used throughout this volume:

. . . to indicate that data are not available;

— 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, 2008–09 or January–June) to indicate the years or months covered, including the beginning and ending years or months;

/ between years (for example, 2008/09) to indicate a fiscal or financial year.

“Billion” means a thousand million; “trillion” means a thousand billion.

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

“n.a.” means not applicable.

Minor discrepancies between sums of constituent figures and totals are due to rounding.

As used in this volume the term “country” does 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.

The boundaries, colors, denominations, and other information shown on the maps do not imply, on the part of the International Monetary Fund, any judgment on the legal status of any territory or any endorsement or acceptance of such boundaries.

PREFACE

The *Global Financial Stability Report* (GFSR) assesses key risks facing the global financial system with a view to identifying those that represent systemic vulnerabilities. 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. Despite ongoing economic recovery and improvements in global financial stability, structural weaknesses and vulnerabilities remain in some important financial systems. The current report highlights how risks have changed over the past six months, traces the sources and channels of financial distress with an emphasis on sovereign risk, notes the pressures arising from capital inflows in emerging economies, and discusses policy proposals under consideration to mend the global financial system.

The analysis in this report has been coordinated by the Monetary and Capital Markets (MCM) Department under the general direction of José Viñals, Financial Counsellor and Director. The project has been directed by MCM staff Jan Brockmeijer and Robert Sheehy, both Deputy Directors; Peter Dattels and Laura Kodres, Assistant Directors; and Matthew Jones, Deputy Division Chief. It has benefited from comments and suggestions from the senior staff in the MCM Department.

Contributors to this report also include Gohar Abajyan, Sergei Antoshin, Ivailo Arsov, Adolfo Barajas, Theodore Barnhill Jr., Reinout De Bock, Phil de Imus, Joseph Di Censo, Dawn Yi Lin Chew, Francesco Columba, Jaime Espinosa, Luc Everaert, Jeanne Gobat, Alessandro Gullo, Vincenzo Guzzo, Kristian Hartelius, Sanjay Hazarika, Geoffrey Heenan, Deniz Igan, Andreas Jobst, Geoffrey Keim, William Kerry, John Kiff, Turgut Kisinbay, Taline Koranchelian, Peter Lindner, Estelle Liu, Yinqiu Lu, Andrea Maechler, Rebecca McCaughrin, Andre Meier, Fabiana Melo, Paul Mills, Srobona Mitra, Ken Miyajima, Michael Moore, Erlend Nier, Hiroko Oura, Jaume Puig, Faezeh Raei, Marta Sánchez-Saché, Christian Schmieder, Liliana Schumacher, Gabriel Sensenbrenner, Tiago Severo, Narayan Suryakumar, Morgane de Tollenaere, Nico Valckx, and Ann-Margret Westin. Martin Edmonds, Ivan Guerra, Oksana Khadarina, Yoon Sook Kim, and Ryan Scuzzarella provided analytical support. Gerald Gloria, Nirmaleen Jayawardane, Juan Rigat, and Ramanjeet Singh were responsible for word processing. David Einhorn and Gregg Forte, of the External Relations Department, and Florian Gimbel, of MCM, edited the manuscript, and the External Relations Department coordinated production of the publication.

This particular issue draws in part on a series of discussions with banks, clearing organizations, securities firms, asset management companies, hedge funds, standards setters, financial consultants, and academic researchers. The report reflects information available up to March 23, 2011.

The report benefited from comments and suggestions from staff in other IMF departments, as well as from Executive Directors following their discussion of the *Global Financial Stability Report* on March 28, 2011. However, the analysis and policy considerations are those of the contributing staff and should not be attributed to the Executive Directors, their national authorities, or the IMF.

EXECUTIVE SUMMARY

Global financial stability has improved over the past six months, bolstered by better macroeconomic performance and continued accommodative macroeconomic policies (see the April 2011 *World Economic Outlook*), but fragilities remain. The two-speed recovery—modest in advanced economies and robust in emerging market economies—has posed different policy challenges for countries. In advanced economies hit hardest by the crisis, governments and households remain heavily indebted, to varying degrees, and the health of financial institutions has not recovered in tandem with the overall economy. Emerging market economies are facing new challenges associated with strong domestic demand, rapid credit growth, relatively accommodative macroeconomic policies, and large capital inflows. Geopolitical risks could also threaten the economic and financial outlook, with oil prices increasing sharply amid fears of supply disruptions in the Middle East and North Africa.

The main task facing policymakers in advanced economies is to shift the balance of policies away from reliance on macroeconomic and liquidity support to more structural policies—less “leaning” and more “cleaning” of the financial system. This will entail reducing leverage and restoring market discipline, while avoiding financial or economic disruption during the transition. Thus, ongoing policy efforts to withdraw (implicit) public guarantees and ensure bondholder liability for future losses must build on more rapid progress toward stronger bank balance sheets, ensuring medium-term fiscal sustainability and addressing excessive debt burdens in the private sector.

For policymakers in emerging market economies, the task is to limit overheating and a buildup of vulnerabilities—to avoid “cleaning” later. Emerging market economies have continued to benefit from strong growth relative to that in advanced economies, accompanied by increasing portfolio capital inflows. This is putting pressure on some financial markets, contributing to higher leverage, potential asset price bubbles, and inflationary pressures. Policymakers will have to pay increasing attention to containing the buildup

of macrofinancial risks to avoid future problems that could inhibit their growth and damage financial stability. In a number of cases, this will entail a tighter macroeconomic policy stance, and, when needed, the use of macroprudential tools to ensure financial stability. Increasing the financial sector’s capacity to absorb higher flows through efforts to broaden and deepen local capital markets will also help.

In the next few months, the most pressing challenge is the funding of banks and sovereigns, particularly in some vulnerable euro area countries. As detailed in Chapter 1 of this *Global Financial Stability Report*, policies aimed at fiscal consolidation and strengthening bank balance sheets in these countries should be supported by credible assurances that multilateral backstops are sufficiently flexible and endowed to facilitate an orderly deleveraging without triggering further fiscal or bank funding strains. In other countries, funding is less problematic, but still a concern. Under a baseline scenario, higher funding costs and a rising government debt stock will cause government interest payments to increase in most advanced economies (see also the April 2011 *Fiscal Monitor*). If deficit reduction continues as projected, the interest costs should generally remain manageable, although much greater progress on medium-term fiscal consolidation strategies will be needed in both the United States and Japan to avoid downside risks to financial stability and to preserve confidence. In Japan, the immediate fiscal priority is to support reconstruction following the earthquake, returning in due course to progress toward medium-term consolidation goals.

Overall, despite the transfer of risks from the private to the public sector during the crisis, confidence in the banking systems of many advanced economies has not been restored and continues to interact adversely with the sovereign risks in the euro area. Analysis presented in this report suggests that in order to restore market confidence and reduce excessive reliance on central bank funding, considerable further strengthening of euro area bank balance sheets will be needed. This will require higher capital levels, if a detrimental

process of deleveraging is to be avoided, and a set of mostly smaller banks will have to be restructured and, where necessary, resolved. In the United States, a lackluster housing market, legacy mortgage problems, and a backlog of foreclosures continue to put pressure on the banking system, limiting credit creation and a return to a fully functioning mortgage market. Larger bank capital buffers and strengthened balance sheets will also be necessary as countries transition to a new and more demanding regulatory regime. Countries in which banking systems are still struggling should enhance transparency (including through more rigorous and realistic stress tests) and recapitalize, restructure, and (if necessary) close weak institutions. Without these longer-term financial sector reforms, short-term funding difficulties may escalate into another systemic liquidity event.

Measuring and mitigating systemic liquidity risks should be at the forefront of the agenda of policymakers. Those risks were a main feature of the latest crisis and have yet to be addressed. Chapter 2 takes a close look at this topic, examining the role that Basel III liquidity requirements will play when they are introduced. The analysis suggests that, while helping to raise liquidity buffers, Basel III will be unable to fully address the systemic nature of liquidity risk. The chapter provides some illustrative techniques for measuring systemic liquidity risk and firms' contribution to it, and suggests some accompanying macroprudential tools that could, after further refinement and testing,

be used to mitigate such risks. For instance, one of the approaches provides a way to gauge, based on a firm's assets and liabilities and its interbank connections, the higher capital needed to ensure that its risk of insolvency does not cause a destabilizing liquidity run during stressful periods. Tools of this type would allow for more effective sharing of the private-public burden of systemic liquidity risk and help reduce central bank interventions during periods of stress.

A common feature of the crisis in many countries was excessive and misallocated credit growth, which helped fuel housing market booms. Chapter 3 examines the connections between the housing finance systems and financial stability, noting that the structure of some countries' housing finance systems led to a deeper housing bust and financial instability. The chapter suggests a set of best practices for housing finance. For the United States, where the housing market and its financing are still problematic, these best practices imply that there should be better-defined and more transparent government participation in the housing market, including a diminished role of the two large government-sponsored entities (Freddie Mac and Fannie Mae). These goals will need to be pursued incrementally, while taking into account the still-weak housing market and economic recovery. Economies seeking to create a strong housing finance system are advised to "go back to basics"—ensuring safe loan origination and encouraging simple and transparent mortgage contracts.

Summary

Risks to global financial stability have declined since the October 2010 *Global Financial Stability Report*, helped in part by improving macroeconomic conditions. However, sovereign balance sheets remain under strain in many advanced economies, structural weaknesses and vulnerabilities in the euro area pose significant risks to bank balance sheets, credit risks remain high, and capital inflows to emerging markets could strain their absorptive capacity.

Many advanced economies are struggling with the legacy of high debt and excessive leverage. High debt levels are evident in many parts of the global economy, including households with negative equity, banks with thin capital buffers and uncertain asset quality, and sovereigns facing debt sustainability challenges.

Sovereign balance sheets are under strain in many advanced economies. As long as sovereign funding concerns persist, investors are likely to have a diminished appetite for riskier credits, in turn driving up funding costs and posing rollover risks. Economies with higher marginal funding costs and larger near-term financing needs are most vulnerable.

Incomplete policy action and reform has left segments of the global banking system vulnerable to further shocks. Despite improvements to balance sheets and significant policy initiatives, some banks remain insufficiently capitalized and vulnerable to rising funding costs. The weak tail of banks needs to be restructured or resolved, and the remaining institutions need to be adequately capitalized.

Elevated household leverage in the United States poses downside risks to housing markets. More structural policies may be needed to reduce this debt burden. Corporate balance sheets in most economies have improved, but some areas remain vulnerable, including small and medium-sized enterprises, the commercial real estate sector, and, in the euro area periphery, domestically focused firms. The ingredients are also in place for increased risk-taking among larger firms.

Capital inflows to emerging markets have rebounded but remain volatile. While inflows are not yet excessive in most markets, closing output gaps and rising inflation complicate policy responses. There are pockets of rising corporate leverage and evidence that weaker firms are accessing capital markets, making corporate balance sheets vulnerable to external shocks.

Policymakers face three key challenges in putting the recovery onto a durable path. They need to (1) address the legacy problems of high debt burdens and weakened balance sheets in advanced economies; (2) develop a stronger, more robust financial system that is subject to greater market discipline; and (3) guard against risks of overheating and the buildup of financial imbalances in emerging markets. For advanced economies, this will require a shift in the balance of policies away from reliance on macroeconomic and liquidity support toward more structural financial policies. In contrast, for emerging markets policies need to rely more on macroeconomic measures, while macroprudential and, in some cases, capital control measures can play a supportive role. In the short run, fragile balance sheets need continued support to ensure an orderly deleveraging, while in the medium run, public assistance needs to be withdrawn and effective market discipline reestablished.

A. What Are the Key Stability Risks and Challenges?

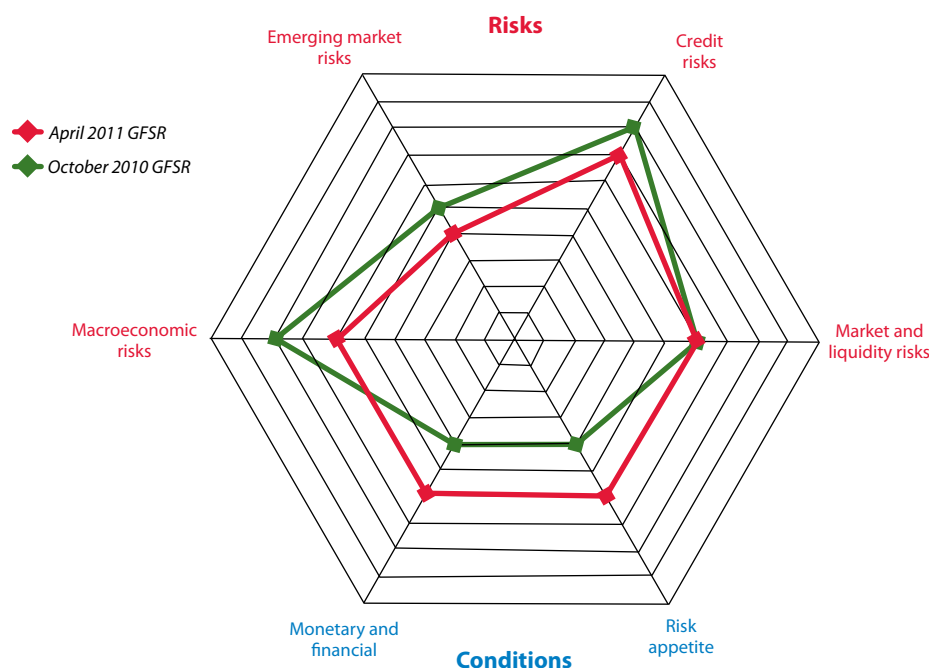
Risks to global financial stability have declined since the October 2010 Global Financial Stability Report (Figures 1.1 and 1.2). Improvements in macroeconomic performance in advanced economies and strong prospects for emerging markets are supporting overall financial stability. However, sovereign and banking system risks still remain high, and are lagging the overall economic recovery. Accommodative monetary and financial conditions helped ease balance sheet strains and supported an increase in risk appetite. However,

remaining structural weaknesses and vulnerabilities in the euro area still pose significant downside risks if not addressed comprehensively. Capital inflows to emerging markets could strain their absorptive capacity, raising concerns about the gradual build up of macrofinancial risks.

The global recovery has gained pace since the October 2010 GFSR, but remains uneven: heavy debt burdens and high unemployment continue to weigh on economic growth in advanced economies, while emerging market economies continue to grow strongly. Overall *macroeconomic* risks have declined, driven down by improvements in activity and lower risks of deflation (see the April 2011 *World Economic Outlook*). Section B of this chapter shows, however, that even nearly four years since the onset of the financial crisis, balance sheet fragilities continue to pose key downside risks to global financial stability and the economic recovery. Geopolitical risks could also threaten the economic and financial outlook, with oil prices increasing sharply amid fears of supply disruptions in the Middle East and North Africa (see Box 1.1).

Note: This chapter was written by a team led by Peter Dattels and comprised of Sergei Antoshin, Ivailo Arsov, Reinout de Bock, Phil de Imus, Joseph Di Censo, Martin Edmonds, Luc Everaert, Vincenzo Guzzo, Kristian Hartelius, Geoffrey Heenan, Matthew Jones, Geoffrey Keim, William Kerry, Taline Koranchelian, Peter Lindner, Estelle Liu, Yinqiu Lu, Andrea Maechler, Rebecca McCaughrin, Andre Meier, Fabiana Melo, Paul Mills, Ken Miyajima, Michael Moore, Jaume Puig, Faezeh Raei, Marta Sánchez-Saché, Christian Schmieder, Gabriel Sensenbrenner, Narayan Suryakumar, Morgane de Tollenaere, and Nico Valckx.

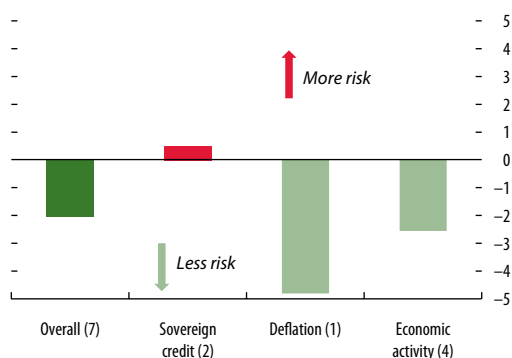
Figure 1.1. Global Financial Stability Map



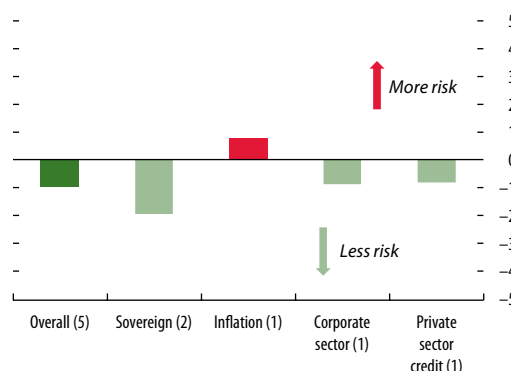
Note: Away from center signifies higher risks, easier monetary and financial conditions, or higher risk appetite.

Figure 1.2. Global Financial Stability Map: Assessment of Risks and Conditions*(In notch changes since the October 2010 GFSR)*

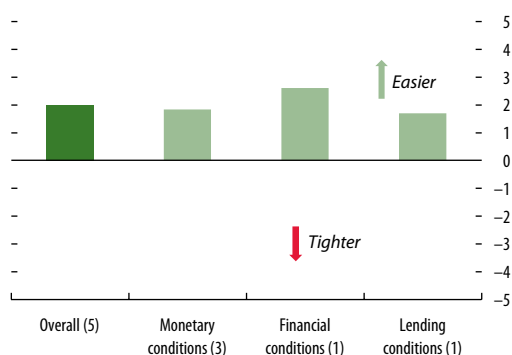
Macroeconomic risks declined despite continued strains in sovereign balance sheets, as the recovery remained on track and deflation risks eased.



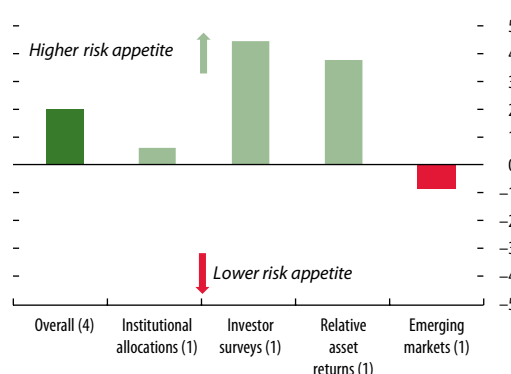
Notwithstanding rising inflationary pressures, *emerging market risks* were also lower, as reflected in continued rating upgrades and favorable growth prospects.



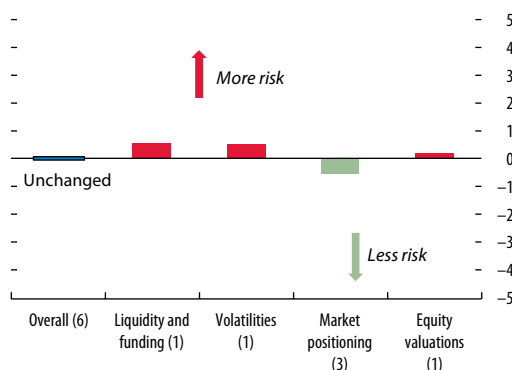
Easier *monetary and financial conditions* driven by continued accommodative policies, including QE2....



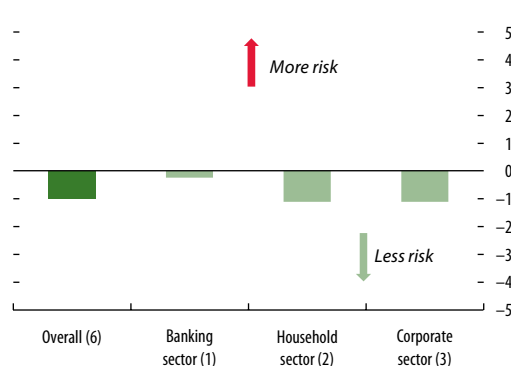
... coupled with the improved macroeconomic outlook boosted *risk appetite*, although inflows to emerging markets decelerated recently.



Supportive policies also helped contain broader *market and liquidity risks* despite new stresses in the euro area.



However, improvements in *credits risks* lagged the real economy, as supportive policies and strong *risk appetite* may be temporarily masking elevated underlying vulnerabilities.



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 GFSR 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 next to each legend indicates the number of individual indicators within each subcategory of risks and conditions. For lending standards, positive values represents slower pace of tightening or faster easing.

Box 1.1. The Middle East: Geopolitical Risk to the Financial Stability Outlook

The political crisis in the Middle East is likely to have a profound and lasting effect on the region. Despite the spike in oil prices, the impact on global markets has been relatively contained so far. The potential for contagion through non-oil channels is moderated by the region's relatively limited trade and financial links to the rest of the world. However, some vulnerable economies in the euro area, as well as some emerging markets, could experience additional pressures if interest rates rise more sharply to combat inflation. If the political crisis deepens and oil supplies are severely disrupted, the potential impact on the world economy would be much more severe.

Regional markets have come under significant pressure...

The events of recent months represent a historic change in the politics and governance of the Middle East and North Africa, and their effect is likely to be felt for years to come. Although most of the financial repercussions were initially limited to the countries at the epicenter of the political events, the oil-exporting countries were eventually affected as the unrest spread (first figure). Overall, since early January stock markets have fallen sharply, and credit default swap spreads are much wider, although some markets have recovered from their worst levels. Citing heightened political risk, and in some cases, disruptions in real activity and fiscal weakening, rating agencies have undertaken numerous actions regarding several Middle Eastern and North African countries, with Bahrain, Egypt, Jordan, Libya, and Tunisia among the countries downgraded. Financial links within the region—cross-border equity holdings as well as Bahrain's position as a regional banking hub—may lead to heightened regional transmission of shocks.

Although intraregional trade links are relatively weak, tourism and remittance flows from the Gulf Cooperation Council countries and other oil-exporting countries to some of the oil importers are expected to weaken substantially, with an adverse real sector impact. Furthermore, reverse migration—from histori-

cal host countries back to the home countries—would add to already stressed labor markets in the region.

...while contagion to global markets has thus far been limited.

The potential for contagion through non-oil channels is moderated by the region's relatively limited trade and financial links to the rest of the world:

- **Trade links.** Outside of the oil sector, the Middle East and North Africa region does not have extensive trade and financial links with the rest of the world. The region is a net importer, and non-oil exports are relatively low. For example, oil exports in 2010 represented 63 percent of the region's total exports of goods and services, and 71 percent for the subgroup of oil exporters.
- **Banking sector links.** The risk of contagion through the international banking system is moderated by the limited credit exposure of western banks to the region. Banks in the United States, United Kingdom, Japan, and Europe have a combined exposure to the larger regional economies of approximately \$330 billion, according to data for the third quarter of 2010 from the Bank for International Settlements. However, the exposures of U.K., U.S., and French banks are not insignificant (second figure). For the United Arab Emirates, U.K. bank exposure is \$57 billion, U.S. exposure is \$13 billion, and French exposure is \$12 billion. French banks have \$22 billion of exposure to Morocco, \$19 billion to Saudi Arabia, and \$17 billion to Egypt.
- **Petrodollar funding flows.** European (and especially U.K.) money markets have been a traditional venue for the recycling of petrodollars for decades, and in recent years the flows have been extended to money markets in other parts of Asia such as Singapore and Tokyo. However, these flows have been working normally so far and are unlikely to be disrupted unless civil unrest becomes severe enough to disrupt the governments of large oil exporters.

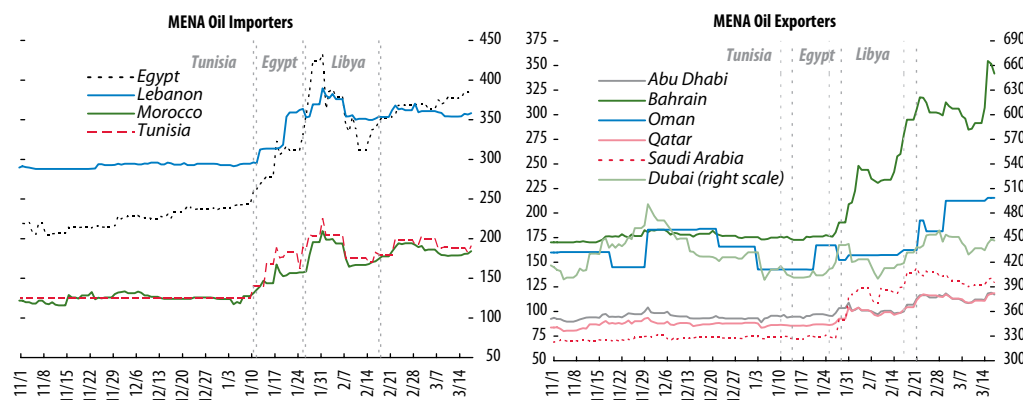
As a result of these limited links, spillovers to broader risk markets have been limited, although there has been some flight to safety, with gold and the Swiss franc trading higher. Market volatility has remained below the levels reached during the euro zone crisis of 2010.

Note: This box was prepared by Gohar Abajyan, Adolfo Barajas, Jaime Espinosa, and Sanjay Hazarika.

Box 1.1 (continued)

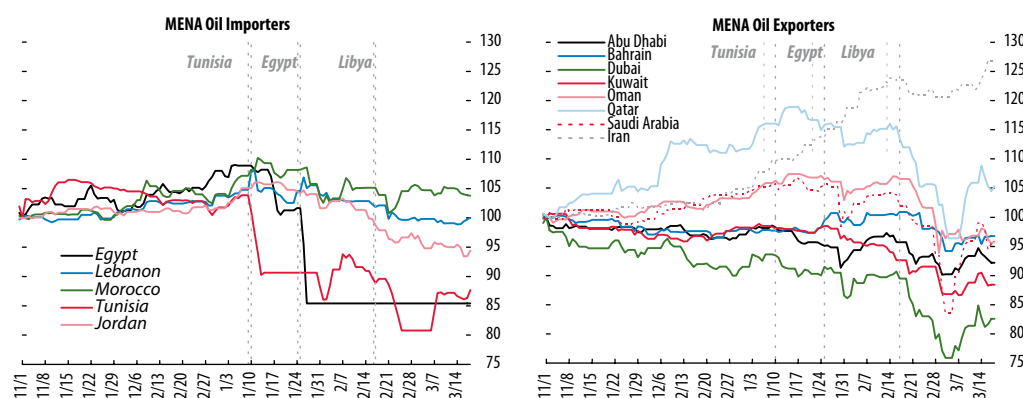
Credit Default Swap Spreads

(Basis points, November 1, 2010 - March 17, 2011)



Stock Markets

(Index; November 1, 2010=100, November 1, 2010 - March 18, 2011)



Sources: Bloomberg L.P.; and Markit.
Note: MENA = Middle East and North Africa.

Nonetheless, vulnerable economies in the euro area, as well as some emerging markets, could see additional pressures if interest rates rise more sharply to combat inflation.

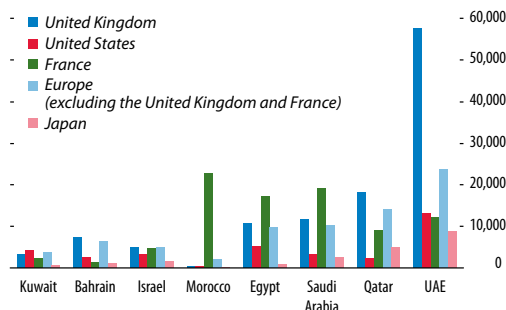
The rise in oil prices is contributing to upward pressure on inflation (third figure) and may lead to earlier-than-expected increases in interest rates. This may put further pressures on funding costs faced by euro area peripheral economies. Rising rates in advanced economies relative to emerging markets could result in a pullback of capital flows to some

emerging economies that have received large carry-trade related inflows.

A spread of political instability represents a tail risk to the global economic and stability outlook.

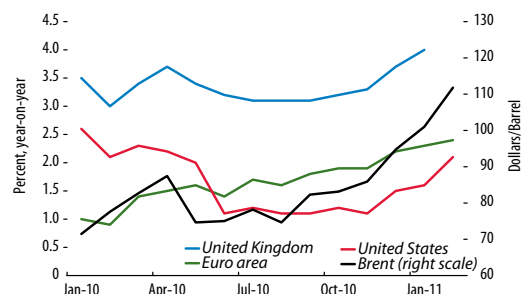
The worst case scenario is if civil unrest spreads to one or more of the larger oil producers and seriously disrupts oil supplies from the region, leading to extremely high oil prices and the destabilization of global markets. The shock to the real economy would hit bank balance sheets and raise the prospect of a double-dip global recession.

Box 1.1 (continued)

Developed Market Bank Exposures to Selected Middle East and North African Countries
(Millions of U.S. dollars)

Source: Bank for International Settlements.

Consumer Price Inflation and Oil Price



Source: Bloomberg L.P.

Monetary and financial conditions have eased further since the October 2010 GFSR (Figure 1.3), helping to remove deflation-related tail risks. Continued accommodative policies, including quantitative easing, coupled with the improved macroeconomic outlook, boosted *risk appetite* and encouraged a rally in risk assets, helped by a search for yield and a shift from fixed-income securities to equities (Figure 1.4). Equities—especially in advanced economies—have benefited from continued positive economic data, though geopolitical tensions and higher and more volatile oil prices have erased some of the recent gains. High-yield and investment-grade credit spreads in the United States, Europe, and Asia have continued to tighten, while investors are moving toward weaker-quality credit in search of yield. As a result, *market and liquidity risks* remain contained, despite renewed episodes of market turmoil in the euro area. Nevertheless, easy monetary and liquidity conditions may be masking underlying vulnerabilities. Rising expectations of monetary policy tightening in the wake of growing inflationary pressures could result in increased funding risks for vulnerable sovereign balance sheets and banking systems. While the financial stability risks from the recent earthquake and tsunami in Japan seem

manageable (see Box 1.2), the energy shortages, supply chain disruptions, and continuing problems at the Fukushima Daiichi nuclear power plant leave considerable uncertainty surrounding the growth impact and ultimate cost of damages.

Sovereign balance sheets remain under strain in many advanced economies, as illustrated by increased sovereign bond market volatility in some euro area countries over the past six months. Sovereign bond yields are higher across advanced economies, partly as economic data have improved (see Annex 1.1), and mainly in the case of certain countries in the euro area, in response to concerns about weakening public sector balance sheets. Section D examines these weaknesses, focusing on the financial stability implications of the ongoing repricing of risk in government funding markets and the associated narrowing of the investor base in more vulnerable euro area sovereigns. The analysis also shows that sovereign funding challenges could extend beyond the euro area, as both the United States and Japan are sensitive to higher funding burdens if interest rates increase substantially from current levels.

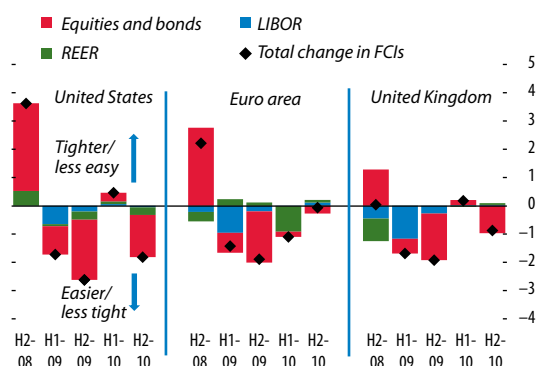
Improvements in underlying *credit risks* in the private sector are lagging behind the overall economic

recovery. Major stability risks remain that could derail the economic recovery, despite significant policy initiatives and some strengthening of bank balance sheets. Since the October 2010 GFSR, banks have sought to raise both the quantity and quality of capital, but progress has been uneven, with European banks generally lagging U.S. banks. European banks have also made less progress in lengthening the maturity of their funding, and remain highly dependent on wholesale funding, with second-tier banks increasingly reliant on covered bond markets and the European Central Bank (ECB) for funding. Banks are also facing pressures on the asset side of their balance sheet, reflecting concerns about exposures to troubled sovereigns and to property markets in Ireland, Spain, the United Kingdom, and the United States. Underlying credit measures show further deterioration in residential and commercial mortgage loans. Although credit growth has been steadily recovering in most advanced economies, it remains sluggish and well below pre-crisis levels, in part owing to still weak bank balance sheets. These weaknesses include excessive leverage, uncertainties about the quality of bank assets, insufficient capitalization in some banks, and generally higher bank funding costs (Section C). In the United States, the weak housing market is likely to extend the household deleveraging process, slowing the economic recovery and weighing on bank balance sheets (Section E).

Emerging markets have continued to receive strong capital inflows, which reflect the still-accommodative policies and relatively slow recovery in mature economies. Overall, *emerging market risks* have declined further since the October 2010 GFSR; renewed stress in the euro area and increased political uncertainty in the Middle East have had only limited spillovers, and growth prospects remain buoyant (Section F). However, the increase in corporate and financial leverage, rising asset valuations, and growing inflationary pressures in emerging market economies raise concerns about the gradual buildup of imbalances, calling for increased vigilance by policymakers and adroit use of policy tools.

The path to durable financial stability remains studded with difficult challenges for policymakers. As discussed in the final section of this chapter, legacy problems of the recent crisis—weak banks and fragile sovereign balance sheets—will need to be fully addressed

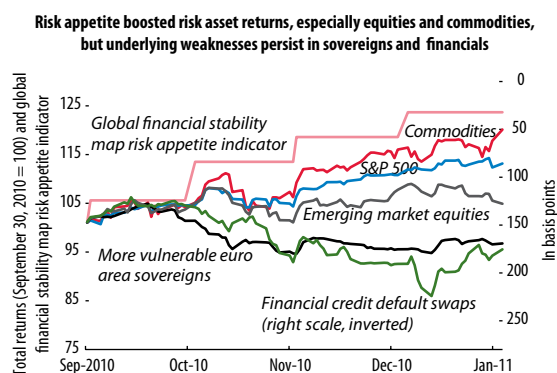
Figure 1.3. Changes in Financial Conditions



Sources: Goldman Sachs; and IMF staff estimates.

Note: A 1 percent change in the financial conditions index (FCI) is scaled to represent the change in financial conditions when each component variable changes by one unit (1 percent change in equity returns and the real effective exchange rate [REER], and 100 basis point changes in LIBOR and bond yields). FCI weights are based on relative effect of financial variables on GDP four to six quarters ahead.

Figure 1.4. Risk Appetite



Sources: Bank of America Merrill Lynch; Bloomberg L.P.; Credit Suisse; EPFR Global; and IMF staff estimates.

Note: The global financial stability map risk appetite indicator represents changes in risk appetite based on a range of indicators (see Figure 1.2). Returns on commodities are measured by the Goldman Sachs GSCI commodity index. Emerging market equities are measured by the MSCI EM index. The more vulnerable euro area sovereigns index includes Greece, Ireland, Portugal, and Spain. Financial credit default swap spreads are the simple average of CDS spreads on U.S. and euro area financials.

Box 1.2. Implications of Japan's Earthquake for Financial Stability

Japanese financial institutions and capital markets remain remarkably resilient in the aftermath of the recent earthquake and tsunami. The Bank of Japan's decisive liquidity operations and expansion of asset purchases have helped financial institutions meet higher liquidity demand and stabilize financial markets, while a coordinated currency intervention successfully prevented excess exchange rate volatility. Based on current estimates, financial stability risks seem manageable and limited to the areas most affected by this natural disaster. Yet energy shortages, supply chain disruptions, and the continuing problems at the Fukushima Daiichi nuclear power plant leave considerable uncertainty surrounding the growth impact and the ultimate cost of damages. The longer-term financial stability consequences of this tragic disaster will likely be most manifest in Japan's fiscal balances. Once reconstruction efforts are under way and the size of the damage is better understood, attention should turn to linking reconstruction spending to a clear fiscal strategy for bringing down the public debt ratio over the medium term.

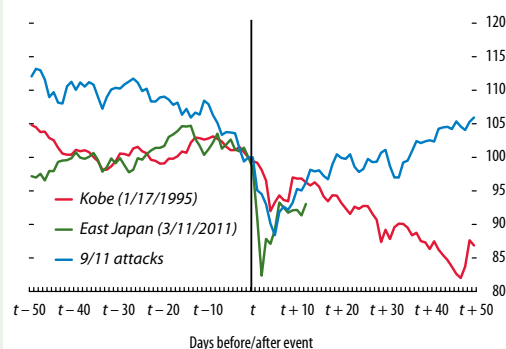
Decisive and coordinated policy actions helped to maintain stability in financial markets in the early days after the earthquake and tsunami. The interbank market remained resilient without serious interruptions to the payments system as the Bank of Japan swiftly responded with ¥15 trillion in the same-day funds-supplying operations, exceeding the previous record of ¥4½ trillion injected after the Lehman collapse. The Bank of Japan also doubled its asset purchase scheme to ¥10 trillion, mainly through an increase in the acquisition of risk assets. An initial bout of panic selling that sent the Topix down 18 percent and wiped out nearly ¥57 trillion (\$710 billion) in market capitalization subsided after a few days (first figure). After a disorderly spike in the yen, the G-7's coordinated intervention stabilized the currency, thereby reducing contagion risks to other asset classes and economies (second figure).

Nonfinancial Japanese corporations are well positioned to weather short-term disruptions from the disaster and fund rebuilding costs. While the

Note: This box was prepared by Sean Craig, Joseph Di Censo, and Akira Otani.

Equity Market Performance

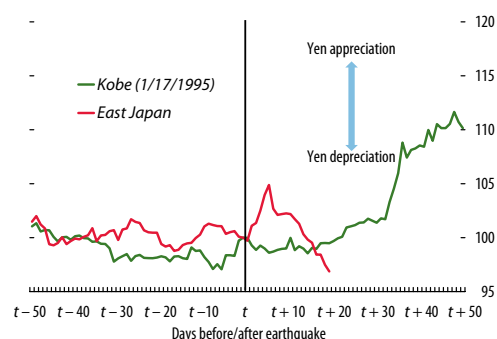
($t - 1 = 100$ on y-axis, $t = \text{event}$ on x-axis)



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

Yen/Dollar Performance

($t = \text{Earthquake}$; $t - 1 = 100$)



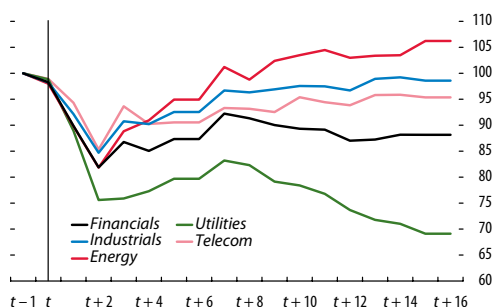
Source: Bloomberg L.P.

debt-to-equity ratio of Japanese companies is high (see Table 1.1), they hold a large amount of liquid assets, including cash and bank deposits. In addition, profitability has recently improved, corporate defaults are low, financing conditions remain accommodative, and the generally high credit ratings of Japanese firms facilitates access to global capital markets as sources of financing. Yet the earnings impact of the disaster remains uncertain and share prices of companies in the most affected sectors have yet to recover fully (third figure).

The Japanese banking sector has limited exposure to the affected regions. As of end-2010, loans in the three hardest hit prefectures—Iwate, Miyagi, and

Box 1.2 (continued)

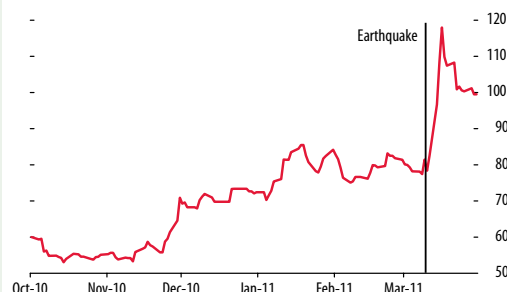
Japan Equity Indices by Sector

(ln days; $t = 3/10/2011$, $t - 1 = 100$)

Sources: Morgan Stanley Capital International; and IMF staff estimates.

Sovereign Credit Default Swap Spreads

(ln basis points, five-year tenor)



Source: Bloomberg L.P.

Fukushima—represent 2.4 percent of total banking system loans and 1.2 percent of total assets. The three megabanks (Mitsubishi-UFJ, Sumitomo-Mitsui, and Mizuho), which account for 53 percent of total banking system assets, are well diversified to any localized increase in credit risk stemming from the disaster. Some regional banks that have high exposures in the affected prefectures could see a material impact, but these institutions do not pose a systemic risk. In addition to loan exposure, these banks also have holdings of regional firms' equity.

Japanese domestic insurance companies are likely to have sufficient reserves to handle claims, though it will take a few months before losses can be estimated with accuracy. The current solvency margin ratios of major Japanese life and non-life insurance companies stand above 700 percent, well in excess of the minimum 200 percent requirement. According to Japanese Cabinet Office estimates, total damages are in the neighborhood of ¥16 trillion to ¥25 trillion, while government-provided co-insurance of residential claims for private non-life insurance companies caps the liability at ¥593 billion (or \$7 billion).¹ Japanese insurance solvency margin ratios would not fall by more than 100 percentage points under the maximum residential earthquake insurance costs and life insurance claims. Insurance companies would still have several times the

minimum capital requirements even after factoring in these losses and the reduced unrealized gain from equity holdings due to the decline in share prices. However, depending on the size of commercial property insurance and business interruption claims, solvency margins could decline further.²

Concerns about Japan's fiscal position have been subdued so far, but could come to the fore as policymakers contemplate reconstruction funding. Priorities would be to focus on reconstruction spending to repair damaged infrastructure and prevent any substantial bottlenecks to restore growth. On balance, the earthquake has raised sovereign risks, even if only at the margin. Though not widely traded, sovereign credit default swaps topped 100 basis points, versus 80 basis points pre-crisis (fourth figure). Japan's gross general government debt of an estimated 230 percent of GDP at end-2011 is the highest among advanced economies, and the primary balance of -8.5 percent of 2011 GDP is the second highest (see Table 1.3). Against this backdrop, spending on reconstruction and on insurance claims shared with private insurance companies is likely to make the fiscal adjustment more challenging, although by how much is not yet known. Japanese government bond yields

¹Residential earthquake claim risk is mostly transferred to the Japan Earthquake Reinsurance Company and government.

²A nontrivial portion of commercial losses will likely be passed on to the global reinsurers. In addition, nuclear risk is a standard exclusion in contracts, so damage related to the nuclear reactors will most likely not affect the industry.

Box 1.2 (continued)

have so far remained stable, as bond investors see reconstruction costs as only temporarily increasing debt issuance given the government's wide range of financing options.³ Furthermore, government bonds are held mostly by domestic investors. Nonetheless, if interest rates rise substantially, there could be an impact on financial stability, as Japanese financial institutions have large government bond holdings (16.8 percent of their total assets). In addition, regional banks have recently increased the duration of their Japanese government bond portfolio, thereby raising their exposure to interest rate risk (see IMF, 2010e, Box 1.1).

Global spillovers will depend on the amount of foreign capital repatriation and the overall growth impact of the disaster. Japanese overseas assets are large and represent a potential source of capital for reconstruction or paying out insurance claims. However, corporates, institutional investors, and households are likely to draw upon liquid yen-

³As detailed in Section D, a relatively minor increase in average funding rates could push Japan's interest costs as a share of GDP over the 10 percent threshold (see Figure 1.20).

denominated assets (mostly cash and deposits) before resorting to selling foreign currency assets in order to generate cash. Based on current estimates, the covered damages to be borne by private insurers seem easily manageable based on their large cash holdings and Japanese government bonds. In addition, official capital flow statistics so far show no evidence of large-scale capital repatriation by either households or institutions. Much uncertainty remains about the growth impact from the earthquake, and supply chain disruptions could ripple through the global economy.

Decisive policy action helped maintain financial stability in the immediate aftermath of Japan's tragic disaster. Large holdings of liquid assets will assist Japanese corporations during the reconstruction effort. Though damage estimates are still preliminary, Japanese financial institutions are well capitalized to meet those claims. Once the reconstruction efforts are under way and the size of the damage is better understood, attention should turn to linking reconstruction spending to a clear fiscal strategy for bringing down the public debt ratio over the medium term.

in advanced economies to attain a more robust financial system that can be subject to full market discipline. The transition to a stronger financial system must be navigated carefully, while advancing the near-term economic recovery in advanced economies and minimizing spillovers to emerging markets and developing economies.

B. Living Dangerously—The Legacy of High Debt Burdens in Advanced Economies

The global financial crisis has put balance sheet weaknesses into sharp relief. Many advanced economies are struggling with the legacy of high debt and excessive leverage, notably in the financial sector. For policymakers, the challenge consists of reducing these vulnerabilities over time and restoring market discipline, without choking off the ongoing economic recovery.

At the heart of the global financial crisis was an abrupt rediscovery of credit risk. Following a period of almost indiscriminate availability of cheap credit, lenders suddenly took a fresh look at borrowers' capacity to repay debt and found reasons for concern. Focused initially on problems in the U.S. subprime mortgage sector, the reassessment of credit risk broadened over time, affecting households, nonfinancial corporations, banks, and sovereigns across much of the industrialized world. The turbulence in some euro area financial markets over the past six months suggests that the process is still ongoing.

Revived fear among investors about credit risk has put a spotlight on high debt levels in many parts of the global economy, including households with negative equity in their homes, banks with thin capital buffers and uncertain asset quality, and sovereigns facing market concerns about debt sustainability (Table 1.1). The global financial crisis also highlighted the inter-

Table 1.1. Indebtedness and Leverage in Selected Advanced Economies¹*(Percent of 2010 GDP, unless noted otherwise)*

	U.S.	Japan	U.K.	Canada	Euro area	Belgium	France	Germany	Greece	Ireland	Italy	Portugal	Spain
Government gross debt, 2011 ²	100	229	83	84	87	97	88	80	152	114	120	91	64
Government net debt, 2011 ^{2,3}	72	128	75	35	67	82	78	55	n.a.	95	101	86	53
Primary balance, 2011 ²	-9.0	-8.6	-5.5	-4.1	-1.7	-0.5	-3.5	-0.3	-0.9	-7.5	0.2	-1.6	-4.6
Households' gross debt ⁴	91	74	107	93	72	55	69	62	68	129	50	103	90
Households' net debt ^{4,5}	-230	-231	-184	n.a.	-129	-204	-131	-130	-56	-60	-178	-126	-74
Nonfinancial corporates' gross debt ⁴	76	138	128	n.a.	142	161	157	69	71	278	119	154	205
Nonfinancial corporates' debt over equity (percent)	105	176	89	72	106	43	76	105	218	113	135	145	152
Financial institutions' gross debt ⁴	97	188	735	n.a.	148	139	148	95	21	664	99	65	113
Bank leverage ⁶	13	23	24	18	26	30	26	32	17	18	20	17	19
Bank claims on public sector ⁴	8	76	7	20	n.a.	22	19	25	27	28	32	16	22
Total economy gross external liabilities ^{4,7}	144	64	696	91	174	417	254	181	194	1,598	153	293	215
Total economy net external liabilities ^{4,7}	19	-52	14	7	13	-43	11	-39	99	102	20	106	90
Government debt held abroad ⁸	32	7	27	20	29	68	64	53	61	59	47	57	50

Sources: Bank for International Settlements (BIS); Bloomberg, L.P.; EU Consolidated Banking Data; U.S. Federal Deposit Insurance Corporation; Haver Analytics; IMF, International Financial Statistics, Monetary and Financial Statistics, and World Economic Outlook databases; BIS-IMF-OECD-World Bank Joint External Debt Hub; and IMF staff estimates.

¹Cells shaded in red indicate a value in the top 25 percent of a pooled sample of all countries shown in table from 1990 through 2009 (or longest sample available). Green shading indicates values in the bottom 50 percent, yellow in the 50th to 75th percentile. The sample for bank leverage data starts in 2008 only.

²World Economic Outlook projections for 2011.

³Net general government debt is calculated as gross debt minus financial assets corresponding to debt instruments.

⁴Most recent data divided by 2010 GDP.

⁵Household net debt is calculated using financial assets and liabilities from a country's flow of funds.

⁶Leverage is defined as tangible assets to tangible common equity for domestic banks.

⁷Calculated from assets and liabilities reported in a country's international investment position.

⁸Most recent data for externally held general government debt (from Joint External Debt Hub) divided by 2010 gross general government debt.

connectedness of balance sheets across sectors and economies. Initially, debt problems spread from the private to the public sector because of sharp declines in tax revenue and the cost of bank bailouts. More recently, weaknesses in some sovereign balance sheets have come back to haunt the private sector through higher country risk premia and fears about writedowns on government bond holdings. These interconnections have become even more complex because of the cross-border dimension of integrated financial markets.

High debt levels represent a lingering vulnerability in many advanced economies.

Heavy debt burdens weigh on economic activity and threaten financial stability by making balance sheets more fragile. When debt is at high levels, its sustainability becomes increasingly sensitive to changes in funding costs and rollover rates, exposing borrowers to sudden shifts in sentiment or market conditions. Moreover, shocks can spread quickly throughout the financial system, especially if they affect highly leveraged entities or if a lack of transparency promotes contagion. Overall, the mosaic of highly indebted

balance sheets documented in Table 1.1 suggests that the following issues are likely to keep risks to global financial stability elevated in the period ahead:

- *Government debt is generally high and on a worrying upward path in a number of advanced economies.* Market concerns about high public debt and large contingent liabilities related to financial sector support have been concentrated so far on a few countries in the euro area. Despite the progress already made, additional policy efforts are needed to secure a comprehensive solution to the fiscal problems and to prevent further contagion. Meanwhile, public debt is also on a problematic trajectory in other parts of the world, notably in Japan and the United States.
- *Households remain highly indebted in the United States and several other advanced economies.* High mortgage debt and the sharp fall in house prices left many U.S. households with negative equity and raised risks to banks from mortgage defaults. Significant vulnerabilities also loom in the household sector in Ireland, and households also face challenges in Spain, following the bursting of housing bubbles there. House-

hold debt remains high in several other advanced economies, notably in Canada, Japan, Portugal, and the United Kingdom.

- *While leverage ratios among nonfinancial firms have trended down and do not seem stretched in many advanced economies, the corporate sector in parts of the euro area and, to some extent, in Japan still exhibit relatively high leverage.* Gross debt levels are high among nonfinancial corporations in many economies, but are often backed by significant equity cushions.
- *In the euro area, the prospects for the financial sector remain closely tied to sovereign stress.* Although their capital ratios have been bolstered since the onset of the crisis, many banks still face investor doubts about their financial future. Problems are most acute in those euro area countries where the very adverse situation in the real estate markets heralds further writedowns, and where strained public balance sheets weigh on the creditworthiness of banks. More generally, still-high bank leverage means that many financial institutions find it difficult to secure market funding on adequate terms in the absence of some form of public support.

For the broader economy, overcoming the legacy of high debt is bound to be a drawn-out process. In principle, there are three possible ways to reduce overall debt levels in the private and public sectors, each presenting specific downsides or risks:

- Any strategy will likely involve the difficult, protracted process of creating financial surpluses for several consecutive years. In the household sector, this process has been under way for some time, as witnessed by the rise in saving rates from pre-crisis levels. Yet, much of the needed public sector belt-tightening is still to come.
- A continued low-interest-rate policy would support deleveraging by effectively transferring resources from savers to borrowers and providing a supportive macroeconomic environment, but there are limits to the effectiveness of monetary policy in expediting the deleveraging process.
- Debts could be reduced through some form of writedown, restructuring, or one-off transfer, as for example in the case of an over-indebted household. This strategy can potentially restore borrower viability

very quickly, but it might prove disruptive to the financial position of the creditors involved.

The main task facing policymakers in advanced economies is to promote deleveraging and restore market discipline, while avoiding financial or economic disruption during the transition. Lingering fragilities in the banking system require particularly urgent attention, as they could amplify and propagate any new shocks to financial stability. Thus, ongoing policy efforts to withdraw implicit public guarantees and ensure bondholder liability for future losses must build on rapid progress toward stronger bank balance sheets.

C. Banking System—Not Enough Has Been Done

Nearly four years after the start of the global financial crisis, confidence in the stability of the banking system as a whole has yet to be fully restored. Markets remain concerned that some banks are too highly leveraged and have insufficient capital, given the uncertainty about the quality of their assets. This is despite improvements to balance sheets and significant policy initiatives. A rise in funding costs is squeezing bank revenues and limits capital generation. The weakest banks need to be restructured or resolved, and the remaining institutions need to be adequately capitalized. This should help restore investor confidence in the banking system, increase lending and profitability, and enable the banking sector to fully support the economic recovery.

Incomplete policy actions and inadequate reforms of the banking sector have left segments of the global banking system vulnerable to further shocks. Many institutions—particularly weaker European banks—are caught in a maelstrom of interlinked pressures that are intensifying risks for the system as a whole (Figure 1.5).

Progress in strengthening capital positions and reducing leverage has been uneven...

Banks have made progress in raising capital ratios, particularly in the United States, where they recapitalized following the publication of the U.S. stress tests in early 2009 (Figure 1.6). Other factors, such as

action by the Federal Reserve, have helped to support institutions in the United States. Banks in Europe have also raised capital, but aggregate balance sheets still remain leveraged and reliant on wholesale funding.¹

...and euro area banks in particular remain vulnerable to funding pressures as their needs mount.

Euro area banks as a whole are still highly dependent on wholesale funding (Figure 1.6).² This contrasts with banks in other countries, such as the United Kingdom, where the use of wholesale markets has been reduced significantly, or with banks in Japan, where aggregate reliance on wholesale funding is lower.³ Moreover, a number of euro area banks have substantial short-term wholesale funding requirements. Current market conditions, with low short-term rates and a steep yield curve, may provide incentives for banks to maintain this short-dated funding. But such funding brings additional vulnerabilities given its high rollover rate and quick repricing. Some larger European banks also fund a significant part of their short-term positions in foreign currency, much of which is from U.S. money market funds. But this funding comes with further risks as it could be subject to quick withdrawal by money managers, as has been seen in the past.

The result is that global banks face a wall of maturing debt, with \$3.6 trillion due to mature over the next two years (Figure 1.7). Bank debt rollover requirements are most acute for Irish and German banks, from 40 percent to one-half of all debt outstanding is due over the next two years (Figure 1.8). These bank funding needs coincide with higher sovereign refinancing requirements (see Section D), heightening competition for scarce funding resources.

¹ It is important to note that U.S. banks' relatively favorable leverage ratio is due, in part, to differences in regulatory accounting, in addition to the other factors mentioned above.

² Central bank liquidity support is included in wholesale funding, though this does not significantly impact the relative rankings in Figure 1.6.

³ U.K. banks, however, have been making use of new wholesale funding instruments, such as put-able certificates of deposit, extendible repos, and long-dated secured funding. Although these instruments are helpful in increasing the maturity of bank funding, they also create new liquidity risks. See Bank of England (2010, Box 3).

Figure 1.5. Banking Sector Challenges

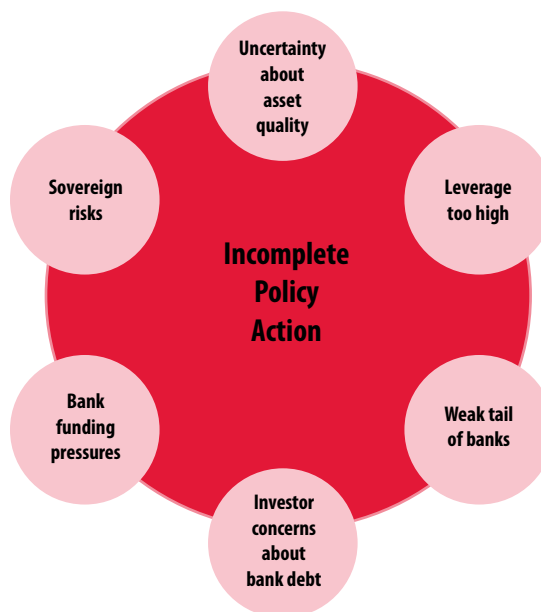
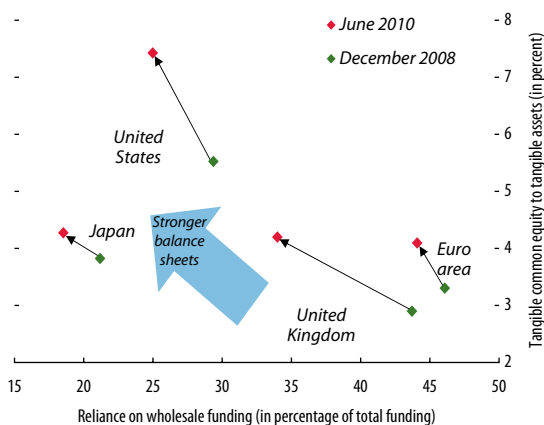


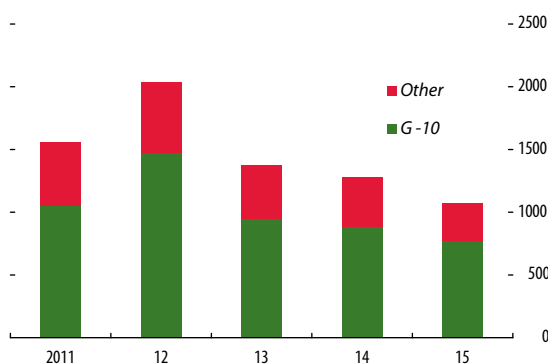
Figure 1.6. Banking System Capital and Reliance on Wholesale Funding



Sources: EU Consolidated Banking Data; national authorities; and IMF staff estimates.

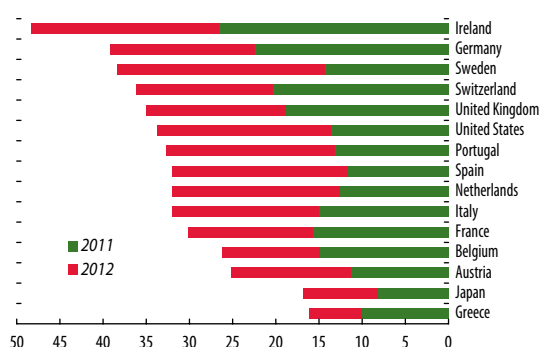
Note: Wholesale funding includes debt and interbank borrowing. Total funding is wholesale funding plus deposits.

Figure 1.7. Global Bank Debt Maturity Profile
(In billions of U.S. dollars, as of March 31, 2011)



Source: Moody's.

Figure 1.8. Bank Rollover Requirement, 2011–12
(In percent of total debt)



Sources: Bloomberg, L.P.; and IMF staff calculations.
Note: The data are for a sample of banks in each country.

A number of banks in Europe—including nearly all banks in Greece, Ireland, Portugal, many of the small and mid-size Spanish *cajas*, and some German *Landesbanken*—have lost cost-effective access to term funding markets. As a result they have turned in varying degrees to repo markets and the ECB for refinancing. But there is still a risk that, in the event of further negative news, a greater number of institutions could face difficulties in rolling over their wholesale funding.

Investor demand for bank debt is falling, reflecting not only underlying vulnerabilities but also changes in the structure of the markets...

In Europe, the entire liability structure at banks is being repriced given investor concerns about potential future private sector burden sharing. The repricing follows the initial communication of the future European permanent crisis resolution framework, the debate on the Irish private sector bail-in, and the *Amager-banken* insolvency in Denmark.⁴ As losses on senior debt become a credible threat to market participants, demand for bank debt from some current investors will decline, potentially reducing the overall funding pool available to banks.

These investor concerns, along with the prospect of increased requirements under Basel III for stable funding sources, are prompting some European banks to issue longer-term debt, such as covered bonds. Although useful as an additional means of raising funds privately, covered bonds effectively subordinate senior unsecured funding, making it even less attractive to investors. Moreover, this type of funding can only provide a limited alternative to unsecured senior bank debt, as issuance will be constrained by the level of collateralization required for the highest ratings.

...acting to push up funding costs and squeezing net revenues...

Wholesale funding pressures have been reflected in a sharp rise in bank debt yields in some euro area countries (Figure 1.9). Marginal wholesale funding

⁴ Some market participants argue that without state support, banks are effectively highly leveraged and illiquid credit funds that should be priced closer to the high-yield corporate market than the sovereign curve. Yet the existing investor base for senior bank debt is dominated by insurance companies and pension funds that have only limited appetite for risk.

costs have risen most in economies where the sovereign is facing greatest market pressure. The spillover of sovereign risk to the banking sector reflects the fact that bank downgrades often follow sovereign downgrades and that implicit (or explicit) government guarantees to the banking sector are perceived to be eroded as sovereign pressures mount.

Increased wholesale funding costs have, in turn, led some banks to bid for deposits in an attempt to bolster their secure funding base. The fierce competition for deposits, in part due to the excess capacity in banking systems, leaves institutions vying for a limited pool of depositors and in some cases has driven up deposit rates paid in new business (Figure 1.10).

The rise in the cost of marginal wholesale and deposit funding—along with lower interest income—has led to a squeeze in net interest margins in some economies (Figure 1.11). This has occurred because increases in second-tier bank funding costs have little impact on the benchmark market rates used to price their loans.

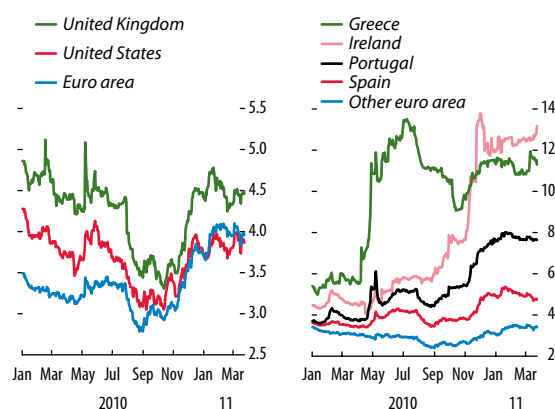
...while markets remain concerned about the quality of bank assets.

Banks also face pressures on the asset side of their balance sheets because of concerns about the quality of bank exposures. This is particularly the case for exposures to real estate—either residential or commercial—in Ireland, Spain, the United Kingdom, and the United States.

Estimates of potential losses on property exposures vary significantly. First, real estate is of uncertain value in a number of markets, such as commercial real estate, where the number of transactions is low. Second, some banks have been rolling over loans that would otherwise have been considered delinquent, a practice that may have been exacerbated by the persistence of low interest rates.⁵ Third, banks—particularly in the United States—have built up an inventory of repossessed properties, and a key challenge is how to reduce that stock without further destabilizing house prices (Section E discusses this in more detail).

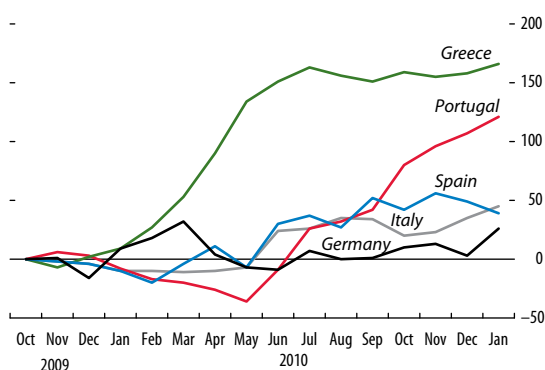
⁵These loans are recorded as performing in bank accounts, but as was discussed in the October 2010 GFSR, these assets often have a higher eventual default rate than standard performing loans.

Figure 1.9. Bank Debt Yields
(In percent)



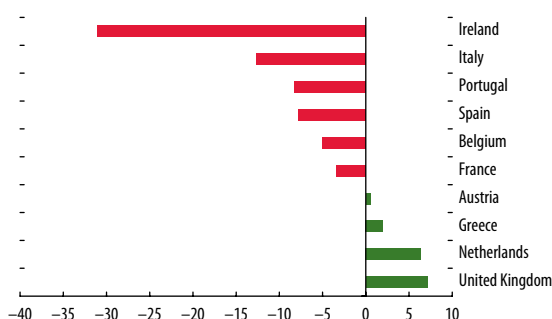
Sources: Barclays Capital; Bloomberg L.P.; and IMF staff estimates.
Note: Figure shows asset-weighted average yields for five-year debt issued by a sample of banks in each economy.

Figure 1.10. Increase in Bank Deposit Rates
(Basis points)



Source: European Central Bank.
Note: Figure shows deposit rates on new business up to one year.

Figure 1.11. Change in Bank Net Interest Margin, June 2010
(Percent, year-on-year)



Sources: EU Consolidated Banking Data; and IMF staff estimates.

Note: The figure shows the percentage change in net interest income over total assets from 2009 to June 2010 (annualized), and shows data for domestic banks in each country.

The value of bank exposures to troubled sovereigns is also uncertain. In Europe, the majority of sovereign debt is held in the banking book and so is accounted for at book value. But investors are concerned that the market value of some of these assets may be considerably lower than the current accounting value. Bank holdings of government bonds issued by countries facing fiscal pressures are large in relation to capital in several banking systems, so the market value of these assets is an important factor in assessing the overall health of these banking systems.

What needs to be done?

Banking sector risks are not homogenous, with vulnerabilities varying across economies and between different types of banks within the same country. Looking across a range of risk indicators for a sample of banks suggests that institutions in Greece and Ireland are currently facing the greatest balance sheet pressures, given the level of sovereign stress, concerns about loans, and high marginal wholesale funding costs (Table 1.2). However, both countries operate under European Commission/ECB/IMF programs, which include capital backstops and space for sovereigns to address fiscal deficit and debt problems. Within the parameters of these programs, these countries' banks benefit from the temporary nonconventional measures of the ECB, which means they are partially and temporarily shielded from higher funding costs.

The analysis also suggests that Spanish *cajas* and Portuguese banks are vulnerable from their holdings of sovereign bonds through exposures to real estate and from high marginal wholesale funding costs. Banks in Austria, the United Kingdom, and the United States have high loan losses, but are aided by relative profitability. German banks, conversely, have low revenues and this has fed through into low capital levels for *Landesbanken* and cooperative banks. These low levels of capital make some German banks, as well as weak Italian, Portuguese, and Spanish savings banks, vulnerable to further shocks.⁶ These findings are based on a sample of banks in each

⁶In Spain, all credit institutions are required to raise capital to meet the new standard of core capital worth at least 8 percent of risk-weighted assets. Recapitalization plans are to be implemented by September 2011.

Table 1.2. Banking Vulnerability Indicators

	Sample Size	Revenue	Asset Quality		Wholesale Funding Costs	Capital Ratios	
			Sovereign bonds	Loans		Aggregate	Distribution
			Loss rate	Loss rate			
	(1)	(2)	(3)	(4)	(5)	(6)	
United States	40						
United Kingdom	4						
Austria	2						
Belgium	2						
France	3						
Germany: Commercial	2						
Germany: Landesbanken	8						
Germany: Cooperative	2						
Greece	6						
Ireland	2						
Italy	5						
Netherlands	3						
Portugal	4						
Spain: International	2						
Spain: Domestic	5						
Spain: Savings	17						

Notes: Colors are allocated by ranking each column into relative terciles, adjusted for borderline cases. The bank-level analysis for (1)–(3) and (5)–(6) is based on a sample of institutions which for European banks is similar to that used in the 2010 CEBS stress test. The CEBS covers around 65 percent of EU banking assets and at least 50 percent of the banking system in each country. In some countries, such as Spain, the sample covers a significantly greater proportion of the banking system.

¹Pre-provision net revenues as a percentage of total assets (2010 or latest available). The terciles are (in percent): >1.2 (green); 1.2 – 0.8 (yellow); <0.8 (red).

²Estimated mark-to-market changes in sovereign bond holdings over total assets. Mark-to-market changes are calculated from end-2009 to March 2011 using sovereign credit default swap spreads. The terciles are (in percent): <0.2 (green); 0.2 – 0.6 (yellow); >0.6 (red).

³Loan loss impairments as a percentage of total loans (2010 or latest available). The terciles are (in percent): <0.6 (green); 0.6 – 1.3 (yellow); >1.3 (red).

⁴Asset-weighted average five-year bank bond yields in March 2011. The terciles are (in percent): <3.9 (green); 3.9 – 5.0 (yellow); >5.0 (red).

⁵Core Tier 1 ratios, per banks' own definition, which in some cases includes public support, aggregated across the countries and sectors (2010 or latest available). The terciles are (in percent): >9.2 (green); 9.2 – 8.5 (yellow); <8.5 (red).

⁶The share of banks in our sample, in terms of total assets, with core Tier 1 ratios below 8 percent (2010 or latest available). The terciles are (in percent): 0 (green); 1 – 49 (yellow); >49 (red).

country (Table 1.2). It is possible, however, that there are weak banks that are outside this sample.

So what needs to be done? The authorities in Ireland, Spain, Germany, the United Kingdom, and the United States have made or are making considerable efforts to crystallize losses, increase capital, and implement deleveraging and divestiture plans in the banking system. But these measures need to be reinforced, broadened across the entire banking system in each country, and extended to a greater range of economies to ensure that the vulnerabilities in the global banking system are removed once and for all (Figure 1.12).

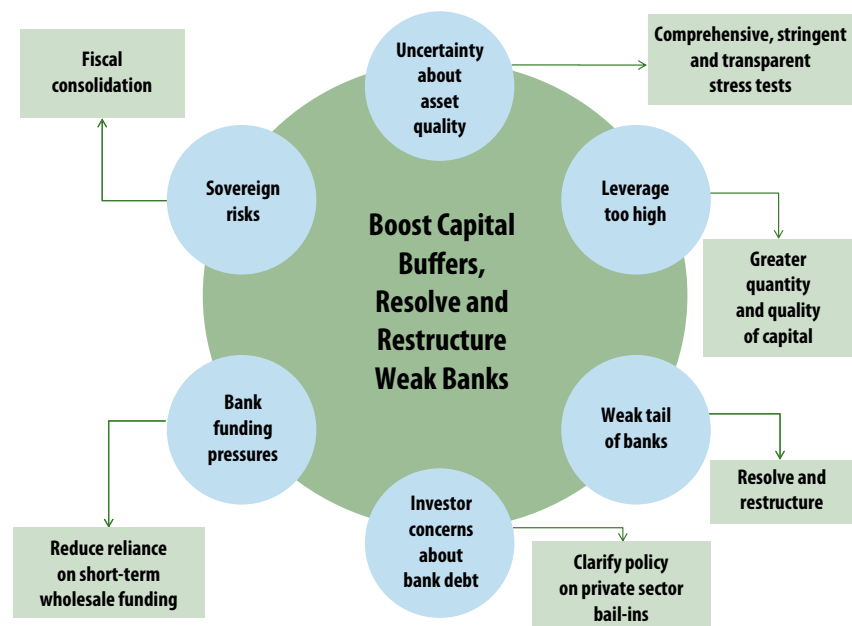
Banks need larger capital buffers...

To restore investor confidence, European bank leverage needs to be reduced further through an increase in the quantity and quality of capital. Better

capital buffers will not only provide a greater cushion against future losses, but will also reduce bank credit risks and help restore access to funding markets. This should start a virtuous circle: as lower funding costs improve bank net revenues, capital generation will be restored and capital levels raised further.

But in times of uncertainty, markets are likely to require a capital buffer in excess of regulatory norms. The crisis has shown that banks that meet regulatory capital requirements can be shut out of wholesale funding markets. Where significant uncertainties remain about bank asset values, creditors will take a conservative view of asset values. Investors will worry about their position in the repayment hierarchy in the event of a bank default and will assess the market value of assets available to repay creditors. In current conditions, this implies lower asset values and hence greater capital

Figure 1.12. Policy Solutions to Banking Sector Challenges



needs for banks to meet capital hurdles. Markets are increasingly assessing banks against higher quality capital, such as core capital, and are anticipating the stricter conditions that are likely under Basel III.

This all means that banks in Europe still need to raise a significant amount of capital to regain funding market access. In current market conditions, it is unlikely that they will be able to raise all of this in markets. Institutions could build capital by reducing dividend payout ratios and retaining a greater proportion of earnings. Banks could also gradually downsize balance sheets to reduce capital and funding needs. But it is likely that some of the capital will need to come from public sources.

...the weakest banks need to be addressed...

Figure 1.13 shows that over 5 percent of banks, representing 2 percent of bank assets in our sample, had core Tier 1 ratios below 6 percent at end-2010. But this figure rises to over 30 percent of banks and almost 20 percent of assets against an 8 percent core Tier 1 ratio. This weak tail of banks has created overcapacity in some banking systems, raising funding costs for all banks in the system, reducing profitability, and

adversely affecting capital generation. Further policy action is needed to restructure and, where necessary, resolve this weak tail of undercapitalized banks.

Some efforts to address the weaker banks are already under way. For example, in Germany, banks are being required to strengthen capital levels further, reduce balance sheet size, and adjust business models. In Spain, fundamental consolidation of the banking system is under way, with capital standards being raised and most of the savings banks likely to spin off their banking operations into commercial banking arms and to seek private equity through initial public offerings (IPOs). These measures need to be implemented fully to ensure that banking systems emerge stronger.

...and measures should be taken to reduce uncertainty about asset quality.

Measures to reduce uncertainty about asset quality should also help reduce the level of capital required by markets and encourage banks to raise private sources of capital. Bank balance sheets currently lack transparency. Measures to enhance transparency have started to be put in place in Spain, but such measures need to be taken forward more thoroughly across a range

of economies. A fundamental improvement is needed in the frequency and quality of bank reporting in the European Union (EU), for example by all institutions reporting a common template that is publically disclosed on a quarterly basis.

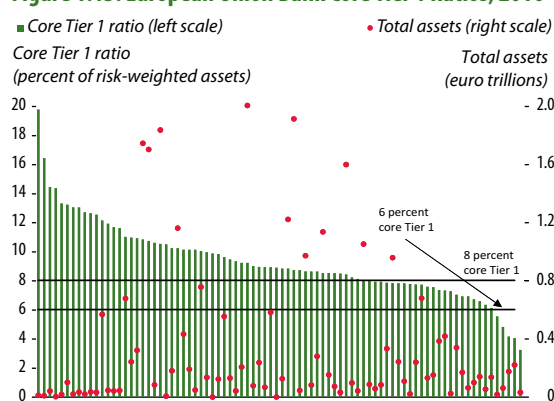
The publication of stress-test results can also make an important contribution to greater transparency. The stress test run by the Committee of European Banking Supervisors (CEBS) in the summer of 2010 initially helped to calm markets. But there is a golden opportunity to improve on this when new stress tests are conducted by the European Banking Authority later this year. These new stress tests should (1) be embedded in a broader crisis management strategy, including the clarification of support for sovereigns and backstops for banks; (2) ensure the broadest possible coverage of banks in each country; (3) incorporate funding costs and liquidity strains; (4) have a more stringent capital hurdle, especially for banks that rely on wholesale funding markets; (5) include ex ante verification of weak assets—particularly real estate—by private consultants for loan books in economies with property overhangs; (6) have stronger supervisory scrutiny to ensure consistency across economies; and (7) require upfront and higher quality capitalization for weaker but viable banks.

Banks could also help to mitigate concerns about asset quality by continuing to write down portfolios to better reflect their risk. For example, in the United States, banks should engage in principal reductions on loans that have been modified. Our analysis suggests that banks in the United States have room to take such measures, which could help relieve some of the problems in residential real estate markets (Section E).

Comprehensive policy measures are needed to allow the banking system to support the economic recovery.

Overall, a comprehensive set of policies—including capital-raising, restructuring and where necessary resolution of weak banks, and increased transparency about banking risks—is needed to solve banking system vulnerabilities. Without these reforms, downside risks will reemerge. If those banks fail to raise capital buffers, they will likely continue to have difficulties in obtaining cost-effective access to funding markets and will increasingly have to rely on central bank financing. This situation is neither healthy nor sustainable.

Figure 1.13. European Union Bank Core Tier 1 Ratios, 2010



Source: SNL Financial.

Banks without access to funding markets may also be forced to shed assets as liabilities come due. Such forced deleveraging could be particularly severe and would cut back the supply of credit to the real economy. Fire sales would also lower asset prices, leading to mark-to-market losses for banks exposed to those assets. Increased bank losses could raise contingent liabilities for governments and raise sovereign risks. This could spill back over to banks through increased funding costs, intensifying the sovereign-bank feedback loop. It is, therefore, imperative that weak banks raise capital to avoid a pernicious cycle of deleveraging, weak credit growth, and falling asset prices.

D. Sovereign Funding Challenges

As recent market developments have demonstrated, sovereign credit risks are a key source of financial instability. Market concerns about the sustainability of public debt can prompt a sharp repricing of assets that damages bank balance sheets and creates an adverse feedback loop through the real economy. In the euro area, recent episodes of volatility in financial markets have weakened the investor base for some countries' government bonds. This erosion of investor demand risks concentrating exposures among vulnerable financial institutions, while increasing funding uncertainty for the sovereign. Under a baseline scenario, government interest bills in advanced economies are projected to rise, notably in parts of the euro area. However, the interest burden should generally remain manageable provided that deficit reduction proceeds as foreseen and contingent liabilities related to the financial sector remain contained. While the United States and Japan continue to benefit from low current rates, both are very sensitive to a potential rise in funding costs.

Sovereign balance sheets in many advanced economies remain vulnerable. Still-high primary deficits have kept public debt on an upward trajectory (Table 1.3). Sizable support schemes for domestic banking systems have further worsened debt dynamics in some economies. Large near-term financing requirements heighten the market pressure on governments whose credit quality has come under scrutiny, as evi-

denced by elevated credit default swap (CDS) spreads and recent rating downgrades. Linkages between the sovereign and the financial system have also intensified in a few cases. The most notable recent examples are Greece and Ireland, where the proportion of public debt held by domestic banks has increased. This trend mirrors a simultaneous decline in the share of government bonds held by nonresidents.

Looking across all indicators shown in Table 1.3, the upward repricing of sovereign credit risk in government funding markets emerges as a key risk to global financial stability. Higher sovereign spreads directly worsen public debt dynamics, which may further ratchet up investor concerns in a self-fulfilling manner—even more so in an environment where risk-free rates are also on the rise as some central banks start tightening policy. Writedowns on government bond holdings could, in turn, weaken balance sheets among banks and other leveraged investors. By acting as a benchmark for interest rates across the whole economy, higher government bond yields also tend to raise the cost of credit for banks, companies, and households. Such repricing can deal a significant blow to the real economy, potentially feeding back into financial instability via higher credit losses in banks. Against this backdrop, this section analyzes current tensions in government funding markets and their interaction with investor perceptions of sovereign risk.⁷

Policymakers have stepped up efforts to forestall further turmoil in euro area financial markets.

Euro area sovereign bond markets suffered another significant bout of volatility over the past six months. Yields on Irish government bonds surged in October 2010 on news about further losses in the national banking system. Spreads for the sovereign bonds of Belgium, Greece, Italy, Portugal, and Spain also reached new highs (Figure 1.14). Even the CDS of France and Germany rose by some 30 to 40 basis points during that period, as the crisis of confidence spilled over to the wider euro area.

Policymakers responded to the turbulence with a range of measures. The ECB made fresh purchases of government bonds in secondary markets under the Securities Market Program, and a joint EU-

⁷ Further discussion of public sector balance sheets is provided by the April 2011 *Fiscal Monitor* (IMF, 2011b).

Table 1.3. Sovereign Market and Vulnerability Indicators*(Percent of 2011 projected GDP, unless otherwise indicated)*

	Fiscal and Debt Fundamentals ¹			Financing Needs ⁴		External Funding	Banking System Linkages			Sovereign Credit		Sovereign CDS
	Gross general government debt ²	Net general government debt ³	Primary balance	Gross general government debt maturing plus budget deficit		General government debt held abroad ⁵	Domestic depository institutions' claims on general government ⁶		BIS reporting banks' consolidated international claims on public sector ⁷	Rating/Outlook (notches above speculative grade/outlook) (as of 3/10/11) ⁸	Five-year (basis points) (as of 3/9/2011)	
	2011	2011	2011	2011	2012		(percent of 2010 GDP)	(percent of depository institutions' consolidated assets)				
Australia	24.1	7.8	-2.1	4.5	3.3	43.4	2.2	1.2	3.2	9	Stable	51
Austria	70.5	50.7	-1.0	7.8	8.6	87.5	15.7	4.5	14.4	10	Stable	76
Belgium	97.3	82.3	-0.5	22.4	22.6	68.3	22.0	6.8	18.3	9	Negative	166
Canada	84.2	35.1	-4.1	18.5	16.4	19.6	19.6	10.3	3.6	10	Stable	n.a.
Czech Republic	41.7	n.a.	-2.6	11.0	10.8	33.4	15.9	13.3	4.9	5	Stable	88
Denmark	45.6	4.4	-3.2	9.3	9.8	41.8	15.5	3.2	6.0	10	Stable	44
Finland	50.8	-52.6	-1.8	11.2	9.7	89.3	6.2	2.3	11.3	10	Stable	35
France	87.6	77.9	-3.5	20.6	19.7	64.4	19.0	4.7	8.8	10	Stable	85
Germany	80.1	54.7	-0.3	11.4	10.5	52.8	25.4	7.6	10.4	10	Stable	48
Greece	152.3	n.a.	-0.9	24.0	26.0	61.5	27.4	12.2	23.3	-1	Negative	1,037
Ireland	114.1	95.2	-7.5	19.5	18.0	59.4	28.2	2.8	8.7	3	Negative	587
Italy	120.3	100.6	0.2	22.8	23.1	47.0	32.1	13.1	15.2	7	Stable	180
Japan	229.1	127.8	-8.6	55.8	52.5	6.9	76.3	23.7	1.6	7	Negative	77
Korea	28.8	27.5	3.5	8.9	5.8	11.5	6.1	4.4	4.8	5	Stable	98
Netherlands	65.6	30.5	-2.2	19.9	16.6	66.4	13.8	3.6	9.2	10	Stable	47
New Zealand	35.8	10.4	n.a.	15.0	7.7	52.6	6.8	3.6	3.0	9	Negative	63
Norway	54.3	-157.3	10.4	-1.2	-3.0	44.4	n.a.	n.a.	7.4	10	Stable	19
Portugal	90.6	86.3	-1.6	21.6	21.0	56.7	15.7	4.8	17.2	5	Negative	498
Slovak Republic	45.1	n.a.	-3.6	14.5	12.8	31.5	19.4	22.0	6.1	6	Stable	88
Slovenia	42.3	n.a.	-3.4	7.2	7.3	63.5	10.9	7.4	6.7	8	Negative	84
Spain	63.9	52.6	-4.6	19.3	18.7	49.6	22.3	6.8	7.1	8	Negative	253
Sweden	37.3	-13.8	-0.9	5.4	4.6	45.2	6.5	2.3	5.3	10	Stable	33
United Kingdom	83.0	75.1	-5.5	15.7	13.6	26.8	6.9	1.5	2.9	10	Stable	58
United States	99.5	72.4	-9.0	28.8	25.6	31.9	7.7	5.3	3.7	10	Stable	43

Sources: Bank for International Settlements (BIS); Bloomberg, L.P.; IMF, International Financial Statistics, Monetary and Financial Statistics, and World Economic Outlook databases; BIS-IMF-OECD-World Bank Joint External Debt Hub; and IMF staff estimates.

Note: Based on projections for 2011 from the April 2011 *World Economic Outlook*. Please see the WEO for a summary of the policy assumptions.

¹As a percent of GDP projected for 2011. Data for Korea are for central government.

²Gross general government debt consists of all liabilities that require future payment of interest and/or principal by the debtor to the creditor. This includes debt liabilities in the form of Special Drawing Rights (SDRs), currency and deposits, debt securities, loans, insurance, pensions, and standardized guarantee schemes, and other accounts payable.

³Net general government debt is calculated as gross debt minus financial assets corresponding to debt instruments. These financial assets are monetary gold and SDRs, currency and deposits, debt securities, loans, insurance, pensions, and standardized guarantee schemes, and other accounts receivable.

⁴As a proportion of projected GDP for the year. Assumes that short-term debt maturing in 2011 will be refinanced with new short-term debt that will mature in 2012.

⁵Most recent data for externally held general government debt (from Joint External Debt Hub) divided by 2010 gross general government debt. New Zealand data are from Reserve Bank of New Zealand.

⁶Includes all claims of depository institutions (excluding the central bank) on general government. UK figures are for claims on the public sector. Data are for third quarter 2010 or latest available.

⁷BIS reporting banks' international claims on the public sector on an immediate borrower basis for the third quarter of 2010, as a percentage of projected 2010 GDP.

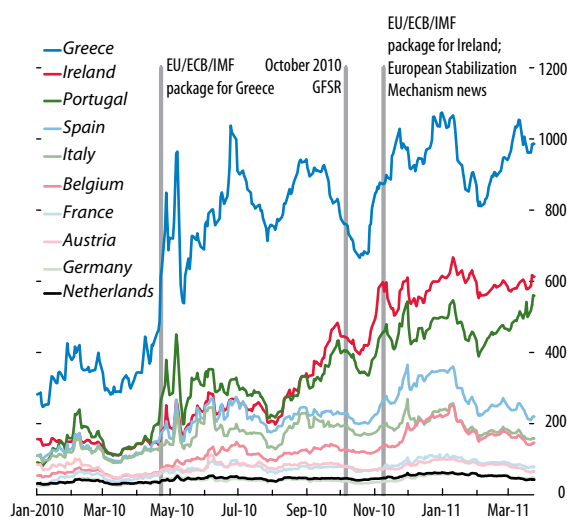
⁸Based on average of long-term foreign currency debt ratings of Fitch, Moody's, and Standard & Poor's, rounded down. Outlook is based on the most negative of the three agencies' ratings.

IMF program provided financial support to Ireland. Fiscal policy efforts complemented these initiatives, as all euro area members have taken steps to reduce their deficits in 2011, in some cases significantly so. A few countries have also made important policy changes in other areas. Spain, for example, has launched labor market and pension reforms while,

as described in the previous section, accelerating bank restructuring and putting in place a new bank recapitalization program.

Euro area policymakers also announced in November 2010 the creation of a European Stabilization Mechanism (ESM) that will replace the current European Financial Stability Facility (EFSF)

Figure 1.14. Sovereign Credit Default Swap Spreads
(Five-year tenors, basis points)



Source: Bloomberg L.P.

when it expires in 2013. The ESM will stand ready to offer financial assistance to member states facing funding difficulties. In extreme cases where debt sustainability cannot be achieved, the ESM will require the government to negotiate a sovereign debt restructuring plan with private creditors. To facilitate this process, standardized collective action clauses must be included in the terms of all euro area government bonds issued after June 2013. As such, the ESM aims to reduce moral hazard and provide a safety valve for cases of unsustainable debt. Its short-term impact, however, may be to complicate the funding of weaker euro area sovereigns, as the new rules for bondholder bail-ins were announced amid serious investor concerns about *existing* debt levels. Indeed, while spreads have generally retreated from their recent peaks, some euro area sovereigns continue to face tense financing conditions.

Public financing requirements remain high in many advanced economies, raising funding risks...

In many advanced economies, the public sector has high funding needs because of persistent primary deficits and the increased reliance on short-term debt financing in the early stages of the financial crisis. For 2011, Japan and the United States face the largest public debt rollovers of any advanced economy at 56 percent and 29 percent of GDP, respectively (Table 1.2). Those euro area sovereigns currently facing the highest market pressure need to cope with rollover rates above 15 percent of GDP. In this environment, the adverse consequences of a poorly received bond auction or weak bond syndication are magnified as investors closely scrutinize sovereign credit risk.

...while a hollowing out of the investor base reduces the demand for high-spread euro area government debt.

The European sovereign debt crisis has fundamentally altered investors' perception of the credit risks and funding prospects of euro area government bonds. Before the crisis, government bonds of countries now considered "high-spread" provided a small additional yield—about 8 basis points more than German bunds—without any perceived increase in risk, partly because volatility was roughly equivalent

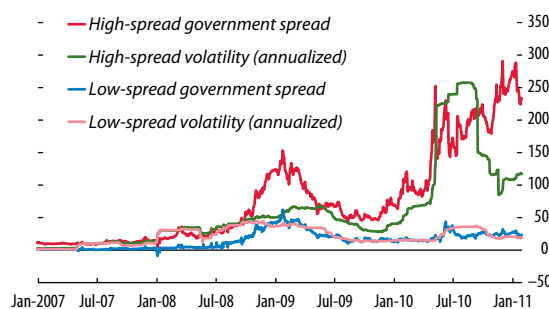
(Figure 1.15).⁸ Since the crisis, the spreads of all euro area government bonds versus German bunds have widened, but those of the high-spread economies now exceed 200 basis points, reflecting a new perception of sovereign credit risk and related funding concerns. In a portfolio context, such wide spreads prompt a recategorization of these government bonds, moving them from the low-credit-risk bucket of (quasi-) governments and supranationals to the higher-credit-risk category of corporate bonds and securitized products. In other words, high-spread euro area government debt is now evaluated against other nongovernment debt classes, such as industrials, utilities, banks, and covered bonds (Figure 1.16).

Yet the increase in high-spread euro area yields may not even be sufficient to compensate for the higher risk, at least when yield volatility is used as the risk indicator. Since late 2009, the volatility of high-spread euro area government bonds has surged to three to four times that of low-spread euro area sovereigns and well above that of other bond classes, including triple-A agencies and supranationals. As a result, the recent elevated volatility sharply reduces the attractiveness of high-spread euro area governments on a risk-adjusted basis (Figure 1.16), both versus their pre-crisis ranking and vis-à-vis unsecured corporate debt, local authority paper, and covered bonds. And as long as important sovereign funding concerns remain, investors are unlikely to lower their estimates of future volatility.

The appetite for high-spread euro area government bonds may have diminished among several institutional investor groups:

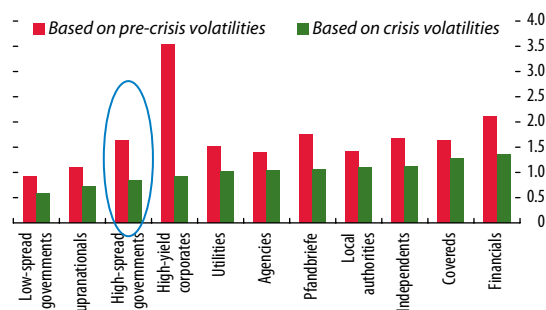
- *Fund managers.* Portfolio mandates with minimum rating thresholds may prompt asset managers to limit their exposure to such bonds. In the event of a downgrade to the minimum ratings criteria, a portfolio manager may be forced to sell the securities unless the client agrees to change the investment

Figure 1.15. Euro Area Treasury Bond Spreads over German Bunds, and Volatility
(In basis points)



Sources: Barclays Capital; and IMF staff estimates.

Figure 1.16. Risk-Adjusted Yields for Euro-Denominated Bonds
(In percent)

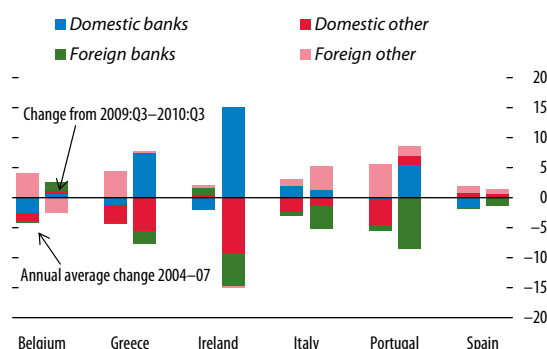


Sources: Barclays Capital; and IMF staff estimates.

Note: Pre-crisis estimated from June 2003 to June 2007; post-crisis July 2007 to December 2010.

⁸ In this section, the term “high-spread” euro area countries refers to Belgium, Greece, Ireland, Italy, Portugal, and Spain, each of which had a sovereign CDS spread that averaged over 150 basis points in the fourth quarter of 2010 and first quarter of 2011. The sample of “low-spread” countries in this section includes Austria, Finland, France, Germany, and the Netherlands. Any composites of these countries are calculated on the basis of the market value of their debt, as implied by the Barclays Capital Indices.

Figure 1.17. Change in General Government Debt Holdings
(As a percent of total debt)



Sources: IMF-BIS-World Bank Joint External Debt Hub (external debt); IMF, International Financial Statistics database (domestic bank holdings); Bank for International Settlements (foreign bank holdings); Eurostat (general government debt).

Note: All series adjusted for market value changes. See Annex 1.2 for details on data methodology.

mandate.⁹ Slippage below these rating thresholds may reduce demand from benchmarked bond funds, and could be sufficiently large to reduce market liquidity and further deter prospective buyers.

- *Banks.* As detailed in Section C, European banks face significant deleveraging pressures and are unlikely to be in a position to absorb incremental government debt issuance at the pace sustained in 2010.
- *Nonbank financial institutions.* Conservative buy-and-hold investors such as insurers and pension funds may eschew riskier sovereigns, because their investment objectives are to match assets with their long-term liabilities, not to take large market directional bets. European insurers will also be preparing for the 2012 implementation of the prudential regulatory requirements of Solvency II, which includes moving to a risk-based capital framework.¹⁰

As a result, investors with mark-to-market requirements may be inclined to sell distressed bonds outright to limit losses and assuage client concerns. Banks and other institutions with shorter maturity exposures are more likely to allow their portfolios to run off naturally to reduce overall exposure. Other investors may prefer to hedge their riskier holdings through CDS purchases or short positions. Although such hedging represents a diminished economic exposure, it would not be reflected in statistics on debt ownership.

With foreign demand shrinking, increased reliance on domestic sources of government financing could heighten risks to financial stability.

Foreign investors are gradually reducing their exposures to the bonds of high-spread euro area governments through both active selling and passive means. In the cases of Greece, Ireland, and Portugal, the challenge of absorbing growing government debt issuance has mostly fallen on domestic banks (Figure 1.17). In Italy and Spain, domestic banks have kept their

⁹ Central banks often apply AAA rating criteria for securities in their reserve portfolios, while Baa3/BBB- is a critical threshold for many private sector bond funds.

¹⁰ To the extent that recent volatility casts high-spread euro government bonds in an unfavorable light from a risk-adjusted return perspective, future demand for these bonds from insurance companies may be constrained.

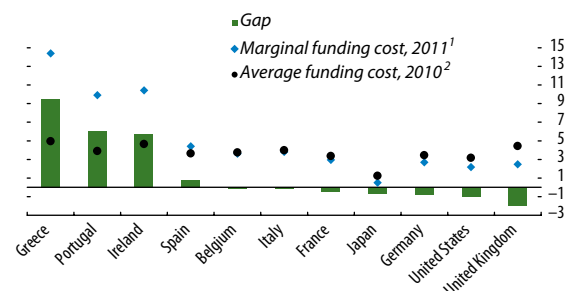
relative holdings of local government debt constant as foreign banks were net sellers. An imbalanced bond investor base poses rollover risks, especially at a time when that marginal buyer confronts deleveraging pressures (Annex 1.2).

The shift in investor attitudes vis-à-vis certain euro area sovereigns foreshadows a sustained rise in government funding costs.

In the absence of confidence-enhancing policy actions, unfavorable investor perceptions could over time lead to a significant increase in average funding costs. The outlook for individual economies depends on two considerations:

- **Marginal rates:** The expected repricing of sovereign debt will be greater if marginal interest rates are well above the *average* rate paid on the current stock of debt. Economies differ significantly in this regard. Indeed, most large economies currently face marginal rates *below* their average rate. The opposite is true for the sovereign debt of Greece, Ireland, and Portugal, because of the sharp run-up in their bond yields since late 2009 (Figure 1.18).¹¹
- **Timing:** The higher the sovereign's near-term financing needs, the faster will be the repricing of debt. Hence, the spotlight will be on economies with high projected deficits or large amounts of debt coming due. Average debt maturities do not vary significantly across advanced economies, ranging mostly around six to seven years. The only notable exception is the United Kingdom, whose public debt is unusually long-dated.¹² A more detailed analysis of near-term debt maturities and projected deficits in Figure 1.19 reveals particularly large funding needs through end-2012 in Japan, followed at some distance by Greece, the United States, and Italy.

Figure 1.18. Average versus Marginal Government Funding Costs
(In percent)

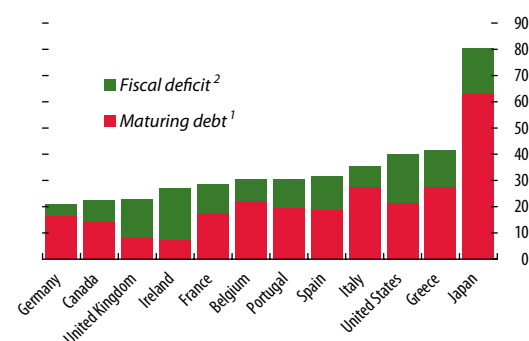


Sources: Bloomberg L.P.; IMF, World Economic Outlook database; and IMF staff estimates.

¹Yield on five-year government bond as of March 31, 2011.

²Computed as 2010 general government interest outlays divided by beginning-of-period debt stock.

Figure 1.19. Sovereign Funding Needs
(Percent of 2011 GDP)



Sources: Bloomberg L.P.; and IMF, World Economic Outlook database.

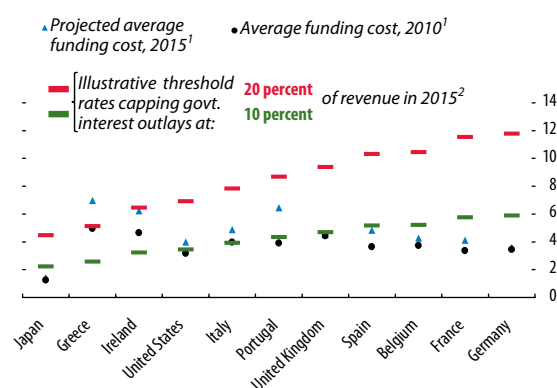
¹All debt (principal only) maturing between April 1, 2011 and December 31, 2012, based on Bloomberg data.

²Sum of projected general government net borrowing in 2011 and 2012.

¹¹ Like most figures in this section, Figure 1.18 focuses on the largest G-7 economies along with those euro area countries currently in the spotlight of financial markets.

¹² Controlling for the effect of quantitative easing changes this picture somewhat. Specifically, the Bank of England's large-scale gilt purchases have effectively replaced longer-term government debt with short-term monetary liabilities, increasing the interest rate risk faced by the consolidated government sector and lowering the effective average maturity of government debt by nearly three years to just above 11 years.

Figure 1.20. Government Funding Costs in 2015
(In percent)



Sources: Bloomberg, L.P.; IMF, World Economic Outlook database; and IMF staff estimates.

¹Computed as interest outlays divided by beginning-of-period debt stock.

²Threshold rates computed to keep interest payments on gross government debt at 10 or 20 percent of revenue, respectively. A 10 percent ratio marks the upper boundary of the AAA rated sovereign universe under Moody's rating approach. For Japan, based on net debt, given large holdings of interest-bearing assets.

To obtain a more precise sense of the challenges facing these economies, we project average funding costs through 2015 using detailed data on debt maturities and WEO forecasts for primary deficits. Debt issuance is assumed to maintain the maturity profile of existing debt, while being priced according to current market forward rates. For Greece and Ireland, the funding contributions from the European Union and the IMF are explicitly taken into account. Under these assumptions, average funding costs are set to rise by as much as 249 basis points for Greece, 149 basis points for Portugal, 211 basis points for Ireland, and 117 basis points for Spain (Figure 1.20). In most other cases, funding costs are projected to increase modestly, reflecting the upward slope of current forward curves.

Investor concerns about sovereign risk can be usefully analyzed through the lens of the government interest bill.

How severe are these changes in funding costs implied by market rates? The answer depends on a country's fiscal position. Rising interest rates weigh more heavily on sovereigns, the higher the debt stock to which they apply, and the lower the revenue flow from which they are paid. In this vein, the ratio of government interest payments to total revenue is routinely used by financial market participants to gauge "debt affordability."¹³ A higher interest bill effectively raises the political price of staying current on the debt, as it requires the public to pay a larger share of taxes without obtaining government services in return. Consistent with this argument, large interest outlays tend to heighten market concerns about sovereign risk, as reflected in credit or inflation risk premia. Rising risk premia, in turn, drive up funding costs over time, compounding the problem of debt affordability and access to market funding.

In light of these considerations, Figure 1.20 presents illustrative interest rate thresholds, denoted by horizontal bars, for each country. The thresholds are computed as those interest rates that would limit

¹³For instance, a 2009 report by rating agency Moody's proposes a 10 percent ratio to mark the boundary of Aaa rated sovereign credit.

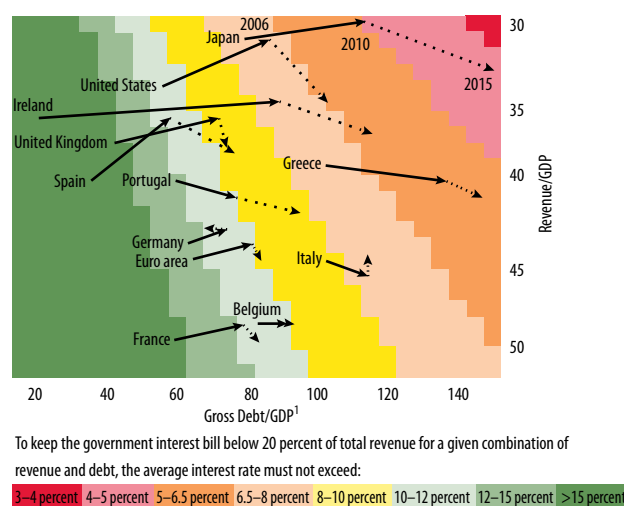
the government interest bill to 10 percent (green) or 20 percent (red) of revenue in 2015.¹⁴ Although any numerical choice is ultimately arbitrary, these values capture the notion of a relatively moderate (10 percent) and a more elevated (20 percent) interest burden, as commonly considered by market participants in assessing credit risk.

Indeed, the average interest bill in most advanced economies since 1980 has been no greater than 8 to 10 percent of revenue, thus staying just within the range considered typical of Aaa rated sovereigns. Ratios above 20 percent have been observed in only about one-tenth of cases over this period, and ratios above 30 percent have been exceedingly rare. Nonetheless, economies can, in principle, sustain even higher funding costs. The purpose of considering specific numerical benchmarks, therefore, is not to pass a definitive judgment on debt affordability, but to indicate the relative strain put on a country's fiscal position by a given cost of funding, and how market participants are likely to assess the associated credit risk.

The largest interest bills are looming for a few euro area countries, although they should remain manageable at projected levels.

As Figure 1.20 makes clear, Greece's projected funding costs appear the most challenging, with an interest bill approaching 30 percent of revenue by 2015. Although this would imply a significant fiscal burden, the country has sustained similarly large interest-to-revenue ratios in the past (see Annex 1.4).¹⁵ Moreover, the very objective of Greece's current IMF-supported program is to restore market confidence and thus lower the country's risk premium over time, notably by delivering on the authorities' commitment to sustained fiscal and structural adjustment. Several other euro area countries currently in the market spotlight are also set to face higher interest bills by 2015, compounding a continued rise in debt (Figure 1.21), but should be able to avoid very elevated ratios under the baseline projections.

Figure 1.21. Funding Cost Thresholds, Debt, and Revenue



Sources: IMF, World Economic Outlook database; and IMF staff estimates.

¹For Japan, based on net debt.

¹⁴The threshold values refer to nominal interest rates conditional upon current inflation forecasts, as embedded in WEO projections for government revenue.

¹⁵There are also precedents from past IMF-supported programs, including Mexico in the mid-1990s and Turkey in the early 2000s, when interest burdens were at least as high.

Although interest rates in the United States and Japan have remained low, both countries are increasingly sensitive to a possible rise in funding costs.

Also striking is the high sensitivity of the United States and especially Japan to a possible rise in funding costs. Indeed, the illustrative interest rate thresholds are lower for those countries than for most euro area members, reflecting a combination of large and rising debt and relatively low government revenue (Figure 1.21).¹⁶ Nonetheless, both countries are projected to maintain comparatively moderate, albeit increasing, interest burdens through 2015. The reason is the very low level of current funding costs, which are in turn attributable to ample global demand for U.S. treasuries as a reserve asset; and a large and loyal domestic investor base for Japanese government bonds. The flip side of these benign circumstances is the potential for severe dislocations if investors were to take fright at some point in the future.

No single indicator captures all relevant aspects of a country's vulnerability to debt repricing. For example, market perceptions of sovereign risk may extend beyond overall debt or interest burdens to include the composition of the investor base or the quality of fiscal institutions. Moreover, markets price not only the baseline outlook, but also the risks around it. The WEO projections considered here generally build in significant improvements in fiscal balances through 2015. Without such improvements, or with growth falling short of forecasts, debt dynamics and financing costs could turn out considerably worse. Similarly, debt service costs could rise sharply—even without new shocks to sovereign risk premia—if higher-than-expected inflation were to force central banks to “normalize” real policy rates more sharply than currently envisaged.¹⁷

¹⁶Low revenue ratios in both countries suggest that there is considerable scope to raise taxes. While this should indeed provide some buffer, voters may not readily accept a larger tax burden. Thus, the general point remains that a high ratio of interest outlays to revenue exacts a significant political price.

¹⁷The April 2011 *Fiscal Monitor* provides a series of useful sensitivity tests in this regard (IMF, 2011b).

Strategies to contain financial stability risks must combine credible medium-term deficit reduction with adequate multilateral backstops for near-term funding needs.

The most pressing financial stability challenge is to bring down marginal funding costs in vulnerable euro area countries. Regaining investor confidence will likely take time and require a comprehensive set of measures that build on the progress achieved so far. At the core of any successful strategy must be a credible medium-term plan to cut the fiscal deficit and arrest the rise in public debt. Where market worries are centered on banking sector fragilities, it is critical to reduce uncertainty by addressing identified weaknesses. Such domestic efforts should be backed at the multilateral level by EFSF/ESM support where necessary. To be effective, these facilities require sufficient scale and flexibility, and should lend at interest rates low enough to support debt affordability, subject to strict conditionality. Looking beyond the euro area, preserving global financial stability will also require much greater clarity on strategies for medium-term fiscal consolidation in both Japan and the United States, as explained in the April 2011 *Fiscal Monitor* (IMF, 2011b).

E. Alleviating Pressures on Households and Firms

U.S. households are highly leveraged, with many in a negative equity position on their home loans. The housing market's inventory overhang raises the risk of further mortgage defaults. More structural policies are needed to reduce the debt burden of households while promoting orderly deleveraging. Weakness persists in parts of the corporate sector of advanced economies, especially among small and medium-sized firms and in the commercial real estate sector.

Household leverage ratios in the United States are elevated relative to some peers (Figure 1.22) and have only recently come off historic highs (Figure 1.23).¹⁸ Mortgage-related debt is the key driver of the overall

¹⁸This section focuses primarily on the U.S. household sector, given its higher leverage ratio, large links to a still impaired housing sector, and importance for financial stability.

trajectory of household liabilities, accounting for about three-fourths of total household debt. During the decade preceding the crisis, leverage rose in the U.S. corporate and commercial banking sectors, but household leverage rose at nearly twice the rate of those sectors over the same period.

Large debt burdens pose downside risks to housing markets.

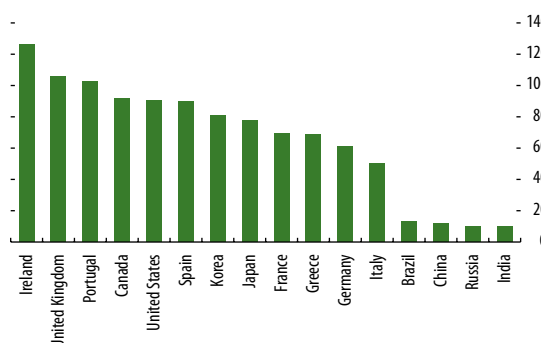
The large overhang of household debt risks further weakening bank balance sheets and credit availability and weighs on housing and other asset prices, an effect that in turn further exacerbates the household debt burden.

The large shadow inventory of houses expected to come to the market will likely continue to dampen the recovery of house prices and exacerbate negative equity (Figure 1.24).¹⁹ Negative equity borrowers who are still current on their payments represent a potential addition to the shadow inventory because they are at high risk of default. Once negative equity exceeds 20 percent, the delinquency or default propensity rises sharply and loan modifications start to lose effectiveness (Annex 1.5). The share of residential mortgages with negative equity has declined since October 2010 from almost 25 percent to around 23 percent, but the decline is mostly attributable to foreclosures rather than a rise in home prices. For now, the time required to recognize foreclosures has slowed the decline in house prices, but a change in banks' behavior to accelerate recognition could push prices lower, leaving more borrowers with negative equity and spurring strategic defaults where homeowners who can afford their mortgage payments choose to default because of negative equity (see Box 1.3).²⁰

¹⁹The shadow inventory represents as many as 6.3 million mortgages, or one in seven home loans and 16 months of additional housing supply. Box 1.3 discusses some options to reduce the shadow inventory of housing and the potential impact of such reductions on bank balance sheets.

²⁰Delays in foreclosures are exacerbated by banks' fear of loan put-backs—the return to their balance sheets of loans previously securitized with such return specified in the event of default.

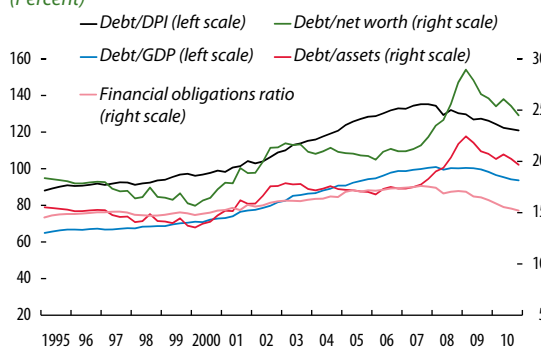
Figure 1.22. Leverage Ratios: Household Debt as a Percent of GDP



Sources: Haver Analytics; national authorities; McKinsey & Co.; and IMF staff estimates.

Note: Various dates, but mostly 2010. In some cases, household debt includes debt issued by non-profit institutions serving households.

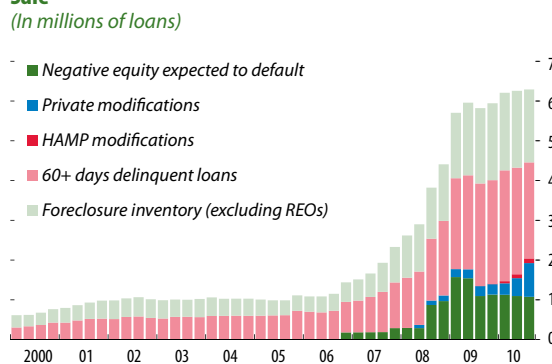
Figure 1.23. Various Measures of U.S. Household Leverage (Percent)



Sources: Federal Reserve.

Note: DPI = disposable personal income.

Figure 1.24. Shadow Inventory of Houses Potentially for Sale



Sources: Mortgage Bankers Association; and IMF staff estimates.

Note: REOs = Real-estate owned. HAMP = Home Affordable Modification Program.

Box 1.3. Examining the Ability of U.S. Banks to Absorb Mortgage Principal Reductions

A key challenge for the U.S. housing market is clearing the large shadow inventory—houses potentially for sale because of current or expected loan delinquency—without destabilizing the normalization in house prices. So far, public and private efforts to mitigate foreclosures have met with limited success. The primary shortcoming has been the inability to induce the payment reductions needed to address borrowers' high-debt profiles and/or the principal reductions to address the large negative equity position of many homeowners (IMF, 2008, 2009a, 2010a, b, and c).¹ As a result, modified loans have had high redefault rates, slowing homeowners' efforts to deleverage and restore their credit scores and lengthening the foreclosure process.

The costly foreclosure process has indeed slowed considerably, raising loss severities. The value destruction associated with foreclosure is generally greater than that associated with loan modification, and loss severities tend to rise the longer it takes to foreclose on a home (IMF, 2010b; Fitch Ratings, 2010).² Since 2005, the average liquidation process has more than doubled to 22 months (Goodman, 2010). A number of issues have complicated this resolution process:

- Many seriously delinquent homeowners have extremely high debt service loads, including junior liens. The median ratio of total debt payments to income of borrowers whose loans have been modified under the Home Affordable Modification Program was 63 percent as of September 30, 2010. In the absence of principal reductions, loan restructurings are likely to be unsustainable, leading to high redefault rates and a postponement of resolutions.
- Principal reductions reduce servicers' fee income, as they lower the outstanding balance on which their various fees are based (Levitin and Twomey, 2011). Servicers' compensation structure is inadequate to

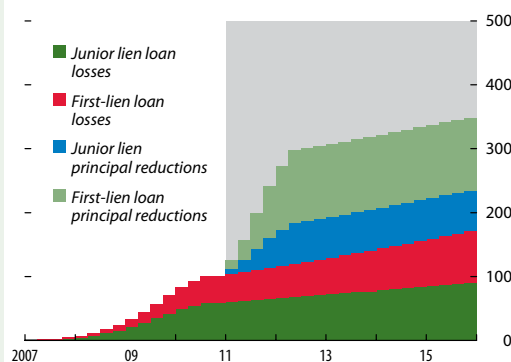
Note: This box was prepared by Geoffrey Keim and Andrea Maechler, with helpful input from John Kiff.

¹According to CoreLogic, 23.1 percent of U.S. homeowners owed more on their mortgages than their homes were worth in the fourth quarter of 2010.

²The longer it takes to foreclose on a loan, the worse shape it is in and the lower its recovery value. The recovery rate would also be lower during severe housing weaknesses, when a large volume of foreclosed properties are likely to hit the market.

Stress Scenario (15 Percent Principal Reduction): Cumulative Residential Real Estate Losses of Top 40 U.S. Banks

(In billions of dollars)



Sources: SNL Financial; and IMF staff estimates.

cover the time-intensive and complex nature of servicing and modifying delinquent loans, while conflicts of interest among investors in mortgage-backed securities further reduce their scope for loan modifications.

One way of assessing the size of the problem is to estimate the ability of the top 40 U.S. bank holding companies to absorb large up-front reductions in principal. We applied a 15 percent principal reduction over six quarters beginning in the first quarter of 2011 on all first-lien residential loans expected both to be at risk of foreclosure and to benefit from restructuring (e.g., negative equity performing loans, modified loans expected to re-default, and loans past due less than 90 days). We also applied a 30 percent writedown on seriously delinquent and foreclosed loans through 2015, to account for a worst-case loss scenario on those loans. For junior liens, we also assumed a 15 percent principal reduction except for those seriously delinquent, which received a 50 percent writedown (see figure).

Our stress tests highlight the capital strength of U.S. banks, showing that capital shortfalls are manageable even under a severe shock. Despite elevated loss rates, capital needs over five years are only \$4.4 billion under a 6 percent Tier 1 common equity ratio (see table). If the top 40 banks were to apply a more aggressive 20 percent principal reduction on

Box 1.3 (continued)**Size and Extent of Capital Shortfalls at Top U.S. Banks under Alternative Scenarios for Capital Reductions on Residential Loans**

	Ratio of Tier 1 Common Equity to Risk-Weighted Assets							
	Capital shortfall (in billions of dollars)				Banks falling below ratio (number)			
	6 percent ratio		8 percent ratio		6 percent ratio		8 percent ratio	
	Top 4	Top 40	Top 4	Top 40	Top 4	Top 40	Top 4	Top 40
Current baseline	0	1.3	1.9	10.7	0	2	1	12
Principal writedowns								
15 percent	0	4.4	17.3	36.7	0	7	2	18
20 percent	0	8.1	36.2	62.8	0	8	2	21

Source: IMF staff estimates.

Note: See box text for details on writedown amounts for first- and junior-lien loans.

first and junior liens, they would require an additional \$8.1 billion in capital to maintain a 6 percent Tier 1 common equity ratio.³

These estimates and their implications for the shadow inventory of houses for sale need to be interpreted with caution. Many uncertainties remain, including the sustainability of the loan restructurings and the impact of more aggressive writedowns on the house price outlook and related loss severities. Fur-

³This scenario implies a 20 percent principal reduction on all categories of first and junior liens except for seriously delinquent and foreclosed junior liens, which receive a 40 percent writedown. The larger principal reduction is also assumed to help raise banks' recovery rates by 10 percentage points (to 80 percent for first liens and 60 percent for junior liens).

thermore, our analysis is restricted to the \$2.1 trillion in total home mortgage loans held on banks' balance sheets, ignoring the role of the \$7.1 trillion residential mortgage-backed securities (18 percent of which are held in private-label mortgage-backed securities).⁴ While the fate of these securities matters for the speed at which the shadow inventory is liquidated, their impact on banks' balance sheets is likely to be limited, given that 85 percent of the \$1.3 trillion held on banks' balance sheets is either guaranteed or issued by a government-sponsored enterprise.

⁴Credit losses associated with the conforming loans underlying agency mortgage-backed securities are covered by the agency guarantee and hence would become a fiscal contingent liability.

Substantial debt reduction is needed to return leverage to more manageable levels.

There is no established threshold for optimal household leverage. Table 1.4 shows the change in leverage ratios, debt, and GDP that are required to return leverage to four different benchmarks: the long-term trend, the leverage ratio that prevailed in 1998 (just before the growth rate in leverage accelerated), liabilities growing in line with GDP since 1998, and liabilities growing along a path similar to that seen in other advanced economies that underwent a banking

crisis. These illustrative scenarios indicate that fairly substantial reductions in leverage (ranging from 10 to 30 percentage points) are needed to return to more "normal" levels.

The limited ability of monetary policy to expedite deleveraging among households puts the spotlight on structural policies.

In theory, lower policy rates and quantitative easing should help smooth the household deleveraging process by increasing the value of household assets

Table 1.4. Different Scenarios for Return to “Equilibrium” Household Debt-to-GDP Ratios

	Leverage Ratio (percent)	Difference from Current Ratio (percentage points)	Change in Debt		Change in GDP	
			(in trillions of dollars)	(percent change)	(in trillions of dollars)	(percent change)
Return to long-term average	63.9	–30.7	–4.5	–32	7.1	48
Return to 1998 levels	68.2	–26.3	–3.9	–28	5.7	39
Growth in line with GDP	67.5	–27.0	–4.0	–29	5.9	40
Other post-crisis experiences	82.7	–11.8	–1.7	–12	2.1	14

Sources: Bureau of Economic Analysis; Federal Reserve; and IMF staff estimates.

Note: The table shows the magnitude of declines in debt or increases in GDP needed to return household leverage to more moderate levels, but some combination thereof is also possible.

through higher asset prices and by reducing the cost of household liabilities through lower interest rates.²¹ These policies (especially during the first round of quantitative easing, or QE1, by the Federal Reserve) appear to have had a positive impact on the asset side of the household balance sheet, as the portfolio rebalancing effect helped to boost the prices of some risky assets held by households and increase new inflows as investors moved money from cash equivalents to higher-yielding assets (Figures 1.25 and 1.26).²²

However, on the liabilities side, the effectiveness of lower rates is more limited. Large numbers of homeowners with delinquent mortgages or low equity cannot benefit from refinancing into lower mortgage rates because home price declines have reduced the value of assets they can pledge as collateral. Banks are also still concerned about conserving liquidity and capital, particularly as the shadow inventory remains large and the issue of mortgage put-backs has not been resolved (see Section D).²³ Other policies aimed at reducing mortgage rates or maturity extensions have also had only limited success in reducing negative equity and

the shadow inventory. These considerations suggest that more structural policies, such as renegotiation or some form of debt reduction—including writedowns of mortgage principal by banks—may be needed.²⁴

In contrast to households, nonfinancial corporations generally entered the crisis with relatively low leverage, high cash balances, and strong balance sheets.

U.S., European, and Asian nonfinancial corporations were in relatively good shape going into the crisis and strengthened further as they derisked and deleveraged their balance sheets. As market confidence deteriorated, they built up cash balances, paid down short-term debt, and reduced their dependence on bank loans. The resulting improvements in net/gross leverage, interest coverage, cash balances (now historically high), cash flow generation, and default rates remain broadly intact. Meanwhile, corporate debt issuers continue to benefit from abundant liquidity, easy monetary policy, a gradual easing in lending standards, and improving credit ratings. At the same time, corporate earnings have rebounded from the crisis lows. Although the recession has ended, companies continue to maintain lean operations.

However, spillovers to the corporate sector from the European sovereign debt turmoil are evident.

Large firms have been mostly insulated from sovereign- and bank-related credit disruptions because of their strong internal finances and access to non-

²¹ The objective of QE1 was geared to reducing mortgage funding costs, while the second round of quantitative easing (QE2) was intended to reduce the risk of deflation.

²² Both flows to risky assets and asset price gains under QE1 were higher than under QE2, even when considering the anticipation effects. Other coinciding factors (such as fiscal stimulus, a successful round of stress tests, restored market confidence, an improvement in corporate fundamentals) may have contributed to the rebalancing under QE1. The more limited impact under QE2 may reflect the fact that markets were already fairly stable and that most of the benefits had already accrued by the time the program was introduced.

²³ Refinancing data illustrate this conundrum: activity picked up sharply in the early months of 2009 and again in mid-2010, but neither the market speculation of QE2, the announcement of the program, nor its implementation appear to have boosted refinancings further.

²⁴ The U.S. administration is already moving in this direction, proposing a settlement with mortgage servicers that calls for banks to bear the loss of principal writedowns on mortgages in negative equity or else face civil fines. However, forging a comprehensive settlement may be complicated legally. For various household debt restructuring options, see Laeven and Laryea (2009).

bank sources of funds. Nonetheless, there have been some spillovers from the sovereign debt turmoil to the corporate sector in Europe. Borrowing rates there have risen above those in the United States, particularly for more domestically focused firms in the euro area periphery, as markets differentiate based on country risk rather than credit risk (Figure 1.27). Such companies were already more exposed, given their higher leverage ratios relative to the rest of the euro area (Figure 1.28) and diminishing cash flows owing to weaker economic activity. Japanese corporations also still bear the burden of substantial debt as a legacy of the 1980s bubble period, but their cash cushion is fairly sizeable.

Although there are few signs of releveraging, the ingredients are in place for increased risk-taking among larger firms.

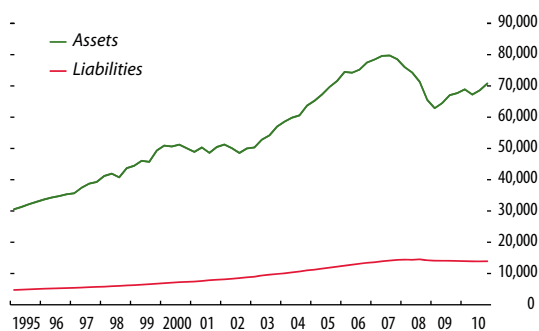
With rising confidence, low volatility, cheap borrowing rates, and ample liquidity, corporations are starting to releverage, albeit very cautiously. For instance, increases in debt-financed mergers and acquisitions and leveraged recapitalizations are beginning to pick up. Leveraged buyout activity has also begun to increase, though deals are small in size and number, and terms are fairly conservative. At the margin, momentum to take on risk is also rising, with the quality of issuance shifting slightly downward (especially in the United States). Excessively low risk-free rates for a protracted period could prompt borrowers to releverage to less sustainable levels. In the absence of demand, large firms flush with cash and with access to cheap credit are likely to exhibit more risk-taking behavior.

Parts of the corporate sector in advanced economies remain weak—especially small and medium-sized enterprises (SMEs) and the commercial real estate sector.

While the trend has improved since the October 2010 GFSR, credit growth among SMEs continues to remain more lackluster than for larger firms. In most advanced economies the difference appears to be due more to constraints on credit demand than on credit availability (Figure 1.29).²⁵ However, where banking

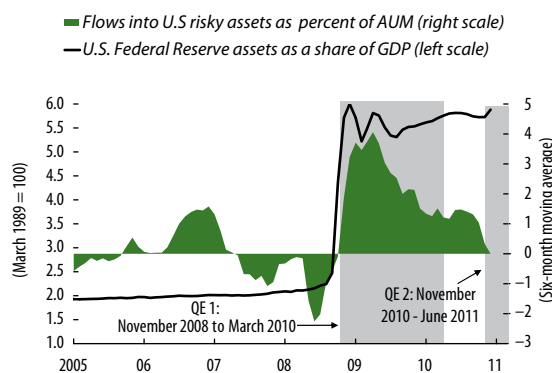
²⁵Lending officer surveys increasingly point to demand-side factors as the dominant constraint. This trend is also reflected in SME surveys such as that of the National Federation of Independent Business, which has found limited credit availability to be only third in

Figure 1.25. Household Balance Sheets
(In billions of dollars)



Sources: Federal Reserve; and Haver Analytics.

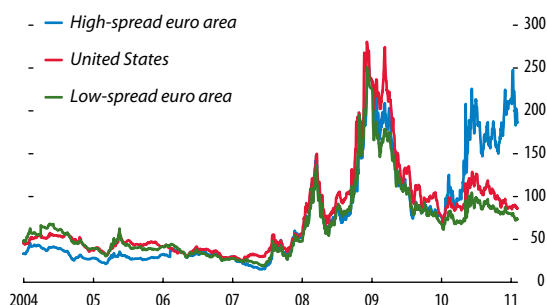
Figure 1.26. Federal Reserve Assets and Flows into U.S. Risky Assets



Sources: Investment Company Institute; Federal Reserve; Organization for Economic Cooperation and Development (OECD); and IMF staff estimates.

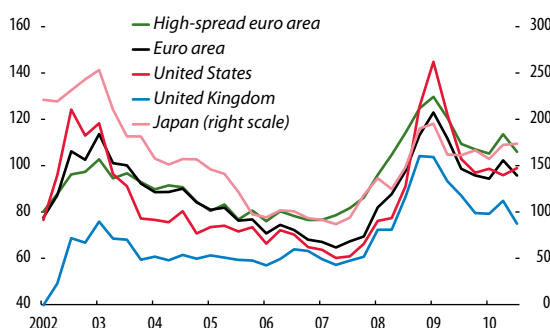
Note: Monthly OECD leading indicators for the United States is used as a proxy for GDP. AUM = assets under management. QE 1 and 2 refer to the Federal Reserve's first and second rounds of quantitative easing.

Figure 1.27. Nonfinancial Corporate Credit Default Swap Spreads
(In basis points)



Sources: Citigroup; Markit; and IMF staff estimates.
Note: High-spread euro area includes Belgium, Greece, Ireland, Italy, Portugal, and Spain. Low-spread euro area includes Austria, Finland, France, Germany, and the Netherlands.

Figure 1.28. Nonfinancial Corporates' Debt-to-Equity Ratios
(In percent)



Sources: Haver Analytics; national authorities; and IMF staff estimates.
Note: High-spread euro area includes Belgium, Greece, Ireland, Italy, Portugal, and Spain.

systems are still under duress, as in the euro area periphery, credit availability is likely more problematic. In addition, the cost of credit is still an issue, as the interest rate spread paid by SMEs relative to the rest of the corporate sector remains above pre-crisis levels. Given their greater dependence on bank financing and especially on smaller banks, SMEs have few alternative sources of credit.²⁶ Since their loans are often collateralized with the owner's personal wealth—usually housing—their collateral value has likely weakened along with the collapse in house prices. Ensuring sufficient support to the SME sector is critical given its economic importance.²⁷

Lending conditions in the U.S. and U.K. commercial real estate sectors have improved markedly and financing markets have reopened, but loan performance continues to deteriorate and prices remain depressed. Tiering by collateral type and lender is significant, and refinancing needs over the next three to five years are daunting (Figure 1.30).²⁸

What are the financial stability implications?

Further structural policies are needed to address the large number of delinquent and underwater mortgages and to facilitate the deleveraging process. In addition, policies should be geared toward absorbing the excess housing supply resulting from liquidations (e.g., conversions to rental properties). At the same time, the authorities need to continue to provide support to the private sector until the debt overhang is reduced or nominal GDP growth rises to a level adequate to support it. Private securitization continues to contract, leaving the overall securitization market dominated by the agency mortgage-backed securities market, which has accounted for 90 to 95 percent of gross issuance since 2008. As stressed in earlier GFSRs, restarting private securitization is critical to repairing credit intermedia-

the ranking of cited causes of low credit growth, the first being weak sales volume and the second uncertainty in business conditions.

²⁶For instance, in the United States, nearly 90 percent of SME funding comes from banks (e.g., lines of credit, loans, credit cards), compared to 30 percent for larger businesses.

²⁷SMEs account for 70 percent of the labor force in Europe and 84 percent in the United States. In both regions, SME job reductions were steeper during the crisis and have lagged the rest of the corporate sector in recovering during this economic cycle.

²⁸More than half of outstanding U.K. commercial real estate debt, and 40 percent of such U.S. debt, is maturing over the next three years.

tion. Private demand for credit is likely to remain sluggish for some time as the private sector deleverages, but it is probably time to transfer some of the government-sponsored lending to the private sector. That requires revamping and clarifying the role of the housing-related government-sponsored enterprises, ensuring that they are adequately capitalized, and providing adequate government support during the transition.²⁹ In addition, a secure, robust private securitization market requires further policy action in credit rating agency oversight, accounting practices, capital charges, and retention policies (IMF, 2009b, Chapter 2). See Section G for further details on policy prescriptions.

F. Macro and Stability Implications of Capital Inflows into Emerging Markets

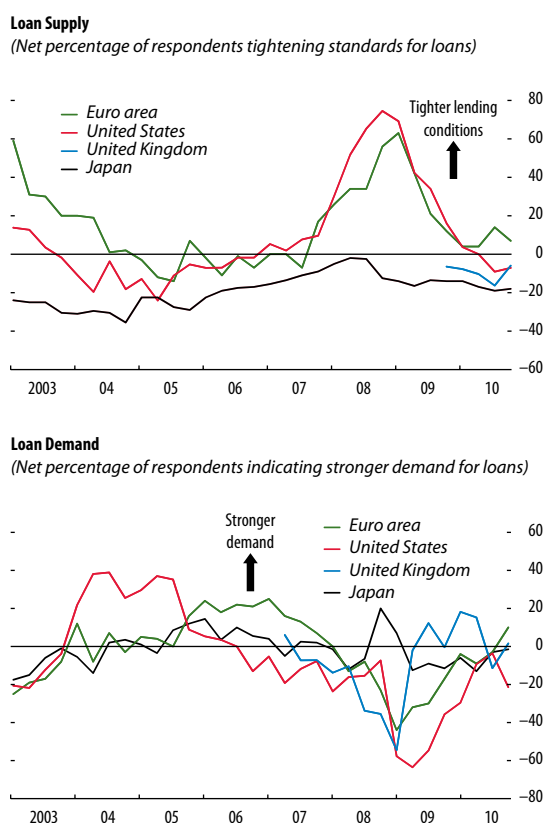
Emerging market economies are receiving an increased flow of foreign capital at a time when their output gaps are closing and their inflation rates are rising. The flows complicate efforts to manage local demand through tighter monetary policy, as rate hikes could spur additional capital inflows. Furthermore, the flows may exacerbate domestic dynamics and add to financial imbalances and vulnerabilities. Strong local issuance of debt and equity has helped absorb the inflows and ease pressures on asset prices, but it is contributing to higher leverage. Macroprudential and in some cases capital control measures can play a supportive role in managing the flows and their effects. But as inflows may prove long lasting, and especially in the context of strong domestic momentum, policies need to rely more on macroeconomic measures—including rate hikes, more flexible exchange rates, and fiscal tightening—to avoid overheating, accumulating financial risks, and undermining policy credibility.

Capital inflows to emerging markets have rebounded from their post-Lehman troughs that persisted into the second quarter of 2010, but aggregate levels remained below previous highs (Figure 1.31).³⁰

²⁹ See Chapter 3 for a discussion on reform of U.S. housing policy.

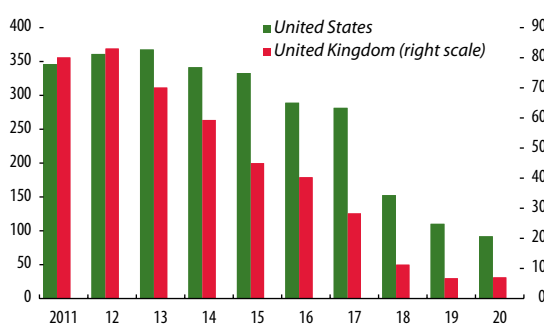
³⁰ Net capital inflows to Latin America rose to their highest levels in more than a decade, and in Asia, those inflows surpassed their pre-global crisis highs but remain below their pre-Asian

Figure 1.29. Lending Conditions for Small and Medium-Sized Enterprises



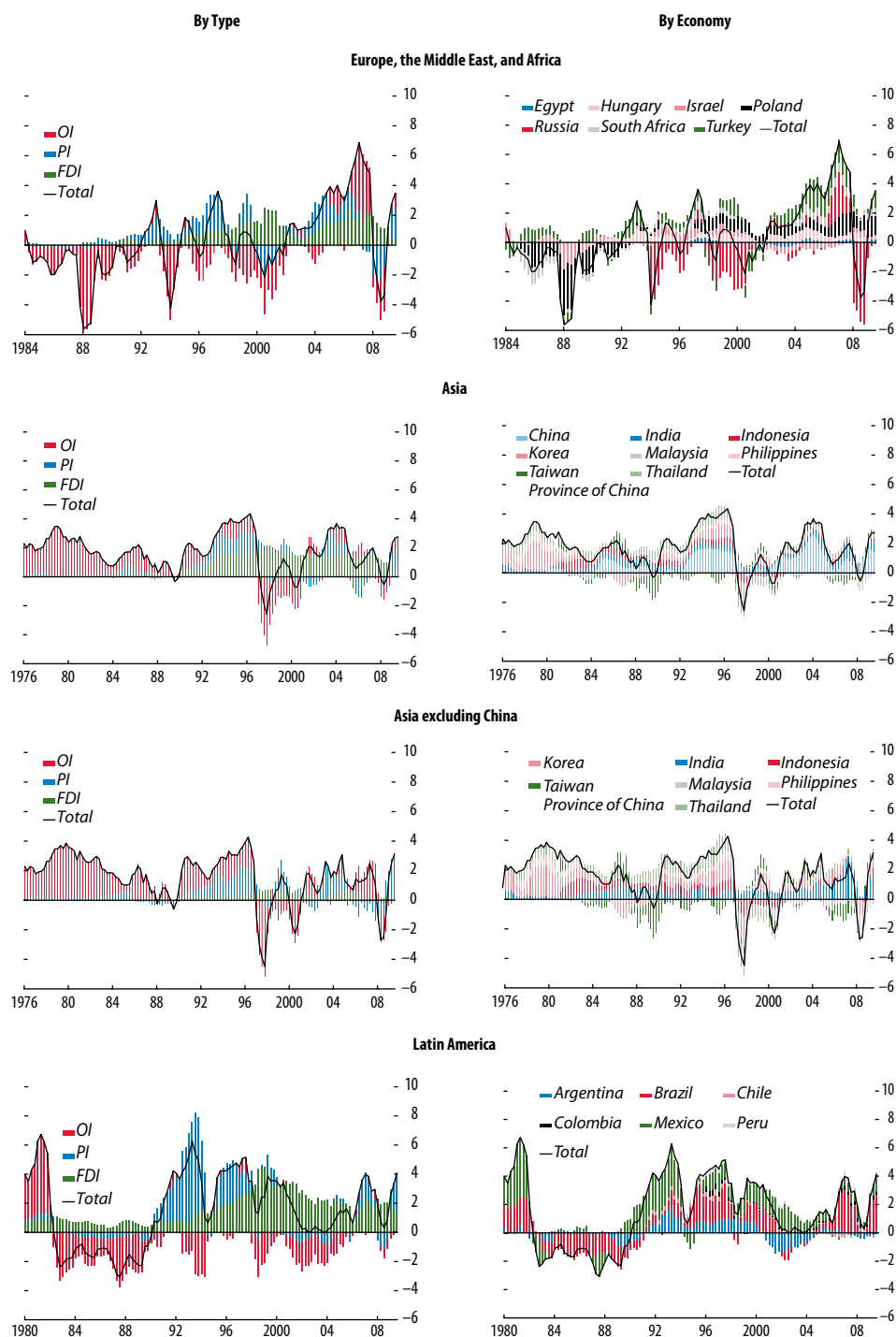
Sources: Haver Analytics; national authorities; and IMF staff estimates.
Note: U.S. data are only for small companies, while data for other countries reflect conditions for small and mid-sized firms.

Figure 1.30. Debt Maturity Profile for the Commercial Real Estate Sector
(In billions of U.S. dollars)



Sources: Trepp LLC; CB Richard Ellis; and IMF staff estimates.
Note: Data for the United States are updated as of the third quarter of 2010. Data for the United Kingdom are updated as of the end of 2010.

Figure 1.31. Net Capital Inflows to Emerging Markets
(Percent of aggregate GDP, through 2010:Q2, four-quarter moving average)



Sources: Haver Analytics; and IMF, International Financial Statistics database.
Note: FDI = foreign direct investment; PI = portfolio investment; OI = other investment.

Portfolio investment represents a greater share of inflows relative to historical experience, reflecting the slower recovery in advanced economies. Bank inflows remain subdued as mature market banks continue to face challenges in repairing their balance sheets, and foreign direct investment flows have stagnated as lingering uncertainty around global growth hampers long-term investment.

There is little evidence that cross-border flows surged owing to quantitative easing in the large advanced economies...

Many market participants and policymakers have attributed the recent strong portfolio inflows in emerging markets to low interest rates and high levels of liquidity created by central banks in large advanced economies. To the extent that quantitative easing increases liquidity and demand for higher-return assets, investments in emerging market assets could be expected to increase, spurring cross-border outflows from the United States to these economies. Contrary to expectations, however, U.S. residents' net purchases of foreign securities recovered during quantitative easing conducted by the Federal Reserve, although they remained below average purchase levels prior to the crisis.³¹

...even though they may have prompted asset reallocation into debt and liquid markets in emerging markets, raising worries that such inflows could complicate monetary policy setting and eventually reverse direction.

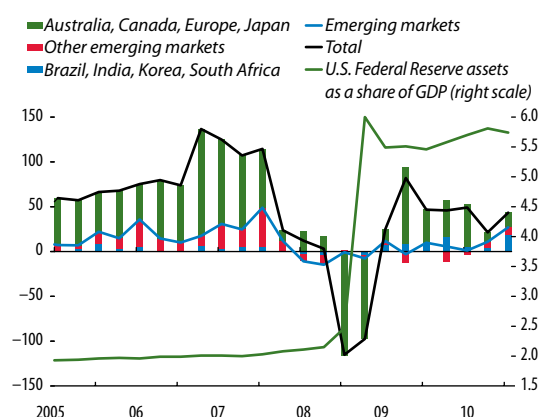
Nonetheless, as Figure 1.32 shows, U.S. investors showed a preference for emerging market assets with stronger growth, higher yields, and more liquid asset markets through the third quarter of 2010.³²

crisis peaks. Net capital inflows to emerging market economies in Europe, the Middle East, and Africa rebounded but remained below their previous highs. See Chapter 4 of the April 2011 WEO for further statistical analyses of capital inflows to emerging markets.

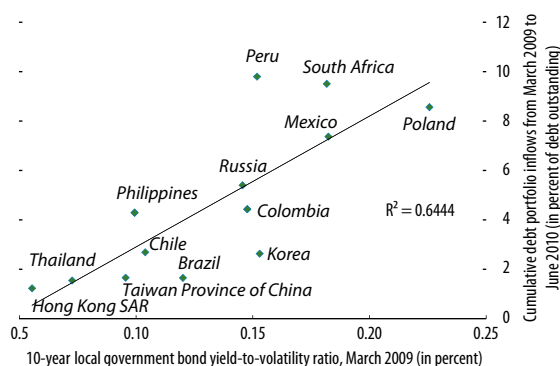
³¹ U.S. investors historically represent a large share of portfolio investment in emerging markets. U.S. balance of payment data with destinations are not available for the second round of quantitative easing by the Federal Reserve.

³² Chapter 4 of the April 2011 WEO shows that U.S. monetary policy tightening has a negative marginal effect on net private capital flows to other economies.

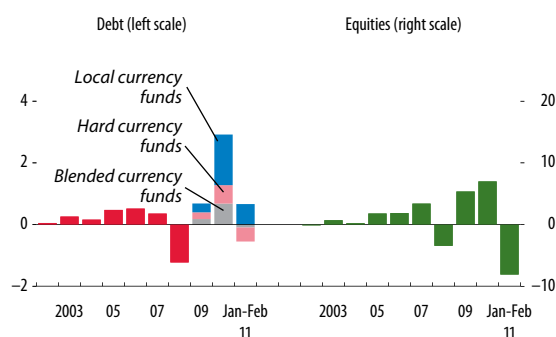
Figure 1.32. U.S. Investment Flows in Foreign Securities
(In billions of U.S. dollars)



Sources: Bureau of Economic Analysis; Federal Reserve; Organization for Economic Cooperation and Development (OECD); and IMF staff estimates.
Note: Europe includes emerging Europe. Monthly OECD leading indicators for the United States are used as a proxy for GDP. Federal Reserve assets adjusted for OECD leading indicators.

Figure 1.33. Portfolio Debt Inflows and Risk-Adjusted Local Government Yields

Sources: Haver Analytics; BNY Mellon inflow™; national authorities; and IMF staff estimates.

Figure 1.34. Average Monthly Retail Flows to Emerging Market Debt and Equity Mutual Funds
(In billions of U.S. dollars)

Sources: EPFR Global; and IMF staff estimates.
Note: 2011 data through week ending March 2.

Debt inflows were particularly strong, with economies that offered higher levels of risk-adjusted local government bond yields (prior to the surge in capital flows) attracting greater foreign inflows (Figure 1.33). This may have excessively compressed long rates and raised risks of volatility (Figure 1.34). Search for yield and a greater willingness to take interest-rate risk has led investors to extend the duration of their local-currency debt holdings, leading to a flattening of local yield curves, which runs counter to the desired normalization of policy rates. Moreover, portfolio inflows could reverse direction relatively quickly, as evidenced by a pullback from some emerging market assets earlier this year.

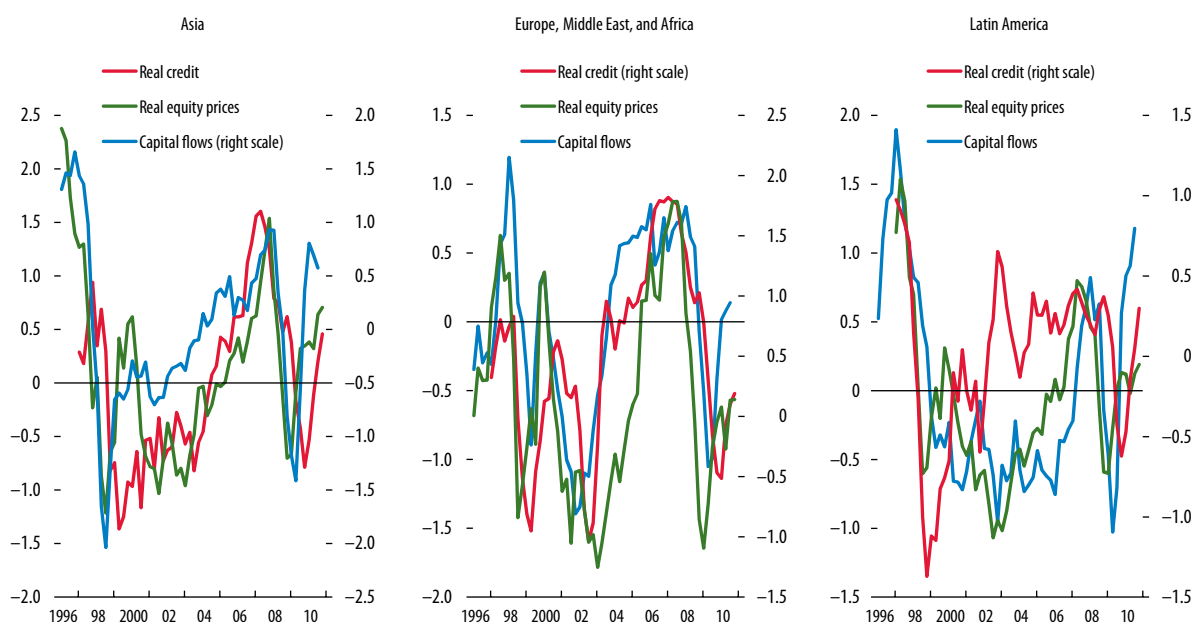
A continuation of strong capital inflows could eventually contribute to financial imbalances and vulnerabilities.

Strong inflows need not lead to financial instability if they (1) are met with a solid supply response that curbs asset appreciation; (2) do not contribute to a buildup of excessive balance sheet leverage; and (3) are allocated toward productive purposes. However, historical episodes of rising capital flows have been associated with acceleration in real credit growth and asset price increases (Figure 1.35). In such mutually reinforcing cycles, capital flows could add to domestic imbalances if brisk capital market issuance were to fuel a corporate leverage boom or if large portfolio inflows stretched asset price valuations. Overall increases in liquidity from external sources could stimulate domestic demand and contribute to inflationary pressures. The paragraphs that follow explore these separate transmission channels and attempt to gauge the extent of the increase in associated vulnerabilities.

The strong issuance of debt and equity by corporations in emerging market economies has absorbed inflows and mitigated pressures for asset prices to rise...

The response of emerging market firms to equity and debt inflows has been strong. Equity issuance rose to the highest levels ever in Brazil and China, and although in India and Korea such issuance remained below pre-global crisis highs, it surpassed

Figure 1.35. Capital Inflows, Real Credit, and Real Equity Prices
(Z score)



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

Note: Portfolio and other investment as a percentage of the size of financial markets. Year-on-year real credit growth. Real equity prices deviations from trend. All variables are transformed into a z score (difference from average in terms of standard deviation). Asia includes India, Indonesia, Korea, Malaysia, and Thailand; EMEA includes Hungary, Poland, Russia, South Africa, and Turkey; Latin America includes Brazil, Chile, Colombia, Mexico, and Peru.

pre-Asian crisis levels.^{33,34} Similarly, the supply of emerging market external corporate bonds in 2010 surpassed historical records in aggregate, led by Latin

³³ Emerging market equity issuance (local and external) rose to record levels because of a mega-issue by Brazil's Petrobras in the third quarter and a number of large issues in China and other parts of Asia. Petrobras sold \$70 billion in equity, \$40 billion of which was acquired by the Brazilian government, and the Agricultural Bank of China raised \$22 billion. The outperformance of equity issuance in emerging market economies is also attributable to the favorable cost of equity funding for firms in emerging markets.

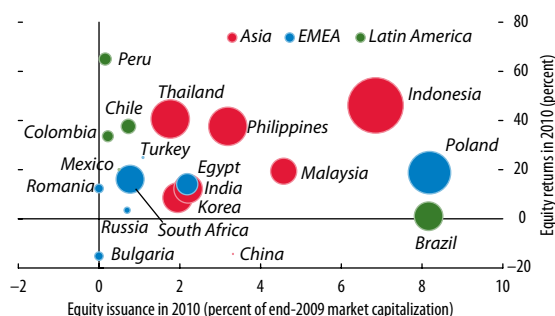
³⁴ The outperformance of emerging market equity issuance also owes to the favorable cost of equity funding for emerging market corporations. Firms in advanced economies are financing more through debt issuance, rather than equity, as the cost of debt financing has fallen to historically low levels at a time when equity financing is expensive. In contrast, emerging market companies have access to relatively cheap equity (along with debt), leading to greater equity financing than that being undertaken by their developed economy counterparts.

American corporate bonds.³⁵ Figure 1.36 shows that large equity issuance appears in some cases to have mitigated equity appreciation stemming from strong foreign portfolio inflows. Brazilian firms issued actively through IPOs, absorbing large inflows without stretching valuations. Some Asian corporate markets have displayed a combination of price and supply responses.

...but, reminiscent of previous capital flow cycles, corporate leverage is increasing and weaker borrowers are accessing funds.

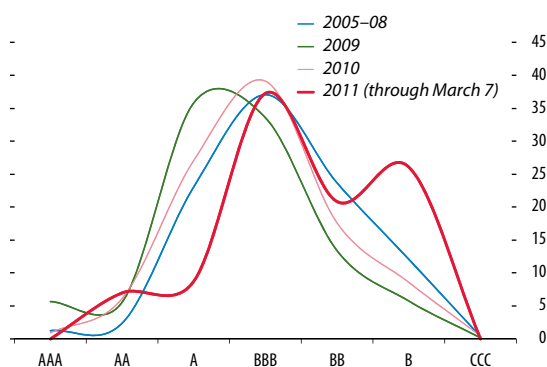
Corporate leverage has increased above historical averages in the largest emerging market economies, and corporate balance sheets look increasingly vulnerable to external shocks to funding costs. Such conditions call for heightened vigilance by

³⁵ Brazilian and Mexican firms sold bonds for near-record amounts in 2010.

Figure 1.36. Emerging Market Equities: Foreign Inflows, Issuance, and Returns in 2010

Sources: Bloomberg L.P.; BNY Mellon iFlow™; Dealogic; and IMF staff estimates.

Note: Bubble is the size of equity inflows in 2010 as a percentage of end-2009 market capitalization. EMEA = Europe, the Middle East, and Africa.

Figure 1.37. Emerging Market External Corporate Issuance by Rating
(Percent of total)

Sources: Bond Radar; and IMF staff estimates.

policymakers (see Box 1.4). Banks have issued a large amount of external bonds and have increasingly been moving away from deposits to wholesale markets to fund their balance sheets (see Box 1.5).³⁶ Overall, as investors moved down the rating spectrum in 2010 amid a shortage in net supply of credit products globally, wholesale funding by lower-rated emerging market corporations rose, a pattern that resembled the profile of the pre-global credit crisis period (Figure 1.37).

Capital flows could exacerbate imbalances by complicating policies in emerging markets...

Risks of overheating vary significantly across economies, depending not only on the strength of capital flows, but also on other domestic circumstances and policies. Table 1.5 shows that inflows of portfolio equity and debt have been rising in large emerging market economies with favorable growth prospects and strong incentives for carry (columns I and II)³⁷ at a time when output gaps are closing and inflation is rising (columns III through V). This has complicated policies to manage local demand, as rate hikes could spur additional capital inflows.

The mosaic of these policy challenges varies across emerging market regions. For instance, risks of a new round of inflation appear to be higher in Asia, where the authorities have reacted to rebounding capital inflows largely by accumulating reserves (column VI), and where real interest rates in the regional economies tend to be low and negative as a result (column VII). Expansionary fiscal policies to counterbalance the slowdown in advanced economies also risk adding to inflationary pressures in the region (column VIII). There are also signs of a substantial acceleration of credit growth, especially in larger emerging market economies and in Latin America more broadly (columns IX to XI). The possibility of systemic asset price bubbles seems remote, but valuations are relatively elevated in smaller Latin American equity markets (column XII) with limited capacity to absorb

³⁶ Some of nonfinancial issuance may represent substitution for bank lending.

³⁷ Brazil and India attracted the largest equity inflows to emerging markets, while Indonesia, Korea, South Africa, Israel, and Poland were the top destinations for global bond investments.

flows through new issuance, and in Asian local government bond markets (column XIII) that have been the main destination of foreign debt flows.³⁸ In Europe, the Middle East, and Africa (EMEA), weak fiscal positions and high loan-to-deposit ratios tend to reflect legacy problems from the global credit crisis that hit these economies harder. Economies in all regions that are more dependent on portfolio and bank flows to meet their external financing needs (column XIV) could be more vulnerable to flow reversals. These possibilities highlight the importance of maintaining sound policies to deal with macroeconomic and financial risks while safeguarding policy credibility in a context of exuberant domestic conditions and strong capital inflows.

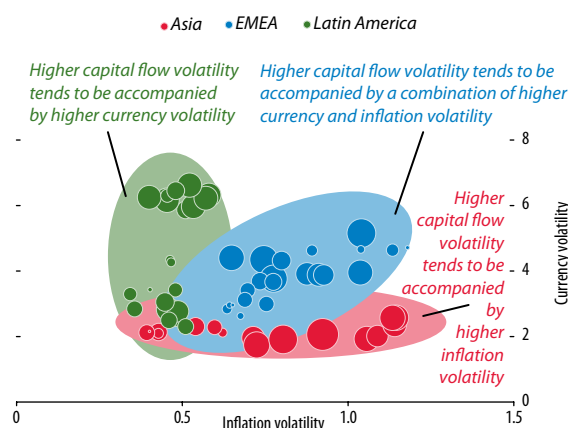
...prompting some emerging markets to introduce macroprudential and capital control measures in managing the financial stability implications of strong inflows...

The policy challenges stemming from the resurgence of capital inflows to emerging markets have been met with macroeconomic policies as well as macroprudential and capital control measures. Macroprudential measures aim to improve the resilience and soundness of the financial sector without discriminating by residency, even though some measures are geared more toward limiting capital inflows. Capital control measures, in contrast, discriminate against inflows by residency. The form of prudential and control measures has varied according to country-specific circumstances (Annex 1.6).

Historically, strong capital flows have challenged the ability of local authorities to manage exchange rates and inflation. Figure 1.38 suggests that over the last decade, willingness to allow greater exchange rate volatility in the face of external shocks has tended to reduce inflation

Figure 1.38. Median Volatility of Inflation, Currencies, and Capital Flows

(2001:Q1 – 2010:Q4, bubble size is capital flow volatility in z-score calculated for each region)



Sources: Haver Analytics; national authorities; and IMF staff estimates.

Note: Three-year standard deviation of (1) quarterly percentage change in goods price index (x axis); (2) quarterly percentage change in nominal effective exchange rates (y axis), and (3) quarterly percentage point change in portfolio investment as a percentage of GDP (bubble size), which is shown in a z-score (deviation from average in the number of standard deviation) calculated for each region, showing data points with above-average capital flow volatility.

³⁸ High prices and speculative dynamics have become a concern in segments of real estate markets in Hong Kong SAR and China. Some Asian and Latin American countries have addressed rising capital inflows and related financial stability issues by tightening macroeconomic policies and introducing macroprudential measures (see Annex 1.6). Some market participants believe the growing popularity of exchange-traded funds (ETFs) may have contributed to equity price appreciation in some emerging economies, and warn that leverage embedded in ETFs could pose financial stability risks if equity prices were to decline for a protracted period (see Annex 1.7).

Table 1.5. Macro and Financial Indicators for Selected Emerging Economies*(Shaded cells represent five economies with highest values for each indicator)¹*

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV
	Net Portfolio Inflows ²		Inflation		Output gap ⁴	External and Domestic Policies			Credit		Bank loan to deposits ¹¹	Asset Valuations ¹²		Non-FDI External Financing Needs ¹³
	Equities	Debt	Level ³	Change ³		Official reserves ⁵	Real interest rate ⁶	Structural fiscal balance ⁷	Credit to private sector ⁸	Change ¹⁰		Equities	Debt	
									Level ⁹					
EMEA														
Egypt	n.a.	n.a.	-0.1	0.2	n.a.	4.2	-3.7	n.a.	-1.9	3.0	0.5	n.a.	n.a.	-0.7
Hungary	0.3	-0.5	-0.3	-0.6	-5.6	1.8	2.2	-1.6	1.0	5.9	1.6	-0.5	-1.7	-1.2
Poland	1.1	2.0	0.3	0.8	-0.4	17.0	0.2	-7.8	1.7	6.7	1.1	-0.4	-1.0	2.2
Russia	0.0	0.8	-0.8	3.0	-4.4	6.5	-0.4	-1.8	0.1	2.5	1.1	-0.5	-1.0	-4.7
Israel	-3.8	2.9	0.3	0.2	0.1	17.0	-0.4	-4.2	-1.4	4.0	1.0	-0.3	n.a.	-2.1
South Africa	0.6	1.8	-0.7	-0.7	-3.0	8.3	1.2	-5.0	-0.5	3.1	1.2	0.5	-1.0	2.5
Turkey	0.5	0.4	-1.5	-2.0	1.0	13.9	0.5	-3.7	1.0	19.0	0.8	0.0	1.4	5.6
Asia														
China	-1.7	0.1	0.9	2.2	n.a.	18.6	1.6	-2.9	1.6	22.1	0.8	0.5	n.a.	-7.4
India	2.1	n.a.	1.2	-0.9	0.0	3.8	-3.7	-10.0	0.2	20.5	0.7	1.0	-1.3	1.7
Indonesia	0.2	1.9	-0.3	1.9	-0.3	46.2	0.0	-0.5	0.6	6.2	0.7	0.9	1.0	-2.3
Korea	0.8	1.8	0.5	0.9	-0.5	8.0	-0.9	2.5	0.1	7.4	1.4	0.9	1.3	-0.9
Malaysia	n.a.	n.a.	-0.2	0.5	-0.5	9.9	0.0	-5.3	0.8	7.4	0.9	0.3	0.7	-9.9
Philippines	n.a.	n.a.	-0.9	-0.9	n.a.	42.8	-0.4	n.a.	0.3	5.7	0.5	0.4	n.a.	-5.1
Taiwan														
Province of														
China	-0.8	-1.3	-0.4	0.1	n.a.	9.7	-0.3	n.a.	0.0	5.5	0.7	-0.3	n.a.	-11.2
Thailand	-1.2	0.2	0.0	-0.2	-2.0	23.7	-1.2	-2.3	1.0	6.8	1.0	0.6	0.9	-5.1
Latin America														
Brazil	2.8	0.1	0.5	1.1	n.a.	20.9	5.7	-3.0	1.4	15.0	0.8	0.6	0.3	0.5
Chile	-2.4	1.8	-0.1	1.8	-1.8	10.0	-0.5	-2.0	-0.5	8.6	1.5	1.8	-0.2	-5.0
Colombia	n.a.	0.2	-1.1	0.9	-0.8	12.2	-0.4	n.a.	1.1	5.3	1.8	1.4	n.a.	2.2
Mexico	n.a.	1.6	-0.0	0.7	n.a.	20.8	0.7	-4.1	1.3	7.6	0.7	0.9	-0.1	0.1
Peru	-0.6	1.2	-0.4	0.4	-0.3	33.2	0.7	-0.4	0.6	8.6	0.9	1.2	-0.3	-3.1

Sources: Bank for International Settlements; Bloomberg, L.P.; Consensus Economics; Haver Analytics; IBES; IMF, International Financial Statistics and WEO databases; and IMF staff estimates.

Note: FDI = foreign direct investment; EMEA = Europe, the Middle East, and Africa.

¹Red cells signal two highest values in each column and orange cells signal next three highest values, except for columns VII and VIII, where shaded values represent lower values.

²In percent of GDP, four-quarter moving average, in z-scores. Mostly up to June 2010.

³End-2010 levels in z-scores relative to 2004–10 period, and change in year-on-year Consumer Price Index from June to December 2010. Wholesale price index used in the case of India.

⁴In percent of potential GDP, 2010 (April 2011 WEO).

⁵Gross international reserves, excluding gold (in dollars), year-on-year percentage changes in end-2010.

⁶Policy rate as of end-February 2011 minus 2011 inflation expectations, in percent.

⁷Estimates of 2010 cyclically-adjusted overall balance, in percent of potential GDP (see IMF April 2011 *Fiscal Monitor*).

⁸Total credit to households and corporates obtained from domestic and international banks and capital markets.

⁹Deviations from 1996–2010 trend, in z-scores in June 2010.

¹⁰In percent, annual change to June 2010.

¹¹Mostly up to September 2010.

¹²Z-scores of valuation ratios for equities (average of price-to-book ratio and dividend yield) and of deviations from estimated equilibrium values for local government bond yields at end-2010 (see April 2010 GFSR, Annex 1.9).

¹³Current account balance plus net FDI inflows (reverse signs) in percent of GDP, 2010 (April 2011 WEO). Positive number represents financing need.

volatility. However, policymakers' sensitivity to currency appreciation and its negative impact on growth may have increased during this difficult moment when uncertainty continues to cloud the global growth outlook. Under these circumstances, volatility in capital flows could have a greater impact on inflation volatility. In addition, the earlier sharp increase in foreign bond flows, and the attendant surge in the share of foreign holdings, have

heightened policymakers' concerns about the implications of capital flow volatility for financial stability.

...although policies may need to rely more on macroeconomic measures to safeguard credibility.

Macroprudential and capital control measures are a complement, not a substitute, for macroeconomic policies. However, policymakers in a number

Box 1.4. Are Debt Vulnerabilities Building in the Emerging Market Corporate Sector?

Leverage has increased for both financial and nonfinancial corporations in emerging market economies, but so far it has not risen at the scale or pace historically observed in the run-up to sudden stops in capital inflows. Nevertheless, the debt of emerging market corporations has increased rapidly, making these firms vulnerable to higher funding costs and weaker earnings.

Leverage and Debt Servicing Capacity around Sudden Stops

The leverage of financial and nonfinancial corporations in emerging markets tended to increase dramatically in the run-up to sudden stops as businesses took advantage of ample foreign funding. On average, the ratio of debt to common equity for all emerging market corporations almost tripled in the three-year period before sudden stops, while the ratio of liabilities to assets increased by around 25 percent (first figure).¹ Leverage tended to spike as total common equity declined with the onset of economic contraction. Leverage of nonfinancial businesses tended to peak in the year of a sudden stop (first figure, period t), whereas leverage of financial corporations tended to peak one year later, in $t + 1$, as weakening credit quality affected bank balance sheets with a lag.²

The capacity to service debt tended to weaken in the run-up to crises, as gauged by the interest coverage ratio (ICR), while the uncovered debt ratio (UDR)—the share of debt for which ICR is less than one—typically increased dramatically during the crises (second figure).³

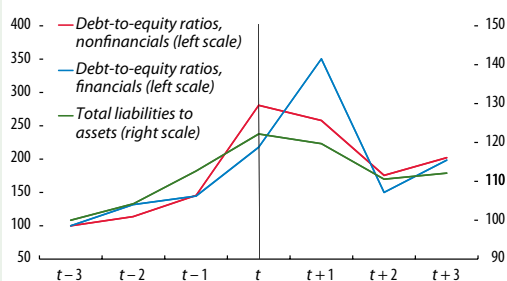
Note: This box was prepared by Kristian Hartelius and Estelle Liu.

¹The data used in the box are taken from the IMF's Corporate Vulnerability Utility (CVU) based on Thomson Reuters data, and Moody's KMV. The CVU data contain annual observations between 1991 and 2009, while the data from Moody's KMV are monthly between January 2006 and November 2010. Similar to Calvo, Izquierdo, and Talvi (2006), the years used for crises in the sample are: Argentina (1998), Chile (1998), Colombia (1997), Indonesia (1997), Korea (1997), Malaysia (1997), Mexico (1994), the Philippines (1997), Russia (1998), Thailand (1997), and Turkey (2001).

²The share of short-term debt tended to increase in the years preceding sudden stops, raising vulnerability to sudden reversals of funding flows.

³ICR is calculated as earnings before interest and taxes (EBIT) divided by total interest rate expense. For a discussion of the concept of UDR, see Jones and Karasulu (2006).

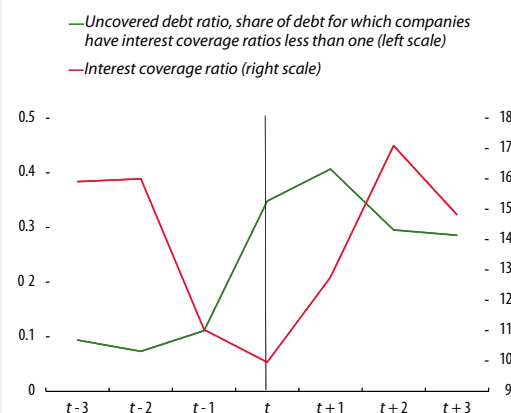
Emerging Market Corporate Leverage around Sudden Stops in t ($t - 3 = 100$)



Sources: Datastream; Worldscope; and IMF staff estimates.

Note: Includes all corporates available in Worldscope. Figures depict average across countries in the crisis sample, with each country series aggregated using market capitalization weights.

Debt Service Indicators for Nonfinancials around Sudden Stops in t



Sources: Datastream; Worldscope; and IMF staff estimates.

Note: Includes all corporates available in Worldscope.

Assessment of the Current Situation

The advent of the financial crisis in 2008 appears to have caused a correction in leverage, though signs point to a rebound. Leverage ratios have increased above historical averages in the largest emerging markets since 2005, but firms in Brazil, Russia, India, and China (the BRIC countries) have deleveraged to some extent since the fourth quarter

Box 1.4 (continued)

of 2008.⁴ In fact, Russian corporations in 2008 experienced leverage dynamics reminiscent of a sudden stop.⁵ Available data for 2010 suggest leverage in the BRIC countries has not recently been building at the scale typically observed ahead of sudden stops (third figure).⁶

Readings on debt service indicators look less worrying than those typically observed ahead of sudden stops. The share of short term-debt, for both nonfinancials and financials, has declined over the past two years, while interest rate coverage ratios in aggregate are above their historical averages.

However, leverage ratios could deteriorate rapidly if the growth of assets or earnings were to weaken.⁷ Stylized stress tests of the nonfinancial sector suggest that a 300 basis point increase in funding costs—driven by a normalization of interest rates in mature markets or a widening of emerging market spreads—would have a significant negative effect on interest rate coverage ratios and increase the average share of uncovered debt to 18 percent, somewhat higher than the levels seen in the run-up to sudden stops (fourth figure).⁸

⁴The pattern of declining leverage ratios since 2008 is similar for other emerging markets. The data sample for the analysis for 2005–10 consists of Argentina, Brazil, Chile, China, Colombia, Egypt, Hungary, India, Indonesia, Malaysia, Mexico, the Philippines, Poland, Russia, South Africa, Sri Lanka, Taiwan Province of China, Thailand, and Turkey.

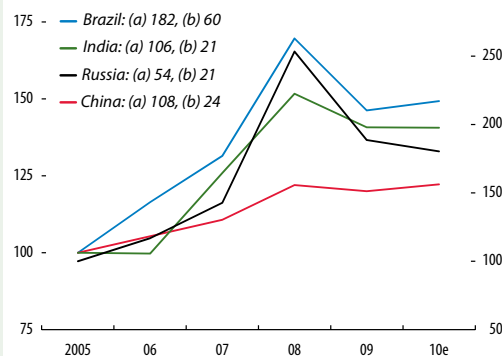
⁵There has been some sectoral differentiation in recent years in the BRIC countries, with bank leverage growing more strongly in Brazil and Russia, and nonfinancial sector leverage rising more strongly in India. In China, bank leverage has been contained despite strong growth in debt in recent years, helped by large initial public offerings in the banking sector.

⁶Data for 2006–09 are from the CVU. The 2010 data point is estimated using the dynamics in the Moody's KMV data for the debt-to-equity ratio through November 2010.

⁷Leverage ratios and debt servicing measures can be misleading when both assets and liabilities are growing rapidly, and when global interest rates are at historical lows. The level of corporate debt has risen rapidly in recent years, with real rates of debt growth in many countries approaching or exceeding those in the run-up to sudden stops historically.

⁸The share of uncovered debt (UDR) rose to around 15 percent on average in emerging markets in 2008 in the wake of the financial crisis, and has since then remained well above the levels seen in the period 2004–07, despite the environment of generally low interest rates. The stress tests are carried out by increasing the estimated average interest rate on debt by 300 basis points for each nonfinancial firm, taking into account the

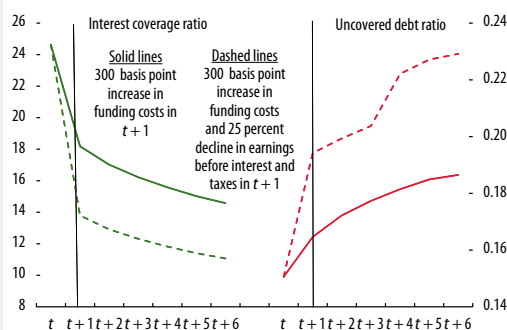
Debt-to-Equity Ratios of the Corporate Sector for Brazil, Russia, India, and China (2005 = 100, Russia on right scale)



Sources: Datastream; Worldscope; and IMF staff estimates.

Note: (a) Debt-to-equity ratio, 2010, in percent; (b) Debt-to-equity ratio, 2010, in percentage points above the average during the period 1994–2009.

Stress Test Scenarios for Nonfinancials



Sources: Datastream; Worldscope; and IMF staff estimates.

If corporate earnings in addition were to decline by 25 percent—a possible scenario if the more extreme risks to financial stability in the advanced economies were to materialize—the share of uncovered debt would increase to 23 percent according to the analysis, which would be similar to the level of stress during some of the sudden stops included in the sample.⁹

average maturity of corporate debt in each country when calculating the cost of funding for each year over a five-year horizon.

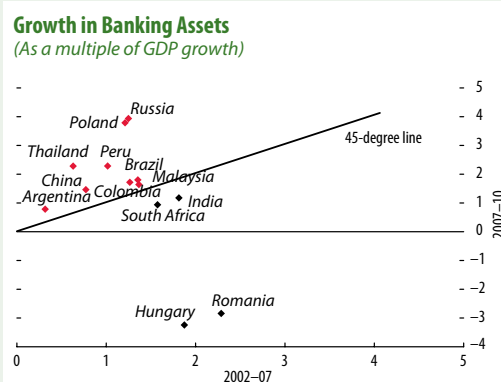
⁹The drop in EBIT in our stress test is milder than the 35 percent drop in earnings that Asian firms experienced in the Southeast Asian crisis of 1997–98.

Box 1.5. Emerging Market Banks: Fueling Growth or Frenzy?

Bank lending in some emerging market economies, particularly in Asia and Latin America, grew at a faster pace between 2007 and 2010 than in the five years leading up to the global financial crisis (first figure). Three factors drove the increase: (1) domestic economic growth, (2) a pullback in international banking, which has provided growth opportunities for local banks, and (3) domestic policies promoting bank lending.¹ Equipped with relatively sound balance sheets in the period leading up to the crisis, banks in emerging markets have supported this growth comfortably so far. But the accelerated credit growth has increased vulnerabilities and raised the risk of overheating in the macroeconomy.

Larger banks, especially state-owned banks in China and Brazil, have been primarily responsible for the sharp rise in credit. Major banks in those two countries expanded their balance sheets by more than 100 percent during the 2007–10 period, reaching sizes comparable to those at large banks in the United States and Europe. Meanwhile, the capital positions of the big lenders remained relatively healthy and benefited from the relatively easy access to capital markets (second figure). Regulatory capital ratios for the bigger banks in emerging markets were at relatively comfortable levels in the second quarter of 2010, although state-owned banks in some emerging markets might need to bolster their capital ratios to sustain current rates of balance sheet growth.²

The accelerated credit growth has come with an increase in vulnerabilities at banks. They have increased their reliance on external financing, shifted away from deposits into wholesale funding, and increased financial leverage while allowing asset



Sources: CEIC; EMED; and IMF staff estimates.

quality to deteriorate. This box focuses on the shifts to external financing and wholesale funding, while Box 1.4 addresses the developments in leverage.

The surge in global debt issuance in 2010 facilitated releveraging of balance sheets at emerging market banks, with smaller banking systems increasing their reliance on external funding. Emerging market banks issued a record \$110 billion in dollar-denominated debt in 2010, led by banks in Russia, Korea, and Brazil. On a positive note, the larger banks extended the duration of their liabilities and used most of the sale proceeds for new lending. However, debt sales in 2010 saw several new names, notably small and medium-sized banks in Brazil, Peru, and Chile, and the apparent increase in reliance on global wholesale funding markets (third figure) raises questions about the capacity of some of the smaller institutions to refinance themselves under tighter conditions.³

Easy access to alternative financing options and ample growth opportunities are luring some banking systems away from deposit-driven asset growth, suggesting that banking-driven credit bubbles may be developing. Lenders in fast-growing econo-

Note: This box was prepared by Narayan Suryakumar.

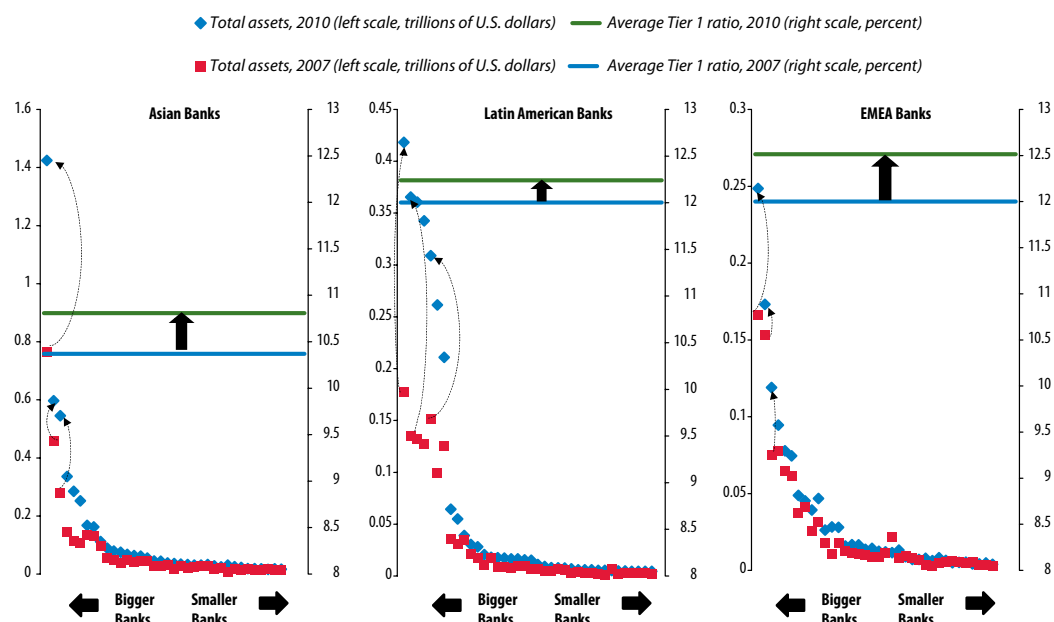
¹Aggregate assets in the banking system compared with nominal GDP, in U.S. dollars. Banking data include public and private banks, domestic and foreign banks, and specialized credit institutions in some countries and are obtained from the respective central bank databases. For some countries, a higher reading on the y axis could be partly a result of relatively slower economic growth rather than entirely the result of bank asset growth.

²Tier 1 capital ratios for the larger banks averaged around 10.8 percent in Asia, 12.4 percent in Latin America, and 12.5 percent in emerging Europe.

³Foreign-currency-denominated debt includes short-term and long-term debt issuance. Debt issued in 2007 is used for comparison purposes, as foreign-exchange-denominated issuance for several emerging market banks in the run-up to the crisis peaked in that year. The figure highlights increased reliance on external wholesale funding and is not representative of increased reliance on overall foreign liabilities.

Box 1.5 (continued)

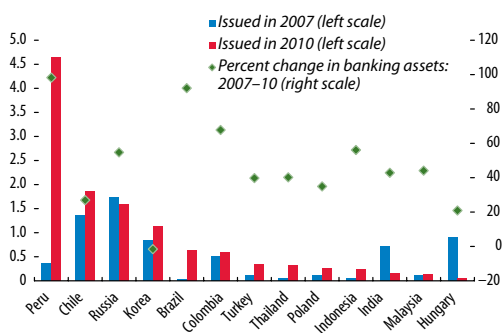
Emerging Market Banks: Asset Growth and Capital Positions



Sources: Bankscope; and IMF staff estimates.

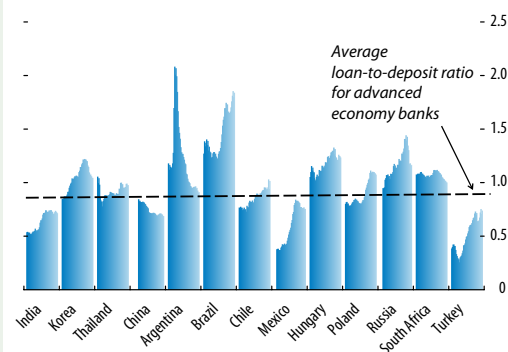
Note: Tier 1 ratios are based on average estimates of large banks only. EMEA = Europe, the Middle East, and Africa.

Foreign-Currency-Denominated Debt Issuance (As a percent of banking assets in 2010)



Sources: Dealogic; CEIC; EMED; and IMF staff estimates.

Loan-to-Deposit Ratios, 2000–10



Sources: CEIC; EMED; and IMF staff estimates.

mies, such as Brazil and Turkey, are relying less on deposits for expanding their loan books, pushing the ratio of loans-to-deposits sharply higher (fourth

figure). The financial crisis helped slow this trend in some of the larger emerging economies (such as Russia and Korea), but weaker lending standards

Box 1.5 (continued)

and regulatory forbearance in other economies helped advance the trend.⁴

⁴Calculated as total domestic credit extended divided by total domestic deposits. Data on loan-to-deposit (LTD) ratios for Brazil include commercial banks and the state-owned banks *Banco do Brasil* and *Caixa Econômica Federal*. LTD ratios are relatively higher for commercial banks in Brazil because of increased reliance on transfers from state-owned lender BNDES and on funding from mutual funds. In Turkey, despite the sharp increases in the recent past, LTD ratios are below peer averages, as evident in the figure.

In summary, emerging market banks have supported domestic credit growth and, given their strong balance sheets, have proved resilient through the financial crisis. However, the rapid credit growth seen in some economies raises the risk of overheating, potentially leading to a deterioration in credit quality, and increased bank reliance on external sources of financing and noncore funding options. These mounting risks call for increased vigilance from authorities and policy actions to tighten credit.

of emerging market economies are relying more on prudential and control measures while delaying macroeconomic policy responses. Consequently, real interest rates have remained negative in many economies in Asia, raising worries among market participants about inflation risks and the credibility of policy management (Figure 1.39). This has led to foreign selling of regional debt and equities.

To address strong momentum in inflation and credit growth, it would be more appropriate to rely on interest rate policies. To the extent that holding currencies at lower exchange rates increases capital inflows in anticipation of future appreciation, greater currency flexibility can mitigate pressure on local absorption and asset prices. Moreover, a more balanced policy mix with tighter fiscal policies could offer a more sustained response to inflows.

Finally, continuing to promote the development of local capital markets through more solid infrastructure and by enhancing the robustness of the banking system are key to ensure that economies have the capacity to absorb structurally higher capital inflows and cope with capital flows volatility.

G. Durable Financial Stability: Getting There from Here

Having made progress in treating the symptoms of the financial crisis, policymakers are now

confronted with three key challenges to put the recovery onto a durable path: (1) address the legacy problems highlighted by the crisis, including high debt burdens and weakened balance sheets in many advanced economies; (2) navigate to a stronger, more robust financial system that is less reliant on public support and subject to greater market discipline; and (3) guard against overheating and the further buildup of financial imbalances, especially in emerging and developing economies. The first two challenges present a delicate problem of sequencing and balance because, pursued too aggressively, they would threaten the still limited recovery in the advanced economies. Yet unless these challenges are addressed starting now, the recovery cannot be shifted to a durable trajectory. In the short run, sovereigns, households, and financial institutions in several economies have fragile balance sheets that need continuing support to avoid a rapid deleveraging. In the medium run, this public and international assistance needs to be withdrawn and effective market discipline reestablished. Legal and policy frameworks need to be amended to facilitate debt restructuring and bank wind-ups without jeopardizing market access of borrowers still heavily dependent on wholesale funding. Thus, policymakers have to find the right balance between progress on the first two challenges without

jeopardizing financial stability or the economic recovery in the process.

The run-up to the financial crisis was marked by excess leverage and high debt burdens for households, sovereigns, and banks in many advanced economies. The policy response to the crisis relied heavily on accommodative monetary and fiscal policies and the transfer of private risk to sovereign balance sheets, further increasing public debt burdens and contingent liabilities. Despite this public support, a significant proportion of bank assets remain in a large number of undercapitalized banks, particularly in some euro area economies.

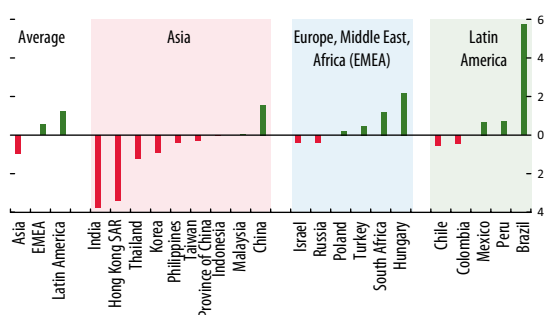
Lingering fragilities in the banking system require particularly urgent attention, as they remain a potential catalyst for any shock to financial stability. Thus, ongoing efforts to withdraw the public guarantees implied by crisis-born policies and ensure the potential for bondholder bail-in (the conversion of debt to equity in a recapitalized bank) to contain the cost of future losses within the private sector should build on the foundation of stronger bank balance sheets.

Overcoming the legacy of high debt will be a gradual process.³⁹ Any strategy will likely involve a politically and economically demanding process of generating successive years of financial surpluses—high saving among households, strong profits and retained earnings for banks, and fiscal consolidation among governments. These efforts may need to be supported by continuing low policy rates, but there are limits to the effectiveness of monetary policy in facilitating the deleveraging process.

Policymakers should now shift their focus from accommodative macroeconomic policies to more structural approaches to strengthening balance sheets and reducing debt burdens.

In the banking sector, viable banks require better capital buffers to provide a greater cushion against future losses and facilitate ongoing access to market funding. This chapter highlights the need for a further core capital within the euro area banking system. Poli-

Figure 1.39. Real Policy Rates in February 2011
(In percent)



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

³⁹ See Annex 1.3 on Dubai's progress in recovering from a debt crisis.

cymakers simultaneously need to reduce balance sheet uncertainty and identify and resolve nonviable banks. This will require greater disclosure about asset quality and exposures as well as rigorous stress tests that examine solvency and funding risks and are backed up by capital support where necessary. In the euro area, weak banks need to be restructured or resolved in order to reduce overcapacity. In the United States, banks should continue to write down distressed loans and reduce principal on mortgages that could benefit from modification.⁴⁰

Sovereign balance sheets also need to be strengthened. Reducing the stock of debt will require credible commitments to limit fiscal deficits on a sustained basis and strengthen institutions to promote better fiscal discipline.⁴¹ Providing greater clarity on the potential support for the banking system will help limit governments' contingent liabilities arising from the financial system. Key structural goals concerning sovereign balance sheets include the following:

- In the euro area, the most pressing challenge is to reduce funding costs for those sovereigns subject to greater market pressure. Regaining investor confidence requires a comprehensive package of measures to arrest the rise in public debt. These could include improved governance of fiscal decision making, including through independent monitoring of targets and enhanced transparency over accruing obligations and contingent liabilities. Domestic efforts aimed at fiscal consolidation and growth-enhancing structural reforms should be backed by EFSF/ESM support, where necessary, with the aim of improving debt sustainability but subject to strict conditionality. The introduction of any mechanism that envisages sovereign debt restructuring needs to be as clear and nondiscretionary as possible to attract foreign investors back to sovereign debt of presently vulnerable euro area countries. See Box 1.6 for a discussion of recent developments in Euro area crisis management and prevention.
- For other economies with vulnerable fiscal positions (notably Japan and the United States), it

is now crucial to establish convincing plans for medium-term deficit reduction to preserve confidence. Although these countries continue to enjoy extraordinarily low funding costs, they will not remain immune forever to deteriorating fiscal developments. Even if the probability of significant turmoil in these large government bond markets is low, its consequences on financial stability could be very severe, for example, from a rapid increase in risk premia.

- National debt management offices need to articulate credible funding strategies centered around limiting refinancing risk by lengthening maturities where necessary, active management of cash flows to smooth bond maturities, and developing a sufficiently diversified investor base.

Policymakers must also navigate the transition to a stronger, more robust financial system that is less reliant on public support and subject to greater market discipline.

The focus of current reform efforts—financial sector regulation and supervision—is aimed at building larger amounts of loss-absorbing capital and sufficient liquidity to survive systemic shocks without public support and to manage those buffers in a countercyclical fashion.⁴² Such reforms (detailed in Box 1.7) should help immunize sovereign balance sheets from the failure of financial institutions, limit the corrosive dynamic between sovereigns and banks that was manifest in recent years, and, through countercyclical provisions, reduce the tendency of banks to amplify credit swings.

As well as preventative measures, better crisis management arrangements, such as strengthened domestic and cross-border bank resolution regimes, are necessary to promote future financial stability. Authorities in various jurisdictions have already embarked on these endeavors.

Policymakers must avoid sowing the seeds of a new crisis in emerging market and developing

⁴⁰ See FDIC (2011) and IMF (2008, 2009a).

⁴¹ See the April 2011 *Fiscal Monitor* (IMF, 2011b).

⁴² See Chapter 2 for detailed discussion of Basel III liquidity requirements.

Box 1.6. Euro Area Crisis Management and Prevention

Since the onset of the sovereign and banking crisis affecting various parts of the euro area, European policymakers have undertaken several episodes of policy reforms in an attempt to get ahead of the crisis. The March 24–25, 2011 decision by the European Council is so far the most comprehensive reform effort, designed to “turn the corner of the financial crisis.” Indeed, adopting a proactive rather than a reactive approach is long overdue, and ensuring consistency of policies has become paramount. A number of elements of the package remain to be clarified and specifics elaborated, expected by June 2011. And the interdependence of national banking systems and sovereigns and the cross-border dimension of the financial crisis still need to be addressed.

The main elements of the March 2011 package are a commitment to increasing the effective amount of financing available under the European Financial Stability Facility (EFSF); clarification of the key parameters of the permanent European Stabilization Mechanism (ESM); a commitment to ambitious stress tests coupled with follow-up plans to deal with vulnerabilities; and better coordination of economic policies and strengthening of the economic governance of the euro area (European Semester, Euro Plus Pact, revised Stability and Growth Pact, and the new Excessive Imbalances Procedure).

Securing a Durable Exit from the Crisis

A number of elements of the March package remain to be clarified, and progress needs to be made in individual country cases. The strengthening of the mechanisms to support countries that are experiencing financing difficulties underpins the authorities’ claim that sufficient resources are available to meet actual and potential member states’ financing needs. The larger effective size of the EFSF is likely to bolster market confidence but the mechanism by which this is to be secured should be clarified as soon as possible. In addition, decisions about adapting the interest rate of the EFSF are urgently needed to help support fiscal sustainability.

Repair and reform of financial systems remain urgent. While stringent stress tests can play a crucial

role, they will be effective only when accompanied by clear plans to force banks to build capital buffers commensurate with the uncertainty about the value of their assets and to wind up unviable business models and banks. Policymakers seem committed to this approach, but the March package has left the onus of dealing with financial sector issues squarely on the national authorities, despite the high potential for cross-border contagion. Hence, to the extent that national fiscal capacity falls short of what is needed to deal with domestic banking problems, countries should seek support from the available euro-area wide facilities. Moreover, action in other countries is also needed to tackle banks that are relying in a chronic manner on European Central Bank (ECB) liquidity support.

National policy action aimed at securing fiscal sustainability and growth continues to be essential. The March package includes a commitment by all national authorities to specific actions to strengthen budgetary positions and boost employment and growth. Increased coordination of these actions under the European Semester and the Euro Plus Pact is highly welcome. Yet the specific actions to be identified by June will need to be ambitious and swiftly implemented to facilitate exit from the crisis.

Preventing a Recurrence of the Sovereign and Financial Tensions

The March package correctly calls for a further strengthening of the economic governance of the euro area to ensure lasting financial stability. It recognizes that, while boosting market discipline will be helpful to discipline fiscal policy, it is better to prevent an unsustainable situation from developing in the first place. Subjecting individual member states to binding commitments on their budgets would be ideal. Short of that, enhanced coordination through the European Semester, strengthening of the Stability and Growth Pact, and the introduction of national fiscal rules (e.g., debt brakes) is likely to go a long way toward establishing fiscal discipline. Should access to market financing nonetheless become problematic, the proposed ESM provides a robust and orderly framework to assist euro area member states, subject to conditionality in order to support discipline. To broaden the avenues of support, some additional flexibility of the ESM’s instruments would be helpful.

Note: This box was prepared by Luc Everaert and Nico Valckx.

Box 1.6 (continued)

But the crisis was not only of fiscal origin. Private sector imbalances, financed by cross-border capital flows, also contributed, as they were associated with equally unbalanced developments in competitiveness. The March 2011 package contains an explicit commitment to boost competitiveness, but specific reforms will need to be identified and implemented without further delay, and peer pressure may not be sufficient to bring about the required reforms. Adding a more binding element to the new excessive imbalance procedure and the Euro Plus Pact would make them more effective in preventing imbalances and promoting sustained growth.

In the wake of the global financial crisis, and given the recent adverse feedback loop between the sovereign and financial tensions, the high degree of financial integration poses a particular challenge for the euro area. It underscores the potential for financial contagion to cross borders and thus the need for robust regulation and a strong European-wide element of supervision and resolution. To decouple banking and sovereign risks and make financial integration in the euro area safer and more effective, a pan-European framework for crisis management and resolution of financial institutions, with a euro area-wide fiscal backstop, should be established.

economies, and ensure that emerging risks are properly addressed.

Foreign capital inflows to emerging markets have risen at a time when output gaps are closing and inflation is rising, complicating macroeconomic policies to manage local demand. At the same time, strong capital inflows warrant increased vigilance by policymakers, as they could eventually contribute to a buildup of financial imbalances and vulnerabilities. Policies in emerging markets need to rely more on macroeconomic measures and, in some cases, capital control measures can play a supportive role. As inflows may prove long lasting, and especially in the context of strong domestic momentum, policies need to rely more on macroeconomic measures, such as rate hikes, more-flexible exchange rates, and fiscal tightening to avoid overheating, accumulating financial risks, and undermining policy credibility.

Moving to a durable financial system requires a careful balance.

How do we get to there from here? The main task facing policymakers in advanced countries is to shift the balance of policies away from reliance on macroeconomic and liquidity support toward more structural policies—less “leaning” and more “cleaning” of the financial system. Policymakers in advanced

economies need to reduce leverage and restore market discipline, while avoiding financial or economic disruption during the transition. Private sector participation in future resolutions is necessary to restore market discipline. However, the transition is best sequenced by addressing legacy problems revealed in the run-up to or in the aftermath of the crisis. Lingering fragilities in the banking system require particularly urgent attention, as they could amplify and propagate any new shocks to financial stability. Thus, ongoing policy efforts to withdraw implicit public guarantees and ensure bondholder liability for future losses must build on rapid progress toward stronger bank balance sheets, ensuring medium-term fiscal sustainability and addressing excessive debt burdens in the private sector.

Annex 1.1 What Factors Are Driving U.S. Bond Yields Higher?⁴³

This annex seeks to disentangle the factors that have contributed to the rise in long-term U.S. bond yields. Despite concerns around debt sustainability, much of the rise in long-term yields does not appear to reflect fiscal issues. Rather, the rise mainly reflects higher real rates and an

⁴³This annex was prepared by Rebecca McCaughrin.

Box 1.7. Regulatory Reforms: Are We There Yet?

The crisis has provided the impetus for a major revision of the financial regulatory framework, but action on the G-20 reform agenda is far from completed. The Financial Stability Board (FSB) and the Basel Committee on Banking Supervision (BCBS) have announced a comprehensive framework to address the root causes of the crisis: excessive leverage, low levels of loss-absorbing capital, bad liquidity management, misaligned incentives, and lack of transparency. Although the framework provides an important starting point, the agenda of unfinished business remains daunting.

Most of the agreed-upon reforms seek to make individual banks less likely to fail. Key measures include improving the quantity and quality of capital, aligning capital requirements to better capture market and counterparty risk and risk in securitized portfolios; introducing a leverage ratio; and establishing measures to increase liquidity buffers and reduce unstable funding structures (BCBS, 2010a and b). There is also progress on other fronts:

- The FSB announced a general proposal to address institutions that are perceived to be “too important to fail” (FSB, 2010a and b). This covers more effective resolution regimes; additional loss-absorption capacity for systemically important financial institutions (SIFIs); more intensive supervision; stronger standards for core financial infrastructure, including for over-the-counter derivatives; and peer review of national policies for global systemically important financial institutions (G-SIFIs).
- Next steps on prudential reform are already under way. The BCBS is revising the market risk framework (including a fundamental review of the distinction between the trading book and the banking book), monitoring the levels of capital for operational risk, and studying how to address concentration of risk.
- The role of hedge funds has drawn renewed attention. Agreements are in place that call for better information about their activities along with a regime for registration, reporting, and oversight (IOSCO, 2009).

Note: This box was prepared by Michael Moore and Fabiana Melo.

- The FSB in April 2009 set forth recommendations to address procyclicality in the financial system (FSF, 2009). In response, the BCBS has proposed a countercyclical buffer designed to accumulate as systemic risk builds up. Accounting standard setters have also proposed expected loss provisioning approaches that will facilitate earlier recognition of credit losses and thus help to dampen procyclicality. Finally, the FSB published in October 2010 new approaches for the use of credit rating agency ratings aimed at reducing procyclicality (FSB, 2010c).
- Several international financial standards have been or are being revised, including in the areas of banking, insurance, and securities regulation as well as payments and securities settlement systems and central counterparties. The FSB is revising its compendium of standards, which is expected to include among “key standards” the new Principles for Effective Deposit Insurance Systems and a new standard on cross-border resolution.

These achievements are laudable, but real progress is also needed in areas where much has been said but less has been accomplished. These include developing (1) a macroprudential policy framework to deal with system-wide risks; (2) coherent resolution mechanisms at both the national level and for cross-border financial institutions; and (3) regulatory approaches to the “shadow banking system.”

The greatest challenge ahead is national implementation of the measures agreed-upon internationally and ensuring the necessary coordination for their success. There is still work ahead related to the SIFI/G-SIFI proposals, with decisions on critical elements yet to be completed. These include (1) the actual definition of a G-SIFI; (2) the size of the capital surcharge; and (3) the composition of supplementary instruments that have loss-absorbing characteristics (e.g., contingent capital).

G-20 economies have agreed to incorporate the new standards and submit to international assessment and peer review processes to ensure consistency in implementation. The agenda for future work is coincident with the priorities already identified by the IMF: global coordination to minimize regulatory arbitrage; coherent resolution mechanisms at the national level and for cross-border financial institutions; an

Box 1.7 (continued)

enhanced macroprudential focus; a broadened regulatory perimeter to address emerging exposures and risks across the entire financial system, not just at banks; and, importantly, more effective supervision (Viñals and others, 2010).

The agenda for the future needs to combine some profound changes in supervisory approach and incentives for the industry to internalize sustainable risk management. For reform initiatives to be successful, it is ultimately the industry that will need to translate them into practice, including risk management

and governance. Supervisors will need to be better coordinated to deal with cross-border and cross-sector exposures, supervising key risks, and taking timely corrective action.¹ If financial stability is to be achieved and maintained, the industry and regulators need to restore the credibility of market discipline, correcting misaligned incentives and enhancing transparency and disclosures.

¹ For more on the importance of effective supervision, see Viñals, Flichter, and others (2010).

increase in the term premium. The implementation of the Federal Reserve's second round of quantitative easing (QE2) appears to have had only a fleeting impact.

Long-term U.S. treasury yields have risen more than 100 basis points since the October 2010 GFSR. This trend is not unique to the United States, with 10-year yields rising by similar magnitudes in other advanced economies as well (Figure 1.40) despite continued accommodative global monetary policy.⁴⁴ The uptick in U.S. yields seems to be partly due to steadily improving growth prospects, as reflected in the “positive surprise gap” (representing upside surprises in incoming economic data) since October (Figure 1.41).

The rise in rates also appears to be attributable to a normalization in inflation expectations. Although actual inflation indicators show subdued price pressures, market-implied inflation indicators point to upside risks in inflation and an upward trajectory in long-term inflation expectations on the back of quantitative easing, stronger growth prospects, and rising commodity prices. This is evident in the rise in 10-year inflation break-evens, five-year/five-year forward break-even inflation rates, and by the increased

probabilities of one-year ahead inflation implied by options on inflation-linked debt (Figure 1.42).

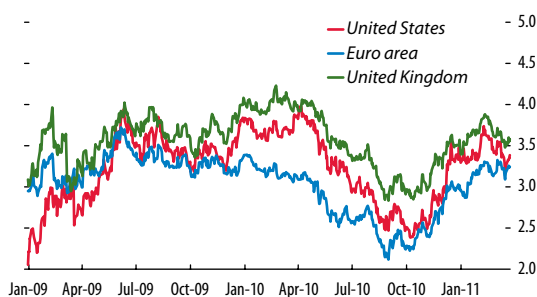
Higher nominal yields also reflect a rise in the term premium. The term premium is intended to compensate holders of long-term bonds for the risk of future interest rate changes. In an environment of low policy rates for a protracted period, the market should charge a lower premium for duration risk since longer-dated debt is less exposed to the risk of an unexpected rise in interest rates. To the extent that quantitative easing reduces duration risk, this should result in a declining term premium.⁴⁵ Indeed, the term premium had been steadily falling since the QE1 program ended and the market started to speculate on the prospects for another program (Figure 1.43). But the impact was short-lived, with the term premium rising once QE2 was implemented. The quick retracement may have partly reflected the smaller ultimate size announced and other offsetting factors that increased duration risk. During QE1, the decline in the term premium also quickly reversed, well before the program concluded.

Credit premia do not appear to have contributed to the rise in nominal yields. Prior to the global credit crisis, it was reasonable to assume that credit risk was negligible for major sovereigns. Pre-crisis sovereign credit default swap (CDS) spreads used to trade

⁴⁴ For further analysis on the rise in global bond yields, see Chapter 2 of the April 2011 *Fiscal Monitor* (IMF, 2011b).

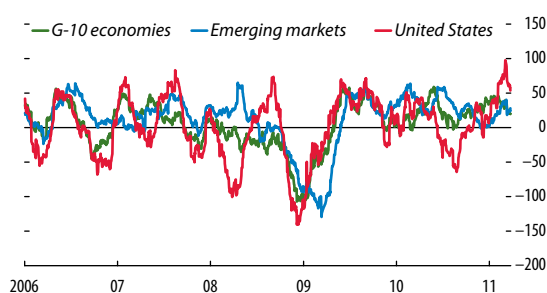
⁴⁵ Gagnon and others (2010) showed that the effect of the Federal Reserve's purchases on the yield curve was primarily through the reduction of the term risk premium.

Figure 1.40. Ten-Year Government Bond Yields
(In basis points)



Source: Bloomberg L.P.

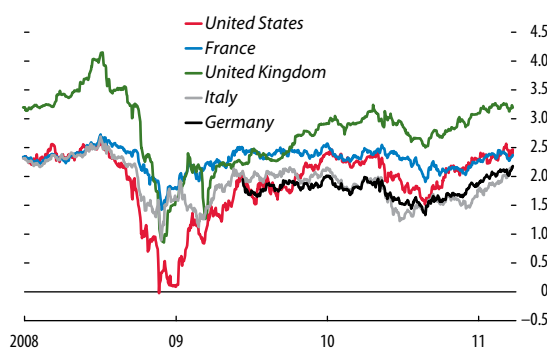
Figure 1.41. Macroeconomic Surprise Indices



Sources: Bloomberg L.P.; and Citigroup.

Note: Weighted historical standard deviations of data surprises, based on actual releases and Bloomberg median consensus. A positive reading indicates that the data beat expectations; a negative print means that the data disappointed.

Figure 1.42. Ten-Year Break-Even Rates
(In percent)



Source: Bloomberg L.P.

around 10–20 basis points on U.S. treasuries and were fairly illiquid and rarely traded. However, as the crisis broadened to sovereign debt markets, CDS spreads widened to 50 basis points, and the risk-free assumption on sovereign debt was invalidated. Given the increased focus on debt sustainability concerns, it now makes sense to incorporate credit risks in deciphering fluctuations in long-term bond yields. Using 10-year CDS pricing as a proxy for credit risk, credit premia in the United States have been unchanged since the October 2010 GFSR, as developments on the fiscal side have had only a modest impact on CDS pricing.^{46,47} Other traditional market-based measures of fiscal vulnerability, such as the shape of the Treasury yield curve and asset swap spreads (e.g., bank credit risk-adjusted swap spreads, the spread between forward rates and Treasury yields, the spread between treasury and overnight index swap rates) show similarly limited fiscal concerns.

Aggregating the underlying components of the nominal yield curve—real yields, inflation premia, term/risk premia, and credit risk—provides a more complete understanding of the specific factors underpinning the rise in rates. As Figure 1.44 illustrates, the rise in 10-year nominal Treasury yields primarily reflects an increase in real rates, reflecting the improvement in growth prospects and a higher (noncredit risk) term premium (possibly reflecting

⁴⁶ Sovereign CDS do not solely reflect the probability of sovereign default. First, various studies show that sovereign CDS overstate the probability of a sovereign debt default. This is because spreads may be driven by factors other than pure default risk, such as market liquidity, counterparty hedging, proxy hedging, speculation, or other factors. For instance, at 50 basis points, 10-year U.S. CDS have a market-implied default probability of 4 percent, assuming a recovery rate of 40 percent. This is high compared with historical default episodes and with the default probabilities assigned by credit rating agencies. Second, since CDS transactions are illiquid, especially on major sovereigns, and represent only a fraction of trading on cash bonds, the liquidity premium embedded in CDS prices likely exaggerates the credit risk. (That said, using bid-ask spreads as a proxy for liquidity, the premium is probably no more than a few basis points.) Third, deriving default probabilities on sovereigns from CDS is more complicated than in the corporate sector: there have been few sovereign debt defaults, not all defaults are alike, and none have involved a major advanced economy.

⁴⁷ Ten-year CDS are used for the sake of consistency with the framework. Using prices on more liquid five-year CDS had no impact on the main conclusions.

supply/demand imbalances)—while credit premia and inflation compensation (and other miscellaneous factors) have exerted less obvious upward pressure on nominal yields.⁴⁸

In sum, this analysis suggests that fiscal concerns do not appear to have led to a higher cost of funding during the most recent run-up in nominal bond yields. Rather, improving growth prospects and higher term premia are the main factors pressuring long-term rates higher. Furthermore, QE2 does not appear to have contained long-term rates. While the anticipation of QE2 initially led to a sharp compression in term premia, that impact was either fleeting or has been more than offset by other factors.

Annex 1.2. Compilation of Investor Base Data for General Government Debt⁴⁹

In this annex, the investor base of total general government debt for each country in Figure 1.17 is decomposed along two dimensions—residency and nonresidency; and bank and nonbank. This decomposition captures a country's funding reliance on external investors and banks. All the debt data are based on the market value to facilitate the comparison and analysis.

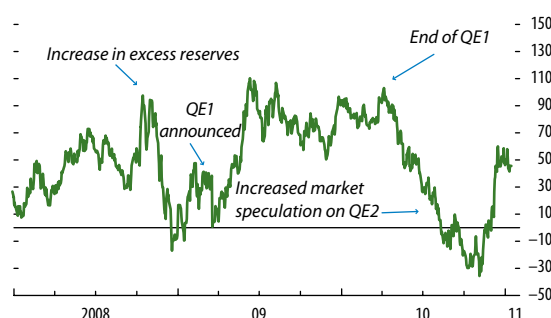
Total general government debt data are from Eurostat's Quarterly Summary Government Finance Statistics. The sum of all the liabilities in the government balance sheet is taken as the total general government debt.

Total external debt is from the Joint External Debt Hub (JEDH) database. The end-of-period exchange rates in the IMF's International Financial Statistics (IFS) are used to convert U.S. dollar debt into euros, given that the exchange rates in the IFS are more in line with the European Central Bank (ECB) reference rates than other sources, such as Bloomberg.

⁴⁸There are two main caveats to this interpretation: first, inflation risk premia include inflation expectations and other miscellaneous factors (e.g., inflation risk premia, liquidity risk, effects of indexation lags, and index basis risk). Second, credit risk and inflation risk may influence the term premium, which would not be captured in this type of mechanistic approach.

⁴⁹This annex was prepared by Peter Lindner and Yinqiu Lu.

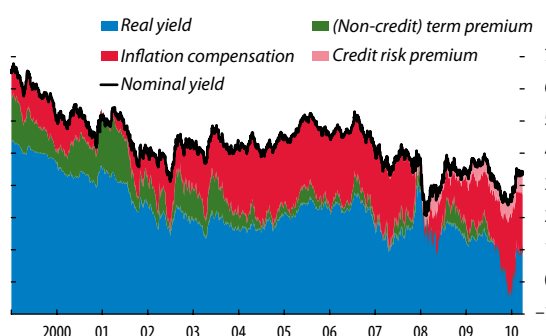
Figure 1.43. Term Premium on U.S. Treasuries
(In basis points)



Sources: Bloomberg L.P.; Federal Reserve; Macroeconomic Advisers; and IMF staff estimates.

Note: QE1 and QE2 refer to the first and second rounds of quantitative easing by the Federal Reserve.

Figure 1.44. Components of 10-Year Nominal Treasury Yield
(In percent)



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

Total domestic debt is a residual after deducting external debt from total general government debt.

Domestic banks' holdings of general government debt come from the IFS statistics on other depository corporations' claim on the general government in their respective countries. The category "other depository corporations" is equal to the category of "other monetary financial institutions" for the euro area. It excludes national central banks and ECB but may include corporations engaged in granting mortgages, mutual funds, and municipal credit institutions.

Foreign banks' holdings of general government debt are calculated with two types of Bank for International Settlements (BIS) cross-border banking statistics. The BIS Consolidated Banking Statistics present banks' international claims on the public sector (Table 9A: G and Table 9C: G). However, the data are not consistent with the principles of external debt statistics as they cover worldwide-consolidated international financial claims of domestically owned banks. The BIS Locational Banking Statistics are consistent with those principles; however, they do not offer information on banks' international claims on the public sector. To address the data limits, the ratio of banks' claims on the public sector to all sectors is assumed to be the same in both the consolidated and locational banking statistics. Accordingly, the share of foreign bank holdings is calculated from the consolidated banking statistics (data in Table 9A:G divided by those in Table 9A:A) and then applied to the external positions of BIS reporting banks in the locational banking statistics (Table 6A) to derive foreign banks' holding of government debt.

Annex 1.3. Dubai: From Debt Overhang to Restructuring, but Risks Remain⁵⁰

The global crisis highlighted the vulnerabilities of Dubai's growth model, which had relied heavily on highly leveraged property development.⁵¹ In November 2009, Dubai World, one of the

largest conglomerates owned by the government of Dubai, announced a moratorium on debt payments. After initial market disruptions, Dubai World achieved a successful debt restructuring thanks to support from the government of Abu Dhabi. Equity injections by the government of Dubai provided lenders the incentive to agree on the restructuring terms, but refinancing problems could re-emerge when restructured loans mature, including those from local banks. Lingering risks to the sovereign balance sheet have also kept Dubai spreads elevated.

Dubai's growth model had remarkable achievements, but it entailed high risks. The model, which was largely implemented through government-related enterprises (GREs), allowed Dubai to multiply its gross national product tenfold between 1990 and 2008 and to become a prime regional hub. Nevertheless, the large-scale and highly leveraged property investments, as well as the expansion into real estate and private equity abroad, generated significant risks: Dubai's debt tripled during 2005–08 to almost 100 percent of GDP, and rollover needs increased dramatically (Figure 1.45).⁵²

Onset of the Crisis

Starting in mid-2008, tight global financial conditions heightened these risks, and a financial crisis erupted in late 2009. The reversal of real estate prices, which had risen sharply in Dubai even relative to global urban centers (Figure 1.46), put pressure on the leveraged GREs, compelling Dubai World to seek the debt standstill in November 2009.

Crisis resolution was relatively quick, owing largely to Abu Dhabi's support. The support amounted to \$20 billion and was disbursed over 2009–10. The government of Dubai used part of the proceeds to bail out Dubai World by injecting equity and paying off bondholders (Figure 1.47). This helped secure rapid agreement from banks on extended maturities to 2014

⁵⁰ This annex was prepared by Gabriel Sensenbrenner.

⁵¹ Dubai is the second largest by GDP of the seven federated states that make up the United Arab Emirates (UAE). The UAE has the fifth largest oil and gas reserves in the world. Abu Dhabi, the largest emirate in the UAE, produces 95 percent of the federation's oil and gas and owns one of the largest sovereign wealth

funds in the world. In contrast, Dubai has a more diversified economy, driven by trade, services, and real estate.

⁵² Compiled from various sources; no official consolidated information exists on Dubai debt.

and beyond, lower interest rates, and make principal and most interest due at maturity. Dubai World's debt restructuring was completed in a few months, with relatively low haircuts of 16 percent or less. Similar restructurings are ongoing in other Dubai GREs. The terms give Dubai time to complete projects and wait for better market conditions to begin selling assets.

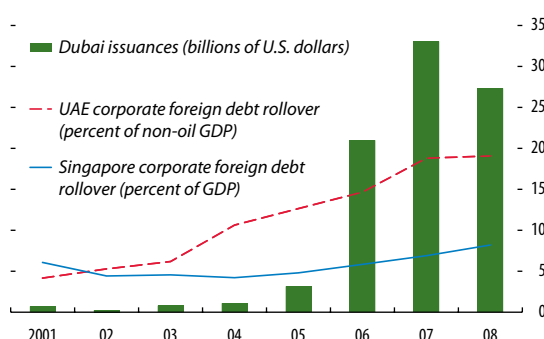
The bailout of the GREs helped push up Dubai's sovereign debt by almost 20 percent of GDP in 2009, demonstrating the fiscal risks posed by GREs (Figure 1.48). Although Dubai regained market access in September 2010, the cost remains elevated, reflecting contingent liabilities from other GREs; rollover needs of \$31 billion in 2011–12; and broader concerns about the solvency of restructured GREs if asset values do not recover to enable repayment of the restructured loans at maturity. These uncertainties are likely to persist even as the government of Dubai develops a strategy to put its GREs on a viable path.

So far, the debt restructuring has affected local banks mainly through higher provisioning, but risks may materialize as restructured loans start to mature. Provisioning started after haircuts on Dubai World debt were firmed up in mid-2010, but early indications are that banks remained profitable in 2010. Dubai World haircuts ranged between 7 and 16 percent, implying provisions of \$1 billion, against net profits of \$4 billion in 2009. Dubai-based banks face additional challenges from greater exposure to Dubai GREs and Dubai real estate: their nonperforming loan ratios are twice the size of those of their peers in Abu Dhabi, and provisioning ratios are lower. Local banks may also require further provisioning in light of the ongoing restructurings of other firms, and they face the 2014 rollover risk. Government support has helped raise the capital adequacy ratio to 21 percent from 13 percent before the crisis, but support will start to decline in 2012.

The Way Forward

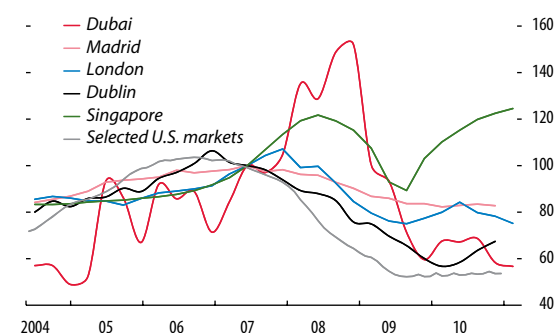
The successful restructuring of Dubai World's debt improved market confidence (Figure 1.49), but additional steps are needed to address remaining uncertainties regarding the solvency of GREs and to mitigate the risks they pose to the sovereign balance sheet (Figures 1.50 and 1.51). These steps include:

Figure 1.45. Dubai: Foreign Borrowing Surge and Rollover Risk



Sources: Dealogic; Joint External Debt Hub; and IMF staff estimates.

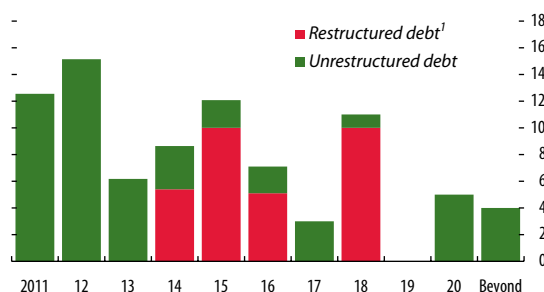
Figure 1.46. Urban Real Estate Prices, CPI-Deflated (Index, 2007:Q1 = 100)



Sources: Case-Shiller; Dubai Land Department; Haver Analytics; national authorities; and IMF staff estimates.

Note: CPI = consumer price index.

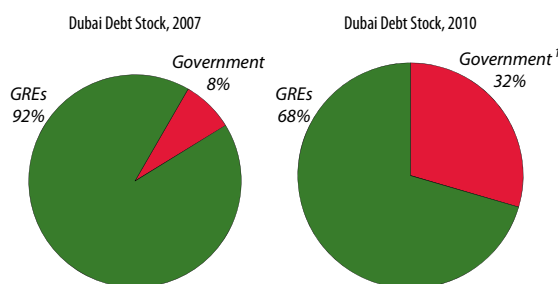
Figure 1.47. Maturity Profile of Debt of Dubai Government-Related Enterprises (GREs) (In billions of U.S. dollars)



Sources: Bloomberg L.P.; Dealogic; Zawya; and IMF estimates.

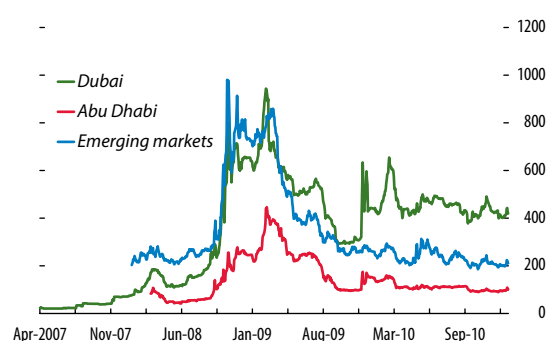
¹Preliminary estimates based on public information about Dubai Holding and other GRE ongoing debt restructurings as well as Dubai World's completed restructuring, excluding explicit government guaranteed debt.

Figure 1.48. Dubai: Composition of Debt
(Percent)



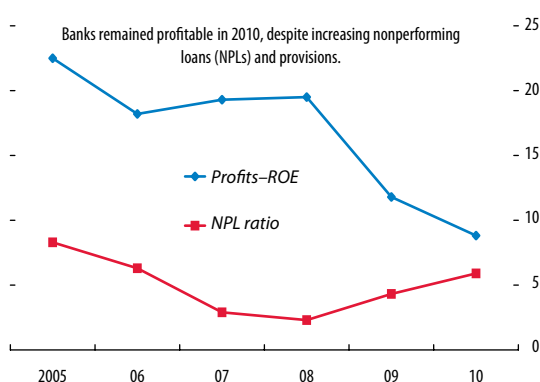
Sources: Dealogic; and IMF staff estimates.
Note: GREs = government-related enterprises.
¹Including GRE debt guaranteed by the Dubai government.

Figure 1.49. Credit Default Swap Spreads
(Basis points)



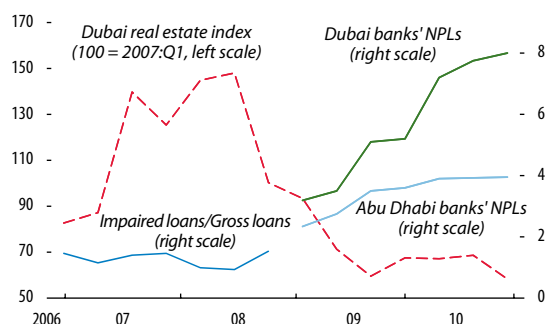
Source: Markit.

Figure 1.50. United Arab Emirates: Recent Developments in Local Banks
(Percent)



Sources: Central Bank of the United Arab Emirates; and IMF staff estimates.
Note: ROE = return on equity.

Figure 1.51. Nonperforming Loans (NPLs) and Real Estate
(Nonperforming loans in percent)



Sources: Bankscope until 2008; Central Bank of the United Arab Emirates for 2009–10; Dubai Land Department.

- Enhancing transparency and disclosure of information, particularly regarding GRE liabilities and financial statements and GRE relations with the government. In the UAE as a whole, this also entails a broader need for improved data capacity.
- Complementing the debt and operational restructuring of GREs to ensure their financial viability without recourse to government guarantees; and clarifying their governance structure.
- Strengthening risk management, through close monitoring of balance sheets and financial transactions of GREs and banks, establishing a fiscal

framework that captures the fiscal risks posed by GREs, and enhancing debt management at the national and subnational levels.

- Improving economic surveillance by adopting countercyclical fiscal policy in the context of a pegged exchange regime, which calls for close coordination between the national and subnational governments and developing consolidated fiscal accounts; and by developing macroprudential policies to discourage high leverage and help avert the resurgence of imbalances.
- Establishing effective legal and institutional frameworks with clear rules for the insolvency regime, credi-

tor rights system, and arbitration to foster confidence in the credit system and in bankruptcy procedures, and to enhance the integrity of the financial markets.

Annex 1.4. Projecting Government Funding Costs through 2015⁵³

This annex describes the methodology, inputs, and assumptions used to project future government funding costs for selected advanced economies. It also provides some additional detail on the results summarized in Section D of this chapter.

Methodology, Inputs, and Assumptions

Governments' annual funding needs for 2011 through 2015 are calculated from the following four inputs:

- The primary deficit of the general government as projected by the IMF's April 2011 *World Economic Outlook*.
- The detailed repayment schedule for principal and interest on existing debt, as provided by Bloomberg. Because this data source does not contain all elements of general government debt, the Bloomberg data are scaled up to ensure that the end-2010 debt stock matches the amount of general government gross debt as estimated by the WEO. This corresponds to the implicit assumption that debt instruments not captured by Bloomberg have the same maturity structure and interest rates as those included in the Bloomberg database. For Greece, the projections are adjusted to reflect the March 2011 agreement with its EU partners whereby the bilateral loans will have their average maturity extended to 7.5 years and interest rate spread lowered by 100 basis points.
- For Greece and Ireland, the prospective repayment schedule on borrowing from the IMF and EU under their respective financial arrangements, as projected in IMF Country Reports No. 10/366 (Ireland) and No. 10/372 (Greece).
- Repayment schedules for new debt contracted after end-2010, as per the assumptions on government funding (see below).

These gross financing needs are assumed to be covered by (1) disbursements from the IMF and EU under the financial arrangements for Ireland and Greece, as projected in the above-mentioned documents; and (2) market issuance of debt. With respect to the latter, governments are assumed to issue new debt in a way that leaves the average maturity of debt outstanding unchanged. To this end, issuance is assumed to occur in seven maturity brackets (1-year, 2-year, 3-year, 5-year, 10-year, 20-year, and 30-year), with relative weights chosen to match the distribution of debt outstanding by maturity bracket at end-2010 (as per Bloomberg). For Greece and Ireland, no issuance is assumed in the 30-year maturity. In each case, the relative weights in the longest two maturities are fine-tuned to ensure that the average maturity of new debt matches exactly that of the initial end-2010 debt stock. While this prevents results from being affected by assumed changes in debt maturities, unreported simulations show that a possible shift toward longer or shorter maturities would not materially affect any of the key results.

The yield on new debt issuance for the period 2012–15 is projected on the basis of market forward rates as of March 31, 2011.⁵⁴ Specifically, future interest rates for Germany, Japan, the United Kingdom, and the United States are based on the forward curves of the respective government bonds. For Belgium, France, Greece, Ireland, Italy, Portugal, and Spain, future interest rates are computed from spreads over the German benchmark curve, in line with market convention. The country- and maturity-specific spreads are equally based on market data as of March 31, 2011. Thus, the yield on the bond of country i with maturity τ issued at time t , $y_{it}(\tau)$ is assumed to have a spread $s_i(\tau)$ over the German benchmark yield curve $YB_t(\tau)$, i.e., $y_{it}(\tau) = YB_t(\tau) + s_i(\tau)$. For simplicity, all new debt instruments are assumed to carry fixed-rate annual coupons. Any debt service arising from new debt issuance is naturally taken into account in calculating principal and interest payments for subsequent years.

To ensure consistency, future gross debt stocks are computed from the above inputs, i.e., as a function

⁵³ This annex was prepared by Andre Meier and Faezeh Raei.

⁵⁴ For 2011, projected interest rate payments are based on WEO projections.

of primary balances and interest bills. Other possible sources of variation in debt stocks, such as valuation effects and asset purchases or sales, are not taken into account. The resulting projections generally differ very little from those in the WEO. Average interest rates, in turn, are computed as the total interest bill in year t , divided by the end-of-period debt stock of year $t - 1$.

Figure 1.20 compares these average interest rates on government debt to illustrative threshold rates, which are computed so as to keep the government interest bill at a fixed proportion of government revenue. For instance, the interest rate threshold corresponding to a 10-percent ratio would be computed as follows:

$$i_{10,t} = 0.1 \times \frac{\text{revenue}_t}{\text{debt}_{t-1}}.$$

These calculations are based on (1) the gross debt projections resulting from the exercise described above, except in the case of Japan, where we rely on net debt projections taken from the WEO, to account for the significant amount of interest-bearing financial assets held by the government; and (2) WEO projections for general government revenue.

Key Results for Baseline Projections

Figure 1.52 provides a more detailed illustration of the interest burden dynamics summarized in Figure 1.20. Specifically, it shows, for each of the 11 countries in the sample, historical average government funding costs since 1995 (in the case of the United States, since 2001, because earlier data are not available from WEO); and the corresponding projections through 2015. The evolution of funding costs is indicated by black lines. To set these funding costs in relation to debt service capacity, the charts also contain background shading. Each horizontal segment represents an interest rate interval that keeps the overall government interest bill in a certain range relative to government revenue. For instance, green shading indicates that at these interest rates, the interest bill would not exceed 10 percent of revenue; orange shading indicates interest rates that imply an interest bill between 10 and 20 percent of revenue; and so forth. Together, black lines and background

shading allow a quick assessment of the strain put on the public finances by actual (historical or prospective) funding costs.

Annex 1.5. Strategic Defaults and Housing Prices in the United States⁵⁵

Borrowers have become more strategic in their default decisions by becoming more willing to exercise their default option on underwater (negative equity) mortgages. This annex quantifies the potential impact of further house price declines on the default rates of U.S. residential mortgages.

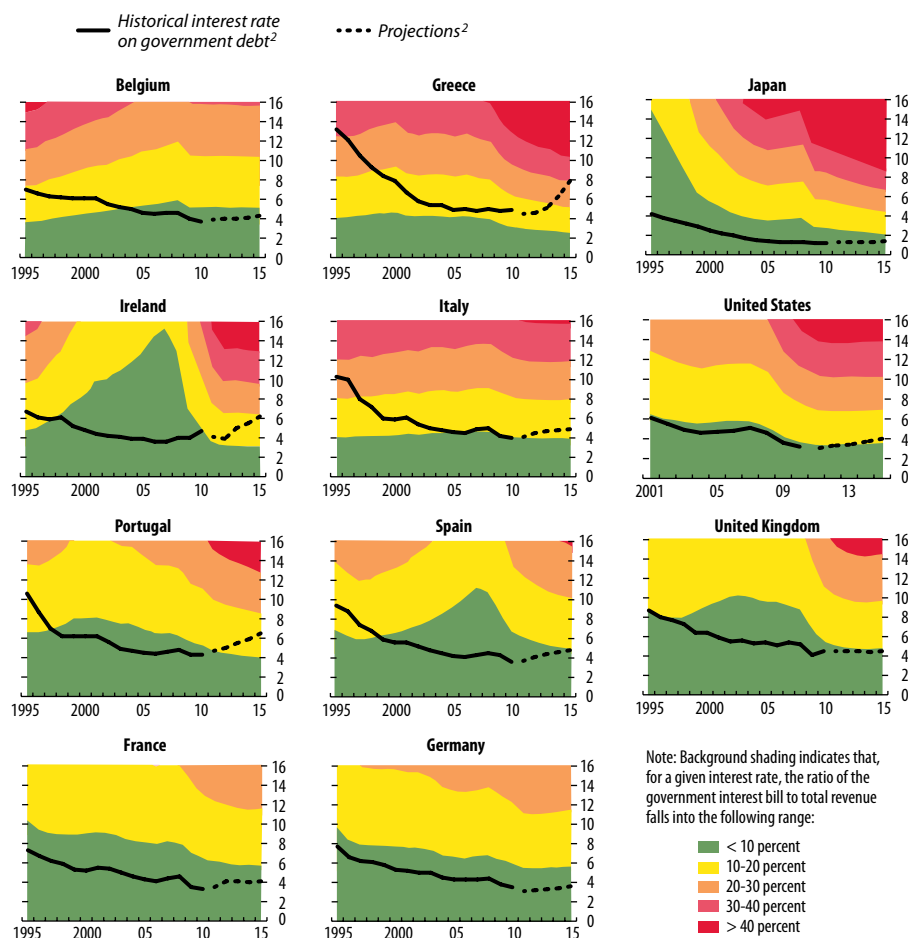
The increase in strategic defaults, coupled with the large share of mortgages that are underwater, is a significant headwind facing the U.S. housing market.⁵⁶ Negative equity poses a major risk because the propensity of borrowers to become delinquent on residential mortgages tends to increase with lower home equity values. The propensity to delinquency increases particularly sharply when home equity is very low. For example, the delinquency probabilities on a mortgage with severe negative home equity (defined as negative home equity of more than 20 percent) is nearly 50 percent higher than the delinquency probability on a mortgage with moderate negative home equity (defined as negative home equity between 0 and 20 percent). Borrowers appear to be more likely to fall behind on mortgage payments when their home equity becomes sufficiently negative even when they are able to service their mortgages. This tendency can be seen by observing that, after controlling for the level of home equity, the probability of delinquency is virtually the same irrespective of the local unemploy-

⁵⁵ This annex was prepared by Ivailo Arsov.

⁵⁶ It is difficult to measure the importance of strategic defaults because the reasons for the default cannot be observed, which raises questions about the direction of the causality between defaults and home equity: do defaults increase as home equity declines, or does an increase in defaults (due, for example, to an increase in unemployment) depress house prices and reduce home equity? Recent studies have produced mixed results on the importance of strategic defaults. Some, such as Elul and others (2010), find strong support for the argument that negative equity drives mortgage defaults, while others, such as Bhutta, Dokko, and Shan (2010), find that negative equity causes a default only when the borrower is also subject to an income shock such as loss of employment.

Figure 1.52. Government Funding Costs and Debt Affordability
(Interest rate, in percent)

These panels show historical and projected average funding costs for selected advanced-economy sovereigns (black lines). In addition, the background shading indicates the “affordability” of different interest rate levels, as defined by the ratio of the resulting government interest bill to total revenue. Green shading denotes a low ratio, red shading a high ratio. For details, see legend at the bottom.¹



Sources: Bloomberg L.P.; IMF, World Economic Outlook database; and IMF staff calculations.

¹Based on WEO data and projections for general government revenue and primary balance. Funding cost projections based on current market forward rates, taking into account the detailed profile of future financing needs as well as EU/IMF funding in the case of Greece and Ireland. Maturity structure of issuance assumed to be held constant over time. Interest bill based on gross debt, except for Japan (net debt).

²General government interest expenditure divided by beginning-of-period debt stock.

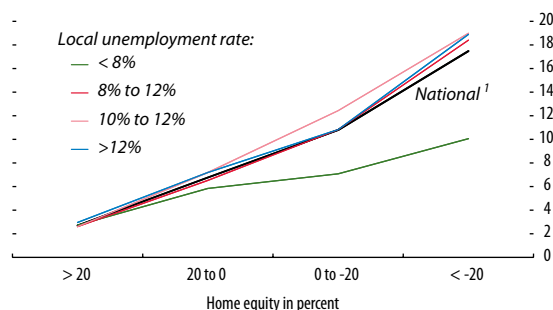
ment rate, which is an indication of the general ability of borrowers to service their mortgages (Figure 1.53).⁵⁷

Mortgage defaults are likely to remain elevated for some time because many borrowers who are current on their payments have experienced substantial

declines in their home equity as a result of the large U.S. housing market correction since 2006 and because these borrowers face higher incentives to strategically default. In mid-2010, around 23 percent of outstanding U.S. mortgages had negative home equity. A large number of these mortgages are likely to be already delinquent or in the process of foreclosure

⁵⁷The unemployment rate is that in the metropolitan statistical area of the property.

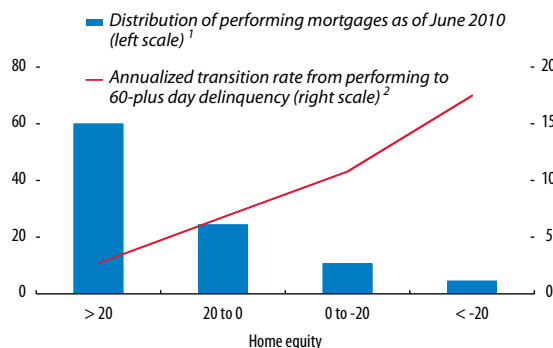
Figure 1.53. Annualized Transition Probability of a Performing Prime Mortgage to 60-Plus Day Delinquency Conditional on Local Unemployment Rate (In percent)



Sources: Amherst Securities; Datastream; Mortgage Bankers Association; IMF staff estimates.

¹Transition rates estimated in three months to June 2010. The national transition rate is the weighted average of the transition rates conditional on the local unemployment rate, with weights given by outstanding mortgages and state unemployment rates as of June 2010.

Figure 1.54. U.S. Mortgage Delinquency Probability and Home Equity Distribution (Percent)



Sources: Amherst Securities; CoreLogic; Mortgage Bankers Association; IMF staff estimates.

¹Estimated home equity distribution of performing mortgages.

²U.S. transition rate to serious delinquency is weighted average of transition rates conditional on the local unemployment rate.

and will not contribute to future delinquencies. An estimate of the home equity distribution of performing mortgages, which adjusts for mortgages that are already delinquent or in foreclosure, suggests that, in mid-2010, about 15 percent of performing mortgages had negative home equity and about 4 percent of performing mortgages had negative home equity greater than 20 percent (Figure 1.54). The estimated home equity distribution of performing mortgages and the observed delinquency propensity indicate that, even in a scenario in which house prices do not decline further, more than 5 percent of the performing mortgages as of mid-2010 are likely to become delinquent because of strategic defaults. To put this in context, the 60-plus day delinquency rate in mid-2010, which includes the mortgages in the process of foreclosure, was 11 percent. Therefore, the estimated additional delinquencies of around 5 percent of performing mortgages represent a significant addition to the already high stock of delinquent mortgages.

Mortgage defaults are at risk of increasing beyond what is indicated by the current large share of mortgages with negative home equity. This is because a large number of performing U.S. mortgages have only a small amount of positive home equity. Further house price declines can push a significant share of the performing mortgages with small positive equity (for which delinquency rates are relatively low) into the set of mortgages with negative equity (for which delinquency rates are significantly higher). Although consensus (average) expectations are for U.S. house prices to decline marginally in 2011 and then to begin a gradual recovery, the range of reported expectations is very wide. The wide range reflects the large degree of uncertainty and the possibility of further large house price declines—some economists are forecasting a drop of 10–15 percent in the next two years.⁵⁸ If declines on the magnitude of the more pessimistic forecasts occur, then mortgage defaults are likely to increase substantially. For example, an instantaneous house price decline of 10 percent will increase the share of performing mortgages in negative equity from 15 percent to 27 percent (see the gray and red bars in Fig-

⁵⁸ See MacroMarkets (2010), which reports the expectations of 110 economists, real estate experts, and investment and market strategists for U.S. house prices until 2015.

ure 1.55) and will, in turn, increase the delinquency rate on performing mortgages in the first year after the price decline from just over 5 percent to around 6.5 percent (see red line in Figure 1.55). A more severe house price decline of 20 percent will increase the share of performing mortgages with negative equity to nearly 40 percent and will push the delinquency rate to 8 percent in the first year after the house price decline. Potential house price declines further worsen mortgage losses because they will not only increase defaults due to lower home equity but will also reduce the recovery rate on defaulted mortgages by lowering the value of the housing collateral.

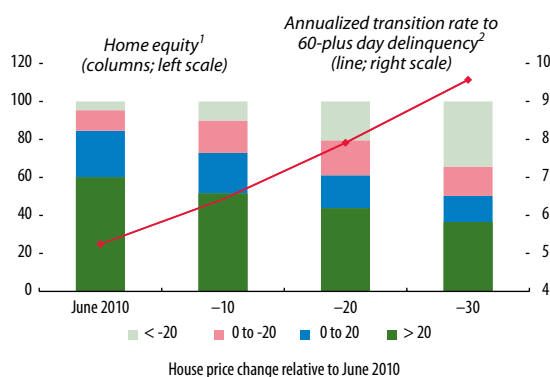
Annex 1.6. Recent Measures to Manage Capital Flows in Selected Economies⁵⁹

The policy challenges stemming from the resurgence of capital flows to Asia and Latin America since mid-2009 have been met with both conventional macroeconomic policies and more direct measures. The latter have varied widely among countries, reflecting (1) a limited willingness to adjust macroeconomic policy, related partly to concerns about excessive exchange rate appreciation; (2) the need to limit risks to the stability of the financial sector; and (3) the goal of reducing the volatility of inflows. The effectiveness of such measures needs to be measured by their effects on the volume and composition of inflows and their impact on financial stability.

Direct measures have had four broad objectives: (1) mitigate complications for central bank market operations stemming from inflows to short-term instruments, (2) limit inflows into local bond markets, (3) reduce risks in both the banking system and the real economy, and (4) limit private sector external borrowing. Table 1.6 summarizes measures used to manage capital flows since 2009 in Asian economies, and this annex elaborates on some of the measures taken in Asia and Latin America.

⁵⁹ This annex was prepared by Geoffrey Heenan, Ceyda Oner, and Rebecca McCaughrin.

Figure 1.55. Home Equity, Delinquency Rate, and House Price Declines
(In percent)



Sources: Amherst Securities; CoreLogic; Datastream; Mortgage Bankers Association; and IMF staff estimates.

¹ Estimated distribution of the home equity of performing mortgages as of June 2010.

² Calculated from the estimated distribution of home equity of performing mortgages. The transition rates for the house price decline scenarios assume that the declines occur instantaneously.

Indonesia: Managing the Impact on Central Bank Operations

Strong foreign demand for central bank securities has complicated sterilization efforts, prompting Bank Indonesia to introduce counter measures. As capital inflows gathered pace through 2009 and into 2010, Bank Indonesia rebuilt its international reserves, partially sterilizing its currency market intervention by selling one- and three-month central bank bills (SBI) (Figure 1.56). However, foreign investors were buying an increasing proportion of these securities, raising concerns that these sterilization operations were attracting additional inflows. In June 2010, seeking to reduce foreign demand for its sterilization instruments, Bank Indonesia introduced a holding period on SBIs. Bank Indonesia also lengthened the term of the SBIs from six to nine months and introduced nontradable term deposits with maturities of up to four months for banks.

While overall inflows have continued to grow, these measures have directed foreign funds into the longer-term SBIs and government bonds (SUNs). Foreign holdings of both long-term SBIs and SUNs have increased both in absolute terms and as a proportion of the total outstanding. Overall, the measures have been effective in reducing foreign ownership of short-term SBIs. As of March 2011, the Bank Indonesia reimposed a limit on short-term foreign currency borrowing of banks to 30 percent of capital, which could limit the capacity of banks to intermediate short-term inflows.

Thailand and Korea: Limiting Inflows into Local Bond Markets

Thailand and Korea re-imposed withholding taxes on foreign investors' holdings of government securities to limit inflows into local bond markets (Thailand in October 2010 and Korea in January 2011), but with little effect so far. In Thailand, inflows fell initially, mostly because of uncertainty about the operational details, but resumed strongly by December (Figure 1.57). In both countries, the impact of these measures on investor behavior is likely to be limited, given the wide coverage of double-taxation treaties signed by each country.

Macroprudential Controls: Reducing Financial Stability Risks Arising from Inflows

Concerns that inflows could fuel excessive credit growth and asset price bubbles, particularly in real estate, have prompted many Asian countries to tighten prudential requirements in order to reduce potential threats to financial stability (Figure 1.58). Several countries tightened real estate lending criteria, including China, Hong Kong SAR, India, Korea, Malaysia, Singapore, and Thailand. Hong Kong SAR also raised the stamp duty on all property transactions. Other policies have included changes in requirements for loan-loss provisioning, increased capital adequacy requirements, and limits on maturity mismatches on bank balance sheets, in line with proposals that were emerging in 2009 and 2010 from the Basel Committee on Banking Supervision. Many central banks have increased reserve requirements, though in part this reflects the unwinding of measures taken at the height of the financial crisis to alleviate funding pressures.

These macroprudential measures do not directly affect capital inflows, but they could limit them by altering banks' demand for external funding and the expectations of both domestic and foreign investors for asset returns. The efficacy of these measures needs to be judged by the extent to which they have reduced financial stability risks, and, to the extent they may have substituted for monetary and exchange rate policies, by whether they effectively contain these macroeconomic risks. It may be too soon to judge, but these measures may have had some effect. Apart from China, overall credit growth remains broadly in line with historical norms, and property price inflation has slowed in the most overheated markets. However, inflation has been rising in a number of countries.

Korea: Limiting Private Sector Foreign Exchange Borrowing

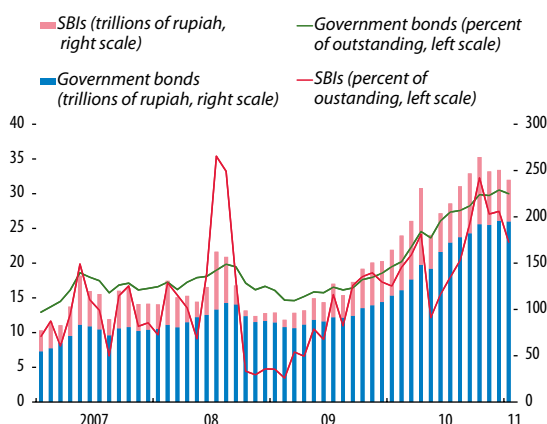
Faced with a sharp reversal in bank short-term funding flows in 2008, Korea tightened limits on bank and corporate funding in foreign currencies (Figure 1.59). In June 2010 and again in October 2010, Korea reduced the allowable size of banks' foreign currency derivatives contracts relative to bank capital and reduced the allowable size of such contracts for corporations relative to

Table 1.6. Selected Capital Flow Management Measures in Asian Economies

Policy Tool	Recent Country Examples	Motivation/Objective
Limits to direct and indirect foreign exchange exposure	Korea (June 2010): Capped foreign exchange forward positions of banks relative to their equity capital. Reduced corporate foreign exchange hedging limit from 125 percent to 100 percent of export receipts.	By limiting derivatives positions, the measure indirectly targets a reduction in external borrowing by the private sector, particularly the banking sector. This exposure was also associated with carry trades onshore, including through “over hedging” of dollar receivables by Korean exporters.
Increase restrictions on external borrowing	India (December 2009): Reinstated interest rate cap on eligible external commercial borrowing that was eliminated during the crisis.	To limit access to foreign credit to best corporate credits and prevent high-cost borrowing.
Minimum holding period on central bank bills	Indonesia (June 2010): One month holding period on central bank bills (SBIs) introduced for both domestic and foreign investors	To limit volatility of flows. SBIs had been subject to sharp shifts in positions relative to global risk appetite, as they were used as a carry trade vehicle. Holding period limits the volatility of flows on exit from positions.
Limited foreign access to central bank instruments	Indonesia (June 2010 – present): Phased out one- and three-month SBIs in favor of six- and nine-month SBIs, and expanded offerings of nontradable term deposits up to six months tenor available to banks operating in Indonesia.	To reduce volatility of inflows, and address concerns that central bank sterilization was attracting further inflows. Short-term SBIs, largely used to sterilize foreign exchange intervention, were a favored vehicle for carry trades.
Other restrictions on foreign access	Taiwan Province of China (November 2009): Financial Supervisory Commission (FSC) barred access to time deposit accounts for foreign investors. Taiwan Province of China (November 2010): FSC extended existing investment of nonresident inbound remittances in domestic securities to 30 percent, to include government securities of remaining maturity greater than one year.	To dampen speculative flows. Time deposits are one avenue for carry trades/currency speculation. Reduced access of nonresidents to government bonds.
Measures to encourage outbound investment by residents	Malaysia (October 2010): Announced that the overseas investment limit of the Employee Provident Fund would be raised from 7 to 20 percent.	
Reserve requirements on foreign currency and nonresident accounts	Taiwan Province of China (January 2011): Raised reserve requirement on local currency accounts held by nonresidents to 90 percent on balances exceeding the outstanding balance on December 30, 2010. Balances below end-2010 levels subject to 25 percent reserve requirement. Required reserves for such accounts are no longer remunerated.	
Withholding tax on foreign holdings of government bonds	Thailand (October 2010): Reimposed 15 percent withholding tax (withdrawn in 2005) for state bonds on foreign investors. Korea (January 2010): Introduced 15 percent withholding tax on foreign holdings of government bonds and central bank securities. In both cases, the impact has been limited due to wide coverage of double taxation treaties.	To slow inflows into government bond markets.
Real estate market measures	Hong Kong SAR (October 2009): Mortgages for luxury property capped at 60 percent loan-to-value (LTV) ratio. Maximum loan amount for nonluxury property capped at \$1.5 million, stamp duty on sales increased. Guidance on mortgage rates. Korea (2009): Ceiling on LTV ratios lowered in Seoul. Singapore (September 2009; February and August 2010): Minimum holding period on private residential property raised to three years. Cap on LTV ratio for mortgage lending lowered for second homes. Interest-only loans banned. India (October 2009): Increase in provisioning requirements for real estate credit; (January March, April 2010): Incrementally increased required reserves for banks. China (2010): Taxes on resale of properties within five years increased. Greater administrative guidance on financing, including lower LTV ratios for second or third homes, higher down payments requirements for mortgages. There was a mandated increase in mortgage rates for second homes, third mortgages were officially discouraged. Property tax being considered.	To curb real estate speculation, in part due to inflows from mainland, particularly at top end of market. To dampen real estate prices. Series of incremental measures target residential property speculation amid signs of overheating. To address potential risks in banking sector from recovery of credit growth. To lessen speculative activity by lowering transaction volumes and leveling off prices.

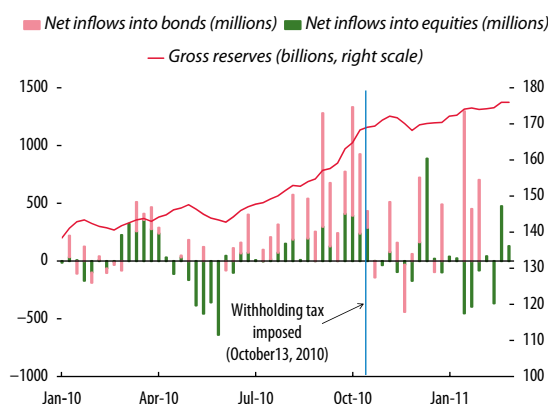
Source: Country authorities.

Figure 1.56. Indonesia: Foreign Holdings of Government Bonds and Bank Indonesia Certificates (SBIs)



Sources: Bank Indonesia; and CEIC.

Figure 1.57. Thailand: Weekly Foreign Portfolio Inflows and Reserves
(In U.S. dollars)



Sources: Bloomberg L.P.; and Thai Bond Market Association.

their export receivables. Since banks that offer currency forwards typically hedge their position by borrowing externally, the limits on forwards indirectly constrain foreign borrowing by banks.

Korea's measures may not curb capital flow volatility, but they could reduce foreign currency exposures among market segments that are relatively vulnerable. The measures have already led to a reduction in foreign exchange derivative positions and related short-term external borrowing among onshore banks. However, as the measures are largely targeted at bank flows, and the capital account remains relatively open, the reliance of other market segments on capital inflows remains unaffected, and they continue to face the risks of reversals.

Brazil: Limits on Foreign Flows into Local Bond Markets and Derivatives

Capital flows have entered Brazil mainly through the equity market and foreign direct investment (FDI). The share of fixed-income inflows is considerably smaller, though it has grown rapidly. Inflows mostly represent real money investors (e.g., sovereign wealth funds, mutual funds, pension funds), but retail inflows have also increased, mostly from Japan.

Brazil was among the first emerging markets to raise taxes on foreign fixed-income investment. Having introduced the *Imposto sobre Operações Financeiras* (IOF, a tax on financial operations) in October 2009, the Brazilian government raised it in late 2010 on fixed-income investments in two consecutive hikes, from 2 percent to 6 percent, and raised the tax on daily margin adjustments on foreign positions in foreign exchange and interest rate futures contracts from 0.38 percent to 6 percent. The IOF on equity inflows was left unchanged at 2 percent. Macroprudential measures were introduced in early 2011 that subject local banks' short dollar positions to reserve requirements of 60 percent on amounts that exceeded the smaller of either \$3 billion or the bank's equity reference level. In addition, the IOF tax on foreign borrowing by local institutions was increased to 6 percent on loans with maturities of up to two years.

Increases in the IOF and the other measures successfully reduced short-term fixed-income inflows, but FDI and other investment equity inflows

accelerated. The measures also had some impact on the currency and the local rates market, with the appreciation of the *real* temporarily slowing (though not reversing) and the local nominal debt curve initially shifting upward.

Peru: Limits on Certain Currency-Related Transactions

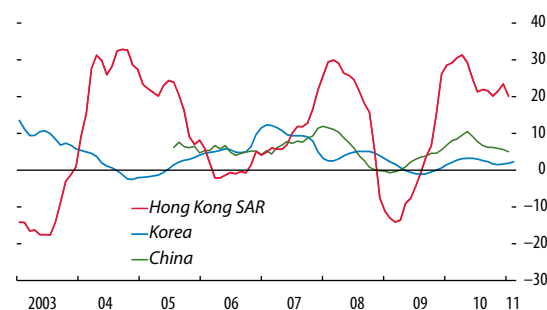
In Peru, capital flows are dominated by longer-term inflows. FDI accounts for about 80 percent of total foreign flows, while longer-term loans represent 20 percent of total foreign flows. Shorter-term portfolio flows remain small (comprising roughly 1 percent of total foreign inflows), although, considering the small size of the domestic market, even a minor increase in portfolio flows could contribute to increased pressures.

In response to strong capital inflows, strong credit growth and other pressures, the central bank introduced a number of administrative measures several times over the last year. These measures include tighter remunerated and unremunerated reserve requirements on local and foreign exchange deposits for residents and nonresidents and new limits on banks' net open derivatives positions. The government is also considering raising the limit on pension fund holdings of foreign assets from 30 percent to 50 percent, which could result in near-term capital outflows, as pension funds raise their exposure to foreign assets.

Although there are important differences in how various countries have responded to the challenge of managing inflows, many of the measures discussed here have been prudential in nature and do not aim to control the volume of portfolio inflows. Rather, they are designed to reduce risks to financial stability and stem the volatility of inflows. The limited evidence so far suggests that these measures have been somewhat effective in altering the composition of inflows, but it may be too early to assess their aggregate impact on credit growth and asset inflation. So far, the volume of capital inflows does not appear to be much affected.

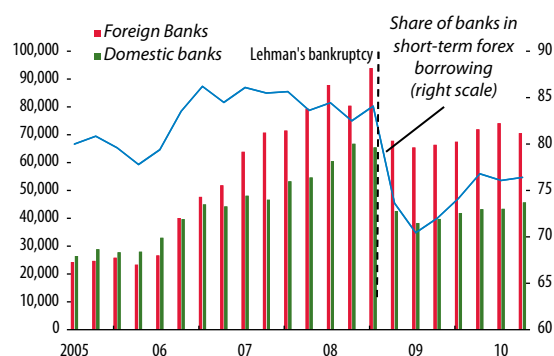
If this experience is repeated in other countries, such capital inflow measures should be seen as complements to, rather than substitutes for, macroeconomic policy responses. Governments may

Figure 1.58. Asian Residential Property Prices
(In year-on-year percent change)



Sources: CEIC; Haver Analytics; and national authorities; and IMF estimates.

Figure 1.59. Korea: Short-Term External Borrowing
(In millions of U.S. dollars)



Source: CEIC.

choose to rescind some of these measures when inflows subside, but those that deal with the volatility of inflows and financial stability risks—including sudden reversals—are more likely to be maintained over the long run.

Annex 1.7. Exchange-Traded Funds: Mechanics and Risks⁶⁰

Exchange-traded funds (ETFs) have become increasingly popular over the past few years. They give investors increased access to emerging market assets while also offering flexibility and leverage to specialized investors. Traditionally, ETFs have physically held underlying assets, but a new breed of ETFs have emerged in Europe that use synthetic replication techniques and derivatives to reduce costs and thereby boost returns. A small percentage of these funds also use leverage to cater to the hedging needs and speculative positions of their nonretail client base. While these enhancements have reduced costs, they add a layer of complexity and increase counterparty and liquidity risks. The disproportionately large size of some ETFs compared with the market capitalization of the underlying reference indices poses a risk of disruptions in some markets from heavy ETF trading. This annex surveys the growth and mechanics of ETFs and highlights some of the key risks pertaining to synthetic replication and the use of leverage and derivatives in ETFs.

Growth

ETFs have grown rapidly since 2007 because of increased interest in fixed-income and emerging market equity funds. Global ETFs saw strong inflows in 2010, growing by more than 14 percent in the first three quarters to nearly \$1.2 trillion in assets under management. The outflows from global mutual funds over this period were of a similar dollar amount.⁶¹ Flows into emerging market ETF equity funds have also been robust, with exposures to this asset class in

2010:Q3 at \$210 billion, or 18 percent of the ETF universe. U.S., European, and Japanese equities constitute more than 50 percent of overall ETF exposures, while Brazil, Russia, India, and emerging Asia equities form the bulk of the emerging market ETF exposures (Figure 1.60). By assets, two-thirds of the ETFs are listed in the United States, while European (22 percent) and Asia-Pacific (7 percent) funds were the fastest growing segments in 2010.

Market Structure and Trading

ETFs are generally index-tracking funds that are traded on exchanges and allow investors to gain exposure to several asset classes on a real-time basis at a relatively low cost compared with similar investment products. ETFs are regulated independently in United States and Europe and have a slightly different investor base in each region.⁶² U.S.-based ETFs have a sizable hedge fund and retail investor base, while institutional holdings are larger among European ETFs.

ETFs emulate the returns on an index by *physically replicating* the underlying index constituents, by *synthetically replicating* the index returns using swaps and other derivatives, or by using some combination of the two. U.S.-based ETFs typically use the physical replication technique due to regulatory constraints.⁶³ When underlying securities are illiquid or unavailable or transaction costs are significant, ETF managers use portfolio sampling techniques to match index returns closely without using full replication.⁶⁴ Nearly half of all ETFs in Europe use the synthetic replication

⁶² U.S. ETFs are governed by the SEC's Investment Company Act of 1940, while those in Europe operate under directives of the Undertaking for Collective Investments in Transferable Securities (UCITS). Other exchange-traded products such as exchange-traded notes (ETNs), which are not discussed in this feature, are bound by different rules.

⁶³ The SEC requires that at least 80 percent of a fund's net asset value (NAV) be in physical assets, and that 85 percent of the assets be highly liquid (convertible to cash within seven days).

⁶⁴ Portfolio sampling involves grouping index securities based on some characteristics (such as industry, value versus growth, market capitalization) and assigning weights to the groups in line with the equivalents weights of the securities in the reference index. Sample securities are then chosen from these groups, and the group weighting is used to match the reference index's performance.

⁶⁰ This annex was prepared by Narayan Suryakumar.

⁶¹ Inflows to ETFs were \$84 billion, and outflows from global mutual funds were \$130 billion.

technique, given its lower costs and the regulations particularly favoring the growth of this segment in the region. Newer types of ETFs, such as *leveraged* and *inverse* ETFs, offer magnified and inverse returns on the performance of an index and use derivatives to match benchmark performances closely, all of which adds layers of complexity and poses higher risks to investors. In 2010:Q3, leveraged and inverse ETFs constituted around \$41 billion of total ETF assets (less than 5 percent of total assets under management), with exposures primarily to US equities.

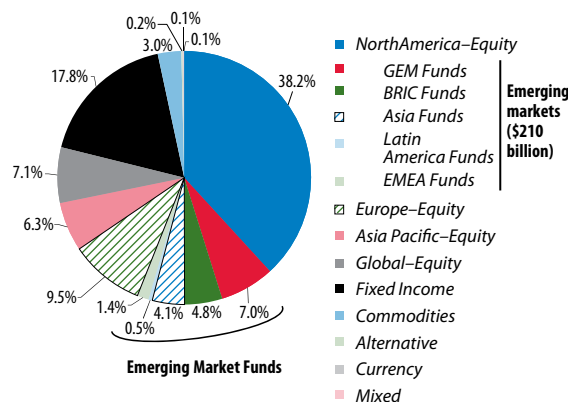
Unlike traditional index funds, dealers typically receive *creation units* of the ETFs in the primary market in exchange for a basket of securities that closely match the ETF's portfolio.⁶⁵ These creation units are then typically split up by dealers and sold as individual ETF shares to investors in the secondary market. In synthetic replication, ETF managers hold a basket of assets, different from the benchmark index's constituents, and swap the returns of this basket for the actual returns on the reference index through total return swaps (TRS) (Figure 1.61). Thus, the provider has effectively transferred the tracking error and rebalancing risk to the TRS counterparty (broker).⁶⁶

Risks and Distortions

Counterparty and Mark-to-Market Risk for the ETF Provider

While synthetic replication eliminates tracking error, it comes at the cost of higher counterparty credit risk. Because the counterparties' creditworthiness guarantees the return on these funds, ETFs, and subsequently investors, are exposed to the risk of one or more coun-

Figure 1.60. Exchange-Traded Fund Assets (\$1.2 Trillion), by Type of Exposure



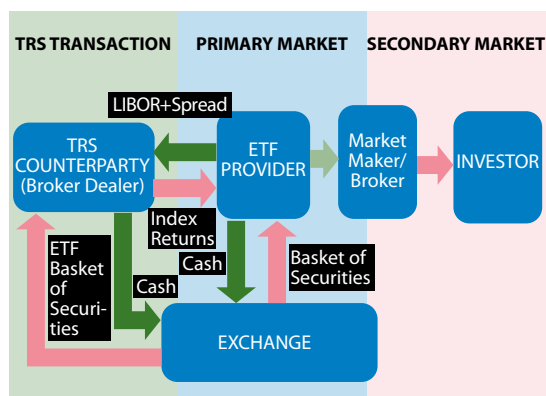
Source: BlackRock.

Note: BRIC = Brazil, Russia, India, and China; GEM = global emerging markets; EMEA = Europe, the Middle East, and Africa.

⁶⁵A creation unit is essentially a block of ETF shares (typically 50,000 shares), with each share roughly representing one unit of the reference index. To redeem shares, dealers sell creation units to ETF providers in exchange for the basket of securities. The redemption of creation units does not involve selling the reference index securities outright, in contrast to mutual funds, and so does not constitute a tax event in the United States.

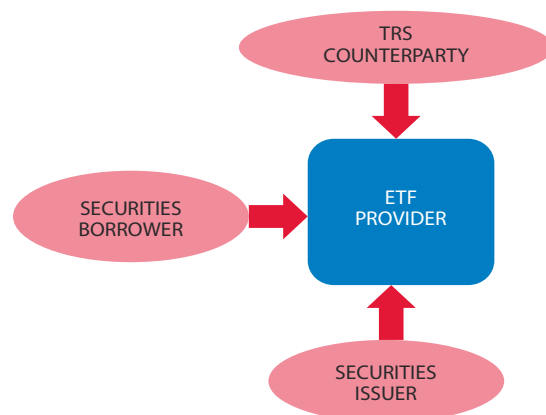
⁶⁶Tracking error is the deviation of an ETF portfolio's return from its benchmark index. Swap-based synthetic replication ETFs have a smaller tracking error than their traditional counterparts, as the drag from dividend withholdings and taxes is eliminated at the provider and is instead managed by the counterparty.

Figure 1.61. Exchange-Traded Fund Trading: Synthetic Replication Based on Total Return Swaps



Note: ETF = exchange-traded fund; TRS = total return swaps.

Figure 1.62. Counterparty Risks in Exchange-Traded Funds



Note: TRS = total return swap.

terparties defaulting (Figure 1.62). Current regulations in Europe on swap-based ETFs mitigate some of this credit risk, as they impose minimum requirements on cash and securities holdings to pay investors if a counterparty defaults.⁶⁷ However, given that a majority of European ETF providers use the synthetic replication method, the gross exposures of these funds raises some concerns on whether current restrictions on derivative contracts are sufficient to curtail counterparty risks from becoming systemic under stressed market conditions.

Securities lending poses yet another counterparty risk, in which a default of the securities borrower could potentially leave the ETF provider scrambling to replace the securities it lent out. Tracking errors can be partially offset by lending securities to hedge funds and other institutions for short-selling and receiving a fee in return.⁶⁸ Regulation currently requires ETF providers to be able to recall securities lent at a short notice and to adequately collateralize such lending. However, participants claim this process currently lacks transparency and that the cash reinvestment guidelines have not been clearly laid out by regulators. In addition, the ETF provider is exposed to the mark-to-market losses on the securities it holds in the swap basket.

Leverage Risk for Investors

Leveraged and inverse ETFs are one of the fastest-growing sectors of the ETF industry.⁶⁹ Exposures of these funds are currently concentrated in U.S. and European equities and less so in emerging market

⁶⁷ According to the UCITS rules in Europe for ETF funds employing synthetic replication, the maximum risk exposure to a single TRS counterparty should be no greater than 10 percent of the fund's NAV, provided the swap exposure is with a major European credit institution. Also, the total risk exposure to all such derivative contracts should not exceed the fund's NAV. In addition, an ETF manager could hold a maximum of 10 percent of the fund's NAV in transferable securities and money market instruments issued by a single body. The synthetic replication technique is currently not used in US-based ETFs due to regulatory restrictions.

⁶⁸ ETFs are bound by rules on securities lending similar to those governing traditional mutual funds. In Europe, ETF providers can technically lend up to 80 percent of their basket of securities to a third party to generate revenues and offset costs due to the TRS agreement.

⁶⁹ While growth rates for this segment have been the fastest among ETF types, leveraged and inverse ETFs still comprise only a small portion of the ETF universe, at less than 5 percent of total assets under management.

securities. Retail investors typically do not buy these leveraged funds, which are generally used by hedge funds for hedging and placing speculative bets. Market sources say that inverse ETFs are popular from a risk management perspective, as investors do not lose any more than their initial investment in the fund, in contrast to a direct short position, in which the investor's losses could potentially be infinite if the index rises. However, besides the obvious leverage risk that investors are exposed to, most leveraged and inverse ETFs reset daily, that is, they are designed to achieve their stated objectives on a daily basis. Hence their performance over longer periods of time can be significantly different from that of the benchmark performance (or inverse of the performance). Therefore, the use of such instruments as risk management tools is limited.

Liquidity Risk

Illiquid assets, reduced market access, and a dearth of derivatives in some emerging markets, combined with the sudden exit of market makers can exacerbate volatility under stressed conditions. While most ETFs are supported by one or more market makers, there is no guarantee of active trading under illiquid conditions. Analysts point to the so-called flash crash in May 2010 as an example of the risks ETFs are susceptible to, when market makers were overwhelmed by a surge in computer-driven selling.⁷⁰ Market makers stopped offering bid-ask quotes, fueling volatility further and the eventual meltdown in equity prices on the Dow Jones index (Figure 1.63) triggered heavy losses for some ETFs. In addition to risks posed by market makers, some illiquid emerging market assets also present challenges to ETF liquidity, as the issuing and redeeming of *creation units* become increasingly difficult under stressed conditions. Some market makers use derivatives to side-step the illiquidity issue, but given that such instruments are either absent or too expensive in most emerging markets, turnovers in such ETFs are typically low.⁷¹ As a significant number

of turnovers do not happen on an exchange but are rather over-the-counter transactions, liquidity is difficult to assess under stressed conditions.

Market Disruptions

The recent increase in commodity price volatility has been partly attributed to the strong flows into commodities-based funds, particularly gold ETFs, amid mounting concerns that the flows are distorting prices away from fundamental factors. Gold ETF funds received net inflows of around \$12 billion in 2009 and another \$9 billion in 2010 as prices surged 62 percent in the two years to over \$1,400 an ounce.⁷² However, flows sharply reversed course in January 2011, with \$3 billion in outflows in one month alone, driving prices sharply lower (Figure 1.64). Such dynamics raise concerns that a reversal of investor flows from other commodity-based funds could potentially increase volatility in the broader market and influence price action in related sector indices. Data show that assets under management in commodity-based funds (including mutual funds, ETFs, and index-linked funds) stood at over \$320 billion in 2010:Q3.

Legal and Policy Risks

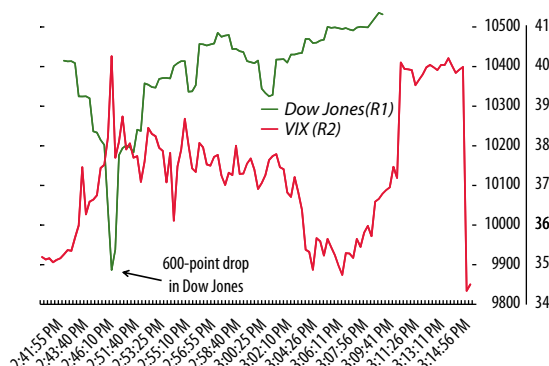
Bankruptcy laws surrounding counterparty defaults and the potential freezing up of collateral at custodial banks remain areas of concern for ETFs involved in TRS and securities lending. In a variation of the swap-based ETF, the provider sometimes transfers all the cash from investors to the TRS counterparty, which in turn pledges collateral to the ETF's account at the fund's custodian bank.⁷³ In such a scenario, if the swap counterparty were to default, it could potentially lead the bankruptcy administrator to freeze all ETF assets, preventing the ETF from liquidating its assets if the need arises. Also, the TRS counterparty has an incentive to provide lower-quality collateral in such an exchange,

⁷⁰On May 6, 2010, the Dow Jones index plunged 600 points within minutes, resulting in several thousand trades being canceled that day. Data show that ETFs were most affected during that incident—nearly 68 percent of all cancelled trades involved ETFs.

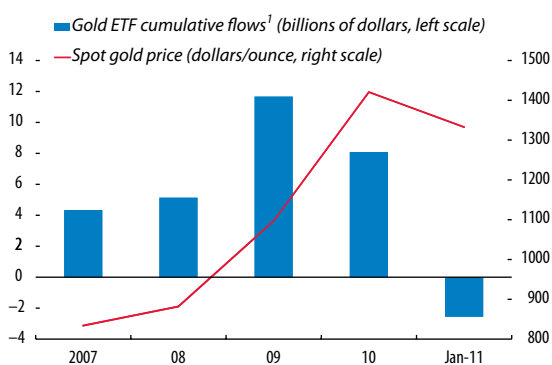
⁷¹Calculated as total shares traded on a monthly basis divided by the ETF's price.

⁷²Most large gold ETFs (such as SPDR Gold Shares ETF) physically hold gold bullion, while others (such as Powershares DB Gold ETF) track the performance of reference indices.

⁷³This agreement is commonly referred to as a fully funded swap. Following Lehman's collapse in 2008, several funds could not access their assets parked at custodial banks because of the bankruptcy proceedings.

Figure 1.63. Flash Crash: Intraday Prices, May 6, 2010

Source: Bloomberg L.P.
 Note: VIX = Index for S & P 500 volatility; Dow Jones = Dow Jones Industrial Average for U.S. stocks.

Figure 1.64. Gold Exchange-Traded Funds

Sources: Bloomberg L.P.; IndexUniverse; and IMF staff estimates.
¹Cumulative annual net flows of large gold exchange-traded funds (ETFs) only.

leaving the ETF provider with potentially illiquid assets to offload in the case of a default of the counterparty.

Separately, local tax laws can affect nonresident investors quite differently, particularly pertaining to dividend withholding. Some ETFs are designed to take advantage of the tax arbitrage between two regional jurisdictions. These strategies have been a source of friction between local authorities and foreign investors, leaving such funds exposed to sudden policy shifts aimed at closing the tax loopholes.

Conclusions

The growth of exchange-traded funds is likely to accelerate over the near term, given their cost advantages and the increased access to emerging markets that they provide. Some analysts put the annual growth estimate at roughly 20–30 percent, citing the growing interest among hedge funds to create and distribute ETFs to a broader investor base. However, this outlook also signals that ETF providers are likely to venture further into more complex instruments to replicate and magnify index returns in relatively closed economies. Regulators in the United States and Europe are beginning to take note of this trend toward complexity, even as investors are calling for a move toward exchange trading of the derivatives-based ETFs, standardizing of reporting, and increasing the transparency of securities lending practices.

References

- Bank of England, 2010, *Financial Stability Report* (London, December).
- Basel Committee on Banking Supervision (BCBS), 2010a, “Basel III: A Global Regulatory Framework for More Resilient Banks and Banking Systems” (Basel: Bank for International Settlements, December). Available via the Internet: www.bis.org/publ/bcbs189.htm.
- _____, 2010b, “Basel III: International Framework for Liquidity Risk Measurement, Standards and Monitoring” (Basel: Bank for International Settlements, December). Available via the Internet: www.bis.org/publ/bcbs188.htm.
- Bhutta, Neil, Jane Dokko, and Hui Shan, 2010, “The Depth of Negative Equity and Mortgage Default Decisions,” Finance and Economics Discussion Series No. 2010-35 (Washington: Board of Governors of the Federal Reserve

- System, May). Available via the Internet: www.federalreserve.gov/pubs/feds/2010/201035/index.html.
- Calvo, Guillermo, Alejandro Izquierdo, and Ernesto Talvi, 2006, "Phoenix Miracles in Emerging Markets: Recovering without Credit From Systemic Financial Crises," Working Paper No. 570 (Washington: Inter-American Development Bank). Available via the Internet: www.iadb.org/res/publications/pubfiles/pubWP-570.pdf.
- CoreLogic, 2010, "Negative Equity Report Q2 2010." Available via the Internet: www.corelogic.com/uploadedFiles/Pages/About_Us/ResearchTrends/CL_Q2_2010_Negative_Equity_FINAL.pdf.
- Dattels, Peter, Rebecca McCaughrin, Ken Miyajima, and Jaume Puig, 2010, "Can You Map Global Financial Stability?" IMF Working Paper No. 2010/145 (Washington: International Monetary Fund).
- Elul, Ronel, Nicholas S. Souleles, Souphala Chomsisengphet, Dennis Glennon, and Robert Hunt, 2010, "What 'Triggers' Mortgage Default?" Working Paper No. 10-13 (Philadelphia: Federal Reserve Bank of Philadelphia, April). Available via the Internet: www.philadelphiafed.org/research-and-data/economists/elul.
- Federal Deposit Insurance Corporation (FDIC), 2011, Opening address, FDIC Chairman Sheila C. Bair, Summit on Residential Mortgage Servicing for the 21st Century, sponsored by the Mortgage Bankers Association, January 19. Available via the Internet: www.fdic.gov/news/news/speeches/chairman/spjan1911.html.
- Financial Stability Board (FSB), 2010a, "Reducing the Moral Hazard Posed by Systemically Important Financial Institutions" (Basel, October 20). Available via the Internet: www.financialstabilityboard.org/search/?sp_q=reducing+the+moral+hazard+of+systemically+important+financial+institutions&adv=1.
- _____, 2010b, "Implementing OTC Derivatives Market Reforms" (Basel, October 25). Available via the Internet: www.financialstabilityboard.org/publications/r_101025.pdf.
- _____, 2010c, "Principles for Reducing Reliance on CRA Ratings" (Basel, October 27). Available via the Internet: www.financialstabilityboard.org/publications/r_101027.pdf.
- Financial Stability Forum (FSF), 2009, "Report of the Financial Stability Forum on Addressing Procyclicality in the Financial System" (Basel, April 2). Available via the Internet: www.financialstabilityboard.org/publications/r_0904a.pdf.
- Fitch Ratings, 2010, "U.S. RMBS Servicers' Loss Mitigation and Modification Efforts Update II" (New York and London, June 16). Available via the Internet (by subscription): www.fitchratings.com.
- Gagnon, Joseph, Brian Sack, Julie Remache, and Matthew Raskin, 2010, "Large-Scale Asset Purchases by the Federal Reserve: Did They Work?" Staff Reports No. 441 (New York: Federal Reserve Bank of New York). Available via the Internet: www.newyorkfed.org/research/staff_reports/sr441.html.
- Goodman, Laurie, 2010, "Strategic Defaults," Amherst Securities Group LP, report presented at CoreLogic Risk Summit, August.
- International Monetary Fund, 2008, "United States: 2008 Article IV Consultation—Staff Report," IMF Country Report No. 2008/255 (Washington, July). Available via the Internet: www.imf.org/external/pubs/cat/longres.aspx?sk=22213.0.
- _____, 2009a, "United States: 2009 Article IV Consultation—Staff Report," IMF Country Report No. 2009/228 (Washington, July). Available via the Internet: www.imf.org/external/pubs/ft/scr/2009/cr09228.pdf.
- _____, 2009b, *Global Financial Stability Report*, World Economic and Financial Surveys (Washington, October). Available via the Internet: www.imf.org/external/pubs/ft/gfsr/2009/02/index.htm.
- _____, 2010a, *Global Financial Stability Report*, World Economic and Financial Surveys (Washington, April). Available via the Internet: www.imf.org/external/pubs/ft/gfsr/2010/01/index.htm.
- _____, 2010b, "United States: 2010 Article IV Consultation—Staff Report," IMF Country Report No. 2010/249 (Washington, July). Available via the Internet: www.imf.org/external/pubs/cat/longres.aspx?sk=24107.0.
- _____, 2010c, "United States: Publication of Financial Sector Assessment Program Documentation—Financial System Stability Assessment," IMF Country Report No. 2010/247 (Washington, July). Available via the Internet: <https://www.imf.org/external/pubs/cat/longres.aspx?sk=24105.0>.
- _____, 2010d, "United States: Selected Issues Paper," IMF Country Report No. 2010/248 (Washington, July). Available via the Internet: <http://imf.org/external/pubs/cat/longres.aspx?sk=24106.0>.
- _____, 2010e, *Global Financial Stability Report*, World Economic and Financial Surveys (Washington, April). Available via the Internet: <http://www.imf.org/external/pubs/ft/gfsr/2010/02/index.htm>.
- _____, 2011a, "Experience in Managing Capital Flows: Cross-Cutting Themes and Proposed Guidelines for Emerging Markets" (unpublished; Washington).
- _____, 2011b, *Fiscal Monitor*, World Economic and Financial Surveys (Washington, April). Available via the

- Internet: www.imf.org/external/pubs/ft/fm/2011/01/fmindex.htm.
- _____, 2011c, *World Economic Outlook*, World Economic and Financial Surveys (Washington, April). Available via the Internet: www.imf.org/external/pubs/ft/weo/2010/01/index.htm.
- International Organization of Securities Commissions (IOSCO), 2009, "Hedge Funds Oversight: Final Report" (Madrid, June). Available via the Internet: www.iosco.org/library/pubdocs/pdf/IOSCOPD293.pdf.
- Jones, Matthew, and Meral Karasulu, 2006, "The Korean Crisis: What Did We Know and When Did We Know It? What Stress Tests of the Corporate Sector Reveal," IMF Working Paper No. 2006/114 (Washington: International Monetary Fund). Available via the Internet: www.imf.org/external/pubs/cat/longres.aspx?sk=19137.0.
- Laeven, Luc, and Thomas Laryea, 2009, "Principles of Household Debt Restructuring," IMF Staff Position Note No. 2009/15 (Washington: International Monetary Fund). Available via the Internet: www.imf.org/external/pubs/cat/longres.aspx?sk=23041.0.
- Levitin, Adam J., and Tara Twomey, 2011, "Mortgage Servicing," *Yale Journal on Regulation*, Vol. 28., No. 1. Available via the Internet: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1324023.
- MacroMarkets, 2010, Home Price Expectations Survey (December). Available via the Internet: www.macromarkets.com/recent_news/press_releases/2010/20101221_housing-survey.pdf.
- U.S. Treasury, 2010, "Making Home Affordable Program: Servicer Performance Report through November 2010." Available via the Internet: www.financialstability.gov/docs/Nov%202010%20MHA%20Report.pdf.
- Viñals, José, and Jonathan Fiechter, with Aditya Narain, Ian Tower, Jennifer Elliott, Pierluigi Bologna, and Michael Hsu, 2010, "The Making of Good Supervision: Learning to Say 'No'," IMF Staff Position Note No. 2010/08 (Washington: International Monetary Fund). Available via the Internet: www.imf.org/external/pubs/ft/spn/2010/spn1008.pdf.
- Viñals, José, Jonathan Fiechter, Ceyla Pazarbasioglu, Laura E. Kodres, Aditya Narain, and Marina Moretti, 2010, "Shaping the New Financial System," IMF Staff Position Note No. 2010/15 (Washington: International Monetary Fund). Available via the Internet: www.imf.org/external/pubs/ft/spn/2010/spn1015.pdf.

Summary

The financial crisis highlighted the lack of sound liquidity risk management at financial institutions and the need to address systemic liquidity risk—the risk that multiple institutions may face simultaneous difficulties in rolling over their short-term debts or in obtaining new short-term funding through widespread dislocations of money and capital markets. Under Basel III, individual banks will have to maintain higher and better-quality liquid assets and to better manage their liquidity risk. However, because they target only individual banks, the Basel III liquidity rules can play only a limited role in addressing systemic liquidity risk concerns. Larger liquidity buffers at each bank should lower the risk that multiple institutions will simultaneously face liquidity shortfalls; but the Basel III rules do not address the additional risk of such simultaneous shortfalls arising out of the interconnectedness of various institutions across a host of financial markets. More needs to be done to develop macroprudential techniques to measure and mitigate systemic liquidity risks.

The chapter suggests three separate methods of measuring systemic liquidity risk, each of which could be used to construct a macroprudential tool. Each technique measures an institution's ongoing contribution to systemwide liquidity risk, thereby establishing an objective basis on which to charge an institution for the externality it imposes on the financial system. The details of the methods described here are only illustrative. Moreover, it is unrealistic to expect there to be a single, best measure for systemic liquidity risk, so the three measures should be viewed as complementary.

The chapter does not take a view on the type of charge that would be best for mitigating systemic liquidity risk—a macroprudential capital surcharge, fee, tax, insurance premium, or some other instrument. Rather, it stresses the importance of having a macroprudential tool that would allow for a more effective private-public burden sharing of systemic liquidity risk management, which in turn would help minimize the tendency for financial institutions to collectively underprice liquidity risk in good times.

The approach taken to address systemic liquidity risk should be multipronged and build on the recommendations made in the October 2010 GFSR, which noted that improvements in market infrastructure could help mitigate systemic liquidity risks. For instance, some risks associated with collateral management in secured funding markets could be addressed through greater use of central counterparties for repurchase agreements and through-the-cycle haircuts, or minimum haircut requirements, for collateral. Also, nonbank financial institutions that contribute to systemic liquidity risk should receive more oversight and regulation. Many of these recommendations are still being implemented.

Policy makers will need to be conscious of the interactive effects of multiple approaches to mitigate systemic risks. For instance, add-on capital surcharges or other tools to control systemic solvency risk could also help lower systemic liquidity risk, allowing less reliance on mitigation techniques that directly address liquidity. Finally, more needs to be done to strengthen the disclosure of detailed information on various liquidity risk measures. Greater transparency would help the market and authorities assess the robustness of individual institutions' liquidity management practices, potentially allowing official liquidity support to be minimized, better targeted, and more effectively provided.

A defining characteristic of the 2007–08 financial crisis was the simultaneous and widespread dislocation in funding markets—that is, the inability of multiple financial institutions to roll over, or obtain, new short-term funding.¹ The crisis further revealed that liquidity risk at financial institutions had significant consequences for financial stability and macroeconomic performance, in part through the banks’ common asset exposures and their increased reliance on short-term wholesale funding. Liquidity risk management decisions made by institutions spilled over to other markets and other institutions, contributing to others’ losses and exacerbating overall liquidity stress.

The freezing up of markets at the peak of the financial crisis required massive official intervention, cross-border coordination, and adjustments to central bank liquidity operations to stabilize the financial system and restore orderly market conditions. Central banks had to assume the role of the money market in distributing liquidity as banks and other lenders shunned each other, particularly beyond very short term maturities, because of rising counterparty risk concerns. Some central banks are still actively supporting the money market. The extent of official intervention is clear evidence that systemic liquidity risks were underrecognized and mispriced by both the private and public sectors.

To avoid a repeat of such events, the Group of Twenty (G-20) has called for increased liquidity buffers in financial institutions and more recently has requested an examination of the contributing role of so-called shadow banks to the buildup of systemic liquidity risk. A number of reforms and initiatives are under way to address shortcomings in financial institutions’ liquidity practices. Under its new international regulatory framework for banks, known as Basel III, the Basel Committee on Banking Supervision (BCBS) has issued two new quantitative liquidity standards to be applied at a global

level, and it has issued qualitative guidance to strengthen liquidity risk management practices in banks.

So far, however, policymakers have not established a macroprudential framework that mitigates systemwide, or systemic, liquidity risk. Systemic liquidity risk is the tendency of financial institutions to collectively underprice liquidity risk in good times when funding markets function well because they are convinced that the central bank will almost certainly intervene in times of stress to maintain such markets, prevent the failure of financial institutions, and thus limit the impact of liquidity shortfalls on other financial institutions and the real economy. If they ignore the tendency to underprice liquidity risk prior to the emergence of shortfalls and then intervene during times of systemic stress, central banks will reinforce these negative externalities and give financial institutions an incentive to hold less liquidity than needed.

Overall, macroprudential regulations that more accurately price the cost of official contingent liquidity support aim to eliminate unnecessary liquidity support by the public sector by better aligning private incentives. This realignment can be achieved in various ways, and this chapter does not take a stand on the type of macroprudential tool to be used: that is, whether a capital surcharge, a fee, a tax, or an insurance premium for contingent liquidity access is the best method. The first priority is to design some type of price-based assessment that would allow for a more effective private-public burden sharing of systemic liquidity risk management; the difficult issues of exactly how to implement it, and who should do so, can be tackled secondarily.

A macroprudential tool that charges an institution for its contribution to systemic liquidity risk presupposes a robust methodology for measuring such risk. This chapter suggests three separate measures of systemic liquidity risk, each of which can be used as the basis for a practical macroprudential tool that could help mitigate it. The methods are only illustrative—a “proof of concept”—in part because only publicly available data are used.

This chapter continues the October 2010 GFSR treatment of the same topic, which focused on funding markets and institutions’ interaction through them. It put forward recommendations to strengthen infrastructure and correct market practices that generate simultaneous and widespread dislocation in funding markets. In contrast, however, this chapter focuses on how to measure systemic liquidity risk through time, an individual

Note: This chapter was written by Jeanne Gobat (team leader), Theodore Barnhill, Jr. (George Washington University), Andreas Jobst, Turgut Kisinbay, Hiroko Oura, Tiago Severo, and Liliana Schumacher. Research support was provided by Ivan Guerra, Oksana Khadarina, and Ryan Scuzzarella.

¹See the October 2010 *Global Financial Stability Report* (GFSR) for a fuller discussion of the factors that contributed to systemic liquidity stress, including the role of various funding markets, and policy recommendations to strengthen the resilience of funding markets.

institution's contribution to this risk, and the tools to mitigate that risk. Overall, of course, financial sector reforms in this area need to tackle both financial markets and institutions. As noted in Chapter 2 of the October 2010 GFSR, greater use of central counterparties for repurchase agreements (repos) and better recording of over-the-counter transactions in repositories could help lower counterparty risk associated with systemic liquidity risk. That chapter further noted that some risks associated with collateral risk management in secured funding markets could be potentially addressed by requiring through-the-cycle haircuts or minimum haircut requirements for collateral. The chapter also noted that money market mutual funds and other nonbank institutions in the shadow banking industry contribute to systemic liquidity risk and require more oversight and regulation.

Systemically important financial institutions (SIFIs) contribute to systemic liquidity risks through size and connectedness with other financial institutions, including through excessive reliance on the same providers of liquidity and large common exposures to similar types of assets. Macroprudential instruments such as add-on capital surcharges or other tools to control systemic solvency risk among SIFIs should also help lower systemic liquidity risk. That is, if other means are effective in capturing the systemic liquidity risk, all the better, as then less reliance on mitigation techniques is needed. Any set of instruments would need to be regularly updated and sufficiently flexible and time-varying to account for all SIFIs and their changing contribution to systemic solvency and liquidity risk over time.

After providing a brief definition of systemic liquidity risk and the difficulty in measuring it, the chapter assesses the quantitative Basel III liquidity rules for banks and notes their limitations in mitigating systemic liquidity risk. It then presents three different approaches to measuring systemic liquidity risk that can be used to construct macroprudential tools to mitigate it. The chapter concludes with some policy recommendations and compares the prudential measures presented here with other recent proposals.

What Is Systemic Liquidity Risk?

Little progress has been made so far in addressing systemic liquidity risk in a comprehensive way. The

slow progress reflects the rarity of systemic liquidity events, the changing and complex interactions between various types of institutions in funding markets, and the conceptual difficulty in modeling them.

The chapter takes the view that liquidity risk can materialize in two basic forms:

- Market liquidity risk, which is the risk that a firm will not be able to sell an asset quickly without materially affecting its price;² and
- Funding liquidity risk, which is the risk that a firm will not be able to meet expected cash flow requirements (future and current) by raising funds on short notice.

The two types of liquidity risks can interact with each other and, through markets, affect multiple institutions. In periods of rising uncertainty, the interaction can give rise to systemic liquidity shortfalls. A negative spiral between market and funding liquidity can develop whereby a sudden lack of funding leads to multiple institutions attempting to sell their assets simultaneously to generate cash. These correlated fire sales of assets may lead suppliers of liquidity to insist on higher margin and larger haircuts (the deduction in the asset's value used as collateral) as the value of collateral (assets pledged) declines. Creditors may become even less likely to provide funding, fearing insolvency of their counterparties, resulting in significant funding disruptions.³ This self-reinforcing process can lead to downward cascades in asset prices and to further declines in a firm's net worth, morphing into a systemic crisis as many institutions become affected.

This interaction underscores the difficulty of disentangling the risk of systemic insolvency from that of systemic illiquidity because the two are closely linked. A key question is whether liquidity events emerge in isolation or whether they are caused by the heightened perception of rising counterparty and default risk of financial institutions. The analysis below uses various

²Market liquidity can also be defined as the difference between the transaction price and the fundamental value of a security (Brunnermeier and Pedersen, 2009).

³See Gorton and Metrick (2009), Brunnermeier and Pedersen (2009), and Shleifer and Vishny (2010) for a discussion of how margin spirals, increases in haircuts on repos, and fire sales affect a firm's ability to borrow, its solvency, and the overall fragility of the financial system.

techniques to attempt to better isolate the systemic liquidity component of a systemic financial crisis.

There is no commonly accepted definition of systemic liquidity risk. This chapter defines it as the risk of simultaneous liquidity difficulties at multiple financial institutions. Such institutions may include not only banks but all financial institutions that engage in maturity transformation by acquiring in markets short-term liabilities to fund longer-term assets and that are thus vulnerable to liquidity runs and shortfalls.

Will Liquidity Rules under Basel III Lower Systemic Risk?

This section evaluates the two proposed liquidity standards for liquidity risk management for banks by the BCBS under Basel III and assesses whether they will help alleviate systemic liquidity risk.

Basel III establishes two liquidity standards—a liquidity coverage ratio (LCR) and a net stable funding ratio (NSFR) to be introduced after an observation period and further refinements. Principles for liquidity risk management existed before the crisis, but these rules represent the first time that quantitative standards for liquidity risk have been set at a global level.⁴

The LCR aims to improve a bank's ability to withstand a month-long period of liquidity stress as severe as that seen in the 2007–08 financial crisis. The LCR is defined as the “stock of high-quality liquid assets” divided by a measure of a bank's “net cash outflows over a 30-day time period.” The resulting ratio should be at least 100 percent. High-quality assets are mostly government bonds and cash, and a maximum of 40 percent of mortgage and corporate bonds may be of a certain lower credit quality. The size of the net outflow is based on assumed withdrawal rates for deposits and short-term wholesale liabilities and the potential drawdown of contingency facilities. The LCR assumes a 100 percent drawdown of interbank deposits and all other short-term financial instruments of less than 30 days' maturity.

⁴The latest version of the framework was published in December 2010. An observation period will precede official implementation of the ratios as a minimum standard. In both cases, any revisions to the factors will be finalized one and a half years before their official implementation, which will be on January 1, 2015 for the LCR and January 1, 2018 for the NSFR.

This chapter could not evaluate the LCR primarily because it required information on the credit quality, ratings, and liquidity characteristics of the ratio's so-called Level II assets—such as covered bonds, rated corporate bonds, and agency debt—that are not publicly available. Furthermore, its analysis would require knowledge of the duration and composition of assets and liabilities, including off-balance-sheet exposures, to calculate the net cash flow impact of stress during a 30-day period. This information is also not available publicly.

The NSFR aims to encourage more medium- and long-term funding of the assets and activities of banks, including off-balance-sheet exposures as well as capital market activities, and thereby reduce the extent of maturity mismatch at the bank. In theory, this would lower a bank's probability of liquidity runs and associated default. The ratio is defined as a bank's available stable funding (ASF) divided by its required stable funding (RSF) and must be greater than 100 percent. It is intended to support the institution as a going concern for at least one year if it is subject to firm-specific funding stress.⁵

Impact of the Net Stable Funding Ratio on Globally Oriented Banks

An NSFR was calculated with publicly available data for each of 60 globally oriented banks in 20 countries and three regions (Europe, North America, and Asia). The institutions encompass commercial, universal, and investment banks. An additional 13 banks that became insolvent during the recent crisis were added to the sample to analyze the predictive power of the NSFR.

To try to calculate a realistic NSFR, a number of assumptions had to be made on how to apply the Basel III weights, or factors, to the components making up the ASF and RSF. These assumptions reflected broad interpretations of the liquidity and stability characteristic of banks' balance sheets (Table 2.1).⁶ The factors were applied uniformly and consistently across all banks. Overall, however, data issues remain

⁵The metric is covered in more detail in BCBS (2010a).

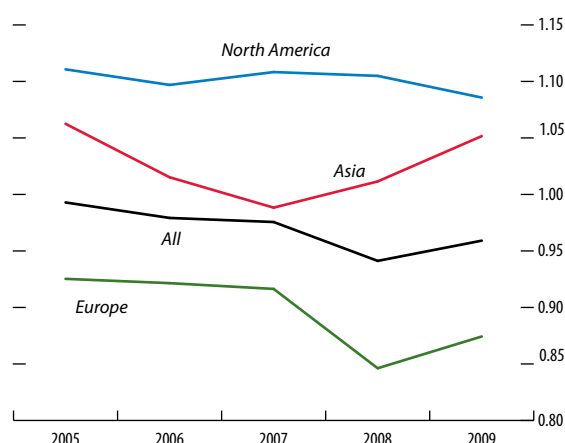
⁶Annual balance sheet data from Bankscope covering the period 2005–09 were used in addition to the banks' annual reports. Stable funding is required for all illiquid assets and securities held, regardless of accounting treatment (for example, trading versus available-for-sale or held-to-maturity designations).

a challenge in the analysis of the NSFR. The internal financial reporting systems at many banks are not consistent with the Basel categories. Further, the lack of harmonized public financial accounting data hinders a comparison of the rules across banks and jurisdictions.⁷ Moreover, some Basel III definitions, such as the treatment of customer deposits and the notion of their stability, are not entirely clear.

Calculations of maturity mismatches, as proxied by the NSFR, deteriorated before and during the crisis (Figure 2.1).⁸ The average NSFR ratio hovered just below 100 percent before the crisis, worsened in 2008, and then improved slightly in 2009. A regional breakdown shows that the NSFR at European banks declined during the crisis, with the ratio improving somewhat in 2009. The NSFR for North American banks declined slightly with the start of the crisis but remained above 100 percent, while Asian banks improved their ratio during the crisis, staying above 100 percent. The recent shortening in the maturity profile among some banks reflects a shorter-term funding structure, including the availability of cheap, safe, and ample central bank financing as well as the requirement to include some off-balance-sheet liquidity commitments on their balance sheets.⁹

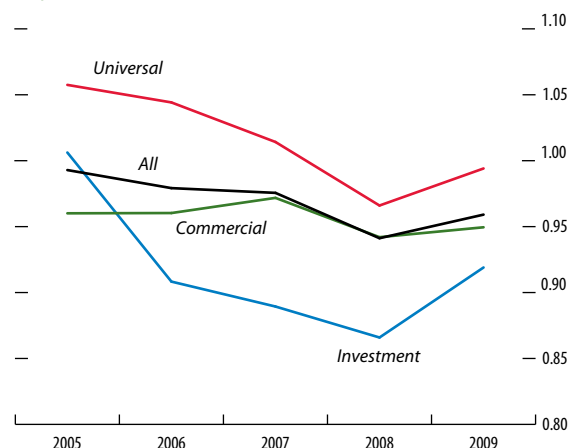
The NSFR declined more sharply for investment and universal banks than for commercial banks (Figure 2.2). The funding profiles improved in 2009 across business models, where universal banks reached the 100 percent threshold. For commercial banks, a key driver of the ratio is their exposure to illiquid loans, which carry a higher RSF factor. Investment banks and universal banks that have investment banking activities exhibit higher variation in the NSFR through time, in

Figure 2.1. Net Stable Funding Ratio by Region
(In percent)



Sources: Bankscope; and IMF staff calculations.

Figure 2.2. Net Stable Funding Ratio by Business Model
(In percent)



Sources: Bankscope; and IMF staff calculations.

⁷The treatment of derivatives is such a case. Banks operating under International Financial Reporting Standards (IFRS) report gross derivative positions, while those under generally accepted accounting principles (GAAP) report netted positions. This can make a difference of up to 20 percent of the balance sheet in some cases. The compromise adopted in this exercise in calculating the NSFR is to net the derivatives and apply a factor to the balance. Another case is decomposition of securities data for investment banks. Part of the securities held by investment banks is highly structured and illiquid, but a breakdown is not available. It is assumed that 30 percent of securities are illiquid or held to maturity, and require stable funding.

⁸Available data run only through the end of 2009.

⁹See Chapter 1 for a more detailed discussion of the refinancing risks of the banking sector.

Table 2.1. Factors Used in Calculations

Available Stable Funding	Factor	Required Stable Funding	Factor
Equity	1.00	Cash	0.00
Tier 2	1.00	<i>Customer loans</i>	0.75
<i>Demand deposits</i>	0.80	<i>Commercial loans</i>	0.85
<i>Saving and term deposits</i>	0.85	<i>Advances to banks</i>	0.00
<i>Bank deposits</i>	0.00	<i>Other commercial and retail loans</i>	0.85
<i>Other deposits and short-term borrowing</i>	0.00	<i>Other loans</i>	1.00
<i>Derivative liabilities</i>	0.00	<i>Derivative assets</i>	0.90
<i>Trading liabilities</i>	0.00	<i>Trading securities</i>	0.15
Senior debt maturing after one year	1.00	<i>Available for sale securities</i>	0.15
Other long-term funding	1.00	Held-to-maturity securities	1.00
Other noninterest-bearing liabilities	0.00	Investments in associates	1.00
Other reserves	1.00	Other earning assets	1.00
		Insurance assets	1.00
		Residual assets	1.00
		Reserves for nonperforming loans	1.00
		Contingent funding	0.05

Sources: Bankscope; and IMF staff calculations.

Note: Categories in italics are IMF staff judgments.

part reflecting their greater reliance on wholesale funding but also their more flexible business models that can adjust to changing circumstances.¹⁰

A cross-section of calculations for 2009 shows that the average NSFR is about 96 percent, just below the “greater than 100 percent” threshold, and that the estimated gap between the ASF and RSF for the 60 global banks is about \$3.1 trillion—that is, if they were to attain an NSFR of greater than 100 percent, they would need to raise a total of \$3.1 trillion in stable funds (Figure 2.3). Close to one-third of the banks each have an NSFR greater than 100 percent, and about half of the banks have an NSFR greater than 90 percent. In comparison, the impact study by the BCBS (2010b) finds that, for 94 large global banks, the average NSFR is 93 percent. For Europe, the Committee of European Banking Supervisors (2010) finds an average estimated NSFR of 91 percent for 50 large banks.

Finally, empirical evidence is mixed, at best, regarding the NSFR’s ability to signal future failures due to liquidity problems (Box 2.1). For a sample of 60 banks, end-2006 data show that seven of the

13 failed banks had an NSFR ratio below 100 percent (with one bank significantly below), but overall, the banks that failed during the crisis are evenly distributed across the range of NSFRs. This empirical weakness could reflect assumptions made in the construction of the NSFR, given the lack of detailed data, or that a number of contingent claims, including those related to special investment vehicles, which created a significant drain on banks’ liquidity, are not properly accounted for. The empirical outcome for the NSFR could also be weakened if failed banks in the sample suffered more from solvency problems and rising counterparty concerns than from liquidity problems.

Pros and Cons and Limitations of Basel III in Addressing Systemic Liquidity Risk

The new liquidity standards are a welcome addition to firm-level liquidity risk management and microprudential regulation. Combined with improved supervision, these rules should help strengthen liquidity management and the funding structure of individual banks and thereby enhance the stability of the banking sector.

In addition, by raising liquidity buffers and reducing maturity mismatches at individual firms, Basel III indirectly addresses systemic liquidity risk because

¹⁰See Ötörker-Robe and Pazabasioglu (2010) for a study on the impact of regulatory reforms on large complex financial institutions.

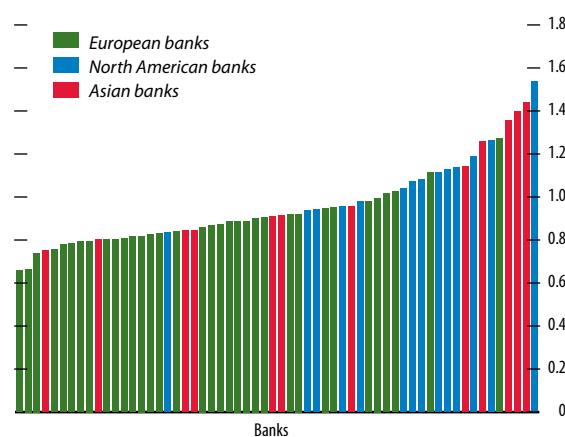
it reduces the chance that numerous institutions will have a simultaneous need for liquidity. Moreover, the new standards penalize exposures to other financial institutions; in this way they reduce the interconnect- edness in the financial system and hence the likelihood of interrelated liquidity losses.

A well-calibrated LCR and NSFR can contribute to the liquidity and funding stability of banks. Further quantitative impact studies are needed to ensure that the factors in the construction of the NSFR are desirable from a financial stability perspective. Moreover, policy- makers need to be sure that weights and factors that feed into the calibrations do not excessively restrict banks in their ability to undertake maturity transformation or in the ability of money markets to act as a buffer in helping institutions manage short-term liquidity. If the calibration is too restrictive, it could encourage migration of some banking activities into the less-regulated financial system, including toward shadow banks, and potentially accentu- ate rather than alleviate systemic risk. A way to address the latter problem would be to extend the quantitative liquidity requirements to these less-regulated institutions.

Policymakers also need to be mindful that the rules do not result in unintended consequences for financial stability. A too-stringent set of rules may force banks to take similar actions to reach compliance, resulting in high correlation across certain types of assets and con- centrations in some of them. The LCR may lead to high holdings in eligible liquid assets that could effectively reduce their liquidity during a systemic crisis. Applying uniform quantitative standards across bank types and jurisdictions has its advantages, but the standards may not be suitable for all countries. For instance, a number of countries may not have the markets to extend term funding for banks given the absence of a bond market in domestic currency, and doing so would require banks to take on exchange rate risks.¹¹

More broadly, at their core the Basel III rules are microprudential, aimed at encouraging banks to hold higher liquidity buffers and to lower maturity mismatches to lower the probability that any individual institution will run into liquidity problems. They are not intended or designed to mitigate systemic liquidity risks, where

Figure 2.3. Net Stable Funding Ratio by Bank, 2009
(In percent)



Sources: Bankscope; and IMF staff calculations.

¹¹The BCBS is considering ways to account for the challenges faced by some countries that do not have a large enough domestic government debt market.

Box 2.1. How Well Does the Net Stable Funding Ratio Predict Banks' Liquidity Problems?

Although the net stable funding ratio (NSFR) was not designed as a predictor of liquidity difficulties, it is useful to ask whether banks that failed during the crisis had NSFRs that under Basel III would have been deemed deficient prior to their failure—that is, well below 100 percent. The analysis shows that the NSFR may have some capacity to signal future liquidity problems, but it would have done so inconsistently prior to the 2007–08 crisis.

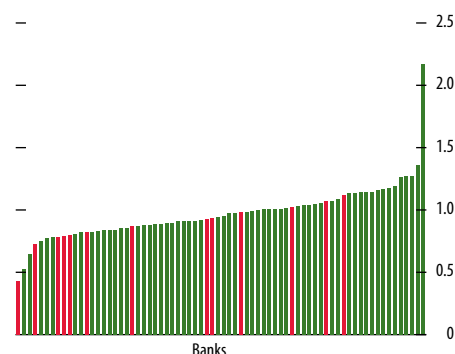
The predictive power of the NSFR for liquidity problems ahead of the 2007–08 financial crisis is explored by calculating the end-2006 NSFR of 60 banks. The exercise also includes 13 failed banks. The challenge in any such analysis is to be able to separate liquidity from solvency problems. When a bank is perceived as insolvent, its funding options can quickly become circumscribed. Similarly, if a bank has severe liquidity problems, it may be forced to sell its assets at fire sale prices, accruing large losses with potential implications for its solvency.

Nevertheless, some studies show that problems at Northern Rock and HBOS, two U.K. banks that failed during the crisis, had less to do with credit-related problems than with funding risk due to their overreliance on securitization and short-term wholesale funding, including asset backed commercial paper, to fund longer-term illiquid assets.¹ Wholesale funding accounted for a considerable portion of the funding sources for these banks, and they were most vulnerable to the rapidly deteriorating conditions in the wholesale funding markets.

Note: This box was prepared by Turgut Kisinbay.

¹See the October 2010 GSFR, *Financial Times* (2008), and Shin (2009).

Net Stable Funding Ratio Estimates for an Expanded Set Including Failed Banks, 2006
(In percent)



Sources: Bankscope; and IMF staff calculations.
Note: Failed banks are depicted in red.

The box figure suggests that, by itself, the NSFR may not be a reliable indicator of future bank liquidity problems; failed banks are close to evenly distributed across the range of NSFRs. The ambiguous result may in part be explained by possible data inconsistencies that can affect the calculation of the NSFR. This includes the different treatment of special purpose vehicles (SPVs). In most jurisdictions exposures to SPVs were reported off-balance sheet before the crisis, but recently they have been better captured in bank disclosures. The NSFR may still be indicative of potential liquidity problems, as half of the banks below the 80 percent level did have such problems. Nevertheless, other complementary indicators and tools are necessary to gauge liquidity risks.

the interactions of financial institutions can result in the simultaneous inability of institutions to access sufficient market liquidity and funding liquidity under stress. Unless the liquidity requirements are set at an extremely high level for all institutions, resulting in a prohibitive cost to the real economy, the possibility always exists that a systemic liquidity event will exhaust all available liquidity. In such circumstances, central bank support is war-

ranted to assure that systemic liquidity shortfalls do not morph into large-scale solvency problems and undermine financial intermediation and the real economy.

Policymakers have not established a macroprudential framework that mitigates systemwide, or systemic, liquidity risk. A problem so far has been the lack of analysis of how to measure systemic liquidity risk and the extent to which an institution contributes to this risk.

Measures of Systemic Liquidity Risk and Potential Macroprudential Tools to Mitigate It

The section presents three separate methods that illustrate the possibilities for measuring systemic liquidity risk and for creating macroprudential tools to mitigate it. These tools are complementary to the Basel III liquidity standards and would accomplish two goals: (1) measure the extent to which an institution contributes to systemic liquidity risk; (2) use this to indirectly price the liquidity assistance that an institution would receive from a central bank. Proper pricing of this assistance would help lower the scale of liquidity support warranted by a central bank in times of stress.

The methods are (1) a systemic liquidity risk index (SLRI), that is, a market-based index of systemic liquidity based on violations of common arbitrage relationships; (2) a systemic risk-adjusted liquidity (SRL) model, based on a combination of balance sheet and market data and on options pricing concepts for a financial institution, to calculate the joint probability of simultaneous liquidity shortfalls and the marginal contribution of a financial institution to systemic liquidity risk; and (3) a macro stress-testing model to gauge the effects of an adverse macroeconomic or financial environment on the solvency of multiple institutions and in turn on systemic liquidity risk.

All three methods use publicly available information but vary in degree of complexity (Table 2.2). Although the focus here is on banks, given data limitations, the methodologies are sufficiently flexible to be used for nonbank institutions that contribute to systemic liquidity risk. Indeed, the proposals build on several strands of recent research that focus on the interactions between financial institutions and markets in the context of systemic liquidity risk.

All three methods combine a cross-sectional dimension (i.e., linkages in liquidity risk exposures across markets and institutions) and a time dimension (i.e., noting changes though time of the various components of liquidity risk) in measuring systemic liquidity risk. Both elements capture developments over time in key market liquidity and funding liquidity variables, including volatilities and correlations for a host of financial instruments and markets, and direct and indirect linkages through common exposures to funding market risks. While the macroprudential measures derived from

the techniques are not explicitly countercyclical—that is, changing over time in the opposite direction of the cycle—they can be adjusted in ways that allow for this.

The development of the associated macroprudential tools is in early stages. Ideally, any such tool would need to be based on a robust measure of systemic risk and allow for extensive backtesting; it would have to be risk adjusted so that institutions that contribute to systemic liquidity risk through their interconnectedness or through their impact pay proportionately more; it should further be countercyclical and time varying—that is, it should offset procyclical tendencies of liquidity risk and change in line with changes to an institution's risk contribution; and finally it should be relatively simple and transparent and not too data intensive to compute and implement. The suggested approaches in this chapter vary in the degree to which they satisfy such criteria.

Systemic Liquidity Risk Index

The new market-based index of systemic liquidity risk presented here exploits the fact that a breakdown of various arbitrage relationships signals a lack of market and funding liquidity. From daily market-based observations, this measure uncovers violations of arbitrage relationships that encompass identical underlying cash flows and fundamentals that are traded at different prices. Constructed using a common-factor approach that captures the similar characteristics of these violations in arbitrage relationships, the index offers a market-based measure of systemic liquidity risk. Traditionally, market-based measures have been used only to monitor market liquidity conditions in various markets (Table 2.3). The approach here integrates these multiple measures and incorporates the observation that they are connected to funding liquidity.

Under normal market conditions, similar securities or portfolios that have identical cash flows are expected to have virtually no difference in price except for relatively constant and small differences reflecting transaction costs, taxes, and other micro features. Any larger mispricing between similar assets should typically be exploited by financial investors through arbitrage strategies (such as short selling the overpriced asset and using the proceeds to buy the underpriced asset). Because these arbitrage strategies are considered virtually risk free, investors are able to obtain funding easily to ensure that violations of the law of one price quickly disappear.

Table 2.2. Main Features of the Proposed Methodologies

Features	Systemic Liquidity Risk Index (SLRI)	Systemic Risk-adjusted Liquidity (SRL) Model	Stress-testing (ST) Systemic Liquidity Risk
Indication of systemic liquidity risk	Sharp declines in the SLRI.	Joint probability that firms will experience a funding shortfall simultaneously (i.e., all risk-adjusted net stable funding ratios (NSFRs) fall below 1 at the same time).	Probability that a given number of banks end stress test with negative net cash flow.
Dimension	Time-series and cross-sectional	Time-series and cross-sectional	Time-series and cross-sectional
Macroprudential tools	Insurance premia used to assess institutions for their exposure to systemic liquidity risk.	Price-based macroprudential insurance premia and/or capital surcharge—used for costing contribution of an institution to systemic liquidity risk.	Capital surcharge used to minimize the probability of triggering a liquidity run for a bank.
Modeling technique	Exploits breakdowns of arbitrage relations, signaling market participant's difficulties in obtaining liquidity. Uses principal components analysis.	Uses advanced option pricing to convert an accounting measure of liquidity risk (NSFR) into a risk-adjusted measure of liquidity risk at market prices, and, thus, is forward-looking by definition.	Derives banks' net cash flows as the result of a stress test. Uses Monte Carlo simulation, network analysis, valuation equations for bank positions, and assumptions about a bank creditors' funding withdrawal response to solvency concerns.
Stochastic or deterministic assessment of liquidity risk	Stochastic, based on bank's equity volatility associated with the SLRI.	Stochastic, based on the exposure to funding shocks, which takes into account the joint asset-liability dynamics in response to changes in market rates.	Stochastic, based on banks' probability of default and bank creditors' response to solvency concerns.
Market/Transaction based	Market-based.	Market-based.	On- and off-balance-sheet-transaction based.
Treatment of funding and market liquidity risks	Indirectly. The SLRI is used to measure heightened market and funding liquidity risks.	Market and funding risks are embedded in equity prices, funding rates, and in their volatility.	Explicit modeling of funding and market liquidity risks using behavior observed during the recent crisis.
Treatment of solvency-liquidity feedbacks	Attempts to isolate counterparty risk to create a clean measure of liquidity risk.	There is no explicit treatment of the impact of solvency risk on liquidity risk. However, the derived risk-adjusted NSFR embeds a recognition that banks are vulnerable to solvency risks.	Integrates solvency and liquidity risks explicitly as well as second round feedback between them.
Treatment of channels of systemic risk	Not modeled directly.	Estimates the non-linear, non-parametric dependence structure between sample firms so linkages are endogenous to the model and change dynamically.	Captures institutions' common sources of asset deterioration—including price spirals driven by asset fire sales, network effects, and contagion.
Ease of computation	Econometrically simple and easy to compute.	Econometrically complex and time consuming.	Econometrically complex and time consuming.
Data requirements	Based on publicly available market data. Can be applied to any institution and system with publicly traded securities. No use of supervisory data.	Minimal use of supervisory data. Approach relies on pre-defined prudential specification of liquidity risk (e.g., NSFR) to assess the impact of maturity mismatches but can be directly linked to non-diversifiable liquidity risk, such as the SLRI.	Can be applied to any institution/system, even those that are not publicly traded. Requires detailed supervisory data, including data to assess underlying credit risks of institution assets.

Source: IMF staff.

However, in turbulent markets, arbitrage can break down. During the recent financial crisis, many arbitrage relationships were violated for relatively long periods. In currency markets, violations of covered interest rate parity (CIP) occurred for currency pairs involving the U.S. dollar. In interest rate markets, the swap spread, which measures the difference between Treasury bond yields and LIBOR swap rates, turned negative (IMF, 2008). In interbank markets, basis

swaps that exchange different maturity LIBOR rates (for example, three-month for six-month) deviated from their close-to-zero norm. In credit markets, the CDS-bond basis, which measures the difference between credit default swaps (CDS) and implied credit spreads on cash bonds, turned negative.

Various factors may explain the breakdowns in arbitrage relationships that occurred during the crisis. As many of these relationships involve a fully funded (cash)

Table 2.3. Indicators for (Systemic) Liquidity Risk Monitoring¹

Indicators	Unsecured interbank rate	Interest rate derivatives	Repo spread	Margins and haircuts on repo collateral	Forex swap rate	Access to central bank liquidity facility
Examples	LIBOR-OIS spread, Euribor-OIS spread, TED spread, LIBOR rate spread-UST repo rate spread.	The probability distribution of LIBOR-OIS spread using derivatives (e.g. interest rate cap).	UST-repo rate, agency MBS repo rate-UST repo rate, U.S. asset-backed CP yields-UST.	Margins and average haircuts for various repo collateral assets.	Short-term foreign exchange swap implied interest rate-LIBOR, longer-term cross-currency basis swap-LIBOR.	Volume of bids for central bank facility at rates above expected marginal rate.
Primary type of liquidity risk	Funding liquidity.	Funding liquidity.	Funding liquidity.	Funding and market liquidity risk.	Foreign exchange funding risk.	Funding liquidity.
Pros	Widely used, easily available in most countries.	Provides probability assessment of liquidity stress events, forward looking.	Measures funding costs that are almost free of counterparty concerns.	Indicate the linkages between market liquidity of collateral and funding liquidity.	Indicates currency funding mismatch.	Measures funding liquidity risks with limited influence of market liquidity.
Cons	Influenced by counterparty risks. Not a representative measure of funding costs where repos are widely used.	Influenced by counterparty risks.	Influenced by market liquidity risk of collateral assets. Limited data availability (most are traded over the counter).	Difficult to collect and aggregate data. Difficult to disentangle liquidity and counterparty risks.	Influenced by counterparty risks.	Requires access to confidential data.
Indicators	Monetary aggregate	Spreads between assets with similar credit characteristics	Violation of arbitrage conditions	Liquidity Mismatch Index	Market microstructure measures	
Examples	Rate of change of the aggregate balance sheet of the financial institutions in a system. Aggregate money supply or credit growth.	UST off the run-on the run; German government guaranteed agency bonds-sovereign yields.	CIP-basis, CDS-bond basis.	Net stable funding ratio and liquidity coverage ratio.	Bid-ask spread, turnover, depth, and volume.	
Primary type of liquidity risk	Macro stock of liquidity.	Market liquidity risk.	Market liquidity risk.	Balance sheet liquidity mismatch risk.	Market liquidity risk.	
Pros	Highlights macro-level links among asset prices, financial institution net worth, and supply of credit to the economy from financial institutions.	Clean measure of market liquidity, controls for counterparty risks.	Signals abnormal financial market conditions.	Attempting to summarize overall liquidity risks of each financial institution. Useful for macroprudential supervision.	Long history in being used to assess market liquidity indicators and pricing impact of liquidity.	
Cons	For accurate measurement, need to look at overall "money" created by all financial institutions including nonbanks.	Available only for specific markets.	Influenced by counterparty risk.	Calibration of weighting system for each asset and/or liability component remains to be done.	Includes transaction costs and may not be related or sensitive to systemic liquidity shocks.	

¹This table was prepared by Hiroko Oura.

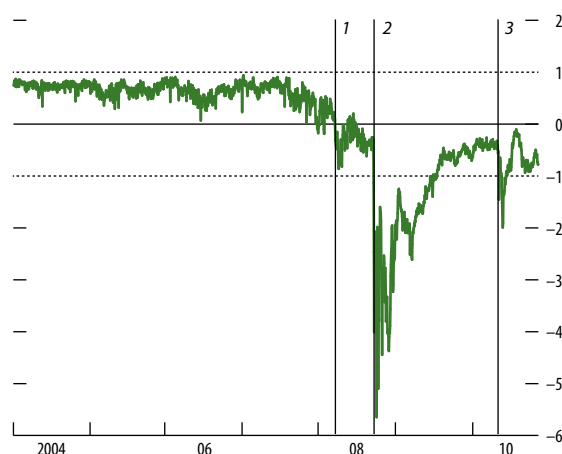
Note: CIP = covered interest rate parity; CDS = credit default swap; CP = commercial paper; Euribor = euro interbank offered rate; OIS = overnight index swap; UST = U.S. Treasury bill.

instrument and one or more unfunded over-the-counter (OTC) derivative positions, concerns over counterparty risk on the OTC derivative may have rendered the arbitrage more risky. Another possibility is that funding costs on the cash instrument were responsible for the deviations, as investors were unable to quickly raise or reallocate funds. That inability in turn could have been due to a rise in market liquidity risk: investors became unable to rebalance their portfolios without incurring

a significant cost because of fire sale conditions. Or it could have been due to a rise in funding risk: investors became unable to borrow or did not have sufficient capital to take advantage of the arbitrage opportunities.¹²

¹²Gromb and Vayanos (2010) examine the impact of banking losses on other financial intermediaries' ability to raise funds to take advantage of arbitrage opportunities.

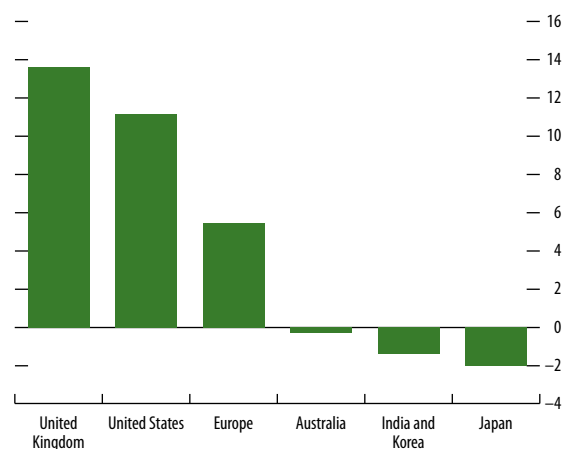
Figure 2.4. Systemic Liquidity Risk Index
(In standard deviations)



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

Note: The dotted band depicts \pm standard deviation around the zero line. Dates of vertical lines are as follows: 1—March 14, 2008, Bear Stearns rescue; 2—September 14, 2008, Lehman Brothers failure; and 3—April 27, 2010, Greek debt crisis.

Figure 2.5. Average Sensitivity of Volatility of Banks' Return on Equity to Systemic Liquidity Risk Index



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

Note: The axis displays sensitivity. The sensitivity accounts for the impact of changes in the SLRI on the measured volatility of stock returns. The sensitivity for each region reflects the average sensitivity for all the individual banks in the corresponding area. Details about the methodology used to compute these sensitivities are available in Annex 2.1.

After controlling for counterparty risk, a number of studies point to liquidity frictions as the driving factors for violations in many of these trading relationships.¹³ Those frictions prevent arbitrage strategists from liquidating positions without incurring large costs, or prevent them from raising capital and funding quickly, or make them unwilling to take large positions because of uncertain asset valuations. Consequently, the magnitude of the pricing discrepancy can be affected by the availability of funding and market liquidity and the ability of investors to process information.

The following analysis examines arbitrage violations of CIP in the foreign currency markets, of the CDS-bond basis in the nonfinancial corporate debt market, the on-the-run versus the off-the-run spread for U.S. treasuries, and of the swap spread in the money market (see Annex 2.1 for a description of the methodology and a potential application to a macroprudential tool). In total, the analysis covers 36 series of violations of arbitrage in three securities markets at various maturities. The principal components analysis (PCA) identifies a common factor across the three asset classes that can explain more than 40 percent of the variation in sample. The time series predictions of this common factor (using the underlying data) can be empirically constructed and are interpreted here as a systemic liquidity risk index (SLRI)—that is, a measure to identify the simultaneous tightening of global market liquidity and funding liquidity conditions (Figure 2.4). Sharp declines in the index are associated with strong

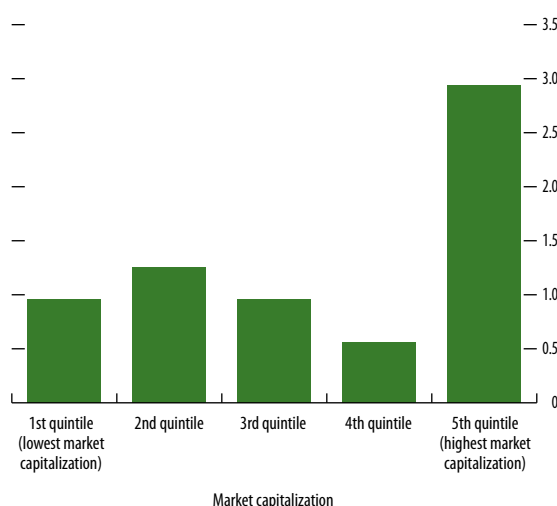
¹³When controlling for counterparty risk (typical measures are the CDS index, the volatility index, and dispersions of quotes for LIBOR), Coffey, Hrun, and Sarkar (2009) and Grifoli and Ranaldo (2010) find that liquidity frictions played a central role in the violations of CIP, as dollar funding constraints kept traders from arbitraging away excess returns. Bai and Collin-Dufresne (2010) find that liquidity factors were critical in explaining the difference in the CDS-bond bases across 250 firms in the United States. Schwarz (2010) finds that liquidity risk explains two-thirds of the LIBOR-OIS spread during the crisis. Mitchell and Pulvino (2010) point to the importance of funding restrictions by institutional investors as impeding the opportunities for arbitrage in closed-end funds. Chacko, Das, and Fan (2010) develop a new liquidity risk measure using exchange-traded funds, which attempts to minimize measurement error, in particular with regard to credit risk. Their liquidity measure can explain both bond and equity returns, and they provide evidence that illiquidity is Granger-caused by volatility in financial markets, but not the reverse. Fontaine and Garcia (2009) use data on the U.S. government debt market to develop a systemic liquidity risk measure.

deviations from the law of one price across the many assets considered and thus suggest a drying up of market and funding liquidity at the global level.

A normalized SLRI is next used to examine whether it can explain the differential effect that systemic illiquidity may have had on banks during the crisis.¹⁴ Overall, the results do not show a strong relationship between the SLRI and a set of 53 globally oriented banks' return on equity (see Box 2.2 for a discussion of the results). However, there is evidence that banks' equity is more sensitive to the SLRI when the banking sector is in distress, suggesting that there may be a relationship with return volatility. Indeed, the analysis finds that declines in the SLRI are correlated with increased volatility in bank equity returns, with some region's banks more sensitive than others (Figure 2.5). This association could reflect greater investor concern over the riskiness of an institution's prospects, including its liquidity risk. Similarly, the analysis finds a strong relationship between the SLRI and equity volatility, controlling for the size of banks, as proxied by market capitalization (Figure 2.6). Interestingly, it is the largest banks that have return volatility most sensitive to liquidity risk, suggesting size may be one possible criterion to determine the banks that should receive more supervisory attention for their liquidity management. Finally, the analysis does not find a strong relationship between a bank's funding risk, as reflected by the NSFR, and the SLRI. This seemingly counterintuitive result can be explained by noting that the NSFR is by design a microprudential indicator measuring structural funding problems in an institution, and hence it is unlikely to adequately proxy for the same type of systemic liquidity risk in the index (Figure 2.7).

Finally, the SLRI can be used to develop a liquidity surcharge scheme designed to assess banks and nonbanks for the costs associated with their exposure to systemic liquidity risk. The proceeds from the surcharges could be accumulated perhaps at the central bank or government or at a private sector insurer. The size of an individual institution's charge would be determined by calculating how much the institution's risk is associated with systemic liquidity risk, condi-

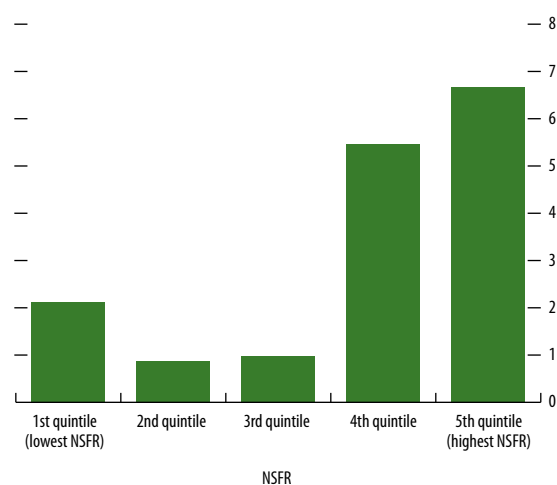
Figure 2.6. Sensitivity of Volatility of Banks' Return on Equity Based on Market Capitalization to Systemic Liquidity Risk Index



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

Note: The axis displays sensitivity. The sensitivity accounts for the impact of changes in the SLRI on the measured volatility of returns on portfolios of individual banks ranked according to their market capitalization. Details about the methodology used to compute these sensitivities are available in Annex 2.1.

Figure 2.7. Sensitivity of Volatility of Banks' Return on Equity Based on Net Stable Funding Ratio (NSFR) to Systemic Liquidity Risk Index



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

Note: The axis reflects sensitivity. The sensitivity accounts for the impact of changes in the SLRI on the measured volatility of returns on portfolios of individual banks ranked according to their NSFR. Details about the methodology used to compute these sensitivities are available in Annex 2.1.

¹⁴The normalization subtracts from the daily SLRI the mean SLRI over the sample period and divides it by its standard deviation.

Box 2.2. How Well Does the Systemic Liquidity Risk Index Explain Banks' Liquidity Problems?

The systemic liquidity risk index (SLRI) may have some promise for signaling liquidity problems, in particular when banks are under stress. This box examines the sensitivity of bank returns to the SLRI and the relation of that sensitivity to certain bank characteristics.

The SLRI introduced in the chapter is intended to gauge a systemic tightening in market and funding liquidity. Its ability to do so can be assessed in relation to bank stock returns and volatility in those returns.¹

The analysis suggests that, for the most part, the SLRI has no strong relationship with stock returns after controlling for market conditions. However, the ability of the SLRI to explain variations in bank credit default swap (CDS) spreads suggests that systemic liquidity shortages adversely affect returns on equity at individual banks when the banking sector as a whole is in distress.

Empirical evidence also indicates that aggregate liquidity conditions reflected by the SLRI affect the volatility in bank stock returns.² Lower systemic liquidity is associated with an increase in the volatility of bank returns after controlling for other aggregate risk factors and for bank-specific measures of risk like the CDS spread. The association suggests that, as investor uncertainty over a bank's prospects increases, tighter funding conditions have a greater impact on the bank's earnings outlook. The analysis also finds that banks in Denmark, the euro area, Norway, Switzerland, the United Kingdom, and the United States

are more exposed, on average, to a decline in the SLRI (signaling a tightening of liquidity conditions) than are banks in Japan, probably because of the more-liquid balance sheets of Japanese banks.

The analysis also examines whether particular bank characteristics are associated with exposure to the SLRI. Two characteristics are examined: (1) market capitalization, as a proxy for size and for whether large banks are more vulnerable to stressed systemic liquidity conditions than smaller banks and (2) the NSFR, as a proxy for funding mismatches—that is, whether banks with a lower NSFR are more exposed to stressed systemic liquidity conditions. Results show some positive relationship between size and exposure to liquidity risk, in particular for the very small and very large banks in the sample. On the second point, the analysis finds a counterintuitive relation between the NSFR and the SLRI. The set of banks with a higher NSFR seem to be more exposed to the SLRI, as the volatility of their daily stock returns increases substantially more (relative to their peers) when the SLRI declines (that is, when it indicates a tightening of liquidity conditions). One would expect to find that banks with a relatively low maturity mismatch (that is, a high NSFR) to be less susceptible to systemic liquidity shortages than banks with a high mismatch, though the measures may be capturing somewhat different concepts of liquidity.

Several robustness checks did not change the main findings. For instance, the SLRI is not materially affected if some of the violations of arbitrage in certain markets are omitted from its computation, such as the swap spread, which is more prone to counterparty risk relative to other arbitrage relationships considered. Additionally, even after controlling for the direct SLRI effects of the average CDS spread for global banks, the resulting SLRI can still explain the riskiness of individual banks.

Note: This box was prepared by Tiago Severo.

¹The discussion here is in terms of the normalized SLRI. The normalization subtracts the mean of the SLRI from the daily SLRI over the sample period and divides by its standard deviation.

²This was found by applying an ARCH (1) process, but the results are also robust to other model specifications such as GARCH, EGARCH, and GJR-GARCH.

tioning the calculation on relatively stressful periods.¹⁵ Such charges should reflect the expected cost to the

government of supporting banks' liabilities under scenarios of systemic liquidity stress. To be effective, the charge would be imposed on all institutions that are perceived as benefiting from implicit public guarantees and hence should cover banks and nonbanks that contribute to systemic liquidity risk.

¹⁵Technically, this would reflect the degree to which each institution's implicit put value on its assets changes as the volatility of equity increases due to systemic liquidity stress as measured by the SLRI.

A Systemic Risk-Adjusted Liquidity Model

The new SRL model presented here combines option pricing with market and balance sheet data to estimate an institution's liquidity risk and then uses this measure to calculate the joint probability of all institutions experiencing a systemic liquidity event (Jobst, forthcoming). This joint probability can then be used to measure an individual institution's contribution to systemic liquidity shortfalls (for all institutions) over time and to calculate a potential surcharge or insurance premium. This contribution to overall systemwide liquidity shortfalls will depend on an institution's funding and asset structure and its interconnectedness.

The innovation of the SRL model is its use of contingent claims analysis (CCA) to measure liquidity risk. CCA is widely applied to measure and evaluate solvency risk and credit risk at financial institutions. In this model, CCA combines market prices and balance sheet information to compute a risk-adjusted and forward-looking measure of systemic liquidity risk. In this way, it helps determine the probability that an individual institution will experience a liquidity shortfall and also helps quantify the associated loss when the shortfall occurs (see Annex 2.2 for a more detailed discussion of the approach).

The SRL model uses as a starting point the current Basel III quantitative regulatory proposal aimed at limiting maturity transformation—the NSFR. The components of the NSFR—available stable funding (ASF) and required stable funding (RSF)—are each transposed into a risk-adjusted and time-varying measure. Doing so permits an institution's net exposure to the risk of liquidity shortfalls to be quantified. The net exposure depends on changes to market perceptions of risk, which can be derived from an institution's equity option prices and from its asset and liability structure. Changes to various risk factors that affect the ASF and RSF (such as volatility shocks in both asset returns and funding costs and the joint dynamics between them) can result in significant losses for individual institutions. Those losses can then be quantified by viewing the liquidity risk as if it was a put option written on the NSFR with a strike price of 1 (the lower threshold that banks will be mandated to maintain under the NSFR).

The SRL model was applied to 13 commercial and investment banks in the United States; firm-level data were obtained from annual financial statements

covering end-2005 to end-2009. The variations in the components of the NSFR—that is, in the ASF and RSF—were used to compute the market-implied expected losses due to liquidity shortfalls under stressed conditions.¹⁶ The results suggest that these individual expected losses can be extreme (Figure 2.8).

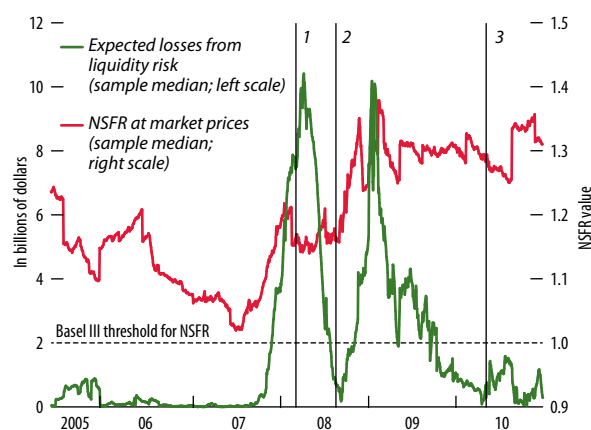
These results provide important insights for policymakers: the NSFR (whether as an accounting measure or a risk-adjusted measure) does not capture the risk of potential liquidity shortfalls under extremely stressed conditions. The median of the risk-adjusted NSFR for the 13 banks stays above 1 (Figure 2.8). In contrast, the median expected losses generated by the SRL model suggests that banks have become more vulnerable to extreme liquidity shocks and that their losses were higher during some time frames, namely in the run-up to the March 14, 2008, Bear Stearns rescue and around year-end 2008. Those results apply especially to firms dependent on funding sources that are more susceptible to short-term (and more volatile) market interest rates; that dependency, in combination with their relatively higher exposure to maturity mismatches, accentuates their vulnerability to liquidity risk. Because the SLR model takes into account the joint asset-liability dynamics between the ASF and RSF, it provides a far deeper analysis of the liquidity risk to which a firm is exposed than does looking at them separately or with only accounting data.

The systemic dimension of the SRL model of a particular institution is captured by three factors:

1. The market's evaluation of the riskiness of the institution (including the risk that the institution will be unable to service ongoing debt payments and offset continuous cash outflows). That evaluation, in turn, is based on a perception of the riskiness as implied by the institution's equity and equity options in the context of the current economic and financial environment.
2. The institution's sources of stable funding. Interest rates affecting both assets and liabilities are modeled as being sensitive to the same markets as the funding sources of every other institution. Changes in common funding conditions establish market-induced

¹⁶Extreme conditions were defined to be those that occur with a probability of 5 percent or less.

Figure 2.8. Illustration of Individual Expected Losses Arising from Liquidity Risk



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

Note: This figure is illustrative for a U.S. bank. Dates of vertical lines are as follows: 1—March 14, 2008, Bear Stearns rescue; 2—September 14, 2008, Lehman Brothers failure; and 3—April 27, 2010, Greek debt crisis. NSFR = net stable funding ratio.

linkages among institutions. The proposed framework thus links institutions implicitly to the markets in which they obtain equity capital and funding.

3. Joint probability distributions. After obtaining risk-adjusted NSFRs for each institution, the likelihood that institutions will experience a liquidity shortfall simultaneously—that is, the probability that the NSFR for each institution falls to 1 or less at the same time—can be made explicit by computing joint probability distributions (see below). Hence, the liquidity risk resulting from a particular funding configuration is assessed not only for individual institutions but for all institutions within a system in order to generate estimates of systemic risk.

Using the results for individual institutions, the SRL model can be applied to estimate systemwide liquidity risk in situations of extreme stress, which is defined as expected shortfall (ES). The accumulated expected losses of the individual institutions' risk-adjusted NSFR would have underestimated joint expected shortfalls between mid-2009 and mid-2010, where the red line exceeds the green line in Figure 2.9.¹⁷ It would have failed to take into account the interlinkages in institutions' funding positions and their common exposure to the risk of funding shocks—that is, the systemic component. In contrast, the ES of the joint distribution of expected losses incorporates nonlinear dependence and the probability of extreme changes in funding costs. The results suggest that (1) if liquidity shortfalls happen simultaneously, the sum of individual losses does not account for their interdependence, and (2) contagion risk from this interdependence gets accentuated during times of extreme stress in markets. The joint expected shortfall may be easier to discern by looking at averages over specified periods (Table 2.4). During the crisis period from late 2008 to 2009, the joint expected shortfall was largest, as one would surmise.

The SRL results imply that some institutions contributed to systemic liquidity risk beyond the expected losses from their individual liquidity shortfalls. During the height of the crisis, the average contribution to extreme increases in system liquidity risk was higher

¹⁷In Figure 2.9, the green line represents the daily sum of individual, market-implied expected losses, and the red line indicates the joint expected shortfall. Both tail risks are measured so that the chances of such events are 5 percent or less.

than if only individual funding pressures were examined. These results illustrate the importance of including the systemic nature of liquidity risk when designing macroprudential frameworks.

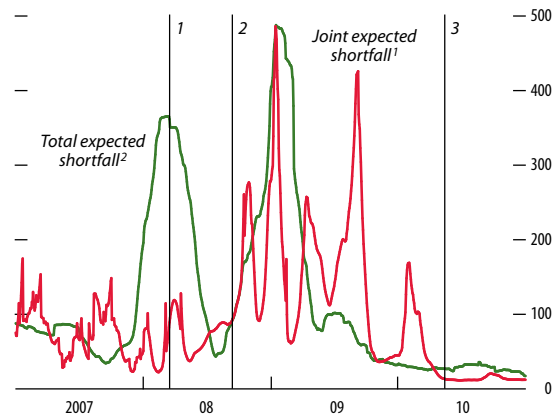
The SRL model can be used to produce two price-based macroprudential tools—a capital surcharge and an insurance premium—that take into account the support that institutions would receive from a central bank in times of systemic liquidity stress and thus represent the individual cost of simultaneous liquidity shortfalls:

- The capital surcharge would be based on an institution's own liquidity risk (highest risk-based NSFR) or on its marginal contribution to joint liquidity risk, whichever of the two is higher.
- The insurance premium would reflect the chance that the institution, in concert with other institutions, falls below the minimum required NSFR of 1.

Table 2.5 presents the distribution of the capital charges over selected U.S. commercial and investment banks and Table 2.6 does so for the value of the insurance premium that would compensate for the joint expected shortfall associated with each bank. The capital charge represents the sum of money (in billions of dollars, as a percent of total capital, and as a percent of total assets of the 13 institutions in the system) that would be needed by the firms to offset liquidity shortfalls occurring when an NSFR of 1 is breached with a probability of 5 percent. Based on the calculations the selected U.S. institutions would need to set aside additional capital of about 0.7 percent of assets (median estimate) in 2010 to capture the externality they impose on others in the system. Basing the capital surcharge on the higher of two indicators (the maximum capital that offsets the amount of individual expected losses or the contribution of an institution to overall expected losses) is motivated by the fact that sometimes the individual component is higher and sometimes the contribution to the systemic risk is higher.

By contrast, the insurance premiums are calculated as the fair value over a one-year horizon to compensate for the liquidity support that would be needed to bring the NSFR above 1 during stressful times (occurring 5 percent of the time). The fair value insurance premium is derived as the actuarial value needed to exceed the present value of RSF over a risk horizon of one year. This premium is multiplied by all short-term uninsured

Figure 2.9. Illustration of Joint and Total Expected Shortfalls Arising from Systemic Liquidity Risk
(95 percent expected shortfall of risk-adjusted net stable funding ratio; in billions of dollars)



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

Note: This figure is illustrative for 13 U.S. banks. Dates of vertical lines are as follows: 1—March 14, 2008, Bear Stearns rescue; 2—September 14, 2008, Lehman Brothers failure; and 3—April 27, 2010, Greek debt crisis.

¹Expected shortfall at the 95th percentile of the multivariate distribution.

²Sum of individual expected shortfall estimates at the 95th percentile over a 30-day sliding window with daily updating.

Table 2.4. Joint Expected Losses from Systemic Liquidity Risk*(In billions of dollars)*

	Pre-Crisis: end-June 2006 to end-June 2007	Subprime Crisis: July 1, 2007 to September 14, 2008	Credit Crisis: September 14, 2008 to December 31, 2009	Sovereign Crisis: January 1 to December 31, 2010
	Systemic Liquidity Risk ¹			
Minimum	14.8	22.4	36.1	17.4
Median	65.4	68.9	150.3	31.4
Maximum	191.8	148.5	486.2	60.2
Memorandum item				
Standard error	18.9	26.6	56.9	8.9

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

Note: This exercise was run on a selected set of 13 large U.S. commercial and investment banks.

¹Expected shortfall at the 95th percentile of the joint distribution of expected losses.**Table 2.5. Capital Charge for Individual Liquidity Risk and Individual Contribution to Systemic Liquidity Risk***(In billions of dollars unless noted otherwise)*

(in millions of dollars unless noted otherwise)

	Individual Expected Shortfall			Contribution to Joint Expected Shortfall			Capital Charge (maximum of (1)–(4))	Share of Total Capital (in percent)	Share of Total Assets (in percent)
	Stress Period: September 14, 2008 to December 31, 2009	Last Quarter (2010:Q4)	Average of 2010:Q1–Q4	Stress Period: September 14, 2008 to December 31, 2009	Last Quarter (2010:Q4)	Average of 2010:Q1–Q4			
	(1)	(2)		(3)	(4)				
	At 95th percentile			At 95th percentile					
Minimum	0.00	0.00	0.03	1.55	0.08	0.27	0.27	1.57	0.20
Median	1.46	0.74	1.18	6.42	0.66	2.05	2.05	4.82	0.73
Maximum	33.32	8.53	9.86	13.51	3.09	5.96	9.86	3.25	0.44

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

Note: This exercise was run on a selected set of 13 large U.S. commercial and investment banks. The last column matches the distributions of the individual capital charges and reported total capital of all sample institutions. In this case, the maximum capital charge for the worst bank in 2010 coincides with a disproportionately higher total capital amount, which reduces the percentage share of the capital add-on for systemic liquidity from 4.82 percent (median) to 3.25 percent (maximum). A similar circumstance applies to the calculations of shares of total assets. For details about the calculation of the capital charge, see Annex 2.2.

liabilities, i.e., the portion of deposits that is not covered by an insurance scheme. This reflects the cost of insuring the downside risk that no cash inflows are available to cover debt service obligations in times of stress.

Overall, the SRL model offers several potential benefits:

- It assesses an institution's liquidity risk from a particular funding configuration not only individually but in concert with all institutions to generate estimates of systemic risk. As such, it takes the systemic components of liquidity risk over time into account by estimating the joint sensitivity of assets and liabilities to changes in market prices.
- It treats liquidity risk as an exposure via a market-risk-adjusted value of the NSFR at high frequency rather than an accounting value as in the current Basel III framework.

- It measures the marginal contribution of each institution to total systemic liquidity risk at a given level of statistical confidence.
- It can be used to construct a capital charge or insurance premium for the institution's contribution to systemic liquidity risk.¹⁸

Moreover, the SRL approach can be used by supervisors within a stress testing framework to examine the vulnerabilities of individual institutions and the system as a whole to shocks to key asset and liability risk factors that underpin the NSFR. In adverse conditions,

¹⁸This contrasts with Perotti and Suarez (2009), who propose a charge per unit of refinancing risk-weighted liabilities based on a vector of systemic additional factors (such as size and interconnectedness) rather than the contribution of each institution to the overall liquidity risk and how it might be influenced by joint changes in asset prices and interest rates.

Table 2.6. Summary Statistics of Individual Contributions to Systemic Liquidity Risk and Associated Fair Value Insurance Premium

	Pre-Crisis: end-June 2006 to end-June 2007	Subprime Crisis: July 1, 2007 to September 14, 2008	Credit Crisis: September 14, 2008 to December 31, 2009	Sovereign Crisis: January 1 to December 31, 2010
Individual contribution to systemic liquidity risk (at 95th percentile; in percent) ¹				
Minimum	1.2	0.6	1.0	1.7
Median	6.8	4.5	8.3	7.6
Maximum	13.4	35.1	16.7	14.5
Total	100.0	100.0	100.0	100.0
Insurance cost based on reported exposure: Fair value insurance premium multiplied by uninsured short-term liabilities (In billions of dollars)				
Minimum	0.7	0.1	0.7	0.1
Median	1.9	1.4	3.9	0.8
Maximum	7.8	17.2	11.3	1.9

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

Note: This exercise was run on a number of selected U.S. banks. Insured deposits here are defined as 10 percent of demand deposits reported by sample banks. Note that the share of deposits covered by guarantees varies by country and could include time and savings deposits. Robustness checks reveal that reducing the amount of uninsured short-term liabilities does not materially affect the median and maximum. For details of the calculation see Annex 2.2.

¹Each bank's percentage share reflects its contribution to the joint distribution of expected losses at the 95th percentile for a selected set of 13 large U.S. commercial and investment banks.

higher volatilities of market funding rates and lower correlation between funding rates can be mechanically imposed in the model to better examine short-term funding vulnerabilities.

A Stress-Testing Framework for Systemic Liquidity Risk

The third new approach to measuring systemic liquidity risk uses stress testing techniques.¹⁹ The method presented below uses standard solvency stress tests as a starting point and adds, as an innovation, a systemic liquidity component. It can be used to measure systemic liquidity risk, assess a bank's vulnerability to a liquidity shortfall, and develop a capital surcharge aimed at minimizing the probability that any given bank would experience a destabilizing run.

The ST framework assumes that systemic liquidity stress is caused by rising solvency concerns and uncertainty about asset values.

The ST approach models three channels for a systemic liquidity event:

- A stressed macro and financial environment leading to a reduction in funding from the unsecured funding markets due to a heightened perception of counterparty and default risk;

- A fire sale of assets as stressed banks seek to meet their cash flow obligations. Lower asset prices affect asset valuations and margin requirements for all banks in the system, and these in turn affect funding costs, profitability, and generate systemic solvency concerns; and
- Lower funding liquidity because increased uncertainty over counterparty risk and lower asset valuations induce banks and investors to hoard liquidity, leading to systemic liquidity shortfalls.

This approach is consistent with the stress testing literature relating bank runs to extreme episodes of market-imposed discipline in which liquidity withdrawals are linked to banks' solvency risk (Table 2.7).

The ST methodology was applied to a set of 10 stylized banks, with June 2010 U.S. Call Report data used to define such banks. The stylized banks differ from each other in their initial capital ratios and sizes and in their risk profiles and loan concentrations.²⁰

The framework first establishes the economic and financial scenarios in which these banks operate to capture the potential impact of changes in volatilities and correlations on asset values, and solvency risks (see Annex 2.3). Capital ratios and associated

¹⁹A detailed explanation of this methodology and its application in a stylized U.S. banking system can be found in Barnhill and Schumacher (forthcoming).

²⁰The banks consist of two small banks (with assets concentrated in California and Florida-Georgia respectively); three middle-size banks (with assets concentrated in the west coast, midwest, and east coast); three large banks; and two megabanks that jointly account for just over 60 percent of total U.S. banking assets.

Table 2.7. Selected Liquidity Stress-Testing (ST) Frameworks

Framework	Bank of England	De Nederlandsche Bank	Hong Kong Monetary Authority	Proposed ST Framework
Data	Bank by bank financial reporting	Bank by bank financial reporting	Bank by bank financial reporting	Bank by bank financial reporting
Origin of liquidity shocks	Funding liquidity shock (cost and access) upon downgrade from solvency shocks (credit and market losses in macro ST).	Valuation losses and/or funding withdrawal to selected liquidity items.	Deposits are withdrawn in line with stressed probability of default (PD) (due to a loss from asset price declines) of the bank.	Asset price shocks. Bank liabilities are withdrawn following stressed PD of the bank.
Feedback, spillover, amplification effects	Linear, normal time linkages. Nonlinear effects using subjective but simple scoring system. Second-round effects through impact on asset price upon bank deleveraging and network effects.	Nonlinear effects as banks take deleveraging actions for larger shocks, and they feed back to asset valuation and funding availability (second-round effects).	Deleveraging to restore lost funding is costly owing to distress in asset markets. Interbank contagion (network effects).	Banks attempt to restore net cash flow by selling assets, which affect on market liquidity of the assets, further tightening funding liquidity (through higher haircuts)
Measurement of stress	Various standard metrics (solvency ratio, liquidity ratio, asset value, credit losses, ratings, profit, etc.).	Distribution of liquidity buffer across banks and across severity of shocks.	Probability of cash shortage and default; expected first cash shortage time; expected default time.	Solvency ratio; distributions of net cash flows and equity; joint probability of multiple institutions suffering from simultaneous cash shortfalls.
Origin of “systemic liquidity” characteristics	Initial macroeconomic shocks and various second-round effects.	From second-round effects.	From initial aggregate shock on asset prices, network effects.	Initial aggregate shock on asset prices and various second-round effects.
Pros	Nonlinear liquidity shocks and various second-round effects.	Nonlinear second-round effects.	Interaction among credit and funding and market liquidity risks.	Nonlinear second-round effects, assess joint probability of liquidity distress, and contribution of individual bank.
Cons	Includes subjective components to model nonlinearity.	Bank behavioral assumption and feedback effect formulated without strong micro foundation.	No feedback effects from distress on banks to asset prices.	Bank behavioral assumption and feedback effect formulated without strong micro foundation.

Note: Bank of England reflects the ST framework proposed by Aikmen and others (2009); De Nederlandsche Bank reflects the ST framework proposed by van den End (2008); and the Hong Kong Monetary Authority reflects the ST framework proposed by Wong and Hui (2009).

banks’ default probabilities are simulated under the set of volatilities and correlations in two periods: a calmer 1987–2006 period; and a more volatile period from 2007 through the first quarter of 2010. With identical initial balance sheet positions, all banks have capital ratios that are lower in the second period than in the first. Applying this method could have signaled to supervisors the potential higher market concerns about bank solvency and the risk posed by the increasing reluctance to provide funding to these banks.

After generating a bank’s capital ratio based on a solvency analysis, the exercise introduces liquidity risk. The withdrawal pattern of the period from 2007 to the first quarter of 2010 is used to develop a hypothetical relationship between a bank’s probability of default and the rate of withdrawal of liabilities during that period. The relationship is determined under two cases. In case 1, withdrawal rates match those experienced by bank holding companies during

the period.²¹ In case 2, withdrawal rates match those experienced by investment banks; since investment banks have a very low level of insured deposits, this case provides a way to calibrate a more stressed scenario than that when banks are known to have insured deposits. Table 2.8 summarizes assumptions on total liability withdrawal rates associated with different default probability ranges for each case.

The stress test assesses whether banks faced with these withdrawal rates can deleverage in an orderly manner. Initially the banks with the higher probability of default stop lending in the interbank market and sell government securities and other liquid assets. Banks pay a higher cost of funding as they are forced to sell potentially less liquid assets, in particular if those assets are associated with a high

²¹During the crisis, some bank holding companies were able to increase their access to insured liabilities by converting large uninsured deposits into smaller insured deposits.

liquidity premium.²² In this way, the model captures the interaction between funding and market liquidity and the second round feedback between solvency and liquidity risks.

In the 2007–10:Q1 financial environment under case 1 (bank holding company withdrawal rate), the probability that about three out of ten banks will simultaneously find themselves unable to make payments (that is, have a negative cash flow) is 3.8 percent (Table 2.9). That is, the risk of a systemic liquidity shock for this hypothetical U.S. banking system as of June 2010 would be low. In this example, the smaller banks are more affected than the larger ones because of their higher credit risk concentration and exposure to the macro risk factors that triggered the recent crisis. In addition, although banking failures occurred among smaller banks, their liquidity shortages did not lead to a systemic liquidity crisis. In the 2007–10:Q1 financial environment under case 2 (investment bank withdrawal rate), the probability that one-third of banks suffer a liquidity shortage increases to 12.7 percent.

Such potential liquidity shortages can create pressures for substantial reductions in bank loan portfolios and affect the economy. Indeed, both liquidity shortages and tighter lending standards and terms led to reductions in bank lending that were observed during the global crisis. In case 1, if the stylized banks facing liquidity runs reduce both securities and loan portfolios, the impact on total loans would be small (Figure 2.10, top panel, vertical axis). In case 2, by contrast, a potential liquidity run could lead to a significant reduction in total loans, of up to 43 percent, although with a low probability of less than 1 percent attached to this event (Figure 2.10, bottom panel, horizontal axis).

These ST results generally show that the ability of banks to weather a financial and economic shock and its impact on solvency and liquidity depends on a number of factors, including: (1) the size of the shock; (2) the adequacy of capital; (3) the availability

²²Developments in bid-ask spreads in several securities markets during the 2000–09 period were used as a proxy for fire sale prices. At the peak of the crisis (September 2008), the size of the bid-ask spread was in the 5–10 percent range across different asset qualities, suggesting a discount factor of 3 to 5 percent to represent the loss suffered by the bank under distress when forced to liquidate assets. These values are in line with Coval and Stafford (2007), Aikman and others (2009), and Duffie, Gârleanu, and Pederson (2006).

Table 2.8. Withdrawal Rate Assumptions

(In percent)

Default Probability	Withdrawal Rate	
	Case 1	Case 2
10–20	5	7–10
20–35	10	14–21
> 35	25	42

Sources: SNL Financial; and IMF staff estimates.

Table 2.9. Probability of Banks Ending the Simulation with a Liquidity Shortage

Number of Banks	Probability	
	Case 1	Case 2
1	98.49	98.49
2	20.28	23.68
3	3.77	12.74
4	1.60	4.25
5	1.13	1.98
6	0.75	1.51
7	0.09	1.13
8	0.00	1.04
9	0.00	1.04
10	0.00	0.09

Sources: SNL Financial; and IMF staff estimates.

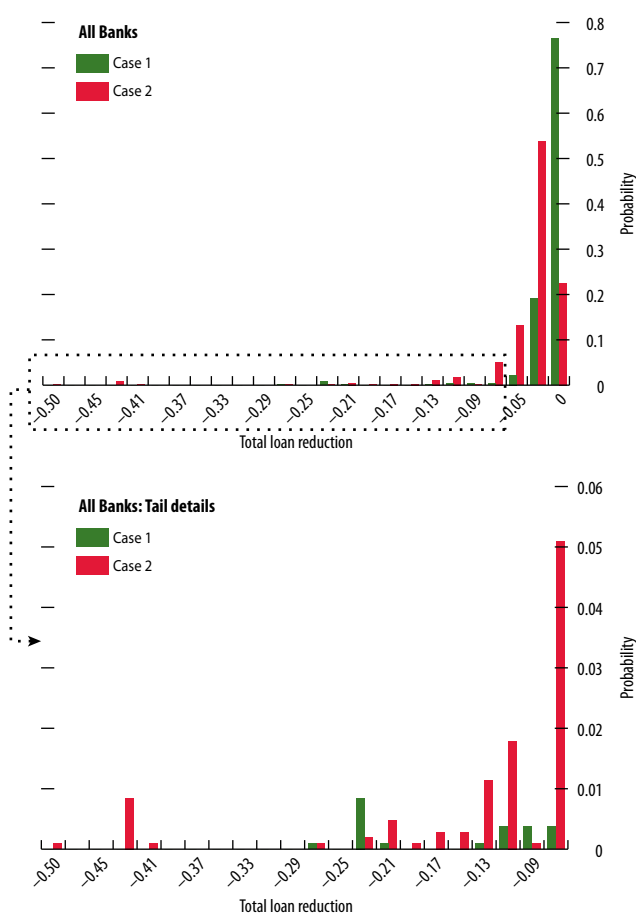
of liquid assets; and (4) the exposure to short-term wholesale liabilities (in this model, interbank exposures). In this framework, if institutions were sufficiently capitalized and, hence, able to sell liquid assets and deleverage in an orderly manner, then there would be no systemic liquidity shock.

The methodology can be used to estimate an additional required capital surcharge or buffer to reduce the risk of future liquidity runs by lowering bank default risk. Given the assumed withdrawal relationships in Table 2.8, the additional capital buffer that would reduce to less than 1 percent the probability of a bank experiencing a liquidity run due to another bank failure over the next year is provided in Table 2.10. Of the 10 stylized banks, the small banks need to add the most capital because of their undiversified asset exposures to the real estate sector, where credit losses have been the highest.

Summary and Policy Considerations

The financial crisis has highlighted the importance of sound liquidity risk management for financial

Figure 2.10. Total Loan Reductions
(As percentage of total loans)



Sources: Bankscope; and IMF staff estimates.
Note: The top panel shows the results of the bottom panel with a finer set of x-axis losses of loans and lower probabilities (y-axis).

stability and the need to address systemic liquidity risks. The new quantitative liquidity standards under Basel III—which are likely to be subject to some revisions—are a welcome addition to the tools available to regulators to achieve better liquidity risk management at individual banks. The prospective Basel III requirements for higher liquidity buffers and lower maturity mismatches at banks will better protect them from liquidity shocks. Higher liquidity buffers for all banks should also have the side-effect of lowering the risk of a systemic liquidity event because the extra liquidity buffer will lower the chances of multiple institutions simultaneously facing liquidity difficulties.

However, the liquidity rules under Basel III are, at their core, microprudential—the focus is on the stability of individual institutions—and not macroprudential, where the focus is on systemic risk. For instance, the chapter's analysis using publicly available data finds that one of the new Basel III measures, the NSFR, would not have indicated problems in the banks that ultimately failed during the 2007–08 crisis—at least some of which failed due to poor liquidity management and overuse of short-term wholesale funding. Therefore, more needs to be done to develop techniques to measure and mitigate systemic liquidity risks.

Although most of the formal attempts to address liquidity risk are microprudential in nature, a number of studies have begun to propose macroprudential tools to deal with its systemic nature (Table 2.11). For example, Brunnermeier and Pederson (2009) emphasize the usefulness of a capital surcharge to reduce liquidity risk associated with maturity mismatches, while Perotti and Suarez (2009; forthcoming) propose a mandatory tax on wholesale funding that could be used to fund an insurance scheme. Others, such as Goodhart (2009), have proposed to limit systemic externalities through a liquidity insurance mechanism in which access to publicly provided contingent liquidity would be permitted if a premium, tax, or fee were paid in advance. Acharya, Santos, and Yorulmazer (2010) suggest that a risk-based deposit insurance premium should not only reflect the actuarial fair value but should also include an additional fee imposed on systemically important institutions to reflect their excessive risk taking and the disproportionate cost they impose on others in the system. Most of these proposals do not, however, provide concrete advice

Table 2.10. Capital Surcharges

	California	Florida-Georgia	West Coast	Midwest	East Coast	Large Bank 1	Large Bank 2	Large Bank 3	Mega Bank 1	Mega Bank 2
Initial capital ratio	0.104	0.057	0.124	0.104	0.080	0.134	0.124	0.095	0.101	0.088
Capital surcharge	0.111	0.216	0.045	0.056	0.123	0.031	-0.011	0.049	0.046	0.026

Sources: SNL Financial; and IMF staff estimates.

Note: Capital surcharges required at time 0 for banks to have a 99 percent confidence level that at time 1 they would have less than a 10 percent probability of failing by time 2.

Table 2.11. Selected Regulatory Proposals for Managing Systemic Liquidity Risk

Author	Goodhart (2009)	Perotti and Suarez (2009; forthcoming)	Brunnermeier and others (2009)	Acharya and others (2010)	Cao and Illing (2009); Farhi, Golosov, and Tsyvinski (2009)	Valderrama (2010)
Proposal	Liquidity insurance: charge break-even insurance premium (collected including good times), monitor risk and sanction on excessive risk-taking.	Mandatory liquidity insurance financed by taxing short-term wholesale funding.	Capital charge for maturity mismatch.	Impose incentive-compatible tax (paid including good times) to access government guarantee (including for loan guarantees and liquidity facilities).	Minimum investment in liquid assets or reserve requirement.	Mandatory haircut for repo collaterals.
Pros	Premiums include add-on factors reflecting the systemic importance of each institution, which could lower systemic liquidity risk.	Each institution pays different charges according to their contribution to negative externalities, reflecting systemic risks.	Calibrating charges to reflect externality measures (e.g., CoVaR) for each institution.	Calibrating tax to reflect each institution's contribution to systemic risks.	If all the relevant institutions hold more liquidity, the system will be more resilient on aggregate. Furthermore, one could potentially introduce add-on requirements for systemically important institutions.	Delink the interaction between market and funding liquidity through cycle. Would affect a wide range of market participants in addition to banks.
Cons	No concrete examples how to calculate the premium.	No concrete example provided how to measure the systemic risk to the wholesale funding structure.	It is not clear whether a solvency-oriented CoVaR can be used for liquidity charge calculation.	No concrete examples how to implement the proposed tax implementation strategy. Refers to difficulties to measure externality or contributions to externality.	Additional analysis needed to fully incorporate systemic aspects due to interconnectedness and other externalities.	No concrete examples given on how to implement.

Source: IMF staff.

about how to calculate the amount of the fee or other surcharge nor how to implement it.

To complement these efforts, this chapter presents three methodologies that measure systemic liquidity risk in a way that can be used to calculate a fee or surcharge. They do so by calibrating an institution's contribution to system-wide liquidity risk and linking that contribution to an appropriate benchmark for an institution-specific charge. In doing so they attempt to account for the interactions between market and funding liquidity risks and those interactions over time (although they have not yet been devised to be explicitly countercyclical). The methodologies are developed here only with publicly available

data, and hence the results are only broadly suggestive. With the more complete data available to supervisors and others, the methodologies could be adjusted for the greater accuracy necessary to become operational.

The chapter does not take a stand on which of the three methods is the best. Rather, through these illustrative calculations, it advances the broader point that supervisory policy should introduce some price-based macroprudential tool that would allow a more effective sharing of the private and public burdens associated with systemic liquidity risk management. It is unlikely at this stage of development that there is a single, best measure of systemic liquidity risk

that can be directly translated into a macroprudential tool. Hence, the methods presented here should be viewed as complementary—examining the issues from different angles—to see which ones might be practically implementable.

Looking forward, therefore, the three methods presented here (and others) would need to be thoroughly examined to see how they would have performed before the crisis and whether they produce similar results in terms of surcharges or insurance premiums. The three different sample periods, the set of institutions on which reliable data was available, and the techniques used in this chapter are sufficiently different from each other that the surcharges or premiums presented here can only be viewed as crude approximations and are not directly comparable. These issues would need to be addressed in order to see whether comparable pricing estimates would result. Although the ease of future operational use will critically depend on data availability, their key attributes will also determine how quickly they can be put into place:

- The SRLI is the most straightforward to compute as it uses standard statistical techniques and market data, looks at violations of arbitrage condition in key financial markets, and can be used to monitor trends in systemic liquidity risk. The more difficult exercise will be to develop a method that links the index to an institution's contribution to systemic risk. Although the chapter outlines one way this can be done, it will require more analysis to ensure other factors are not confounding the results. Assuming this is satisfactorily demonstrated, the next step could be to construct a premium, and proceed with the difficult decisions about the amount of coverage, who would hold the proceeds, and when they would be used.
- The SRL model has the advantage of using daily market data and standard risk-management methods to translate individual contributions to systemic risk into a macroprudential measure. The SRL can produce timely (and forward looking) measures of risk of simultaneous liquidity shortfalls at multiple financial institutions. It can either be used as a standalone prudential instrument or be embedded into a ST framework. For the SRL to provide a

robust methodology it would be important to assure that the funding liquidity risk measure applied (currently using the NSFR as proxy) be accurate.

- Finally, the ST framework is the one most familiar to financial stability experts and supervisors and thus the one that is easiest to implement in the short-run. As with other stress testing techniques, it captures systemic solvency risk by assessing the vulnerabilities of institutions to a common macro-financial shock, but then it adds this to the risk of liquidity shortfalls and assesses transmission of liquidity risk to the rest of the system through their exposures in the interbank market.

Despite which method is pursued to mitigate systemic liquidity risk, policymakers need to be mindful that any such macroprudential tool would need to be jointly considered in the broader context of other regulatory reforms that have been proposed, including possible charges or taxes for systemically important financial institutions or mandatory through-the-cycle haircuts and minimum margin requirements for secured funding. For instance, add-on capital surcharges or other tools to control systemic solvency risk could help lower systemic liquidity risk, thereby allowing possibly for less reliance on mitigation techniques that directly address liquidity.

Another important policy goal is to improve the data that are integral to the proper assessment of liquidity risk. The limitations encountered in this analysis by relying only on publicly available data suggest that more disclosure of detailed information is needed to better assess the strength of the liability structure of banks' balance sheets to withstand shocks and their use of various liquidity risk management techniques. Richer data would help investors and counterparties evaluate the liquidity management practices at individual institutions. General information about the use of funding markets and institutions' own liquidity buffers would also help supervisors assess the probability that liquidity strains are building up; together with restricted information about intra-institution exposures, the information would help reveal the possible impairment of various funding markets. With more detailed public and private information, official liquidity support would likely be better targeted and more effectively provided. A first step to addressing significant data gaps is being achieved

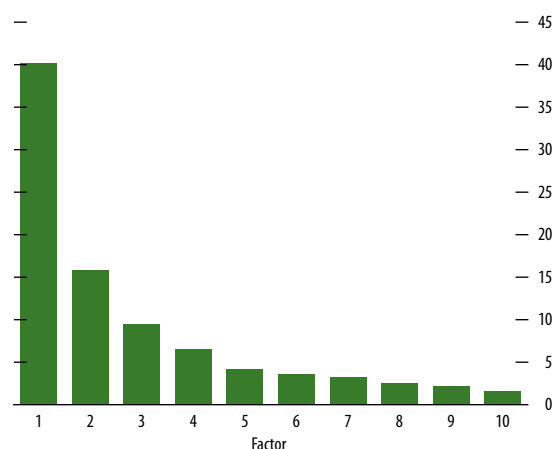
at the national and international levels through the action plans articulated in two reports prepared by the IMF and Financial Stability Board (FSB) Secretariat and endorsed by the G-20 Ministers of Finance and Central Bank Governors (the so-called G-20 Data Gaps Initiative).²³ In this context, work on developing measures of aggregate leverage and maturity mismatches in the financial system is expected to be completed in time for a June 2011 G-20 Data Gaps report.

Annex 2.1. Methods Used to Compute a Systemic Liquidity Risk Index²⁴

The computation of the SLRI follows a traditional principal components analysis (PCA). Daily data were collected on 36 violations of arbitrage covering the CIP, the corporate CDS-bond basis, the swap spread, and the on-the-run versus off-the-run spread between 2004 and 2010. These arbitrage relationships involve securities traded in the euro area, Japan, South Korea, Singapore, Switzerland, the United Kingdom, and the United States. Figure 2.11 shows the first 10 factors resulting from the PCA, ordered according to their ability to account for the variation of the violations of arbitrage data in the sample. Clearly, the first principal component captures the bulk of the common variation across the 36 time series. This dominant factor is interpreted as an indicator of systemic liquidity risk in global capital markets.

A potential limitation of the SLRI is its lack of explicit treatment of the counterparty risk that underpins the ability of some traders to borrow to execute the arbitrage strategies. It is difficult to control for the effects of counterparty risk, since essentially all market-based measures of liquidity contain solvency risk, and measures of solvency risk are also affected by (market) liquidity conditions. In an attempt to explicitly mitigate the role of counterparty risk, the SLRI was regressed against the average CDS spread comprised of the 53 banks in the sample used below to analyze the relationship of the SLRI to bank performance. The residuals of the regression were taken as a new indicator of systemic liquidity conditions (NewSLRI). This

Figure 2.11. Principal Component Analysis: Total Variation Explained by Each Factor
(In percent)



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

²³IMF/FSB (2009, 2010).

²⁴This annex was prepared by Tiago Severo and draws on Severo (forthcoming).

approach likely overestimates the role of bank-related counterparty risk in the violations of arbitrage, since the average CDS spread for banks also reflects the impact of global liquidity conditions on the banking sector. This is confirmed by regressions in which the coefficient on the SLRI is statistically significant, indicating that it explains much of the variation of bank CDS spreads over time.

The two liquidity indicators are similar in many respects. They are both very stable until early 2008 and become more volatile around the time of the March 2008 Bear Stearns collapse. After the September 2008 Lehman bankruptcy, both indexes decrease sharply, reflecting shortages in liquidity. The SLRI and the NewSLRI become less connected with each other starting in early 2009. Unfortunately, it is hard to claim that one index is superior to the other because, in practice, one cannot disentangle the true counterparty risk embedded in the SLRI.

The link between the SLRI and bank performance is analyzed with those caveats in mind. A simple model of bank returns is estimated with data on the daily equity returns of 53 global banks in Australia, Denmark, the euro area, India, Japan, New Zealand, Norway, Sweden, Switzerland, South Korea, the United Kingdom, and the United States:

$$R^i(t) = \beta_0^i + \beta_M^i \times R_M(t) + \beta_L^i \times L(t) + \varepsilon^i(t). \quad (1)$$

$R^i(t)$ is the daily dollar log-return on bank i , β_0^i is a constant, $R_M(t)$ the daily dollar log-return on the MSCI, a global index of stock returns, and represents the market factor. $L(t)$ is the daily SLRI and $\varepsilon^i(t)$ is the residual. β_M^i represents a bank's exposure to equity market risk, whereas β_L^i captures its exposure to systemic liquidity risk. The estimated β_L^i are not statistically significant for all but a few of the U.S. banks. Even for those banks, the estimates are not robust once one controls for heteroskedasticity and autocorrelation of the residuals through a generalized autoregressive conditional heteroscedasticity (GARCH) model.

Interestingly, the impact of liquidity on returns is much stronger once the regressions are conditioned on the overall returns of the banking sector. More specifically, a portfolio return for the banking sector is constructed on the basis of the weighted returns for all

banks in the sample, with market capitalization as the weight. Then, equation (1) is re-estimated using observations for the X percent worst days of this banking portfolio, where X is set to 25.²⁵ Conditional on the banking sector being in distress, bank returns seem to be strongly negatively affected by liquidity conditions. This effect is much more pronounced for U.S. and U.K. banks, whereas it is unimportant for Japanese banks. Banks in Australia, Europe, India, and South Korea lay in the middle of the distribution.

Importantly, many of the conditional estimates discussed above are not robust if the NewSLRI is substituted for the SLRI or if bank-specific information is included in the regressions. For instance, if data on each bank's CDS spread is added as a control for solvency risk in equation (1), the estimated β_L^i become insignificant for many banks. However, this approach likely underestimates the importance of systemic liquidity, since the bank-specific CDS spread is, again, also contaminated by aggregate liquidity conditions. Because it contains information about idiosyncratic shocks affecting banks as well, the ordinary least squares technique tends to attribute more weight to this variable in the regression relative to the systemic liquidity index.

That the conditional regressions based on low banking returns better explain the links between the SLRI and the level of returns means that the true link between bank equity and systemic liquidity might reside in higher moments of the return distribution (the variance of returns, for example). To study this possibility, a model of heteroscedastic stock returns is estimated in which the volatility of bank equity is a function of the SLRI and ARCH terms. More specifically, it is assumed that:

$$\begin{aligned} R^i(t) &= \beta_0^i + \beta_M^i \times R_M(t) + \beta_L^i \times L(t) + \beta_X^i \\ &\quad \times X(t) + \varepsilon^i(t)\sigma(t) \end{aligned} \quad (2)$$

$$\sigma^2(t) = \exp(\omega_0^i + \omega_L^i L(t) + \omega_Y^i \times Y(t)) + \gamma^i \varepsilon^{i2}(t-1), \quad (3)$$

where the errors are distributed according to a normal distribution with a mean of 0 and a variance of 1,

$$\varepsilon^i \sim N(0,1).$$

²⁵Results are similar for values of X percent = 30 percent or X percent = 20 percent, for example.

The variables $R^i(t), R_M(t), L(t)$ are defined as before. X and Y represent additional controls included in the model—for example, the log of the VIX, the LIBOR-overnight index swap (OIS) spread, bank-specific CDS spreads, and so on. Parameters $[\beta_0^i, \beta_M^i, \beta_L^i, \omega_\theta^i, \omega_L^i, \gamma^i]$ are estimated by maximum likelihood. The choice of the exponential functional form for the conditional heteroskedasticity was made to avoid negative fitted values for the volatility process and to facilitate convergence of the estimation algorithm.

The estimated ω_L^i are strongly negative for virtually all banks in the sample. This suggests that decreases in the SLRI are associated with increases in the volatility of bank stocks, that is, banks become riskier as liquidity dries up. Such an intuitive result is robust to the inclusion of several controls in X and Y . In particular, it holds true even after including data on bank-specific CDS spreads both in equations (2) and (3). Moreover, the results are robust to the substitution of NewSLRI for SLRI, which likely understates the importance of systemic liquidity risk, as discussed above.

Liquidity Surcharge Calculation

Using the volatility model above, one can compute a liquidity surcharge designed to assess banks on the basis of their contribution to the externality associated with their excessive exposure to systemic liquidity risk. The technique relies on the contingent claims analysis (CCA) approach, in which public authorities are assumed to provide an implicit guarantee for bank liabilities. The guarantee is modeled as an implicit put option on the assets of the bank, with strike price and maturity determined by the characteristics of bank debt. The estimated ω_L^i allows regulators to calculate the degree to which each bank's implicit put value changes as the volatility of equity increases because of liquidity stress.

More specifically, on the basis of option pricing formulas, the unconditional volatility of the market value of a bank's assets can be recovered using data on the characteristics of its liabilities and the observed unconditional volatility of the bank's equity. This information is sufficient to calculate the unconditional price of the implicit put granted to banks by public authorities. An identical calculation is performed using the estimated volatility of equity conditioned on a liquid-

ity stress period, say when the SLRI is 2 or 3 standard deviations below its mean, but keeping other factors constant. This yields the value of the put conditioned on a systemic liquidity stress period. The difference between the prices of the conditional and the unconditional puts represents the increase in the value of contingent liabilities due to liquidity shortages.

Banks can thus be charged by the public authorities according to their individual contribution to these conditional liabilities, making them, in essence, prepay the costs of relying on public support during periods of systemic liquidity distress. Of course, the details underpinning the put values (both unconditional and conditional) would need to be decided, but interestingly, this hypothetical surcharge would not be contaminated by idiosyncratic liquidity risk, since the SLRI is systemic in nature. Moreover, to the extent that the bank-specific CDS spreads are included in equations (2) and (3), neither would the liquidity surcharge be directly affected by solvency risk. This feature helps to address concerns about the overlap between capital and liquidity regulation.

Annex 2.2. Technical Description of the Systemic Risk-Adjusted Liquidity Model²⁶

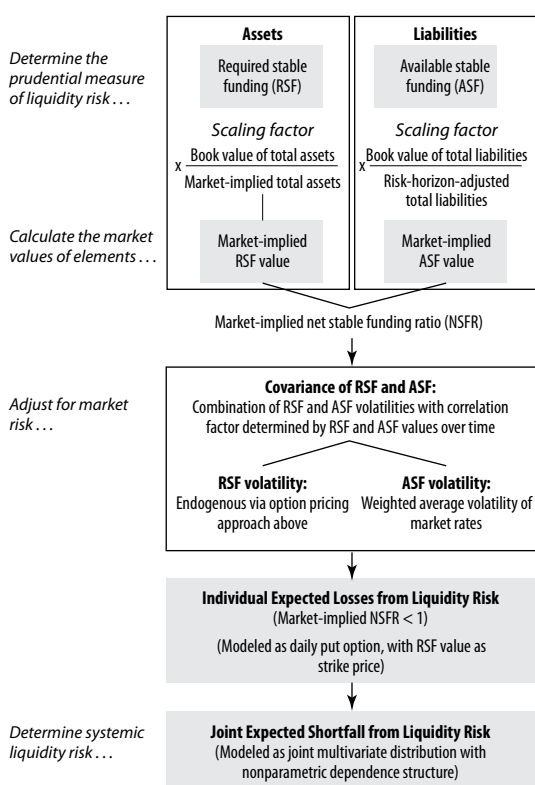
The proposed systemic risk-adjusted liquidity (SRL) model combines market prices and individual firms' balance sheet data to compute a risk-adjusted measure of systemic liquidity risk. That measure links a firm's maturity mismatch between assets and liabilities and the stability of its funding with those characteristics at other firms that are subject to common changes in market conditions.

The methodology follows three steps (Figure 2.12):

Step 1: Derive a daily measure of the NSFR at market prices, where the required stable funding (RSF) and available stable funding (ASF) values reflect differences between the balance sheet and actual market values of total assets to liabilities of each firm. The actual balance sheet measures of ASF and RSF values are re-scaled by the ratio of the book value of total assets to implied assets (which are obtained as a risk-neutral density from equity option prices with maturities

²⁶This annex was prepared by Andreas Jobst and draws on Jobst (forthcoming).

Figure 2.12. Methodology to Compute Systemic Liquidity under the Systemic Risk-Adjusted Liquidity Model



between 3 and 12 months), and by the ratio of the book value of total liabilities to the present value of total liabilities, respectively.²⁷

*Step 2: Determine the expected losses from liquidity risk using an adapted version of CCA.*²⁸ The market-implied expected loss associated with the liquidity position defined by the revised NSFR measure (obtained in step 1) can be modeled as an implicit put option in which the present value of RSF represents the “strike price,” with the short-term volatility of all assets underpinning RSF determined by the implied volatility derived from equity options prices.²⁹ More specifically, the option value is determined on the basis of the assumption that the value of the ASF follows a random walk with intermittent jumps that create sudden and large changes in the valuation of the liabilities (which is modeled as a Poisson jump-diffusion process). The volatility of these liabilities included in the ASF is computed as a weighted average of the observed volatilities of latent factors derived from a set of market funding rates deemed relevant for banks, as identified by a dynamic factor model.³⁰ These two

²⁷Estimations of these scaling factors, and the subsequent covariance and the joint expected losses, are computed over a rolling window of 120 working days to reflect their changing characteristics.

²⁸The CCA is a generalization of option pricing theory pioneered by Black and Scholes (1973) and Merton (1973). It is based on three principles that are applied in this chapter: (1) the values of liabilities are derived from assets; (2) assets follow a stochastic process; and (3) liabilities have different priorities (senior and junior claims). Equity can be modeled as an implicit call option, while risky debt can be modeled as the default-free value of debt less an implicit put option that captures expected losses. In the SRL model, the Gram-Charlier extension combined with a jump-diffusion process is applied to account for biases in the Black-Scholes-Merton specification (Backus, Foresi, and Wu, 2004; Bakshi, Cao, and Chen, 1997).

²⁹The NSFR reflect the impact of funding shocks as an exposure to changes in market prices in times of stress. The procedure can be applied to other measures of an individual firm’s liquidity risk.

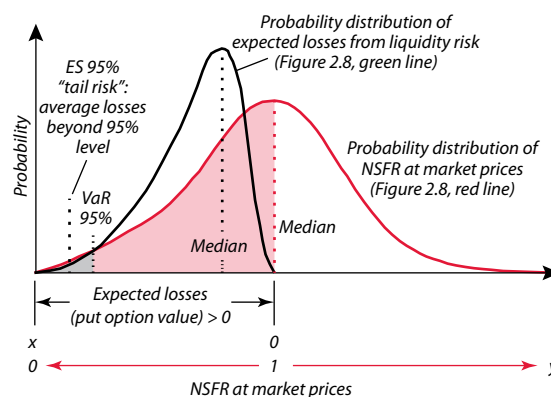
³⁰A dynamic factor model of the ASF is specified based on one principal component extracted from each group of maturities of observed market rates: short-term sovereign rate (with maturities ranging from three to twelve months); long-term sovereign rates (with maturity ranging from three to ten years); total equity market returns (domestic market and Morgan Stanley Composite Index); financial bond rates (investment grade, both medium- and long-term); domestic currency LIBOR (ranging from three to twelve months); and the domestic short-term currency OIS as

time-varying elements provide the basis for computing a put option, which has intrinsic value (is in-the-money) when the market value of the ASF falls below that of the RSF, constituting an expected loss due to liquidity shortfall. The value of this derived put option can be shown to result in significant hypothetical cash losses for an individual firm as the risk-adjusted NSFR declines.

Figure 2.13 illustrates the relation between these expected losses (step 2) and the NSFR at market prices (step 1) as distribution functions (based on multiple observations of each over a certain period of time). Expected losses arise once there is some probability that the NSFR drops below the regulatory requirement to be greater than 1. The greater the potential funding distress projected by a declining NSFR, the greater are these losses. The tail risk of an individual expected liquidity shortfall is represented by the expected shortfall (ES) at the 95th percentile, which is the area under the curve beyond the value-at-risk (VaR) threshold value.

Step 3: Derive systemic (aggregate) expected losses for all sample firms. Use the probability distribution of expected losses arising from an individual firm's implied NSFR (obtained in step 2) to calculate a joint probability of all firms experiencing a liquidity shortfall simultaneously (step 3). One combines the marginal distributions of these individual expected losses with their nonlinear dependence structure (estimated via a nonparametric copula function) to determine an extreme value multivariate distribution by following the aggregation mechanism proposed under the systemic CCA framework (Gray, Jobst, and Malone, 2010; Gray and Jobst, 2010; Gray and Jobst, forthcoming; and Jobst, forthcoming). Using this multivariate distribution, one can use estimates of the joint tail risk, such as the ES at a statistical confidence level of 95 percent or higher, to gauge systemic liquidity risks. One can also extract the time-varying contribution of each individual firm to the joint distribution (by calculating the cross-partial derivative) and use this amount to develop a capital surcharge or a fair value risk premium for systemic liquidity risk.

Figure 2.13. Conceptual Relation between the Net Stable Funding Ratio at Market Prices and Expected Losses from Liquidity Risk

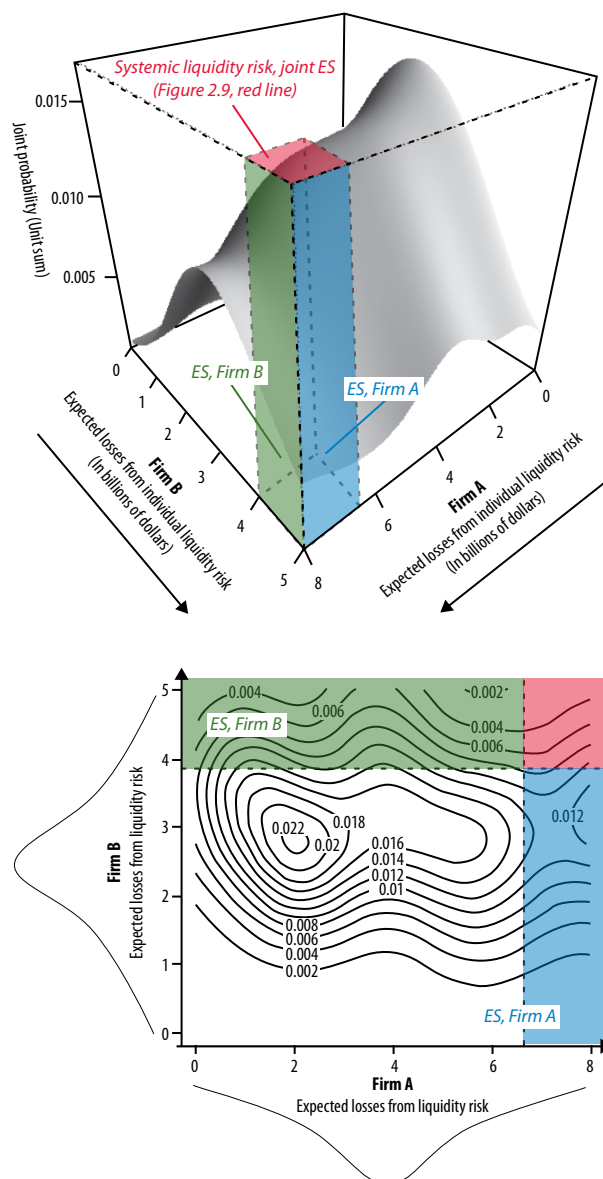


Source: IMF staff estimates.

Note: Expected losses are modeled as a put option. NSFR = net stable funding ratio; VaR = value at risk; ES = expected shortfall.

explanatory variables. The volatility of ASF is calculated as the average volatility of these market rates weighted by the regression coefficient of each principal component.

Figure 2.14. Conceptual Scheme for the Probability Distribution of Joint Expected Shortfall from Liquidity Risk: Two-Firm (Bivariate) Case
(In percent)



Sources: IMF staff estimates.
Note: Expected losses are modeled as a put option.
ES= expected shortfall. ES shown at 95 percent confidence level.

Figure 2.14 illustrates the bivariate case of expected losses determining the joint probability of two sample firms experiencing a liquidity shortfall at the same time, using the estimation results from step 3. The top panel of Figure 2.14 shows the density function of two firms (Bank A and Bank B). The probability of systemic liquidity risk is captured by combining the individual bank estimates (depicted by the green and blue panels), which generates the joint expected shortfall at the 95th percentile (red cube). The top panel can also be shown in two-dimensions as a so-called contour plot (see bottom panel of Figure 2.14.).

Capital Surcharge and Insurance Premium Calculations

In particular, the above measure of systemic liquidity risk, if applied to a banking system, can be used to calibrate two price-based measures, a capital surcharge and an insurance premium, either of which could be used as a macroprudential tool to help mitigate systemic liquidity risk. Implicitly, these two measures proxy for the amount of contingent support that banks would receive from a central bank in times of systemic liquidity stress.

- A capital surcharge could be based on a firm's own liquidity risk (highest risk-based NSFR over some pre-specified period, such as one quarter) or its marginal contribution to joint liquidity risk, whichever is higher.
- An insurance premium could be based on an actuarial fee imposed on firms, which would be used to compensate them for expected losses in a systemic event when they fall below the minimum required NSFR of 1 in concert with other banks.

Numerical examples of these two approaches are in the main text of the chapter, and their calculations are explained below.

For the capital surcharge, the method follows the current bank supervisory guidelines for market risk capital requirements (BCBS, 2009), in which the VaR is calculated each day and compared to three times the average quarterly VaRs over the last four quarters. The maximum of these two numbers becomes the required amount of regulatory capital for market risk. In a similar way, each firm j would need to meet an additional capital requirement, c_{SLR}

(in dollars), at time t , to offset its contribution to systemic liquidity risk at a statistical confidence level of $a = 0.95$. First, choose the higher of (1) the previous quarter's expected shortfall $ES(a)_{j,t-1,\tau}$ at percentile a associated with *individual* expected losses and (2) the average of this quarterly measure over the preceding four quarters, multiplied by an individual multiplication factor κ_j . This amount would be compared to the last available average quarterly *marginal contribution*, $\overline{MC(a)}_{j,t-1,\tau}$, measured as a probability multiplied by the systemwide $ES(a)_{t-1,\tau}$, in dollars, and the average of this quarterly measure over the preceding four quarters, multiplied by a multiplication factor κ . The higher of the two maximums would then be the surcharge. Therefore, based on an estimation window of τ days for ES, the capital surcharge c_{SLR} would be

$$c_{SLR} = \max \left\{ \begin{array}{l} \max \left\{ ES(a)_{j,t-1,\tau}; \kappa_j \times \frac{1}{4} \sum_{t=-4}^0 ES(a)_{j,t,\tau} \right\}; \\ \max \left\{ \overline{MC(a)}_{j,t-1,\tau} \times ES(a)_{t-1,\tau}; \right. \\ \left. \kappa \times \frac{1}{4} \sum_{t=-4}^0 \left(\overline{MC(a)}_{j,t,\tau} \times ES(a)_{t,\tau} \right) \right\} \end{array} \right\}$$

The comparison of the two maximums is motivated by Figure 2.9, whereby an individual firm's liquidity risk (its own expected loss) may be higher than its systemic risk contribution, which underscores the importance of analyzing the interlinkages between firms and how they influence the realization of joint tail risks. Note that the amount of capital to be withheld is exactly the (probabilistic) amount needed to offset the losses that would be incurred for a given level of statistical confidence when the NSFR > 1 requirement is violated.

An alternative method is to require firms to pay a systemic liquidity insurance premium that would amount to a prepayment for liquidity support based on the likelihood of a systemwide liquidity shortfall. The individual contribution to systemic liquidity risk can be used to calculate a fair value price for insurance specific to each firm. To illustrate this, the average marginal contribution of each firm to systemwide expected shortfall (with statistical probability a) is first divided by the average of the discounted present value of RSF over the previous four quarters. This is the ratio of the potential systemically based dollar

losses of firm j to its required stable funding—the probabilistic proportion of underfunding (if greater than 1) in times of stress, akin to a probability of distress for a certain risk horizon. Assuming that this probability is constant over time and can be expressed as an exponential function over time, the fair value of a risk-based insurance premium can be obtained as the natural logarithm of 1 minus the above ratio and multiplied by the negative inverse of the time period under consideration. Unlike the capital surcharge, which is meant to absorb losses at any point in time, the insurance premium is measured over time (in this case, one year ahead) and thus spreads out the probability of the firm's experiencing a liquidity shortfall over a risk horizon and as a result will appear as a lower cost.

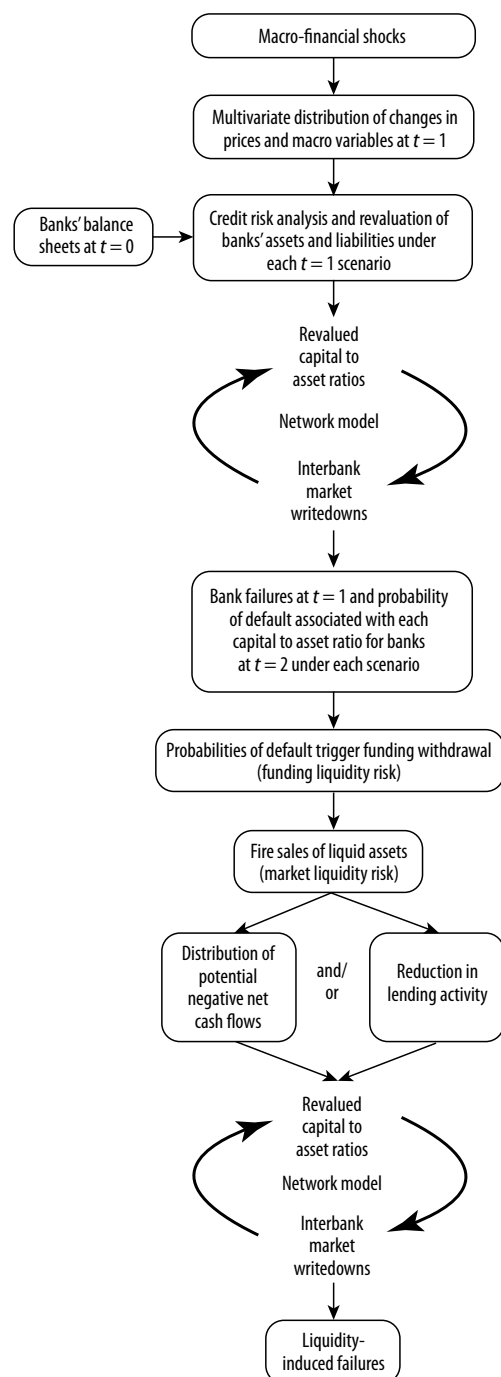
More specifically, the cost f_{SLR} of insuring stable funding over the short term against possible liability run-offs can be calculated by multiplying the estimated conditional insurance premium with the value of average uncovered short-term liabilities $L_{j,t}^{ST}$ (i.e., excluding secured deposits) over the previous four quarters as a nominal base. This amount would compensate for the individual firm's cost of future systemic liquidity support. Thus, firm j 's premium would be,

$$f_{SLR} = -\frac{1}{T} \ln \left(1 - \frac{\sum_{t=-4}^0 \left(\overline{MC(a)}_{j,t,\tau} \times ES(a)_{t,\tau} \right)}{\sum_{t=-4}^0 \overline{RSF}_{j,t} \times \exp(-r(T-t))} \right) \times \frac{1}{4} \sum_{t=-4}^0 \overline{L}_{j,t}^{ST}$$

where r is the risk-free rate and $T-t$ (that is, residual maturity) is the time horizon.³¹

Because they take into account a single firm's time varying contribution to systemic liquidity risk, either the capital surcharge or the insurance premium could be used as price-based macroprudential tool to instill incentives for more resilient and diversified funding structures. Based on estimates during times of stress, both measures could be refined to avoid procyclical tendencies. For instance, in the context of the capital surcharge, the multiplication factor κ_j could be calibrated on data obtained during times of stress and set

³¹Note that this approach could also be used to identify the effectiveness of closer supervisory monitoring in response to identified liquidity problems of a particular bank. That can be done if remedial actions decrease the bank's contribution to overall systemic risk from liquidity shortfalls up to the point where it closely matches the individual liquidity risk.

Figure 2.15. Systemic Liquidity Risk ST Framework

such that minimum prudential levels of capital charges are maintained.

Annex 2.3. Highlights of the Stress-Testing Framework³²

The stress-test (ST) approach takes as a starting point the view that systemic liquidity runs are extreme episodes of market-imposed discipline stemming from concerns about the value of bank assets—in the latest crisis, from depressed values for subprime mortgages and structured products affected by the fall in house prices (see Afonso, Kovner, and Schoar, 2010).

The ST approach is applied to 10 stylized U.S. banks calibrated with Call Report data: two small local banks with assets concentrated in California and Florida-Georgia respectively; three middle-sized regional banks (east coast, midwest, and west coast); three large banks; and two megabanks. The Call Report is the term used for the data collected quarterly by the Federal Financial Institutions Examination Council from most insured banks in the United States. The megabanks account for just over 60 percent of banking assets in this stylized sample. The approach proceeds in four stages: (1) modeling of the financial and economic environment; (2) credit risk modeling; (3) systemic solvency risk modeling; and (4) systemic liquidity risk modeling (Figure 2.15).

Financial and Economic Environment Modeling

A forward-looking simulation methodology is applied to the 10 banks simultaneously for modeling correlated systemic solvency and liquidity risks. One element that makes the model systemic is that all entities (individuals, financial and nonfinancial institutions, regulators, governments, and so on) will experience the same financial and economic environment. Financial and economic shocks can be expected to produce correlated solvency and liquidity risks for banks, some of which have similar asset and liability structures.

³²This annex was prepared by Theodore Barnhill Jr. and Liliana Schumacher and draws on Barnhill and Schumacher (forthcoming).

The simulation of the financial and economic environment requires the specification of trends, volatilities, and correlations of a number of important financial and economic variables. From this set of variables and their statistical attributes, thousands of potential future financial environments are created over a selected time-step (for example, T1 is one year). A “bad” regime can be chosen to demonstrate a higher risk of an adverse period. In this application, the variables in the financial and economic environment include domestic and foreign interest rates, interest rate spreads, foreign exchange rates, U.S. economic indicators, global equity indices, equity returns from 14 S&P sectors, and real estate returns from 20 Case-Shiller regions. The adverse period 2007–2010:Q1, with low equity returns and negative regional real estate returns, is used to generate the stress test results.

Credit Risk Modeling³³

Bank solvency and liquidity risks are driven by bank asset and liability structures, loan credit quality, sector and regional loan concentrations, and equity capital levels. In this application, the 10 stylized banks are constructed to be representative of the U.S. banking system, with various sizes, asset and liability structures, and equity capital ratios taken from aggregated, publicly available data. A larger or smaller number of banks could be modeled.

Changes in the ratio of equity capital to assets, and hence solvency risks, are outputs of a standard credit risk model. For instance, assessments of business and mortgage credit risk are based on simulations, respectively, of business debt-to-value ratios and property loan-to-value ratios using a Merton-type model.³⁴ Recovery rates on business loans are systematically related to stock market returns, and those for mortgage loans are assumed to be the property loan-to-value ratio less a 30 percent liquidation cost.³⁵ Correlated market risk for approximately 100 other bank assets and liabili-

ties is also modeled. These analyses produce correlated capital ratios and solvency risk assessments (probabilities of default) for all 10 banks in each run of the simulation at the selected time step, which allows systemic risk assessments to be undertaken.

Systemic Solvency Risk Modeling

The outcomes of the risk assessments of the financial and economic environment and bank portfolios after many simulation runs are joint distributions of each of the 10 bank's ratio of equity capital to assets and other balance sheet information at the selected time step. This information is used to estimate the banks' correlated default probabilities and systemic banking system risks.

During times of economic stress, it is likely that default losses on loans will increase, and many banks will either fail or be weakened significantly, particularly if they have similar asset and liability structures. This is just the time when the failure of several banks could, through interbank credit defaults, precipitate a number of simultaneous bank failures.

The interbank credit risk is modeled using a network methodology. In the current study, and consistent with current U.S. regulations, a bank fails when its ratio of equity capital to assets falls below 2 percent.³⁶ In this case, the bank becomes incapable of honoring its interbank obligations and defaults on them.³⁷ The recovery rate on these interbank obligations is set at 40 percent, and this would affect other banks' capital ratios and potentially lead to additional bank failures. The network methodology is applied repeatedly until no additional banks fail, after which the probability of multiple simultaneous bank failures (that is, systemic solvency risk) can be computed.

³³The risk assessments reported in this analysis were undertaken with the ValueCalc Banking System Risk Modeling Software, copyright FinSoft, Inc. The IMF does not endorse the use of this, or any other, software.

³⁴For a more detailed discussion, see Barnhill and Maxwell (2002).

³⁵See Varma and Cantor (2005). For more information see Barnhill, Papapanagiotou, and Schumacher (2002).

³⁶The Prompt Corrective Action provision in the FDIC Improvement Act of 1991 states that a bank should be closed when its tangible capitalization reaches 2 percent. The trigger point for bank failure could be set in the ST framework model at any relevant regulatory level, including the new leverage ratio as proposed under Basel III.

³⁷In the current study precise information on inter-bank borrowers' and lenders' identities is unavailable; hence the amount of interbank loans made between each bank is assumed to be proportional to their total inter-bank borrowing and lending.

Modeling Correlated Systemic Liquidity Risk

The model's primary contribution to stress testing is the addition of correlated liquidity runs on banks, driven by heightened risks, or uncertainties, regarding future bank solvency. When multiple banks fail, it is highly likely that the risk of future insolvency for the remaining banks is elevated. At the end of each run of the time step simulation (for example, at T1), future (T2) solvency risks for each bank are computed. When a bank's probability of default at T2 is 10 percent (or 20 percent, or 40 percent), it is assumed that it results in a liquidity run that reduces that bank's total liabilities by 5 percent (or 10 percent, or 25 percent, respectively).³⁸

Banks that face a liquidity run are assumed to follow the following sequence of events. At first, banks stop lending in the interbank and repo markets, liquidate interest bearing bank deposits, sell government securities, and sell other securities. If these steps do not produce adequate liquidity, they ultimately default on their obligations. Second, the banks sell their liquid securities and reduce their loan portfolios in proportions similar to that observed in U.S. bank holding companies having elevated failure probabilities. Additional bank losses result from the sale of assets at fire sale prices.

It is possible to estimate the distribution of potential banking system loan reductions resulting from systemic liquidity events. In severe cases, such reduced bank lending may lead to a credit shortage with substantial adverse impacts on the real economy.

Both liquidity failures of counterparty banks and the fire sale of assets may produce further losses for banks that adversely affect their solvency. Again, these can be modeled with a network methodology applied repeatedly until no additional banks fail. In this way the probability of multiple simultaneous bank failures (that is, correlated systemic solvency and liquidity risk) can be assessed.

Correlated systemic solvency and liquidity risks may be reduced by moderating the volatility in the financial and economic environment or by altering banks' asset

and liability structures, loan credit quality, sector and regional loan concentrations, and equity capital levels. The model can assess the systemic impact of changes in any combination of these variables.

Data Requirements

The ST approach, which is quite data intensive, has the following data requirements. In some cases, it may be possible to substitute expert opinion for data that may not be available.

- Time series related to the financial and economic environment in which banks operate. These series need to be of sufficient length to allow trends, volatilities, and correlations to be estimated during both "normal" and "stress" periods. The following data are of interest:
 - short-term domestic and foreign interest rates and their term structures
 - interest rate spreads for loans of various credit qualities (securities)
 - foreign exchange rates (as relevant)
 - economic indicators (gross domestic product (GDP), consumer price index, unemployment, and so on)
 - commodity prices (oil, gold, and so on)
 - sector equity indices
 - real estate prices
- Information on banks' assets, liabilities, and, ideally, off-balance-sheet transactions, including hedges, such as:
 - various categories of loans, including information about their credit quality, maturity structure, and currencies of denomination
 - currency and maturity structure of the other assets and liabilities
 - capital as well as operating expenses and tax rates
 - clients' leverage ratios and recovery rates, to be able to calibrate credit risk models
 - interbank exposures, including bilateral credit exposures among the various banks
- Information to enable calibration of behavioral relationships, such as:

³⁸These assumptions are based on the analysis of changes in total liabilities for a group of about 700 insured bank holding companies relative to their estimated probability of default. System-wide weighted average default probabilities are modeled and it is assumed that they have some impact on the market's assessment of future bank default probabilities and liquidity runs.

- between banks' default probabilities and funding reduction due to bank creditors' concerns about solvency
- between asset fire sales and asset values (including haircuts), which in turn affect liquidity and solvency ratios

References

- Acharya, Viral V., Thomas F. Cooley, Matthew P. Richardson, and Ingo Walter, 2010, "Regulating Wall Street: The Dodd-Frank Act and the New Architecture of Global Finance" (New York: Wiley and Sons).
- Acharya, Viral V., Joao A. C. Santos, and Tanju Yorulmazer, 2010, "Systemic Risk and Deposit Insurance Premiums," *Economic Policy Review* (New York: Federal Reserve Bank of New York, August).
- Afonso, Gara, Anna Kovner, and Antoinette Shoar, 2010, "Stressed, Not Frozen: The Federal Funds Market in the Financial Crisis," Federal Reserve Bank of New York Staff Reports No. 437 (March).
- Aikmen, David, Alessandro Piergiorgio, Bruno Eklund, Prasanna Gai, Sujit Kapadia, Elizabeth Martin, Nada Mora, Gabriel Sterne, and Matthew Willison, 2009, "Funding Liquidity Risk in a Quantitative Model of Systemic Stability," Bank of England Working Paper No. 372 (June).
- Backus, David, Silverio Foresi, and Liuren Wu, 2004, "Accounting for Biases in Black-Scholes," Working Paper, New York University, Goldman Sachs Group, and Baruch College.
- Bai, Jennie, and Pierre Collin-Dufresne, 2010, "The Determinants of the CDS-Bond Basis During the Financial Crisis of 2007–2009," Federal Reserve Bank of New York Working Paper (September).
- Bakshi, Gurdip, Charles Cao, and Zhiwu Chen, 1997, "Empirical Performance of Alternative Option Pricing Models," *Journal of Finance*, Vol. 52, No. 5, pp. 2003–49.
- Barnhill, Theodore, and W. Maxwell, 2002, "Modeling Correlated Interest Rate, Exchange Rate, and Credit Risk in Fixed Income Portfolios," *Journal of Banking and Finance*, Vol. 26, No. 2-3, pp. 347–74.
- Barnhill, Theodore, P. Papapanagiotou, and Liliana Schumacher, 2002, "Measuring Integrated Market and Credit Risk in Bank Portfolios: An Application to a Set of Hypothetical Banks Operating in South Africa," *Financial Markets, Institutions and Instruments*, Vol. 11, No. 5 (December).
- Barnhill, Theodore, and Liliana Schumacher, forthcoming, "Modeling Correlated Systemic Liquidity and Solvency Risks in a Volatile Environment with Incomplete Information," IMF Working Paper (Washington: International Monetary Fund).
- Basel Committee on Banking Supervision (BCBS), 2009, "Revisions to the Basel II Market Risk Framework" (Basel: Bank for International Settlements, July).
- _____, 2010a, "Basel III: International Framework for Liquidity Risk Measurement, Standards and Monitoring" (Basel: Bank for International Settlements, December).
- _____, 2010b, "Results of the Comprehensive Quantitative Impact Study" (Basel: Bank for International Settlements, December).
- Black, Fischer, and Myron Scholes, 1973, "The Pricing of Options and Corporate Liabilities," *Journal of Political Economy*, Vol. 81, No. 3, pp. 637–54.
- Brunnermeier, Markus, Andrew Crocket, Charles Goodhart, Martin Hellwig, Avi Persaud, and Hyun Song Shin, 2009, "The Fundamental Principles of Financial Regulation," Geneva Reports on the World Economy 11.
- Brunnermeier, Markus, and Lasse Pedersen, 2009, "Market Liquidity and Funding Liquidity," *Review of Financial Studies*, Vol. 22, No. 6, pp. 2201–38.
- Cao, Jin, and Gerhard Illing, 2009, "Endogenous Systemic Liquidity Risk," CESIFO Working Paper No. 2627 (April).
- Chacko, George, Sanjiv Das, and Rong Fan, 2010, "An Index-Based Measure of Liquidity," Working Paper (August). Available via the Internet: www.scu.edu/business/economics/upload/Chacko2010.pdf.
- Coffey, Niall, Warren Hrun, and Asani Sarkar (2009), "Capital Constraints, Counterparty Risk and Deviations from Covered Interest Parity," Federal Reserve Bank of New York Staff Reports No. 393 (October).
- Committee of European Banking Supervisors (CEBS), 2010, "Results of the Comprehensive Quantitative Impact Study," (December 16). Available via the Internet: www.eba.europa.eu/Publications/Quantitative-Impact-Study.aspx.
- Coval, Joshua, and Erik Stafford, 2007, "Asset Fire Sales (and Purchases) in Equity Markets," *Journal of Financial Economics*, Vol. 86, pp. 479–512.
- Duffie, Darrell, Nicolae Gârleanu, and Lasse Pedersen, 2006, "Valuation in Over-the-Counter Markets," NBER Working Paper No. 12020 (Cambridge, Massachusetts: National Bureau of Economic Research).
- Farhi, Emmanuel, Mikhail Golosov, and Aleh Tsyvinski, 2009, "A Theory of Liquidity and Regulation of Financial Intermediation," *Review of Economic Studies*, Vol. 76, No. 3, pp. 973–92.
- Financial Times*, 2008, "Wholesale Jitters Take Toll on HBOS," September 16.

- Fontaine, Jean-Sébastien, and René Garcia, 2009, "Bond Liquidity Premia," Bank of Canada Working Paper 28.
- Goodhart, Charles, 2009, "Liquidity Management," Jackson Hole Financial Stability and Macroeconomic Policy Symposium, Federal Reserve Bank of Kansas City, August.
- Gorton, Gary B., and Andrew Metrick, 2009, "Securitized Banking and the Run on the Repo," NBER Working Paper No. 15223 (Cambridge, Massachusetts: National Bureau of Economic Research).
- Gray, Dale F., and Andreas A. Jobst, 2010, "New Directions in Financial Sector and Sovereign Risk Management," *Journal of Investment Management*, Vol. 8, No.1, pp. 23–38.
- _____, forthcoming, "Systemic Contingent Claims Analysis (Systemic CCA)—Estimating Potential Losses and Implicit Government Guarantees to Banks," IMF Working Paper (Washington: International Monetary Fund).
- Gray, Dale F., Andreas A. Jobst, and Samuel Malone, 2010, "Quantifying Systemic Risk and Reconceptualizing the Role of Finance for Economic Growth," *Journal of Investment Management*, Vol. 8, No.2, pp. 90–110.
- Griffoli, Tommaso, and Angelo Ranaldo, 2010, "Limits to Arbitrage During the Crisis: Funding Liquidity Constraints and Covered Interest Parity," Swiss National Bank Working Paper (June). Available via the Internet: www.cepr.org/meets/wkcn/5/5571/papers/RanaldoFinal.pdf.
- Gromb, Denis, and Dimitri Vayanos, 2010, "A Model of Financial Market Liquidity Based on Intermediary Capital," *Journal of the European Economic Association*, Vol. 8 (April/May), No. 2–3, pp. 456–66.
- International Monetary Fund (IMF), 2008, *Global Financial Stability Report*, World Economic and Financial Surveys (Washington: International Monetary Fund, October).
- _____, 2010, *Global Financial Stability Report*, World Economic and Financial Surveys (Washington: International Monetary Fund, October).
- _____, and Financial Stability Board (IMF/FSB), 2009, "The Financial Crisis and Information Gaps," Report to the G-20 Finance Ministers and Central Bank Governors (October).
- _____, and Financial Stability Board (IMF/FSB), 2010, "The Financial Crisis and Information Gaps," Progress Report, Action Plans and Time Tables (May).
- Jobst, Andreas A., forthcoming, "Measuring Systemic Risk-Adjusted Liquidity," IMF Working Paper (Washington: International Monetary Fund).
- Merton, Robert, 1973, "Theory of Rational Option Pricing," *Bell Journal of Economics and Management Science*, Vol. 4 (Spring), pp. 141–83.
- Mitchell, Mark L., and Todd C. Pulvino, 2010, "Arbitrage Crashes and the Speed of Capital," AQR Capital Management Working Paper (October).
- Ötler-Robe, İnci, and Ceyla Pazarbasioglu, 2010, "Impact of Regulatory Reforms on Large and Complex Financial Institutions," Staff Position Note No. 2010/16 (Washington: International Monetary Fund, November).
- Perotti, Enrico, and Javier Suarez, 2009, "Liquidity Risk Charges as a Macroprudential Tool," CEPR Policy Insight No. 40 (London: Centre for Economic Policy Research). Available via the Internet: www.cepr.org/pubs/PolicyInsights/CEPR_Policy_Insight_040.asp.
- _____, forthcoming, "Regulation of Liquidity Risk," CEPR Policy Insight (London).
- Schwarz, Krista, 2010, "Mind the Gap: Disentangling Credit and Liquidity in Risk Spreads," Working Paper (The Wharton School). Available via the Internet: <http://finance.wharton.upenn.edu/~kschwarz/Spreads.pdf>.
- Severo, Tiago, forthcoming, "Measuring Systemic Liquidity Risk Using Violations of Arbitrage Relationships across Markets," IMF Working Paper (Washington: International Monetary Fund).
- Shin, Hyun Song, 2009, "Reflections on Modern Bank Runs: A Case Study of Northern Rock," *Journal of Economic Perspectives*, Vol. 23, No. 1, pp.101–19.
- Shleifer, Andrei, and Robert Vishny, 2010, "Fire Sales in Finance and Macroeconomics," NBER Working Paper 16642 (Cambridge, Massachusetts: National Bureau of Economic Research).
- Valderrama, Laura, 2010, "Macroprudential Regulation under Repo Funding," IMF Working Paper No. 10/220 (Washington: International Monetary Fund).
- van den End, Jan Willem, 2008, "Liquidity Stress-Tester: A Macro Model for Stress-testing Banks' Liquidity Risk," Dutch National Bank Working Paper No. 175 (May).
- Varma, Praveen, and Richard Cantor, 2005, "Determinants of Recovery Rates on Defaulted Bonds and Loans for North American Corporate Issuers: 1983–2003," *Journal of Fixed Income*, Vol. 14 (March), No. 4, pp. 29–44.
- Wong, Eric, and Cho-Hoi Hui, 2009, "A Liquidity Risk Stress-Testing Framework with Interaction between Market and Credit Risks," Hong Kong Monetary Authority Working Paper 06/2009 (Hong Kong: Monetary Authority, March).

Summary

Housing market booms followed by busts have been associated with financial instability and significant costs to the economy in many countries over the years, reflecting the importance of the housing sector. Still, the degree to which such house price boom-bust episodes have led to more widespread financial instability differs between countries, in part because of important differences in countries' housing finance systems, including the role of government. This chapter analyzes housing finance systems in a number of representative advanced and emerging economies in order to identify factors that enhance the stability of housing finance systems and financial stability more generally. In particular, it examines aspects of housing finance systems in some advanced economies that contributed to financial instability in the recent crisis.

The chapter draws in large part on empirical analyses that confirm that rapid mortgage credit growth and strong house price increases go hand in hand. The analyses also account for the impact of a number of housing finance characteristics on mortgage credit and house prices. In particular, they suggest that government participation in housing finance exacerbated house price swings and amplified mortgage credit growth during the run-up to the recent crisis, particularly in advanced economies. Countries with more government involvement also experienced deeper house price declines. Moreover, higher loan-to-value ratios are significantly associated with higher house price and credit growth over time for advanced economies, in line with other studies. This effect disappears when emerging economies are included in the sample over the most recent period, possibly due to less formal loan limits in these countries, where lending to a large extent still takes place in unregulated sectors.

Based on an evaluation of evidence presented in the chapter, including the empirical analyses, three broad areas of best practices for stable housing finance systems emerge: (1) enhanced risk management, underwriting standards, and supervision; (2) more careful calibration of government participation; and (3) improved alignment of incentives of participants using capital market funding. When discussing these best practices, the chapter also notes additional aspects that need to be considered by policymakers in emerging market countries as they set up their housing finance systems.

Lastly, based on the best practices, the chapter makes specific recommendations for the housing finance system in the United States, where the recent crisis in part had its origins. This system remains unique in many ways and an overhaul is needed. The U.S. administration's recently released housing finance reform proposal is a welcome step. Reform of the U.S. housing finance system should address current gaps in the regulatory, supervisory, and consumer protection frameworks; aim for better defined and more transparent government involvement in the housing market, showing relevant items on the government's budget; reconsider the role of the housing government-sponsored enterprises, with a view to creating a more level playing field in mortgage markets; and encourage "safe" private-label securitization, including by improving the alignment of incentives. Such reforms would have a significant positive effect on the U.S. financial system and would help bolster global financial stability.

In many countries, house price swings have been associated with financial instability. There are several examples of house price booms and busts over the past two decades, including in Sweden in the early 1990s, and in Ireland, Spain, the United Kingdom, and the United States during the current crisis (Figure 3.1). These house price gyrations can carry a significant cost to the economy, reflecting the importance of housing in the construction industry, household budgets, and overall wealth. Still, the degree to which such house price boom-bust episodes have led to more widespread financial instability differs between countries, in part because of important differences in countries' housing finance systems, including the role of government in the housing market.

The recent financial crisis was triggered by problems in the U.S. domestic subprime mortgage markets, where cumulative loss rates of securitized subprime loan portfolios exceeded 20 percent by end-2010. In the wake of the crisis, U.S. housing defaults have accelerated, reaching their highest level since the 1930s, with 11.1 million residential properties (or 23.1 percent of the total) having negative equity mortgages (that is, where the outstanding loan balance is greater than the property value) as of end-2010 (CoreLogic, 2011).

The purpose of this chapter is to bring theoretical concepts and empirical evidence to bear on housing finance systems in a number of representative advanced and emerging economies in order to identify factors conducive to a stable housing finance system and financial stability more generally. In particular, the chapter will examine those aspects of housing finance systems in some advanced economies that have contributed to financial instability, in part through empirical analyses. It will make recommendations on how to mitigate these factors by outlining a number of best practices that emerge from evidence presented in the chapter. The chapter will also discuss the extent to which these best practices might be applicable in emerging economies as they set up their housing finance systems. In doing so, the chapter will not

focus on other factors affecting financial stability, nor on other aspects of housing finance such as measures to promote social housing. The concept of housing finance will be interpreted broadly, encompassing not only specific product types and lender structures but also the degree of government participation and the importance of the legal system for a well-functioning mortgage market. The chapter concludes with a number of policy recommendations to encourage more stable housing finance systems in advanced and emerging market economies and some proposals specifically for the reform of housing finance in the United States.

Housing Booms and Busts—Theory and Stylized Facts

Before examining the effects of housing finance on financial stability, it is useful to review why housing markets have been implicated in many episodes of financial instability. Housing booms and busts are often associated with systemic financial stress. The recent experiences in the United States, Spain, Ireland, and, to a lesser extent, the United Kingdom provide fresh examples of unsustainable housing booms that have turned into busts, with sizable output losses and banking crises in some cases.¹ Reinhart and Rogoff (2009) show that the six major historical episodes of banking crises in advanced economies since the mid-1970s were all associated with a housing bust. They document that this pattern can also be found in many emerging market crises, including the Asian financial crisis of 1997–98, with the magnitude of house price declines being broadly similar in both advanced and emerging market countries.²

Given that housing busts weaken household and financial sector balance sheets, housing-linked recessions are, on average, more severe than recessions that are not accompanied by housing busts. Based on 1960–2007 cross-country data from the Organization for Economic Cooperation and Development (OECD), Claessens, Kose, and Terrones (2008) show that output losses in recessions accompanied by hous-

Note: This chapter was written by a team headed by Ann-Margret Westin, and comprised of Dawn Yi Lin Chew, Francesco Columba, Alessandro Gullo, Deniz Igan, Andreas Jobst, John Kiff, Andrea Maechler, Srobona Mitra, and Erlend Nier, with research support from Ivailo Arsov and Yoon Sook Kim.

¹See Crowe and others (2011a), in particular their Figure 3.

²Stresses on the financial system can of course arise from sources other than a housing bust, including sovereign and currency crises, a general deterioration of economic prospects, and regional contagion.

ing busts are two to three times greater than they would otherwise be. Moreover, housing busts tend to prolong recessions (averaging 18 quarters, compared with four quarters for the typical recession), as falling house prices act as a further drag on household consumption and residential investment while putting financial intermediary balance sheets under stress.

Since house purchases typically involve household borrowing, house prices are likely to be strongly driven by credit conditions and household leverage.³ An influential set of studies (Stein, 1995; Kiyotaki and Moore, 1997) posit that households can borrow only a fixed multiple of their down payment. This assumption of a fixed “leverage ratio” implies an “accelerator” mechanism, where a positive or negative shock to income (or net worth) is amplified by an expansion, or contraction, in borrowing capacity, in turn influencing house prices. Positive shocks to household income translate into larger house price increases where prevailing leverage ratios are higher (e.g., in the United Kingdom), and smaller increases in countries where such leverage ratios are lower (e.g., in Italy).⁴

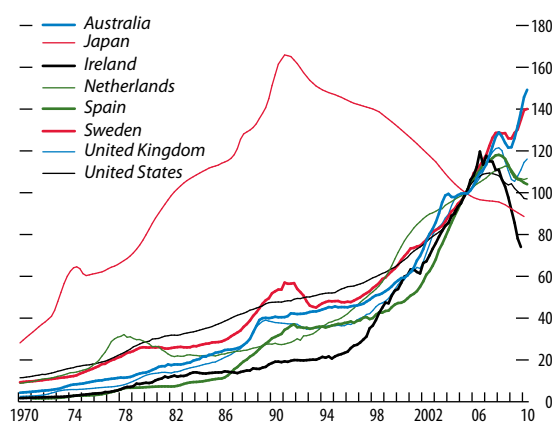
Leverage—and lending standards more broadly—can evolve in a procyclical fashion, resulting in powerful swings in house prices (Geanakoplos, 2010). Relaxing lending standards in good times drives up both credit and house price growth while a tightening of standards puts downward pressure on house prices. A number of studies of the recent housing boom in the United States show that rapid growth in credit to prime and subprime borrowers was associated with a sharp deterioration in lending standards that in turn fueled house price appreciation.⁵

³As documented in a large body of previous empirical literature, in addition to credit, house prices are strongly driven by fundamentals such as income and population growth. Parts of the theoretical literature stress nonfinancial frictions, such as overly optimistic (adaptive) expectations on both the demand and supply side as additional forces that can drive prices away from fundamentals (Shiller, 2008; McCue and Belsky, 2007; Burnside, Eichenbaum, and Rebelo, 2011).

⁴Existing evidence confirms the presence of such a mechanism both within the United States and across the OECD (Lamont and Stein, 1999; Almeida, Campello, and Liu, 2005).

⁵See Favara and Imbs (2009); Dell’Ariccia, Igan, and Laeven (2008); Geanakoplos (2010); and Mian and Sufi (2009a). U.S. subprime mortgage originations almost tripled over 2000–06, reaching \$600 billion or 20 percent of all mortgage origina-

Figure 3.1. House Price Indices
(2005 = 100)



Source: Organization for Economic Cooperation and Development.
Note: Nominal house prices.

When the housing cycle turns, often triggered by a shock to expectations, and as house prices begin to fall, high existing leverage can further increase the severity of the housing bust through three main channels.⁶

- First, when house prices fall and lending standards for new loans tighten, homeowners with low or negative equity mortgages are unable to refinance and will increasingly be driven to—or will choose to—default on their loans. A default reduces a borrower's credit standing, making it difficult for the borrower to become eligible for a new mortgage and removing the household from the pool of potential buyers of homes, thus further depressing prices.^{7,8}
- Second, following a borrower default, lenders will sell the property, leading to further price declines, especially when potential buyers are constrained by the tight lending standards that prevail in falling markets.⁹
- Third, homeowners with negative equity mortgages have reduced incentives to maintain their property, because the increase in value is likely to accrue to the lender if the probability of eventual default and foreclosure is high.

tions in 2006. During this time, the required down payment on U.S. subprime mortgages gradually decreased, reaching a low of 2.7 percent in mid-2006, as house prices peaked.

⁶A shock to expectations can affect credit conditions, in turn precipitating the bust. For instance, according to Geanakoplos (2010), unexpectedly high default rates on subprime loans starting in 2007 constituted “scary bad news” that led to a repricing of risk, a tightening of loan terms, and a reduced supply of credit, in turn dragging down house prices.

⁷Mian and Sufi (2009b) document a tight relationship between the increase in the household debt-to-income ratio across 450 U.S. counties in the run-up to the crisis and subsequent increases in default rates and declines in house prices.

⁸An effective court-supervised personal bankruptcy framework, providing for collective enforcement of creditor rights and rehabilitation of debtors, can be a useful tool when multiple creditors are present. In the event of a widespread scenario of distressed household debt, such a framework may have to be complemented with more comprehensive government-sponsored debt restructuring programs. In designing such frameworks, it is essential to set up proper incentives and take into account the perspectives of both borrowers and creditors, also to mitigate any risks of moral hazard deriving from loan restructurings (Laeven and Laryea, 2009).

⁹There is strong evidence from the United States that foreclosures depress house prices and that this effect is much larger during the housing downturn than during the boom (Lin, Rosenblatt, and Yao, 2009).

A housing bust can put considerable financial stress on financial intermediaries engaged in providing mortgage credit, affecting both their solvency and liquidity. High rates of default on mortgages reduce profitability and deplete available capital cushions, especially when recovery values achieved through foreclosure are lower than expected. Moreover, the bust can squeeze funding liquidity. For example:

- In the run-up to the recent crisis, large U.S. commercial and investment banks met a significant part of their funding needs through repurchase contracts of securitized mortgage assets held on their balance sheets. When the crisis materialized, the required margin (or haircut) on these contracts increased sharply, putting a squeeze on the banks' liquidity positions (Geanakoplos, 2010).
- Meanwhile, Irish banks met their funding needs mostly through deposits or unsecured wholesale funding, following a pattern that can be found in a number of housing bust episodes in various countries. Some of these funding sources can quickly dry up if the solvency of the lenders becomes increasingly uncertain. Financial stress on lenders can lead to a contraction of mortgage credit and credit more broadly, adversely affecting both household consumption and business investment. In extreme cases, stresses on intermediary balance sheets can lead to a systemic financial crisis involving both a credit crunch and widespread failures of lenders.

Empirical evidence points to three underlying factors that have been associated with both housing busts and banking crises and that are particularly significant because of their impact on both the supply of credit and financial sector vulnerabilities in the run-up to the crisis:

- Excessive competition and aggressive lending, often in the wake of financial sector deregulation that prompts financial intermediaries to compete for market share by relaxing lending standards (seen in previous crises in Asia, including Japan, and in the Nordic countries, and in some OECD countries, including the United States, during the current crisis);¹⁰

¹⁰See Favara and Imbs (2009) and Dell’Ariccia, Igan, and Laeven (2008) for the U.S. prime and subprime mortgage segments, respectively, and Merrouche and Nier (2010) for evidence across the OECD.

- Capital inflows that sustain the supply of credit to households while leading to vulnerable funding for mortgage lenders and borrowers (seen in previous crises in Asia and the Nordic countries; and in many advanced and emerging economies during the current crisis);¹¹
- An extended period of low monetary policy rates, as the reversal of this accommodative stance can lead to liquidity problems for households and lenders (seen in the U.S. savings and loan crisis and in the Japanese housing bubble of the 1980s). In the current crisis, the evidence on the role of monetary policy appears more mixed.¹²

Lastly, it is important to note that not all housing busts end in a financial crisis. There are examples of severe housing busts that left the financial sector largely unscathed (e.g., in Hong Kong SAR in the 1990s) (Crowe and others, 2011b). Whether a banking crisis emerges as a result of a housing bust may depend on whether the housing boom was the result of a deterioration of lending standards, the degree of leverage, or whether solvency and liquidity buffers are strong enough to sustain the financial system through the bust.¹³

Global Housing Finance Landscape

Housing finance systems differ considerably across countries along a number of dimensions, including product diversity, type of lender, mortgage funding, and the degree of government participation. Some of today's systems are the result of accident or history.

¹¹See Aizenman and Jinjark (2009) for evidence on advanced and emerging economies, and the IMF (2010c) for emerging Europe. Merrouche and Nier (2010) find that the impact of capital inflows on the buildup of financial imbalances is attenuated where the supervisory environment is strong.

¹²Maddaloni and Peydro (2010) show that low policy rates led to a relaxation of lending standards for euro area banks over 2002–08. However, IMF (2009b) and Merrouche and Nier (2010) find no evidence that differences in the path of monetary policy across the euro area or wider OECD had an effect on household indebtedness or house prices between 1999 and 2007. For the United States, Del Negro and Otrok (2007) find that the effect of policy rates on house prices was small in comparison with the total magnitude of U.S. house price fluctuations over 1986–2005.

¹³Dynamic provisioning, as operated in Spain since 2000, is an example of such a buffer (Crowe and others, 2011b).

Examples are the launch of the current Danish mortgage lending system after the great fire of Copenhagen in 1795, which spurred the need for an organized mortgage credit market to quickly provide funding to build a large number of new buildings (see Box 3.1); and the German *Pfandbriefe* (covered bond) system, which dates to 1769 and was heavily influenced by the aftermath of the Seven Years' War. In response to the latest crisis, a number of countries have also taken steps to further strengthen their mortgage market regulations (Table 3.1).

There is more diversity in the products offered in advanced economies (Table 3.2), which may reflect lenders' ability to hedge the related exposures and the broader range of funding opportunities. Housing finance systems in emerging and newly industrialized economies (ENIEs) have started to evolve only recently (Tables 3.3 and 3.4).¹⁴ In some cases, they were spurred by deregulation: for example, capital account liberalization allowed the entry of advanced-economy financial institutions, while growing urbanization and changes in property ownership rules increased the demand for housing.

An efficient mortgage market relies on a number of fundamental legal underpinnings (Box 3.2). Among advanced economies, the key determinants of the market depth of housing finance are collateral and bankruptcy laws that define the legal rights of borrowers and lenders (Warnock and Warnock, 2008). The efficiency of the legal system may have an impact on borrowing costs and on the costs of financing for capital market products backed by mortgages. One important element relates to the costs, duration, and effectiveness of the enforcement and foreclosure process in the event a borrower defaults. Excessively long and costly enforcement and forced sale procedures may create uncertainties for lenders and investors. Information should be tracked through credit registries, allowing lenders to gauge default probabilities. Detailed information on housing transactions, including prices, should be available. This

¹⁴This group of countries includes emerging Europe (including the Czech Republic, since its reclassification as an "advanced economy" was more recent than the period examined), Latin America, emerging Asia, and newly industrialized Asian economies (Hong Kong SAR, South Korea, Singapore, and Taiwan Province of China, also classified as "advanced" for *World Economic Outlook* purposes), and South Africa.

Table 3.1. Crisis Measures

Economy	Year	Measures
Brazil	2009	Banco do Brazil and the Federal Economic Fund to grant real estate loans at below-market rates; launch of a housing (Minha casa minha vida) subsidy program.
Canada	Mid-2008 to April 2011	Reduced maximum amortization periods (30 years from 35 years) for new government-backed insured mortgages with loan-to-value (LTV) more than 80 percent; increase in minimum down-payment (with insurance) from 0 to 5 percent. Tightened mortgage insurance rules in 2008, 2010, and 2011, requiring, among other things, all borrowers, regardless of choice of mortgage product, to qualify for a standard five-year fixed-rate mortgage, and reducing the maximum LTV ratio to 85 percent when refinancing. Require borrowers with variable rate loans or fixed for less than five years to be qualified at the average major lender-posted five-year rate. Withdraw government insurance backing on lines of credit secured by homes, such as home equity lines of credit.
Chile	2009	New subsidies to middle-income housing sectors; enhanced coverage for housing foreclosure insurance; increasing the LTV of state-subsidized housing to 90 percent; government will facilitate the use of negotiable mortgage-backed loans for house purchases and authorize the social security agencies to issue them.
China	Late 2009 to end-2010	Reduce tax incentives; tightening eligibility criteria for land-development projects; requiring state-owned enterprises to exit land and property development business if not already core; banning banks from extending loans to speculators; increasing down-payment requirements; and increasing interest rates.
Finland	2010	Recommendations for maximum amortization period of 25 years for mortgage affordability calculations and LTV limit of 90 percent.
Hong Kong SAR	September 2009 to end-2010	Lowering maximum LTV to 60–70 percent (depending on property value); LTV limit of 50 percent for non-owner occupied; standardizing debt-service-to-income (DTI) limits to 50 percent; insurance denied for LTVs > 90 percent (from 95 percent).
Hungary	2009–10	General interest subsidies for housing replaced by a special mortgage program aimed at young families; LTV limit of 75 percent for all mortgage and long-term consumer loans in forint; modification in banks' scoring system for approval of household loans; funding by covered bonds restricted to an LTV limit of 70 percent. In June 2010, there was a ban on registering collateral for foreign-currency mortgage loans.
India	November 2010	LTV limited to 80 percent for residential loans; increase in risk-weights of housing loans (above 7.5 million rupees) to 125 percent; increase loan-provisioning for housing with "teaser rates" to 2 percent.
Ireland	2009	Introduced Code of Conduct on Mortgage Arrears for all regulated mortgage lenders; subsequently revised in 2010 to include more detailed requirements for lenders when dealing with borrowers experiencing arrears and financial difficulties.
Israel	May–October 2010	Guidelines to require banks to raise provisions by 0.75% for mortgages with LTV above 60%; higher risk-weights for highly levered floating interest mortgages.
Malaysia	March 2009 to November 2010	Mortgage-interest tax relief (up to a limit) for 3 years and deferred loan payments for retrenched home-owners for 1 year as crisis-stimulus; capital gains tax reinstated for properties sold within 5 years; LTV on third-homes limited to 70 percent.
Mexico	2009	Rules for constituting "niche banks" published in Nov. 2009, which will help specialized nonbank intermediaries to convert to niche banks. Changes also planned in the regulation of <i>sofoles</i> . A regulatory framework for covered bonds is about to be introduced to support long-term bank financing to the housing sector. The regulatory framework for asset-backed securities has been strengthened, through a mandatory requirement for issuers to maintain a subordinated bond as a percentage of total issuance; enhanced information and analytical tools available to investors; and increased requirements on trustees and portfolio administrators.
Netherlands	2010–11	New standards to prevent granting disproportionately large mortgage loans. The income and capacity to pay of the borrower have to be better accounted for, the loan-to-income ratios are stricter, and the LTV ratio cannot exceed 110 percent, with 50 percent of the loan being redeemed within 30 years.
Norway	2010	Residential mortgage guidelines on ability to pay and LTV limit of 90 percent.
Poland	2007 to January 2011	Mortgage interest-tax deductibility abolished; "Recommendation S" with tightened borrower-eligibility on foreign-currency mortgage loans, with lower cap on debt-service-to-income ratio.
Singapore	February 2010 to January 2011	Seller's stamp duty on property sold within a year introduced; LTV limit reduced from 90 to 80 percent (60 percent for second and subsequent mortgages granted by FIs regulated by the MAS); increasing housing grants to lower-income households; lengthening the minimum occupancy period for nonsubsidized flats; raising the seller's stamp duty rates to 16 percent if sold within a year, 4 percent if sold in the 4th year.
South Korea	July 2009 to August 2010	Lower LTV limits on non-speculative (in addition to the previous speculative) mortgages; tightened DTI limits. In 2010, temporary suspension of the DTI ratio cap for people who own at most one home; waiver period on transaction taxes for owners of multiple properties; and support for low-income homeowners, renters and the construction sector.
Spain	2007–10	Reduction of fees for changes in mortgage conditions; increase in public guarantees for certain mortgage securitizations; temporarily deferred loan payments for unemployed; strengthening in credit institutions' provisions for nonperforming loans.
Sweden	October 2010	Maximum LTV limit of 85 percent established by a Financial Supervisory Authority guideline.
Thailand	2009 to November 2010	LTV relaxed from 70 to 80 percent; risk-weights on LTV higher than 80 percent increased to 75 percent; relaxation of LTV limits for certain types of dwellings.
United Kingdom	2009 to January 2011	Contemplating tightened mortgage regulations, laying out a number of proposals in its 2009 Mortgage Market Review Discussion Paper, followed by two 2010 consultation papers on responsible lending, focusing on enhancing borrower affordability assessment, and improving the distribution and disclosure process, respectively. The UK government announced a package of measures to enhance consumer protection in the mortgage market. Notably, the FSA is given responsibility for the whole residential mortgage market, transferring some regulatory responsibilities from the office of fair trading.
United States	2008–10	From a supervisory perspective, tightened real estate evaluation and appraisal guidelines, enhanced disclosures for home mortgage transactions, and implemented registration requirements for mortgage loan originators; adopted policy supporting prudent commercial real estate loan workouts; and created an independent Consumer Financial Protection Bureau. From a housing support perspective, expanded scope of Community Reinvestment Act regulation to support communities affected by high foreclosure levels; and introduced programs to promote sustainable loan modifications. The Federal Reserve also purchased \$1.25 trillion of agency MBS to reduce the cost and increase the availability of mortgage credit. From a financial stability perspective, injected capital and placed Fannie Mae and Freddie Mac in conservatorship.

Sources: Canada Mortgage and Housing Corporation (2010); Central Bank of Ireland (2010); Crowe and others (2011b); ECLAC (2010); EC (2007); European Mortgage Federation (2010); www.federalreserve.gov/; Finance Canada (2010); FSA (2009, 2010a, b); FIN-FSA (2010); Finansinspektionen (2010); Finanstilsynet (2010); Hong Kong Monetary Authority (2010a and b); Lea (2010b); Netherlands Authority for the Financial Markets (2010); www.hm-treasury.gov.uk/press_06_11.htm.

Table 3.2. Housing Finance Features in Advanced Economies, 2008

Economy	Main Lenders ¹	Mortgage Funding			Mortgage Loan Features			
		Deposits/Other	Covered Bonds/ Residential Loans Ratio (percent)	Residential Mortgage- Backed Securities/ Residential Loans Ratio (percent)	Predominant Interest Rate Type	Maximum LTV on New Loans ²	Typical Loan Term (years)	Prepayment Penalties ³
Australia	Bank and nonbank specialist “mortgage originators”; building societies and credit unions; mortgage brokers (30 percent)	Mainly, plus wholesale funds		16.7	Variable	90–100	25	Change in cost of funds
Austria	Banks and Bausparkassen (mainly savings banks)	Mainly	7.0	3.1	Fixed	80	25–30	
Belgium	Banks	Mainly		29.9	Fixed	100	20	
Canada	Banks and specialized nondepository and mortgage brokers (31 percent)	Mainly (banks); securitization (nonbanks)	1.0	31.0	Mixed	80 [95]	25–35	Higher of lost interest or three months, beyond a pre-specified penalty-free limit
Denmark	Mortgage and retails banks		114.7	0.1	Mixed	80	30	Yield maintenance on short-term fixed with noncallable bonds
France	Mortgage and retails banks	Mainly (banks)	22.5	1.8	Fixed	100	15–20	Maximum six months interest or 3 percent of outstanding balance
Germany	Banks and Bausparkassen (mainly savings banks)	Mainly	19.0	1.8	Fixed	80	20–30	Interest margin damage and reinvestment loss on fixed rate
Ireland	Banks and building societies and mortgage brokers	Mainly (banks)	15.6	29.6	Variable	100+	21–35	
Italy	Banks	Mainly	2.1	30.8	Mixed	80	20	
Japan	Banks and specialized mortgage institutions	Mainly		4.0	Mixed	70–80	20–30	None
Netherlands	Banks and mortgage banks and brokers (60 percent)	Mainly	3.6	30.8	Fixed	125	30	Yield maintenance on fixed rate
Portugal	Banks	Mainly, plus wholesale funds	14.5	27.3	Variable	90	25–35	
Spain	Banks (commercial and savings) and mortgage brokers (55 percent)	Some, plus covered bonds and securitization	45.6	24.1	Variable	100	30	2.5 percent up to yield maintenance on fixed rate; 0.5 percent on variable rate
Sweden	Bank and mortgage institutions	Some, plus covered bonds	53.7	0.3	Variable	80–95	30–45	
United Kingdom	Banks and building societies and mortgage brokers (60 percent)	Mainly	14.0	31.2	Variable	110	25	2–5 percent of amount repaid
United States	Banks and mortgage brokers (68 percent 2004; 10 percent 2010)	Mainly securitization	0.1	64.1	Fixed	100+	30	Up to 5 percent on ARMs only

Sources: Housing Finance Network; Lea (2010b); Crowe and others (2011b); Warnock and Warnock (2008); European Mortgage Federation; Federal Reserve Board; Reserve Bank of Australia; Bank of Canada; European Securitization Forum; European Central Bank (2009).

¹Banks include commercial and savings banks.

²Maximum with insurance or for covered bonds in brackets; average for Japan and Sweden.

³ARM = adjustable rate mortgages; LTV = loan to value. There is complete waiver in certain circumstances, for instance, if the property is sold (Germany), hardship or relocation of the borrower (Netherlands), or the borrower is unemployed (France).

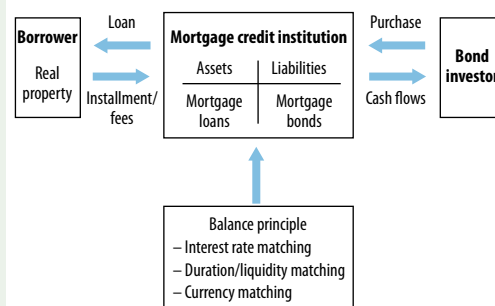
Box 3.1. The Danish “Balance Principle” Mortgage Model¹

Denmark has a sophisticated housing finance system with a unique arrangement of asset-liability matching that has helped maintain mortgage market stability over the last two centuries.² The system, which relies on mortgage financing via covered bonds, underwent a regulatory overhaul in 2007 following the adoption by the European Union of the Capital Requirements Directive a year earlier. This box focuses on the market structure, products, and risk management practices prior to this overhaul. It also briefly describes the main changes under the new regulatory regime.

Danish mortgage banks are specialized lenders restricted to conducting narrowly defined mortgage credit activities. They originate and service mortgage loans and fund themselves through the issuance of mortgage bonds (including, since 2007, covered mortgage bonds, as discussed below). The mortgage bank adds a small margin, typically 50 basis points, to cover administrative costs, credit risk, and profit. The mortgage loan remains on the balance sheet of the mortgage bank throughout the loan term. The risk assumed by the mortgage banks is largely limited to credit risk, which is mitigated by strict loan underwriting criteria, including a maximum loan-to-value ratio of 80 percent. Market risk, including prepayment risk, is passed on to the bond investors, typically pension funds and commercial banks. Long-term fixed-rate bonds are callable by the bank at par in the event of prepayments. To fund mortgages with shorter-term resets, such as those with adjustable rates, various other configurations are available.

Under the strict balance principle, each new mortgage loan is in principle funded by the issuance of new mortgage bonds of equal size and identical cash flow and maturity characteristics. The traditionally dominant product in the Danish market—the 30-year, fixed-rate, callable annuity

The Balance Principle



loan funded by a pass-through callable mortgage bond—is the prototype product associated with this balance principle. Starting in the mid-1990s, bullet mortgage bonds, having a shorter maturity than the associated adjustable-rate loans, came to dominate the market, with bonds being rolled over at the time interest rates are reset. In either case, proceeds from the sale of the bonds are passed to the borrower to purchase the property, and the interest and principal payments are passed to the investors holding the mortgage bonds (see figure). Bonds are issued on an ongoing basis by the mortgage bank in individual series backed by a specific pool of loans, resulting in large and liquid tradable bond issues. The functioning and liquidity of the secondary mortgage market has been facilitated by internal market-making agreements by Danish mortgage banks (prior to 2008), and the acceptance by banks of mortgage bonds issued by other banks when a borrower seeks to prepay the loan by delivering the bond, as discussed further below.

A distinctive feature of the Danish mortgage market is that borrowers can have the right to prepay their mortgage at any time at the lower of par value or the prevailing market price of the relevant mortgage bonds. For example, suppose that a homeowner takes out a Dkr 200,000 30-year mortgage at 5 percent. Suppose that one year later the house must be sold and the mortgage prepaid. By then the outstanding balance would be about Dkr 198,000. However, if interest rates had increased by 100 basis points, the homeowner would be able to pay it down for only about Dkr 175,000. On the other hand, if rates had

Note: This box was prepared by Ann-Margret Westin with contributions from Jay Surti.

¹This box draws on Danske Markets (2010); Frankel and others (2004); IMF (2007); and Realkreditrådet (2010).

²As a testament to the robustness of the Danish mortgage system, since its inception more than 200 years ago, all investors in Danish mortgage bonds have been paid in full.

decreased, the loan would be prepaid at par (that is, Dkr 198,000). In the first case, the bank buys (puts) back the related mortgage bond in the market, and in the latter case the bank sells (calls) the bond. In both cases the bank's asset-liability balance is maintained.

The Danish mortgage market has changed somewhat since covered bond legislation came into force in 2007, bringing Danish markets in line with the covered bond provisions of the new Basel II-based EU Capital Requirements Directive. Since the introduction of the new framework, under which universal banks can also issue covered bonds alongside the established specialized mortgage banks, most of the new mortgage loan financing has been done through the issuance of covered (mortgage) bonds, against which regulatory capital requirements are less than on traditional mortgage bonds.³ The 2007 legislation allows covered

(mortgage) bonds to be issued under a general balance principle, which does not require strict cash flow matching. So far, two of the five biggest mortgage banks have opted to follow the general principle rather than the strict balance principle to take advantage of its flexibility. The new legislation also requires that loan-to-value thresholds apply on a continuous basis for the loans in the pool for the covered bonds and not only at the time of loan origination, as was the case before.

banks can issue covered mortgage bonds (*særligt dækkede realkreditobligationer*). In practice, however, there is little difference apart from differences in how universal banks and mortgage banks calculate capital adequacy requirements. Traditional mortgage bonds (*realkreditobligationer*) issued after December 31, 2007, are not compliant with the covered bond criteria in the EU Capital Requirements Directive.

³ While universal banks can issue covered bonds (*særligt dækkede obligationer*) to finance mortgages, only mortgage

helps appraisers value prospective house purchases for interested parties and allows lenders to keep track of the value of their collateral.

Mortgage Loan Characteristics Vary across Countries

Although the maturity of mortgage loans is typically 20 to 30 years, fixing mortgage interest rates for more than five years is rare. The U.S. mortgage market is unusual because of the prevalence of long-term fixed-rate mortgages with interest rates fixed for 30 years and their funding through residential securitization (see below). This may be a reflection of the influential role played by Fannie Mae and Freddie Mac, the two large U.S. housing government-sponsored enterprises (GSEs), and the existence of deep hedging markets for long-term interest-rate risk. Inflation-indexed interest rates are widely used in many ENIEs (particularly in Latin America) because of those countries' historically high and volatile domestic interest rates. The influx of cheap foreign funds into emerging Europe, especially during 2004–07, encour-

aged the use of interest rates indexed to foreign currency (mainly the euro, Swiss franc, and Japanese yen), with mortgages often denominated in these currencies.

Most countries have some form of prepayment penalties (Table 3.2). Prepayment penalties are designed to compensate the lender for reinvestment risk and for the cost of processing the repayment. In some countries, penalties have a stipulated maximum (e.g., in Canada, France, Italy, and Spain), and they are sometimes restricted to certain conditions (e.g., in Germany, if the borrower is moving out or if the lender refuses a request to increase the mortgage) (Lea, 2010b). Basically only the United States has no prepayment penalties for fixed-rate mortgages. In Japan, whether a penalty is required or not depends on each contract. Penalty-free prepayments are also allowed in Denmark, where the system relies on the so-called “balance principle”—that is, the terms of the loan are matched by the terms of the mortgage bond that funds it, allowing an unwinding of the funding side without rollover risk for the lender (Box 3.1).

Table 3.3. Housing Finance Systems in Emerging and Newly Industrialized Economies, 2008

Economy	Main lenders	Mortgage Funding		Notes
		Deposits ("fx" if foreign currency funding is used and foreign currency loans granted)	Covered Bonds/Residential Loans Ratio (percent)	
Brazil	Banks and nondepository mortgage companies and government housing companies	Largely (through housing finance schemes, directly and indirectly owned by government)		Two housing finance systems operate alongside each other: the Sistema Financeiro de Habitação and the Sistema de Financiamento Imobiliário. Only less than 50 per cent of property purchases were financed with mortgages. Under SFH regulations, banks are required to direct 65 percent of savings deposits balances into real estate lending. A government-owned bank has 75 percent share of the housing credit market.
Chile	Banks and mortgage administrators of insurance companies	Depends upon product	2.0	With a share of 58.7 percent, Hipotecarios No Endosables is by far the most important mortgage instrument-as its flexible terms enjoy growing popularity with banks and borrowers. These mortgages are mainly financed with issuances of long-term senior and subordinated corporate bonds.
China	Banks	Largely		The five large commercial banks, all of which are mostly state-owned, have the largest share.
Croatia	Banks (95 percent) and Bausparkassen	Largely(fx) plus parent bank funds		
Czech Republic ¹	Banks and Bausparkassen (33 percent)	Largely	50.6	Revenue interest from mortgage covered bond tax exempt until 2008.
Hungary	Banks (>50 percent), Mortgage banks (38 percent) and Bausparkassen (5 percent)	About half, fx	45.5	Since the crisis, covered bond funding has been restricted to low-LTV loans; and reduced incentives for foreign exchange mortgages.
India	Banks and housing finance companies	Deposits and capital markets, refinancing from National Housing Board	<1.0	Financing through the organized sector continues to account only for less than 30 percent of the total housing investment in India. Working to establish Mortgage Credit Guarantee Company which is intended to offer mortgage insurance services. HDFC Ltd., a special-purpose vehicle of the National Housing Board, issued its first mortgage-backed security in August 2000.
Indonesia	Banks	Mainly		Only a part (according to estimates 20–25 percent) of the total housing demand is financed by the mortgage sector. State-owned financial institution has the largest share.
Malaysia	Banks and Treasury Housing Loan Division	Some plus refinancing through Cagamas plus unsecured debt	4.0	Treasury Housing Loan Division (12 percent) which provides (subsidized) housing loans to government employees only; Employees' Provident Fund, early withdrawal for house ownership; Cagamas are government-promoted secondary mortgage liquidity facilities, are not involved in origination but only in refinancing. Loans sold to Cagamas are not off balance sheet. Malaysia has issued staff housing loan receivables via Cagamas, to further develop the asset backed securities market.
Mexico	Banks, nondepository SOFOLES, housing funds (INFONAVIT and FOVISSSTE, 51 percent)	Largely	10.0	INFONAVIT/FOVISSSTE (funds for housing for workers) loans carry an implicit subsidy; and the "Esta es tu casa" program which offers upfront subsidies for low-income households willing to buy property. The government offers indirect subsidies to the housing market by explicitly guaranteeing obligations of the Sociedad Hipotecaria Federal (SHF), a government housing finance agency. The SHF supports the market for residential mortgage-backed securities (RMBS) by offering mortgage insurance, financial guarantees and by assuring the liquidity of the market but it does not issue RMBS itself.

Table 3.3 (continued)

Table 3.3 (continued)

Economy	Main lenders	Mortgage Funding			Notes
		Deposits ("fx" if foreign currency funding is used and foreign currency loans granted)	Covered Bonds/ Residential Loans Ratio (percent)	Residential Mortgage-Backed Securities/Residential Loans Ratio (percent)	
Poland	Universal banks (the three largest players at end 2008 had a market share of about 35 percent for new mortgages).	Largely, fx	1.0		The share of foreign-currency mortgage lending declined to 30 percent in 2010 from 70 percent in the pre-crisis period.
Russia	Banks and mortgage banks and cooperatives	Nonbanks mainly deposits; banks other means refinancing through AHML, securitization, mortgage certificates and debt obligations.	18.2	0.1	The central bank estimates that only 10–15 percent of the real estate in Russia is bought using bank loans. In 2009: tax rebate increased for purchasing and building residential property; government support through grants and guarantees to the government-owned AHML, a mortgage liquidity facility.
Singapore	Banks and Housing Development Board				State-owned Housing Development Board has the largest share.
South Africa	Banks and specialized mortgage institutions, including government agencies	Mainly (including wholesale deposits from pension funds and insurance companies)			The National Housing Finance Corporation provides wholesale financing to financial intermediaries and lends directly to low- and medium income individuals. The Rural Housing Loan Fund lends to intermediary housing lenders who, in turn, lend to individual low-income earners.
South Korea	Banks (80 percent) and nonbanks and finance companies				Korea National Housing Corporation (KNHC) provides low-income public (rental) housing plus for sale; nonbanks offer bullet loans; foreign-bank sponsored lenders provide higher-LTV and low-interest loans to bypass regulations on domestic banks; since the 2008–09 crisis, regulators are shifting from LTV-driven standards to DTI driven ones. The government-sponsored Korea Mortgage Corporation (KoMoCo) issued several MBS collateralized by mortgage exposures, whose origination is subsidized by government funds.
Taiwan Province of China	Banks	Mainly			
Thailand	Banks and housing finance agencies	Mainly; also government-backed bonds	Low		State-owned financial institution has the largest share.

Sources: European Mortgage Federation; Housing Finance Network; Merrill Lynch Guide to Emerging Mortgage and Consumer-Credit Markets, Vol. 1.

Note: LTV = loan-to-value ratio; AHML = Agency for Housing Mortgage Lending.

¹The Czech Republic has been reclassified as an advanced economy; it was an emerging economy during the pre-crisis years.

Loan-to-value (LTV) ratios on new loans vary widely across and within countries (Tables 3.2 and 3.4; and Box 3.3). For example, the average LTV ratio in Brazil ranges from 80 to 100 percent; in South Korea, the LTV range limit for covered bonds is substantially lower than that for insured mortgage loans (Table 3.4).¹⁵ Average LTV ratios for new loans are not necessarily representative—for example, while the average LTV ratio in the United States was 76 percent

in the years before the crisis, loans with LTV ratios above 100 percent were also widely available. Official LTV ratios are not informative in some ENIEs, where a majority of mortgage loans are originated in the unregulated sectors.¹⁶ Some countries rely on regulatory LTV ceilings. However, such limits apply only to certain parts of their financial system, leaving room for regulatory arbitrage.

¹⁵See the section below on mortgage funding for a description of covered bonds.

¹⁶Lenders in the unregulated sector are neither regulated nor official credit-granting institutions.

Table 3.4. Mortgage Market Characteristics in Emerging and Newly Industrialized Economies, 2008

Economy	Government Support							Interest Rate Type	Loan-to-Value Ratio (LTV)			
	Subsidies to First-Time Buyers Up Front	Subsidies to Buyers through Savings Account Contributions	Subsidies to Selected Groups, Low-Income	Provident Funds Early Withdrawal for Housing Purposes	Housing Finance Funds, Govt. Agency Providing Guarantees, Loans	Tax Deductibility of Mortgage Interest	Capital Gains Tax Deductibility		Maximum Allowed with Mortgage Insurance	Average	Observed Maximum ¹	For Covered Bonds
Brazil	Yes	Yes	Yes	Yes	Yes			Variable		80–100	100	
Chile	Yes	Yes			Yes (credit enhancements to lenders)			Variable			75	75–100 (depending upon the mortgage product)
China			Yes	Yes				Variable		60	80	
Croatia		Yes, through Bauspar (15 percent)				Yes		Fixed/Variable	75			70
Czech Republic ²		Yes (Bauspar, up to 15 percent)				Yes (up to maximum level)		Fixed (Mixed)			100	
Hungary		Yes, Bauspar						Variable (Mixed)			70	70 (in 2009)
India	Yes		Yes, through soft loans		Yes	Yes	Yes, if invested in a second property	Mixed			110	85
Indonesia	Yes		Yes (also to moderate income)		Yes			Variable			90	80–90
Malaysia			Yes, to government employees	Yes	Yes, through Cagamas, but without formal govt. support			Variable			80	90
Mexico	Yes	Yes (savings leveraged to market-based mortgage finance)	Yes	Yes (housing fund)	Yes			Variable			95 (depends upon the provider)	
Poland	Yes (limited interest rate subsidies during first 8 years of loan)					Only for loans originated before 2007 and subject to a cap	Yes (with limits)	Variable			100	
Russia			Yes		Yes	Yes		Fixed/Variable		60		85
Singapore			Yes, through Housing Development Board	Yes	Yes (loan origination)	Yes		Variable		<70	80	80–90
South Africa			Yes		Yes			Variable			100	
South Korea			Yes, through National Housing Fund		Yes (long-term fixed interest loans); MBS	Yes, up to a maximum		Variable	80	60–70	70	60–70 (40–60 regulatory)
Taiwan Province of China	Yes	Yes	Yes			Yes, up to a maximum		Variable			100	
Thailand	Yes, tax breaks				Yes	Yes, up to a maximum		Fixed/Variable			90–100	70–90 (100 by Government Housing Bank)

Sources: European Mortgage Federation; Housing Finance Network; Merrill Lynch Guide to Emerging Mortgage and Consumer-Credit Markets, Vol. 1; Warnock and Warnock (2008); Crowe and others (2011b).

Note: MBS = mortgage-backed securities.

¹The observed maximum refers not only to published maximum LTV ratio, but also to anecdotal evidence from various sources cited.

²The Czech Republic has been reclassified as an advanced economy; it was an emerging economy during the pre-crisis years.

Box 3.2. Legal Prerequisites for Housing Finance Systems

To be effective and efficient, housing finance systems need to be supported by explicit legal institutions and instruments. These are not only necessary to acquire and transfer ownership rights in real estate, but also represent the foundation for the orderly functioning of mortgage lending. Legal arrangements must also take into account the additional layers of complexity raised by the mobilization of collateral in the secondary mortgage market. This box outlines the basic elements of a well-functioning legal framework for a housing finance system.

A robust legal framework for housing finance systems should include rules on the foundation of the system, mortgage lending, and the mobilization of loans and secured interest in collateral in secondary mortgage markets.

Foundation

The legal regime to *acquire and transfer ownership rights* in real estate should encompass (1) the accessibility of ownership rights over the land and the buildings on it; (2) the right to sell, lease, or encumber; and (3) the right to enjoy property without being hindered by third parties. These rights might be checked by the (constitutional) right of the state to acquire property for public needs.

Reliable and readily accessible *land registries* should identify and enforce ownership rights against third parties. Title insurance and property surveys by certified surveyors can address shortfalls in this area.

It should be possible to establish and enforce real estate *collateral* at low cost, ensuring predictability and efficiency as to the lender's ability to enforce its rights. The effective establishment of real estate collateral may be achieved through a variety of legal techniques. These include not only mortgages, but also instruments broadly resembling trusts, such as the provisional transfer of title to receivables or the fiduciary transfer of the secured property to the lender, and leasing structures. These instruments give rights of varying strength to the lender. For mortgages, key elements are:

- Clear rules for the creation of mortgages. Typically, this implies having an instrument securing the lien to the property, such as a deed in writing in a nota-

rized form identifying the mortgaged property, and a registration requirement with a public registry. Priority will depend on the timing of registration; such registries should hence be reliable and readily accessible.¹

- Priority rights of the lender over the mortgaged assets, which, as rights *in rem*, will also apply when the assets are transferred.
- Validity and enforceability of the mortgage in case of the borrower's bankruptcy.
- Enforcement rules ensuring that lenders can promptly foreclose and sell the secured assets at market value.

Mortgage Lending

A variety of legal (including regulatory and contractual) measures can incentivize mortgage lending and homeownership. Each may have a specific impact as it addresses different players, products, or stages involved in mortgage finance:

- The ranking of mortgage lenders impacts the availability and pricing of credit (with first-ranking liens offering strong incentives).
- Legislation may provide for the exemption from “claw-back provisions” allowing the reversal of transactions undertaken within a specific period before the borrower's insolvency. Laws may also provide that the proceeds from the sale of the mortgaged property are to go to the lender, outside of the ordinary bankruptcy proceeding (without the need for ascertaining the lenders' claim in such proceedings).
- Laws may exempt mortgage lenders from going to court to enforce their claims.
- Prudential requirements may facilitate access to finance for certain categories of borrowers where additional guarantees are provided, or set advantageous risk weightings on banks' capital ratios for owner-occupied mortgage loans.
- Government housing finance agencies may be established to develop the domestic housing finance market.

¹A question arises whether the transfer of the mortgage creditor should be registered: the development of mortgage-backed securities requires that such transfers be possible with minimal individual registration requirements.

Note: This box was prepared by Dawn Chew and Alessandro Gullo.

Box 3.2 (continued)

Some of those measures may conflict with borrower/homeowner safeguards. For instance, special laws can provide triggers for the termination of mortgage loans on terms more favorable for borrowers than would otherwise apply under a more general framework.

Mobilization of Loans and Collateral in Secondary Mortgage Markets

A legal precondition for creating secondary mortgage markets hinges on the ability to legally assign (mobilize) the loans and corresponding security interest in collateral, which differs across jurisdictions. Key elements include:

- The fact that the mortgage is accessory to the loan claims, so that the assignment of the loan claims involves the transfer of the mortgage that secures them;
- Rules on the set-off of any amounts due by the borrower and by the lender;
- The enforceability of the assignment vis-à-vis the borrowers, once they are notified, so that amounts paid by them are due to the assignee without being trapped in the insolvency of the originating bank.

This involves complying with formalities for the transfer of the mortgage;

- The mitigation of rules on claw-back, applicable in case of insolvency of the lender or of the borrowers; and
- The exemption of ordinary rules to facilitate the mobilization of collateral through mortgage funding schemes. For instance, securitization laws could provide for shorter claw-back periods or for simplified rules on the transfer of mortgages as a pool.

The ability to transfer collateral from one party to another through mortgage funding models creates economic and legal links, with the fund providers being given some forms of right or interest in the underlying mortgage loans. Legal frameworks should adequately reflect such links to protect financial stability, for instance, by earmarking mortgage payments to mortgage bonds (see Box 3.1 on the Danish model) or by legally prescribed overcollateralization requirements. Further, legal arrangements should align legal forms with the economic substance of these links and mitigate distorted incentives or informational asymmetries (see Box 3.7 on incentive misalignments).

In the wake of the recent crisis, there has been renewed interest in alternative mortgage products that encourage better risk management. They include shared equity models, where increases in property values are shared between the homeowner and the lender. They also include schemes that allow borrowers to limit their inflation risk (through index linking), or their interest rate risk (through capped mortgages, or products in which borrowers do not fully bear the cost of interest rate increases).¹⁷ Property derivatives and insurance-type contracts for hedging could help protect investors or households against fluctuations in house prices. Moreover, so-called Islamic mortgages might

promote better incentive alignment and reduce the financial stability risks that may be associated with conventional mortgages. Islamic financial products are based on the idea that lenders and borrowers share both risks and returns; such products also tend to offer more efficient dispute resolution because the lender retains ownership of the asset, akin to a financing lease (Jobst, 2007).

Substantial Government Presence in Housing Markets

Government participation in the housing markets takes many forms. It includes social housing policies to benefit low-income and first-time homebuyers; tax incentives; state-owned financial institutions that originate mortgage loans; and state-sponsored, or state-owned, housing finance agencies that (mostly) provide liquidity facilities for the mortgage markets

¹⁷Such products may be structured like insurance: the borrower pays a premium, and if rates go above a certain level, the protection pays out.

(Figures 3.2 and 3.3; and Table 3.5).¹⁸ While the aim of government participation is generally to provide affordable housing and promote homeownership, it might also constrain competition in the financial sector, which in turn might widen interest rate spreads and limit the range of available mortgage products. Government participation is more prevalent in the average ENIE, reflecting the importance of large state-owned firms in the domestic mortgage markets and savings schemes encouraging house purchases. Among advanced economies, the United States is unusual because of its significant influence of government policies in the housing finance sector. Various forms of government participation in the housing market include the following:

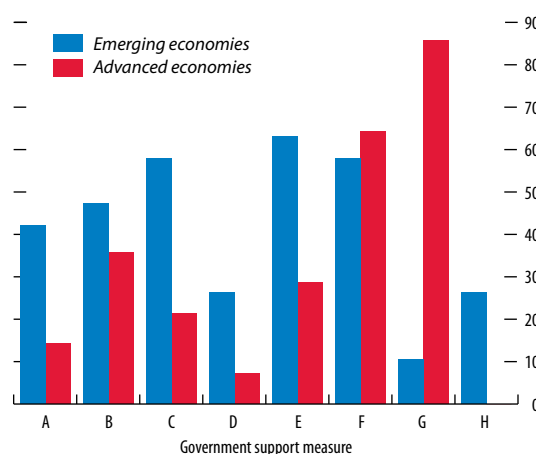
- **Affordable housing policy mandates.** Unlike the U.S. housing GSEs, none of the government-backed institutions in Japan or the Netherlands have a formal mandate to provide affordable housing for low-income households. Upfront subsidies to first-time or low-income homebuyers are much more prevalent in ENIEs. A unique feature in continental Europe, such as in Germany and Hungary, is the presence of a contractual savings system in which the government subsidizes housing loans by contributing to household savings accounts in specialized savings banks, or *Bausparkassen*.¹⁹
- **Housing finance agencies.** The United States is unique because of the preponderance of government-sponsored housing finance agencies involved in securitization markets (through Fannie Mae, Freddie Mac, and Ginnie Mae) and mortgage insurance (through the Federal Housing Administration) (Box 3.4).²⁰ The

¹⁸See Table 3.5 for an index of government participation constructed from a weighted-sum of eight types of measures (each takes the value 1 if it is present in a country, zero otherwise). While the index does not quantify the depth of government participation, it provides a snapshot of the breadth of its presence in the housing finance market.

¹⁹Contractual savings systems involve a contract that requires the customer to save an agreed amount over a prescribed period in return for a commitment by the credit institution to provide a loan on pre-specified terms whose amount depends on the amount saved (www.housing-finance-network.org/index.php?id=284). The French and German systems are slightly different (Dübel, 2009), but both require a longer-term savings requirement.

²⁰Although Fannie Mae and Freddie Mac were not explicitly guaranteed, they enjoyed an implicit government guarantee;

Figure 3.2. Government Participation in Housing Finance
(Percentage of countries that have the government support measures detailed below)

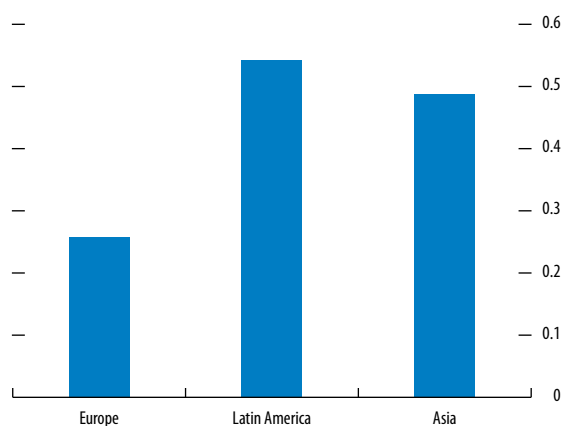


Source: IMF staff estimates.

Note: See Table 3.5 for details. The government support measures in the x-axis are as follows:

- A) subsidies to first-time or other buyer up front;
- B) subsidies to buyers through savings account contributions or through preferential fees;
- C) subsidies to selected groups, low income;
- D) provident funds early withdrawal for house purchase;
- E) housing finance funds or government agency that provides guarantees/loans;
- F) tax deductibility of mortgage interest;
- G) capital gains tax deductibility; and
- H) state-owned institution majority market player >50 percent.

Figure 3.3. Government Participation in Housing Finance: Emerging and Newly Industrialized Economies
(Index of government participation)



Source: IMF staff estimates.

Note: Index lies between 0 and 1; the higher the index, the greater the government participation. See Table 3.5 for details of the index.

Table 3.5. Index of Government Participation in Housing Finance Markets, 2008

Category Weight	Government Support Categories and Weights ¹									
	Category (A)–(D)				Category (E)	Category (F)–(G)		Category (H)		
	0.25				0.25	0.25		0.25		
Subcategory Weight	0.0625	0.0625	0.0625	0.0625	0.25	0.125	0.125	0.25		
	Subsidies to First-Time or Other Buyers Upfront (A)	Subsidies to Buyers through Savings Account Contributions or through Preferential Fees (B)	Subsidies to Selected Groups, Low and Middle Income (C)	Provident Funds Early Withdrawal for House Purchases (D)	Housing Finance Funds, Government Agency Provides Guarantees, Loans (E)	Tax Deductibility of Mortgage Interest (F)	Capital Gains Tax Deductibility (G)	State-owned Institution Majority Market Player in Mortgage Lending > 50 percent (H)	Index of Government Participation (higher weight to subcategory H) (I)	Alternative Index of Government Participation (equal weights to the eight subcategories) (J)
Emerging and newly industrialized economies										
Brazil	1	1	1	1	1			1	0.75	0.75
Chile	1	1			1				0.38	0.38
China			1	1				1	0.38	0.38
Croatia		1				1			0.19	0.25
Czech Republic ²		1				1			0.19	0.25
Hungary		1				1			0.19	0.25
India	1		1		1	1	1		0.63	0.63
Indonesia	1		1		1			1	0.63	0.50
Malaysia			1	1	1				0.38	0.38
Mexico ³	1	1	1	1	1				0.50	0.63
Poland	1					1	1		0.31	0.38
Russia			1		1	1			0.44	0.38
Singapore			1	1	1	1		1	0.75	0.63
Slovak Republic ²		1			1				0.31	0.25
Slovenia ²		1				1			0.19	0.25
South Africa			1		1				0.31	0.25
South Korea			1		1	1			0.44	0.38
Taiwan Province of China	1	1	1			1			0.31	0.50
Thailand	1				1	1		1	0.69	0.50
Average										
(percent of countries in A-H and regional average of index in I-J)	42	47	58	26	63	58	11	26	0.40	0.41
Advanced economies										
Australia	1	1	1				1		0.31	0.50
Austria ³	1	1	1						0.19	0.38
Belgium						1	1		0.25	0.25
Canada				1	1		1		0.44	0.38
Denmark						1	1		0.25	0.25
France		1				1	1		0.31	0.38
Germany		1					1		0.19	0.25
Ireland						1	1		0.25	0.25
Italy						1	1		0.25	0.25
Japan					1	1			0.38	0.25
Netherlands					1	1	1		0.50	0.38
Spain ³		1				1	1		0.31	0.38
United Kingdom							1		0.13	0.13
United States			1		1	1	1		0.56	0.50
Average										
(percent of countries in A-H and regional average of index in I-J)	14	36	21	7	29	64	86	0	0.29	0.31

Sources: Housing Finance Network; Merrill Lynch Guide to Emerging Mortgage and Consumer-Credit Markets, Vol 1; Crowe and others (2011b); IMF staff estimates.

¹Cells marked with "1" indicate the existence of the government participation measure; column (I) = 0.0625*((A)+(B)+(C)+(D)) + 0.25*(E) + 0.125*((F) + (G)) + 0.25*(H); Column (J) = 0.125 *(sum of (A)–(H)).

²These countries are currently classified as advanced economies; they were emerging economies during the pre-crisis years.

³Government support in Mexico is available to workers only in the formal sector. Subsidies through downpayments in Spain, rather than through savings accounts contributions. An Austrian housing assistance scheme (*Wohnbauförderung*) supports mostly low-income and some first-time buyers.

market share of mortgages backed by government entities in other advanced economies, such as Japan and South Korea, is smaller than that of their U.S. counterparts (Lea, 2010a and b). Non-U.S. housing GSEs in advanced economies have only limited or no portfolio accumulation. The German development bank, *Kreditanstalt für Wiederaufbau*, provides mortgage loan subsidies to commercial banks that lend to borrowers that use these funds for energy-efficient housing and other socially desirable purposes (business start-ups, homes for the elderly). Malaysia's government-promoted secondary mortgage liquidity facilities (Cagamas) are involved in refinancing but not in origination.

- **Supervisory and regulatory structures.** Most advanced economies have a single mortgage regulator or rules governing the involvement of multiple regulators in this area. The United States is unusual because of its fragmented regulatory structure, with mortgage lenders regulated by multiple authorities, depending on the type of financial institution.²¹
- **Tax incentives.** Tax deductibility of mortgage interest is widespread among both advanced economies and ENIEs, although the nature of these tax breaks varies considerably. Most governments provide incentives for owner-occupied housing, mainly through favorable tax treatment. As noted in Keen, Klemm, and Perry (2010), within a comprehensive income tax system, a fully neutral taxation of owner-occupied housing would require full taxation of imputed rents and capital gains on housing, combined with mortgage interest deductibility. In practice, however, imputed rents and capital gains on primary residences are rarely taxed, creating a general bias toward housing, which is reinforced by the mortgage interest relief where it exists.²² Many countries provide full

or partial deduction of mortgage interest payments, often capped at low marginal tax rates. Only the United States allows for nearly full deductibility without taxing imputed rent.

- **Government participation and homeownership.**

The rationale for government participation in housing finance is often to promote homeownership. However, the two factors are not always correlated. Many countries in western Europe, as well as Australia, have achieved high homeownership rates without extensive government participation (Figures 3.4 and 3.5; and Lea, 2010b). Some countries have lower rates of homeownership partly because of strong public support for rental housing. For example, Germany provides incentives for rental investment but not for homeownership.

Mortgage Funding Dominated by Deposits

Banks tend to play a major role in originating mortgage loans, which are mostly funded by bank deposits. However, the role of nonbanks and the use of wholesale and cross-border funds became increasingly important in the run-up to the recent crisis.²³ ENIEs tend to rely on traditional mortgage funding through bank deposits because of their relatively small financial sectors and their less-developed financial infrastructures. Covered bonds play a large (and increasing) role in Europe's mortgage funding markets. In 2008, covered bonds accounted for about half of the residential loans in Hungary, Spain, and Sweden, and for more than half in the Czech Republic.²⁴ In the United States and the (largely Asian) ENIEs, state support has encouraged securitization through the use of mortgage-backed securities (MBS) (Ketkar and Ratha, 2000; IMF, 2003; and Box 3.5).²⁵ In some ENIEs, only state-owned finance

during the recent crisis, these GSEs received over \$130 billion in capital injections (and are hence now effectively government owned) and were placed in conservatorship (U.S. Treasury and HUD, 2011).

²¹While all U.S. mortgage lenders are subject to one or more federal and/or state laws, the strength and intensity of oversight of these companies varied prior to the crisis, with deposit-taking institutions and bank holding companies and their subsidiaries generally subject to more rigorous supervision compared with independent mortgage brokers and lenders.

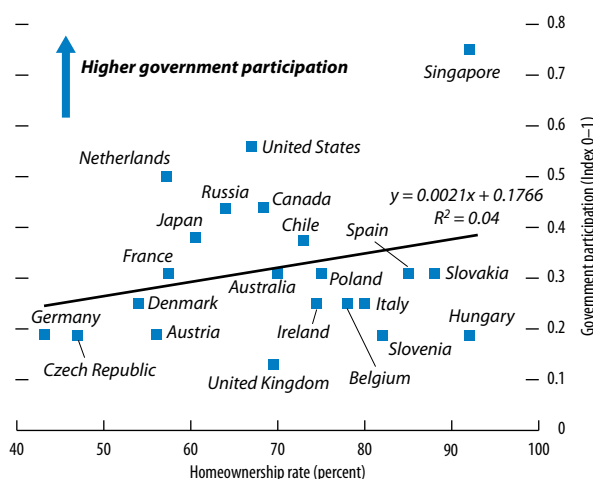
²²The Netherlands and Switzerland being exceptions in that they tax imputed rent (IMF, 2009a).

²³For instance, more than 50 percent of mortgages were sold through mortgage brokers (owned by banks and nonbanks) in the Netherlands, Spain, the United Kingdom, and the United States. Also, between 2004 and 2007, cross-border interbank loans grew on average by 25 percentage points of GDP in emerging Europe compared with about 11 percentage points of GDP in emerging Asia, and even less in Latin America.

²⁴In the euro area, the outstanding value of mortgage covered bonds rose by almost 80 percent between 2003 and 2007 (ECB, 2009; Lea 2010a).

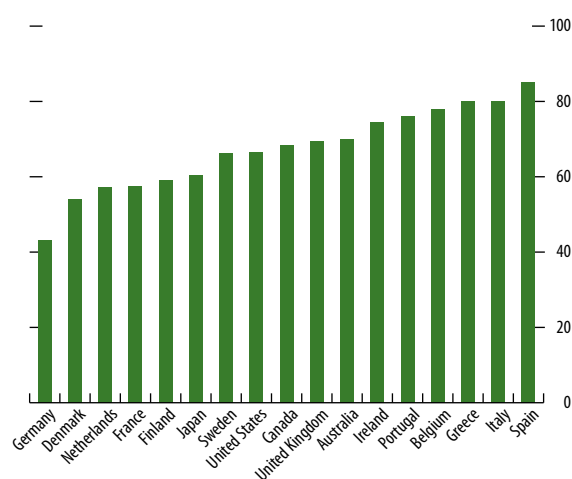
²⁵In ENIEs, MBS were initially denominated in foreign currencies or inflation-indexed monetary units. Over the last

Figure 3.4. Homeownership Rate and Government Participation in Housing Finance



Sources: European Mortgage Federation; Australian Bureau of Statistics; Japan, Ministry of Internal Affairs and Communications, Statistics Bureau; Singapore, Department of Statistics; U.S. Census Bureau; and IMF staff estimates.

Figure 3.5. Homeownership Rate
(In percent of total number of dwellings; latest available year)



Sources: European Mortgage Federation; Australian Bureau of Statistics; U.S. Census Bureau; and Japan, Ministry of Internal Affairs and Communications, Statistics Bureau.

Note: Years for the data are as follows: United States, 2010; Denmark, Ireland, and Greece, 2009; Finland, Japan, the Netherlands, Spain, and Sweden, 2008; Belgium, France, and the United Kingdom, 2007; Australia, Canada, and Portugal, 2006; Germany and Italy, 2002.

agencies can issue MBS (Malaysia and South Korea). During the crisis, mortgage securitization slowed in many emerging economies, even though delinquency rates remained low and origination standards have generally been high. These markets have, however, generally recovered, reflecting persistent housing demand and growing local investor interest.

Covered bonds are debt obligations secured by a dedicated reference (or “cover”) portfolio of assets, with the issuer remaining fully liable for all interest and principal payments. In the event of issuer default, investors have a preferred claim on the assets in the cover portfolio. In order to ensure that the payment obligations are sufficiently over-collateralized, issuers are obliged to immediately replace any nonperforming loans with performing loans. If these assets fail to generate sufficient cash flows upon liquidation to repay these investors, issuers may be fully liable up to their registered capital. Because of this dual recourse to both reference assets and the issuer, the funding costs of covered bonds typically are well below that of senior unsecured debt securities issued by the same institution.

In contrast, MBS are usually designed to be “bankruptcy remote” from issuers; their performance is solely based on the underlying assets. MBS transactions involve the transfer of risk associated with a portfolio of mortgage loans into special-purpose vehicles funded with the issuance of one or more “tranches” of securities.²⁶ Tranching allows MBS to offer more flexibility than covered bonds, because it creates securities with distinct risk-return profiles. Securitization also permits more flexibility in terms of asset-liability management, because issued securities pass all cash flows through to investors. In addition, securitization can be used to transfer market and credit risk to capital markets, whereas covered bonds transfer only market risk. Securitization also provides access to capital-market-

10 years, however, issuers in ENIEs have gravitated toward securitizing in local currencies in their domestic capital markets.

²⁶Tranche holders are paid in specific order, starting with the “senior” tranches (least risky) and working down through one or more levels to the “equity” tranche (most risky). If some of the expected cash flows are not forthcoming (e.g., some loans default), and after any cash flow buffers are depleted, the payments to the equity tranche are reduced. If the equity tranche is depleted, then payments to the “mezzanine” tranche holders are reduced, and so on up to the senior tranches.

Box 3.3. Experience with Limits on Loan-to-Value Ratios for Residential Mortgages

A number of countries have used limits on loan-to-value (LTV) ratios to tame housing booms or increase resilience in the face of a bust. This box examines this practice to assess whether such ratios can be useful for other countries.

A number of countries have, historically or more recently, used limits on LTV ratios as a macroprudential tool. This experience is surveyed in Borio and Shim (2007) and Crowe and others (2011b). LTV limits can serve a number of objectives, including reining in booms in mortgage credit and real estate prices; reducing the probability of default when the housing market turns sour; and reducing losses, given default, by increasing recovery values. Before the crisis, several Asian emerging countries used LTV limits to tame real estate booms, while the explicit use of LTV limits in advanced economies has been relatively rare, with Canada and Denmark as the only significant examples.¹ Some countries have also combined LTV limits with limits on debt-service-to-income (DTI) ratios, such as in China, where the introduction of a 70 percent LTV ceiling in 1997 was followed up with 50 percent DTI limits in 2004. Hong Kong SAR has had LTV limits since the 1990s that are credited with reducing the fall-out from the real estate bust in 1997. In Croatia, on the other hand, a 75 percent LTV limit had little success as it pushed lending to unregulated sectors.

Since the beginning of the crisis, some countries have introduced new LTV limits. Canada, South Korea, and Sweden have introduced or lowered LTV limits; similarly, a few (mainly Asian) countries lowered eligibility limits as a countercyclical stimulus measure, but this was quickly

reversed as renewed capital inflows rekindled fears of real estate booms (Malaysia, Thailand, China).

A recent IMF survey of 42 member country authorities on macroprudential tools found that more than a third of the countries recently implemented an LTV limit, while almost two thirds considered it a possible policy tool. According to the survey, the objectives of LTV limits are to promote financial stability and consumer protection more generally by limiting the spillover risk stemming from the housing sector. While it was deemed too early to assess the effectiveness of the LTV limits implemented in recent years, countries with a longer experience often saw it as an effective way of dealing with real estate booms.

Due to data limitations, the effect of LTV ratios in controlling real estate prices and mortgage activity is difficult to assess empirically. For example, the coverage of LTV limits can vary widely between countries. That said, the existing empirical literature tentatively supports the effectiveness of LTV ratios in taming housing booms.² For example, according to Crowe and others (2011b), a 10 percentage point tightening in the LTV ratio leads to a decline in house prices of between 8 and 13 percentage points. There is also evidence that LTV limits have an effect on the “financial accelerator mechanism,” reducing the transmission from increases in income to increases in house prices (Almeida, Campello, and Liu, 2005). Evidence in Claessens, Kose, and Terrones (2011a and b) also indicate that lower LTV and DTI limits could be required for emerging markets, as they tend to suffer deeper recessions with more severe financial downturns than advanced economies do.

Note: This box was prepared by Francesco Columba, Srobona Mitra, and Erlend Nier.

¹See Box 3.1 on strict underwriting standards, including LTV limits, in the Danish mortgage model.

²See Annex 3.2 for further empirical evidence of the impact of LTV ratios in reducing housing booms.

based funding to banks that do not have sufficient stand-alone credit quality to issue debt directly.

Furthermore, credit growth is generally stronger in an economy in which securitization plays a bigger role than in an economy dominated by covered bond financing. There are several reasons for this.

The range of eligible assets that can be funded with covered bonds is typically quite narrow.²⁷ Moreover,

²⁷The vast majority of covered bonds are issued under “special law” frameworks that set uniform standards for product structures, collateralization, and cover pool credit quality. Although they do

Box 3.4. Housing Finance and the U.S. Housing Crisis

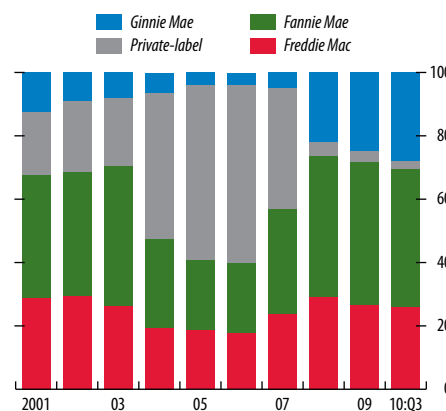
Since the 1930s, the U.S. authorities have provided a wide range of support to facilitate access to mortgage credit. While this has provided access to stable and affordable long-term mortgage financing, there is limited evidence that it has boosted homeownership, made the system more efficient, or provided buffers against economic stress (in the absence of extraordinary fiscal support). Meanwhile, it may have exacerbated the amplitude of the recent boom-bust cycle. This box details the various forms of U.S. government participation in housing finance and evaluates their role in the U.S. housing crisis.

Government participation in the U.S. housing market includes a plethora of tax breaks and subsidies, including mortgage interest deductions at the federal level, as well as state and local property tax deductions and exclusion from capital gains taxation. There is also the 1979 Community Reinvestment Act that encourages U.S. depository institutions to lend in low-income neighborhoods. These initiatives may have promoted the purchase of more and bigger homes than would otherwise have been possible, exacerbating leverage and the severity of boom-and-bust dynamics. That said, these subsidies predated the recent housing crisis by many years and did not change in the run-up to the subprime boom (Tsounta, forthcoming; IMF 2010b; Committee on the Budget, 2008).

The government also provides mortgage market support through government-sponsored enterprises (GSEs) such as Fannie Mae and Freddie Mac. Before being brought into conservatorship in October 2008, these two major GSEs were private companies that were exempt from federal income taxes and securities registration requirements for their debt securities. They were also allowed to operate with lower capital requirements than their purely private-sector counterparts and benefited from an implicit government guarantee that lowered funding costs. Their business model involves purchasing primarily conventional conforming mortgages (meeting GSEs' underwriting standards and specific loan limits) from private lenders to hold in their own portfolios or pack-

Note: This box was prepared by Andrea Maechler with contributions from Paul Mills.

Market Share of Mortgage-Backed Securities, by Issuer
(In percent)



Source: Inside MBS & ABS.

age into mortgage-backed securities (MBS).¹ Since 1992, they have also had “affordable housing goals” to facilitate homeownership opportunities for low-income and minority groups.² Government-owned Ginnie Mae plays a similar role, except that it focuses on mortgages guaranteed by the Federal Housing Administration and the Department of Veterans Affairs. In addition, the Federal Home Loan Banks provide collateralized lending to mortgage originators to help them fund mortgages.

The GSEs have enhanced liquidity in the mortgage finance system and created a deep and liquid secondary mortgage market that has significantly reduced regional differences in credit access (GAO, 1996, 2009). In addition, the GSEs’ ability to standardize underwriting criteria and mortgage products, while eliminating credit risk for holders of agency MBS, has allowed the development of a dynamic forward market that has been an important component in the success of 30-year, no-prepayment-penalty, fixed-rate mortgages.³ Also, GSE-underwritten

¹In exchange for a “guarantee fee,” the GSEs guarantee the payment of interest and principal of their MBS, but investors continue to bear the interest rate and prepayment risk.

²For example, in 2008, 56 percent of the loans purchased by the GSEs were required to be granted to low-income families (up from 30 percent in 1993).

³The forward “to be announced” market, where MBS trades can be settled for a future date without specifying the

Box 3.4 (continued)

securitization has helped lower mortgage interest rates below what they otherwise would have been (by around 13 to 28 basis points), although GSE shareholders and executives have also greatly benefited from the GSEs' implicit subsidy (Naranjo and Toevs, 2002; Passmore, Sparks, and Ingpen, 2002; GAO, 2009; Passmore, Sherlund, and Burgess, 2005). In contrast, the GSEs' purchases of agency and private-label MBS for their own investment portfolio were found to have no significant effects on either primary or secondary mortgage rates (Lehnert, Passmore, and Sherlund, 2008).

There is only limited evidence that the GSEs' housing goals have supported homeownership for targeted groups (Brent and Thibodeau, 2004; Bostic and Gabriel, 2006), or that lower interest rates were particularly useful for increasing homeownership rates (Painter and Redfearn, 2002). Homeownership rates in the United States increased steadily throughout the 1990s and early 2000s, peaking in 2004 at just below 68 percent of all households (CBO, 2009). This lack of a strong correlation between homeownership and housing subsidies seems to hold across time and countries (Tsounta, forthcoming).

There is also mixed evidence on the stabilizing role of the GSEs during economic downturns in the absence of additional public support. Some studies found that the GSEs helped preserve wide access to mortgage credit during recent recessions in the United States, as well as during the Asian financial crisis and the Long Term Capital Management collapse in the late 1990s (Quigley, 2006; Peek and Wilcox, 2006). In contrast, the GAO (1996) found little buffering effect of Fannie Mae in some states

underlying pool of loans, allows mortgage lenders to lock in rates in advance of closing, further reducing interest rate risk for loan originators.

during the savings and loan crisis in the 1980s. During the recent global financial crisis, the GSEs became instrumental in supporting the U.S. mortgage markets, although only after having been put in conservatorship and receiving considerable government support.

At the same time, the GSEs may have crowded private-sector lenders into peripheral and riskier markets (Ellen, Tye, and Willis, 2010). The GSEs lost much market share to private lenders when private-label MBS issuance exploded between 2004 and 2007 (Coleman, LaCour-Little, and Vandell, 2008; Dell'Ariccia, Igan and Leaven, 2008; Federal Housing Finance Agency, 2010). This explosion, which was driven by a combination of financial innovation, increased investor risk appetite, and lax supervision, focused on higher-risk portions of the market (e.g., subprime, alt-A, teaser rates).

The GSEs also purchased a large share of higher-risk mortgages and senior tranches of private label MBS in their efforts to maintain market share and pursue their increasingly tight affordable housing goals (Pinto, 2010; GAO, 2010). These nontraditional assets, particularly those purchased in 2006 and 2007, have accounted for the bulk of the GSE losses since the housing market began to deleverage sharply in 2007 (Federal Housing Finance Agency, 2010). However, Bhutta (2009) finds no evidence that the affordable housing goals led the GSEs to take great risks, and Dell'Ariccia, Igan and Laeven (2008) find that the dilution in underwriting standards (measured as lower denial rates of loan applications) was most acute in the nonconforming nontraditional mortgage markets, not those associated with the GSEs.

Government participation in the U.S. housing market has been pervasive but has not yielded many of the expected benefits to prospective or existing homeowners. It is clear that an overhaul is needed.

the on-balance-sheet nature of covered bonds requires full capital coverage of the underlying reference

make covered bonds rather rigid in comparison to MBS, these special laws also provide legal transparency and a regulatory stamp of approval, resulting in greater standardization, more cost-effective funding, and a more certain legal regime ensuring the enforceability of credit claims, especially as regards bankruptcy protection. Also, in some EU countries special law covered bonds get preferred regulatory treatment such as reduced regulatory risk weightings.

portfolio, which limits the range of potential issuers even in countries where covered bonds are not subject to special licensing. Also, the legal protection of covered bond investors implies an encumbrance of banks' highest-quality assets, which could conflict with depositors' rights in case of bank insolvency.

On the other hand, securitization's potential for risk transfer can lead to incentive misalignments between MBS issuers and investors with respect to the perfor-

Box 3.5. Emerging Market Mortgage Securitization

The evolution of capital-market-based funding in emerging market economies has favored the development of mortgage-backed securities (MBS) over covered bonds (Ketkar and Ratha, 2000; IMF, 2003), often with substantial public sector involvement. This box reviews the current state of mortgage securitization in these countries and outlines some of the risks that remain.

In emerging market countries, governments often maintain a significant role in MBS markets, usually through the sponsorship of specialized mortgage agencies akin to the government-sponsored enterprises in the United States (Jobst, 2006). Mexico, South Korea, and Malaysia are the most prominent emerging market countries where such agencies have been created in response to concerns regarding housing finance shortages, as bank-based housing finance remains insufficient to meet rising credit demand. These institutions sometimes start out as direct lenders or insurers (e.g., South Korea) and then over time are given the additional task of promoting the development of the domestic MBS market (e.g., Mexico).¹ For instance, in 1999, the South Korean government created the Korea Mortgage Corporation, replaced in 2004 by the Korea Housing Finance Corporation, which has issued several MBS collateralized by mortgages whose origination is subsidized by government funds from the National Housing Fund and the National Agricultural Cooperatives Federation. Similarly, in Malaysia, the issuance of MBS backed by housing loan receivables by *Cagamas*, the government-promoted housing securitization body, has helped develop the domestic bond market. In Latin

and Central America, Mexico has been a leader in state-sponsored mortgage securitization since 2009, when the *Fondo de la Vivienda del Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado* (Fovissste), the state employees' social security fund, and the *Instituto del Fondo Nacional de la Vivienda de los Trabajadores* (Infonavit), the government-run housing agency, overtook *sofoles* (specialized mortgage lending institutions) as the largest issuers of residential MBS through regular securitizations and the *Hipotecaria Total* platform, modeled after the Danish mortgage platform (see Box 3.1).

Despite these successes, mortgage securitization remains a work in progress in most emerging market countries, while recent global regulatory reforms have made covered bonds relatively more attractive as an alternative funding mechanism. Viable mortgage securitization markets require an adequate legal and regulatory framework—well-developed bankruptcy laws, clarity as to mortgage loan transfer procedures, and reliable issuer-investor dispute resolution mechanisms. In some cases, the local banking sector lacks the economies of scale to support cost-effective securitization operations, in which case the joint issuance of MBS via syndication can provide access to capital markets to small regional credit institutions.² That said, higher Basel III capital requirements will increase the costs that emerging market banks will face when securitizing their assets. As a result, the Mexican issuers, such as Infonavit and Fovissste, are expected to turn to covered bonds as an alternative to residential MBS during 2011.

Note: This box was prepared by Andreas Jobst.

¹In the recent past, federal, state, and local authorities (municipalities and provinces) as well as government agencies in various emerging market countries have used securitization to monetize future local tax revenues, deferred sales tax revenue, oil and gas royalties, future water receivables, toll road revenues, and sovereign lease receivables as a relatively cheap funding source.

²For example, in Spain, regional savings banks known as *cajas* and credit cooperatives engage in so-called “club funding” as a way of syndicating their market-based funding of mortgages. Similar arrangements exist in Germany, where smaller savings banks (*Sparkassen*) syndicate the issuance of *Pfandbriefe*. In Italy (as well as in other countries), syndication of real estate financing has become the basis for multiseller transactions.

mance of the reference asset portfolio. A number of recent policy initiatives are aimed at mitigating these potential conflicts of interest, including several initiatives to incentivize issuers to retain more exposure to the

credit risk of their securitization products.²⁸ However,

²⁸The 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act requires a uniform 5 percent economic interest in

some of these initiatives ignore already existing risk retention mechanisms, such as overcollateralization, excess spread, and representations and warranties.²⁹ Meanwhile, the U.S. private-label mortgage securitization market remains almost completely shut down, and MBS issuance volumes elsewhere remain well below pre-crisis levels, leaving covered bonds as the primary source of capital-market-based mortgage funding.

Housing Finance and Financial Stability

As already discussed, housing booms and busts are intimately linked with the provision of credit. However, there has so far been little discussion about the extent to which national differences in housing finance relate to housing booms and busts.³⁰ This section examines more specifically the relationship between mortgage credit growth, house price movements, financial stability, and the role of housing finance characteristics in this context.

Several countries experienced strong growth in mortgage debt in the last decade before the crisis, including Australia, Denmark, Ireland, the Netherlands, Spain, Sweden, and the United States. The ratio of mortgage debt to GDP reached more than 100 percent by 2009 in Denmark and the Netherlands (Figure 3.6).³¹ In some emerging European countries, mortgage debt grew by 25 to 45 percentage points of

GDP over the decade (Figure 3.7). Based on 2004–05 data, the share of households with a mortgage ranged from approximately 45 percent in the United States to 40 percent in the United Kingdom and 20 percent in the euro area. While the share of households with a mortgage generally increases with income level, the share of households with mortgages in the United States remained higher relative to the euro area for all income levels; in particular, the percentage of low-income households with mortgage debt, which might have a bearing on financial stability, was only 4 percent in the euro area, compared with 10 percent for the United Kingdom and 16 percent for the United States (ECB, 2009).

The crisis has taken a toll on all mortgage markets, although the severity of its impact has varied between countries. The mortgage portfolio performance of U.S. banks has been significantly worse than that of their counterparts in other countries, reflecting the strong deterioration in U.S. underwriting standards, as well as the significant downturn of the real economy. Spain and the United Kingdom have also seen a substantial increase in mortgage defaults, but to a much lesser extent than in the United States. In general, while many countries have seen greater house price volatility compared with the United States, households in these countries have, in aggregate, faced lower levels of negative equity and lower default rates than their U.S. counterparts (Figure 3.8). Delinquencies on securitized loans in Europe, Canada, and Australia have increased, but remain well below those in the United States.

This section draws in large part on two sets of empirical studies summarized in Box 3.6 and outlined in Annexes 3.1 and 3.2, which reconfirm the relationship between rapid mortgage credit growth and strong house price increases. The analysis in Annex 3.1, which focuses on a sample of advanced and emerging economies in the recent crisis, indicates that, indeed, controlling for the state of the economy (as measured by GDP growth), stronger mortgage credit growth during the boom was associated with not only higher house price growth during that time, but also with a larger house price decline and higher levels of nonperforming loans during the subsequent bust. In fact, past mortgage credit growth and the state of the economy explain the bulk of the cross-country variation in the

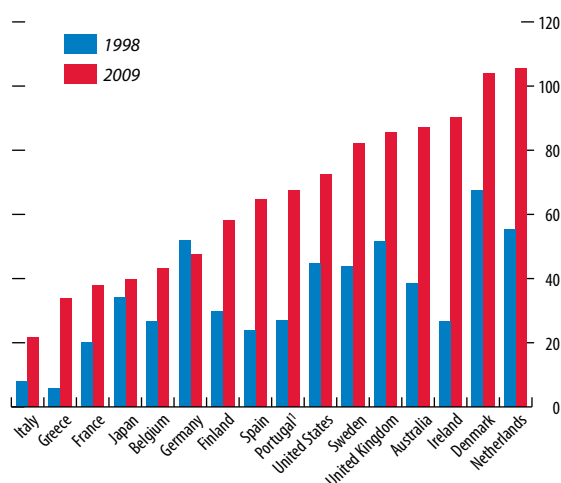
the underlying assets to be retained by issuers (with only a few permissible exemptions). Similar rules became effective in the European Union in January 2011 as part of the revised Capital Requirements Directive.

²⁹Excess spread is the difference between the interest received from the underlying loan portfolio and what is paid out to bondholders, portions of which can accrue to securitizers if the loan portfolio performance exceeds preset levels. Representations and warranties are contractual clauses that allow securitization vehicles to put back loans to originators that do not meet pre-agreed underwriting standards; they can be accompanied by disclosure of repurchase requests to reveal deficiencies in underwriting standards. For further details, see IMF (2009c, Chapter 2).

³⁰The available evidence is largely confined to the impact of institutional features on access to credit and the role of these features in determining more standard business cycles (IMF, 2008).

³¹The significant reliance on mortgage debt in Denmark reflects the effectiveness of the mortgage system; for example, the Danish corporate structure is dominated by small and medium-size enterprises that do not have access to the corporate bond market but frequently finance their business activities through mortgage loans (IMF, 2007).

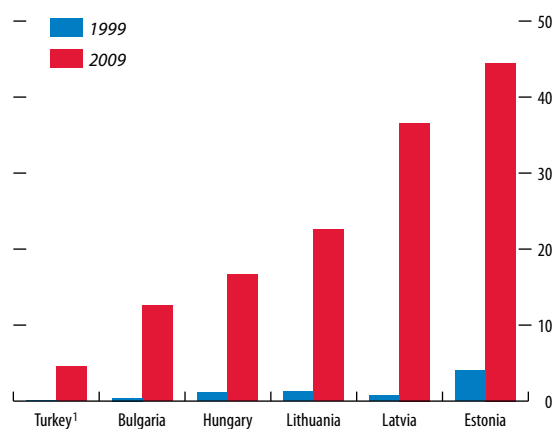
Figure 3.6. Residential Mortgage-Debt-to-GDP Ratio: Advanced Economies
(In percent)



Sources: European Mortgage Federation; Bank of Japan; U.S., Board of Governors of the Federal Reserve Systems; U.K., Office for National Statistics; and Australian Bureau of Statistics.

¹For Portugal, 1999 instead of 1998.

Figure 3.7. Residential Mortgage-Debt-to-GDP Ratio: Emerging Europe
(In percent)



Source: European Mortgage Federation.

¹For Turkey, 2002 instead of 1999. 2002 = 0.1.

house price slowdown and the increase in bank loan losses during the bust. The analysis in Annex 3.2, which focuses on advanced economies over a longer time horizon, confirms the strong positive relationship between house price movements and household credit growth, also when controlling for the main fundamental drivers of house prices.³² On average, a 10 percent increase in household credit is associated with an increase in house prices of about 6 percent. Moreover, the relationship works both ways, with house price increases in turn leading to stronger credit growth by boosting both household net worth and expectations of further house price increases. Lastly, the relationship between credit growth and changes in house prices is found to be stronger in the upswing; in the downturn, it almost disappears, suggesting that the speed of household deleveraging lags the fall in house prices.

Next, the empirical analyses in Annexes 3.1 and 3.2 are extended to account for the impact of a number of housing finance characteristics on mortgage credit and house price changes. They include the degree of government participation in the mortgage market, LTV ratios, and the types of mortgage products (Table 3.6).

Government Participation in the Mortgage Market

During the pre-crisis boom period, government participation in housing finance, as captured by a composite index (Table 3.5), tended to amplify the relationship between rising house prices and mortgage credit growth, particularly in advanced economies (Annex 3.1). Also, countries with more government participation experienced a deeper house price decline in the recent crisis. These findings are supported by the Annex 3.2 analysis, which suggests that government participation exacerbates house price swings for advanced economies over a longer time period, also accounting for other country-specific characteristics. The results might reflect both the lower cost of pre-crisis credit (due to government subsidization) and a relaxation in lending standards by the private sector

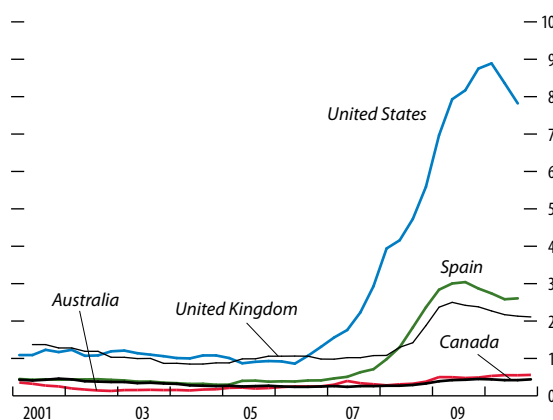
³²Crowe and others (2011a) confirm this relationship. Lecat and Mesonnier (2005) also find a strong positive correlation between the growth of credit and house price increases in a study of 18 OECD countries from 1985–2002. The analysis in Annex 3.2 extends this sample, in particular by incorporating the more recent experience.

(due to increased competition between the private sector and the government).³³

In addition to the analyses based on the composite government participation index, specific aspects of government participation are also included in the analyses in Annexes 3.1 and 3.2 to explain changes in house prices and mortgage credit. In particular, the analysis in Annex 3.2 suggests that subsidies to first-time home buyers, tax deductibility of capital gains on housing, and government provision of mortgage guarantees or credit tend to amplify house price swings by exacerbating both the boom and the subsequent bust. These results, which point to substantial unintended consequences of such government participation, are confirmed by a recent study by the OECD (2011) on housing policies, which suggests that certain tax breaks to homeowners are particularly likely to distort demand and lead to volatility in house prices.

Meanwhile, the presence of mortgage interest deductibility per se does not help to explain cross-country variations in house prices and mortgage credit growth during the recent crisis (Annex 3.1), although the extent and specific form of the interest deductibility might still matter. The distributional impact of mortgage interest relief can be complex, although deductibility is likely to favor wealthier households (see IMF, 2009a, 2010b; OECD, 2011).³⁴ Ellis (2008) suggests that in the United States, mortgage interest rate deductibility, combined with the lack of prepayment penalties, has contributed to growth in household leverage and mortgage indebtedness through cash-out refinance and second mortgages.³⁵ In particular, owner-occupied housing used to serve as a sort of forced savings mechanism in the United States, since households were required to make down payments of at least 20 percent to make the mortgages conform to the GSEs' criteria. More recently, however, the introduction of more accommodative mortgage products

Figure 3.8. Nonperforming Residential Mortgage Loans
(In percent of total residential mortgage loans outstanding)



Sources: Federal Reserve Bank of New York; Reserve Bank of Australia; Bank of Spain; U.K., Council of Mortgage Lenders; and Lea (2010b).

Note: Nonperforming loans that are more than 90 days in arrears. For Australia, Canada, and the U.S., banks only.

³³See Chiquier and Lea (2009) for a discussion on how subsidized mortgage credit can jeopardize financial stability by encouraging rapid mortgage credit growth.

³⁴For the United States, this was reiterated by the President's Advisory Panel on Federal Tax Reform (2005).

³⁵A cash-out refinance means that the borrower takes out cash in addition to the existing loan balance, implying that the new loan balance will consist of the current loan balance plus the cash-out amount.

Table 3.6. Which Housing Finance Features Help Explain Growth in House Prices, Mortgage Credit, and Nonperforming Loans?

Effect On:	Housing Finance Characteristics							Other Factors				Reference
	Higher Government Participation Index (higher value = more participation; see Table 3.5)							Higher Past Growth in Mortgage Credit	Higher House Price Growth	Lower GDP Growth		
	Higher LTV	Variable versus Fixed Rate	Overall Index	Subsidies to First-Time Buyers	Tax Deductibility of Capital Gains	Government Provision of Guarantees or Mortgage Loans	Tax Deductibility of Mortgage Interest					
House price growth												
During recent crisis (2007–09), for advanced and ENIEs, did the characteristic contribute to decline in house prices?	—	—	x					x		x		Annex 3.1
Does the characteristic amplify house price booms in advanced countries over 1980–2010?	x	x	—	x	x	—	—	x				Annex 3.2
Does the characteristic amplify house price busts in advanced countries over 1980–2010?	x	x	x	x	x	x	—	x				Annex 3.2
Nonperforming loans/total loans growth												
During the recent crisis (2007–09), for advanced and ENIEs, did the characteristic contribute to increase in NPLs?	—	—	—					x		x		Annex 3.1
Mortgage credit growth												
Does the characteristic help explain increases in mortgage credit/GDP during the pre-crisis period (2004–07), for advanced and ENIEs?	—	x	x							x		Annex 3.1

Note: X = statistically significant at 10 percent level. An empty cell indicates that the characteristic was not included in that particular econometric specification; ENIEs = emerging and newly industrialized economies; NPLs = nonperforming loans.

together with higher median house prices implied that mortgage interest rate deductibility contributed to increased leverage, in turn contributing to the increase in house prices.³⁶

³⁶Apart from financial stability concerns, the U.S. mortgage interest rate deduction is also costly—at \$104.5 billion in fiscal year 2011 it is the second largest tax expenditure, that is, government revenue that is foregone through the provisions of tax deductions, etc. Meanwhile, it does not seem to have had a discernible impact on the homeownership rate (Hilber and Turner, 2010). In this context, it is interesting to note the recent proposal by the U.S. Fiscal Commission to limit

Loan-to-Value Limits and Lending Standards

The empirical results on the impact of LTV ratios on financial stability are somewhat mixed. Based on maximum observed LTV ratios, the Annex 3.2 study suggests that a high LTV ratio strengthens the effect of real GDP growth on house price growth

mortgage interest deductibility to \$500,000 (compared with the current \$1 million) and apply it only to first mortgages of principal residences (National Commission on Fiscal Responsibility and Reform, 2010).

Box 3.6. Empirical Analyses of the Relationships among House Prices, Credit, and Housing Finance Characteristics

Two empirical analyses are undertaken in the chapter on the relationship between house prices, credit, and housing finance characteristics. The first study focuses on the recent crisis for a larger sample of both advanced and emerging market economies; the other study focuses on a smaller sample of advanced economies over a longer time period.

The first analysis covers 36 advanced and emerging market economies during two episodes: the 2004–07 global liquidity expansion (the “boom” period), and the 2007–09 crisis period (the “bust”) (see Annex 3.1). The aim is to capture the feedback effects between house price changes and financial stability (mortgage credit growth and loan-loss growth) during the recent crisis. In order to capture these cross effects, two equations are estimated using Zellner’s “seemingly unrelated regressions” (SUR) model. All variables, except for the housing finance characteristics, are measured as growth rates over each of the two episodes. Controlling for real GDP growth, the additional influence of mortgage finance characteristics is explored—the predominant interest rate type (i.e., fixed versus other types); the maximum observed loan-to-value ratio; and an index of government participation (see Table 3.5).

The two-equation panel-data model of inflation-adjusted house price changes and the change in the share of nonperforming loans is estimated for both episodes. Next, the impact of different housing finance characteristics on cross-country crisis outcomes is estimated. Finally, the SUR model of pre-crisis mortgage credit growth and house price changes is estimated to test whether housing finance characteristics explain

the pre-crisis mortgage credit boom, which is strongly associated with crisis severity.

The second analysis covers 19 countries in the Organization for Economic Cooperation and Development from 1980 to the second quarter of 2010 (see Annex 3.2). It examines the relationships among house prices and credit and the impact of housing finance characteristics on house price swings based on panel regressions that capture both the cross-section and time-series dimensions of the data, while controlling for differences across countries using country-fixed effects. The dependent variable in all regressions is the one-year change of the nominal house price index, which is regressed on a range of potential drivers of house prices.

The basic relationship between house price swings and household credit is examined, controlling also for the main fundamental drivers of house prices, namely real GDP growth, inflation, and the rate of population growth. Next, the contribution of different housing finance characteristics to house price volatility is examined. This analysis assesses (1) whether a given characteristic amplifies the effect of a change in fundamentals (such as income or population growth) on house prices; and (2) whether the characteristic affects the magnitude of housing busts across the sample. Last, the analysis is extended to examine whether government participation in housing markets—based both on the composite index and specific dimensions—amplifies the effect of income shocks on house prices and affects the magnitude of busts.

for advanced economies over time. This relationship is highly significant and economically relevant and also holds if population growth is substituted for GDP growth. The results also document a positive relationship between LTV ratios and the magnitude of house price busts, confirming the notion discussed earlier that higher leverage can adversely affect house price dynamics in the downturn. By contrast, when simultaneously estimating nonperforming loans and

house price growth for a more varied set of countries (Annex 3.1), LTV ratios do not help explain house price or mortgage credit growth in the run-up to the recent crisis, or the depth of the house price downturn or increase in loan losses during the crisis. This might in part reflect the fact that LTV ratios may not be representative in many emerging economies, where loans are mostly originated by lenders in the unregulated sectors.

A positive relationship between LTV limits and house price increases over time is supported by other studies, although concerns regarding this relationship are also noted. Crowe and others (2011b), using LTV ratios at origination for the 50 U.S. states, find a strong positive association between LTV ratios and house price growth. However, they also note the difficulty in establishing the causality between LTV ratios and house price and mortgage credit dynamics. Also, a review of the experience of countries that have implemented mandatory LTV limits suggests that the effectiveness of such limits can erode over time (e.g., through regulatory arbitrage). Empirical studies on LTV limits are also hampered by a lack of data. Ideally, LTV limits could be combined with debt-service-to-income (DTI) limits, as discussed in Box 3.3; while the LTV ratio captures borrowers' ability to repay the loan by selling the property, the DTI ratio captures their ability to service the loan during its lifetime.

More generally, and as noted earlier, relaxed lending standards and increased household leverage have been shown to be associated with higher house price increases, which in turn are associated with stronger house price declines and financial stability problems during the bust. Furthermore, housing booms that are mainly driven by relaxed lending standards are more likely to result in a subsequent banking crisis. In fact, an overriding theme in the run-up to the recent crisis (and many earlier ones) was the erosion of mortgage underwriting standards in certain countries. This reflected increased competition and aggressive lending, lax regulation and supervision, and incentive misalignment for private-label residential mortgage-backed securitization. Aided by abundant liquidity, relaxed lending standards led to an overall increase in mortgage credit growth, including for low-income households, in turn spurring the house price boom and subsequent bust and significantly contributing to financial instability.

Mortgage Products

The empirical analyses suggest that the prevalence of variable-rate loans amplifies mortgage credit growth and in turn house price swings. While variable rate loans expose unhedged borrowers to

interest rate risk and the banks to credit risk when interest rates go up, the lower variable rates relative to fixed rates might lure myopic borrowers to take on excessive credit.

Certain U.S. mortgage products have been linked to higher rates of default, such as subprime adjustable-rate mortgages, balloon mortgages, and interest-only mortgages.³⁷ Subprime loans and loans without any documentation, rare or nonexistent outside the United States, have defaulted at very high rates (Figure 3.9). Such loans have generally been originated by mortgage brokers that are subject to little or no supervision and have been regulated only by licensing agreements. Certain mortgage products such as second-lien contracts and silent second liens (whose existence is not disclosed to the originator of the first lien), which have been limited to the United States (ECB, 2009), have contributed to increased leverage. Meanwhile, as discussed above, reliance on foreign-currency-denominated mortgages (especially in euros, Swiss francs, and Japanese yen) in emerging Europe has exposed borrowers (and indirectly banks) to exchange rate risks, in particular as household incomes typically are denominated in local currencies.³⁸

Still, product design has not been singled out as a cause of mortgage default outside the United States, and other factors could be more important in explaining delinquencies. In Spain and the United Kingdom, lower interest rates on adjustable-rate mortgages have been credited for keeping default rates down in the recent crisis. The United Kingdom also had a significant share of subprime lending, peaking at 8 percent of mortgages in 2006, with U.K. lenders providing loans to borrowers with both adverse credit and limited documentation (Lea, 2010a). However, while U.K. nonconforming private-label securitized

³⁷A balloon mortgage does not fully amortize over the life of the loan, leaving a balance at the end of the term. An interest-only mortgage does not amortize at all; monthly payments consist only of interest, and the principal balance is paid off when the loan matures.

³⁸For example, with 60 percent of new mortgage loans denominated in Swiss francs, Hungarian households experienced difficulty in repaying their debt as the Hungarian forint depreciated against the franc in 2010. The Hungarian authorities are currently discussing a support scheme for distressed mortgage borrowers (IMF, 2011).

loans have had high delinquency rates, the number of foreclosures has been much smaller than in the United States.³⁹ In the end, the dominant product in any given country will represent a balance between borrower and lender needs, as well as regulations, history, and degree of sophistication of the financial system (Lea, 2010b).

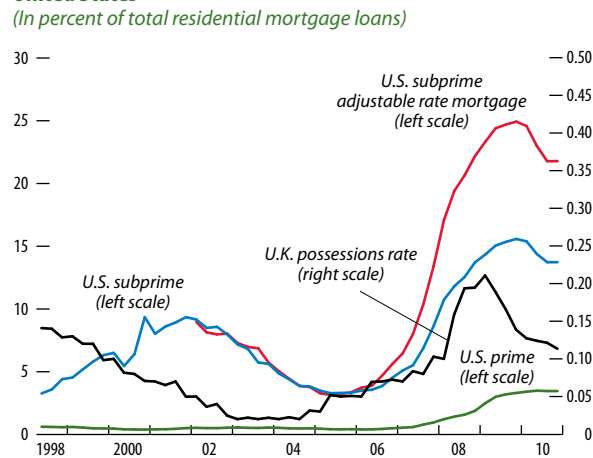
In addition to the housing finance characteristics included in the empirical analyses as discussed above, other housing finance characteristics might also be important for financial stability, including the role played by private-label securitization, nonrecourse mortgages, and lack of prepayment penalties. These factors are discussed further below.

Securitization and Servicing versus Covered Bonds

In the run-up to the crisis, private-label residential mortgage securitization in the United States was associated with a deterioration in underwriting standards and incentive problems. Furthermore, as loans have become delinquent, servicers currently have little incentive to renegotiate loans, even when they have the contractual ability to do so, because their income depends on fees that are based on the outstanding principal balance of the loans (Box 3.7). As a result, the U.S. homeowner mortgage support program (Home Affordable Modification Program—HAMP) puts an emphasis on the importance of incentivizing servicers (IMF 2009c, Chapter 2; Levitin and Twomey, 2011).

Covered bonds, backed by high-quality mortgages combined with greater accountability by the originating institutions, have contributed to safer mortgages in Europe and could complement securitization as capital-market mortgage financing.⁴⁰ Still, there might be challenges in introducing covered bonds in the United States, as noted by Surti (2010). Such a system would require stricter underwriting standards, because the

Figure 3.9. Home Foreclosures in the United Kingdom and the United States
(In percent of total residential mortgage loans)



Sources: U.S. Mortgage Bankers Association; and U.K., Council of Mortgage Lenders.

³⁹In part this might reflect the existence of a homeowner mortgage support program in the United Kingdom, as well as historically low interest rates and recourse lending. In the United States, the Home Affordable Modification Program has been less successful in averting foreclosures, as evidenced by the small fraction of allotted funding actually spent, in part probably due to an insufficient emphasis on principal writedowns.

⁴⁰Other factors also help explain the safety of mortgages in Europe, including lower LTV levels and full-recourse loans.

Box 3.7. Mortgage Finance Unbundling and Incentive Misalignments

Policymakers and observers are expressing increasing frustration with the efforts of U.S. mortgage servicers to mitigate foreclosures. This box explores some of the aspects of the servicing business that explain why volumes of loan modifications have been so disappointing, even though they apparently maximize expected loan portfolio net present values. The analysis demonstrates the importance of financial infrastructure in housing finance systems.

It is widely acknowledged that avoiding foreclosure more likely than not maximizes the net present value (NPV) of seriously delinquent loans (Fitch Ratings, 2008). Foreclosure is a lengthy process, and the severity of losses during such processes tends to be greater than during more orderly unwinds.¹ In many cases, the expected NPV of a seriously delinquent loan is maximized if creditors exercise some degree of forbearance, including loan modifications that involve partial forgiveness of payment and principal.

However, the foreclosure mitigation mathematics should also account for the possibility that modified loans will slip back into delinquency (“redefault”) if the reduction in payments or principal is not sufficient, or that delinquent loans will become current (“self cure”) without any loan modifications (Adelino, Gerardi, and Willen, 2009; Das, 2010; Haughwout and Okah, 2009).² In any case, most delinquent loans do not enter any sort of loss mitigation program, including those subsidized by the government, or even become part of foreclosure proceedings within six months of becoming seriously delinquent (Agarwal and others, 2011).

Note: This box was prepared by John Kiff with contributions from Robert Sheehy.

¹Foreclosure costs include the legal and other transaction costs; principal and interest payments lost during the foreclosure process; the higher loss severities associated with distressed sales of the property; and any further home price depreciation that might occur during the process.

²Also, the severity of the loss from a foreclosure can be reduced if the lender can recoup some of the deficiency (the amount by which the loan balance exceeds the foreclosure proceeds), although in cases where the delinquency is an affordability issue, as it probably is with many seriously delinquent U.S. subprime loans, such recourse may not be worth pursuing. Furthermore, in some of the hardest-hit U.S. states, lenders cannot legally pursue recourse actions on certain residential mortgages (Pence, 2006).

Furthermore, once securitized, seriously delinquent mortgages are less likely to be modified than are (“portfolio”) loans held on lender balance sheets (Agarwal and others, 2011). This could be because the quality of securitized loans was so poor from the outset that, from the lender viewpoint, it is uneconomic to restructure them.³ The poor modification performance has also been attributed to loan servicer under-resourcing, plus several potential incentive conflicts between servicers and mortgage-backed securities (MBS) holders.

Most loans that are securitized in the United States are managed by third-party servicers as agents for the trusts that represent the interests of the MBS investors.⁴ Depending on the contractual arrangements, servicing income is usually comprised of:

- A percentage of the outstanding principal balance (“servicing fees”) deducted each month from the payments received from borrowers;
- Interest income (“float”) on the funds received from borrowers before sending them on to the trust (usually the payments come in at the beginning of the month and go out to the trusts at the end). These funds include escrow accounts for taxes and insurance;
- Ancillary fees charged to borrowers for late payments and bounced checks, and to the trust for collection costs, even on delinquent loans; and
- A “retained interest” in a first-loss tranche of the MBS (usually only if the servicer is an affiliate of the securitizer).

Although servicing and ancillary fee maximization would appear to incentivize servicers to avoid foreclosures, modification negotiation is expensive “high-touch” work, for which servicers are not compensated. Furthermore, all of that work is for naught if the modified loan redefaults or if the loan would have cured without modification. Neither are servicers in a hurry to foreclose seriously delinquent loans, because

³The ratio of total debt payments to income of borrowers whose loans have been modified under the U.S. government’s Home Affordable Modification Program was 63 percent as of September 30, 2010.

⁴U.S. banks are unique in outsourcing mortgage loan servicing. See Levitin and Twomey (2011) for a comprehensive analysis of servicing economics.

Box 3.7 (continued)

they will ultimately be reimbursed for all of their fees accrued until the foreclosure process starts. In a period of large-scale delinquencies, foreclosure delays may thus be exacerbated by an incentive structure that does not press for rapid resolution.

In addition, MBS senior tranche holders, who make up the majority of MBS investors, are highly incentivized to push for foreclosures, so that they can accelerate their cash inflows at the expense of junior tranche holders.

In the end, servicing is more than just collecting and distributing periodic cash flows, and it should not be ignored in the design of a mortgage system. In traditional systems, in which loans are serviced

by lenders that retain the economically material risk exposure to the loans, such special considerations are not necessary. However, in systems in which servicing has been unbundled, the interests of investors and the financial system would be better served by contractual arrangements that better anticipate large-scale serious delinquencies.⁵ Also, potential conflicts of interest between servicers and investors should be disclosed.

⁵With regard to better aligning servicer compensation and cost structure, the U.S. initiative announced by the Federal Housing Finance Agency (www.fhfa.gov) on January 18, 2011, is a welcome development.

underlying mortgages would remain on the banks' balance sheet. Moreover, relatively lenient personal bankruptcy rules might not be conducive to the introduction of covered bonds in the United States; since issuers are required to replace defaulting loans in cover pools, this could imply more frequent asset replacement.⁴¹

Nonrecourse Mortgages

The use of full-recourse mortgage loans, which allow the lender to pursue deficiency judgments, has helped limit the number of foreclosures in advanced economies other than the United States.⁴² Empirically,

full recourse has been associated with lower default rates in Europe (Duygan-Bump and Grant, 2008). At the same time, lenders might have fewer incentives to undertake fair value assessments for full-recourse mortgages, which in turn could lead to riskier lending; lenders might also have fewer incentives to undertake loan modifications. In a minority of U.S. states, mortgage loans are considered nonrecourse debt.⁴³ Such mortgages have encouraged some borrowers to opt for “strategic default” (Ghent and Kudlyak, 2010; Jagtiani and Lang, 2010).⁴⁴ By further increasing the supply of housing, strategic defaults put further downward pressure on house prices. Nonrecourse mortgages might

⁴¹The Federal Deposit Insurance Corporation (FDIC) has also raised concerns about the protection of depositors in a covered bond system (see www.fdic.gov/news/news/speeches/chairman/spoct2510.html). These concerns, which in part may reflect unease regarding the procyclicality of residential mortgage loan quality in the United States (as underscored by their credit performance during the crisis), are generally addressed by capping the share of covered bonds in the total liabilities of a bank, in particular by limiting asset eligibility.

⁴²A deficiency judgment is a court order against a borrower for the balance of the mortgage debt in the case of a sale of the foreclosed property that does not fully satisfy the loan obligations. In contrast, a nonrecourse mortgage implies that the lender has recourse only to the underlying property, not to any income or other wealth of the borrower.

⁴³A limited number of U.S. states (California being the most significant) do not hold debtors personally liable for mortgage loans, thus prohibiting deficiency judgments. Other states limit deficiency judgments to the difference between mortgage debt and the fair value of the foreclosed property (instead of the sales price at foreclosure). Still other states prohibit deficiency judgments but only after nonjudicial foreclosure is chosen. Practices and interpretations vary significantly across states. In practice, deficiency judgments are sometimes not sought not because they are prohibited but due to the time and costs involved, and given borrowers' lack of other assets to satisfy the claim.

⁴⁴That is, when a borrower who might be able to service the mortgage chooses to default because the value of the underlying property is less than the mortgage amount. See further Chapter 1 for a discussion of strategic default.

also give borrowers fewer incentives to maintain their properties, because they can more easily walk away in case of house price declines.

Lack of Prepayment Penalties

As noted above, the lack of prepayment penalties for fixed-rate mortgages in the United States is seen as having contributed to increased household leverage and mortgage indebtedness through cash-out refinancing. Such refinancing booms can lead to mortgage market volatility (ECB, 2009; Lea, 2010b). At the same time, while stringent payment penalties may act to deter equity withdrawal, they may also make it more expensive for borrowers to deleverage.⁴⁵ Also, Kiff (2009) suggests that transaction costs on U.S. mortgage refinancing often offset the lack of formal prepayment penalties. Hence, the impact of prepayment penalties on leverage may be limited.

Conclusions and Policy Implications—Back to Basics

This chapter discussed current housing finance practices in a number of representative advanced and emerging economies, as well as the impact of those practices on financial stability. National authorities and policymakers may find this analysis helpful as they reassess the structure and health of their housing finance systems, with particular attention given to those features that contribute to financial stability.

Country-specific housing finance systems vary significantly and have sometimes been shaped by pivotal historic events. Today's housing finance systems are determined by a range of factors, including the products offered to investors (floating or fixed interest rates over various maturities); the use of prepayment penalties; funding (deposits versus capital markets); the degree of lender recourse to defaulted borrowers' other assets and income; and government participation, including tax breaks. While different systems can work well to provide

stable housing finance, a number of best practices emanate from the discussion and empirical analyses. They focus on enhanced underwriting and supervision; better calibrated government participation; and better-aligned incentives in capital-market mortgage funding.

Best Practices

Enhanced Risk Management, Underwriting Standards, and Supervision

It is almost impossible to overstate the importance of improved internal risk management and underwriting standards by all mortgage loan originators and brokers, with penalties for poor underwriting complemented by enhanced prudential supervision. Good underwriting standards that are consistent across various types of mortgage lenders and brokers will need to become, once more, a hallmark of the mortgage origination business. Such standards need to take into account the value of the underlying property, the borrower's creditworthiness, verification of the submitted information, and sound and independent appraisals.

In this context, LTV and DTI limits could serve as useful prudential tools to dampen credit and hence house price growth, although some caution will need to be exercised when implementing such limits, as discussed further below.⁴⁶ As shown above, past mortgage credit growth, together with the state of the economy, explain the bulk of the cross-country variation in the house price slowdown and the increase in bank loan losses in the recent crisis—the faster you grow, the harder you fall (Annex 3.1). While the evidence of the empirical analyses on LTV limits are somewhat mixed—possibly reflecting the fact that LTV ratios may not be representative in many of the emerging economies that are included in the Annex 3.1 analysis—the balance of evidence, also drawing on other empirical literature, seems to support a positive relationship between LTV ratios and credit and house price growth, at least in the short run. Together, such prudential measures, which would set the limits for

⁴⁵Prepayment penalties are the norm in Canada, but borrowers can usually prepay 15 to 20 percent of the original mortgage loan balance annually without paying a penalty or any transaction cost (Kiff, 2009). Such a scheme potentially discourages the building of cash-out, refinancing-driven leverage, while encouraging deleveraging when the borrower has excess liquidity.

⁴⁶The focus of this chapter is on the underlying structure of housing finance systems, rather than on macroprudential measures such as countercyclical LTV limits (see Crowe and others, 2011a) and dynamic provisioning.

conforming loans, would provide a buffer to draw on in a housing bust (Crowe and others, 2011a).

Still, as noted earlier, the effectiveness of prudential limits might weaken over time as borrowers are pushed into the unregulated sectors. Hence, it will be important to implement such limits consistently across mortgage originators (banks and nonbanks). It will also be important that such limits be comprehensive and take into account all liabilities of the borrower, in addition to the first mortgage. The exact definition of conforming loan will need to take into account individual country housing and mortgage market characteristics, such as the relative cost of real estate. Lastly, absolute LTV limits might be blunt instruments that exclude potentially creditworthy first-time buyers/borrowers.⁴⁷ Rather, mortgages that do not meet the strict LTV prudential limit could, for example, still be made available to those borrowers who agree to purchase adequate mortgage insurance.⁴⁸ Alternatively, bank supervisors would need to assign higher capital risk weights for nonconforming mortgages (Scharfstein, 2010).

Better-Calibrated Government Participation

The role of government in the housing market should be carefully reviewed as it may unintentionally contribute to financial instability.⁴⁹ In particular, there is a need for well-calibrated government participation with less focus on direct provision of mortgage credit and more concern about systemic effects and externalities. Better calibrated government participation would also rely on more targeted measures to achieve social objectives, such as affordable housing for low-income households. Dedicated government agencies need to be transparent and carefully constructed. In addition, government guarantees should be explicit and priced upfront to mitigate the moral haz-

ard problem—that is, lenders taking excessive risk based on the implicit assumption that the government will eventually rescue them in the event of a crisis.

A disproportionate focus on homeownership might exacerbate house price swings through government-led subsidization of mortgage loans and a relaxation of lending standards in response to growing competition between the government and financial firms. Some countries might want to reconsider their policies in this regard: for example, good-quality rental housing could be a better option for low-income households. A more level tax treatment across owner-occupied and rental housing would help reduce the current bias toward homeownership. In particular, in the absence of taxation of imputed rents and capital gains on housing, countries should reassess policy tools such as mortgage interest deductibility, which should be capped and apply only to first mortgages on primary residences.

Improved Alignment of Incentives in Capital Market Funding

Originator-investor incentives in the private-label residential mortgage securitization markets should be well aligned. In the run-up to the recent crisis, incentive misalignments in the U.S. residential MBS underwriting process incentivized the maximization of mortgage volumes (and fees) at the expense of mortgage quality. In this regard, the aforementioned policy initiatives that are designed to incentivize loan originators to retain credit risk exposure to their securitization transactions and the underlying loans may be helpful. Also, a general improvement of underwriting standards, as discussed above, should help support the revival of private-label securitization (IMF, 2009c). As discussed in Box 3.7, servicing standards and oversight also need to be improved, and servicer incentives should be better aligned with those of the originators and investors.

Covered bonds could become an important capital market complement to securitization for mortgage funding. However, any effort to encourage covered bond markets should take into account their potential impact on bank failure resolution and deposit insurance programs.

Additional Important Aspects

The best practices outlined above represent important steps toward a more stable housing finance system.

⁴⁷See Financial Services Authority (2009) for further discussion about concerns in using LTV limits.

⁴⁸Mortgage insurance plays an important role in high-LTV lending in some countries (Blood, 2009) and can be an important tool for reconciling the policy goals of widening access to homeownership while mitigating the risks of such lending. Proponents also point to the built-in insurer incentives to promote prudent and countercyclical lending standards, as insurers would be likely to raise premia in the boom (and reduce them during the bust) (Joyce and Molesky, 2009).

⁴⁹Government participation in the mortgage market is also costly from a public finance point of view, even as it has not proven particularly effective in raising homeownership rates.

There are also other aspects of housing finance that might have a bearing on financial stability but that might work differently in different countries, depending on their legal framework, financial infrastructure, and so on. Moreover, when it comes to mortgage products, there may be important differences in viewpoint between lenders and borrowers. For example, while an interest rate cap on adjustable-rate mortgages reduces the potential payment shock to (and default risk of) borrowers, it can reduce the yield for lenders. Mortgages that limit borrowers' personal liability have been shown to provide incentives for them to strategically default on their mortgage. However, the extent to which lenders actually pursue deficiency judgments in the case of delinquencies on full-recourse mortgages also depends on a number of other factors, including the legal infrastructure of the country and the other resources of the borrower. Also, efficient loss mitigation mechanisms for seriously delinquent mortgage loans are important, as speed can be of the essence in avoiding negative feedback loops of housing market stress.

For policymakers in emerging economies who are in the process of developing housing finance structures, there are additional aspects to be considered when implementing the best practices outlined above. In particular, it will be important that the new systems be commensurate with the legal and financial infrastructures of the country. As discussed in Box 3.3, LTV and DTI limits should be lower for emerging markets, as they tend to suffer deeper recessions with more severe financial downturns than advanced economies (Claessens, Kose, and Terrones, 2011a and b). Also, as noted previously, the implementation of LTV limits might be particularly challenging in some of these economies because a large share of mortgage origination is accounted for by the unregulated, informal financial sector. Meanwhile, DTI limits might not properly take into account incomes derived from informal sectors.

Furthermore, risky and complex products such as foreign currency mortgages or foreign-currency-indexed mortgage rates should be avoided in markets that do not provide sufficient hedging opportunities or where originators are unable to price in the related risk.⁵⁰ Also, the choice of funding tools, such as

covered bonds or securitization, will need to depend on the ability to oversee the risks involved and fully understand the underlying legal components. Moreover, government participation in emerging economies should focus on better regulation and information provision (e.g., through the creation of credit bureaus and efforts to increase financial literacy among consumers), while refraining from directly providing mortgage products or distorting mortgage prices through subsidies and tax exemptions (Chiquier and Lea, 2009).

Reform of the U.S. Housing Finance System

The U.S. housing finance system is unusual in many respects. An overhaul of important aspects of this system is needed, in line with the best practices outlined above and in Box 3.4, and as discussed in the recent U.S. Financial Sector Assessment Program (IMF, 2010a). It is noteworthy that while the United States did not experience the largest house price decline among advanced economies in the recent crisis, it did experience the most severe impact on its mortgage market and financial system among large economies. The U.S. administration has recently published a proposal for reform of the U.S. housing finance system, underlining the need for further discussion on this topic (U.S. Treasury and HUD, 2011). While an overhaul of the housing finance system will take years to complete, U.S. authorities need to step up their efforts now to develop and implement an appropriate action plan.

In line with the best practices outlined above, there is a pressing need for enhanced internal risk management at financial institutions and for improved underwriting standards and supervision. Current gaps in the regulatory, supervisory, and consumer protection frameworks should be addressed. Moreover, there is a need for better-defined and more transparent government participation in the housing market, with all such policy measures, including strict affordable housing policy goals, transparently shown in the government's budget. Housing tax expenditures should be reviewed, and the role of the GSEs should be reassessed so as to create a more level playing field in the U.S. mortgage markets. While the GSEs were not at

⁵⁰Households in emerging economies typically have limited opportunities to hedge against foreign currency risks, although in

countries where remittances play an important role, there are in fact some natural hedging possibilities.

the root of the recent crisis, their structure contributed to the recent financial distress (U.S. Treasury and HUD, 2011). A more level playing field combined with better incentive alignment in the private-label MBS market will help revive this market. Such reforms would have a significant positive effect on the U.S. financial system and would help bolster global financial stability. They would also help strengthen U.S. sovereign creditworthiness, given the current public finance burden of the GSEs (see Chapter 1).

The U.S. administration's recent recommendations on housing finance reform (U.S. Treasury and HUD, 2011) appear broadly in line with the discussion in this chapter. Indeed, the recommendations focus on winding down the GSEs by gradually raising their insurance guarantee fees, reducing their investment portfolios, and lowering the ceiling for conforming loans. The recommendations also focus on reducing the government's role in housing finance. In particular, they deemphasize homeownership as a policy goal and call for more focused housing policies, including more explicit and targeted government participation. However, they do not address the mortgage interest tax deduction, which, as discussed in the chapter, is both expensive and regressive. The recommendations also note the importance of improving market oversight while increasing transparency and accountability, and they emphasize the need for incremental change, mindful of operational complexities of transition, not least because of the still fragile state of housing markets.

The U.S. administration's report presents three long-term options with different degrees of explicit government participation, all of which appear to be headed in the right direction, although some concerns and challenges remain.

The first option—a fully privatized system of housing finance with a government role limited to helping narrowly targeted groups of low-income borrowers—implies the least government participation. This could raise uncertainty and moral hazard during times of crisis, as many might expect government support in times of severe financial stress. It also assumes that private markets are able to step in and substitute for GSE issuances at an affordable price, which could lead to more volatile mortgage markets.

The second option—a privatized system plus a public guarantee mechanism that could be scaled up in a

crisis—could, for example, use an above-market guarantee fee that would be attractive only during market stress. However, it faces important design challenges, such as avoiding crowding out private markets in normal times and fueling moral hazard during turbulent times (e.g., if the premium is lowered during stress).

The third option is a privatized system plus public catastrophic reinsurance, with first-loss insurance coverage from private sources (the reinsurance would pay out once shareholders of private guarantors are wiped out).⁵¹ That option is likely to provide the lowest-cost access to mortgage credit and would make government participation (and taxpayer exposure) explicit. However, pricing the catastrophic insurance will be challenging given the need to avoid overinvestment in housing that would exacerbate distortions and contingent liabilities.

In the foreseeable future, there seems to be a continued need for government guarantees for securitized mortgages, given the significant remaining uncertainty and vulnerability in the U.S. mortgage market, particularly in the private-label residential MBS market. Substantial swings in the cost of mortgage financing could be particularly damaging at a time when weaknesses in real estate markets continue to weigh on the economic recovery. However, government guarantees should be explicit and fully accounted for on the government's balance sheet. Over the medium term, and with appropriate reforms to encourage “safe” securitization as discussed in the chapter, the GSEs should be wound down to make way for private-label securitization to reemerge as a viable option. Ultimately, the details of implementation will be key. The challenge will be to strike the right balance between delivering an appropriate level of explicit government participation and discouraging another cycle of overinvestment.

In conclusion, a vibrant and healthy mortgage market is an important factor driving both macroeconomic growth and global financial stability. Learning from experience, policymakers should seek to establish robust mortgage market structures and provide adequate oversight aimed at ensuring their careful implementation.

⁵¹This would be similar to FDIC deposit insurance.

Annex 3.1. The Impact of Housing Finance Modes on House Prices and Loan-Loss Growth during the Recent Crisis⁵²

House price changes, mortgage credit growth, and loan losses are influenced by mortgage market structures, and the empirical results presented in this annex highlight which mortgage market features are the most influential. The aim is to capture the feedback effects between house price changes and loan-loss growth or that between the house price changes and mortgage credit growth. Then the additional influence of mortgage finance characteristics is explored. The analysis covers 36 countries during two episodes: the 2004–07 global liquidity expansion (the “boom”), and the 2007–09 crisis period (the “bust”).

Econometric Model

A two-equation panel-data model of inflation-adjusted home price changes and the change in the proportion of nonperforming loans is estimated. The simultaneous equation setup captures the feedback between house price growth and financial stability, with mortgage market structures as potential drivers of both during each of the two episodes. Controlling for real GDP growth, three potential housing finance characteristics are considered: the predominant interest rate type (fixed (= 1) versus “other”); the maximum observed loan-to-value (LTV) ratio; and an ordinal measure of government participation (a zero to 1 index that weighs eight forms of participation).⁵³ In order to capture the cross-effects of loan performance on house prices and vice versa, the equations are estimated using Zellner’s “seemingly unrelated regressions” (SUR) model. All variables, except for the housing finance characteristics, are measured as growth rates over each of the two episodes.

⁵²This annex was prepared by Srobona Mitra.

⁵³The participation measures considered are upfront subsidies to first-time buyers; subsidies to low-income buyers; indirect subsidies through saving-account contributions; early withdrawals from provident funds for house purchases; existence of housing finance funds owned by government; presence of tax deductibility of mortgage interest; tax deductibility of capital gains; and majority market share of state-owned financial institutions as mortgage originators. See Table 3.5 for details.

$$\begin{aligned}\Delta H_{it} &= \alpha_1 + \beta_1 \Delta FS_{it} + \gamma \Delta Y_{it} + \\ &\quad \Phi_1 (\text{Housing Finance Characteristics}) + \varepsilon_{1it} \\ \Delta FS_{it} &= \alpha_2 + \beta_2 \Delta H_{it} + \gamma_2 \Delta Y_{it} + \\ &\quad \Phi_2 (\text{Housing Finance Characteristics}) + \varepsilon_{2it},\end{aligned}$$

where

$i = 1 \dots 36$ countries (although, some specifications substantially reduce the sample;

$t = 2004\text{--}2007, 2007\text{--}2009$ (two episodes);

H = Real House Price; Y = Real GDP Growth;

FS = Financial Stability; and

$\Delta FS = \{\text{Change in non-performing loans/loans (“NPL-ratio”), Change in (mortgage) credit/GDP ratio}\}$.

Estimation method: SUR with period and country-fixed effects, or SUR cross-section.

Economies and Data Sources

The economies are Australia, Austria, Belgium, Bulgaria, Canada, China, Czech Republic, Denmark, Spain, Estonia, Finland, France, Germany, Greece, Hong Kong SAR, Hungary, Ireland, Italy, Japan, South Korea, Lithuania, Latvia, Mexico, Malaysia, the Netherlands, Norway, the Philippines, Poland, Russia, South Africa, Singapore, Slovenia, Sweden, Thailand, Taiwan Province of China, the United Kingdom, and the United States.

The emerging and newly industrialized economy (ENIE) dummy equals 1 for Bulgaria, China, the Czech Republic, Estonia, Hong Kong SAR, Hungary, South Korea, Lithuania, Latvia, Mexico, Malaysia, the Philippines, Poland, Russia, South Africa, Singapore, Slovenia, Thailand, and Taiwan Province of China. Some specifications limited the sample of countries according to availability of data.⁵⁴

Data on house price indices are from the Organization for Economic Cooperation and Development and the Global Property Guide, deflated by consumer price indices from the IMF’s International Financial Statistics; mortgage or housing credit from Haver Analytics; index of government participation constructed in Table 3.5 (sources listed in the table); interest rate type and LTV ratios from Warnock and Warnock (2008); and non-

⁵⁴The Czech Republic and Slovenia are currently classified as “Advanced Economies” for World Economic Outlook purposes. However, they were part of the ENIE group during most of the 2004–07 period and have been included among the ENIEs for the purpose of this econometric analysis.

performing loans/total loans from Statistical Appendix tables on financial soundness indicators in previous issues of the IMF's *Global Financial Stability Report*.

Results

- Growth in house prices and overall loan-losses in the economy are associated with each other (Table 3.7, columns 1 and 2). Controlling for the state of the economy (GDP growth), 1 percent lower house price growth is associated with about a 0.1 percentage point higher nonperforming loan (NPL) ratio.
- Growth in house prices and mortgage credit growth feed back into each other as well (Table 3.7, columns 3 and 4). In particular, 10 percentage point higher mortgage credit in percent of GDP is associated with 16 percentage points higher growth of real house prices. This is comparable to the 6 percent higher growth of nominal house prices found in Annex 3.2, although credit growth is measured differently. Furthermore, 10 percent higher house price growth is associated with a 0.4 percentage point higher ratio of mortgage credit to GDP.
- Past mortgage credit growth and the recession explain the bulk of the cross-country variation in the house price slowdown and the increase in banking sector loan losses during the crisis (Table 3.7, columns 5 and 6). In particular, 1 percentage point higher mortgage credit growth (in percent of GDP) during the pre-crisis boom is associated with 0.66 percentage point lower house price growth and a 0.15 percentage point higher NPL ratio during the crisis.
- There is mild evidence that countries with variable interest rates experienced a deeper house price downturn and higher nonperforming loans during this crisis (Table 3.7, columns 7 and 8), but these effects are not statistically significant. However, taking into account the evidence in Table 3.8 (columns 5 and 6) that countries with predominantly variable rates had higher mortgage credit growth during the boom episode, and that the boom-time credit growth explains the subsequent bust, the effect of the interest rate type is already accounted for when the boom-time credit growth is included in Table 3.7, columns 7 and 8.
- Greater government participation in housing finance did not provide a cushion against the crisis (Table 3.7, columns 9 and 10). Among housing finance characteristics, countries with higher government participation in housing finance experienced a deeper house price downturn after a level effect on emerging economies is accounted for. No separate effect of the tax deductibility of mortgage interest was found (and not shown in the table), mainly because of its preponderance across countries.
- Maximum LTV ratios do not help explain crisis outcomes or the pre-crisis boom (columns 11 and 12 in Table 3.7 and columns 7 and 8 in Table 3.8). Maximum observed LTV ratios neither explain the depth of the house price downturn or the increase in loan losses during the crisis. Furthermore, threshold effects of high LTV ratios (for instance, above 80 percent) were not found to be important for the outcome on financial stability. Typical and average LTV ratios on new loans are not representative for guiding policies on financial stability purposes when much higher LTV ratios are widely available. For instance, the average LTV ratio in the United States was 76 percent, but LTV ratios of 100 percent were widely available before the crisis. Crowe and others (2011b), using LTV ratios at origination across a panel of the 50 U.S. states, find a strong association between LTV ratios and house price growth. Also, as shown in Annex 3.2, there is some evidence that LTV ratios could explain house price movements over a longer sample in advanced economies.
- Mortgage credit growth was fueled by house price growth and vice versa (columns 3 and 4 in Table 3.7, and columns 1 and 2 in Table 3.8). However, during the crisis, it is hard to explain the mortgage credit crunch, owing to the multitude of factors that could have restrained mortgage lenders or household borrowers.
- Mortgage credit and real GDP growth explains 50 percent of the pre-crisis house price growth; real house price growth alone explains 20 percent of mortgage credit growth before the crisis.
- Government participation amplified the effect of higher house prices on mortgage credit growth before the crisis, but mostly in advanced economies (Table 3.8, columns 3 and 4). This effect is also confirmed (but not displayed) and strengthened if the real house price equation is excluded from the two-

Table 3.7. Joint Determinants of Growth in Real House Prices, Mortgage Credit, and Loan Losses

Explanatory Variables	Two-Episode Panel (2004–07 and 2007–09) ¹		Two-Episode Panel (2004–07 and 2007–09) ¹		Crisis—2007–09 Episode Cross-Section (Basic)		Crisis—2007–09 Episode Cross-Section (Type of Interest Rate)		Crisis—2007–09 Episode Cross-Section (Government Participation)		Crisis Episode Cross-Section— 2007–09 Episode (LTV)	
	Seemingly Unrelated Regression		Seemingly Unrelated Regression		Seemingly Unrelated Regression		Seemingly Unrelated Regression		Seemingly Unrelated Regression		Seemingly Unrelated Regression	
	(Feasible GLS)		(Feasible GLS)		(Feasible GLS)		(Feasible GLS)		(Feasible GLS)		(Feasible GLS)	
	Change in real house price (percent)	Change in NPL ratio (pp)	Change in real house price (percent)	Change in housing credit/ GDP ratio (pp)	Change in real house price (percent)	Change in NPL ratio (pp)	Change in real house price (percent)	Change in NPL ratio (pp)	Change in real house price (percent)	Change in NPL ratio (pp)	Change in real house price (percent)	Change in NPL ratio (pp)
	Equation 1	Equation 2	Equation 1	Equation 2	Equation 1	Equation 2	Equation 1	Equation 2	Equation 1	Equation 2	Equation 1	Equation 2
	1	2	3	4	5	6	7	8	9	10	11	12
Change in real house price (percent)		–0.07 (0.01)***		0.04 (0.02)*		–0.07 (0.06)		–0.07 (0.06)		–0.15 (0.08)*		0.13 (0.07)**
Change in NPL ratio (pp)	–7.51 (0.98)***		–4.31 (1.07)***	–0.75 (0.38)**	–0.66 (0.54)		–0.64 (0.54)		–0.97 (0.50)*		0.93 (0.45)**	
Change in mortgage credit-to-GDP ratio (pp)	0.83 (0.37)**	–0.02 (0.04)	1.64 (0.38)***									
Change in real GDP (percent)	2.3 (0.26)***	0.11 (0.04)***	2.73 (0.27)***		0.5 (0.25)**	–0.2 (0.08)***	0.51 (0.25)**	–0.21 (0.08)***	0.42 (0.23)*	–0.18 (0.09)*	0.93 (0.21)***	–0.35 (0.08)***
Change in mortgage credit-to-GDP ratio (pp) in 2004–07					–0.66 (0.24)***	0.15 (0.08)**	–0.65 (0.24)**	0.15 (0.08)*	–0.63 (0.20)***	0.11 (0.09)	–1.16 (0.18)***	0.35 (0.09)***
Type of interest rate (predominantly fixed = 1, others = 0)							0.61 (4.42)	–0.71 (1.42)				
Index of government participation (0–1, see Table 3.5) ¹									–16.25 (7.51)**	–3.47 (3.21)		
LTV ratio (maximum observed)											0.01 (0.08)	0.02 (0.03)
Dummy for ENIEs (DUMENIE)									–4.59 (2.39)*	0.93 (1.01)	–10.80 (2.12)***	3.04 (0.95)***
Constant	–25.5 (7.9)***	–0.61 (0.89)	–36.61 (8.00)***	6.79 (2.05)***	–0.64 (1.73)	0.16 (0.56)	–0.75 (1.89)	0.28 (0.61)	7.19 (3.12)**	0.76 (1.38)	–4.53 (6.97)	–1.71 (2.83)
Country fixed effects	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Period fixed effects	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
No. of observations	66	66	66	66	32	32	32	32	23	23	32	32
R ²	0.94	0.90	0.95	0.78	0.62	0.60	0.62	0.60	0.67	0.63	0.62	0.61

Source: IMF staff estimates.

Note: NPL ratio = Nonperforming loans/total loans; LTV = loan-to-value; GLS = generalized least squares; pp = percentage points; ENIEs = emerging and newly industrialized economies. Standard errors in parenthesis; ***, **, * = statistically significant coefficients at the 1, 5, and 10 percent levels.

¹The results are robust to both the indices of government participation shown in Table 3.5.

Table 3.8. Joint Determinants of Growth in Real House Prices and Mortgage Credit, Pre-Crisis Episode, 2004–07

Explanatory Variables	Pre-crisis—2004–07 Episode Cross-Section (Basic)		Pre-crisis—2004–07 Episode Cross-Section (Government Participation)		Pre-crisis—2004–07 Episode Cross-Section (Type of Interest Rate)		Pre-crisis—2004–07 Episode (LTV)	
	Seemingly Unrelated Regression (Feasible GLS)		Seemingly Unrelated Regression (Feasible GLS)		Seemingly Unrelated Regression (Feasible GLS)		Seemingly Unrelated Regression (Feasible GLS)	
	Change in Real House Price (percent)	Change in Mortgage Credit/GDP Ratio (pp)	Change in Real House Price (percent)	Change in Mortgage Credit/GDP Ratio (pp)	Change in Real House Price (percent)	Change in Mortgage Credit/GDP Ratio (pp)	Change in Real House Price (percent)	Change in Mortgage Credit/GDP Ratio (pp)
	Equation 1	Equation 2	Equation 1	Equation 2	Equation 1	Equation 2	Equation 1	Equation 2
	1	2	3	4	5	6	7	8
Change in real house price (percent)		0.12 (0.02)***		0.25 (0.14)*		0.14 (0.02)***		0.16 (0.02)***
Change in mortgage credit- GDP-ratio (pp)	3.88 (0.62)***		1.73 (0.55)***		4.99 (0.64)***		4.33 (0.61)***	
Change in real GDP (percent)	2.05 (0.49)***		–1.13 (1.37)		1.14 (0.64)*		1.18 (0.67)*	
Dummy for ENIEs (DUMENIE)			–10.97 (16.10)	–2.51 (2.96)	36.15 (13.45)***	–8.69 (1.76)***	27.92 (13.28)**	–7.69 (1.96)***
Change in real GDP (percent) * DUMENIE			1.97 (1.49)					
Index of government participation (see Table 3.5) ¹			–11.71 (17.19)	0.77 (9.22)				
Change in real house price * Index of government participation				0.36 (0.57)				
Change in real house price * Index of government participation * DUMENIE				–0.73 (0.42)*				
Type of interest rate (Predominantly fixed = 1, others = 0)					54.26 (62.22)	–7.85 (2.68)***		
Type of interest rate * Change in real GDP					–1.92 (7.18)			
LTV ratio (maximum observed)							0.39 (0.34)	–0.05 (0.07)
Constant	–27.73 (9.64)***	3.33 (1.23)***	16.3 (12.09)	1.88 (3.66)	–42.81 (10.25)***	7.46 (1.27)***	–65.38 (30.71)**	10.44 (6.24)*
No. of observations	36	36	26	26	36	36	36	36
R ²	0.51	0.20	0.27	0.38	0.52	0.48	0.52	0.34

Source: IMF staff estimates.

Note: LTV = loan-to-value; GLS = generalized least squares; ENIEs = emerging and newly industrialized economies; pp = percentage points. Standard errors in parenthesis; ***, **, * = statistically significant coefficients at the 1, 5, and 10 percent levels.

¹The results are robust to both the indices of government participation shown in Table 3.5.

equation model or if a different index of government participation is used (from Table 3.5). This result complements the finding in Annex 3.2 that government participation amplifies house price swings over a longer time series for advanced economies.

Annex 3.2. Evidence on House Prices, Credit, and Housing Finance Characteristics in Advanced Economies⁵⁵

This annex examines empirically the extent to which house prices are driven by credit and whether and how differences across countries in housing finance systems affect house price dynamics. The data are for 19 countries in the Organization for Economic Development and Cooperation (OECD) from the first quarter of 1980 to the second quarter of 2010.⁵⁶ The annex examines empirical relationships between house prices and potential drivers using panel regressions that allow for exploiting variation in both the cross-section and time-series dimensions of the sample, while controlling for differences across countries using country-fixed effects.

The dependent variable in all regressions is the one-year change of the nominal house price index,⁵⁷ which is regressed on a range of potential drivers of house prices. Some of the exercises examine housing busts. Based on quarterly data for the 19 countries during the period examined, the analysis identifies 37 episodes of nominal house price declines lasting more than a year (busts).

The first exercise examines the basic relationship between house price swings and household credit. The results suggest that house price appreciations are positively and strongly associated with the growth in household credit extended by banks (Table 3.9). On average, a 10 percent increase in household credit leads to a 6 percent increase in nominal house prices. The results remain strong when credit growth is lagged. They continue to hold when year fixed effects are included, which control for all common variation across time (including potentially correlated house price swings).

There is also evidence that increases in house prices lead to further increases in credit (not shown), suggest-

ing a two-way relationship where increases in credit and house prices feed each other.

Most interestingly, the relationship is different during periods of housing busts: during a bust the positive relationship between household credit growth and house price changes nearly disappears. This may be explained with deleveraging processes that lag the decrease in nominal house prices.

A second set of exercises examines whether the relation between house price swings and the growth in household credit holds when controlling for the main fundamental drivers of house prices, namely real GDP growth, inflation, and the rate of population growth (Table 3.10).

The results show that the relation between credit and prices remains statistically strong when fundamental drivers are included and that inclusion of the additional controls does not change the magnitude of the effect. The effect of the growth of bank loans to households on house price swings is similar in magnitude and sign to that of real GDP growth (Table 3.10, equation 8).

The growth of population has a quite large effect, but it is less statistically significant than that of GDP growth. It may compete with household credit, since higher population growth would tend to lead to household formation and new household borrowing. Inflation does not seem to play a role in house price dynamics.

Additional exercises verify that the relationship between credit and prices is robust to the inclusion of further control variables, such as short- and long-term interest rates and unemployment.

A third set of exercises investigates how different characteristics of housing finance affect the magnitude of house price swings. These exercises exploit both the cross-sectional and time series dimensions of the dataset by allowing changes through time (e.g., in income) to interact with differences across countries (in housing characteristics), resulting in a large number of observations. Since the effects of housing finance characteristics on house prices would work through an effect on credit, credit growth is dropped from the regressions.

The exercise finds that both loan-to-value (LTV) ratios and the prevailing contract type play a role in amplifying house price dynamics. A high LTV ratio strengthens the effect of real GDP growth on house price growth (Table 3.11). This relationship is highly significant and economically relevant, with a coefficient nearly half of the base effect. It is in line with prior evidence obtained

⁵⁵This annex was prepared by Francesco Columba and Erlend Nier.

⁵⁶The sample length differs across countries depending on data availability.

⁵⁷OECD nominal house price data.

Table 3.9. House Prices and Household Bank Credit

Explanatory Variables	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6	Equation 7	Equation 8
Bank loans to households one-year percent change	0.76*** <i>0.17</i>	0.54*** <i>0.20</i>			0.64*** <i>0.19</i>	0.52** <i>0.21</i>		
Bank loans to households one-year lagged percent change			0.47*** <i>0.14</i>	0.32** <i>0.13</i>			0.37** <i>0.13</i>	0.27** <i>0.14</i>
Bank loans to households one-year percent change * bust dummy					-0.51** <i>0.21</i>	-0.39 <i>0.26</i>		
Bank loans to households one-year lagged percent change * bust dummy							-0.36* <i>0.19</i>	-0.13 <i>0.23</i>
Bust dummy					-0.05** <i>0.02</i>	-0.05** <i>0.02</i>	-0.07*** <i>0.02</i>	-0.07*** <i>0.02</i>
Constant	-0.01 <i>0.01</i>	0.02 <i>0.03</i>	0.01 <i>0.01</i>	-0.01 <i>0.01</i>	0.01 <i>0.02</i>	0.01 <i>0.03</i>	0.04*** <i>0.01</i>	0.02 <i>0.01</i>
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	No	Yes	No	Yes	No	Yes	No	Yes
R ²	0.31	0.46	0.12	0.36	0.50	0.57	0.41	0.52
Number of observations	289	289	285	285	289	289	285	285

Source: IMF staff estimates.

Note: The dependent variable is the one-year growth rate of nominal house price index. Standard errors are below parameter estimates in italics. Estimation performed by panel regression and standard errors are clustered by country. ***, **, and * = statistically significant coefficients at the 1, 5, and 10 percent levels.

Table 3.10. House Prices, Household Bank Credit, and Macroeconomic Controls

Explanatory Variables	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6	Equation 7	Equation 8
Bank loans to households one-year percent change	0.55*** <i>0.16</i>	0.57** <i>0.19</i>	0.76*** <i>0.18</i>	0.64*** <i>0.19</i>	0.75*** <i>0.18</i>	0.63*** <i>0.19</i>	0.52*** <i>0.17</i>	0.55*** <i>0.18</i>
Real GDP one-year percent change	0.94*** <i>0.20</i>	0.58*** <i>0.17</i>					0.95*** <i>0.21</i>	0.60*** <i>0.17</i>
CPI annual inflation			-0.01 <i>0.01</i>	0.01 <i>0.01</i>			-0.01 <i>0.01</i>	0.01 <i>0.01</i>
Population one-year percent change					1.02 <i>0.93</i>	1.14 <i>0.86</i>	1.82** <i>0.91</i>	1.55* <i>0.85</i>
Bank loans to households one-year percent change * bust dummy		-0.63*** <i>0.18</i>		-0.54* <i>0.24</i>		-0.53** <i>0.20</i>		-0.69*** <i>0.2</i>
Bust dummy		-0.03* <i>0.02</i>		-0.05** <i>0.02</i>		-0.05** <i>0.02</i>		-0.03 <i>0.02</i>
Constant	-0.01 <i>0.01</i>	0.01 <i>0.02</i>	-0.01 <i>0.01</i>	0.01 <i>0.02</i>	-0.02 <i>0.01</i>	0.01 <i>0.02</i>	-0.02** <i>0.01</i>	-0.01 <i>0.02</i>
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.39	0.52	0.31	0.49	0.32	0.50	0.39	0.53
Number of observations	289	289	289	289	287	287	287	287

Source: IMF staff estimates.

Note: The dependent variable is the one-year growth rate of nominal house price index. Standard errors are below parameter estimates in italics. Estimation performed by panel regression and standard errors are clustered by country. ***, **, and * = statistically significant coefficients at the 1, 5, and 10 percent levels.

by Almeida, Campello, and Liu (2005) and points to the presence of an accelerator mechanism: a high LTV ratio amplifies the effect of income shocks on house prices.

A further and novel finding is that the prevalence of more flexible rate contracts also amplifies house price swings associated with changes in income, perhaps

because these contracts look more affordable to prospective borrowers, even though they make households carry greater interest rate risk.

Both results continue to hold when housing characteristics are interacted with the growth in population, rather than growth in GDP, as an alternative measure

Table 3.11. House Prices and Housing Finance Characteristics

Explanatory Variables	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6
Real GDP one-year percent change	0.88*** <i>0.14</i>	0.24 <i>0.29</i>	1.12*** <i>0.15</i>	1.08*** <i>0.15</i>	0.51*** <i>0.15</i>	-0.02 <i>0.30</i>
Population one-year percent change	0.18* <i>0.10</i>	0.10 <i>0.10</i>	-0.03 <i>0.07</i>	-0.07 <i>0.06</i>	0.09 <i>0.08</i>	-0.02 <i>0.10</i>
Maximum LTV ratio * real GDP one-year percent change	0.41*** <i>0.09</i>				0.37*** <i>0.10</i>	
Flexibility of mortgage interest rate * real GDP one-year percent change		0.62*** <i>0.15</i>				0.53*** <i>0.16</i>
Bust dummy			-0.07*** <i>0.01</i>	-0.06*** <i>0.01</i>	-0.06*** <i>0.01</i>	-0.05*** <i>0.01</i>
Bust dummy * maximum LTV ratio			-0.01*** <i>0.00</i>		-0.01*** <i>0.00</i>	
Bust dummy * flexibility of mortgage interest rate				-0.02*** <i>0.00</i>		-0.01*** <i>0.00</i>
Constant	0.01*** <i>0.00</i>	0.02*** <i>0.00</i>	0.04*** <i>0.01</i>	0.01*** <i>0.02</i>	0.04*** <i>0.01</i>	0.04*** <i>0.00</i>
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.27	0.27	0.34	0.34	0.37	0.38
No. of observations	543	543	543	543	543	543

Source: IMF staff estimates.

Note: The dependent variable is the one-year growth rate of nominal house price index. Standard errors are below parameter estimates in italics. Estimation performed by panel regression and standard errors are clustered by country. ***, **, and * = statistically significant coefficients at the 1, 5, and 10 percent levels. LTV = loan to value.

of changes in housing demand. They do not change when country-fixed effects are dropped and instead a random effects model is estimated (not shown).

Perhaps most interestingly, these housing finance characteristics are shown to have an effect on the severity of the bust. Where LTV ratios are high, busts are deeper on average. Likewise, where contract terms are more flexible, busts are deeper on average, with the annual decline in house prices about 25 percent faster for both variables.

Overall, the results suggest that contract terms and lending standards matter for house price dynamics. Policies that aim to reduce the amplitude of booms and busts in the housing sector may consider exploring tools such as a maximum LTV ratio or a move to more fixed-rate and longer-term contracts.

Finally, the analysis examines the effect of government participation in housing markets. The analysis looks at both a composite index of government participation, also used in Annex 3.1, and specific dimensions of the index. For all variables, the exercise examines whether participation amplifies the effect of income shocks on house prices and whether participation affects the magnitude of busts.

The analysis finds fairly strong evidence that government participation tends to exacerbate house price swings, both when looking at the composite index of government participation in a bust and during both booms and busts when focusing on specific dimensions (Table 3.12).

Subsidies to first-time buyers are shown to both amplify house price swings in the upturn and lead to deeper subsequent busts. Similarly, tax deductibility of capital gains tends to both amplify the boom and exacerbate the bust.

Perhaps most strikingly, government provision of guarantees or mortgage loans tends again to exacerbate rather than cushion housing busts, all else equal, pointing to substantial unintended consequences of such participation.

References

Adelino, Manuel, Kristopher Gerardi, and Paul S. Willen, 2009, "Why Don't Lenders Renegotiate More Home Mortgages? Redefaults, Self-Cures, and Securitization," Boston Federal Reserve Bank Working Paper 09-04 (July 6).

Table 3.12. House Prices and Government Participation

Explanatory Variables	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6	Equation 7	Equation 8
Real GDP one-year percent change	1.19** <i>0.45</i>	1.06*** <i>0.20</i>	1.41*** <i>0.26</i>	1.08*** <i>0.15</i>	1.09*** <i>0.24</i>	1.11*** <i>0.21</i>	1.81*** <i>0.27</i>	1.18*** <i>0.19</i>
Population one-year percent change	0.07 <i>0.07</i>	−0.20 <i>0.48</i>	0.07 <i>0.08</i>	−0.07 <i>0.06</i>	0.01 <i>0.07</i>	−0.06 <i>0.06</i>	0.01 <i>0.08</i>	−0.01 <i>0.06</i>
Government participation * real GDP one-year percent change	1.10 <i>0.89</i>							
Subsidies to first time homebuyers * real GDP one-year percent change			0.57* <i>0.27</i>					
Capital gains tax deductibility * real GDP one-year percent change					0.74** <i>0.31</i>			
Government Agency providing guarantees/loans * real GDP one-year percent change							−0.40 <i>0.43</i>	
Bust dummy		−0.03** <i>0.01</i>		−0.06*** <i>0.01</i>		−0.04** <i>0.01</i>		−0.06*** <i>0.01</i>
Bust dummy * Government participation		−0.15*** <i>0.04</i>						
Bust dummy * Subsidies to first time homebuyers				−0.04** <i>0.01</i>				
Bust dummy * Capital gains tax deductibility						−0.04*** <i>0.00</i>		
Bust dummy * Housing finance funds/Government Agency providing guarantees/loans								−0.04** <i>0.01</i>
Constant	0.01** <i>0.00</i>	0.04*** <i>0.00</i>	0.01** <i>0.00</i>	0.03** <i>0.01</i>	0.01*** <i>0.00</i>	0.04*** <i>0.00</i>	0.01** <i>0.01</i>	0.04*** <i>0.00</i>
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.26	0.36	0.26	0.34	0.27	0.35	0.26	0.34
No. of observations	398	398	398	398	398	398	398	398

Source: IMF staff estimates.

Note: The dependent variable is the one-year growth rate of nominal house price index. Standard errors are below parameter estimates in italics. Estimation performed by panel regression and standard errors are clustered by country. ***, **, and * = statistically significant coefficients at the 1, 5, and 10 percent levels.

Agarwal, Sumit, Gene Amromin, Itzhak Ben-David, Souphala Chomsisengphet, and Douglas D. Evanoff, 2011, “The Role of Securitization in Mortgage Renegotiation,” Charles A. Dice Center for Research in Financial Economics Working Paper 2011–2 (January).

Aizenman, Joshua, and Yothin Jinjara, 2009, “Current Account Patterns and National Real Estate Markets,” *Journal of Urban Economics*, Vol. 66, No. 2, pp. 75–89.

Almeida, Heitor, Murillo Campello, and Crocker Liu, 2005, “The Financial Accelerator: Evidence from the International Housing Markets” (unpublished; New York University).

Ambrose, Brent W., and Thomas G. Thibodeau, 2004, “Have the GSE Affordable Housing Goals Increased the Supply of Mortgage Credit?” *Regional Science and Urban Economics*, Vol. 34, No. 3, pp. 263–73.

Bhutta, Neil, 2009, “GSE Activity and Mortgage Supply in Lower-Income and Minority Neighborhoods: The Effect of the Affordable Housing Goals,” Finance and

Economic Discussion Series 09/03 (Washington: Federal Reserve Board).

Blood, Roger, 2009, “Mortgage Insurance,” in *Housing Finance Policy in Emerging Markets*, ed. by Loïc Chiquier and Michael Lea (Washington: World Bank).

Borio, Claudio, and Ilhyok Shim, 2007, “What Can (Macro-) Prudential Policy Do to Support Monetary Policy?” BIS Working Paper No. 242 (Basel: Bank for International Settlements).

Bostic, Raphael W., and Stuart A. Gabriel, 2006, “Do the GSEs Matter to Low-Income Housing Markets? An Assessment of the Effects of the GSE Loan Purchase Goals on California Housing Outcomes,” *Journal of Urban Economics*, Vol. 59, No. 3, pp. 458–75.

Burnside, Craig, Martin Eichenbaum, and Sergio Rebelo, 2011, “Understanding Booms and Busts in Housing Markets,” NBER Working Paper 16734 (Cambridge, Massachusetts: National Bureau of Economic Research).

- Canada Mortgage and Housing Corporation, 2010, "Canadian Housing Observer." Available via the Internet: www.cmhc-schl.gc.ca/en/corp/about/cahoob.
- Central Bank of Ireland, 2010, "Code of Conduct on Mortgage Arrears" (December, revised). Available via the Internet: www.financialregulator.ie/press-area/press-releases/Pages/NewMeasurestoProtectMortgageHolders-FacingArrears.aspx.
- Chiquier, Loïc, and Michael Lea (eds.), 2009, *Housing Finance Policy in Emerging Markets* (Washington: World Bank).
- Claessens, Stijn, M. Ayhan Kose, and Marco E. Terrones, 2008, "What Happens During Recessions, Crunches and Busts?" IMF Working Paper 08/274 (Washington: International Monetary Fund).
- , 2011a, "How Do Business and Financial Cycles Interact?" IMF Working Paper (forthcoming; Washington: International Monetary Fund).
- , 2011b, "Financial Cycles: What? How? When?" in *NBER International Seminar in Macroeconomics 2010*, ed. by Richard Clarida and Francesco Giavazzi (forthcoming; Cambridge, Massachusetts: National Bureau of Economic Research).
- Coleman, Major, Michael LaCour-Little, and Kerry Vandell, 2008, "Subprime Lending and the Housing Bubble: Tail Wags Dog?" *Journal of Housing Economics*, Vol. 17, No. 4, pp. 272–90.
- Committee on the Budget, 2008, "Tax Expenditures; Compendium of Background Material on Individual Provisions" (Washington: Congressional Research Service, December).
- Congressional Budget Office (CBO), 2009, "An Overview of Federal Support for Housing," Economic and Budget Issue Brief (November 3). Available via the Internet: www.cbo.gov/ftpdocs/105xx/doc10525/HousingPrograms.1.1.shtml.
- CoreLogic, 2011, "Q4 Negative Equity Report" (March). Available via the Internet: www.corelogic.com/About-Us/ResearchTrends/Negative-Equity-Report.aspx?WT.mc_id=036_crlg_1e_ner_1_110308.
- Crowe, Christopher, Giovanni Dell'Ariccia, Deniz Igan, and Pau Rabanal, 2011a, "Policies for Macrofinancial Stability: Options to Deal with Real Estate Booms," IMF Staff Discussion Note 11/02 (Washington: International Monetary Fund).
- , 2011b, "How to Deal with Real Estate Booms: Lessons from Country Experiences," IMF Working Paper (forthcoming; Washington: International Monetary Fund).
- Danske Markets, 2010, "Danish Covered Bond Handbook" (September). Available via the Internet: www.danskemarkets.com.
- Das, Sanjiv R., 2010, "The Principal Principle: Optimal Modification of Distressed Home Loans," paper presented at the Federal Reserve System and the Federal Deposit Insurance Corporation Conference on Mortgages and the Future of Housing Finance Conference (October 15).
- Del Negro, Marco, and Christopher Otrok, 2007, "99 Luftballons: Monetary Policy and the House Price Boom Across U.S. States," *Journal of Monetary Economics*, Vol. 54, No. 1962–985.
- Dell'Ariccia, Giovanni, Deniz Igan, and Luc Laeven, 2008, "Credit Booms and Lending Standards: Evidence from the Subprime Mortgage Market," IMF Working Paper 08/106 (Washington: International Monetary Fund).
- Dübel, Hans-Joachim, 2009, "Contract Savings for Housing," in *Housing Finance Policy in Emerging Markets*, ed. by Loïc Chiquier and Michael Lea (Washington: World Bank).
- Duygan-Bump, Burcu, and Charles Grant, 2008, "Household Debt Repayment Behaviour: What Role Do Institutions Play?" *Economic Policy*, Vol. 24, No. 57, pp. 107–40.
- Economic Commission for Latin America and the Caribbean (ECLAC), 2010, "The Reactions of the Governments of the Americas to the International Crisis: An Overview of Policy Measures Up to 31 December 2009" (United Nations).
- Ellen, Ingrid Gould, John Napier Tye, and Mark A. Willis, 2010, "Improving U.S. Housing Finance Through Reform of Fannie Mae and Freddie Mac: Assessing the Options," NYU Furman Center for Real Estate and Urban Policy White Paper (May). Available via the Internet: www.furmancenter.org/research/publications.
- Ellis, Luci, 2008, "The Housing Meltdown: Why Did It Happen in the United States?" BIS Working Paper No. 259 (Basel: Bank for International Settlements).
- European Central Bank (ECB), 2009, "Housing Finance in the Euro Area," ECB Occasional Paper No. 101 (Frankfurt: European Central Bank). Available via the Internet: www.ecb.europa.eu/pub/scientific/ops/date/html/ops2009_en.html.
- European Commission (EC), 2007, "White Paper on the Integration of EU Mortgage Credit Markets," COM 807 Final (Brussels: European Commission). Available via the Internet: http://ec.europa.eu/internal_market/finservices-retail/credit/mortgage_en.htm.
- European Mortgage Federation, 2010, "Hypostat 2009" (Belgium, November). Available via the Internet: www.hypo.org.
- Favara, Giovanni, and Jean Imbs, 2009, "Credit Supply and the Price of Housing" (unpublished; HEC Lausanne Swiss Finance Institute).

- Federal Housing Finance Agency, 2010, "Conservator's Report on the Enterprises' Financial Performance," Third Quarter. Available via the Internet: www.fhfa.gov/Default.aspx?Page=311.
- Finance Canada, 2010, "Government of Canada Takes Action to Strengthen Housing Financing," Press Release 2010-011, Ottawa (February 16).
- Financial Services Authority (FSA), 2009, "Mortgage Market Review," FSA Discussion Paper 09/3 (October). Available via the Internet: www.fsa.gov.uk/pages/Library/Communication/PR/2009/140.shtml.
- , 2010a, "Mortgage Market Review—Responsible Lending," Consultation Paper 10/16 (July). Available via the Internet: www.fsa.gov.uk/pages/Library/Policy/CP/2010/10_16.shtml.
- , 2010b, "Mortgage Market Review—Distribution & Disclosure," Consultation Paper 10/28 (November). Available via the Internet: www.fsa.gov.uk/pages/Library/Policy/CP/2010/10_28.shtml.
- Financial Supervisory Authority of Finland (FIN-FSA), 2010, "Supervisory Release of Household Housing Finance," Supervision Release 20/2010 (June 8). Available via the Internet: www.finanssivalvonta.fi/en/Publications/supervision_releases/Pages/20_2010.aspx.
- Finansinspektionen, 2010, "Mortgages Capped at 85 Percent as of 1 October," Press Release (July 9). Available via the Internet: www.fi.se/Press/Pressmeddelanden/Listan/Bolanetak-pa-85-procent-fran-1-oktober.
- Finanstilsynet, 2010, "Banks' Adjustment to Finanstilsynet's Guidelines on Home Mortgage Loans," Press Release 38/2010 (October 4). Available via the Internet: www.finanstilsynet.no/en/Document-repository/Press-releases/2010/Q4/Banks-adjustment-to-Finanstilsynets-guidelines-on-home-mortgage-loans.
- Fitch Ratings, 2008, "Making Dollars and Sense of Loan Modifications," Fitch Ratings Structured Finance U.S. Residential Mortgage Special Report (April 3).
- Frankel, Allen, Jacob Gyntelberg, Kristian Kjeldsen, and Mattias Persson, 2004, "The Danish Mortgage Market," *BIS Quarterly Review* (March) (Basel: Bank for International Settlements). Available via the Internet: www.bis.org/publ/qrpdf/r_qt0403.htm.
- Geanakoplos, John, 2010, "Solving the Present Crisis and Managing the Leverage Cycle," *Federal Reserve Bank of New York Economic Policy Review* (August) (New York: Federal Reserve Bank).
- Ghent, Andra C., and Marianna Kudlyak, 2010, "Recourse and Residential Mortgage Default: Theory and Evidence from U.S. States," Federal Reserve Bank of Richmond Working Paper No. 09-10R (June, revised). Available via the Internet: www.richmondfed.org/publications/research/working_papers/2009/wp_09-10R.cfm.
- Government Accountability Office (GAO), 1996, "Housing Enterprises, Potential Impacts of Severing Government Sponsorship," GA/GGD-96-120 (May). (Washington: U.S. Government Accountability Office). Available via the Internet: www.gao.gov/new.items/d10144t.pdf.
- , 2009, "Fannie Mae and Freddie Mac," Analysis of Options for Revising the Housing Enterprises' Long-Term Structures," GAO-09-782 (September) (Washington: U.S. Government Accountability Office). Available via the Internet: www.gao.gov/new.items/d09782.pdf.
- , 2010, "The Cooperative Model as Potential Component of Structural Reform Options for Fannie Mae and Freddie Mac," GAO-11-33R (November 15) (Washington: U.S. Government Accountability Office). Available via the Internet: www.gao.gov/new.items/d1133r.pdf.
- Haughwout, Andrew F., and Ebiere Okah, 2009, "Below the Line: Estimates of Negative Equity among Nonprime Mortgage Borrowers," *Federal Reserve Bank of New York Economic Policy Review*, Vol. 15, No. 2, pp. 31-43.
- Hilber, Christian A. L., and Tracy M. Turner, 2010, "The Mortgage Interest Rate Deduction and Its Impact on Homeownership Decisions," The London School of Economics and Political Science (September). Available via the Internet: http://rlab.lse.ac.uk/_new/publications/abstract.asp?index=3682.
- Hong Kong Monetary Authority (HKMA), 2010a, "Prudential Measures for Residential Mortgage Loans," Circular (August 19). Available via the Internet: www.info.gov.hk/hkma/eng/guide/index.htm.
- , 2010b, "Prudential Measures for Property Mortgage Loans," Circular (November 19). Available via the Internet: www.info.gov.hk/hkma/eng/guide/index.htm.
- International Monetary Fund, 2003, "Assessing Public Sector Borrowing Collateralized on Future Flow Receivables," Executive Board Paper (Washington, June). Available via the Internet: <http://www.imf.org/external/np/fad/2003/061103.pdf>.
- , 2007, "Denmark: Financial Sector Assessment Program—Technical Note—The Danish Mortgage Market—A Comparative Analysis," Country Report No. 07/123 (Washington, March). Available via the Internet: www.imf.org/external/pubs/cat/longres.cfm?sk=20599.0.
- , 2008, *World Economic Outlook*, World Economic and Financial Surveys (Washington, April).
- , 2009a, "Debt Bias and Other Distortions: Crisis-Related Issues in Tax Policy," Fiscal Affairs Department (Washington, June).

- , 2009b, *World Economic Outlook*, World Economic and Financial Surveys (Washington, October).
- , 2009c, *Global Financial Stability Report*, World Economic and Financial Surveys (Washington, October).
- , 2010a, “United States: Publication of Financial Sector Assessment Program Documentation—Financial System Stability Assessment,” IMF Country Report No. 10/247 (Washington, July). Available via the Internet: www.imf.org/external/pubs/cat/longres.aspx?sk=24105.0.
- , 2010b, “United States: Selected Issues Paper,” IMF Country Report No. 10/248, (Washington, July). Available via the Internet: www.imf.org/external/pubs/cat/longres.aspx?sk=24106.0.
- , 2010c, *Regional Economic Outlook: Europe—Building Confidence*, World Economic and Financial Surveys, (Washington, October). Available via the Internet: www.imf.org/external/pubs/ft/reo/reorepts.aspx?ddlYear=-1&ddlRegions=15.
- , 2011, “Hungary: Staff Report for the 2010 Article IV Consultation and Proposal for Post-Program Monitoring,” IMF Country Report No. 11/35 (Washington, February). Available via the Internet: www.imf.org/external/pubs/cat/longres.aspx?sk=24614.0.
- Jagtiani, Julapa, and William W. Lang, 2010, “Strategic Default on First and Second Lien Mortgages During the Financial Crisis,” Federal Reserve Bank of Philadelphia Working Paper No. 11–3 (December) (Philadelphia: Federal Reserve Bank). Available via the Internet: www.philadelphiafed.org/research-and-data/publications/working-papers.
- Jobst, Andreas, 2006, “Sovereign Securitization in Emerging Markets,” *Journal of Structured Finance*, Vol. 12, No. 3 (Winter), pp. 2–13.
- , 2007, “The Economics of Islamic Finance and Securitization,” *Journal of Structured Finance*, Vol. 13, No. 1 (Spring), pp. 1–22.
- Joyce, J. Robert, and Michael F. Molesky, 2009, “Addressing Financial System Pro-Cyclicality: A Role for Private Mortgage Insurance,” *Housing Finance International* (March), pp. 30–37.
- Keen, Michael, Alexander Klemm, and Victoria Perry, 2010, “Tax and the Crisis,” *Fiscal Studies*, Vol. 31, No. 1, pp. 43–79.
- Ketkar, Suhas, and Dilip Ratha, 2000, “Securitization of Future Flow Receivables: A Useful Tool for Developing Countries,” *Finance & Development*, Vol. 38, No. 1. Available via the Internet: www.imf.org/external/pubs/ft/fandd/2001/03/ketkar.htm.
- Kiff, John, 2009, “Canadian Residential Mortgage Markets: Boring but Effective,” IMF Working Paper No. 09/130 (Washington: International Monetary Fund).
- Kiyotaki, Nobuhiro, and John Moore, 1997, “Credit Cycles,” *Journal of Political Economy*, Vol. 105, No. 2, pp. 211–48.
- Laeven, Luc, and Thomas Laryea, 2009, “Principles of Household Debt Restructuring,” IMF Staff Policy Note, 09/15. Available via the Internet: www.imf.org/external/pubs/ft/spn/2009/spn0915.pdf.
- Lamont, Owen, and Jeremy Stein, 1999, “Leverage and Housing Price Dynamics in U.S. Cities,” *RAND Journal of Economics*, Vol. 30, No. 3, pp. 498–514.
- Lea, Michael, 2010a, “Alternative Forms of Mortgage Finance: What Can We Learn From Other Countries?” Harvard Joint Center for Housing Studies National Symposium (April). Available via the Internet: www.hofinet.org/documents/doc.aspx?id=271.
- , 2010b, “International Comparison of Mortgage Product Offerings,” Research Institute for Housing America, Mortgage Bankers Association (Washington, September). Available via the Internet: www.housingamerica.org/Publications/InternationalComparisonofMortgage-ProductOfferings.htm.
- Lecat, Remy, and Jean-Stephane Mesonnier, 2005, “What Role do Financial Factors Play in House Price Dynamics?” Banque de France Bulletin Digest No. 134.
- Lehnert, Andreas, Wayne Passmore, and Shane M. Sherlund, 2008, “GSEs, Mortgage Rates, and Secondary Market Activities,” *Journal of Real Estate Finance and Economics*, Vol. 36, April, pp. 279–84.
- Levitin, Adam J., and Tara Twomey, 2011, “Mortgage Servicing,” Georgetown Public Law and Legal Theory Research Paper No. 11-09. Available via the Internet: www.ssrn.com/abstract=1324023.
- Lin, Zhengou, Eric Rosenblatt, and Vincent Yao, 2009, “Spillover Effects of Foreclosures on Neighborhood Property Values,” *Journal of Real Estate Finance and Economics*, Vol. 38, No. 4, pp. 387–407.
- Maddaloni, Angela, and Jose-Luis Peydro, 2010, “Bank Risk-Taking, Securitization and Low Interest Rates” (unpublished; Frankfurt: European Central Bank).
- McCue, Daniel, and Eric S. Belsky, 2007, “Why Do House Prices Fall? Perspectives on the Historical Drivers of Large Nominal House Price Declines,” Harvard University Joint Center for Housing Studies Working Paper W07–3.
- Merrouche, Ouarda, and Erlend Nier, 2010, “What Caused the Global Financial Crisis? Evidence on the Drivers of Financial Imbalances 1999–2007,” IMF Working Paper 10/265 (Washington: International Monetary Fund).
- Mian, Atif, and Amir Sufi, 2009a, “The Consequences of Mortgage Credit Expansion: Evidence From the U.S. Mortgage Default Crisis,” *Quarterly Journal of Economics*, Vol. 124, No. 4, pp. 1449–496.

- , 2009b, “Household Leverage and the Recession of 2007 to 2009 (unpublished; University of Chicago, October).
- National Commission on Fiscal Responsibility and Reform, 2010, “The Moment of Truth,” White House, December. Available via the Internet: www.fiscalcommission.gov/news/moment-truth-report-national-commission-fiscal-responsibility-and-reform.
- Naranjo, A., and A. Toevs, 2002, “The Effects of Purchases of Mortgages and Securitization by Government Sponsored Enterprises on Mortgage Yield Spreads and Volatility,” *Journal of Real Estate Finance and Economics*, Vol. 25, pp. 173–96.
- Netherlands Authority for the Financial Markets, 2010, “New Standards for the Provision of Mortgage Loans to Protect Consumers” (April 21). Available via the Internet: www.afm.nl/en/professionals/afm-actueel/nieuws/2010/apr/nieuwe-normen-hypotheekverstrekking.aspx.
- Organization of Economic Cooperation and Development (OECD), 2011, “Housing and the Economy: Policies for Renovation,” *Economic Policy Reforms 2011—Going for Growth* (Paris: Organization for Economic Cooperation and Development).
- Painter, Gary and Christian Redfearn, 2002, “The Role of Interest Rates in Influencing Long-Run Homeownership Rates,” *Journal of Real Estate Finance and Economics*, Vol. 25, No. 2–3, pp. 243–67.
- Passmore, Wayne, Shane M. Sherlund, and Gillian Burgess, 2005, “The Effects of Housing Government-Sponsored Enterprises on Mortgage Rates,” Federal Reserve Board Finance and Economics Discussion Series, 2005–06.
- Passmore, W., R. Sparks, and J. Ingpen, 2002, “GSEs, Mortgage Rates, and the Long-Run Effects of Mortgage Securitization,” *Journal of Real Estate Finance and Economics*, Vol. 25, pp. 215–42.
- Peek, J., and J. Wilcox, 2006, “Housing, Credit Constraints, and Macro Stability: The Secondary Mortgage Market and Reduced Cyclicity of Residential Investment,” *American Economic Review*, Vol. 96, No. 2, pp. 135–40.
- Pence, Karen M., 2006, “Foreclosing on Opportunity: State Laws and Mortgage Credit,” *Review of Economics and Statistics*, Vol. 88, No. 1, pp. 177–82.
- Pinto, Edward J., 2010, “Government Housing Policies in the Lead-up to the Financial Crisis: A Forensic Study” (November 4). Available via the Internet: <http://www.aei.org/docLib/Government-Housing-Policies-Financial-Crisis-Pinto-102110.pdf>.
- President’s Advisory Panel on Federal Tax Reform, 2005. Available via the Internet: <http://govinfo.library.unt.edu/taxreformpanel>.
- Quigley, John M., 2006, “Federal Credit and Insurance Programs: Housing,” *Federal Reserve Bank of St. Louis Review*, Vol. 88, No. 4, pp. 281–309.
- Realkreditrådet, 2010, “The Traditional Danish Mortgage Model” (June). Available via the Internet: www.realkreditraadet.dk/Research/_Articles/Publications.aspx?M=News&PID=4170&NewsID=444.
- Reinhart, Carmen M., and Kenneth S. Rogoff, 2009, “This Time is Different, Eight Centuries of Financial Folly” (Princeton, New Jersey: Princeton University Press).
- Scharfstein, David, 2010, “Comments on the Future of Housing Finance,” presentation at the FRS/FDIC Conference on Mortgages and the Future of Housing Finance, October 25–26. Available via the Internet: www.fdic.gov/bank/analytical/cfr/oct2010-conf.html.
- Shiller, Robert J., 2008, *The Subprime Solution—How Today’s Global Financial Crisis Happened, and What to Do about It* (Princeton, New Jersey: Princeton University Press).
- Stein, Jeremy, 1995, “Prices and Trading Volume in the Housing Market: A Model with Down Payment Effects,” *Quarterly Journal of Economics*, Vol. 110 (May), pp. 379–406.
- Surti, Jay, 2010, “Can Covered Bonds Resuscitate Residential Mortgage Finance in the United States?” IMF Working Paper 10/277 (Washington: International Monetary Fund).
- Tsounta, Evridiki, forthcoming, “Home Sweet Home; Government’s Role in Reaching the American Dream,” IMF Working Paper (Washington: International Monetary Fund).
- U.S. Department of the Treasury (U.S. Treasury) and Department of Housing and Urban Development (HUD), 2011, “Reforming America’s Housing Finance Market: A Report to Congress” (February).
- Warnock, Veronica Cacadac, and Francis E. Warnock, 2008, “Markets and Housing Finance,” *Journal of Housing Economics*, Vol. 17, No. 3, pp. 239–51.

GLOSSARY

Adjustable-rate mortgage (ARM)	A mortgage loan whose interest rate is periodically adjusted according to the change in a base index. The ARM rate is usually the sum of the rate in the base index and a fixed margin.
Alt-A mortgage	Short name for alternative-A paper, which is a U.S. mortgage loan whose credit risk is rated as being between that of a prime loan and that of a <i>subprime loan</i> . The elements of an alt-A loan that make it riskier than a prime mortgage may include weaker documentation of income and a higher loan-to-value ratio.
Annuity loan	A loan whose principal and interest will be fully paid with a stream of regular, fixed payments, such as monthly mortgage payments, over a specified, limited period of time. Also called an amortizing loan.
Asset-backed security	Any security, including commercial paper, that is collateralized by the cash flows from a pool of underlying assets, such as loans, leases, and receivables. When the cash flows are collateralized by real estate, an ABS may be called a <i>mortgage-backed security</i> (MBS); when the cash flows are divided into <i>tranches</i> , an ABS may be called a <i>structured credit product</i> .
Balloon mortgage	A mortgage that is not fully amortized over the life of the loan but instead requires a large payment at the end of the term.
Basel III	A comprehensive set of reform measures, introduced by the Basel Committee on Banking Supervision during 2009 and 2010 in response to the global financial crisis, complementing and strengthening existing Basel Committee international standards. Basel III aims to improve the banking sector's ability to absorb shocks arising from financial and economic stress; improve risk management and governance; and strengthen banks' transparency and disclosures. It includes a comprehensive revision of the Basel capital adequacy standards and also proposes, for the first time, minimum liquidity standards for banks.
Basis	The difference in the yields of two financial instruments that have similar risk characteristics and produce similar cash flows. Also refers to the difference between the price of a futures contract and the value of the underlying cash instrument or commodity.
<i>Bausparkassen (Bauspar)</i>	A contractual savings and loan system in Germany executed through savings banks. It provides low-cost home-construction and home-improvement loans to participants after a pre-defined period of membership. The government contributes to the system via housing benefits ("Wohnungsbauförderung") and other subsidies. See also <i>contractual savings systems</i> .
Building society	A financial institution, owned by its members, that offers banking and other financial services, especially mortgage lending.

Bullet bond	A noncallable coupon-paying debt instrument with a single repayment of principal on the maturity date. The coupon is the annual interest rate stated on the bond when it is issued and is typically paid semiannually.
Callable (or redeemable) bond or loan	A bond or loan that gives the issuer the option of redeeming it on any of one or more dates before it reaches maturity. On redemption, the issuer cancels the obligation in exchange for a defined price to be paid to the bond holders. A callable loan can be prepaid in advance of maturity.
Cash-out refinance	A refinancing of a loan in which the borrower receives cash in excess of the existing loan balance, so that the new loan balance equals the old loan balance plus the cash-out amount.
Charge-off	A deduction from a bank's loan loss reserves in recognition of the outstanding balance of a loan that it deems uncollectible. See also <i>writedown</i> .
Claw-back	In this report, the recovery of assets or benefits deemed to have been unfairly distributed by an entity within a specific period before its insolvency.
Capital Requirements Directive	The Directive issued by the European Union for the financial services industry that introduced a supervisory framework reflecting the Basel II rules on capital measurement and capital standards.
Collateral	Assets pledged or posted to a counterparty to secure an outstanding exposure, derivative contract, or loan.
Conservatorship	A legal process in which an entity called a conservator is granted authority to preserve the assets of another entity.
Contingent claims analysis (CCA)	A methodology that combines balance sheet data and market prices of traded securities to infer the implicit value of assets and contingent liabilities of a corporation. The method has been extended to study entire economic sectors and countries.
Contractual savings system	A system in which a prospective borrower contractually agrees with a credit institution to save a specific amount over a prescribed period, in exchange for which the institution agrees to provide a loan, on pre-specified terms, whose amount depends on the amount saved. See also <i>Bausparkassen</i> (<i>Bauspar</i>).
Counterparty risk	The risk faced by one party in a contract that the other, the counterparty, will fail to meet its obligations under the contract.
CoVaR	"Conditional" (Co) <i>value at risk</i> (VaR) measures the VaR of a portfolio of institutions according to the stressed condition of a given institution. CoVaR is thus a measure of an institution's potential contribution to systemic risk.
Covered bond	Debt obligation in which the originator's or issuer's obligation to make all interest and principal payments is secured by a dedicated reference (or "cover") portfolio of assets. A covered bond is typically not <i>structured</i> .

Covered interest parity (CIP)	A condition in which a sum of money invested for a fixed period of time at the domestic interest rate yields the same value as a transaction in which (1) the same amount of domestic currency is exchanged at the spot rate for a foreign currency, (2) the foreign currency is invested at the foreign interest rate for the same period of time as in the domestic transaction, and (3) the foreign currency is exchanged back to the domestic currency via a forward rate that was fixed at the beginning of the transaction.
Credit default swap (CDS)	A derivative contract through which a protection seller provides insurance to a protection buyer against the credit risk of a “reference asset” underlying the swap. A “credit event” regarding the reference asset—a default most commonly, or other breach of specified terms—will trigger a payout to the protection buyer. CDS payouts can be either “physical,” whereby the protection seller pays to the protection buyer the face value of the reference asset or delivers the asset; or in “cash,” whereby the protection seller pays the protection buyer the difference between the face value and the current price of the reference asset. A “single name” CDS contract references a security of a single firm or government agency, whereas CDS index contracts reference standardized indices based on baskets of liquid single-name CDS contracts. See also <i>credit derivative</i> .
Credit derivative	A contract under which an agent buys or sells protection against the credit risk associated with a specific reference entity (or specified range of entities). For a periodic fee, the protection seller agrees to make a payment to the buyer on the occurrence of a credit event (usually default in the case of a <i>credit default swap</i>).
Credit rating	A measure of the risk that the payment terms agreed to by an entity or contained in a financial instrument will not be fulfilled. The rating is typically expressed as a letter grade issued by private sector credit rating agencies. For example, from the most creditworthy to the least, Fitch Ratings and Standard & Poor’s use AAA, AA, and so on, down to D.
Debt-to-income (DTI) ratio	The amount of monthly debt payment obligations as a percent of monthly income.
Deficiency judgment	A court order against a borrower for the balance of a mortgage debt when the proceeds from the sale of the foreclosed property securing the debt are less than the outstanding loan balance. The judgment is possible only when the lender has full recourse to the borrower’s income or other assets to satisfy the debt. See also <i>nonrecourse mortgage</i> .
Delinquency	Failure to make contractual payments on a loan. The seriousness of a delinquency is usually specified in terms of being more than a certain number of days overdue (e.g., more than 30 or 60 or 90 days overdue). See also <i>nonperforming loan</i> .
Derivative	A financial instrument (or, more simply, an agreement between two parties) whose value is derived from the price of an underlying asset to which it is linked, such as a security or currency. Examples include stock options, currency and interest rate swaps, <i>credit derivatives</i> , and <i>credit default swaps</i> .

Dynamic provisioning	The build-up of loan loss reserves by a bank during an economic upturn to provide greater protection for the bank during a downturn, when loan losses rise. Under traditional provisioning, funds are added to reserves (as a charge against earnings) when a loan begins to show signs of impairment (“point in time” provisioning). Dynamic provisioning requires the bank to anticipate a certain degree of loss in advance of actual impairment (“expected loss” provisioning) as well as to extend the projection period through the full economic cycle (“through the cycle” provisioning). The bank supervisory authorities in Spain introduced dynamic provisioning in 2000.
European Financial Stability Facility (EFSF)	An institution set up in May 2010 by the 16 euro area member states to preserve financial stability. The EFSF can issue bonds or other debt instruments, guaranteed by all the member states, in support of member states in financial difficulty. To be replaced by the <i>European Stabilization Mechanism</i> in 2013.
European Stabilization Mechanism (ESM)	An emergency financing program for member states of the European Union that draws funds from the financial markets under the guarantee of the European Commission, with the budget of the European Union as collateral. The mechanism, which will replace the euro area <i>European Financial Stability Facility</i> , becomes operational in 2013.
Event study	A statistical method to assess the short-term impact of an event, such as a corporate announcement or a state’s announcement of capital controls, by observing the change in variables of interest, such as the firm’s stock price or the exchange rate of the country’s currency, around the time of the announcement.
Excess spread	The difference between the interest received on the basis of a loan portfolio and what is paid out to bondholders, portions of which can accrue to securitizers if the performance of the loan portfolio exceeds preset levels.
Exchange traded fund (ETF)	An investment fund traded on stock exchanges. Many of them track an index, such as the S&P 500. ETFs feature relatively low costs and high tax efficiency.
Fire sale	A panic condition in which many holders of an asset or class of assets attempt a market sale simultaneously, thereby driving down the price to extremely low levels. The fire sale may also characterize the acceptance of a low price for assets by a seller facing bankruptcy or other impending distress.
Fixed-effects panel data estimation	An econometric technique applied to panel data (data that incorporate both cross-sectional and time series variables) to account for possible time-invariant unobserved characteristics in the underlying data.
Foreclosure	A legal action in which a lender takes control of assets pledged or mortgaged by a defaulted borrower, including real estate, usually with the intention of selling the assets to recover the balance owed by the borrower.
Funding	In this report, the process by which banks issue or assume liabilities associated with assets on their balance sheets.

Generalized autoregressive conditional heteroskedasticity (GARCH)	A statistical technique that adjusts a model's estimates to account for the time variation in the volatility of shocks (statistical errors) derived in the model.
Government-sponsored enterprise (GSE)	An entity with private ownership and a public charter to support a particular sector of the economy, such as agriculture or housing, through credit insurance or by purchasing standardized loans from lenders. In the United States, the principal housing GSEs are Fannie Mae and Freddie Mac.
Group of Twenty (G-20)	The G-20 Finance Ministers and Central Bank Governors was established in 1999 to bring together systemically important advanced and emerging market economies to discuss key issues in the global economy. Its participants are drawn from 19 countries plus the European Union.
Haircut	A discount applied to the market value of collateral to reflect its market, credit, and market risk.
Hedge fund	An investment pool, typically organized as a private partnership or entity. It is lightly regulated and is thus free to use a variety of investment techniques—including short positions, transactions in <i>derivatives</i> , and <i>leverage</i> —to boost returns and manage risk.
Hedging	Offsetting an existing risk exposure by taking an opposite position in the same or a similar risk—for example, in related derivatives contracts.
Home Affordable Modification Program (HAMP)	A program sponsored by the U.S. Treasury in which qualifying mortgage borrowers and their servicers modify the loan payment schedule to improve affordability.
Imputed rent	Net value of the services rendered by a house to its owner-occupant for which rent would otherwise be paid to a landlord.
Interest rate derivative	A <i>derivative</i> contract that is linked to one or more reference interest rates.
Interest-only mortgage	A mortgage whose monthly payments consist of interest payments only; the original amount borrowed is paid back when the loan matures.
International Financial Reporting Standards (IFRS)	Standards, interpretations, and the framework of accounting adopted by the International Accounting Standards Board (IASB).
Islamic finance	Islamic finance is predicated on extending religious principles of the shari'ah to financial transactions. Since only interest-free forms of finance are permissible, any financial agreement under Islamic law is based on the idea of sharing risks (and returns) in lawful activities (halal) that require financial compensation for the temporary use of an asset. An Islamic mortgage is structured as a financing lease, in which the lessor (i.e., lender) acquires property at the request of the borrower and leases it to the borrower for an agreed sum of rent payments. The repayment might also include a portion of the agreed resale price, which allows borrowers to gradually acquire total equity ownership for a pre-determined sales price.

Land registry	A system for recording ownership, possession, or other rights in land (usually operated by a government agency or department) to provide evidence of title, facilitate transactions, and prevent unlawful disposal. The information recorded and the protection provided will vary by jurisdiction.
Large and complex financial institution (LCFI)	A financial institution involved in a diverse range of financial activities, usually across many jurisdictions. Typically it is interconnected with other financial institutions and so is considered systemically important.
Leverage	The proportion of debt to equity, or assets to equity, or, in the case of banking, assets to capital. Leverage can be built up by borrowing with both on- and off-balance-sheet transactions, the latter of which are not captured by the conventional leverage measures. In this report, the term is also used to refer to the ratio of credit to GDP.
Leveraged buyout (LBO)	The purchase of a controlling interest in a company largely through the use of borrowed funds (see also <i>leverage</i>).
LIBOR (London interbank offered rate)	An index of the interest rates at which banks offer to lend unsecured funds to other banks in the London wholesale money market.
Loan-to-value (LTV) ratio	The outstanding balance on a loan as a proportion of the value of the asset (for instance, house) pledged as collateral against the loan.
Moral hazard	A condition in which an entity will tend to act less carefully than it otherwise would because the consequences of a bad outcome will be largely shifted to another party. For example, financial institutions have incentives to take excessive risks if they believe that governments will step in and support them in crisis periods.
Marginal tax rate	In a tiered income tax rate system, the rate applied to the last dollar of income earned. For instance, in a progressive tax system, the tax rate will rise on each portion of income that exceeds a threshold. In contrast, the total amount of tax paid as a percentage of the total amount of income is the average tax rate.
Mark-to-market valuation	The act of recording the value of an asset according to its current market price rather than its book value (which is generally the acquisition cost less any impairments).
Mortgage-backed security (MBS)	A security, backed by pooled mortgages on real estate assets, that derives its cash flows from principal and interest payments on those mortgages. MBS can be backed by residential mortgages (residential mortgage-backed securities, or RMBS) or mortgages on commercial properties (commercial mortgage-backed securities, or CMBS). A <i>private-label</i> MBS is typically a <i>structured credit product</i> . RMBS that are issued by a <i>government-sponsored enterprise</i> are not structured.
Mortgage servicer	Firm responsible for collecting and remitting loan payments, managing escrow accounts for property taxes and insurance, dealing with delinquent accounts, and supervising foreclosures and property sales.
Nonrecourse mortgage	A mortgage for which the lender has recourse only to the underlying property, and not to any income or other wealth of the borrower, in the event of borrower default. See also <i>deficiency judgment</i> .

Nonperforming loans (NPL) and NPL ratio	Loans for which the contractual payments are delinquent, usually defined as being overdue for more than a certain number of days (e.g., more than 30 or 60 or 90 days). The NPL ratio is the amount of nonperforming loans as a percent of gross loans.
Ordinary least squares (OLS)	A method for estimating the unknown parameters in a linear regression model. The method minimizes the sum of squared distances between the observed responses in the dataset and the responses predicted by the linear approximation. Also known as linear least squares.
Overnight indexed swap (OIS)	An interest rate swap in which the compounded overnight rate in the specified currency is exchanged for some fixed interest rate over a specified term.
Over-the-counter (OTC) derivative	A financial contract whose value derives from an underlying reference value such as the price of a stock or bond, an interest rate, a foreign exchange rate, a commodity price, or some index and that is negotiated and traded bilaterally rather than through an exchange.
Pass-through callable mortgage bond	A <i>callable</i> security that is composed of pooled mortgages and transmits, or “passes,” the mortgage payments from debtors to the investors. Not a <i>structured</i> security.
<i>Pfandbriefe</i>	<i>Covered bonds</i> used in Germany for mortgage funding. Created by an executive order of Frederick II of Prussia in 1769.
Principal component analysis (PCA)	Technique that allows researchers to summarize the information on large datasets and extract a few components that statistically explain most of the common variation in the data.
Private-label security	An <i>asset-backed security</i> not issued or backed by a <i>government-sponsored enterprise</i> or public sector entity. Unlike a <i>covered</i> bond or a <i>pass-through</i> bond, it is typically a <i>structured credit product</i> (divided into <i>tranches</i> of varying risk).
Procyclicality	The tendency of changes in asset prices and valuations to move in line with macroeconomic business and financial cycles. For example, during the recent credit cycle, the <i>mark-to-market</i> valuation of collateral in secured funding markets worked procyclically to exaggerate price movements.
Put option	A financial instrument that allows, but does not require, its owner to sell (“put”) an asset to the option seller at a certain price (the <i>strike price</i>) at a specific future date. The option is of value to its owner if the market price of the asset drops below the strike price.
Quantitative easing	An expansion of a central bank’s balance sheet through purchases of government securities and other assets, funded through the creation of base money (cash and bank reserve balances).
Regulatory arbitrage	Avoiding or reducing regulatory restrictions by taking advantage of differences in regulatory treatment across countries or across types of financial institutions, as well as by taking advantage of differences between economic risk and risk as measured by regulatory guidelines.

Representation and warranties	Contractual clauses that allow investors in <i>securitization</i> vehicles to return loans to originators that do not meet pre-agreed underwriting standards; the clauses can be accompanied by disclosure of requests for such returns to reveal deficiencies in underwriting standards.
Repurchase transaction (repo)	A sale of a security coupled with an agreement to repurchase the security at an agreed price at a future date. This transaction occurs between a cash borrower (or securities lender), typically a fixed-income securities broker-dealer, and the cash lender (or securities borrower), such as a money market mutual fund or a custodial bank. The securities lender receives cash in return and pledges the legal title of a security as collateral.
Retained securitization	Assets that have been packaged into a security on a bank's balance sheet but have not been sold in the market. See also <i>securitization</i> .
Rights in rem	A claim directed against an asset or property, as opposed to a person.
Risk aversion	The degree to which an investor who, when faced with two investments with the same expected return but different risk, prefers the one with the lower risk. That is, it measures an investor's aversion to uncertain outcomes or payoffs.
Secondary mortgage market	The market for the sale of securities or bonds collateralized by the value of mortgage loans.
Securitization	The creation of securities from a portfolio of existing assets or future receivables. The securities are placed under the legal ownership or control of investors through a special intermediary created for the purpose, known as a <i>special purpose vehicle</i> (SPV) or special purpose entity (SPE).
Seemingly unrelated regression (SUR)	A method of estimating the parameters of a system of equations that accounts for heteroskedasticity and contemporaneous correlation in the errors across equations. Also known as Zellner's method,
Special-purpose vehicle or entity (SPV or SPE)	Usually a subsidiary company with a balance sheet structure and legal status that makes its obligations secure even if the parent company goes bankrupt. See also <i>securitization</i> .
Settlement	The act that discharges the obligation to transfer funds or securities between two or more parties.
Strategic default	A borrower's decision to default because the value of the underlying property is less than the outstanding mortgage balance, regardless of the borrower's ability to make the mortgage payments.
Stress test	A process that evaluates an institution's ability to financially withstand adverse macroeconomic and financial situations.
Strike price	The price at which a specific derivative contract can be exercised. In the context of a <i>put option</i> , the strike price is the contractual price at which the underlying asset can be sold.

Structured credit product	An <i>asset-backed security</i> in which the payouts of the underlying assets are divided into <i>tranches</i> of varying risk and sold separately.
Subprime loans	Loans to borrowers whose lack of creditworthiness disqualifies them for the lowest-cost (prime) loans or intermediate-cost (<i>alt-A</i>) loans.
Sudden stop	A sudden slowdown in the flow of private capital into emerging market economies. Sudden stops are usually followed by sharp decreases in output, private spending, and credit to the private sector and appreciation in the real (that is, adjusted for relative purchasing power) exchange value of the currency.
Swap	An agreement between counterparties to exchange periodic payments based on different reference financial instruments or indices on a predetermined notional amount.
Swap spread	The difference between the government bond yield and the fixed rate on an interest rate swap of the equivalent maturity.
Systemic liquidity risk	The risk that many financial intermediaries will simultaneously face severe financial difficulty—for example, through an inability to acquire funds or through a need to sell assets—and thereby incur major losses.
Systemic (solvency) risk	The risk that the failure of one financial institution would cause large losses to other financial institutions, thus threatening the stability of financial markets.
Tangible assets (TA)	Total assets less intangible assets (such as goodwill and deferred tax assets).
Tangible common equity (TCE)	Total balance sheet equity less preferred debt and intangible assets. See also <i>tangible assets</i>
Teaser rate	A low interest rate that is scheduled to increase later. Offered to attract potential borrowers.
Tier 1 capital	A regulatory measure of the capital supporting the lending and deposit activities of a bank. It contains the most loss-absorbing forms of regulatory capital and consists primarily of common stock, retained earnings, and perpetual preferred stock. The more loss-absorbing capital held by the bank, the greater the protection of uninsured depositors and other bank creditors in the event of a bank failure.
Tier 2 capital	A regulatory measure of the capital supporting the lending and deposit activities of a bank. Less loss-absorbing than <i>Tier 1 capital</i> , it includes undisclosed reserves, general loss reserves, and subordinated term debt.
Too important to fail (TITF)	A financial institution considered to be so large, interconnected, or critical to the workings of the wider financial system that its disorderly failure would destabilize both the financial system and the wider economy. Hence, public funds would normally be deployed to prevent such a failure.

Tranches of securities	Tranches (slices) represent a hierarchy of payment and risk typically associated with an asset-backed security, and each tranche is sold separately. The claim of the “senior” tranche (least risky) on payments flowing from the security have first priority; the claim of the “mezzanine” tranche is next; and that of the “equity” tranche (most risky) is lowest. If some of the expected cash flows are not forthcoming (e.g., some of the securitized loans default), and after any cash flow buffers are depleted, the payments to the senior tranche continue in full while those to the equity tranche are reduced. If payments made to the equity tranches are completely absent, payments to the mezzanine tranche are then reduced. The senior tranche would be the last to receive a reduced or zero payment. See also <i>private-label security</i> .
Value at risk (VaR)	An estimate of the monetary loss over a given time period that is statistically unlikely to be exceeded at a given probability level (typically the 95 percent confidence level). See also <i>CoVaR</i> .
Wholesale funding	The funding of banks in private markets, which is used in addition to deposits from customers, to finance bank operations. Wholesale funding sources include, but are not limited to, debt issuance, short-term instruments such as certificates of deposit and commercial paper, repo transactions, and interbank borrowing.
Writedown	The recognition in a set of accounts that an asset may be worth less than earlier supposed.
Yield maintenance	A penalty, imposed if a borrower pays off a loan before maturity, that allows the lender to attain the same yield as if the borrower had made all scheduled mortgage payments until maturity. Also called a prepayment penalty.

SUMMING UP BY THE ACTING CHAIR

The Acting Chair made the following remarks at the conclusion of the Executive Board's discussion of the Global Financial Stability Report on March 28, 2011.

Executive Directors welcomed the improvement in financial stability on the heels of the global economic recovery. They agreed, however, that vulnerabilities requiring the continued attention of policymakers remain, especially in advanced economies. Emerging market economies, which are generally enjoying a stronger rebound, face different policy challenges.

Directors concurred that the key task for policymakers is the transition from measures that mainly responded to the symptoms of the crisis to structural reforms that address its underlying causes. They noted that many policy challenges highlighted in previous GFSRs have yet to be addressed. Directors agreed that paving the way for an unwinding of public support to financial institutions and the restoration of market discipline calls for stronger actions to strengthen the global financial system.

In particular, Directors underscored that funding of banks and sovereigns could prove difficult in some advanced economies, especially in some euro area countries. In the period ahead, these difficulties could be exacerbated by rising funding costs. Directors emphasized the linkage between public debt sustainability and bank balance sheets, and concurred that the risks of a funding disruption would be limited if banks strengthen their balance sheets, sovereigns improve their medium-term fiscal plans, and the private sector reins in its indebtedness.

Directors agreed that a combination of actions may be needed to restore to full health the financial systems, including recapitalization, restructuring, and, in some cases, closure of weak financial institutions. In this context, they noted that a high level of transparency in policy implementation, which for some Directors would include rigorous and realistic stress tests, could improve market sentiment.

Directors shared the view that, while the recent surge in capital inflows to emerging markets could support investment and growth, pressures are building in some countries, setting the stage for excessive leverage and asset price bubbles. Some Directors were of the view that the impact on capital flows to emerging markets of monetary policy in advanced economies deserved more analysis in the GFSR, suggesting that it was an important factor in explaining the rebound in flows. A few other Directors, however, considered that monetary policy settings in advanced economies play a more limited role in determining capital flows.

Directors agreed that overheating in emerging market economies complicates policy responses to safeguard financial stability. A combination of measures may be required, including a reorientation of the macroeconomic policy mix and macroprudential measures to limit the buildup of financial vulnerabilities. Some Directors noted that carefully deployed capital controls could help manage inflow surges, although a few other Directors were skeptical about their effectiveness except in special circumstances.

Overall, Directors agreed with the staff's assessment of the near-term policy challenges. These include reducing the debt burdens and repairing the financial system in advanced economies; controlling the risks of overheating and asset bubbles in emerging market economies; and, in all countries, enhancing market discipline.

Directors welcomed the analysis in Chapter 2, which contributes to the development of techniques for measuring and mitigating systemic liquidity risk. They called for further work in this area as well as on the associated macroprudential policies. In this context, they agreed that Basel III regulations were a step in the right direction, but that more needs to be done since Basel III rules apply only to banks and only partially account for the interconnectedness of various institutions and

their common exposures to funding markets. Directors also supported the call for improving the information available to market participants to allow a fuller assessment of an institution's liquidity risk management.

Directors supported the “back to basics” approach to housing finance outlined in Chapter 3, which recommends best practices in underwriting, supervision, and risk management; a more careful consideration of government participation in housing markets; and a better alignment of incentives in mortgage

funding. More broadly, Directors cautioned that the sophistication of housing finance systems needs to be commensurate with a country's legal and financial infrastructure, and that emerging market countries should first focus on developing sound regulation and adequate information provision as they develop housing finance. Lastly, Directors shared the staff assessment of the need to reform the U.S. housing finance system, where the recent crisis had its origin, and noted recent U.S. proposals in this area.

