World Economic and Financial Surveys

Summary Version

Global Financial Stability Report

Responding to the Financial Crisis and Measuring Systemic Risks

APR 09

INTERNATIONAL MONETARY FUND

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April 2009

International Monetary Fund
Washington DC

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Recommended bibliographic citation: International Monetary Fund, 2009, *Global Financial Stability Report: Responding to the Financial Crisis and Measuring Systemic Risks* (Washington, April).

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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, 1997–99 or January–June) to indicate the years or months covered, including the beginning and ending years or months;

/ between years (for example, 1998/99) 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 1/4 of 1 percentage point).

"n.a." means not applicable.

Minor discrepancies between 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.

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. In the current crisis, the report traces the sources and channels of financial distress, and provides policy advice on mitigating its effects on economic activity, stemming contagion, and mending the global financial system.

The analysis in this report has been coordinated in the Monetary and Capital Markets (MCM) Department under the general direction of Jaime Caruana, the former Financial Counsellor and Director, and finalized by the present Financial Counsellor and Director, José Viñals. The project has been directed by MCM staff Jan Brockmeijer, Deputy Director; Peter Dattels and Laura Kodres, Division Chiefs; and Elie Canetti and Brenda González-Hermosillo, Deputy Division Chiefs. It has benefited from comments and suggestions from the senior staff in the MCM Department and especially, Mahmood Pradhan, Assistant Director.

Contributors to this report also include Myrvin Anthony, Sergei Antoshin, Amitabh Arora, Barbara E. Baldwin, Christian Capuano, Alexandre Chailloux, Jorge Chan-Lau, R. Sean Craig, Marco Espinosa-Vega, Kay Giesecke, Dale Gray, Kristian Hartelius, Geoff Heenan, Heiko Hesse, David Hoelscher, Gregorio Impavido, Andreas Jobst, John Kiff, Rebecca McCaughrin, Paul Mills, Ken Miyajima, Christopher Morris, Inci Ötker-Robe, Michael Papaioannou, L. Effie Psalida, Mustafa Saiyid, Jodi Scarlata, Miguel Segoviano, Seiichi Shimizu, Juan Solé, Mark Stone, Tao Sun, Rupert Thorne, Ian Tower, and Luisa Zanforlin. Martin Edmonds, Oksana Khadarina, Yoon Sook Kim, In Won Song, Carolyne Spackman, and Narayan Suryakumar provided analytical support. Christy Gray, Nirmaleen Jayawardane, and Ramanjeet Singh were responsible for word processing. Andrew Lo, Art Rolnik, and Ken Singleton provided helpful comments. David Einhorn of the External Relations Department edited the manuscript and 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, standard setters, financial consultants, and academic researchers. The report reflects information available up to February 28, 2009.

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 30, 2009. 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

The global financial system remains under severe stress as the crisis broadens to include households, corporations, and the banking sectors in both advanced and emerging market countries. Shrinking economic activity has put further pressure on banks' balance sheets as asset values continue to degrade, threatening their capital adequacy and further discouraging fresh lending. Thus, credit growth is slowing, and even turning negative, adding even more downward pressure on economic activity. Substantial private sector adjustment and public support packages are already being implemented and are contributing to some early signs of stabilization. Even so, further decisive and effective policy actions and international coordination are needed to sustain this improvement, to restore public confidence in financial institutions, and to normalize conditions in markets. The key challenge is to break the downward spiral between the financial system and the global economy. Promising efforts are already under way for the redesign of the global financial system that should provide a more stable and resilient platform for sustained economic growth.

To mend the financial sector, policies are needed to remove strains in funding markets for banks and corporates, repair bank balance sheets, restore cross-border capital flows (particularly to emerging market countries); and limit the unintended side effects of the policies being implemented to combat the crisis. All these objectives will require strong political commitment under difficult circumstances and further enhancement of international cooperation. Such international commitment and determination to address the challenges posed by the crisis are growing, as displayed by the outcome of the G-20 summit in early April.

Without a thorough cleansing of banks' balance sheets of impaired assets, accompanied by restructuring and, where needed, recapitalization, risks remain that banks' problems will continue to exert downward pressure on economic activity. Though subject to a number of assumptions, our best estimate of writedowns on U.S.-originated assets to be suffered by all holders since the outbreak of the crisis until 2010 has increased from $2.2 trillion in the January 2009 *Global Financial Stability Report* (GFSR) *Update* to $2.7 trillion, largely as a result of the worsening base-case scenario for economic growth. In this GFSR, estimates for writedowns have been extended to include other mature market-originated assets and, while the information underpinning these scenarios is more uncertain, such estimates suggest writedowns could reach a total of around $4 trillion, about two-thirds of which would be incurred by banks.

There has been some improvement in interbank markets over the last few months, but funding strains persist and banks' access to longer-term funding as maturities come due is diminished. While in many jurisdictions banks can now issue government-guaranteed, longer-term debt, their funding gap remains large. As a result, many corporations are unable to obtain bank-supplied working capital and some are having difficulty raising longer-term debt, except at much more elevated yields.

A wide range of nonbank financial institutions has come under strain during the crisis as asset prices have fallen. Pension funds have been hit hard—their assets have rapidly declined in value while the lower government bond yields that many use to discount their liabilities have simultaneously expanded their degree of underfunding. Life insurance companies have suffered losses on equity and corporate bond holdings, in some cases significantly depleting their regulatory capital surpluses. While perhaps most of these institutions managed their risks prudently, some took on more risk without fully appreciating that potential stressful episodes may lie ahead.

The retrenchment from foreign markets is now outpacing the overall deleveraging process, with a sharp decline of cross-border funding intensifying the crisis in several emerging market countries. Indeed, the withdrawal of foreign investors and banks together with the collapse in export markets create funding pressures in emerging market economies that require urgent attention. The refinancing needs of emerging markets are large, estimated at some $1.8 trillion in 2009, with the bulk coming from corporates, including financial institutions. Though notoriously difficult to forecast, current estimates are that net private capital flows to emerging markets will be negative in 2009, and that inflows are not likely to return to their pre-crisis levels in the future. Already, emerging market economies that have relied on such flows are weakening, increasing the importance of compensatory official support.

Despite unprecedented official initiatives to stop the downward spiral in advanced economies—including massive amounts of fiscal support and an array of liquidity facilities—further determined policy action will be required to help restore confidence and to relieve the financial markets of the uncertainties that are undermining the prospects for an economic recovery. However, the transfer of financial risks from the private to the public sector poses challenges. There are continuing concerns about unintended distortions and whether the short-term stimulus costs, including open-ended bank support packages, will combine with longer-term pressures from aging populations to put strong upward pressure on government debt burdens in some advanced economies. Home bias is also setting in as officials are encouraging banks to lend locally and consumers to keep their spending domestically oriented.

These risks, discussed in Chapter 1, represent some of the most difficult issues that the public sector has faced in half a century. We outline below what we believe are the key elements to break the downward spiral between the financial sector and the real economy.

Immediate Policy Recommendations

Even if policy actions are taken expeditiously and implemented as intended, the deleveraging process will be slow and painful, with the economic recovery likely to be protracted. The accompanying deleveraging and economic contraction are estimated to cause credit growth in the United States, United Kingdom, and euro area to contract and even turn negative in the near term and only recover after a number of years.

This difficult outlook argues for assertive implementation of already-established policies and more decisive action on the policy front where needed. The political support for such action, however, is waning as the public is becoming disillusioned by what it perceives as abuses of taxpayer funds in some headline cases. There is a real risk that governments will be reluctant to allocate enough resources to solve the problem. Moreover, uncertainty about political reactions may undermine the likelihood that the private sector will constructively engage in finding orderly solutions to financial stress. Hence, an important component to restoring confidence will be clarity, consistency, and the reliability of policy responses. Past episodes of financial crisis have shown that restoring the banking system to normal operation takes several years, and that recessions tend to be deeper and longer lasting when associated with a financial crisis (see Chapter 3 of the April 2009 World Economic Outlook). This same experience shows that when policies are unclear and not

implemented forcefully and promptly, or are not aimed at the underlying problem, the recovery process is even more delayed and the costs, both in terms of taxpayer money and economic activity, are even greater.

Given the global reach of this crisis, the effect of national policies can be strengthened if implemented in a coordinated fashion among affected countries. Coordination and collaboration should build upon the positive momentum created by the recent G-20 summit, and is particularly important with respect to financial policies to avoid adverse international spillovers from national actions. Specifically, cross-border coordination that results in a more consistent approach to address banking system problems, including dealing with bad assets, is more likely to build confidence and avoid regulatory arbitrage and competitive distortions.

In the short run, the three priorities identified in previous GFSRs and explicitly recognized in the February 2009 G-7 Communiqué remain appropriate: (i) ensure that the banking system has access to liquidity; (ii) identify and deal with impaired assets; and (iii) recapitalize weak but viable institutions and promptly resolve nonviable banks. In general, the first task is for central banks, while the latter two are the responsibility of supervisors and governments. Progress has been made in the first area, but policy initiatives in the other two areas appear to be more piecemeal and reactive to circumstances. Recent announcements by authorities in various countries recognize the need to deal with problem assets and to assess banks' resilience to the further deteriorating global economy in order to determine recapitalization needs. These are welcome steps and as details become available will likely help reduce uncertainty and public skepticism. Lessons from past crises suggest the need for more forceful and effective measures by the authorities to address and resolve weaknesses in the financial sector.

Proceed expeditiously with assessing bank viability and bank recapitalization.

The long-term viability of institutions needs to be reevaluated to assess their capital needs, taking into account both a realistic assessment of losses to date, and now, the prospects of further writedowns. In order to comprehend the order of magnitude of total capital needs of Western banking systems, we have made two sets of illustrative calculations that factor in potential further writedowns and revenues that these banks may experience in 2009–10. The calculations rely on several assumptions, some of which are quite uncertain, and so the capital needed by banks should be viewed as indicative of the severity of the problem. The first calculation assumes that leverage, measured as tangible common equity (TCE) over tangible assets (TA), returns to levels prevailing before the crisis (4 percent TCE/TA). Even to reach these levels, capital injections would need to be some $275 billion for U.S. banks, about $375 billion for euro area banks, about $125 billion for U.K. banks, and about $100 billion for banks in the rest of mature Europe. The second illustrative calculation assumes a return of leverage to levels of the mid-1990s (6 percent TCE/TA). This more demanding level raises the amount of capital to be injected to around $500 billion for U.S. banks, $725 billion for euro area banks, $250 billion for U.K. banks, and $225 billion for banks in the rest of mature Europe. These rough estimates, based on our scenarios, suggest that in addition to offsetting losses, the additional need for capital derives from the more stringent leverage and higher capital ratios markets are now demanding, based on the uncertainty surrounding asset valuations and the quality of capital. Without making a judgment about the appropriateness of using the TCE/TA ratio, it is important to note that these amounts are lessened to the degree that preferred equity is converted into common equity (generating more of the loss-absorbing type of capital) and to the degree that governments have guaranteed banks against further losses of some of the bad assets on their balance sheets. In the United States, for instance, the amount of preferred shares issued in recent years is quite large and could help to raise the TCE/TA ratios if converted. In several countries, governments have agreed to take large proportions of the future losses incurred on selected sets of assets by some banks.

Thus, to stabilize the banking system and reduce this uncertainty, three elements are needed:

- A more active role of supervisors in determining the viability of institutions and appropriate corrective actions, including identifying capital needs based on writedowns expected during the next two years.
- Full and transparent disclosure of the impairment of banks' balance sheets, vetted by supervisors based on a consistent set of criteria.
- Clarity by supervisors regarding the type of capital required—either in terms of the tangible common equity or Tier 1—and the time periods allotted to reach new required capital ratios.

Conditions for public infusion of capital should be strict. In addition to taking stock of writedowns and available capital, bank supervisors who are in the process of evaluating the viability of banks will also need to assure themselves of the robustness of their funding structures, their business plan and risk management processes, the appropriateness of compensation policies, and the strength of management. Viable banks that have insufficient capital should receive capital injections from the government that preferably encourages private capital to bring capital ratios to a level sufficient to regain market confidence in the bank and should be subject to careful restructuring. While these institutions hold government capital, their operations should be carefully monitored and dividend payments restricted. Compensation packages and the possible replacement of top management should be examined carefully. Nonviable financial institutions need to be resolved as promptly as possible. Such resolution may entail a merger or possibly an orderly closure as long as it does not endanger system-wide financial stability.

Restructuring may require temporary government ownership. The current inability to attract private money suggests that the crisis has deepened to the point where governments need to take bolder steps and not shrink from capital injections in the form of common shares, even if it means taking majority, or even complete, control of institutions. Temporary government ownership may thus be necessary, but only with the intention of restructuring the institution to return it to the private sector as rapidly as possible. Most importantly, tangible common equity needs to be sufficient to allow the bank to function again—as this is the type of capital that markets are requiring to be held against potential writedowns. Most capital injections from governments thus far have come as preferred shares and these have carried with them a high cost that may impair the banks' ability to attract other forms of private capital. Consideration could be given to converting these shares into common stock so as to reduce this burden. Uncertainty about further policy intervention also deters private capital, and thus clear messages to counter such uncertainty are needed. In a systemic banking crisis, preferential treatment of new bondholders and disadvantaging previous bondholders could well be destabilizing, since many bondholders are themselves financial institutions facing stress. Authorities need to be cognizant of the legal conditions under which their intervention may be considered a "credit event," triggering credit derivative deliveries so as to avoid further systemic effects for other institutions or markets.

Cross-border cooperation and consistency is important. Cross-border coordination of the principles underlying public sector decisions to provide capital injections and the conditions for such injections is crucial in order to avoid regulatory arbitrage or competitive distortions. While difficult to coordinate policies in today's political climate, authorities could usefully aim to provide comparisons between their proposals and others taken abroad as a way to provide more clarity.

Address "bad assets" systematically—asset management companies versus guarantees.

Given the differences in the problems faced by banking systems and the degree to which they have bad assets, various approaches have been adopted. The most important priority is to choose an appropriate approach, ensure that it is adequately funded, and implement it in a clear

manner. However, the use of different techniques between countries makes it all the more important that they coordinate the underlying principles to be applied when valuing the assets and determining the share of losses to be borne by the public sector. Among the methods being used so far, the United Kingdom has favored keeping the assets in the banks but providing guarantees that limit the impact of further losses. An alternative is to place the bad assets in a separate asset management company (AMC) (a so-called "bad bank"), an approach that Switzerland has adopted with UBS and that Ireland is also pursuing. This latter approach has the advantage of being relatively transparent and, if the bulk of the bank's bad assets are transferred to the AMC, leaves the "good bank" with a clean balance sheet. The United States has provided a guarantee against a pool of assets that are either troubled or vulnerable to large losses in the case of Citibank and Bank of America, as well as proposing to establish private/public partnerships to purchase impaired assets from banks. The current proposal has elements to encourage private sector participation, but it is not clear yet whether banks will have enough incentive to actually sell their impaired assets. In general, different approaches can work depending on country circumstances.

Moreover, since valuation issues remain an important source of uncertainty, governments need to establish methodologies for the realistic valuation of illiquid, securitized credit instruments that they intend to support. When assets are not traded regularly and their market prices are based on "fire sales," valuation should be based on expected economic conditions to determine the net present value of future income streams. Preferably, while recognizing the complexity of some of the assets, such a basic methodology should be agreed upon and consistently applied across countries to avoid overly positive valuations, regulatory arbitrage, or competitive distortions. The Financial Stability Board, working with standard setters, would be best placed to promote a coordinated approach.

Provide adequate liquidity to accompany bank restructuring.

Bank funding markets remain highly stressed and will only recover once counterparty risks lessen and banks and providers of wholesale market liquidity are more certain about how their funds are to be deployed. Many governments have introduced measures to protect depositors and have guaranteed various forms of bank debt, but little longer-term funding is available without such government backstopping. Even so, the wholesale funding gap remains large and the structure of national schemes could be made more consistent with each other to improve clarity and reduce frictions. As a result, central banks will need to continue to provide ample short-term liquidity to banks, and governments will need to provide liability guarantees, for the foreseeable future. However, it is not too early to consider exit policies, which in any case should be implemented gradually. Such policies should aim to gradually reprice the facilities and restrict the terms of their use so that there are incentives for banks to return to private markets.

* * *

In addition to the three priorities concerning advanced countries' banking sectors, other immediate policy measures are to address the spread of the crisis to emerging market countries and the risk of financial protectionism.

Assure that emerging market economies have adequate protection against the deleveraging and risk aversion of advanced economy investors.

The problems of the advanced country banking sectors and the global contraction are now having severe effects on emerging market countries. We project annual cross-border portfolio outflows of around 1 percent of emerging market GDP over the next few years. Under reasonable

scenarios, private capital flows to emerging markets could see net outflows in 2009, with slim chances of a recovery in 2010 and 2011.

As in advanced economies, emerging market central banks will need to assure adequate liquidity in their banking systems. However, in many cases the domestic interbank market is not a major source of funding, as much bank funding has been sourced externally in recent years. Thus, central banks may well need to provide foreign currency though swaps or outright sales. Those central banks with large foreign exchange reserves can draw on this buffer, but other means, such as swap lines with advanced country central banks or the use of IMF facilities, should also be a line of defense. The greater resources available to the IMF following the G-20 summit can help countries buffer the impact of the financial crisis on real activity and, particularly in the developing countries, limit the effect on the poor. Moreover, IMF programs can play a useful role in catalyzing support from others in some cases.

The vast majority of the rollover risk in emerging market external debt is concentrated in the corporate sector. Direct government support for corporate borrowing may be warranted. Some countries have extended their guarantees of bank debt to corporates, focusing on those associated with export markets. Some countries are providing backstops to trade finance through various facilities—helping to keep trade flowing and limiting the damage to the real economy. Even so, contingency plans should be devised in order to prepare for potential large-scale restructurings in case circumstances deteriorate further.

Within Europe, the strong cross-border dependencies make it essential that authorities in both advanced and emerging countries work together to find mutually beneficial solutions. The recently issued report of the "de Larosière Group" provides a good start for discussing intra-European Union coordination and cooperation. Concerns over the rollover of maturing debt and the continued external financing of current account deficits in emerging Europe require action. Joint action is also needed to address banking system problems—including coordination on stress tests involving the parent and subsidiaries, better home/host cooperation, and data sharing—as well as preparations to deal with stresses arising from household and corporate debt service. In cases where western European banks have multiple subsidiaries in emerging European countries, joint discussions among the relevant supervisors of how to deal with common predicaments would likely result in better outcomes for all parties.

Coordinate policies across countries to avoid beggar-thy-neighbor treatment.

Pressure to support domestic lending may lead to financial protectionism. When countries act unilaterally to support their own financial systems, there may be adverse consequences for other countries. In a number of countries, authorities have stated that banks receiving support should maintain (or preferably expand) their domestic lending. This could crowd out foreign lending as banks face ongoing pressure to delever their overall balance sheets, sell foreign operations, and seek to remove their riskier assets, with damaging consequences for emerging market countries and hence for the wider global economy. At the same time, recent agreements among the parents of banks in some countries to continue to supply their subsidiaries in host countries with credit are heartening.

Macroeconomic Policy Consistency and Reinforcement

In order to provide a foundation for a sustainable economic recovery, it is critical to stabilize the global financial system. As also noted in the April 2009 *World Economic Outlook,* policies aimed at the financial sector will also be more effective if they are reinforced by appropriate fiscal and monetary policies.

Promote fiscal and financial policies that reinforce each other.

Restoring credit growth is necessary to sustain economic activity. Fiscal stimulus to support economic activity and limit the degradation of asset values should improve the creditworthiness of borrowers and the collateral underpinning loans, and combined with the financial policies to bolster banks' balance sheets would enable sound credit extension. Also, seed funds for private-public partnerships for infrastructure projects could raise demand for loans.

For those countries where there is fiscal room to maneuver, fiscal stimulus will be looked at positively by markets, potentially helping to restore overall confidence. However, for governments already suffering large deficits or poor policymaking institutions, the markets may be less welcoming. Already, market concern at the potential fiscal cost of public support of the banking systems is evident in countries where explicit or implicit support has been provided, especially where the financial system is large compared to the economic size of the country. Although there has been some improvement recently, higher government bond yields, widening credit default swap spreads, or weakening currencies are all manifestations of this concern. Authorities should reduce their refinancing risks by lengthening their government debt maturity structure, to the extent that investor demand allows.

It is clear that stimulative policies are needed now, but careful attention must be paid to the degree of fiscal sustainability and implications for the government's funding needs in any stimulus package, particularly given the contingent risks to the government's balance sheet.[1] Where stimulus packages suggest fiscal targets may be missed, packages need to be accompanied by credible medium-term fiscal frameworks for lowering deficits and debt levels.[2] Without such policies, governments may risk a loss in confidence in the governments' solvency.

Use unconventional central bank policies to reopen credit and funding markets, if needed.

A number of countries have rapidly lowered nominal policy rates as their first line of defense against the recession, and some are nearing (or have already arrived at) a rate close to zero while spreads on consumer and business lending rates continue to be high. In some cases, unconventional central bank policies to reopen credit and funding markets have been used, and others may need to be considered. The effectiveness of additional tools is difficult to gauge so far, but it is evident that moves to expand and alter the composition of the central banks' balance sheet are becoming more common. As central banks increasingly use such tools, more thought should be given to appropriate exit strategies when conditions improve. Governments may need to provide assurances both to the integrity of the central bank's balance sheet and its overall independence.

For some emerging market countries, interest rate policy in the present environment is complicated by the need to consider exchange rate implications. Some countries may have no scope to lower rates, and may even need to raise them, if cutting rates would lead to capital outflows. As with fiscal policy, individual country circumstances will dictate how monetary policy can be used. Some countries may be able to ease pressures on the exchange rates by providing foreign currency liquidity.

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[1]See the section entitled "Costs of Official Support, Potential Spillovers, and Policy Risks" in Chapter 1; and Box 3.5 in Chapter 3.

[2]See the IMF paper "The State of Public Finances: Outlook and Medium-Term Policies After the 2008 Crisis," March 6, 2009. Available via the Internet: http://www.imf.org/external/np/pp/eng/2009/030609.pdf.

Setting the Stage for a More Robust Global Financial System

The immediate priority of policymakers is to address the current crisis. At the same time, work is continuing to develop a more robust financial system for the longer term. In addition to providing for a more resilient and efficient financial system after the crisis clears, a clear sense of direction about longer-term financial policies can also contribute to removing uncertainties and improving market confidence in the short term. While many of the proposals below may appear conceptual, their implications are real. Their proper implementation will require significant changes in structures and resources, while international consistency will be essential.[3]

There is little doubt that the crisis will require far-reaching changes in the shape and functioning of financial markets, and that the financial system will be characterized by lower levels of leverage, reduced funding mismatches, less counterparty risk, and more transparent and simpler financial instruments than the pre-crisis period. The private sector has a central responsibility to contribute to this new environment by improving risk management, including through attention to governance and remuneration policies.

Since neither market discipline nor public oversight were sufficient to properly assess and contain the buildup of systemic risks, improved financial regulation and supervision are key components to preventing future crises. The emphasis should be on how to detect and mitigate systemic risks through better regulation.

While attempts to eliminate all systemic risk would not only be impossible, but also would slow economic growth and constrain creativity and innovation, the current crisis demonstrates that greater emphasis should be placed on systemically focused surveillance and regulation. At the same time, a better macroprudential framework for monetary policy would also help to mitigate systemic risks. While we should strive for regulation that provides incentives for private institutions, wherever possible, to take actions that reinforce financial stability, we should recognize that system-wide stability is a public good that will be undervalued by private institutions and regulations will need to force systemically important firms to better internalize the overall societal costs of instability. For this to occur, the mandates of central banks, regulators, and supervisors should include financial stability. A clear framework to assess and act upon systemic risks will need to be in place, with a clear delineation of who is the lead systemic regulator.

To be able to mitigate systemic risks, those risks will need to be better defined and measured. Chapters 2 and 3 both shed light on various metrics to help identify systemically important institutions by observing both direct and indirect linkages. In some cases, the measures could be viewed as a starting point for the consideration of an additional capital surcharge that could be designed as a deterrent to firms becoming "too-connected-to-fail." Even if not formally used, the proposed measures could guide policymakers to limit the size of various risk exposures across institutions. Clearly, such methods would require very careful consideration and application in order to avoid outcomes whereby institutions find other means of taking profitable exposures. More discussion and research is needed before regulations based on this work could be put into place.

As regards regulatory reforms, we see five priority areas: extending the perimeter of regulation to cover all systemically important institutions and activities, preventing excessive leverage and reducing procyclicality, addressing market discipline and information gaps, improving cross-

[3]For a set of recommendations along these lines, see the IMF paper "Lessons of the Financial Crisis for Future Regulation of Financial Institutions and Markets and for Liquidity Management," February 4, 2009. Available via the Internet: http://www.imf.org/external/np/pp/eng/2009/020409.pdf.

border and cross-functional regulation, and strengthening systemic liquidity management. The main lessons can be summarized as follows.

Define systemically important institutions and the perimeter of prudential regulation.

As recognized by the recent G-20 Communiqué, this crisis has demonstrated that regulation needs to encompass all systemically important institutions. Traditionally, only a core set of large banks has been regarded as systemically relevant, but the crisis has shown that other nonbank financial intermediaries can be systemically important and their failure can cause destabilizing effects. Not only does an institution's size matter for its systemic importance—its interconnectedness and the vulnerability of its business models to excess leverage or a risky funding structure matter as well.

In order to better capture systemic risks, regulation needs to be expanded to a wider range of institutions and markets. While certainly not all financial institutions need to be regulated, prudential supervision will need to cover some institutions that had previously been viewed as outside the core institutions (e.g., investment banks). Moreover, certain activities (such as credit derivatives and insurance) will need to be overseen by regulators regardless of the type of legal structure in which they are placed.

A two-tiered approach may work best. A wider tier would be required to provide information from which supervisors would determine which institutions are systemically important. The other tier would be a narrower—though wider than at present—perimeter of more intensified prudential regulation and oversight that would include all systemically important institutions. While these institutions would receive more intense scrutiny given their systemic importance, other institutions would continue to be overseen as participants in the payments or banking system or for consumer or investor protection purposes. Chapters 2 and 3 provide methodologies that could be used to discern how close institutions are to each other and thus the contours of an inner tier. These methods will be further explored as the IMF works toward a practical definition of a systemically important institution as requested by the G-20.

Prevent excessive leverage and curb procyclicality.

New regulatory approaches are needed to avoid the buildup of systemic risk and the subsequent and difficult deleveraging process. Finding solutions for how to limit leverage going forward and reduce the procyclical tendencies inherent in business practices and existing regulation remains challenging. Regulation should attempt to reinforce financial institutions' sound risk-based decision-making, whereas deterring risk-taking in the global economy would be unhelpful. Regulation should provide incentives that support systemic stability, while discouraging regulatory arbitrage and short-termism, but the higher standards should be phased in gradually over time so that they do not exacerbate the present situation.

Capital regulation and accounting standards should include incentives and guidance that permit the accumulation of additional capital buffers during upswings when risks tend to accumulate and are typically underestimated. This would better reflect the risks through the cycle and thus add to capital and provisions that could be used to absorb losses during the downswings. Ideally, these countercyclical capital requirements would not be discretionary, but act as automatic stabilizers and be built into regulations. This would not limit the capacity of supervisors to act with supplementary measures if needed. An upper limit on leverage based on a simple measure could be useful as a supplementary restriction to more robust risk-weighted capital calculations.

Accounting rules and valuation practices should be strengthened to reflect a broader range of available information on the evolution of risks through the cycle. Accounting standard setters and prudential authorities should collaborate to achieve these objectives, with particular emphasis on enabling higher loan loss provisions during periods of rapid credit expansion, evaluating approaches

to valuation reserves or adjustments when valuation of assets on the trading book are highly uncertain, and examining other ways to dampen adverse dynamics potentially associated with fair value accounting.

It is also necessary to reduce the procyclicality of liquidity risk by taking measures to improve liquidity buffers and funding risk management. During upswings, greater attention needs to be given to funding maturity structures and the reliability of funding sources that can prove vulnerable during downturns.

Address market discipline and information gaps.

It is important to address the gaps in information that have been revealed by the crisis. In many cases the information needed to detect systemic risks is either not collected or not analyzed with systemic risk in mind, especially those data needed to examine systemic linkages, as this requires information about institutions' exposures to one another. However, in addition to some technical difficulties in collecting these data and formally measuring the exposures, there are legal impediments to their collection across different types of institutions within a country and across borders. Consistency of reporting and definitions and greater information-sharing across jurisdictions are needed to begin to make headway in this area.

Better information is needed on off-balance-sheet exposures, complex structured products, derivatives, leverage, and cross-border and counterparty exposures, supplementing the existing set of indicators used in early warning frameworks. Disclosure practices should be strengthened for systemically important financial institutions, including valuation methodologies and risk management practices, a revamped set of financial soundness indicators, and more effective assessments of systemic risk by policymakers. These elements are reinforced by the analysis in Chapters 2 and 3. As well, greater availability of reliable public information will help investors to perform proper due diligence, the failure of which was a major contributor to the present crisis.

Strengthen cross-border and cross-functional regulation.

Enhanced cross-border and cross-functional regulation will require improvements in institutional and legal settings. Progress is needed in reducing unnecessary differences, tackling impediments to supervision of globally and regionally important firms, with more harmonized early remedial action, bank resolution legal frameworks, and supervisory practices to oversee cross-border firms. An appointment of a lead regulator, in principle the home authority, by the college of regulators overseeing a firm would be essential to ensure adequate oversight. Home countries should endeavor to strengthen cooperation with host countries so as to assure lines of communication are open when rapid responses are required—contingency planning should involve all relevant parties.

Improve systemic liquidity management.

In terms of systemic liquidity management, central banks can learn some lessons from the crisis in terms of the flexibility of their operational frameworks, the infrastructure underlying key money markets, and the need for better mechanisms for providing cross-border liquidity.

Another way of limiting systemic linkages and the risks of multiple-institution distress is to provide clearing facilities that mitigate counterparty risk by netting trades and making the clearing facility a counterparty to every trade. Recent attempts to provide some of these services for the credit default swap market are welcome. However, allowing a large number of proposed institutions risks diluting much-needed counterparty risk mitigation by splitting up the volumes and reducing netting opportunities. A competitive environment could potentially lead to cost-cutting measures that may compromise risk management systems. Thus, if multiple clearing facilities are permitted, they should be subject to strong oversight using globally accepted standards, ensuring the ability to clear and

settle across borders and in multiple currencies. Box 2.4 provides the principles for their construction.

* * *

Many of these recommendations have already been discussed in international fora and are forming the basis for new or altered regulation or supervisory guidance. The Financial Stability Board, through its main working group, has established a set of subgroups to provide policy guidance in a number of areas, including some of those emphasized here. The Basel Committee is considering changes to the Basel II framework and to its liquidity risk management framework. The International Accounting Standards Board and the Financial Accounting Standards Board have both issued guidance on how to value illiquid assets and have made other alterations to their accounting guidance and standards given the crisis and its causes. Other international organizations are reviewing their guidelines and best practices. For its part, the IMF will be revamping its Financial Sector Assessment Programs as well as improving its multilateral and bilateral surveillance. The joint Early Warning Exercise, conducted by the IMF in cooperation with the Financial Stability Board, will enhance the global coordination of risk assessments with the aim of making stronger policy recommendations to prevent a buildup of systemic risks.

CHAPTER 1

STABILIZING THE GLOBAL FINANCIAL SYSTEM AND MITIGATING SPILLOVER RISKS

Systemic risks remain high and the adverse feedback loop between the financial system and the real economy has yet to be arrested, despite the wide range of policy actions and some limited improvement in market functioning. Further effective government action—particularly geared toward cleansing balance sheets and strengthening institutions—will be required to stabilize the global financial system and to provide the foundation for a sustainable economic recovery. The banking system needs additional equity to absorb further writedowns as credit deteriorates, and risks are broadening to encompass nonbank institutions. The crisis has spread to emerging markets, with the collapse of international financing, posing challenges to corporates, households, and banks as well as raising sovereign risk. The global policy response, including the IMF's enhanced lending framework, should help to mitigate crisis risks from deepening. There remains considerable scope for further public commitments in larger economies, but extensive provision of financing and the transfer of balance sheet risk from the private to the public sector have increased tail risks for certain mature market sovereigns.

Against this backdrop, Chapter 1 first outlines the key financial stability risks that have materialized since the October 2008 Global Financial Stability Report. Then, it examines the deleveraging process and its effects on the real economy. The following section assesses the vulnerability of emerging markets to global stress, especially focusing on the refinancing risks facing corporates. The outlook for global credit markets is then evaluated, along with IMF staff estimates of potential global financial writedowns. The stability risks facing financial institutions are assessed and the effectiveness of the policy response evaluated. The chapter concludes with a discussion on sovereign risks. Box 1.1 summarizes the key financial stability challenges and policy priorities detailed in the chapter.

A. The Global Financial Stability Map

The global financial stability map (Figure 1.1) presents an overall assessment of how changes in underlying conditions and risk factors bear on global financial stability in the period ahead.[1] Nearly all the elements of the map point to a degradation of financial stability, with emerging market risks having deteriorated the most since October 2008.

Note: This chapter was written by a team led by Peter Dattels and comprised of Myrvin Anthony, Sergei Antoshin, Amitabh Arora, Elie Canetti, R. Sean Craig, Kristian Hartelius, Geoff Heenan, Gregorio Impavido, Rebecca McCaughrin, Ken Miyajima, Chris Morris, Inci Ötker-Robe, Michael Papaionnou, Mustafa Saiyid, Rupert Thorne, and Ian Tower.

[1]Annex 1.1 details how indicators that compose the rays of the map are measured and interpreted. The map provides a schematic presentation that incorporates a degree of judgment, serving as a starting point for further analysis. The rest of the report elaborates on our overall assessment of global financial stability.

Box 1.1. Near-Term Financial Stability Challenges and Policy Priorities

Global financial stability has deteriorated further, with emerging market risks having risen the most since the October 2008 Global Financial Stability Report. Notwithstanding some improvements in short-term liquidity conditions and the opening of some term funding markets, other measures of instability have deteriorated to record or near-record levels.

The global credit crunch is likely to be deep and long lasting. The process ultimately may lead to a pronounced contraction of credit in the United States and Europe before the recovery begins. IMF analysis suggests that financing constraints have been a large contributor to the widening of credit spreads, making repairing funding markets imperative to help avert a deeper recession.

Credit cycles have turned sharply, with the deterioration moving to higher-rated credits and spreading globally. The deterioration in credit quality has increased our estimates of loan writedowns, which would put further pressure on financial institutions to raise capital and shed assets.

The deleveraging process is curtailing capital flows to emerging markets. On balance, emerging markets could see net private capital outflows in 2009 with slim chances of a recovery in 2010 and 2011. This decline is likely to slow credit growth, impairing corporate refinancing prospects.

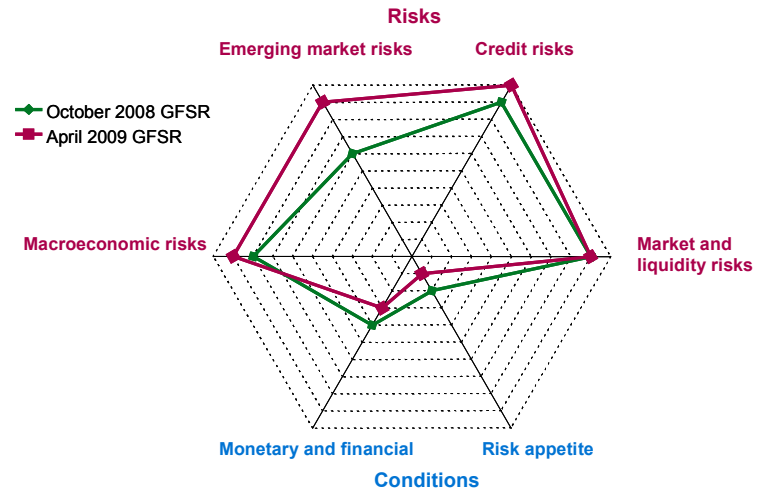
Within emerging markets, European economies have been hardest hit, reflecting their large domestic and external imbalances, fueled by rapid credit growth prior to the crisis. Banks operating in emerging markets may face mounting writedowns and require fresh equity, while corporates face large refinancing needs, increasing risks for emerging market sovereigns. While authorities have been proactive in responding to the crisis, policies are being challenged by the scale of resources required.

Fiscal burdens are growing as a result of bank rescue plans and macroeconomic stimulus packages. Increased funding needs and illiquid capital markets have exerted pressure on sovereign credit spreads and raised concerns about the market's ability to absorb increased debt issuance and about the crowding out of other borrowers. The United States faces some of the largest potential costs of financial stabilization, as do a number of countries with large banking sectors relative to their economies or concentrated exposures to the property sector or emerging markets. (e.g., Austria, Ireland, the Netherlands, Sweden, and the United Kingdom).

Stabilizing the financial system requires further policy actions. The global policy response to date has been unprecedented, but has not prevented the onset of the adverse feedback loop with the real economy. It is thus necessary to undertake further forceful, focused and effective policy action to stabilize the financial system. In particular, the public sector should ensure viable institutions have sufficient capital when it cannot be raised in the market, accelerate balance sheet cleansing and bank restructuring, and harmonize measures supporting funding markets. Public support measures also need to consider the risk of solvency pressures among other financial institutions (e.g., insurance companies, pension funds).

The economic downturn has gathered momentum, resulting in a deterioration in *macroeconomic risks*. The IMF's baseline forecast for global economic growth for 2009 has been adjusted sharply downward to the slowest pace in at least four decades. The reduction in trade financing has exacerbated the slowdown in global trade, particularly affecting emerging economies. A raft of official measures that transfer risk from private sector financial institutions to the public sector has increased pressures on sovereign balance sheets and credit (see Section E).

Figure 1.1. Global Financial Stability Map



Source: IMF staff estimates.
Note: Closer to center signifies less risk, tighter monetary and financial conditions, or reduced risk appetite.

Uncertainty about the scale of the downturn and continued stress on the financial system has further increased *credit risks*. The core financial system remains fragile and public confidence low, as the credit deterioration has intensified and spread to higher-quality assets (Figure 1.2). The global financial system is facing a once-in-a-century event, where credit risks have risen to extremely high levels. Activity has improved in credit markets receiving government support, but other sectors remain moribund (see Section D). Household balance sheets have come under pressure due to mounting job losses, falling net worth, and tight credit conditions. Expected credit writedowns by financials have ballooned, and, with private markets largely unwilling to provide capital to the banking system, the tail risk of more public sector ownership has increased.[2] Estimates for U.S. and European banking systems suggest both are undercapitalized (see Section E).

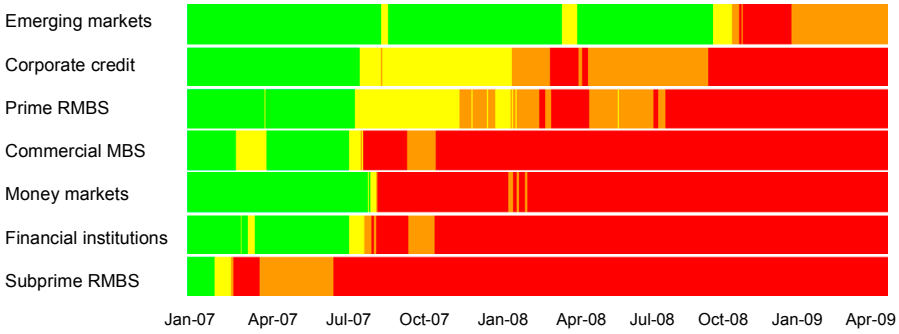
Our assessment is that *emerging market risks* have heightened the most since the last GFSR, moving out three notches. Cross-border bank lending to emerging markets has begun to contract. Capital market financing is sporadic, and limited to higher-quality borrowers. Emerging market corporates face falling revenues and large financing needs and household balance sheets are under pressure (see Section C). Emerging market banks face liquidity and solvency pressures. Financing conditions could tighten further as a number of mature market banks active in emerging markets may ration credit and sell subsidiaries to preserve capital for their home markets. These pressures are most pronounced in central and eastern Europe, given their higher reliance on cross-border and wholesale funding, weaker balance of payments positions, and higher degree of credit risk (see Table 1.1). By contrast, in Latin America and Asia, the bigger risks are related to the dramatic collapse in global trade (including trade financing) and domestic activity.

While government guarantees of bank debt have allowed some medium-term funding, *market and liquidity risks* remain elevated. Interbank markets have improved, but are still functioning only at very short maturities (see Section E). *Monetary and financial conditions* have tightened despite global policy easing as credit standards continue to be tightened (albeit at a more moderate pace). In addition, rising nonperforming loans and pressures to delever have weakened the monetary policy transmission mechanism, constraining the effect of lower policy rates on new lending. *Risk appetite*

[2]See Chapters 2 and 3 on various measures of systemic risks.

has diminished as confidence remains depressed and counterparty risks high, adding to the pressures to further unwind positions in riskier assets.

Figure 1.2. Heat Map: Developments in Systemic Asset Classes



Source: IMF staff estimates.
Note: The heat map measures both the level and 1-month volatility of the spreads, prices, and total returns of each asset class relative to the average during 2004-06 (i.e., wider spreads, lower prices and total returns, and higher volatility). The deviation is expressed in terms of standard deviations. Green signifies a standard deviation under 1, yellow 1-4 standard deviations, orange 4-7, and red greater than 7. MBS = mortgage-backed security; RMBS = residential mortgage-backed security.

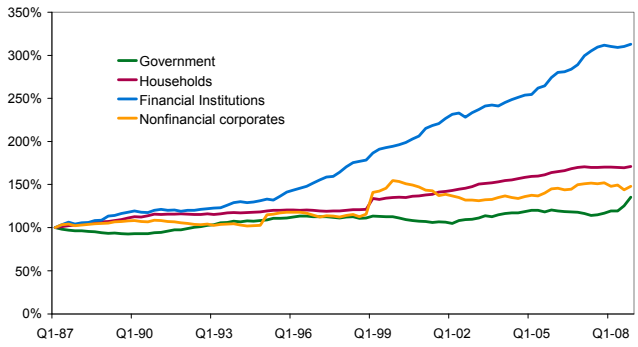
B. Global Deleveraging and Its Consequences

Previous GFSRs have highlighted that the global credit crunch will be deep and long-lasting, as deleveraging accelerates in advanced economies and balance sheet adjustments take place over at least the next couple of years. This process has strongly negative global ramifications, raising crisis risks for emerging economies.

History suggests deep deleveraging will need to play out, although policies can lessen the economic consequences.

Financial institutions and households, in particular, had built up record levels of debt and are now seeking to reduce leverage (Figure 1.3). Deleveraging is being driven by mounting bank writedowns and the reversal of the intertemporal savings choices made by households and some corporates compared to the previous decade. Deteriorating credit quality has pushed up our estimates of bank writedowns, increasing pressures on banks and other financial institutions to raise capital and shed assets (see Sections D and E). Recent quarters have shown that the assumed moderation in macroeconomic and financial volatility, which had given many confidence to lever up their balance sheets, was a mirage. Leverage increases the probability of bankruptcy if volatility is high, and it is natural for private economic agents to want to lower leverage as they recognize that their earlier volatility assumptions were overly optimistic. Previous GFSRs have shown that various instruments and sectors of the financial system—structured investment vehicles (SIVs), conduits, constant-proportion debt obligations (CPDOs), auction rate securities (ARS), and hedge funds—were predicated on high leverage. To the extent that many of these elements of the "shadow banking system" have already collapsed or are in serious difficulty, leverage is naturally declining.

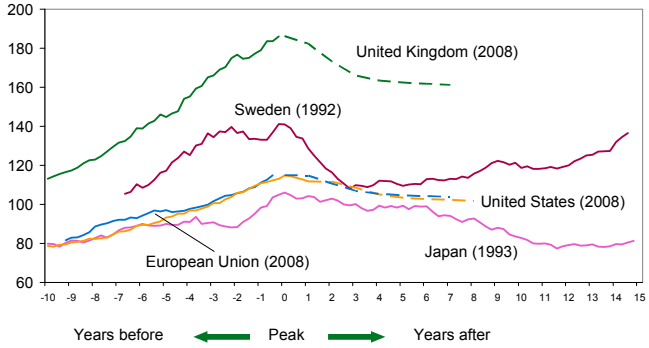
Figure 1.3. Ratio of Debt to GDP Among Select Advanced Economies
(In percent, GDP-weighted, 1987 = 100)



Sources: Bank of Japan; Bureau of Economic Analysis; Federal Reserve; Office of National Statistics; and IMF staff estimates.

The buildup of leverage that preceded this crisis was substantial, and certainly on a par with other periods in history that have ended in a collapse in credit. Figure 1.4 compares the ratio of bank credit to GDP in the current crisis to that in Japan and Sweden in the run-up to their crises in the early 1990s. Three features are apparent. First, the rise in bank credit in the United Kingdom has been massive, and has been greater in the United States and European Union than in Japan in the years preceding its bubble. Second, the crises in Japan and Sweden both caused the bank-credit-to-GDP ratio to drop by around a quarter from its peak. Third, Sweden achieved its deleveraging rapidly, and then started to rebuild, while deleveraging in Japan continued over more than a decade. The current trajectories for the United States and Europe appear similar to the Japanese path, but policies discussed in the Section E can lessen the economic impact and speed the recovery period.

Figure 1.4. Bank Credit to the Private Sector
(In percent of nominal GDP)

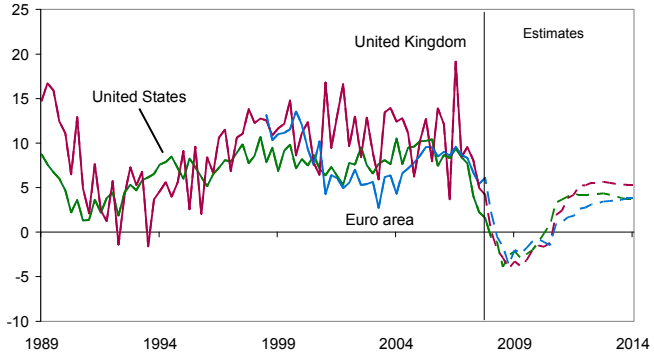


Sources: National authorities; and IMF staff estimates.
Note: Dashed lines are forecasts. Year of credit peak in parentheses.

The global credit crunch is likely to be deep and long lasting.

The October 2008 GFSR envisaged that, if there were a substantial inflow of capital to the banking system (then estimated at $675 billion) and some assets were sold to achieve higher capital ratios, credit would decelerate but not contract. That has proved optimistic; equity capital for banking has been very difficult to raise from the private sector, the forces driving deleveraging have strengthened as the depth of the economic downturn has become clear, and credit spreads in many cases remain at historic highs. We estimate U.S. and European private sector credit could contract at a 4 percent quarter-on-quarter annualized rate at its most negative (Figure 1.5), reinforcing the deleveraging process.[3] A major element of the deleveraging process is the sale of bank assets, either to public sector entities or to nonbanks, and the maturing of other assets.[4] This process still has a long way to go, as many illiquid assets have average remaining maturities of three to five years, although the adjustment of bank balance sheets is supported by purchases from government-

Figure 1.5. Private Sector Credit Growth
(Borrowing as a percentage of debt outstanding, quarter-on-quarter annualized, seasonally adjusted)



Source: IMF staff estimates.

[3]The estimate combines the current *World Economic Outlook* GDP growth assumptions with a number of other assumptions (see Annex 1.4 of the October 2008 GFSR) to generate a possible path for the growth of credit. Policy measures being taken globally to support the supply of credit are assumed to soften the credit contraction somewhat. The forecasts conservatively assume credit to the private sector grows or shrinks at the same pace as bank assets. The former is a national accounts concept that focuses on flows from banks based in the country/region to residents of that country/region. Some bank lending is to nonresidents but, likewise, some borrowing by residents is from foreign banks.

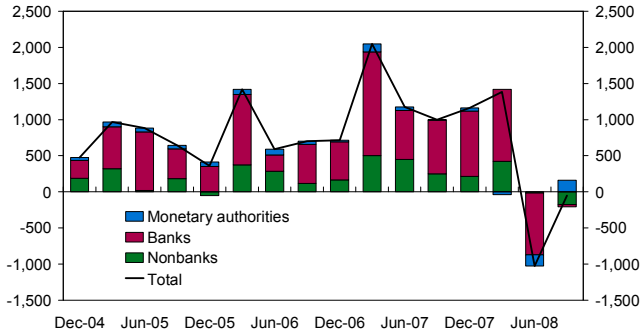
[4]Often, the terms banks offer to refinance a loan will make it uneconomic to the borrower. The loan will thus be allowed to mature rather than remain on the balance sheet.

sponsored asset management corporations, of which $2.6 trillion in the United States and Europe is assumed in this scenario.

Further pressures to deleverage come from heavy past reliance on wholesale funding.

Much of the credit buildup was financed through wholesale funding, which has since diminished. Those markets are unlikely to return to their former size in the foreseeable future. There remains a risk that this could force a more rapid, disorderly deleveraging. Large-scale official funding support has replaced a substantial part of the wholesale market. While in many jurisdictions banks can now issue government-guaranteed longer-term debt, banks' funding gaps remain large. Much of the earlier buildup in wholesale funding had occurred across borders, but the availability of cross-border funding has now contracted sharply (Figure 1.6).[5] As long as banks need to rely on guarantees and short-term liquidity for funding, pressures for balance sheets to shrink will constrain lending (see Section E).

Figure 1.6. BIS Reporting Banks: Cross-Border Liabilities, Exchange Rate-Adjusted-Changes
(In billions of U.S. dollars)

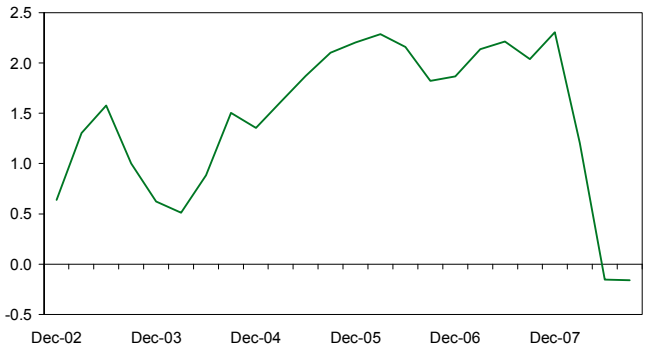


Sources: Bank for International Settlements; and IMF staff estimates.

The retrenchment from foreign markets is outpacing the overall deleveraging process.

The proportion of cross-border assets in banks' total assets fell again in the third quarter of 2008, as cross-border lending is falling at an even faster rate than overall credit (Figure 1.7). Three factors are likely driving the faster pace of cross-border deleveraging. First, increased credit risk concerns accentuate home bias in lending, as some banks perceive themselves less able to manage credit risk from a distance. Second, cross-currency and foreign exchange swap markets are impaired, and there are still some limits on the use of assets denominated in foreign currencies as collateral when accessing central bank facilities.[6] Third, cross-border exposures typically involve a higher regulatory capital charge due to currency or country risk. So shedding these assets is a quick way to improve capital ratios.

Figure 1.7. BIS Reporting Countries: Cross-Border Assets as a Proportion of Total Assets
(Annual change in percentage points)



Sources: Bank for International Settlements; and IMF staff estimates.

These factors and risks are particularly strong in the case of lending to emerging markets, further accelerated as a result of sovereign downgrades in emerging markets. The collapse in cross-border funding has already been a critical element in the intensification of the crisis in several

[5]Cross-border liabilities of Bank for International Settlements (BIS) reporting banks fell more than $1 trillion in the second quarter of 2008, but were little changed in the third quarter (adjusted for exchange rate changes).

[6]This has been relieved somewhat by the expansion in bilateral swap arrangements and other foreign currency liquidity facilities introduced by many central banks.

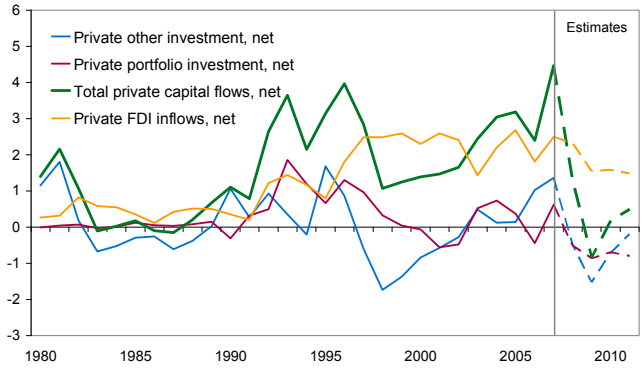
countries. A retreat of total cross-border lending to the levels seen as recently as 2004 would imply a contraction of a further 10 percent, or $3 trillion. Such a contraction would most likely hit emerging markets disproportionately.

Domestic official support programs for banks are accentuating home bias, which may be accelerating the pace of cross-border deleveraging. This applies to support by both mature and emerging market governments, which is often provided on the condition, or the understanding, that lending to the domestic economy be maintained.

As a result, capital flows to emerging markets are likely to reverse as foreign direct investment fails to offset bank and portfolio outflows.

Net private flows to emerging markets peaked at 5 percent of emerging market GDP in 2007 (Figure 1.8). However, the credit crunch in mature markets will likely cause significant outflows by banks in the coming years, as cross-border lending comes to a halt and a number of parent banks may begin curtailing financing to emerging market subsidiaries. An econometric analysis suggests outflows by banks could reach 5 percent of GDP in many emerging European countries, where cross-border bank inflows soared to unsustainable levels in recent years (see Annex 1.2). Such outflows would not be without precedent. Banking outflows of this magnitude were seen in some countries during the Latin American debt crisis in the early 1980s and again during the Asian financial crisis in 1997–98.

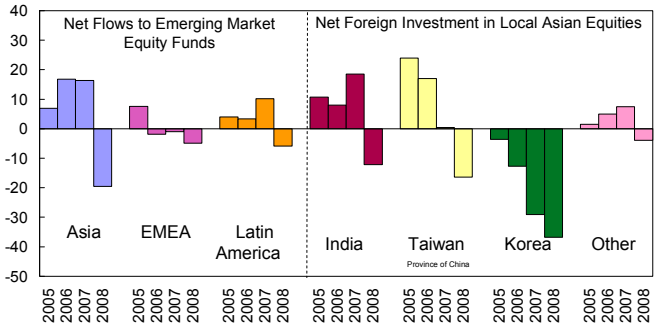
Figure 1.8. Emerging Market Net Private Capital Flows
(In percent of GDP)



Source: IMF, World Economic Outlook database.

Emerging markets experienced large portfolio outflows at the end of 2008, and outflows are likely to continue over the coming years, given continued pressures for leveraged investors to shed assets, the risk of further redemptions from emerging market funds and crowding out from government-guaranteed mature market bonds (Figure 1.9). We project annual portfolio outflows of around 1 percent of emerging market GDP over the next few years. Foreign direct investment in emerging markets is set to slow significantly, given diminished appetite from private equity firms, the lack of credit available to finance acquisitions, and sharply deteriorating cyclical growth prospects in emerging markets. On balance, emerging markets will likely see net private capital outflows in 2009, with slim chances of a recovery in 2010 and 2011. Moreover, risks to these projections appear to be to the downside, given how protracted the current global crisis is likely to be.

Figure 1.9. Net Foreign Equity Investment in Emerging Economies
(In billions of U.S. dollars)



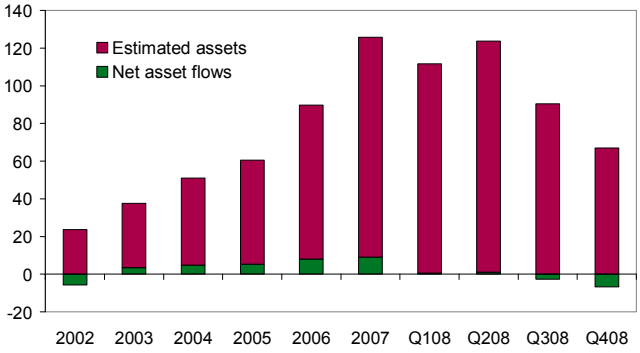
Sources: Bloomberg L.P.; Emerging Portfolio Research; and IMF staff estimates.
Note: "Other" includes Indonesia, Philippines, Thailand, and Vietnam. EMEA = Emerging Europe, the Middle East, and Africa.

The global credit crunch has reduced the investor base for emerging market assets.

Emerging market assets under management by hedge funds have dropped by about half from their peak in early 2008 as these funds have faced severe redemption pressures, exacerbated by negative performance, and reduced leverage (Figure 1.10). In the fourth quarter of 2008, withdrawals

accounted for nearly one-third of the total $23 billion decline in assets under management. Retail investors have also withdrawn, with dedicated emerging market bond and equity funds experiencing substantial outflows, losing several years worth of inflows in the second half of 2008—a magnitude similar to the outflows seen in 1998.[7] Surveys suggest crossover investors have shifted heavily away from emerging markets into mature market corporate bonds, including government-guaranteed debt, amid a reevaluation of the diversification benefits from emerging markets as theories of "decoupling" proved wrong. Over the longer term, market participants believe emerging markets will retain a core of institutional investors committed to strategic allocations. The reduction in the number of investors, however, combined with the disappearance of some broker-dealers, is likely to impair the liquidity of emerging market assets for several years to come.

Figure 1.10. Emerging Market Hedge Funds: Estimated Assets and Net Asset Flows
(In billions of U.S. dollars)

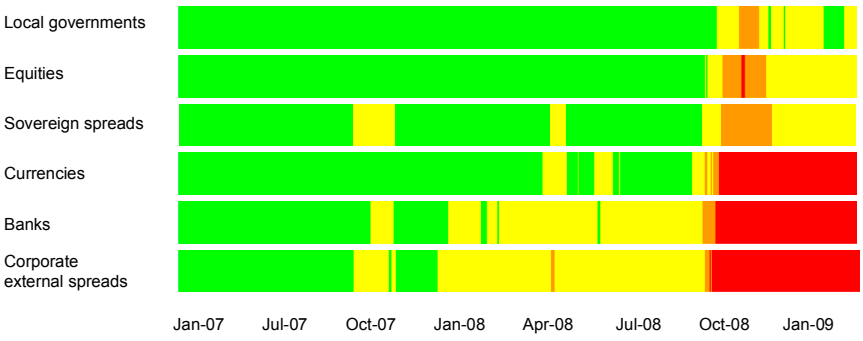


Source: Hedge Fund Research.

C. The Crisis Has Engulfed Emerging Markets

Pressures on emerging markets intensified in September 2008, following the collapse of Lehman Brothers, as counterparty risks rose and as the credit crunch's impact on economic activity became indisputable (Figure 1.11). A large set of interlinked risks has already pushed some emerging markets into crisis, and threatens many more, particularly in emerging central and eastern Europe. The severity of the crisis in emerging markets and the risks of spillovers call for a strong and coordinated response from policymakers at a global level to ensure that adequate liquidity is available. The decision taken at the recent G-20 summit to increase the resources available to the IMF can serve as an example in this respect. Policies should also be aimed at keeping mature market financial institutions engaged, through close cooperation between home and host authorities. Emerging market policymakers, in turn, need to strengthen their financial systems and policies for the more challenging global economic environment.

Figure 1.11. Heat Map: Developments in Emerging Market Systemic Asset Classes



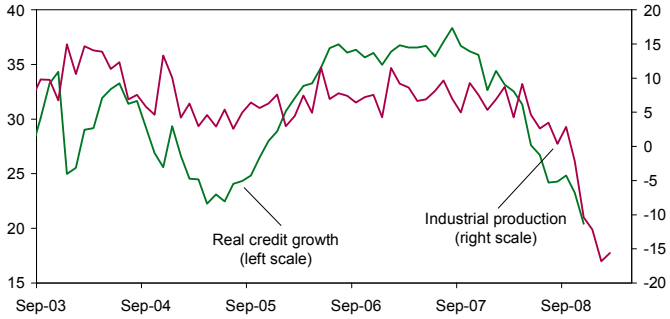
Source: IMF staff estimates.
Note: The heat map measures both the level and 1-month volatility of the spreads, prices, and total returns of each asset class relative to the average during 2004-06 (i.e., wider spreads, lower prices and total returns, and higher volatility). The deviation is expressed in terms of standard deviations. Green signifies a standard deviation under 1, yellow 1-4 standard deviations, orange 4-7, and red greater than 7.

[7]It took about three years for inflows to return to emerging market dedicated investment funds after the Asian financial crisis in 1997–98.

Crisis risks in emerging Europe have increased sharply...

Emerging Europe has been hit hard by global deleveraging. The impact has flowed through the same financial linkages with mature markets that previously allowed the region to build up a high degree of leverage through rapid foreign-financed credit growth (Table 1.1). Cross-border bank funding is now being disrupted as the banking crisis in western Europe intensifies.[8] Growth in credit to the private sector is falling rapidly, intensifying the vicious circle between output declines and deteriorating asset quality (Figure 1.12).

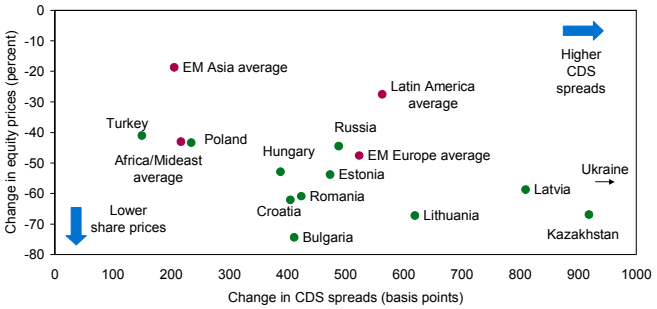
Figure 1.12. Emerging Europe: Real Credit Growth to the Private Sector and Output
(In percent, year-on-year)



Sources: Bloomberg L.P.; IMF, International Financial Statistics database; and IMF staff estimates.
Note: GDP-weighted average for emerging European countries shown in Table 1.1.

As a result, external debt spreads have risen sharply, stock markets have collapsed, and currencies have come under pressure, especially in those countries with large domestic and external imbalances (Figure 1.13). Households and corporates in a number of countries have built up large foreign exchange exposures in the run-up to the crisis, and further currency depreciation could result in severe loan writedowns across the region, eroding the capital and asset quality of banks, including parents of foreign-owned subsidiaries.[9] In countries with tightly managed exchange rate regimes, the fear of currency and stock market collapse also risks capital flight, such as that experienced in Russia and Ukraine.

Figure 1.13. Emerging Market Performance of Credit Default Swap Spreads and Equity Prices
(August 29, 2008–March 16, 2009)



Sources: Bloomberg L.P.; Datastream; and IMF staff estimates.
Note: Using countries in Table 1.1. State Bank of India for India's CDS spreads. Regional average values are weighted by GDP. For Ukraine, changes in CDS spreads and equity prices are 3119 bps and -62%, respectively.

...and financial interconnectedness within Europe increases the risk of adverse feedback loops.

Most emerging European countries are highly dependent on western European banks, which own the majority of banking systems in these countries (see Box 1.2). The parents are largely concentrated in just a few countries (Austria, Belgium, Germany, Italy, and Sweden), and in some cases, the claims of the western European banks on emerging Europe are large relative to home country GDP as well (Austria, Belgium, and Sweden).

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[8]Previous editions of the GFSR have highlighted strains in banking systems that relied heavily on financing through international debt markets, such as Kazakhstan and Russia, which were impacted earlier in the crisis.

[9]Table 1.1 shows that foreign currency loans (mostly in dollars, euros, and Swiss francs) make up at least half of total loans in the Baltics, Bulgaria, Croatia, Hungary, Romania, Serbia, and Ukraine.

Table 1.1. Macro and Financial Indicators in Selected Emerging Market Countries[1]

	Current Account Balance[2]	External Debt Refinancing Needs in 2009[3]	Net External Position vis-à-vis BIS-Reporting Banks[4]	Average Real Credit Growth over the Last 5 Years[5]	Loan/Deposit[6]	Forex Share of Total Loans
	(Percent of GDP)	*(Percent of reserves)*	*(Percent of GDP)*	*(Percent, year-on-year)*	*(Ratio)*	*(Percent of total loans)*
Europe						
Bulgaria	-12.3	188	-34.9	35.9	1.3	66.9
Croatia	-6.5	136	-44.5	13.1	1.1	62.0
Czech Republic	-2.8	236	-13.1	16.0	0.8	13.6
Estonia	-6.3	210	-68.8	27.3	2.1	85.3
Hungary	-3.9	171	-50.2	14.3	1.4	65.7
Kazakhstan	-6.4	82	-5.1	50.1	1.7	43.6
Latvia	-6.7	331	-57.6	38.4	2.8	89.3
Lithuania	-4.0	425	-41.5	43.2	2.0	64.0
Poland	-4.9	169	-15.4	14.7	1.1	32.6
Romania	-7.5	127	-32.5	47.1	1.3	55.5
Russia	0.2	34	3.1	34.5	1.3	15.3
Serbia	-12.2	...	-12.2	26.2	1.2	68.0
Turkey	-1.1	110	-11.9	29.8	0.7	28.9
Ukraine	0.6	208	-17.6	47.5	2.0	59.5
Gulf States						
Kuwait	25.8	109	3.8	19.8	1.1	...
Saudi Arabia	-1.8	…	22.3	22.2	0.9	8.2
United Arab Emirates	-5.6	…	-12.2	32.5	1.2	18.9
Africa						
Egypt	-3.0	14	8.5	0.9	0.6	28.0
Ghana	-10.9	13	-5.0	26.4	0.8	...
Nigeria	-9.0	...	10.3	34.2	1.1	...
South Africa	-5.8	49	4.4	12.8	1.2	...
Uganda	-6.2	…	...	17.7	0.8	...
Asia						
China	10.3	14	0.7	11.3	0.8	...
India	-2.5	33	-8.9	18.2	0.8	...
Indonesia	-0.4	73	-7.5	15.1	0.8	19.8
Korea	2.9	93	-18.9	6.3	1.2	8.5
Malaysia	12.9	23	-8.3	5.2	0.9	...
Pakistan	-5.9	28	2.4	13.5	0.7	...
Philippines	2.3	39	-2.2	...	…	...
Thailand	0.0	34	1.3	2.6	1.0	...
Vietnam	-4.8	8	-7.4	26.4	1.1	21.2
Latin America						
Argentina	2.3	85	2.5	14.6	0.7	15.8
Brazil	-1.8	40	-7.1	15.9	0.8	...
Chile	-4.8	84	-7.2	11.6	1.4	...
Colombia	-3.9	52	0.5	16.0	2.0	6.3
Mexico	-2.5	64	-2.1	11.7	0.8	11.6
Peru	-3.3	27	-2.2	8.2	0.9	57.5
Venezuela	-0.4	59	19.7	45.8	0.8	<0.5

Sources: Bloomberg L.P.; Bank for International Settlements (BIS); IMF, Direction of Trade Statistics database, International Financial Statistics database, World Economic Outlook database; and IMF staff estimates.

[1] The shaded boxes of the table point to areas of potential concern. Cut-off values are as follows: current account balance below -5 percent of GDP; refinancing needs in excess of 100 percent of reserves; net external liabilities to BIS-reporting banks above 10 percent of GDP; average real growth of credit to the private sector greater than 30 percent year-on-year; loan-to-deposit ratio exceeding 1; and foreign-currency denominated loans exceeding 50 percent of total loans.

[2] Projections of the current account balance and GDP for 2009 in dollar terms from the WEO.

[3] Short-term debt at initial maturity at end–2008 plus amortizations on medium- and long-term debt during 2009, estimated by IMF staff.

[4] Data on external positions of reporting banks vis-à-vis individual countries and all sectors from the BIS, as of September 2008.

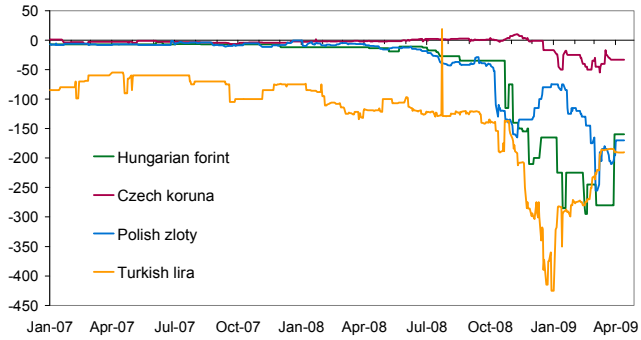
[5] Average growth of credit to the private sector, adjusted for inflation.

[6] Credit to the private sector relative to demand, time, saving, and foreign currency deposits.

These interlinkages create feedback loops between emerging and western Europe that could exacerbate the crisis. For instance, the deteriorating financial condition of emerging European subsidiaries affects their parents' liquidity and capital position. This has led to rating downgrades and higher funding costs for the parents, reducing their capacity to maintain funding to the subsidiaries, which further weakens the financial strength of the subsidiaries. Capital injections and wholesale funding guarantees to some parent banks by their home authorities have lessened risks to their subsidiaries, but raise other concerns, such as whether the parent banks will be pushed to divert credit to their home market. Sovereign credit default swap (CDS) spreads and bond yields of home countries with substantial exposures to emerging Europe have risen sharply on concerns about the potential costs of bailing out banks. Subsidiaries with loan-to-deposit ratios close to one (Table 1.1)

can rely largely on their own funding sources to maintain lending, but, together with locally-owned banks, face difficulties using local currency deposits to fund foreign currency loans owing to the dislocation in foreign exchange and cross-currency swap markets. Liquidity in these markets remains well below its level prior to September 2008, while the swap basis remains very wide for some currencies as global banks have scaled back dollar and euro liquidity (Figure 1.14). The Hungarian and Polish central banks recently introduced foreign exchange swap facilities to supplement private markets, which has contributed to a narrowing of cross-currency swap spreads.

Figure 1.14. Cross-Currency Basis Swap Spreads
(In basis points, one-year tenors)



Source: Bloomberg L.P.
Note: All basis swaps are quoted against Euribor, except the Turkish lira which is quoted against U.S. dollar Libor.

In Latin America and Asia, the dramatic drop in trade and domestic activity is leading to a collapse in working capital available to corporates.

Cross-border funding risks are somewhat less acute in Asia and Latin America, given that countries in these regions entered the crisis with generally stronger external balances, larger international reserves, and deeper local funding markets (see Table 1.1). Still, Asian and Latin American asset prices have fallen substantially over the past three quarters.

The Asian corporate sector looks likely to be hit hard by extremely large drops in trade volumes. Sharp drops in export revenues are leading some companies to burn through cash reserves rapidly, implying that financing needs will pick up. However, foreign financing is increasingly scarce. Hedge funds that had been a major source of capital for Asia's corporate expansion are now mostly trying to sell their largely illiquid assets, while foreign banks are deleveraging. Banks in Asia and Latin America are less impacted by the crisis than in emerging Europe, as they are mostly still well-capitalized and locally funded with low loan-to-deposit ratios, but are increasingly concerned about the quality of their loan books and are scaling back working capital financing to corporates.[10] A concern is that funding of bigger corporates will squeeze out small and medium-sized enterprises and new entrants.

The abrupt fall in trade volumes in recent months appears to have been worsened by the disruption in the provision of finance for working capital, including trade finance. The cost of trade finance has increased significantly and its modalities have changed, returning from open-account trade financing to more traditional structures (see Box 1.3).[11] Many exporters have restricted the credit they are willing to provide their customers as a result of reduced access to capital and heightened concerns about customer creditworthiness.[12] To address these concerns, the March 2009 G-20 summit committed up to $250 billion to support trade financing through export credit and investment agencies, and through multilateral development banks.

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[10]China, where banks have been expanding balance sheets vigorously in response to stimulus measures, serves as a notable exception.

[11]Open-account trade financing is when the shipment occurs before payment is received, so the transaction is effectively financed by the exporter.

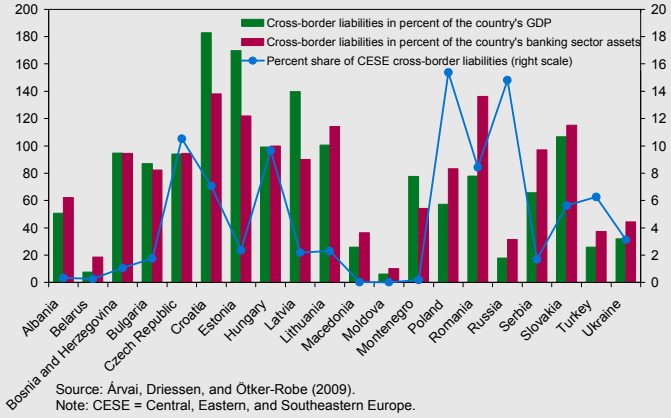
[12]Other exporters have been forced to give more generous trade credit terms to customers, such as a lengthening of payment terms. Whether exporters are tightening trade credit terms for customers or being forced to give them more generous terms may reflect which party has more bargaining power in any particular relationship. Either way, the net effect will be a reduction in the supply of such credit, since in the latter case, exporters will be repaid more slowly and may therefore have to restrict credit to other customers.

Box 1.2. Cross-Border Exposures and Financial Interlinkages within Europe

Financial interlinkages within Europe have grown markedly with the rise in foreign ownership of banking systems in central, eastern, and southeastern Europe (CESE). Foreign ownership has brought important benefits to the host countries, including advanced technology and risk management techniques, increased access to cross-border funding, and rapid financial deepening. It has also brought important benefits to home countries in terms of income generation. At the same time, the growing financial links have raised susceptibility to negative spillovers for the hosts, as well as for the home countries.

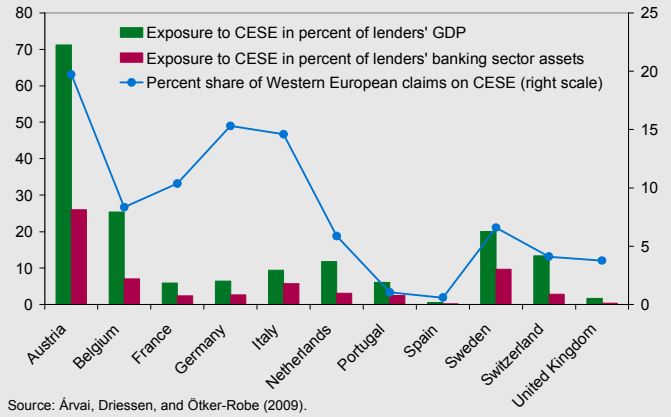
Bank for International Settlements data show the interlinkages are substantial. Most CESE countries are highly dependent on western European banks, either through direct borrowing by their private nonbank sectors or through local banks. Many countries use large amounts of cross-border funding, in relation both to their GDP and to the size of their banking system assets (see first figure). CESE countries' funding exposures are fairly concentrated, with Austria, Germany, and Italy accounting for the largest share of claims on the region (see table). The Baltics obtain their funding mainly from Sweden. Such concentration of funding sources makes a large number of CESE countries heavily exposed to potential adverse developments in parent banks.

Borrowers' Funding Exposure



Source: Árvai, Driessen, and Ötker-Robe (2009).
Note: CESE = Central, Eastern, and Southeastern Europe.

Lenders' Credit Exposure to CESE, end-2007



Source: Árvai, Driessen, and Ötker-Robe (2009).

Western European bank credit exposures to CESE are generally not large in terms of the size of their own economies, but there are important exceptions (see second figure). Austria has the largest exposure to CESE. The claims of its banks amount to over 70 percent of its GDP and 26 percent of its banking system assets. Belgian and Swedish bank exposures are also relatively high in terms of their GDP, though much less so in relation to banking system assets. Even where direct credit exposures are well diversified across the CESE region (e.g., in Austria) or economically negligible (e.g., France, Germany, and Italy), potential economic and financial spillovers within CESE and western Europe could increase the impact well beyond those direct exposures.

Cross-border exposures have important implications for regional contagion and the spillover of financial pressures to real economies:

- Financial shocks could be transmitted by the "common lender channel," in which a western European banking sector has a large exposure to a trigger CESE country while being an important source of credit for other countries in the region. A shock affecting the trigger country that pressures banks in the common lender country could thus spill over to other CESE countries.
- CESE banks that are subsidiaries of foreign parents and are heavily dependent on parent funding to support credit growth could face a sudden shortfall of, or costly access to, credit, if the parent bank withdraws its lending to the subsidiary, or charges a much higher interest rate on its funding. While the reputational risk to the parent and the damage to its long-term business plans make this unlikely, Western banks have been facing increasing balance sheet pressure to slow lending and liquidity provision abroad as funding conditions in home countries become more difficult.

Some straightforward conclusions are that:

- The greater the dependence of a CESE country on funds from a regional common lender, the higher is its exposure to problems triggered in the common lender's banks.
- The greater the dependence on a common lender, and the greater the latter's exposure to a trigger country, the higher is the possibility of spillovers.
- The risk of spillovers is highest when the common lender has activities substantially concentrated in the region (e.g., Austria). They are smaller when the common lender's exposure to the CESE is small in terms of its own economic size (e.g., Italy), since exposures to any potential trigger country's problems are economically too small to affect the funds available to others.

This analysis does not represent an assessment of the financial or macroeconomic vulnerability of individual countries. It only gauges a country's susceptibility to spillovers from problems in another country in the region, and helps identify the channels for such potential effects. The actual vulnerability of a country will depend on its macroeconomic fundamentals; the capitalization, liquidity, and general soundness of its banking systems and other key institutions; the maturity structure of its debt; and the nature of the regulations that affect financial relations between home and host institutions.

Note: This box was prepared by Inci Ötker-Robe, drawing heavily on Árvai, Driessen, and Ötker-Robe (2009).

Box 1.2 (concluded)

CESE Funding Exposure to Western Europe, December 2007

(In percent of each borrower's total cross-border liabilities)

Borrower \ Lender	Austria	Belgium	France	Germany	Italy	Netherlands	Portugal	Spain	Sweden	Switzerland	United Kingdom	Other	Total
Albania	46.6	0.0	9.8	0.5	20.1	0.1	...	...	...	0.1	0.1	22.8	100
Belarus	48.8	1.3	3.6	29.7	5.5	4.2	0.7	0.7	0.1	2.4	0.3	2.6	100
Bosnia and Herzegovina	49.9	0.1	0.1	22.5	25.7	0.7	...	0.0	0.0	0.3	0.0	0.5	100
Bulgaria	15.0	5.1	6.8	6.0	20.4	1.8	...	0.2	0.1	11.3	0.2	33.2	100
Cyprus	7.2	6.9	8.2	22.0	2.6	2.0	0.4	0.1	1.5	11.3	5.9	31.8	100
Czech Republic	29.7	24.3	18.2	5.8	9.9	3.6	0.1	0.4	0.1	0.5	...	7.4	100
Estonia	0.8	0.3	0.3	3.2	1.6	0.1	...	0.1	78.7	0.1	0.0	14.9	100
Croatia	36.4	0.4	8.2	19.4	32.5	0.2	0.0	0.0	0.0	0.2	0.6	2.1	100
Hungary	24.6	12.0	7.0	23.4	18.4	4.3	0.3	0.8	0.2	0.6	...	8.5	100
Latvia	1.9	0.0	0.6	10.4	2.9	0.0	0.0	0.1	58.6	0.1	0.5	24.9	100
Lithuania	0.9	0.2	0.8	8.6	1.7	0.2	0.1	0.0	64.4	0.4	0.1	22.4	100
Macedonia	6.9	0.3	0.2	5.4	1.4	0.2		0.2	...	0.6		84.7	100
Moldova	32.5	1.1	...	19.5	33.2	4.7	3.2	0.7	...	...	0.7	4.3	100
Montenegro	34.1	0.5	1.5	37.6	24.5	0.2	...	...	...	0.3	...	1.4	100
Poland	6.2	8.0	7.4	18.1	20.5	9.9	4.7	1.6	2.5	2.2	1.1	17.7	100
Romania	33.1	0.7	15.0	15.7	8.3	5.8	0.1	0.1	0.1	5.6	0.2	15.4	100
Russia	8.7	3.7	13.1	19.6	9.0	9.0	0.1	0.8	2.9	8.8	...	24.2	100
Serbia	36.3	0.2	5.8	12.8	19.5	0.0	...	0.0	0.0	5.7	0.1	19.5	100
Slovakia	36.1	15.3	5.8	4.7	23.6	5.8	0.0	0.1	0.1	0.1	...	8.4	100
Turkey	1.4	8.7	9.6	11.0	...	11.1	0.7	0.3	0.2	5.0	...	52.0	100
Ukraine	25.6	1.3	20.1	9.1	5.9	6.4	0.2	0.1	4.0	16.2	1.3	9.9	100
CESE	17.8	7.7	10.0	14.4	13.3	6.1	0.9	0.6	6.1	3.8	3.2	16.2	100

Source: Árvai, Driessen, and Ötker-Robe (2009).
Note: CESE = Central, Eastern, and Southeastern Europe.

Box 1.3. Effects of the Global Financial Crisis on Trade Finance: The Case of Sub-Saharan Africa

The global financial crisis has affected the cost, volumes, and modalities of trade finance. Reports from most regions indicate trade finance has become more expensive, volumes have been hit, and banks have moved away from funded open-account facilities, which had become most common in recent years, to more traditional forms of trade finance as counterparty risk rose rapidly. It has also become increasingly difficult to obtain trade finance insurance: trade insurers, like monolines, have had excessive amounts of troubled assets on their balance sheets, are now forced to deleverage, and, therefore, have cut back on their activities dramatically.

As elsewhere, trade finance in sub-Saharan Africa has become significantly more expensive, usually involves shorter maturities, and has contracted in scale, although in this stage of the global crisis declining volumes also reflect a drop in global demand. Spreads have reportedly increased from 100 to 150 bps to around 400 bps over LIBOR as country risk and counterparty concerns intensify, with much higher spreads reported in some cases.

Higher trade finance costs stem not only from higher spreads on borrowing and fees, but also from delays in payments and deliveries, foreign exchange shortages, and cash constraints. In *Nigeria*, importers are increasingly being asked by banks to pay in foreign exchange (obtained from the central bank against proof of imports) at the time when letters of credit are being opened, which pushes them to rely on more expensive funding in local currency and constrains their working cash balances. *Ghanaian* banks are charging more to facilitate import transactions (as are corresponding banks abroad) and see a significant shift toward the use of pre-paid letters of credit as foreign exchange shortages in the domestic market intensify. Alternatively, they charge for documentary collections (a fee-for-service option that does not bear a bank guarantee risk) and collateral management arrangements.

Trade finance has been increasingly routed through either the largest well-established local banks (with long-term relationships with correspondent international banks) or via local subsidiaries of international banks. International banks now often either do not roll over or cancel funded overdraft facilities without warning. The situation may be particularly difficult in some low-income countries, where even large domestic banks may have limited international reputation.[1] And disruption may intensify as the macroeconomic shocks unfold.[2] As a rule now, international banks do not confirm clients' letters of credit unless they are prepaid, or have cash or other tangible collateral. They focus on longstanding relationships with known large local banks and have stopped doing business with second-tier banks, which are forced to seek access to trade finance through first-tier competitors.[3]

Note: This box reports on discussions with banks, corporates, regulators, and government officials in a number of sub-Saharan countries, and was prepared by Effie Psalida.

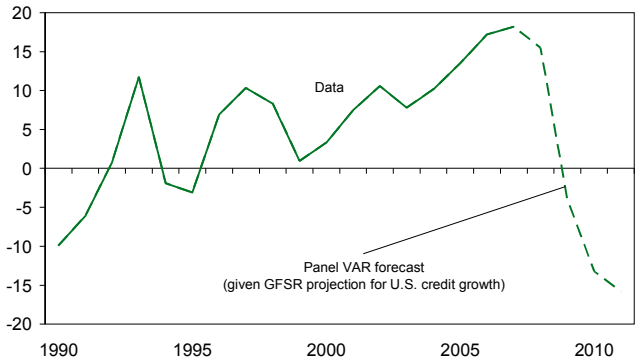
[1]International Finance Corporation staff have noted that even large domestic banks, with limited nostro balances to provide collateral, are encountering sizable difficulties in maintaining trade finance arrangements.

[2]Information on trade finance is normally proprietary between corporate customer and bank, between the two correspondent banks, or directly between corporates: data compilation is difficult and most evidence is anecdotal or impressionistic.

[3]A large South African bank, which intermediates much trade financing in sub-Saharan Africa, argues that foreign exchange is becoming harder to access in the region, that some larger banks have in recent months missed payment due dates, and that the bank itself is now extending trade credit in sub-Saharan Africa only on a case-by-case basis (evaluating both corporate and bank involved).

Credit growth in emerging markets is set to decelerate sharply as capital inflows come to a halt.

Figure 1.15. Emerging Market Real Credit Growth
(In percent year-on-year, average in panel)

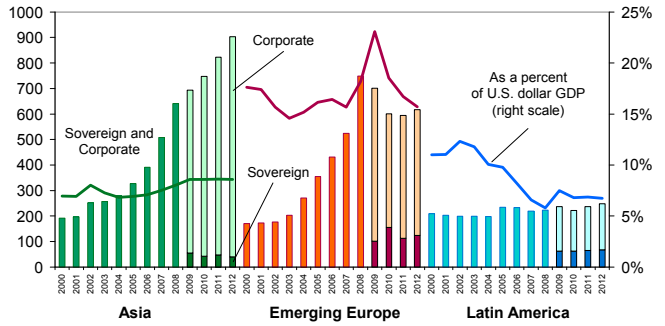


Sources: IMF, World Economic Outlook database; and IMF staff estimates.

The econometric analysis presented in Annex 1.2 indicates that emerging markets that have been relying on foreign inflows to finance credit booms could see real credit contract by as much as 15 percent a year over the next couple of years, which would be similar to the magnitudes seen in previous episodes of "sudden stops" in emerging markets (Figure 1.15). The global policy response under way, with increased resources to the IMF and other international financial institutions, will help mitigate the drop in credit growth in emerging markets. However, large credit contractions are still likely to materialize in some countries in emerging Europe. Credit growth is set to slow considerably also in Asia and Latin America over the coming years, as banks in these regions are increasingly reluctant to lend with deteriorating economic conditions and rising loan writedowns.

Emerging market corporates are vulnerable to financial distress, as they have high external debt refinancing needs...

Figure 1.16. External Debt Refinancing Needs
(In billions of U.S. dollars)



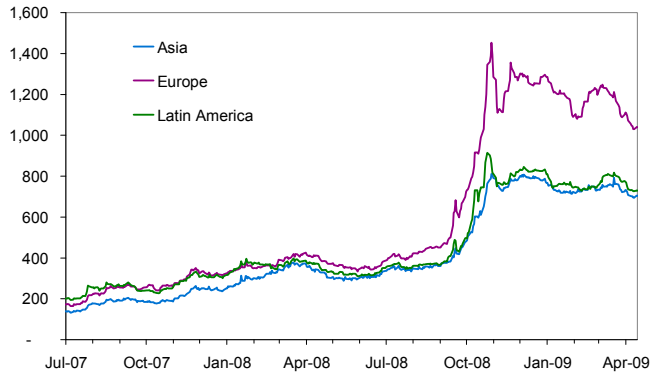
Sources: Bloomberg L.P.; IMF, International Financial Statistics database, World Economic Outlook database; and IMF staff estimates.
Note: Amortization of medium- and long-term debt on the year and short-term debt oustanding at the end of the previous year. Corporate debt includes financials.

Given the run-up in emerging market corporate external debt in recent years, a slowdown in financing will impair the ability of these corporates to meet their debt refinancing needs. IMF estimates suggest refinancing needs (calculated as short-term debt plus amortizations of medium- and long-term debt) faced by emerging markets will grow from an estimated $1.8 trillion in 2008 and in 2009 to $2.0 trillion by 2012 (Figure 1.16).[13] The bulk of the increase is projected to come from corporates (including financial institutions). The requirements of emerging Europe are large not only in absolute terms—estimated corporate refinancing needs in 2009 amount to $124 billion in Russia, $83 billion in Poland, and $62 billion in Turkey—but also in relation to official reserves, highlighting the region's vulnerability to a continued seizing up of capital flows to emerging markets (see Table 1.1). As a share of GDP in U.S. dollars, the estimated refinancing needs in 2009 amount to 9 percent in Asia, 23 percent in emerging Europe, and 8 percent in Latin America. Although substantial, corporate refinancing needs are less alarming in relation to official reserves and GDP in Asia and Latin America, and corporate debt spreads have not increased as dramatically as in emerging Europe (Figure 1.17).

[13]These figures include refinancing needs in the Middle East and Africa, which are not shown in Figure 1.15. The time profile through 2012 assumes that a sudden stop does not occur, with refinancing needs in each year including around $1 trillion of short-term liabilities such as trade credits, intercompany loans, and nonresident deposits.

Currency depreciations are exacerbating the refinancing risk for corporates with high external indebtedness. In addition, corporates in a number of countries (such as Brazil, Indonesia, Korea, Mexico, and Poland) have suffered significant losses on currency derivative strategies that they took in anticipation of continued appreciation of domestic currencies that have, in fact, since depreciated sharply.

Figure 1.17. Emerging Market Corporate Bond Spreads
(In basis points over treasuries)



Source: JPMorgan Chase & Co.

...that will be difficult to meet.

In light of the substantial challenges that emerging market corporates face, mature-market investment managers are loath to allocate resources toward the corporate debt market. Emerging market corporates had not yet become an established asset class prior to the crisis, with relatively few funds benchmarked to the main emerging market corporate indices. Now, most corporate bond funds have been suspended, with only a pool of fairly illiquid assets remaining under management. The overhang of illiquid assets, combined with the general retrenchment from emerging market assets, will make it difficult to regenerate an investor base for emerging market corporates that could underpin a revival of primary markets.

Domestic financing is not likely to be a sufficient substitute. In emerging Europe, corporate external refinancing needs for 2009 are especially large relative to the size of domestic credit markets. There are hardly any markets for domestic corporate bonds in emerging Europe, and external private refinancing needs amount to more than 50 percent of domestic bank credit to the private sector on average in the region. In Asia and Latin America, local funding may be able to mitigate the drop-off in foreign inflows to a greater extent, given that corporate external refinancing needs are in general smaller relative to domestic bank credit, and that local corporate bond markets are more developed than in emerging Europe.[14] However, small- and medium-sized corporates in Asia and Latin America are still likely to run into difficulties rolling over their debt.

Emerging market banks face mounting writedowns and require fresh equity as economic conditions deteriorate rapidly.

Table 1.2. Potential Writedowns and Capital Needs for Emerging Market Banks by Region
(In billions of dollars)

Region	Total Assets	Potential Writedowns	Potential Capital Buffer	Capital Needs
Asia (excluding China)	4,668	270	148	122
Europe/Middle East/Africa	3,959	345	203	142
of which: Eastern Euope	2,056	185	83	102
Latin America	2,957	181	144	37
Total	11,584	796	495	301

Source: IMF staff estimates.

Estimates of the potential scale of writedowns on loans and securities at emerging market banks have been rising sharply in recent months. Writedowns in emerging market banking systems (including in the subsidiaries of foreign parent banks), could reach $800 billion or around 7 percent of assets (Table 1.2). While some systems have large capital buffers that could absorb writedowns of this scale, many emerging market banks (particularly in emerging Europe) will require fresh capital, possibly totaling $300 billion.[15] Much of this will have to be financed by the official sector, as there is little prospect of a timely resurgence of

[14]External corporate refinancing needs are equivalent to about 10 percent of domestic bank credit to the private sector in China, India, and Brazil.

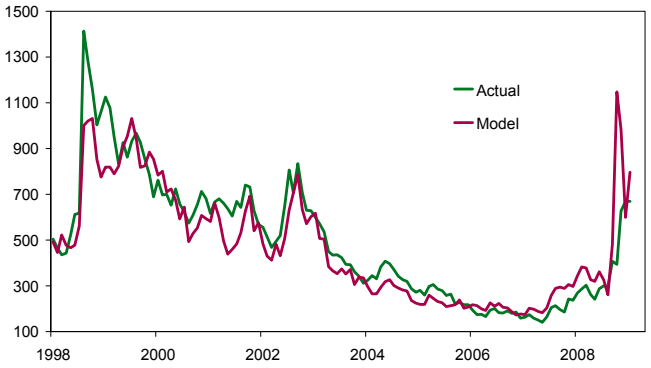
[15]These figures exclude China.

private investor interest in these institutions. But some governments will themselves be hard-pressed to provide capital to the banks operating in their countries, as their fiscal positions are stretched by the economic downturn and the need for stimulus spending. Foreign banks with subsidiaries in emerging market countries are facing mounting credit writedowns at home and will find it difficult to make up the capital shortfalls of their subsidiaries. Thus, it is likely that many emerging market banks will face challenges in repairing capital deficiencies.

Emerging market sovereigns will suffer spillovers from banking and corporate distress.

Concern about the consequences for public finances of stimulus plans and bailout packages is raising market premia for sovereign risk. Our sovereign bond spreads model indicates that emerging market spreads have risen as a result of continued stress in core mature financial markets and deteriorating emerging market fundamentals (Figure 1.18).[16] Given the likely length and depth of the credit crunch in core markets, there is a risk that spreads will remain elevated throughout 2009 and 2010. In addition, rating agencies have downgraded sovereign debt ratings or outlooks in many emerging European countries, attributed in part to the cost of financial support packages.

Figure 1.18. Aggregate Emerging Markets Bond Index Global Spread
(In basis points)



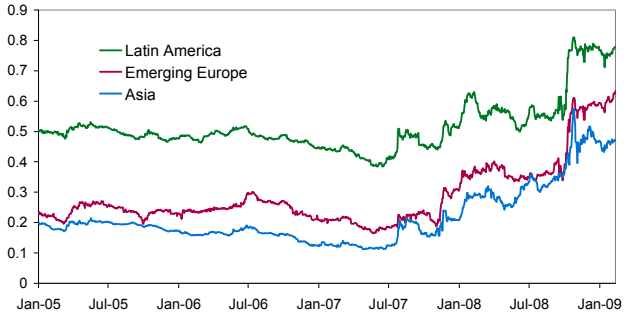
Sources: JPMorgan Chase & Co.; and IMF staff estimates.

Concerns about domestic banking conditions have also caused more volatile conditions for public sector debt, including some protracted interruptions in financing for emerging European sovereigns. Government issuers have had to shorten maturities as investors retreat from risk, increasing refinancing risks.

Hedging behavior has contributed another channel for spillovers from corporate and banking sector distress to sovereigns. In many cases, investors are hedging against risks on what are now illiquid holdings of emerging market corporate bonds by buying protection on sovereigns in CDS markets. This appears to have contributed to a rise in sovereign CDS spreads, above and beyond concerns about sovereign credit quality.

IMF analysis shows the extent to which CDS spreads have priced in concerns about spillovers to emerging market sovereigns from mature market banks (see Annex 1.3). Market estimates of risks for emerging market sovereigns and the mature market banks exposed to them increased in tandem up to September 2008. However, in the fourth quarter of last year, risks in emerging market sovereigns moved significantly higher than in mature market banks, as the latter received support from their own governments. The analysis shows that the

Figure 1.19. Distress Dependence between Emerging Market Sovereigns and Advanced Country Banks
(Average conditional probabilities for the region)



Source: IMF staff estimates.
Note: Probability of emerging market sovereign default in the event of default by a mature market bank exposed to the region.

[16]See Box 1.5 of the April 2006 GFSR for details about the model.

risk of distress for emerging market sovereigns in the case of default by a parent bank has increased substantially in recent months across all regions (Figure 1.19).

Emerging market sovereigns may also face spillover risks from increased mature market issuance of government and government-guaranteed debt, which may crowd out emerging market sovereign borrowers to some extent (see Section F).

Emerging economies face unique policy challenges given the scale of resources required.

Emerging economies have introduced a range of policies to deal with the challenges of global deleveraging and risk aversion, but the scale of interventions needed in markets and banking systems will likely strain already limited resources.

Like their mature market counterparts, emerging market central banks have expanded liquidity provision to their banking systems, often by reducing relatively high reserve and liquid asset requirements and reversing the direction of open market operations in order to inject, rather than absorb, liquidity. However, the effect has been limited given that domestic interbank markets were often not a significant source of bank funding.

Many countries have introduced or expanded deposit insurance schemes to shore up confidence in local banks. The capacity to provide a credible deposit insurance safety net has sometimes been limited, particularly where the deposit base was highly dollarized. Some countries with additional resources have been able to extend guarantees to other bank liabilities.

Central banks have addressed the collapse in cross-border bank funding by providing dollars to local banks through swaps or outright sales of foreign currency. A few have been able to arrange swap lines with advanced economy central banks. In some cases, countries have imposed capital controls or measures to limit conversion of domestic currency to foreign exchange.

Some countries have directly supported credit for the corporate sector, including trade finance. This has been particularly important where local banks, facing their own pressures to deleverage, have been hard pressed to substitute for the drop in foreign financing.

Meeting the challenges of financing shortfalls facing emerging markets will require a significant, coordinated response from the international community...

The international community will need to provide a large amount of resources and avoid measures that exacerbate existing deleveraging pressures on emerging markets. The decision by the G-20 to substantially increase the resources of the IMF and provide other forms of finance to emerging markets is an important step. The recent reforms of the IMF's lending facilities, introducing a Flexible Credit Line and streamlining conditionality, will provide support to emerging markets in the face of the global crisis (Box 1.4). However, additional short-term liquidity support from major advanced economy central banks to emerging market central banks may be needed on a case-by-case basis to address immediate refinancing pressures. This will be particularly important in emerging Europe, where major banks active in the region have rolled over existing funding, but may curb new funding.

Substantial longer-term resources would help emerging market countries shore up their financial systems, replenish reserves that are being rapidly depleted to finance measures to alleviate the crisis, and ease macroeconomic adjustment. In this context, the pledge of up to 24.5 billion euros in 2009 and 2010 by the European Bank for Reconstruction and Development, the European Investment Bank, and the World Bank to support banking sectors and bank lending to enterprises in emerging Europe, and the decision by the European Union to increase crisis support to noneuro members, mark welcome initiatives. With the passage of time, the provision of such support will increasingly need to be conditioned on the adoption of a broader set of corrective policies.

Box 1.4. Enhanced IMF Lending Capabilities and Implications for Emerging Markets

In response to the global credit crisis, the IMF overhauled its lending framework and expanded its resources.[1] *Reforms were aimed at bolstering contingent lending instruments for crisis prevention, facilitating larger and more frontloaded financing and further streamlining conditionality. Markets have responded favorably to the reforms. This box discusses the key elements of the reforms and their implications for emerging markets.*

In late March, the IMF overhauled its lending framework, with the intent of better tailoring IMF facilities to the varying needs of its member countries. This reform included the creation of the Flexible Credit Line (FCL), the modernization of conditionality, and the simplification of (nonconcessional) lending terms. To bolster the IMF's lending capacity, the G-20 group of leading economies agreed to triple the resources available to the IMF to $750 billion. These measures will provide reassurance that the IMF will have the tools and resources needed, in turn restoring confidence to emerging markets. In addition, the G-20 agreed to support a general allocation of the IMF's Special Drawing Rights (SDRs) equivalent to $250 billion which will boost global liquidity.

The FCL is geared toward making conditions for access to IMF resources more flexible for countries with very strong fundamentals and policies. The key design feature of the FCL is the reliance on an ex-ante screening process of qualification rather than the traditional ex-post program conditions.[2] The FCL is expected to perform a catalytic role by providing assurances to investors that resources would be available if needed and therefore helping ensure the country's continued access to international capital markets.

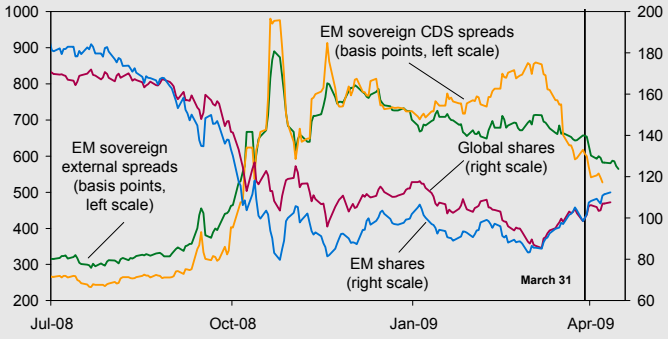
Other key elements of the overhaul of the IMF's lending toolkit included: increased flexibility of high-access precautionary Stand-by Arrangements to ensure all members have access to effective insurance instruments; streamlined conditionality by discontinuing the use of structural performance criteria; the elimination of seldom-used facilities; and the simplification of repayment terms of nonconcessional loans. The IMF is also working on an overhaul of its concessional lending facilities.

To meet the additional demand for capital, the G-20 pledged up to $1.1 trillion, including (i) commitment to immediately increase bilateral financing to the IMF from members by $250 billion, subsequently incorporated into an expanded and more flexible New Arrangements to Borrow, increased by up to $500 billion; [3] (ii) a $250 billion equivalent increase in SDRS to supplement existing official reserves of member countries;[4] (iii) $100 billion in additional funds provided by multilateral development banks; and (iv) $250 billion in trade credit provided by the World Bank and national export credit agencies.

The overhaul of the IMF's lending toolkit and the expansion of international financial institutions' resources are key elements of the global policy response, and its stabilizing effect has already been evidenced. By increasing access to external financing at favorable terms, risks of heightened balance of payment pressures have been reduced. To date, FCL arrangements have been approved for Mexico (with access of $47 billion or 1,000 percent of quota) and Poland ($20.5 billion or 1000 percent of quota). Since the approval of the IMF's reforms, external credit and credit default swap spreads on emerging market sovereigns have tightened about 80 basis points, while comparable corporate credit spreads have tightened 40 basis points, though both remain near mid-October 2008 levels (see first figure). Emerging market shares rebounded, outperforming mature market stocks. Cross-currency swaps also narrowed in several countries, reflecting an easing in foreign currency funding constraints. Emerging European assets—where refinancing concerns are most acute—especially benefited (see second figure). Default probabilities receded, while currency, equity, and debt markets outperformed assets in other regions. Economies outside the region that applied for

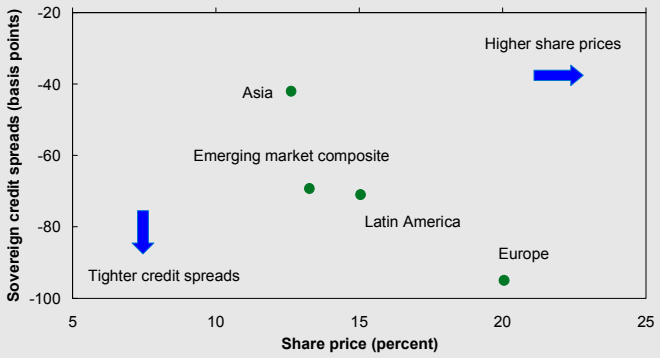
FCL funding or were perceived as benefiting from potentially higher access to official financing experienced gains across a range of core local assets. Several sovereign and quasi-sovereign borrowers have taken advantage of the improving financing environment to issue debt, while others are planning new issues. Nonetheless, risk appetite remains lukewarm—as demonstrated by still tepid flows into emerging market assets—and funding and credit markets remain severely strained.

Sovereign Risk Premia and Share Prices



Sources: Bloomberg L.P.; JPMorgan Chase & Co.; and Morgan Stanley Capital International.
Note: Share prices represent MSCI indices in dollar terms, March 31, 2009=100. CDS = credit default swaps; EM = emerging markets.

Emerging Market Regional Asset Performance
(Change March 31-April 10)



Source: JPMorgan Chase & Co.; Morgan Stanley Capital International; and IMF staff estimates.

Note: The main author of this box is Rebecca McCaughrin.

[1]See detailed material on the reforms at www.imf.org/external/np/sec/pn/2009/pn0940.htm.

[2]The qualification criteria include: a sustainable external position, a capital account position dominated by private flows, a track record of sovereign access to international capital markets at favorable terms, a relatively comfortable reserve position, sound public finances, low and stable inflation, a solvent banking system, effective financial sector supervision, and data transparency and integrity.

[3]Bilateral credit lines have already been committed by Japan ($100 billion), Europe ($100 billion), Norway ($4.5 billion), Canada ($10 billion), and Switzerland ($10 billion).

[4]The G-20 supported SDR allocation would raise the stock of SDRs nearly nine-fold to $282 billion at current exchange rates. Given that allocations are proportional to quotas, emerging markets will receive about $80 billion, which will directly augment their reserves, and which can be exchanged for reserve currencies.

...and from national policymakers. Policies for Europe will have to take into account the particular importance of cooperation given the especially close linkages between mature and emerging Europe.

Given the speed and intensity of the crisis, policy actions have at times not been sufficiently coordinated either globally, or between mature and emerging countries within regions. The various channels for spillovers in both directions imply that systemic and comprehensive approaches are needed. Indeed, one of the important lessons that policymakers, including those at the IMF, drew from the Asian crisis is the dangers inherent in pursuing a one-country-at-a-time approach, although policies should also take care to recognize relevant differences between countries.

Financial support measures for parent banks in mature markets should take into account the risk of introducing home bias that may stifle the timely resumption of banking inflows to emerging markets. Similarly, advanced country bank deposit guarantees may have caused deposit outflows from emerging market banks where local authorities do not have sufficient resources to match the mature market guarantees. These problems may be especially acute in emerging Europe, where links between mature parent banks and emerging market subsidiaries are particularly strong. International financial support packages to emerging market countries may need to include elements that can offset such effects by providing financing for policy measures that can support continued capital inflows and funding of local banks by the private sector.

Joint action should be taken to clean up bank balance sheets and ensure that banking groups are addressed in a coherent and durable manner. Regional stress tests involving both parent and subsidiaries could help establish the level of impairment to assets and capital needs.

The absence of clear rules for cross-border crisis management and burden-sharing raises uncertainty about the costs the host country will bear, including the recapitalization needs of foreign-owned subsidiaries. There is also a need for clear rules on cross-border crisis prevention and mechanisms for the unwinding of public policy intervention. In the longer term, more harmonized prudential regulations and supervisory practices may enhance the effectiveness of supervision and regulation of cross-border banks, and reduce regulatory arbitrage. Joint supervisory analysis and inspections of systemically important banks should take into consideration the interconnectedness of risks and test for spillover risks that amplify the overall risk exposures of banks active in the region.[17]

Policymakers should also prepare for corporate and household distress, which will imply a need to plan for orderly debt restructurings in some cases.

Steps also need to be taken to prepare for wide-ranging corporate and household balance sheet stress. Some combination of public sector support and targeted corporate restructuring will likely be necessary in many countries.[18] In countries such as Kazakhstan, Russia, and Ukraine, the systemic importance of some of the corporates and the size of their funding gaps suggest the need for a comprehensive approach that would help ensure that any large-scale restructurings take place in an orderly manner, including with consensual private sector involvement. There will likely be a need for national authorities to coordinate on debt restructuring, given the importance of cross-border exposures.

Household debt restructuring may be necessary where households took on foreign-exchange denominated liabilities, notably mortgages. In such cases, the authorities will need to assess whether the problem is large enough to require a generalized solution. Government-sponsored debt relief programs, perhaps with some form of risk- or loss-sharing between the government and banks (and possibly combined with bank recapitalization), may be needed to reduce the costs to the economy of

[17]See Chapter 2 for methods to measure interconnectedness of risks and systemic linkages.

[18]Annex 1.4 outlines principles involved in such restructuring drawn from country crisis experience.

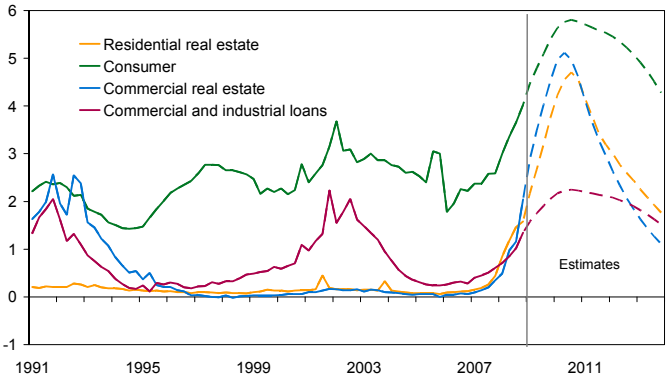
widespread defaults, including costs associated with mortgage foreclosures, which could add further downward pressure on house prices and widen the problem.[19]

D. The Deteriorating Outlook for Household and Corporate Defaults in Mature Markets and Implications for the Financial System

Real estate, consumer, and corporate cycles have turned in a global synchronized fashion...

Credit cycles have turned sharply across asset classes and geographical areas, with the deterioration moving to higher-rated corporate credits and other assets that had previously escaped the worst of the problems. Previous GFSRs have documented the rise in delinquencies across a range of credit markets and provided scenarios for projected charge-off rates on credit. An update of that analysis using the latest *World Economic Outlook* forecasts of a deeper and more protracted recession, larger declines in house prices, and a longer period of tight lending conditions (Figure 1.20) results in a higher projected rate of credit deterioration compared to the last GFSR.[20]

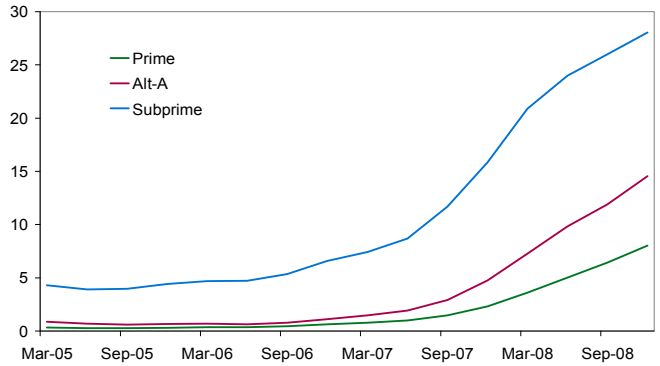
Figure 1.20. U.S. Loan Charge-Off Rates: Baseline
(In percent)



Sources: Federal Reserve; and IMF staff estimates.

Residential mortgage credit performance has continued to weaken in the United States and in Europe. Home prices in major advanced economies have already fallen roughly 10 percent from their peaks on average, with the sharpest declines in the United States (27 percent) and the United Kingdom (21 percent). Futures markets are pointing to substantial further declines. In the United States, delinquency and foreclosure rates have continued to rise on both prime and nonprime loans (Figure 1.21) and

Figure 1.21. Delinquency Rates on U.S. Residential Mortgage Loans
(In percent of total loans, 90+ days)



Source: Bloomberg L.P.

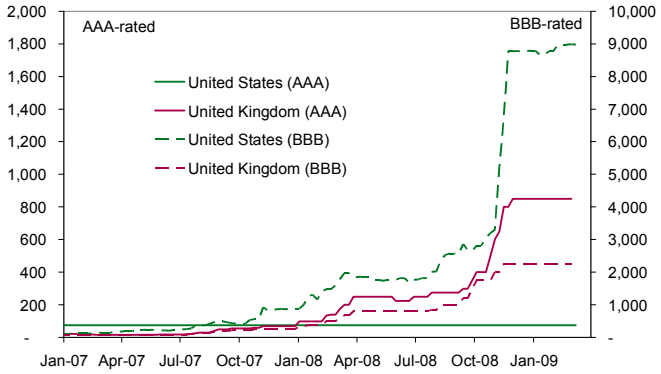
[19]Such programs could include some elements of principal reduction, lowering of interest rates, or extension of loan terms. In some cases, it could include redenomination of mortgages into domestic currency loans, though consideration would then need to be given to the impact of what are likely to be higher domestic interest rates on the debtor's ability to pay. Bank regulators may also need to give consideration to special provisioning treatment for restructured loans.

[20]Under our baseline case, where U.S. GDP bottoms out at –3.3 percent year-on-year in 2009:Q3, lending conditions cease tightening around the end of 2010, and home prices fall a further 18 percent from now until end-2010, charge-off rates on U.S. residential real estate loans peak at roughly 4.7 percent, consumer and commercial real estate loans at 5.3 percent, consumer loans at 5.8 percent, and commercial and industrial loans at 2.2 percent. Under an adverse (deflationary) scenario, where GDP bottoms out at –6.5 percent in 2010, normalization of lending conditions is postponed by 1.5 years, home prices drop by an additional 35 percent by 2012, and charge-off rates on residential real estate loans peak at roughly 9 percent, commercial real estate loans at 11 percent, consumer loans at 7.5 percent, and commercial and industrial loans at 3 percent.

foreclosure moratoriums and other work-out efforts have failed to reverse the deterioration. In some cases, public interventions, including large-scale purchases of mortgage-backed securities (MBS), have helped reduce primary and secondary mortgage rates and contain or narrow spreads.[21] Nevertheless, issuance of MBS has continued to decline, with U.S. and European originations down 40 percent year-to-date from already depressed levels during the same period last year.[22]

Commercial mortgages are following the same pattern as residential mortgages. Until recently, the outlook for commercial mortgages had appeared slightly brighter, as occupancy rates remained high, and contractual arrangements looked more robust. However, this apparent resilience has disappeared—commercial real estate prices have already dropped 21 percent since the peak in the United States, 35 percent in the United Kingdom, and are starting to edge lower elsewhere in Europe. Commercial real estate loan performance has begun to deteriorate in the United States and the United Kingdom. Delinquencies have started to rise, and will doubtless accelerate as the economic cycle deteriorates further. U.S., U.K., and euro area commercial mortgage-backed security (CMBS) spreads have widened on average over 3,000 basis points, 575 basis points, and 575 basis points, respectively, since the last GFSR, though with significant differentiation across the capital structure (Figure 1.22). The supply of commercial mortgages remains weak, with interest rates high. U.S. and European CMBS securitizations both collapsed 90 percent last year, and have been nearly nonexistent so far this year.[23]

Figure 1.22. Spreads on Commercial Mortgage-Backed Securities
(In basis points, 10-year tenor, spread to government securities)



Sources: JPMorgan Chase & Co.; and Morgan Stanley.

...taking a toll on balance sheets.

Economic stress is also putting pressure on household balance sheets and debt servicing, in turn triggering deterioration in consumer credit markets. At the start of the crisis, U.S. households borrowed more heavily on credit cards and other forms of consumer credit as other credit channels began to close. That trend has since ceased, and consumer credit in Europe has also started to contract, as the financial condition of consumers has weakened sharply. This is illustrated by rising delinquencies, bankruptcies, and charge-off rates, while spreads have widened across most consumer

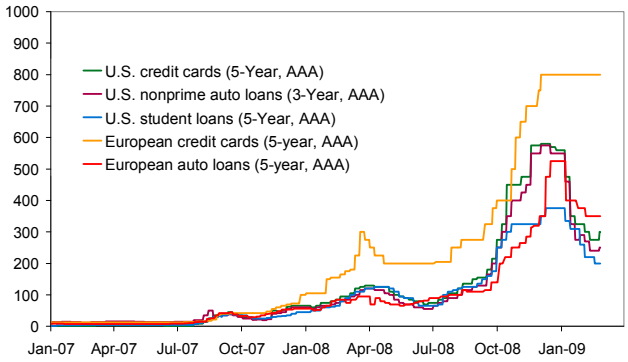
[21]For instance, U.S. 30-year conforming MBS spreads have narrowed roughly 100 basis points since the peak.

[22]For prime mortgages, rates have fallen and credit terms have eased, so lower issuance reflects either lower demand (e.g., consumers are unwilling or unable to refinance or take out new mortgages) or rationed lending. In the nonprime segment, rates have edged up, and securitization markets are still closed, suggesting that supply may still be the constraining factor. In both cases, longer loan processing, credit verification, and home appraisal times may be slowing the translation of mortgage applications into loans.

[23]In part, this reflects difficulties hedging loans. The CMBX, an index of credit defaults swaps linked to CMBS and commonly used as a hedging instrument, remains volatile and continues to diverge from the cash market. This makes it difficult to hedge prior to the execution of CMBS deals. In the United Kingdom, banks are reluctant to lend, as they are still digesting earlier heavy lending to property companies that are now experiencing severe difficulties. Moreover, with the drop-off in consumer demand, a number of retailers and manufacturers are under pressure, with banks frequently holding commercial real estate collateral against the credits.

credit sectors since the last GFSR (Figure 1.23).[24] Rates remain high and securitization anemic, suggesting that supply-side constraints predominate.[25] Since the peak, U.S. nonmortgage ABS issuance has fallen by more than 80 percent. European issuance, meanwhile, has continued to be supported by retained securitizations.[26] In some countries, public programs are offering alternative funding sources, access to liquidity, and favorable capital treatment, but these have yet to revive securitization volumes.

Figure 1.23. Spreads on Consumer Credit Asset-Backed Securities
(In basis points, spread to swaps)



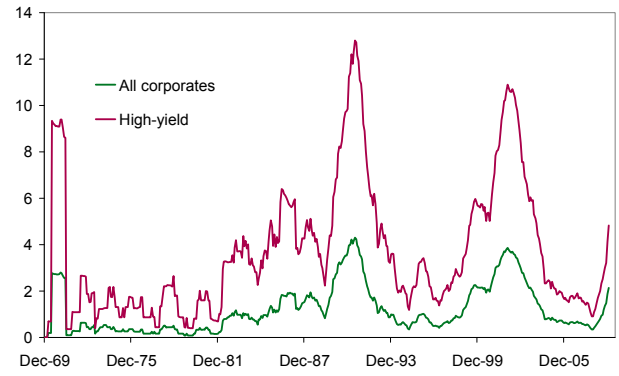
Sources: JPMorgan & Co.; Morgan Stanley; and Markit.

The corporate credit cycle is turning.

Nonfinancial corporates entered the crisis with strong liquidity positions, relatively low leverage, and generally sound balance sheets. However, corporate credit quality has deteriorated rapidly amid the weakening economic backdrop, tight lending conditions, and increased funding costs. Leading indicators, such as purchasing manager indices and new industrial orders, suggest the outlook for corporate cash flows is grim, and corporate bankruptcies are set to rise. Bankruptcy filings are rising in the United States and the United Kingdom, and conditions for debtor-in-possession (DIP) financing have tightened sharply.[27]

Globally, corporate default rates have risen to 2.1 percent (and 4.8 percent on high-yield debt, in particular), and are set to rise further (Figure 1.24).[28] Various forward-looking credit indicators, such as downgrade-to-upgrade ratios, the proportion of borrowers on negative outlook, the proportion of lower-grade, high-yield issuers, and the share of distressed-priced debt, have increased dramatically in recent months. In

Figure 1.24. Global Corporate Default Rates
(In percent)



Source: Moody's.

[24] There has been some retracement since the announcement of the Federal Reserve's Term Asset-Backed Securities Loan Facility (TALF) program, which provides financing on a non-recourse basis to holders of high-rated ABS backed by newly and recently originated loans. Highly-rated CMBS, which are also eligible under the program, have seen a similar improvement.

[25] Falling volumes of credit with lower interest rates suggest lower demand is the main driver (a leftward shift of the *demand* curve), but lower volumes with *higher* interest rates (as here) suggests credit supply is the driver (a leftward shift of the *supply* curve). It is the latter that we characterize as a credit crunch.

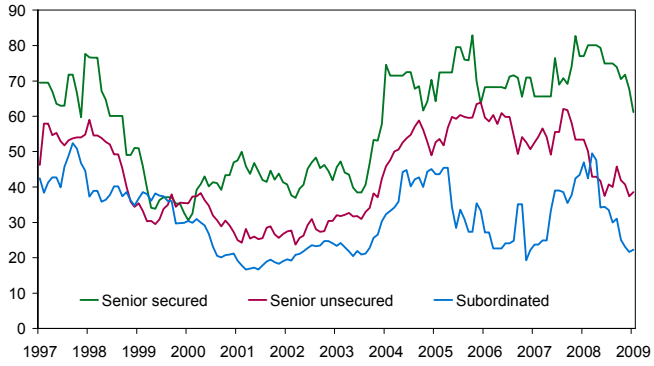
[26] Retained securitizations refers to securitizations that are generated because they are eligible as collateral for obtaining liquidity from the central bank.

[27] DIP financing is used by companies to cover their operating expenses during a restructuring process.

[28] Private sector forecasts project U.S. speculative default rates will exceed levels seen in past recessions.

addition, borrowers are breaching covenants in their loans more frequently, and recovery rates on defaulted bonds continue to slide (Figure 1.25).

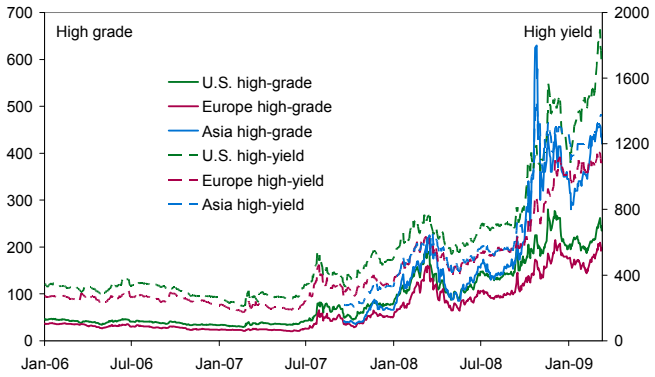
Figure 1.25. Average Recovery Rates on Defaulted U.S. Bonds
(In percent, trailing twelve months)



Source: Moody's.

As bank credit remains tight, corporates have been forced to turn to capital markets as an alternative, but at higher costs. Global corporate bond markets have seen a flurry of activity since the beginning of the year—nonfinancial corporate issuance has risen 68 percent year-to-date relative to the same period in 2008. Activity has favored large, liquid, high-quality borrowers in sectors considered less vulnerable to the recession, and has been mostly geared toward refinancing existing debt.[29] New deals have been issued at considerably higher spreads than a year ago as investors have been worried about a deterioration in credit quality and possible future crowding out by sovereign and government-guaranteed debt. Corporates—even high-quality issuers—have been willing to pay punitive rates in order to replace bank financing or to hoard cash. Many still have untapped prenegotiated credit lines, but have preferred to keep those as a back-up in case bank lending remains scarce (and to improve their negotiating position vis-à-vis banks).

Figure 1.26. Corporate Credit Default Swap Spreads
(In basis points)



Source: JPMorgan Chase & Co.

In secondary markets, a large share of global corporate debt is now trading at distressed levels (Figure 1.26). Some 70 percent of the high-yield market and 12 percent of high-grade debt is currently trading at spreads above 1,000 basis points. At such elevated spreads, the cost of funding exceeds many borrowers' hurdle rate or return on capital, threatening their viability. The rise in spreads has surprised many observers. Box 1.5, which seeks to disentangle the factors driving spreads, finds that the increase is being driven not just by worsening corporate profitability expectations and economic uncertainty, but also by financing constraints. Indeed, the analysis shows that financing constraints (as measured by total liabilities of issuers and London Interbank Offered Rate (LIBOR)-overnight index swap (OIS) spreads) have been the single greatest contributor to the widening in investment-grade spreads, particularly during the most recent period. This makes the repair of funding markets imperative to help avert an even deeper recession (see Section E).[30]

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[29]The spike in activity, in part, reflects a backlog of deals from late last year, but also may represent opportunistic capital-raising to frontload 2009 financing needs as issuers take advantage of better liquidity conditions rather than wait to refinance closer to redemption dates.

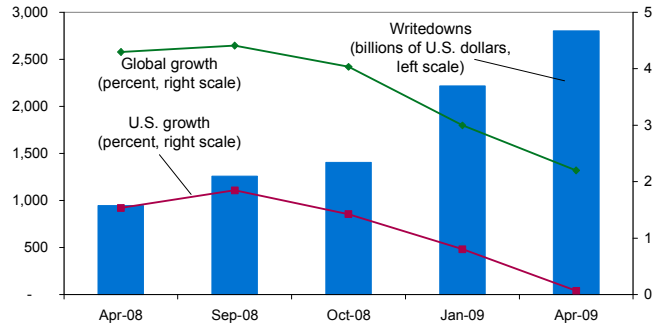
[30]Box 1.5 provides a rule of thumb that narrowing LIBOR-OIS spreads by half a percent reduces the cost of borrowing for U.S. investment-grade firms by a full percentage point.

Even though corporate debt outstanding is not unusually high by historical standards, refinancing that debt as it matures may yet pose serious challenges if spreads remain wide.[31] Cash flows at large U.S. and European companies are still generally ample to cover their interest payments, but this is less true for lower-quality and smaller corporates. High-yield borrowers are expected to need to refinance nearly 50 percent more debt this year than last year, and financing pressures will increase in 2011 and beyond as substantial amounts of debt issued during the leveraged buyout boom of 2005–07 matures.

Credit deterioration is feeding back to higher writedowns across all sectors.

As a result of continued pressures in credit markets, global financial institutions and other holders could face larger potential writedowns, according to our estimates (Table 1.3). Looking at the range of assets originated in the United States over the same cumulative period (2007–10) as in prior GFSRs, expected writedowns have risen to some $2.7 trillion, up from the $2.2 trillion estimated at our interim update in January 2009, and from the $1.4 trillion estimated in October 2008.[32] The rise represents the credit deterioration that the worsening economic cycle is creating (Figure 1.27). Considering a much wider set of outstanding loans and securities to include European-originated loans and related securities as well as Japanese-originated assets (totaling some $58 trillion compared to earlier estimates based on $27 trillion of U.S. originated loans and securities) provides a broader, albeit more uncertain, assessment of potential writedowns of some $4.1 trillion.[33] While banks are expected to bear about two-thirds of the writedowns, other financial institutions including pension funds and insurance companies also have significant credit exposures.[34] Among other market participants, hedge funds have suffered losses related to both mark-to-market declines and forced asset liquidations due to redemptions.

Figure 1.27. Estimates of Economic Growth and Financial Sector Writedowns



Source: IMF, *Global Financial Stability Report, World Economic Outlook,* various issues. Estimates of potential writedowns for 2007-2010 on U.S. originated assets as reported in the GFSR and GFSR quarterly updates. GDP growth (year-on-year) is average for 2007-2010.

[31]Corporate debt-to-GDP ratios in the United States, United Kingdom, and Japan are below or only slightly above historical peaks, whereas financial sector and household leverage ratios are well above record levels.

[32]Higher losses on U.S.-originated assets than in previous estimates reflect higher assumed charge-off rates, as loan performance has deteriorated faster than previously expected, and higher market-implied losses on CMBS, consumer ABS, and to a lesser extent, lower-quality residential MBS.

[33] For further details on the methodology for deriving loss estimates, see Annex 1.5.

[34]U.S. pension funds alone may incur writedowns of at least $200 billion on their credit exposures, over and above their equity valuation losses.

Table 1.3. Estimates of Financial Sector Potential Writedowns (2007-2010) as of April 2009

(In billions of U.S. dollars)

		Estimated Writedowns					
	Outstanding	October 2008 GFSR	April 2009 GFSR	Banks[1]	Insurers	Other[2]	Implied Cumulative Loss Rate (Percent)
United States							
Loans							
Residential mortgage	5,117	170	431	206	22	204	8.4
Commercial mortgage	1,913	90	187	116	9	62	9.8
Consumer	1,914	45	272	169	14	89	14.2
Corporate	1,895	120	98	61	5	32	5.2
Municipal	2,669	...	80	50	4	26	3.0
Total for loans	13,507	425	1,068	601	53	414	7.9
Securities							
Residential mortgage	6,940	580	990	604	99	287	14.3
Commercial mortgage	640	160	223	136	22	65	34.8
Consumer	677	...	96	59	10	28	14.2
Corporate	4,790	240	335	204	33	97	7.0
Total for securities	13,047	980	1,644	1,002	164	477	12.6
Total for loans and securities	26,554	1,405	2,712	1,604	218	890	10.2
Europe[3]							
Loans							
Residential mortgage	4,632	...	192	119	10	63	4.1
Commercial mortgage	2,137	...	105	65	5	34	4.9
Consumer	2,467	...	175	109	9	58	7.1
Corporate	11,523	...	416	258	21	137	3.6
Total for loans	20,759	...	888	551	44	292	4.3
Securities							
Residential mortgage	1,390	...	195	119	19	56	14.0
Commercial mortgage	181	...	31	19	3	9	17.4
Consumer	250	...	18	11	2	5	7.1
Corporate	1,227	...	61	37	6	18	5.0
Total for securities	3,048	...	305	186	31	89	10.0
Total for loans and securities	23,807	...	1,193	737	75	381	5.0
Japan							
Loans							
Consumer loans	3,230	...	65	58	3	3	2.0
Corporate loans	3,339	...	67	60	3	3	2.0
Total for loans	6,569	...	131	118	7	7	2.0
Securities							
Corporate debt	789	...	17	11	2	5	2.2
Total for loans and securities	7,358	...	149	129	8	12	2.0
Total for all loans	40,835	...	2,087	1,271	104	712	5.1
Total for all securities	16,884	...	1,966	1,199	197	570	11.6
Total for all loans and securities	57,719	...	4,054	2,470	301	1,283	7.0
Expected writedowns of mature market banks on emerging market assets	...	...	...	340	...	...	...
Total potential writedowns for mature market banks	...	...	...	2,810	...	...	...

Sources: Bank for International Settlements; European Securization Forum; Federal Reserve, *Flow of Funds* (Q3 2008); national central banks; and IMF staff estimates.

[1]Mainly banks in advanced economies.

[2]Included in this category are estimated losses for U.S. GSEs of approximately $250 billion, as well as expected writedowns for hedge funds, pensions, and other non-bank financial institutions.

[3]Europe includes Euro area and the United Kingdom.

Note: See Annex 1.5 for details on writedown estimation methodology.

Box 1.5. Modeling Corporate Bond Spreads: A Capital Flows Framework

This box seeks to explain the widening in U.S. investment-grade corporate bond spreads, based on a combination of business cycle variables, volatility, and financial strains in the corporate, banking, other financial, and household sectors. The analysis suggests that financing constraints have played a pronounced role in driving spreads wider during the current period. As such, alleviating the pressures on funding markets is critical to improving the cost of financing for corporates. A 50 basis point reduction in the London Interbank Offered Rate (LIBOR)-overnight index swap (OIS) spread would translate into a roughly 100 basis point decline in corporate spreads.

List of Variables

Type of Issuer/Holder	Type of Activity		
	Operating	Investing	Financing
Bond issuers			
Nonfinancial corporates	CapU (IP)	GDP, VIX	TL, EQ
Commercial banks	CH	GDP, VIX	TL, EQ, LOS(CDOR)
ABS issuers	ABS		
Bond holders			
Households	UR	GDP, VIX	HP
Commercial banks	CH	DR, VIX	TL, EQ, LOS(CDOR)
LIC and mutual funds	EQ	DR, VIX	FL

CapU = capacity utilization rate (%); IP = industrial production, yearly growth (%); CH = charge-off rate for bank loans (%); ABS = the ABS spread (bps); UR = unemployment rate (%); EQ = equity prices, yearly growth (%); GDP = gross domestic product, yearly growth (%); VIX = the implied CBOE volatility index VIX (%); DR = the corporate default rate (%); TL = total liabilities of bond issuers, yearly growth (%); LOS = the Libor-OIS spread (bps); CDOR(t) is the spread between the 1-month commercial deposit and the fed funds rate (bps) ; HP = residential house prices, yearly growth (%); FL = mutual funds' net flows, % of total assets.

This study attempts to model corporate bond spreads based on a cash-flows approach to explain the underlying key drivers. The equilibrium spreads are ultimately determined by cash flows or internal funds available to bond issuers and bond buyers. The study identifies factors affecting the cash flows from operating, investing, and financing activities across the major classes of bond issuers and bond holders. The drivers are intended to represent expected profitability, uncertainty, and liquidity constraints. The model displays linkages among financial strains in major sectors of the economy, asset returns, financial and economic risks, macroeconomic activity, and losses in the system.

Previous studies of corporate spreads have found it difficult to explain the sharp increase in spreads during the recent crisis. The conventional approach is to regress spreads on a broad range of macroeconomic and financial variables. Large residuals arising from these models are attributed to an unexplained component driven by illiquidity premia. In this study, spreads are modeled by explicitly accounting for illiquidity premia and funding strains.

The Capital Flows Approach

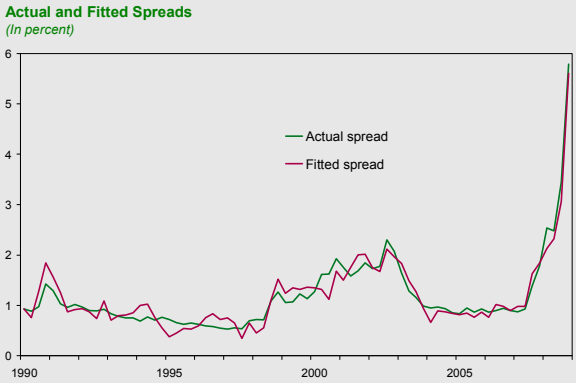
The analysis first introduces a new framework based on net cash flows for bond issuers and bond holders. Corporate spreads are modeled based on the supply-demand equilibrium conditions.

Three crucial sectors are identified from the supply side: nonfinancial corporates, commercial banks, and asset-backed securities (ABS) issuers, which are responsible for 33 percent, 7 percent, and 33 percent, respectively, of all corporate bond liabilities in the United States. The demand side is represented by households, commercial banks, life insurance companies, and mutual funds, which hold 16 percent, 8 percent, 17 percent, and 9 percent, respectively, of all corporate bonds.

The study models corporate spreads based on cash flows. Cash flows define the willingness of suppliers to issue bonds, and buyers to purchase bonds, and are generated and dispersed by three types of activities: operating, investing, and financing. For any given set of economic and financial conditions, each type of activity contributes to the decision of a supplier to sell, or a buyer to purchase, a bond, thus helping to determine the equilibrium price (spread over the risk-free rate).

For each sector and by type of activity, the study identifies the factors driving cash flows (see table). *Operating* cash flows are affected by either indicators of revenue, such as industrial production growth, or failure or loss rates, such as charge-offs for bank loans (see first figure). Cash flows from *investing* activities of bond issuers are driven by expected profitability proxied by GDP but hampered

Box 1.5 (continued)



by uncertainty represented by the VIX. Cash flows from *financing* activities are affected by refinancing needs, represented by leverage, and cost of capital and funding, such as the cost of equity for corporates and the LIBOR-OIS spreads for banks. Variables that are highly correlated with others, such as personal income which is closely related to GDP, are omitted.

Estimation

A separate model is developed for each of the three types of cash flows, each of which provides a good fit. The estimation is carried out over 1990–2008, with a quarterly frequency.

Operating cash-flows model:

$$S(t) = \underset{}{6.028} \underset{5.4}{-0.282*D(t)} \underset{-2.7}{-0.060*CapU(t)} \underset{-4.3}{-0.013*EQ(t)} \underset{-4.6}{+0.005*D(t)*ABS(t)}, \quad (1)$$

where $S(t)$ is the U.S. investment-grade corporate spread (in percent), $D(t)$ is the dummy 0,1 to identify the period when ABS spreads become available (in 2006:Q1).

Investing cash-flows model:

$$S(t) = \underset{}{0.352} \underset{2.2}{-0.116*GDP(t)} \underset{-4.1}{-0.119*D1(t)*GDP(t)} \underset{-2.4}{+0.051*VIX(t)} \underset{7.2}{+0.040*D1(t)*VIX(t)}, \quad (2)$$

where $D1(t)$ is the dummy 0,1 to characterize the increased sensitivity of spreads to fundamentals during the last cycle (six years).

Financing cash-flows model:

$$S(t) = \underset{}{0.982} \underset{11.3}{+0.028*TL(t)} \underset{3.1}{-0.022*EQ(t)} \underset{-8.7}{+0.018*D2(t)*LOS(t)} \underset{14.4}{-0.034*D2(t)*FL(t)}, \quad (3)$$

Combined model:

Bringing these together gives the following combined cash-flows model which incorporates business cycle variables, a measure of volatility, equity prices, and indicators of financing constraints:

$$S(t) = \underset{t}{7.999} \underset{6.3}{-0.094*CapU(t)} \underset{-5.9}{+0.035*VIX(t)} \underset{8.2}{-0.014*EQ(t)} \underset{-5.9}{+0.043*TL(t)} \underset{4.5}{+0.617*CDOR(t)} \underset{4.5}{-0.028*HP(t)} \underset{-6.0}{-0.042*FL(t)} \quad (4)$$

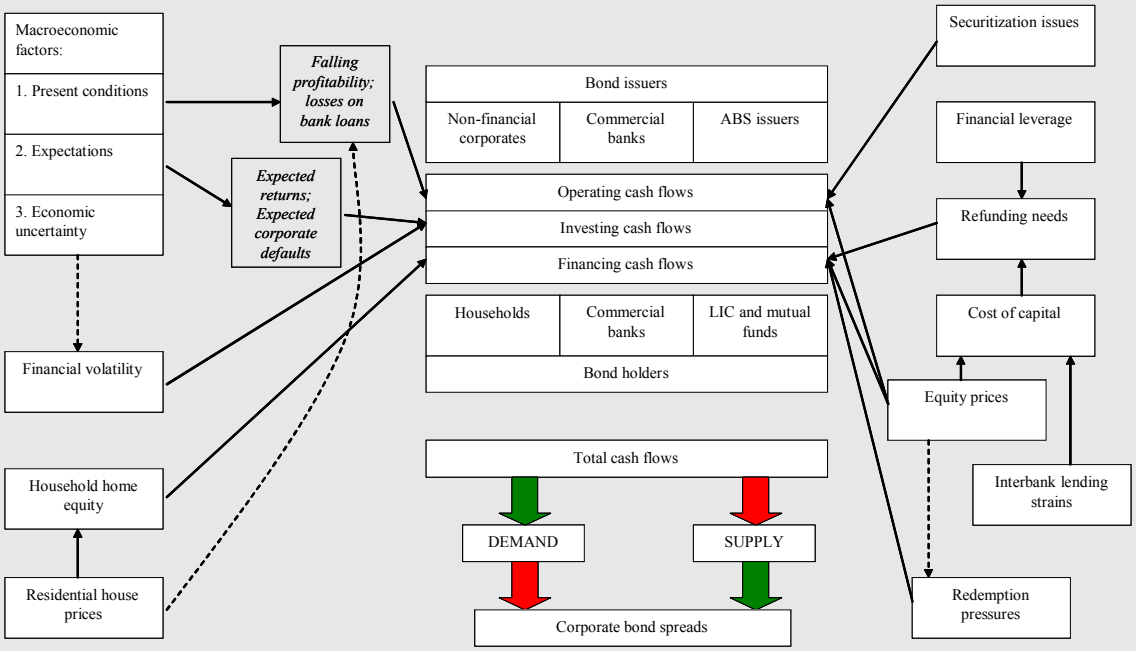
The model provides a very good fit (second figure) and the values of the coefficients indicate that the relationships are economically meaningful.

The combined model explains 93 percent of the variation in spreads, of which 57 percent is explained by the interaction of the factors, 7 percent is explained uniquely by capacity utilization, 10 percent uniquely by the VIX, 2 percent uniquely by equity prices, and 17 percent uniquely by the combination of the financing constraints indicators, particularly, house price declines and growth in total liabilities of bond issuers.

Implications

The capital flows framework developed in this study allows one to capture explicitly the effects of stress in various economic sectors on corporate spreads. The analysis suggests that corporate spreads can be largely explained by the fundamentals and risks related to both uncertainty and financing constraints. Policy implications should be drawn with caution, since, as with any regression analysis, the equations display measures of correlation rather than causality. For example, if the LIBOR-OIS spread were to decline by 50 basis points—possibly as a result of some policy action—it would be associated with a roughly 100 basis point decline in corporate spreads. This provides some perspective on the scale of challenges and potential benefits for policymakers contemplating intervention in the market for corporate finance.

Cash Flow Drivers for Bond Holders and Bond Issues



Note: This box was prepared by Sergei Antoshin.

Note: Throughout this study the data for the United States are used, but the analysis could be applied to Europe, for which the corresponding data are readily available.

E. Stability Risks and the Effectiveness of the Policy Response

Stability has proven elusive to attain.

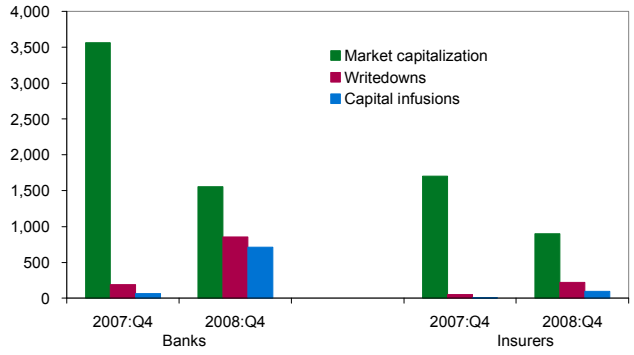
The prior sections underscore that confidence in the international financial system remains fractured and systemic risks elevated. Policy actions have prevented an even deeper crisis, but the limited market improvement to date has been insufficient to prevent the onset of the adverse feedback loop with the real economy. Despite some recent tentative signs of improvement, bank equity prices, and to a lesser extent, senior debt prices, have continued to decline as writedowns mount and long-term earnings prospects remain uncertain. The impairment of financial institutions and core funding markets is curtailing credit to corporates, which have themselves also faced cash flow pressures from the deteriorating economy. This section discusses stability risks to core financial institutions and assesses the effectiveness of policy measures in repairing financial sector balance sheets and reopening credit markets. The main message is that stabilizing the financial system remains a key priority and, although progress is being made, further policy efforts will be required.

Loss recognition is incomplete and capital is insufficient under a recession scenario.

Under the scenario of global recession and continuing credit pressures, we project banks could incur roughly $2.8 trillion in credit-related writedowns over 2007–10 (see Table 1.3), of which about one-third have already occurred. Credit deterioration could substantially deepen for European banks in particular, including through their exposure to emerging Europe (see Section C). The size of the losses may ultimately turn out lower to the extent that forceful and well targeted actions by authorities manage to restore confidence and establish a more virtuous cycle, giving support to credit markets. Authorities in several countries have already made substantial efforts to strengthen bank balance sheets, and limit some of the downside risks faced by banks. Banks worldwide have raised about $900 billion in capital to date (half of which has come from public sources), but additional equity is still needed to cushion potential writedowns and to restore investor confidence.

Mounting writedowns are depleting equity, increasing investor concerns about the size of capital cushions protecting bank solvency.

Figure 1.28. U.S. and European Bank and Insurance Company Market Capitalization, Writedowns, and Capital Infusions
(In billions of U.S. dollars, end of period)



Source: Bloomberg L.P.

Since the start of the crisis, market capitalization of global banks has fallen by more than half from $3.6 trillion to $1.6 trillion, while the value of preferred shares and subordinated debt has also fallen sharply, underscoring concerns about the size and quality of capital cushions (Figure 1.28). Banks are increasingly being judged by markets on a contingent set of cash flows they could receive. Table 1.4 provides an illustration of banks' equity needs under a number of assumptions about the future environment for banking, including earnings streams and capital adequacy measures asserted by the market. Accordingly, there is considerable uncertainty surrounding these approximate top-down scenarios.[35] Moreover, the assessment of the needed recapitalization for specific banks

[35] For the purpose of analyzing bank equity requirements, in addition to exposure to Euro area and U.K. originated credit reflected in Table 1.3, bank exposure to credit originated in Denmark, Iceland, Norway, Sweden, and Switzerland was considered. Analysis of equity requirements in Table 1.4 has not included Japanese banks.

should be done on the basis of the actual portfolio, prevailing capitalization, and expected revenues. In addition, the illustrations aggregate across banking systems and therefore do not show the substantial variation between banks within those systems. With those important caveats, if banks were to bring forward to today loss provisions for the next two years, before expected earnings, U.S. and European banks in aggregate would have tangible equity close to zero (Table 1.4).[36,37] This suggests equity cushions may need to be bolstered to sustain market confidence through the cycle.

The focus on the quality of bank capital has also intensified. Broader measures of capital, such as Tier 1, are seen by investors as offering insufficient protection and are therefore currently viewed as a less reliable basis for investor valuation and counterparty assessment. Instead, markets have increasingly focused on tangible common equity (TCE) and attach less weight to other components of regulatory capital, such as Tier 2 capital, hybrid securities, preferred shares, deferred tax assets, and the value of intangible assets on the balance sheet. Furthermore, with expected writedowns mounting, common equity is being depleted, reducing its share in total capital relative to other components with weaker loss-absorbing characteristics. In cases of banks with still-sufficient Tier 1 capital, converting preferred equity—both public and private—into common equity would rebalance the capital structure by increasing loss-absorbing capital.[38] More broadly, decisive and up-front policy implementation could alleviate the above scenario by bolstering confidence in banks and reducing credit strains, ultimately reducing the amount of public equity needed if private markets reopen. As confidence in valuation of assets improves, bank capital structures are seen to have been strengthened, and the economic outlook becomes less uncertain, market focus may return to the broader measures of capital adequacy. The use of TCE as a measure of capital adequacy in our scenarios should thus not be interpreted as a judgment regarding the appropriateness of this measure going forward, but rather as recognition of its present predominance in market assessments.

[36]This analysis responds to the request at the March 14, 2009 meeting of G-20 finance ministers and central bank governors for the IMF to assess the actions required to support lending and growth. The analysis is necessarily aggregate and stylized, and is not intended to substitute for detailed analysis of the needs of specific institutions or portfolios.

[37]Bringing forward the expected writedowns for loans proximates a mark-to-market for the loan book.

[38]Preferred stock has the advantage over common equity of setting a contractual rate of return (at a rate that can be set to incentivize banks to repay it when it regains market access). In practice, preferred stock issued to governments may have different eventual loss-absorbing characteristics relative to preferred stock issued to the private sector, as the government may be ready to convert their holding into equity to absorb losses if needed. Nevertheless, until that happens, markets may still be concerned about the policy risk; straightforward injections of common equity would be a simpler way of building confidence.

Table 1.4. Bank Equity Requirement Analysis
(in billions of dollars, unless shown)

	United States[1]	Euro Area	United Kingdom	Other Mature Europe[2]
Estimated Capital Positions at end-2008				
Total reported writedowns to end-2008	510	154	110	70
Capital raised to end-2008	391	243	110	48
Tier 1/RWA ratios at end-2008	10.4%	7.3%	9.2%	7.3%
TCE/TA end-2008	3.7%	2.5%	2.1%	2.3%
Scenario Bringing Forward Writedowns				
Expected Writedowns 2009-10 (1)	550	750	200	125
Writedown-adjusted Tier 1/RWA ratio	6.7%	1.1%	4.7%	1.7%
Writedown-adjusted TCE/TA	0.1%	-0.2%	0.4%	0.5%
Allowance for Expected Earnings				
Expected net retained earnings 2009 and 2010 (2) (after taxes and dividends)	300	600	175	100
Net drain on equity (retained earnings) 2009 and 2010 (3) = (1) - (2)	250	150	25	25
Equity Requirements				
Equity needed to reduce leverage to 25 times[3]	275	375	125	100
Equity needed to reduce leverage to 17 times[4]	500	725	250	225

Source: IMF staff estimates.

[1]Excludes government-sponsored enterprises, which are expected to receive equity injections from the government of up to $250 billion to help support writedowns.

[2]Denmark, Iceland, Norway, Sweden, Switzerland.

[3]The approximate leverage assumed in the GFSR deleveraging scenario (a 4 percent TCE/TA ratio).

[4]The approximate leverage multiple of U.S. banks in the mid-1990s (a 6 percent TCE/TA ratio), prior to the build-up in leverage in the banking system that contributed to the crisis.

Note: Tier 1 = Tier 1 capital; RWA = risk-weighted assets; TA = tangible assets; TCE = tangible common equity.

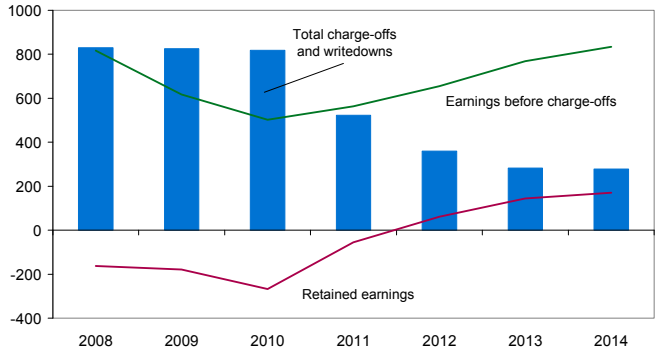
The long-term viability of institutions needs to be reevaluated to assess both prospects for further writedowns and potential capital needs. To provide a gauge for equity needs, the first calculation in Table 1.4 assumes that leverage, measured as TCE over tangible assets (TA), is reduced to 25 times (4 percent TCE/TA), consistent with the deleveraging scenario and toward levels that existed prior to the crisis.[39] Even to reach these levels, capital injections would need to be some $275 billion for U.S. banks, about $375 billion for Euro area banks, about $125 billion for U.K. banks, and about $100 billion for banks in the rest of mature Europe. The second calculation illustrates the potential impact of a return of leverage to levels of the mid-1990s (around 6 percent TCE/TA). To achieve this more demanding level would require about $500 billion for U.S. banks, about $725 billion for Euro area banks, about $250 billion for U.K. banks, and about $225 billion for the banks in the rest of mature Europe. These rough estimates suggest that in addition to offsetting losses, the additional need for capital derives from the stringent leverage and capital requirements markets are now demanding, based on the uncertainty surrounding asset valuations and the quality of capital. The authorities in several countries have introduced schemes that "ring-fence" certain troubled assets on bank balance sheets, and allow for risk-sharing between the bank and the government against further declines in the prices of these assets. This can helpfully remove some of the tail risk of large further declines in the prices of those assets, and thus help restore investor confidence in bank balance sheets. In some cases, it may play a useful complementary role alongside recapitalization and limit the additional capital required.

[39]TCE is calculated as total equity, less preferred shares and intangible assets; TA are total assets less intangible assets. The 4 percent and 6 percent scenarios illustrated are levels often seen by market participants as denoting a well-capitalized bank. Regulators and supervisors are often ready to see capital ratios decline during an economic downturn and be rebuilt as growth and profitability rebound.

Near term, bank earnings offer only a partial cushion to writedowns.

Applying the model described in Section D, lower operating earnings going forward will reduce the cushion against further credit writedowns on capital. Under the stylized scenario, banks' pre-provision earnings are forecast to drop by between a third and a half (Figure 1.29). This is less than the 50 percent drop experienced by U.S. banks during the Great Depression, but in line with the experience of Japanese banks during the 1990s.[40]

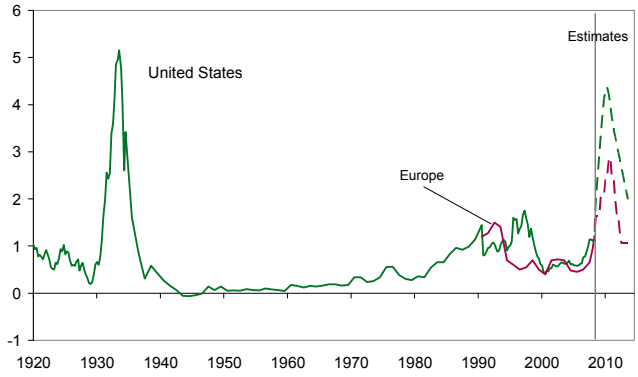
Figure 1.29. U.S. and European (including U.K.) Bank Earnings and Writedowns
(In billions of U.S. dollars)



Source: IMF staff estimates.

Charge-offs are forecast to peak at 4.2 percent in the United States, 3.4 percent in the United Kingdom, and 2.8 percent in the Euro area (Figure 1.30). In each case, these are levels that are well above those experienced during the 1991–92 recession, though below those estimated to have been experienced in the United States during the Great Depression.

Figure 1.30 Commercial Bank Loan Charge-Offs
(In percent of total loans)



Source: IMF staff estimates.

The resulting decline in net profit is expected to be severe, but not unprecedented. Under the scenario, banks would post losses in all three regions during 2008–10, making flat returns in 2010 and returning to profitability subsequently, albeit at modest levels (due to less use of leverage, lower fee income from securitization, and heavier regulatory burdens). This is broadly consistent with the period of time it took banks to return to profitability during the Great Depression and in Sweden in the early 1990s (although the writedowns are less severe than either of those more extreme cases). Dividends and taxes are assumed to play a minor role in determining the future path of capital. Under the scenario, dividend payout ratios decline to 20 percent of pre-tax earnings (from 60 percent) in the period to 2010—partly reflecting greater government involvement in dividend policy—but then rebound to 40 percent at the end of the period. Deferred tax assets built up during the loss periods are all expected to be used promptly as banks return to profit. In addition, the procyclicality of Basel II risk weightings is likely to mean risk-weighted assets (RWA) rise at a faster pace than total assets, as a

[40]The period over which the drop in revenues takes place is shortened to two years (from the four years it took in Japan), in part to reflect the more sudden global growth collapse. During Sweden's banking crisis, the revenue decline was around 20 percent in one year only. Oyama and Shiratori (2001) find that Japanese banks' overall margins were broadly stable during the 1990s as deregulation of deposit rates narrowed the spread between deposit rates and market interest rates, but banks widened lending spreads to riskier customers. During the current cycle, Western banks' margins are expected to be squeezed as they pay more to attract deposits, but with more limited scope to raise lending margins to customers as loan demand is weak.

decline in asset quality contributes to reduced credit ratings.[41] As a base case, we assume RWA grow 8 to10 percent faster than total assets through 2011, but less rapidly thereafter.

The public sector should ensure viable banks are sufficiently capitalized to restore market confidence.

Experience with addressing banking system crises suggests that the public sector should ensure viable institutions have sufficient capital when it cannot be raised in the market and to do so through a single up-front operation.[42] Market participants are less confident to transact and invest where they see the risk of further, as yet unspecified, major policy interventions.

A decision to use official resources to supply capital should not be taken lightly. In addition to taking due account of the cost to taxpayers, care should be exercised as fiscal balances are already under pressure around the world. Steps should be taken to encourage private sector participation in recapitalization to the extent possible under current market conditions. However, further bold steps are needed at this point to restore market confidence, including committing the necessary government funds, even where this may mean taking temporary majority or full government control of financial institutions.

Potential new providers of capital and funding are currently deterred by uncertainty over banks' balance sheet health and the macroeconomic outlook, as well as by uncertainty over the treatment of their claims in the event of further government support. Thus, governments need to design capital injection programs that protect potential new investors from policy risk, both through the convincing size of the capital injection and through the seniority provided to new investments, which may require new legal protection for the investors in some countries. Government support could pose risks to fiscal sustainability in more indebted countries that need to be taken into account in deciding the extent of overcapitalization.

Addressing troubled assets remains a priority.

Authorities have used a variety of policies to address banks' troubled assets. In so doing, they hope to mitigate the adverse feedback loop by reducing the pressure on banks to pare lending in order to delever. As well, they aim to reduce the risk premiums that investors and counterparties continue to place on banks as a result of the uncertainty about the scale of eventual writedowns stemming from troubled, often opaque, assets.

Policy measures taken have so far in this domain had only a limited effect in improving market confidence. Policies have assisted in offsetting, ring-fencing or providing additional clarity about troubled assets, but have generally not been sufficient in magnitude and have not been applied comprehensively. Table 1.5 summarizes specific measures and their effectiveness.

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[41]The Basel II regime requires the risk weights applied to assets in order to calculate capital requirements to be adjusted as assessments of creditworthiness and market volatility change. Banks may use credit assessments either by rating agencies or by themselves. In practice, creditworthiness assessments weaken and market volatility rises during economic downturns. This raises the RWA measure, and hence the capital requirement. Our assessment of an 8 to 10 percent annual rise is based on discussions with supervisory and bank contacts.

[42]Hoshi and Kashyap (2008) document how serial recapitalizations of the Japanese banking system in the late 1990s and early 2000s were too small and failed to close the "capital gap." Their definition of the capital gap includes elements of deferred tax assets that are unlikely to be used, and an estimate of the under-provisioning for loan losses. In the calculations presented in the stress test in this section, neither adjustment is seen as necessary for mature market banks, although it will be important to continue to monitor how realistic loan provisions are, and the usability of deferred tax assets.

Table 1.5. Policy Measures to Address Troubled Assets

Measure	Policy Objective	Effectiveness
Inclusion of illiquid assets as eligible collateral in central bank operations	Ease funding of illiquid assets	Successful in providing short-term funding; but concerns remain about certainty of long-term funding and about solvency.
Enhanced disclosure of troubled asset valuations and risks. Movement of some assets from trading book for valuation on accrual basis.	Reduce uncertainty and unnecessary volatility in illiquid asset valuations	Volatility in reported balance sheets reduced by move to banking book. But market confidence in asset valuations remains low, and concerns have spread to a much wider range of assets as the economy worsens.
Central bank or other official sector purchases of illiquid loans and securitizations	Provide official funding to lending markets where private sector demand dries up	Effective in supporting high-quality, short-term lending markets, notably commercial paper. The first phase of the U.S. Troubled Asset Relief Program abandoned plans to buy structured assets from the market; the Public-Private Investment Program will instead seek to purchase assets thorough a public-private partnership.
Official sector "solvency guarantees" of portfolios of assets, covering assets that are troubled or vulnerable to the economic downturn	Cap banks' losses on troubled assets	The United Kingdom has launched such a program. U.S. operations for Citibank and Bank of America eased some of the immediate pressures on the banks, but now are being supplemented with other measures to address troubled assets and stress-test the capital adequacy of major U.S. banks.
"Bad bank," with capped exposure for the bank transferring the assets, and the remainder of the risk with the official sector	Remove troubled assets from banks' balance sheets and cap losses	Most suitable where a bank's main problem concerns a given set of troubled assets. More successful than other measures in cleansing banks' balance sheets (e.g., for UBS in Switzerland and for Irish banks) but can be costly.

Source: IMF staff.

The recent U.S. Treasury announcement of the Public-Private Investment Program (PPIP) is an important development in this context. While the details are still being worked out, the initiative would give an impetus to price discovery and secondary trading in distressed mortgage/credit securities. This should provide greater clarity on the value of such securities on bank balance sheets. The PPIP provides incentives to encourage investor purchase of troubled assets through the provision of leverage while capping private sector investors' losses at their original equity investment. By increasing the price that investors are prepared to bid for assets, it should facilitate sales by banks. However, it appears less likely to successfully bridge the gap between the price that investors are willing to pay and the price that banks are willing to accept for loans (which banks mostly hold at book value) than for securities (which banks mostly hold at fair value). It therefore remains to be seen whether the program, which provides funding initially to finance up to $500 billion of asset purchases, will make a significant dent in the total size of troubled assets on banks' balance sheets. The findings of the U.S. regulators' stress tests, including the assessment of impairments of loans and actions needed by banks to achieve satisfactory capital buffers, may prove an important element in banks' incentives to participate in the program.

The "bad bank" approach has the advantage of being relatively transparent and leaving the "good bank" with a clean balance sheet. However, as the table illustrates, different approaches can work depending on country circumstances. The most important priority is to choose an appropriate approach, fund it adequately, and implement it clearly. With some national initiatives recently reinvigorated, measures to address troubled assets are accelerating, including private-public investor partnerships. As these gain traction, they have the capacity to significantly improve the outlook for banking systems and the global economy.

Bank funding markets will continue to need support.

There has been some modest thawing in borrowers' ability to access capital markets since the October 2008 GFSR (Table 1.6), but securitization markets remain impaired and interbank and cross-currency swap markets remain stressed.

Securitized loans have declined by $1.6 trillion in the United States since 2006, and by $534 billion in Europe (although securitizations retained on banks' own balance sheets for use as central bank collateral have remained high) (Figure 1.31). Given the previous importance of securitization in bank funding, impairment of the securitization process will continue to limit access to credit.

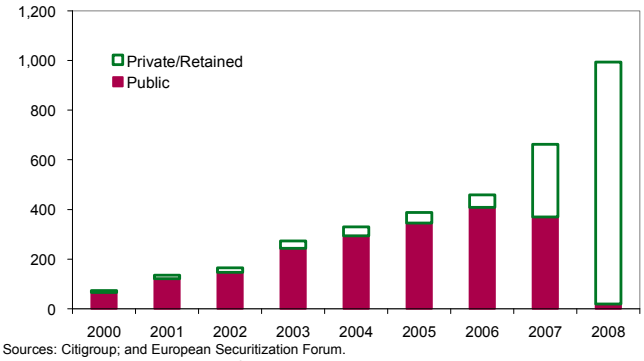
Although LIBOR-OIS spreads have receded somewhat, they remain elevated compared to the pre-crisis period, and term funding is still available only on a small scale owing to liquidity hoarding and continuing concerns about counterparty credit risk. Some banks continue to shun term interbank markets entirely, instead depositing surplus liquidity with central banks. Until balance sheet concerns are eliminated through effective banking system measures, central banks are likely to remain major suppliers of term funding.

Table 1.6. Tentative Easing in Credit Conditions
(End of period)

	2007:Q1	2008:Q4	March 2009
United States			
3-month LIBOR-OIS spread (basis points)	8	123	99
Commercial paper outstanding (US$ billions)	2,005	1,612	1,422
Lending survey (percent tightening)	11	70	61
Investment-grade corporate OAS (basis points)	90	604	545
Agency-backed MBS OAS (basis points)	68	120	80
Euro area			
3-month LIBOR-OIS spread (basis points)	6	115	82
Commercial paper outstanding (US$ billions)	756	647	687
Lending survey (percent tightening)	...	65	64
Investment-grade corporate OAS (basis points)	47	397	413
United Kingdom			
3-month LIBOR-OIS spread (basis points)	11	165	120
Commercial paper outstanding (US$ billions)	132	158	167
Lending survey (percent tightening)	2	28	...
Investment-grade corporate OAS (basis points)	78	492	570
Japan			
3-month LIBOR-OIS spread (basis points)	16	73	49
Commercial paper outstanding (US$ billions)	164	825	348
Lending survey (diffusion index)	5	...	...
Investment-grade corporate OAS (basis points)	20	86	104

Sources: Bloomberg L.P.; Merrill Lynch; national central banks; and IMF staff estimates.
Note: MBS = mortgage-backed security; OAS = option-adjusted spread; OIS = overnight index swap.

Figure 1.31. European Securitization Gross Issuance
(In billions of U.S. dollars)



Sources: Citigroup; and European Securitization Forum.
Note: Private/retained securitization refers to securitizations that are generated because they are eligible as collateral for repo funding from the central bank.

Authorities have responded by introducing new liquidity facilities, asset purchase schemes, and guarantees for bank debt issuance to prevent fire sales of assets and bank failures (Table 1.7). The measures announced so far provide up to $8.9 trillion of financing, but this amounts to less than one-third of the ongoing wholesale financing needs of banks. Government guarantees are new and still mostly undrawn, so most actual financing support has come through new central bank liquidity provision of $2 trillion. Banks have rapidly built up guaranteed issuance since the facilities were introduced in late 2008, totaling $460 billion in 10 countries through January—$130 billion in the United States alone.

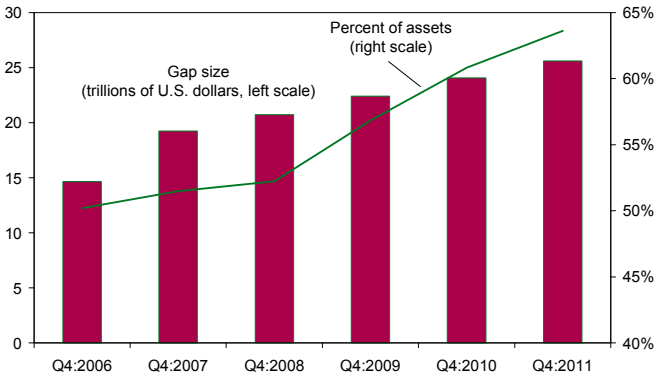
Table 1.7. Bank Wholesale Financing and Public Funding Support
(In billions of U.S. dollars)

	Wholesale Funding in 2008:Q2	Central Bank Liquidity (Crisis Balance Sheet Growth)	Government Asset Purchases Commitment	Government Guarantee Commmitment
United States				
Money market	1,908	980	1,850	1,830
Longer term	2,908			
Euro Area				
Money market	12,015	820	225	1,400
Longer term	8,877			
United Kingdom				
Money market	3,869	150	450	1,250
Longer term	1,349			
Total	**30,926**	**1,950**	**2,525**	**4,480**

Sources: Bankscope; national central banks; and IMF staff estimates.
Note: guarantees only includes those with announced limits (not open ended guarantees) and U.K. and U.S. guarantees of Bank of America, Citigroup, Lloyds, and RBS.

Despite these efforts, private bank funding markets are mostly closed—banks rely on central banks and the government (for guaranteed unsecuritized funding), raising the question of how large this financing might conceivably need to be. For an order-of-magnitude estimate, we project the maximum refinancing gap for the 22 largest global banks that would arise if no private wholesale funding were available.[43] The gap rises from $20.7 trillion in late 2008 to $25.6 trillion in late 2011, despite bank assets remaining roughly constant on average over the period and customer deposits growing in parallel with nominal GDP (Figure 1.32).[44] The rise reflects the large volume of existing long-term debt that will mature and need to be refinanced.

Figure 1.32. Refinancing Gap of Global Banks



Source: IMF staff estimates.

[43]The refinancing gap is short-term wholesale funding plus maturing long-term debt. It excludes customer deposits and equity. It grows as long-term debt matures and is assumed to be refinanced as short-term wholesale funding The banks are drawn from seven countries: the United States (5); France (4); the United Kingdom (4); Germany (2); Italy (2); Switzerland (2); and the Netherlands (1). Publicly-owned banks are excluded.

[44]The financing gap scenario uses the same assumptions as other scenarios in the chapter. It incorporates the same paths for bank asset growth, credit growth and bank recapitalization used in Figure 1.4 and Table 1.5, but adds the assumption that deposits grow at nominal GDP. Data on the volume of bank debt maturing each year is taken from Bloomberg.

Refining measures together with addressing capital needs and the troubled asset overhang should ease strains.

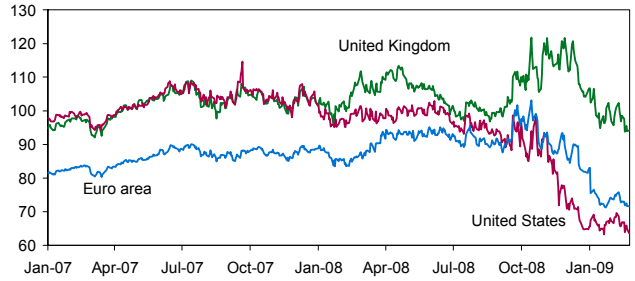
Deleveraging involves reducing excessive reliance on wholesale funding. This, together with capital injections and addressing troubled assets, will reduce funding strains and improve market functioning. In the interim, however, measures supporting funding could be further refined and be made more efficient. In particular:

- Access to foreign currency funding could be further improved to ensure that banks can fund their holdings of foreign currency assets in the interbank and cross-currency swap markets. Thus far, official funding facilities have been largely in domestic currency, with only a few central banks also providing U.S. dollar or other foreign currency funding.
- Government guarantee schemes need to be consistent with each other in structure and clearly implemented (see next section). In some cases, the lack of clarity of government schemes has slowed bank efforts to secure funding and dampened investor interest.
- The implementation of unconventional monetary policy will be needed to support financial intermediation, reduce risk premiums and reopen securitization markets (Box 1.6).
- Policymakers need to develop an exit strategy to enable public financing to be withdrawn once conditions are conducive to a recovery of private markets. For example, while below-market pricing and relaxed terms of official facilities may be necessary to improve market functioning under current conditions, they will eventually need to be reassessed to ensure borrowers have the incentive to return to private markets.

Insurance companies and pension funds are coming under increasing strain as asset prices fall.

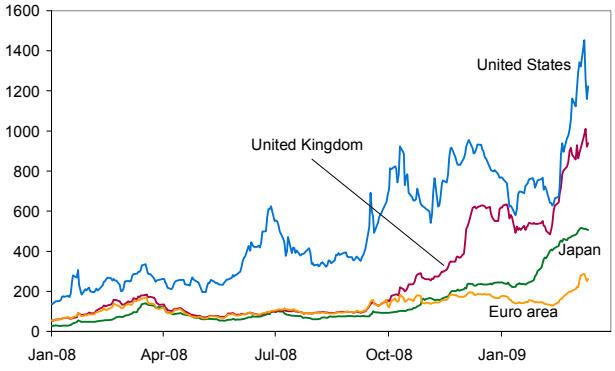
A wide range of nonbank financial institutions has come under strain during the crisis as asset prices have fallen (Figure 1.33). Life insurance companies and reinsurers have suffered substantial falls in shareholder equity since mid-2007, leading to rating downgrades and rises in CDS spreads that endanger their business models (Figure 1.34). In aggregate, by 2008:Q3, the book value of shareholder equity had fallen by 15 to 20 percent since the beginning of the crisis, and will have fallen considerably further since then. Market estimates of value have fallen much more sharply, with the S&P 500 subindex for life and health insurers by mid-March down over 70 percent since the crisis began. Rating agencies, which attempt to assess insurers' balance sheets on a mark-to-market basis, are threatening further downgrades. These actions place pressure on insurers to delever and lower risk.

Figure 1.33. Pension Funds of Large U.S. and European Companies: Estimated Funding Levels
(In percent)



Source: Hewitt Associates.
Note: The funding level for accounting purposes, as a percentage of the net present value of liabilities. The calculations project forward the last publicly reported levels by using movements in market prices and interest rates since then. The U.S., euro area and U.K. companies comprise the constituent firms of the S&P 500, Eurostoxx 50 and FSE 350 indices.

Figure 1.34. Insurance Sector Credit Default Swap Spreads
(In basis points)



Source: Datastream.

Box 1.6. Recent Unconventional Measures of Selected Major Central Banks

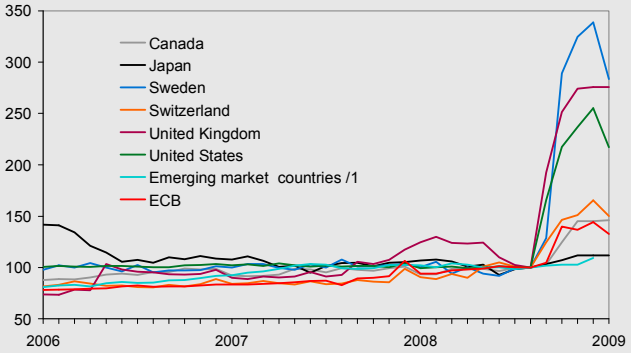
Since the start of the current crisis, major central banks have taken a variety of "unconventional" measures. Ordinarily, most major central banks are concerned with steering a short-term interest rate to attain macroeconomic objectives. However, financial stress has greatly impeded the standard interest rate and balance sheet channels of monetary policy.[1] Consequently, central banks have introduced new tools to lower market interest rates across the yield curve and stimulate credit creation in order to support economic activity. The table summarizes examples of such measures undertaken by major central banks.

Early in the current crisis, many advanced country central banks have extended conventional *liquidity easing* measures aimed at particular financial markets. Initially, these efforts involved loosening the terms and availability of central bank facilities already in place, such as standing lending windows. Thereafter, access to central bank lending was enhanced by extending the tenor of central bank financing, widening the range of counterparty financial institutions, and swapping liquid government securities on the books of central banks for illiquid assets held by banks. Importantly, central banks have widened collateral eligibility to ensure that collateral availability does not constrain liquidity provision. In the United States, collateral normally available only at the discount window was made available for open market operations. In the United Kingdom, additional securities, including some well-rated asset-backed securities and covered bonds, were accepted in the three-month repo operation. The European Central Bank already had a broad eligibility list and thus did not need to make substantial changes. Several central banks also undertook foreign exchange swaps or loans with other central banks to alleviate severe shortages of foreign exchange. In most respects, these liquidity easing measures are in line with the standard central bank lender-of-last-resort function, although their range and magnitude are well above traditional levels.

As the impact of the crisis on credit markets became clear, several central banks introduced *credit easing* measures aimed at alleviating stresses in credit markets deemed to play a key role in supporting economic activity. Many of these measures finance purchases by investors in important securities markets, such as mortgages and commercial paper. In a few cases, central banks are directly providing financing to final corporate borrowers. Central banks have generally preannounced upper limits on credit easing facilities rather than target levels, and these upper limits have themselves been adjusted in line with changing conditions. These measures have an important quasi-fiscal element and are thus usually done in close coordination with the government.

The advent of zero or near-zero policy interest rates of large advanced country central banks has blocked the interest rate channel and led to *quantitative easing*. This typically involves central bank purchases of government or government-guaranteed securities from banks or other institutions. Quantitative easing increases reserve money and the size of the central bank balance sheet with a view to the macroeconomic objective of boosting the access of households and businesses to credit by lowering the longer-term yield curve and helping improve the liquidity of balance sheets.

Real Central Bank Assets of Selected Countries, January 2006-March 2009
(August 2008 = 100)



Source: IMF, International Financial Statistics database.
/1 Median for 27 medium and large emerging market countries.

Box 1.6 (continued)

Unconventional measures have led to increases, some very large, in the sizes of the balance sheets of advanced country central banks (see figure). The balance sheet impact of the measures reflects whether or not the policy interest rate has dropped to zero or near zero, as well as the aggressiveness of easing and the nature of the financial system. In particular, quantitative easing involving government securities tends to be more important in bank-centered systems (Japan and the United Kingdom), whereas credit easing with private securities generally plays a larger role in market-centered systems (the United States)

Gauging the effectiveness of unconventional measures is difficult because transmission to the economy is complex and opaque. The success of most unconventional measures hinges not just on the design and magnitude of the measures themselves, but also on the willingness and ability of creditors to lend and of borrowers to borrow. Further, unconventional measures overlap; for example, a liquidity-easing measure aimed at a particular class of financial institutions may (if unsterilized) lead to an increase in reserve money, thus giving the measure the flavor of quantitative easing. The liquidity-easing measures were followed by a general reduction in funding costs for banks and by signs of an abatement in funding pressures, especially during times of seasonal tightness (quarter-end). Some of the early credit easing measures seemed to have helped alleviate pressures in commercial paper, mortgage, and corporate bond markets, and in a few cases access to these facilities is running down.

The important challenges and risks posed by unconventional measures have attracted considerable attention.

- Unconventional measures may inadvertently *allocate credit to inefficient markets at the expense of efficient markets*, constraining financial sector restructuring in the short run, and impairing future economic growth.
- The gradual replacement of high-quality and liquid assets with illiquid claims on central bank balance sheets *reduces operational flexibility* and thereby may constrain future monetary management.
- The quasi-fiscal nature of some unconventional measures blurs the distinction between monetary and fiscal policies and, together with pressure to continue to provide financing, could potentially *compromise central bank independence.*
- The *inflation potential* of a swelling of reserve money has led inflation expectations to tick up in response to some announcements of unconventional measures by central banks.

Ongoing and detailed communication can help to reduce the risks. Central banks and fiscal agents engaging in quasi-fiscal measures should publicly explain the objectives, expected effects, and potential fiscal implications of unconventional policy tools. Careful statement of central bank views on the macroeconomic outlook will facilitate the eventual resumption of positive policy interest rates and absorption of liquidity.

A comprehensive exit strategy is also crucial. The strategy should encompass the resuscitation of financial markets displaced by unconventional measures, as well as the resumption of fully market-based monetary operations. Importantly, a plan will be needed to wind down liquidity and credit-easing measures, which can include a tightening of funding conditions, traditional mopping up operations, and adjustment of the reserve requirement framework. In some cases, amendments to central bank legislative frameworks may be needed to provide the necessary instruments. Ideally, an exit strategy should be part of the initial design of unconventional measures.

Beginning in September 2008, many emerging market countries began to take measures to ease foreign exchange and domestic currency liquidity conditions, but unconventional measures may

not play as important a role for them as for the advanced countries. The liquidity easing measures—reinforced in some cases by foreign exchange liquidity provided by reserve currency central banks—seemed to have had some success in alleviating short-term liquidity pressures. However, the size of emerging market country central bank balance sheets has not increased by anywhere near the same magnitude as those of their advanced country counterparts (see figure). This probably reflects the tighter constraints on liquidity-easing measures faced by emerging market countries, including external vulnerability, shallower financial markets, conflicts between macroeconomic and systemic stability objectives, and less firm central bank independence. These constraints compel most emerging market countries to keep positive real interest rates to compensate for the risk of exchange rate depreciation and capital outflows, precluding the quantitative easing measures associated with near-zero policy interest rates, and limiting the size of central bank balance sheet increases.

Selected Recent Central Bank Measures

Measure	Purpose	Central Bank
Standard Operation, Technical Changes		
Expansion of eligible collateral, counterparties, and terms for regular operations	Facilitate provision of central bank reserves to money markets when there is insufficient availability of standard collateral	Most central banks in advanced countries and some emerging economies
Unlimited liquidity provision in market operations	Facilitate provision of central bank reserves to money markets, particularly when forecasting the demand for liquidity becomes unreliable	European Central Bank, Bank of Japan
Liquidity Easing		
Lending government securities in exchange for illiquid securities	Assist repo and other collateralized transactions	Federal Reserve, Bank of England
Currency swap arrangements between central banks, and between central banks and commercial banks	Facilitate foreign currency provision to banking sector, globally, in the face of segmentation of fx markets	Federal Reserve with 14 central banks, Swiss National Bank with European Central Bank, and some emerging economies in range of currencies
Foreign currency provision in domestic markets	Provide foreign currency funding for non-banks especially trade credit	Some emerging economies. e.g., Brazil
Credit Easing		
Outright purchase of private sector securities	Support mortgage and housing markets and restore securitization market issuance	Federal Reserve, Bank of England, Bank of Japan
Direct liquidity provision to borrowers and investors	Facilitate the extension of credit to households and business	Federal Reserve, Bank of Japan
Quantitative easing		
Outright purchase of government or government-guaranteed securities	Provide long-term funds and/or lower long-term yield curve	Federal Reserve, Bank of England, Bank of Japan and some emerging economies

Source: IMF staff.

Note: This box was prepared by Mark Stone, Alexandre Chailloux, Seiichi Shimizu, and Simon Gray.
[1]See Chapter 2 of the October 2008 *Global Financial Stability Report* (IMF, 2008b).

Like banks, writedowns at insurance companies and pension funds have pushed solvency measures to low levels.[45] Solvency buffers may not prove sufficient. Several factors, similar to those that have weighed on banks' capital adequacy, have also affected insurers and pension funds. For instance, (1) solvency, accounting, and valuation policies have been procyclical; (2) increased asset correlation has reduced the benefits of diversification; (3) declines in risk-free interest rates (used to discount future liabilities) have pushed up the net present value of liabilities; and (4) increased

[45]Hewitt Associates has estimated that, by February 2009, the solvency ratios for accounting purposes of pension funds for major U.S. companies had decreased to 65 percent of liabilities, for major euro area companies to 72 percent, and remained around 95 percent for major U.K. companies.

volatility in asset prices has pushed up the expected cost to insurers of guarantees of minimum returns or minimum policy values that they have given to clients.

Pension funds and life insurers do not face the same short-term liquidity pressures as banks, but they still present financial stability concerns. The longer-term nature of their liabilities has prevented forced asset sales, and leverage is relatively low (in the case of insurers and some defined benefit pension funds) to nonexistent (in the case of most defined contribution and corporate pension funds). However, even in the absence of liquidity strains, solvency pressures can lead to rapid asset sales in order to reduce risk—as was the case in 2001–03 when stock market falls led to massive equity liquidations. As such, potential links between insurance companies and pension funds and financial stability need to be considered in designing public support measures. Moreover, since life insurance companies, reinsurers, and pension funds are often holders of substantial amounts of senior debt of banks, they are directly affected by the treatment of investors in banking support operations.

Policies should aim to reduce the risk of solvency pressures exacerbating the deleveraging process.

Efforts by insurance companies and pension funds to rebuild solvency are likely to add to the market pressures arising from the need of banks to rebuild capital and reduce leverage. Insurers and pension funds need to be given additional time to rebuild solvency levels to appropriate levels, without jeopardizing the condition of the institutions or the claims of the policyholders of fund members. Some countries have already lengthened the periods over which funding levels for liabilities need to be rebuilt. The need for this in the future could be reduced by measures to encourage the buildup of more adequate buffers in good times that take account of asset risk over the economic cycle and the volatility of mark-to-market measures. A framework also needs to be put in place to wind down systemically important insurance companies when they become insolvent.

F. Costs of Official Support, Potential Spillovers, and Policy Risks

The costs of backstopping banking systems are adding to fiscal burdens...

Government support operations are proving essential to addressing the crisis, and experience suggests that early and substantial government intervention to deal with crises helps to contain their long-term costs, both to the government and to the economy. Nevertheless, the short- and medium-term costs to governments of supporting banking systems are adding considerably to fiscal burdens and contingent liabilities. These costs are combining with those from macroeconomic stimulus packages to add to the more general cyclical fiscal pressures from the recession. Although the eventual costs of the support operations announced to date are highly uncertain and will not be known for several years, we can make estimates today of their expected order of

Table 1.8. Public Debt and Stabilization Costs
(In percent of GDP)

	Gross Government Debt			Financial Stabilization Costs[1]
Country	2008 (Percent of GDP)	2010 (Percent of GDP)	2008-2010 (Percentage point change)	(Percent of GDP)
Canada	64	77	13	4.4
France	67	80	13	1.8
Germany	67	87	19	3.1
Italy	106	121	15	0.9
Japan	196	227	30	1.7
United Kingdom	52	73	21	9.1
United States	71	98	27	12.7

Sources: Debt to GDP estimates are from the IMF, *World Economic Outlook*, April 2009. Financial stabilization costs are estimates by the IMF Fiscal Affairs Department in "Companion Paper - the State of Finances and Medium-Term Policies after the 2008 Crisis,"March 6, 2009.
[1]Based on support measures announced through mid-February. This is the net cost which is gross support minus recovery over the next 5 years. The recovery rates are different by types of support, with higher recovery expected from guarantees and central bank liquidity support.

magnitude. They include three elements: the net costs of direct support to banks; expected eventual costs of guarantees; and costs, net of recoveries, of central bank liquidity provision.[1]

The calculation indicates that financial stabilization costs will add substantially to public debt in many countries (Table 1.8).[2] The United States, United Kingdom, and Ireland face some of the largest potential costs of financial stabilization given the scale of mortgage defaults. Financial stabilization costs are also expected to exceed 7 percent of GDP for certain countries that do not necessarily have significant domestic mortgage problems. These countries either have large banking assets relative to GDP (Netherlands, Ireland) and/or significant exposure to emerging Europe (Austria, Sweden).[3]

...putting pressure on sovereign credits...

The potential costs of support operations as well as the general deterioration in fiscal balances are pressuring sovereign bond and CDS spreads.[4] Two factors appear important in explaining the movement in CDS spreads.

First, spreads are wider for *smaller economies* than for larger ones (Table 1.9). Larger economies have deeper and more liquid capital markets, which tend to facilitate financing of their deficits. Further, as discussed earlier, some smaller economies have large banking assets relative to GDP, raising market concerns about potential fiscal costs of financial stabilization. CDS protection may also be being bought as a proxy hedge against macroeconomic risk when local securities markets are too illiquid to sell in size or go short.

Table 1.9. Mature Market Sovereign Credit Default Swap Spreads and Debt Outstanding

	Median CDS Spread as of April 8, 2009 (basis points)	Median Debt Outstanding as of December 2008 (percent of GDP)
Smaller economies	100	46
Larger economies	64	69

Sources: Bloomberg L.P.; IMF, World Economic Outlook database; and IMF staff estimates.
Note: Larger economies are six mature countries with GDP greater than $2 trillion. Smaller countries are 13 other countries with traded CDS contracts. CDS - credit default swap.

Second, the level of CDS spreads appears to be affected in large part by the *increase in funding needs*, arising both from rises in fiscal deficits, and from the funding needs of financial stabilization, as opposed to the size of the current stock of indebtedness. For example, CDS spreads have widened considerably more in the United Kingdom relative to other large economies, despite the fact that the country's current debt is low relative to GDP (Figure 1.35), although in percentage terms it rises

[1]The expected costs to the public exchequer of guarantees are estimated in two ways. First, historical experience suggests likely losses to governments based on the size of bank balance sheets as well as certain other measures of fiscal management. Second, traded financial instruments provide market estimates of the likelihood of individual bank defaults, given recovery values. These financial instruments provide a market valuation of the government's contingent liability should it decide to cover bank losses.

[2]IMF (2009a) shows calculated costs for a larger set of countries.

[3]Switzerland and Belgium also have relatively large banking sector relative to GDP and markets remain concerned about sovereign risk in these countries. For example, the five-year sovereign credit default swap spread for Switzerland was about 105 basis points on April 13, 2009—wider than Sweden and the Netherlands, but tighter than Ireland and Austria.

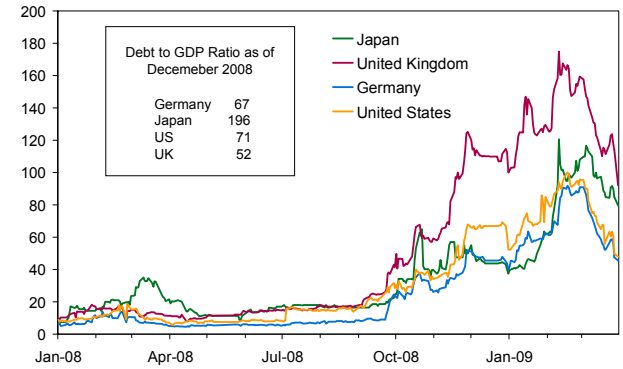
[4]Municipal credits have also come under pressure. Although local government authorities in advanced economies generally entered the crisis with comfortable operating fund balances and reserves, the economic downturn is already straining their budget balances. Revenue streams are falling and expenditures are rising, especially among municipalities hardest hit by housing slumps. In addition, borrowing costs in local government debt markets have risen. As such, in contrast to some past credit crises, local government bonds have not functioned as a safe haven.

sharply (Table 1.10). This suggests that concerns about short-term financing needs, rather than long-term fiscal sustainability, may be driving a large part of CDS spreads.

Although advanced economy governments to date have generally been able to meet their funding needs, there have been some signs that the demand for government debt is becoming more volatile (Figure 1.36). Even in some major mature markets, auctions have been occasionally undersubscribed or canceled as issuance volumes have increased and the ability of market-makers to take auction risk and provide liquidity has diminished. As home bias and risk aversion have increased, sovereigns are likely to need to depend much more heavily on the domestic investor base until global market conditions improve. They have also needed to shorten the maturity of recent issues, heightening refinancing risk in the future.

In order to address investor concerns, governments need to clearly communicate the potential costs of financial support packages as part of a sustainable medium-term budget framework, including a credible commitment to fiscal correction once economic conditions improve.[50]

Figure 1.35. Large Economy Credit Default Swap Spreads
(In basis points)



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

Table 1.10. Expected Guaranteed Debt Issuance

	Announced Amounts (Billions of U.S. dollars)	Relative to 5-Year Average of Net Debt Issuance[1] (Percent)
Ireland	641	2,708
Sweden	169	606
Germany	556	576
Belgium	114	537
Austria	108	444
Netherlands	254	310
United Kingdom	375	291

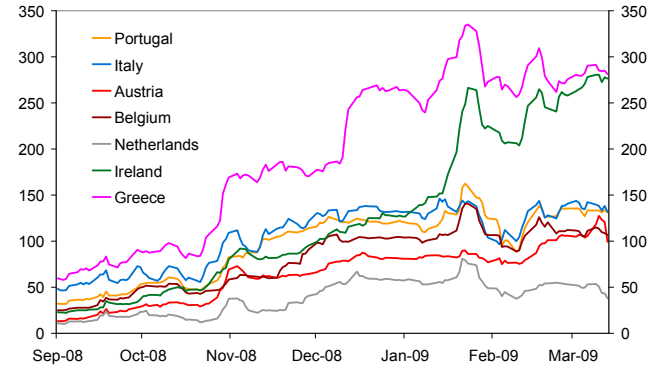
Sources: Bank for International Settlements; and IMF staff estimates.

[1]Net debt issuance combines private and sovereign net issuance averaged from 2003 to 2007 from BIS data.

...and raising concerns about market digestion and "crowding out" of borrowers.

Projected issuance of government and government-guaranteed bank securities will be very large in 2009 as a result of increased budget deficits and continuing bank refinancing needs. This leads to potential crowding-out risks. One such risk is that the higher quality of government/government-guaranteed paper in a risk-averse environment will crowd out private sector issuers. Table 1.10 highlights some countries where the announced government-guaranteed debt is greater than three times the average annual total net issuance of private sector and sovereign debt in the past five years. Note that this guaranteed debt issuance will occur over and above the considerable sovereign debt required to be issued to finance fiscal deficits.

Figure 1.36. Benchmark Five-Year Government Bonds
(Spreads over German bunds in basis points)



Source: Bloomberg L.P.

[50]IMF (2009b) sets out four important components of a government strategy during the crisis to maintain market confidence that fiscal solvency is not at risk.

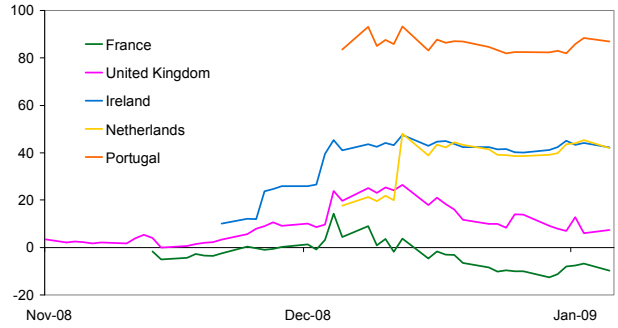
A second risk is that the benchmark sovereign issuers squeeze out smaller or weaker sovereign counterparts. For example, based on current fiscal and financial stabilization plans, the United States, Japan, Germany, and the United Kingdom are projected to issue about $4 trillion of net additional government/government-guaranteed debt in 2009, which would amount to about 280 percent of the five-year average net sovereign debt issued by *all* mature economies. This volume of issuance will add to the challenges facing emerging market sovereign and corporate issuers in raising funds, especially in mature market currencies, while markets remain risk-averse.

"Pooling" solutions may reduce liquidity premia of government-guaranteed bank debt.

The patchwork of different guarantee schemes across Europe, varying fee structures, and in some cases the lack of clarity over the details of the schemes themselves have strained bank efforts to secure funding and dampened investor interest. At present, investors are pricing guaranteed debt substantially below straight government debt. This reflects several factors. First, the guaranteed bonds may not be as liquid as the sovereign bonds. Second, investors can still suffer mark-to-market writedowns and delays in payments if the bank issuer faces problems and the guarantee needs to be called upon. Third, in some cases the guarantee is from an agency, rather than from the government itself, so the relationship between the agency and the government needs to be checked by the investor. Fourth, the instruments are new and have special terms and conditions, so approvals have to be sought, for example from institutional investors' credit committees.

Pricing of these instruments shows a distinct tiering by country, proximity of the guaranteeing body to the government, and bank. Figure 1.37 highlights that the spread on the issues guaranteed by sovereigns perceived as less capable of backing their guarantee is wider than for those that are deemed well able to stand behind their promises, such as the United States and France. French issuance is especially tightly priced because it is directly issued by a government agency rather than a bank, meaning that bond liquidity is pooled and that the agency, rather than the investor, is exposed to any delays in payment.

Figure 1.37. Swap Spreads of Government-Guaranteed Bonds
(In basis points)



Source: European Central Bank.

Sovereign debt managers should consider extending maturities.

Authorities will need to carefully manage actual and potential public sector debt burdens so that current funding difficulties for banks do not transform into funding and debt sustainability problems for the sovereign. Increased credit spreads will add to governments' borrowing costs and debt sustainability issues. To date, falling risk-free interest rates, as benchmark government securities have benefited from a flight to quality and liquidity, have generally offset the effect of increased credit spreads on governments' borrowing costs. However, as liquidity pressures on financial institutions ease, inflation fears return, and the weight of supply builds, borrowing costs may begin to rise. During the crisis, many sovereigns have shortened the average maturity of their issuance in response to increased investor demand for more liquid shorter-dated securities, thus increasing their refinancing risk. Nevertheless, authorities should take the opportunity of the currently low level of real long-term yields to lengthen the maturity of issuance where possible to reduce their
refinancing risk.

In sum, policies need to recognize the limits of national sovereign balance sheets, which may call for more regional or global approaches to bring about financial stability.

The size of the fiscal costs is best contained by early, forceful, and effective policy action to stabilize the global financial system. The public sector should ensure viable institutions have sufficient capital when it cannot be raised in the market, accelerate balance sheet cleansing, and refine measures supporting funding markets. Government support, however, could pose risks to fiscal sustainability in more indebted countries. The challenges facing emerging European economies provide a current example. In these economies, the burden of stabilizing economies and financial systems may be too large to be managed solely by national governments and, because of the potential for contagion, solutions will require coordination and outside stabilization support. Furthermore, where the transfer of private to sovereign risks in resolutions may prove too costly in relation to sovereign capacity or benefits, other forms of private sector involvement in restructuring may be called for (see Annex 1.4).

Annex 1.1. Global Financial Stability Map: Construction and Methodology[51]

This annex outlines our choice of indicators for each of the broad risks and conditions in the global financial stability map (see Figure 1.1). To complete the map, these indicators are supplemented by market intelligence and judgment that cannot be adequately represented with available indicators.

To begin construction of the stability map, we determine the percentile rank of the current level of each indicator relative to its history to guide our assessment of current conditions, relative both to the October 2008 GFSR and over a longer horizon. Where possible, we have therefore favored indicators with a reasonable time series history. Events that surpass historical experience raise associated risks or conditions to the boundary in the graphical representation. However, the final choice of positioning on the map is not mechanical and represents the best judgment of IMF staff. Table 1.11 shows how each indicator has changed since the last GFSR and our overall assessment of the movement in each risk and condition.

Table 1.11. Changes in Risks and Conditions Since the October 2008 *Global Financial Stability Report*

Conditions and Risks	Changes since October 2008 GFSR
Monetary and Financial Conditions	↓
G-7 real short rates	↑
G-3 excess liquidity	↔
Financial conditions index	↓
Growth in official reserves	↔
G-3 lending conditions	↓
Risk Appetite	↓
Investor risk appetite survey	↔
Investor confidence index	↓
Emerging market fund flows	↑
Risk aversion index	↓
Macroeconomic Risks	↑
World Economic Outlook global growth risks	↑
G-3 confidence indices	↑
OECD leading indicators	↑
Implied global trade growth	↑
Global breakeven inflation rates	↑
Mature market sovereign CDS spreads	↑
Emerging Market Risks	↑↑↑
Fundamental EMBIG spread	↑
Sovereign credit quality	↑
Credit growth	↓
Median inflation volatility	↑
Corporate spreads	↑
Vulnerability to capital flows	↑
Credit Risks	↑
Global corporate bond index spread	↑
Credit quality composition of corporate bond index	↑
Speculative-grade corporate default rate forecast	↑
Banking stability index	↔
Loan delinquencies	↑
Household balance sheet stress	↔
Market and Liquidity Risks	↔
Hedge fund estimated leverage	↔
Net non-commercial positions in futures markets	↑
Common component of asset returns	↑
World implied equity risk premia	↓
Composite volatility measure	↔
Funding and market liquidity index	↓

Source: IMF staff estimates.

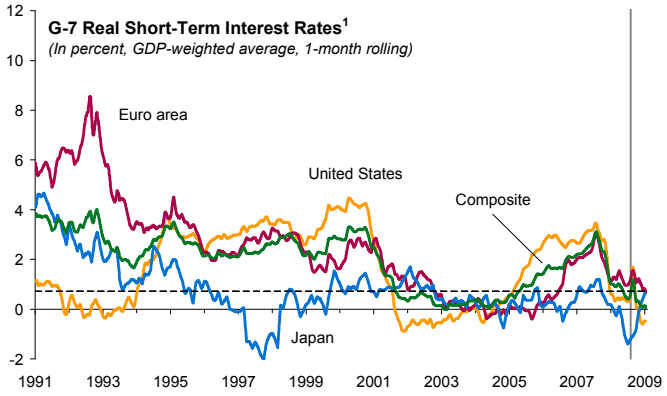
Note: Changes are defined for each risk/condition such that ↑ signifies higher risk, easier monetary and financial conditions, or greater risk appetite, and ↓ signifies the converse; ↔ indicates no appreciable change. The number of arrows for the six overall conditions and risks corresponds to the scale of moves on the global financial stability map.

Monetary and Financial Conditions

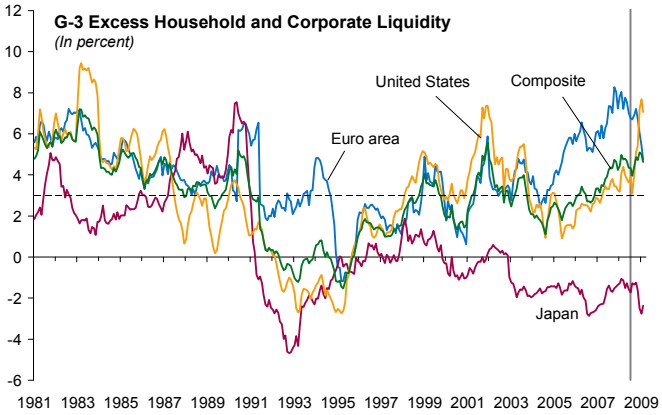
The availability and cost of funding linked to global monetary and financial conditions (Figure 1.38). To capture movements in general monetary conditions in mature markets, we begin by examining the cost of short-term liquidity, measured as the average level of real short rates across the G-7. We also take a broad measure of excess liquidity, defined as the difference between broad money growth and estimates for money demand. Realizing that the channels through which the setting of monetary policy is transmitted to financial markets are complex, some researchers have found that including capital market measures more fully captures the effect of financial prices and wealth on the economy. We therefore also use a financial conditions index that incorporates movements in real exchange rates, real short- and long-term interest rates, credit spreads, equity returns, and market capitalization. Rapid increases in official reserves held by the central bank create central bank liquidity in the domestic currency and in global markets. In particular, the recycling of dollar reserves in the United States contributes to looser liquidity conditions. To measure this, we look at the growth of official international reserves held at

[51]This annex was prepared by Ken Miyajima.

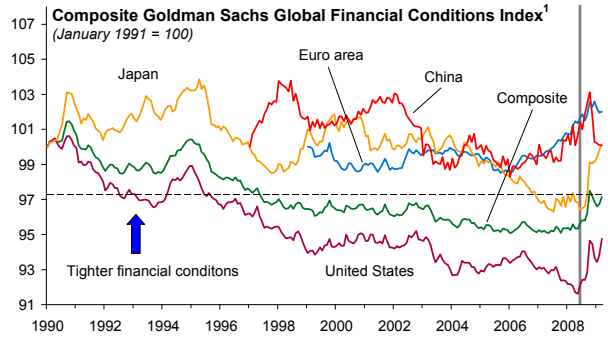
Figure 1.38. Global Financial Stability Map: Monetary and Financial Conditions



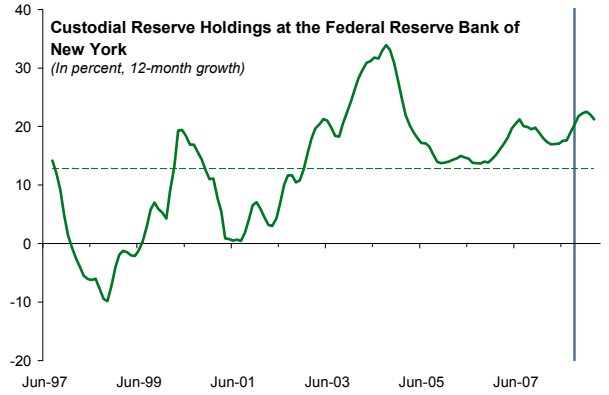
Sources: Bloomberg L.P.; and IMF staff estimates.
[1]Canada and the United Kingdom are included in the composite but not shown separately.



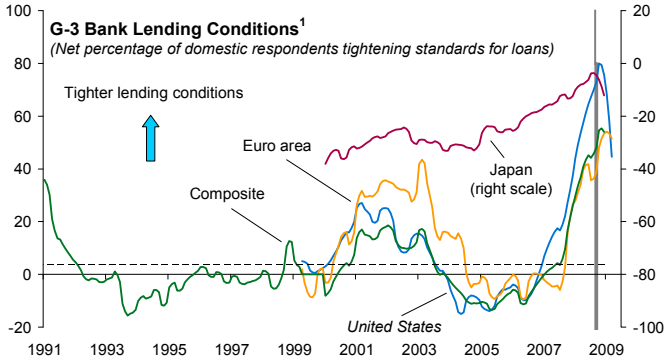
Sources: Bloomberg L.P.; OECD; and IMF staff estimates.



Sources: Goldman Sachs; and IMF staff estimates.
[1]A GDP-weighted average of China, euro area, Japan, and the United States. Each country index represents a weighted average of variables such as interest rates, credit spreads, exchange rates, and financial wealth.



Sources: Federal Reserve Bank of New York; and IMF staff estimates.



Sources: Lending surveys by Bank of Japan, European Central Bank, and Federal Reserve Board for households and corporates; and IMF staff estimates.
[1]Monthly-interpolated GDP-weighted average. Euro area 1999:Q1 to 2002:Q4 based on values implied by credit growth. Composite and Japan showing up to 2008:Q4.

Note: Dashed lines are period averages. Vertical lines represent data as of the October 2008 GFSR.

the Federal Reserve. While most of the above measures capture the price effects of monetary and financial conditions, to further examine the quantity effects we incorporate changes in lending conditions, based on senior loan officer surveys in mature markets.

Risk Appetite

The willingness of investors to take on additional risk by increasing exposure to riskier asset classes, and the consequent potential for increased losses (Figure 1.39). We aim to measure the extent to which investors are actively taking on more risk. A direct approach to this exploits survey data. The Merrill Lynch Fund Manager Survey asks around 200 fund managers what level of risk they are currently taking relative to their benchmark. We track the net percentage of investors reporting higher-than-benchmark risk-taking. An alternative approach is to examine institutional holdings and flows into risky assets. The State Street Investor Confidence Index uses changes in equity holdings by large international institutional investors relative to domestic investors to measure relative risk tolerance.[52] The index extracts relative risk tolerance by netting out wealth effects and assuming that changes in fundamentals symmetrically affect all kinds of investors. We also take account of flows into emerging market bond and equity funds, as these represent another risky asset class. Risk appetite may also be inferred indirectly by examining price or return data. As an example of this approach, the Goldman Sachs Risk Aversion Index measures investors' willingness to invest in risky assets as opposed to risk-free securities, building on the premises of the capital asset pricing model.[53] By comparing returns between government debt and equities, the model allows the level of risk aversion to move over time. Taken together, these measures provide a broad indicator of risk appetite.

Macroeconomic Risks

Macroeconomic shocks with the potential to trigger a sharp market correction, given existing conditions in capital markets (Figure 1.40). Our principal assessment of the macroeconomic risks is based on the analysis contained in the *World Economic Outlook* and is consistent with the overall conclusion reached in that report on the outlook and risks for global growth. We complement that analysis by examining various economic confidence measures. The first of these is a GDP-weighted sum of confidence indices across the major mature markets to determine whether businesses and consumers are optimistic or pessimistic about the economic outlook. Second, recognizing the importance of turning points between expansions and slowdowns of economic activity, we incorporate changes in the Organization for Economic Cooperation and Development's composite leading indicators. Third, in order to gauge inflection points in global trade, we include global trade growth estimates implied by the Baltic Dry Index, a high-frequency indicator based on the freight rates of bulk raw materials that is commonly used as a leading indicator for global trade. The fourth component is market-implied inflation expectations, based on intermediate-dated yield differentials between nominal and inflation-linked domestic bonds. Finally, in order to help assess stress levels on sovereign balance sheets, we examine a GDP-weighted average of the cost that investors need to pay to protect themselves against defaults of selected mature market sovereign debt.

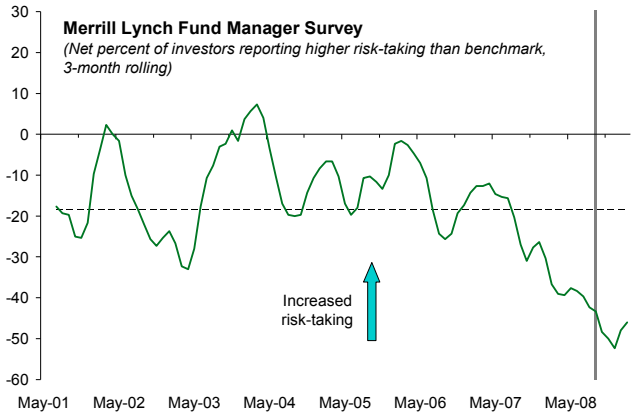
Emerging Market Risks

Risks to global financial stability stemming from emerging market asset classes (Figure 1.41). These risks are closely linked to, but differ from, the macroeconomic risks described above, as the latter measures risks related to growth, inflation, or international trade of the global economy. Using an econometric model of emerging market sovereign spreads, we identify the movement in the

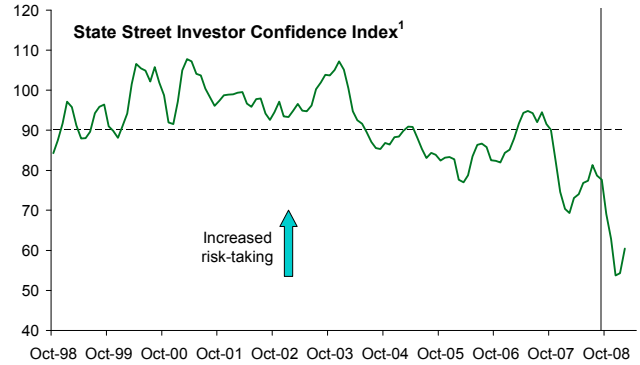
[52]The estimated changes in relative risk tolerance of institutional investors from Froot and O'Connell (2003) are aggregated using a moving average. The index is scaled and rebased so that 100 corresponds to the year 2000.

[53]The index represents the value of the coefficient of risk aversion.

Figure 1.39. Global Financial Stability Map: Risk Appetite

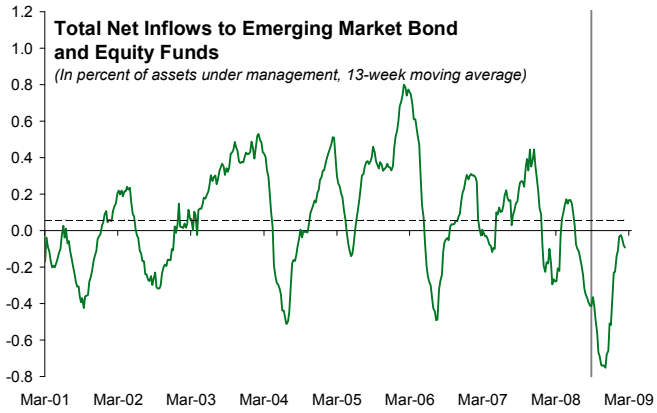


Sources: Merrill Lynch.

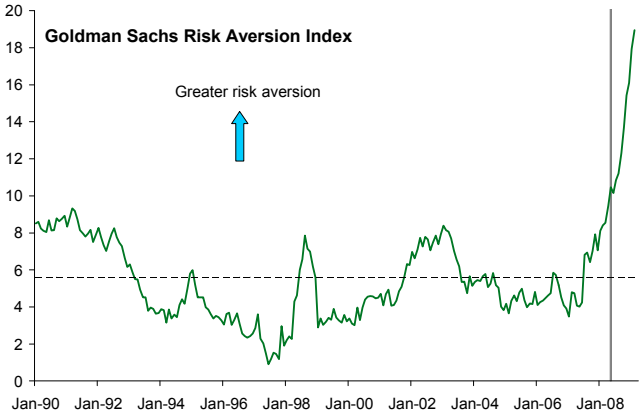


Source: State Street Global Markets.

[1]The estimated changes in relative risk tolerance of institutional investors from Froot and O'Connell (2003) are integrated to a level, scaled, and rebased so that 100 corresponds to the average level of the index in the year 2000. 3-month rolling average of the published index.



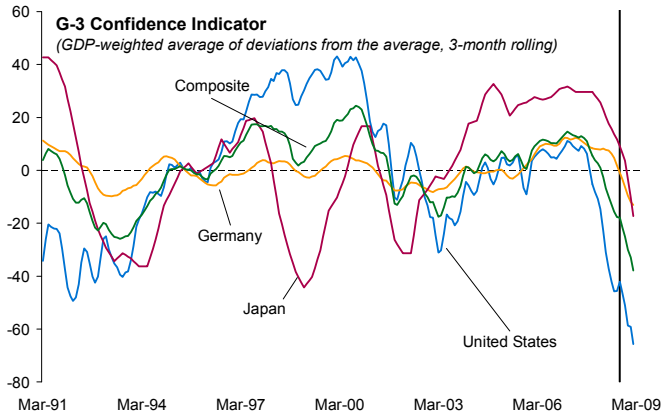
Sources: Emerging Portfolio Fund Research, Inc.; and IMF staff estimates.



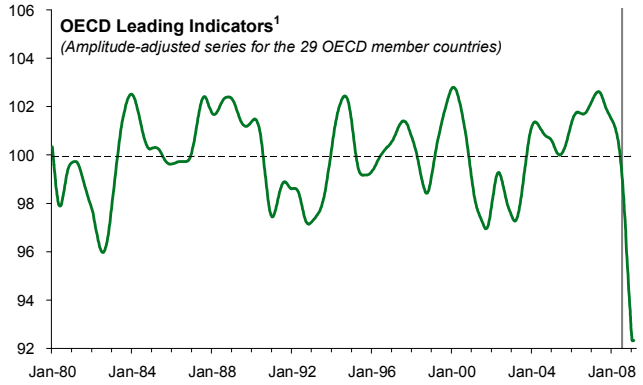
Source: Goldman Sachs.

Note: Dashed lines are period averages. Vertical lines represent data as of the October 2008 GFSR.

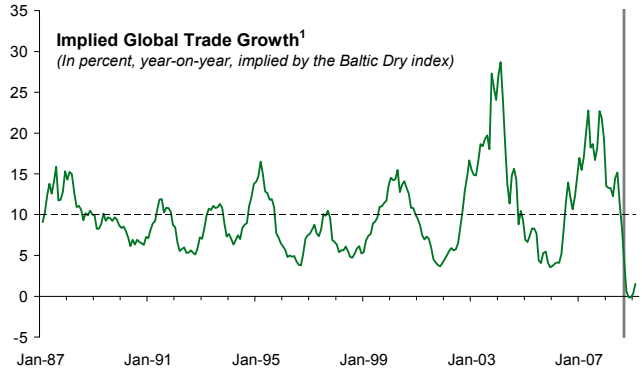
Figure 1.40. Global Financial Stability Map: Macroeconomic Risks



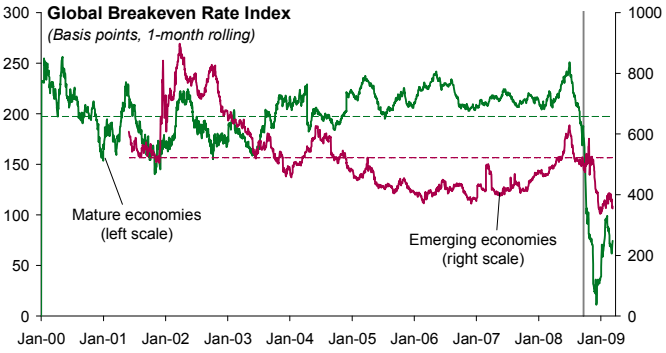
Sources: Bloomberg L.P; and IMF staff estimates.



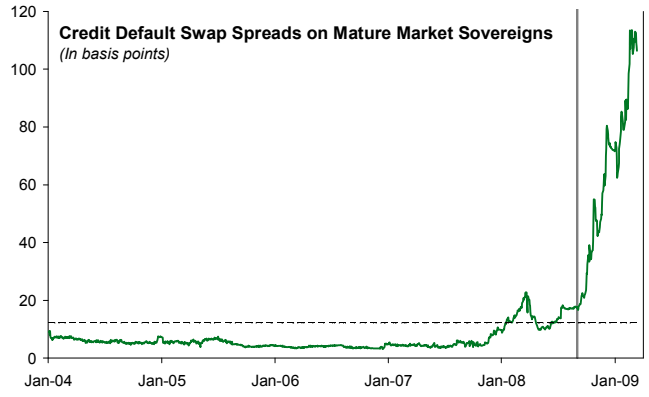
Source: OECD.
[1]Amplitude adjustment is carried out by adjusting mean to 100 and the amplitude of the raw index to agree with that of the reference series by means of a scaling factor.



Sources: The Baltic Exchange; and IMF staff estimates.
[1]The Baltic Dry Index is a shipping and trade index measuring changes in the cost of transporting raw materials such as metals, grains, and fuels by sea.



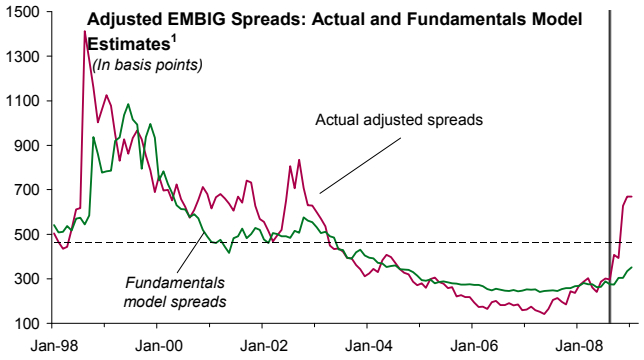
Sources: Barclays Capital; and IMF staff estimates.
Note: Tracking GDP-weighted longer-term breakevens, or inflation expectations, for Australia, Brazil, Canada, Colombia, France, Germany, Italy, Japan, Korea, Mexico, Poland, South Africa, Sweden, Turkey, the United Kingdom, and the United States. The ranking of the observations is determined by z-score in absolute terms relative to their long-run averages.



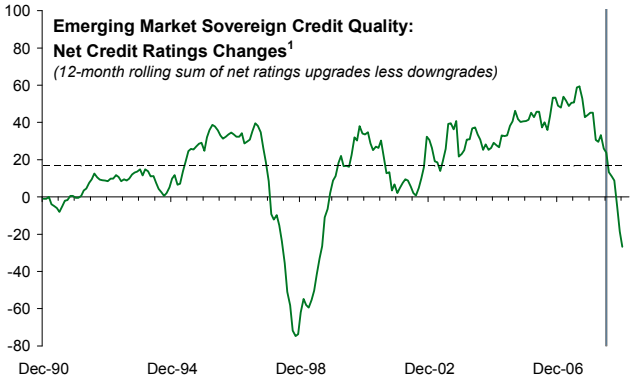
Sources: Datastream; and IMF staff estimates.
Note: GDP-weighted average of France, Germany, Italy, Japan, Spain, United Kingdom, and United States.

Note: Dashed lines are period averages. Vertical lines represent data as of the October 2008 GFSR.

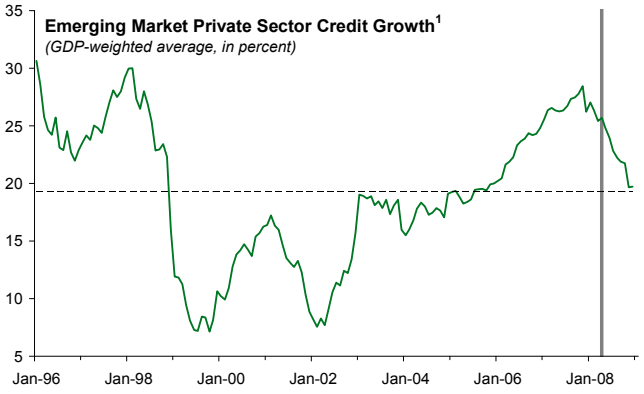
Figure 1.41. Global Financial Stability Map: Emerging Market Risks



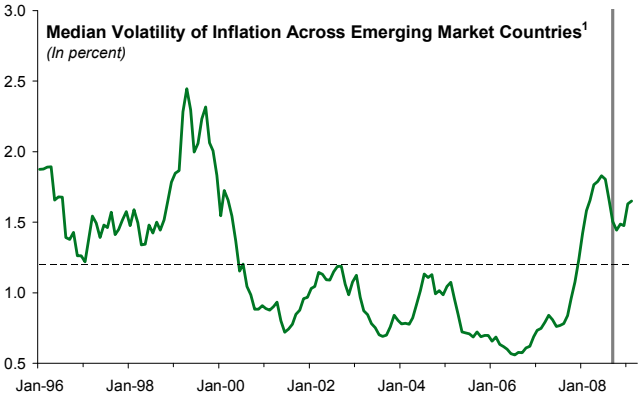
Sources: Bloomberg L.P.; JPMorgan Chase & Co.; The PRS Group; and IMF staff estimates.
[1]EMBIG = Emerging Market Bond Index Global. The model excludes Argentina because of breaks in the data series related to debt restructuring. Owing to the short data series, the model also excludes Indonesia and several smaller countries. The analysis thus includes 32 countries.



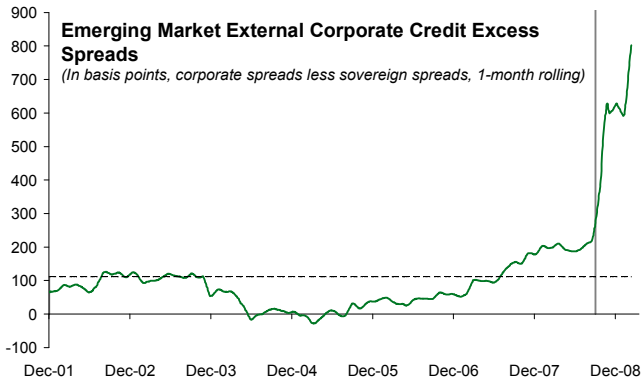
Sources: JPMorgan Chase & Co.; and IMF staff estimates.
[1]Net actions of upgrades (+1 for each notch), downgrades (-1 for each notch), changes in outlooks (+/- 0.25), reviews and creditwatches (+/- 0.5).



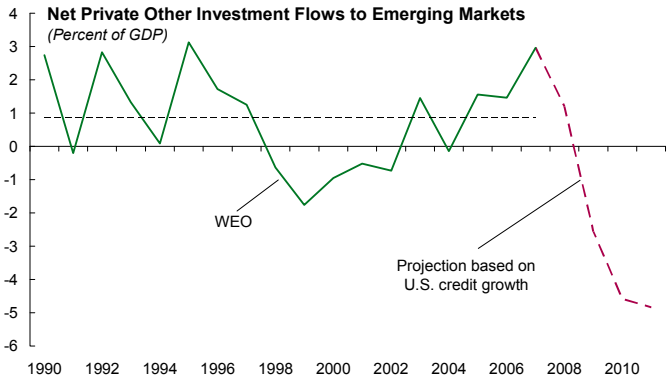
Sources: International Monetary Fund, International Financial Statistics; and IMF staff estimates.
[1] 44 countries.



Sources: Bloomberg L.P.; and IMF staff estimates.
[1]Average of 12-month rolling standard deviations of consumer price changes in 36 emerging markets.



Sources: JPMorgan Chase & Co; and IMF staff estimates.
Note: Unweighted average of Brazil, China, Colombia, Egypt, Kazakhstan, Mexico, Malaysia, Peru, Russia, and Ukraine.



Sources: International Monetary Fund, *World Economic Outlook*; and IMF staff estimates.
Note: 31 selected emerging economies. The ranking is measured by the differences between WEO projection and staff estimates based on US credit growth in 2009, 2010, and 2011.

Note: Dashed lines are period averages. Vertical lines represent data as of the October 2008 GFSR.

Emerging Market Bond Index Global (EMBIG) spreads accounted for by changes in fundamentals, as opposed to the movement in spreads attributable to other factors. Included in the fundamental factors are changes in economic, political, and financial risks within each country.[54] This is complemented with a measure of the trend in sovereign rating actions by credit rating agencies to gauge changes in the macroeconomic environment and progress in reducing vulnerabilities arising from external financing needs. In addition to these factors relating to sovereign debt, we also include an indicator of growth in private sector credit. Other components of the subindex include a measure of the volatility of inflation rates, and a measure of corporate credit spreads relative to sovereign spreads. Lastly, we forecast econometrically a subcomponent of capital flows to emerging markets from projected credit growth in the United States.

Credit Risks

Changes in, and perceptions of, credit quality that have the potential for creating losses resulting in stress to systemically important financial institutions (Figure 1.42). Spreads on a global corporate bond index provide a market price-based measure of investors' assessment of corporate credit risk. We also examine the credit-quality composition of the high-yield index to identify whether it is increasingly made up of higher- or lower-quality issues, calculating the percentage of the index comprised of CCC or lower rated issues. In addition, we incorporate forecasts of the global speculative-grade default rate produced by Moody's. Another component of the subindex is a banking stability index, which represents the expected number of defaults among large complex financial institutions (LCFIs), given at least one LCFI default (Segoviano and Goodhart, forthcoming). This index is intended to highlight market perceptions of systemic default risk in the financial sector. To capture broader credit risks, we also include delinquency rates on a wide range of other credit, including residential and commercial mortgages and credit card loans. Also included is a measure of stress on household balance sheets, constructed as the total amount of financial obligations[55] scaled by disposable income for U.S. households.

Market and Liquidity Risks

The potential for instability in pricing risks that could result in broader spillovers and/or mark-to-market losses (Figure 1.43). An indicator attempting to capture the extent of market sensitivity of hedge fund returns provides an indirect measure of institutional susceptibility to asset price changes. The subindex also includes a speculative positions index, constructed from the net noncommercial positions relative to overall open interest for a range of futures contracts as reported to the Commodity Futures Trading Commission. The index typically rises when speculators are taking relatively large positional bets on futures markets, relative to commercial traders. Also included is an estimation of the proportion of variance in returns across a range of asset classes that can be explained by a common factor. The higher the size of a common factor across asset-class returns, the greater the risk of a disorderly correction in the face of a shock. An additional indicator is an estimate of equity risk premia in mature markets using a three-stage dividend discount model. Low equity risk premia may suggest that investors are underestimating the risk attached to equity holdings, thereby increasing potential market risks. There is also a measure of implied volatility across a range of assets.

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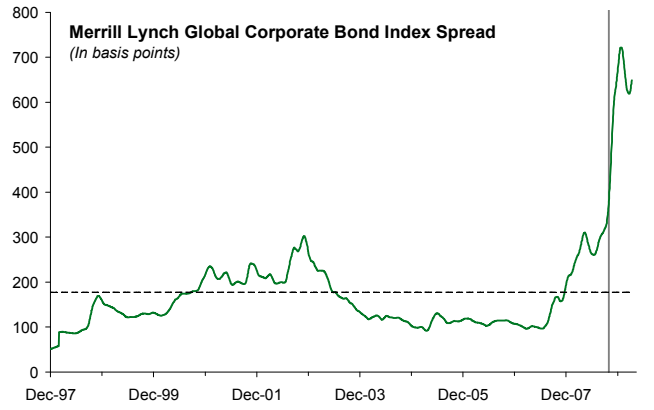
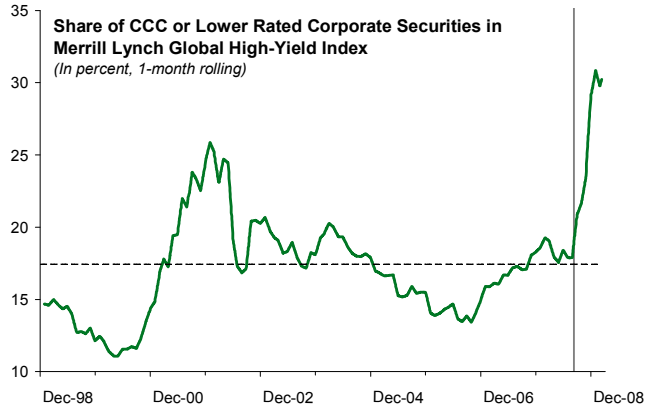
[54]The economic risk rating is the sum of risk points for annual inflation, real GDP growth, the government budget balance as a percentage of GDP, the current account balance as a percentage of GDP, and GDP per capita as a percentage of the world average GDP per capita. The financial risk rating includes foreign debt as a percentage of GDP, debt service as a percentage of GDP, net international reserves as months of import cover, exports of goods and services as a percentage of GDP, and exchange rate depreciation over the last year. The political risk rating is calculated using 12 indicators representing government stability and social conditions.

[55]Estimated payments on outstanding mortgages, consumer debt, auto leases, rental contracts, homeowners' insurance, and property tax.

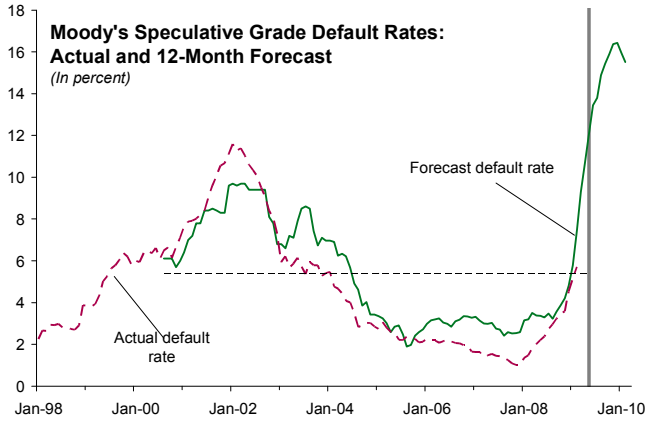
Figure 1.42. Global Financial Stability Map: Credit Risks



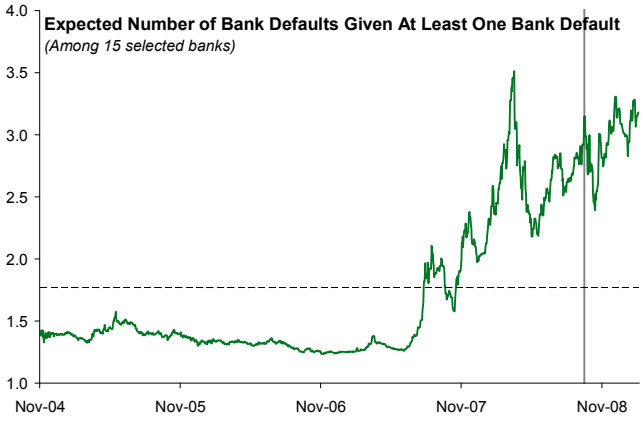
Sources: Merrill Lynch; and IMF staff estimates.



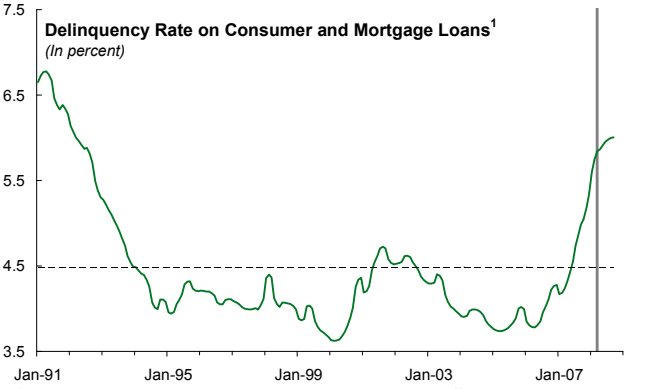
Sources: Merrill Lynch; and IMF staff estimates.



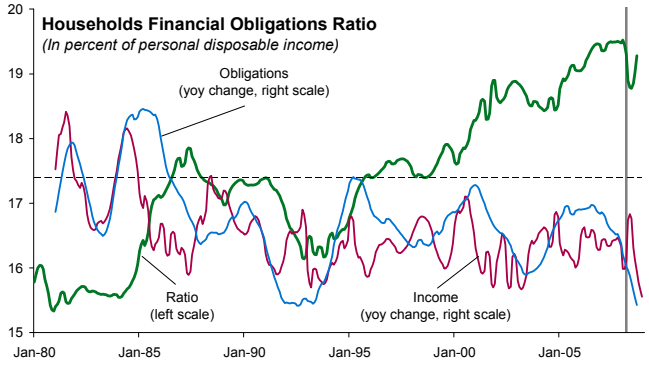
Source: Moody's.



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



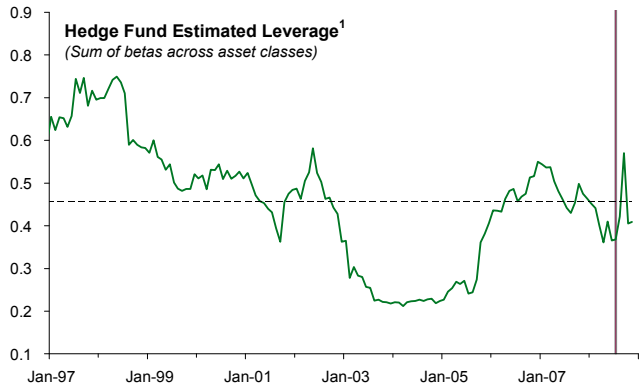
Sources: Federal Reserve; Mortgage Bankers Association; and IMF staff estimates.
[1]30-, 60-, and 90-day delinquencies for residential and commercial mortgages, and credit card loans in the United States. Quarterly data are extrapolated into monthly frequency.



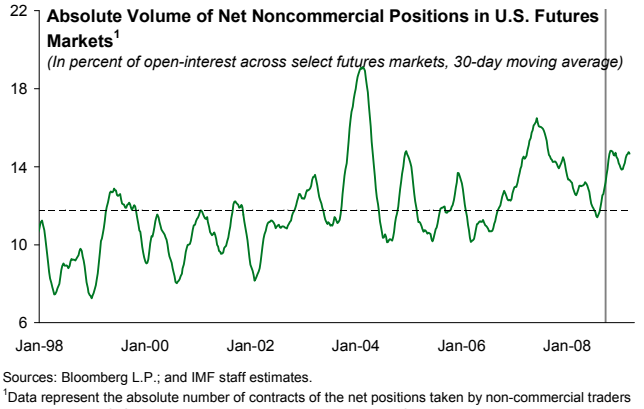
Sources: Federal Reserve; and IMF staff estimates.
Note: Financial obligations consist of the estimated required annual payments on outstanding mortgages, consumer debt, automobile lease, rental on tenant-occupied property, homeowners' insurance, and property tax.

Note: Dashed lines are period averages. Vertical lines represent data as of the October 2008 GFSR.

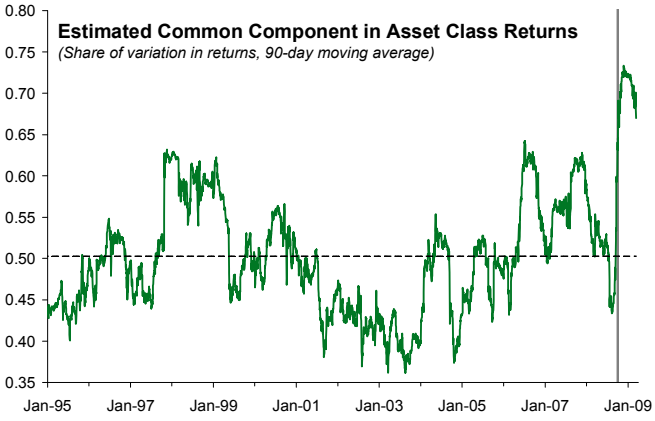
Figure 1.43. Global Financial Stability Map: Market and Liquidity Risks



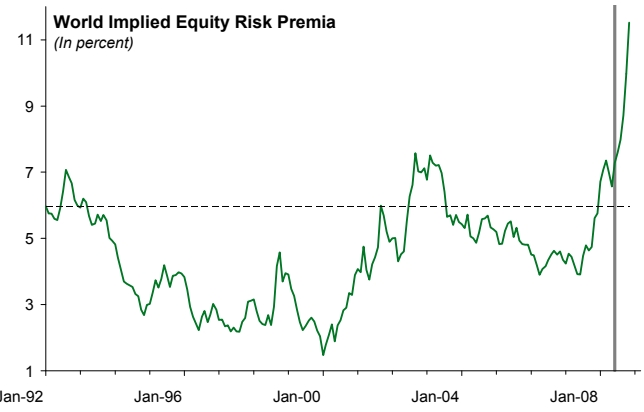
Sources: Credit Suisse Tremont Index LLC; and IMF staff estimates.
[1]36-month rolling regressions of hedge fund performance versus real asset returns.



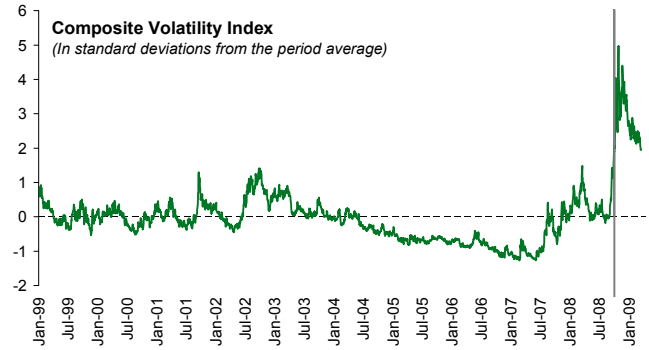
Sources: Bloomberg L.P.; and IMF staff estimates.
[1]Data represent the absolute number of contracts of the net positions taken by non-commercial traders in 17 selected U.S. futures markets. Higher volume is indicative of heavier speculative positioning across markets, either net-long or net-short.



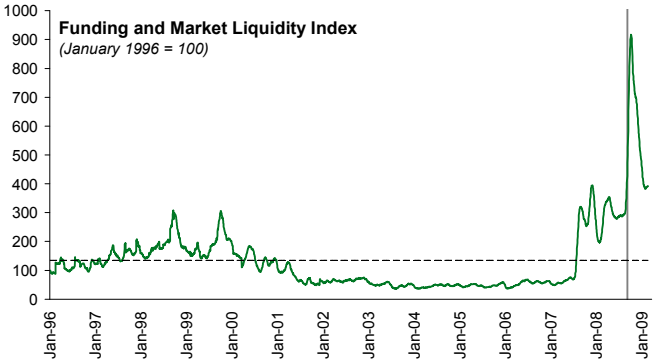
Sources: Bloomberg L.P.; JPMorgan Chase & Co.; and IMF staff estimates.



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



Sources: Bloomberg L.P.; and IMF staff estimates.
Note: Representing an average z-score of the implied volatility derived from options from stock market indices, interest, and exchange rates. A value of 0 indicates the average implied volatility across asset classes is in line with the period average (from 12/31/98 where data is available). Values of +/-1 indicate average implied volatility is one standard deviation above or below the period average.



Sources: Bloomberg L.P.; and IMF staff estimates.
Note: Based on the spread between yields on government securities and interbank rates, spread between term and overnight interbank rates, currency bid-ask spreads, and daily return-to-volume ratios of equity markets. A higher value indicates tighter market liquidity conditions.

Note: Dashed lines are period averages. Vertical lines represent data as of the October 2008 GFSR.

Finally, to capture perceptions of funding conditions, secondary market liquidity, and counterparty risks, we incorporate the spread between major mature-market government securities yields and interbank rates, the spread between interbank rates and expected overnight interest rates, bid-ask spreads on major mature-market currencies, and daily return-to-volume ratios of equity markets.

Annex 1.2. Predicting Private "Other Investment" Flows and Credit Growth in Emerging Markets[56]

To assess the impact of the credit crunch in advanced economies on credit flows to emerging markets, we develop a fixed-effects vector autoregression model with one lag containing the following variables:

(1) Growth in U.S. domestic credit, year-on-year;

(2) Net private other investment flows to emerging markets, as percent of GDP;

(3) Emerging market real domestic credit growth, year-on-year, deflated by the consumer price index;

(4) Emerging market real GDP growth, year-on-year.

The data set contains annual observations for 31 emerging markets from 1990 to 2007.[57] The "other investment" category of the financial account contains cross-border bank financing and trade credits and is of particular importance for financial stability over the next few years, given the risks to emerging markets from shrinking global bank balance sheets.

The impulse responses have the expected signs, including positive effects on capital inflows and emerging market credit growth from positive shocks to U.S. credit growth (Figure 1.44).[58] Using the GFSR projection for U.S. credit growth as input (see Figure 1.5), the model yields forecasts for net private other investment flows, emerging market credit growth, and emerging market GDP growth.[59]

The model's projection of cross-border bank flows to emerging markets implies a "sudden stop," with substantial net outflows of other investment that average around 5 percent of GDP over the next few years (Figure 1.45). Outflows of this magnitude were registered in the late 1990s by several Southeast Asian countries, and in the early 1980s by Latin American countries. In line with the dire outlook for cross-border bank financing, the model predicts that real credit will contract by as much as 15 percent in emerging markets in 2010 and 2011 (Figure 1.46). Again, the predicted magnitudes are similar to credit contractions in previous financial crises in emerging markets. The knock-on effects on GDP growth could be considerable according to the model, with average emerging market growth stalling in 2010 and 2011 (Figure 1.47).

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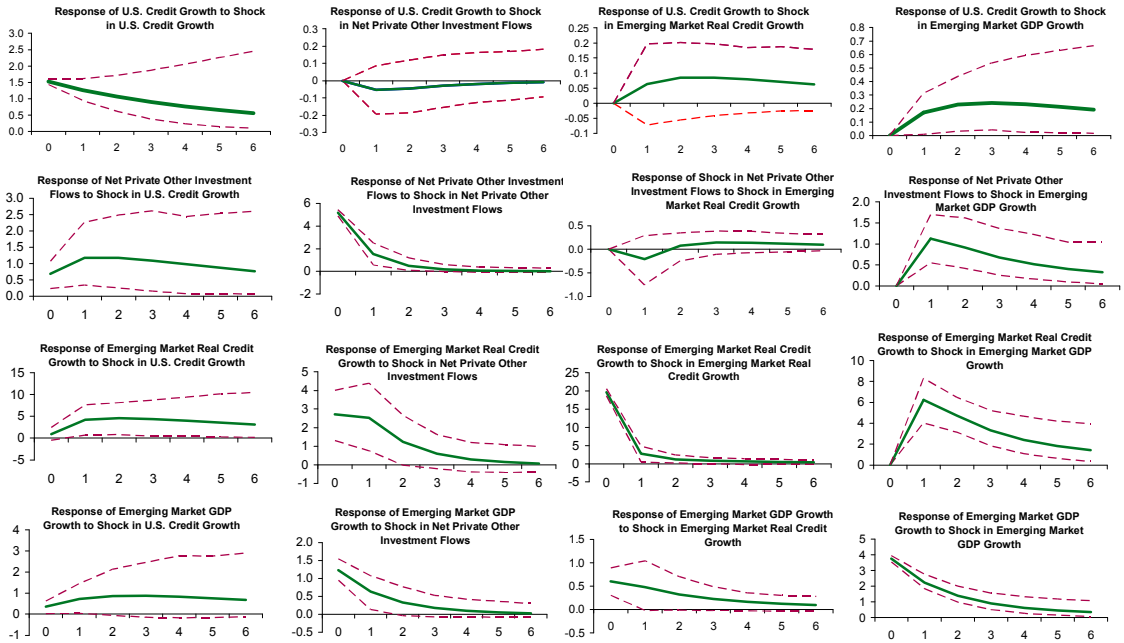
[56]This annex was prepared by Kristian Hartelius.

[57]The code used to estimate the model and produce impulse response functions was written by Inessa Love at the World Bank.

[58]The point estimates of the parameters yield mean reverting model dynamics. There is, however, a potential unit root in any measure of U.S. credit growth between 1990 and 2007. The unit root is not present in a longer sample between 1970 and 2007, and there is no theoretical reason to believe that U.S. credit growth should be nonstationary in the long run. A model with two lags does not exhibit widening error bands, but makes less economic sense. Given that global financial integration increased greatly from around 1990, the preferred model contains one lag and is estimated over the period 1990–2007.

[59]The credit growth numbers are treated as a series of shocks to the model. The shock in period *t* is measured as the scaled difference between the GFSR forecast for U.S. credit growth and the model dynamics for U.S. credit growth without a shock in *t* (but incorporating shocks from previous periods).

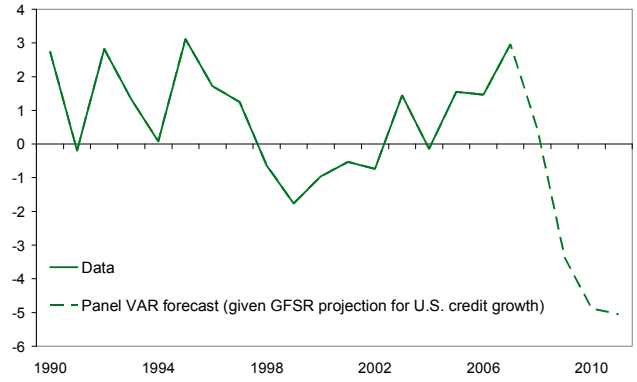
Figure 1.44. Impulse Responses



Sources: IMF staff estimates.
Note: Dashed red lines represent 90 percent confidence bands. One standard deviation Cholesky orthogonal shocks.

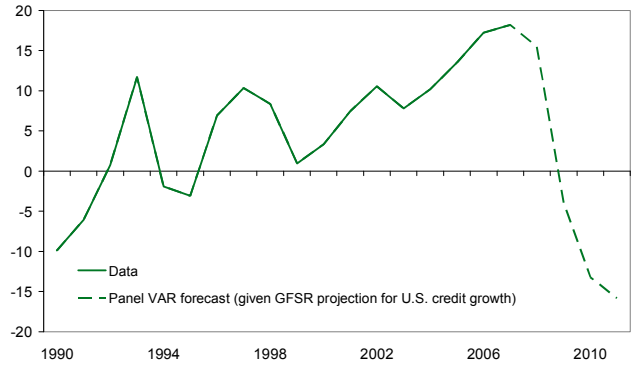
Figure 1.45. Net Private Other Investment Flows to Emerging Markets

(Percent of GDP, average in panel)



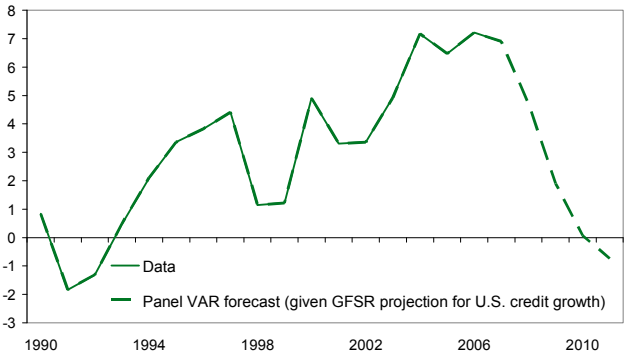
Source: IMF staff estimates.

Figure 1.46. Emerging Market Real Credit Growth
(Percent year-on-year, average in panel)



Source: IMF staff estimates.

Figure 1.47. Emerging Market GDP Growth
(Percent year-on-year, average in panel)



Source: IMF staff estimates.

These model projections, however, may be too extreme for many emerging markets for several reasons. First, the model estimates common coefficients for all countries in the sample between 1990 and 2007, and therefore generates forecasts for the "typical" or "average" emerging market country. Second, the model does not take into account the potential in many emerging markets for policy responses that are stronger than the average response in the sample, made possible by historically large international reserves and strong fiscal positions. Third, the global policy response under way, with increased resources for the IMF and other international financial institutions, may mitigate the impact of the financial crisis on emerging markets. Finally, the model does not account for the potential stabilizing effect of parent bank support for lending by their emerging market subsidiaries, to the extent that such support currently is stronger than on average in the sample.

Annex 1.3. Spillovers Between Foreign Banks and Emerging Market Sovereigns[60]

The methodology in Segoviano and Goodhart (forthcoming) analyzes how problems in advanced country banking systems are linked with increasing risks to emerging markets.[61] It uses CDS spreads on sovereign and bank bonds to derive the probabilities of distress of banks and sovereigns priced into the markets (Figure 1.48). We estimate linkages among vulnerabilities between Latin American, eastern European, and Asian emerging markets and the advanced country banks with large regional presences in these regions.[62] To illustrate them, we present distress dependence matrices estimated for each of these regions (Table 1.12) at specific dates.[63] These matrices report probabilities that a bank/country in the row will become distressed if the bank/country in the

[60]This annex was prepared by Miguel Segoviano.

[61]This approach allows us to recover linear (correlations) and nonlinear distress dependence among the banks and sovereigns included in the analysis. This dependence changes throughout the economic cycle, reflecting the fact that dependence increases in periods of distress.

[62]The countries and banks analyzed in Latin America are Brazil, Chile, Colombia, and Mexico. The banks are BBVA, Citigroup, HSBC, Santander, and Scotia Bank. In eastern Europe, the countries are Bulgaria, Croatia, Czech Republic, Estonia, Hungary, and the Slovak Republic, and the banks are Citigroup, Erste, Intesa, Société Generale, and Unicredito. In Asia, the countries are China, Indonesia, Korea, Malaysia, the Philippines, and Thailand, and the banks are BNP, Citigroup, DBS, Deutsche, HSBC, JP Morgan Chase, Standard and Chartered.

[63]We choose specific dates to show how conditional probabilities of distress have changed from a pre-crisis period to the post-Lehman episode.

column becomes distressed.[64] In order to analyze how distress dependence has evolved over time, we also estimate the time series of the conditional probabilities of distress of banks/countries if other banks/countries default (Figure 1.48).[65]

The analysis shows that risks in sovereigns and banks increased markedly after October 2008. In the run-up to the crisis, there was little concern about risks to sovereigns and parent banks in eastern Europe, and risk perceptions in Latin America and Asia were falling (Figure 1.48). From July 2007 to September 2008, both sovereign risk and bank risk increased and moved in tandem, but since October 2008, risk in sovereigns has been significantly higher than in banks (Figure 1.49). This may reflect the deepening downturn in emerging economies in late 2008 and the support received by banks in developed countries from their sovereigns.

Bank problems appear to have a significant impact on sovereign distress. This is seen by comparing the probability of distress of the emerging market sovereigns conditional on distress in the mature market banks in July 2007, when sovereigns appeared to have low risk of contamination, and in September 2008. In the last quarter of 2008, sovereign risk conditional on bank risk has increased further (Figure 1.49).

Banks' geographical role matters in sovereign distress. Quadrant 3 of the distress dependence matrices shows the distress of Spanish banks to be associated with the highest distress in Latin America and Italian banks in eastern Europe. Distress of Standard Chartered is associated with significant stress in Asia (quadrant 3, column average). These results suggest that geographic roles matter, since these banks have a substantial presence in the respective regions under analysis.

Direct links between banks and countries matter. Distress in countries with a particularly large foreign bank presence—such as Mexico and the Czech Republic—is more strongly associated with potential banking distress (quadrant 2). Direct links from individual banks to countries also matter—for example, distress at Citigroup, Intesa, and DBS are relatively more important for Mexico, Hungary, and Indonesia, respectively, than for other countries (quadrant 3).

The results also illustrate the influence of systemic risk, which constitutes an indirect link on Asia, over and above direct regional and bilateral links. Direct ownership and lending by foreign banks is generally lower in Asia than in eastern Europe or Latin America, insulating banking systems somewhat from these direct links, and increasing the relative importance of indirect links involving bank and/or sovereign distress. In addition, links between banks may be somewhat less important for emerging Asia, as borrowing through debt markets tends to play a larger role in local financial systems. Indirect effects are particularly evident in Korea and Indonesia.[66]

Overall, the results indicate that systemic bank risks and emerging market vulnerabilities appear to be highly dependent. This likely reflects the fact that distress in individual banks is a bellwether for the state of the overall financial system, via direct or indirect links. The bottom line is that policies to limit systemic risks in advanced country financial systems would also sharply reduce risks to emerging markets.

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[64]These matrices can be estimated for each day. They report links across countries (bottom right, quadrant 4), and across banks (top left, quadrant 1). The bottom left (quadrant 3) reports how sovereign distress is conditional on bank problems, while the top right (quadrant 2) indicates the opposite direction.

[65]Note that there is a daily time series for each of the quadrants described in the previous footnote. Each observation in the time series corresponds to the average of the conditional probabilities in each quadrant, at each day.

[66]An important strength of our approach is that market prices reflect perceptions of *direct links* and *indirect links*. For the former, market presence might be an important element, as in Latin America and eastern Europe; however, for the latter, liquidity pressures and systemic banking distress/macroeconomic spillovers might play an important role. This feature of our approach appears to be particularly relevant in Asia.

Table 1.12 Distress Dependence Matrices: Sovereign and Banks

(As of February 11, 2009)

Latin America

	BBVA	Santander	Citigroup	HSBC	Row Average
BBVA	1.00	0.73	0.33	0.64	0.67
Santander	0.73	1.00	0.32	0.63	0.67
Citigroup	0.75	0.72	1.00	0.78	0.81
HSBC	0.59	0.57	0.31	1.00	0.62
Column average	0.77	0.76	0.49	0.76	0.69
Mexico	0.87	0.86	0.81	0.87	0.85
Colombia	0.82	0.82	0.65	0.82	0.78
Brazil	0.82	0.82	0.70	0.82	0.79
Chile	0.74	0.73	0.56	0.74	0.69
Column average	0.81	0.81	0.68	0.81	0.78

	Mexico	Colombia	Brazil	Chile	Row Average
BBVA	0.28	0.26	0.28	0.36	0.29
Santander	0.28	0.26	0.28	0.36	0.29
Citigroup	0.59	0.46	0.54	0.64	0.56
HSBC	0.26	0.23	0.25	0.33	0.27
Column average	0.35	0.30	0.34	0.42	0.35
Mexico	1.00	0.65	0.80	0.87	0.83
Colombia	0.66	1.00	0.66	0.75	0.77
Brazil	0.76	0.61	1.00	0.80	0.79
Chile	0.57	0.48	0.55	1.00	0.65
Column average	0.75	0.69	0.75	0.86	0.76

Eastern Europe

	Intesa	Unicredito	Erste	SocGen	Citigroup	Row Average
Intesa	1.00	0.48	0.30	0.45	0.21	0.49
Unicredito	0.60	1.00	0.37	0.55	0.27	0.56
Erste	0.56	0.54	1.00	0.57	0.34	0.60
SocGen	0.38	0.37	0.27	1.00	0.18	0.44
Citigroup	0.52	0.52	0.45	0.53	1.00	0.60
Column average	0.61	0.58	0.48	0.62	0.40	0.54
Bulgaria	0.71	0.72	0.72	0.74	0.63	0.70
Croatia	0.80	0.79	0.76	0.77	0.66	0.76
Hungary	0.83	0.81	0.81	0.78	0.66	0.78
Slovakia	0.35	0.36	0.30	0.35	0.33	0.34
Estonia	0.69	0.67	0.64	0.64	0.56	0.64
Czech Republic	0.61	0.63	0.64	0.59	0.45	0.58
Column average	0.67	0.66	0.64	0.65	0.55	0.63

	Bulgaria	Croatia	Hungary	Slovakia	Estonia	Czech Republic	Row Average
Intesa	0.14	0.18	0.19	0.18	0.17	0.24	0.18
Unicredito	0.18	0.22	0.24	0.23	0.21	0.31	0.23
Erste	0.26	0.31	0.35	0.28	0.29	0.47	0.33
SocGen	0.12	0.15	0.15	0.15	0.13	0.20	0.15
Citigroup	0.31	0.36	0.38	0.40	0.33	0.44	0.37
Column average	0.20	0.24	0.26	0.25	0.23	0.33	0.25
Bulgaria	1.00	0.71	0.67	0.76	0.71	0.78	0.77
Croatia	0.63	1.00	0.68	0.70	0.68	0.82	0.75
Hungary	0.57	0.65	1.00	0.65	0.64	0.85	0.73
Slovakia	0.30	0.31	0.30	1.00	0.31	0.40	0.44
Estonia	0.58	0.62	0.61	0.65	1.00	0.73	0.70
Czech Republic	0.39	0.46	0.50	0.50	0.45	1.00	0.55
Column average	0.58	0.62	0.63	0.71	0.63	0.76	0.66

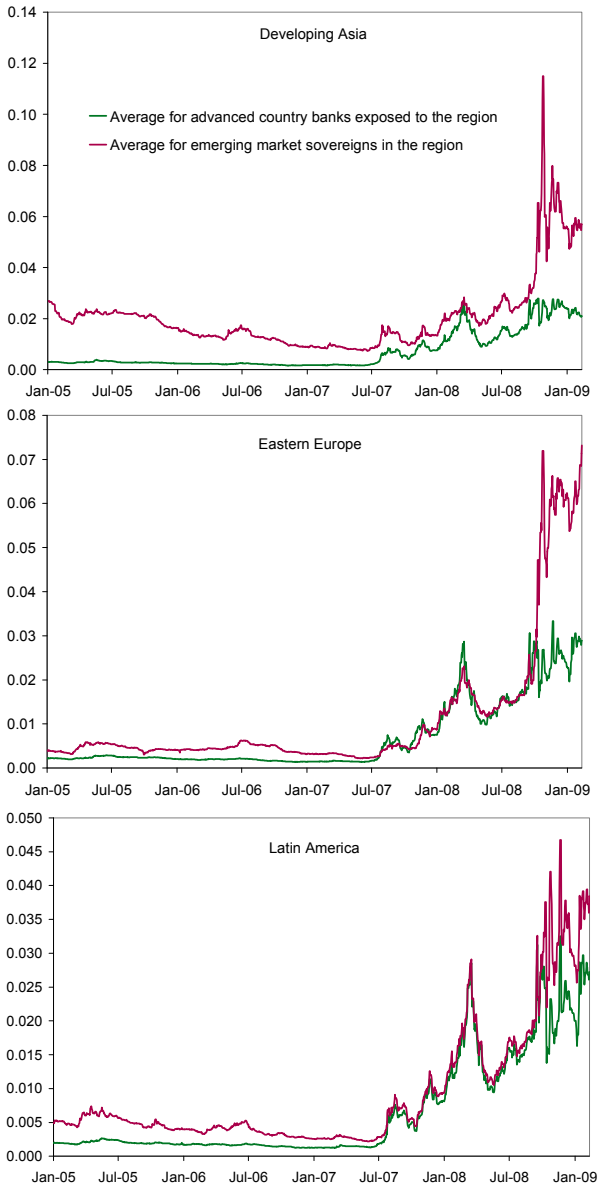
Asia

	HSBC	StanChart	Citigroup	Deutsche	BNP	DBS	JPMorgan	Row Average
HSBC	1.00	0.40	0.24	0.47	0.59	0.24	0.28	0.46
StanChart	0.73	1.00	0.37	0.65	0.79	0.40	0.42	0.62
Citigroup	0.60	0.51	1.00	0.68	0.65	0.36	0.85	0.66
Deutsche	0.39	0.30	0.23	1.00	0.57	0.18	0.30	0.42
BNP	0.35	0.25	0.15	0.40	1.00	0.15	0.19	0.36
DBS	0.48	0.43	0.28	0.43	0.52	1.00	0.30	0.49
JPMorgan	0.27	0.23	0.34	0.36	0.33	0.15	1.00	0.38
Column average	0.55	0.45	0.37	0.57	0.63	0.36	0.48	0.49
Korea	0.59	0.59	0.40	0.55	0.62	0.71	0.40	0.55
Malaysia	0.42	0.44	0.31	0.45	0.50	0.55	0.31	0.43
Thailand	0.41	0.41	0.28	0.37	0.44	0.48	0.28	0.38
China	0.41	0.37	0.27	0.36	0.41	0.38	0.30	0.36
Philippines	0.47	0.51	0.36	0.49	0.53	0.55	0.33	0.46
Indonesia	0.68	0.69	0.52	0.63	0.69	0.83	0.51	0.65
Column average	0.50	0.50	0.36	0.48	0.53	0.58	0.36	0.47

	Korea	Malaysia	Thailand	China	Philippines	Indonesia	Row Average
HSBC	0.20	0.20	0.19	0.22	0.14	0.13	0.33
StanChart	0.36	0.38	0.35	0.36	0.27	0.24	0.32
Citigroup	0.34	0.36	0.33	0.36	0.26	0.25	0.14
Deutsche	0.15	0.18	0.15	0.16	0.12	0.10	0.11
BNP	0.12	0.14	0.12	0.13	0.09	0.08	0.40
DBS	0.47	0.51	0.44	0.39	0.31	0.31	0.13
JPMorgan	0.13	0.15	0.13	0.15	0.10	0.10	0.23
Column average	0.25	0.27	0.24	0.25	0.18	0.17	0.24
Korea	1.00	0.69	0.61	0.61	0.48	0.44	0.52
Malaysia	0.49	1.00	0.46	0.46	0.38	0.33	0.48
Thailand	0.43	0.46	1.00	0.38	0.29	0.30	0.45
China	0.39	0.42	0.34	1.00	0.28	0.25	0.60
Philippines	0.57	0.63	0.48	0.51	1.00	0.42	0.78
Indonesia	0.78	0.84	0.74	0.70	0.63	1.00	0.58
Column average	0.61	0.67	0.60	0.61	0.51	0.46	0.57

Source: IMF staff estimates.

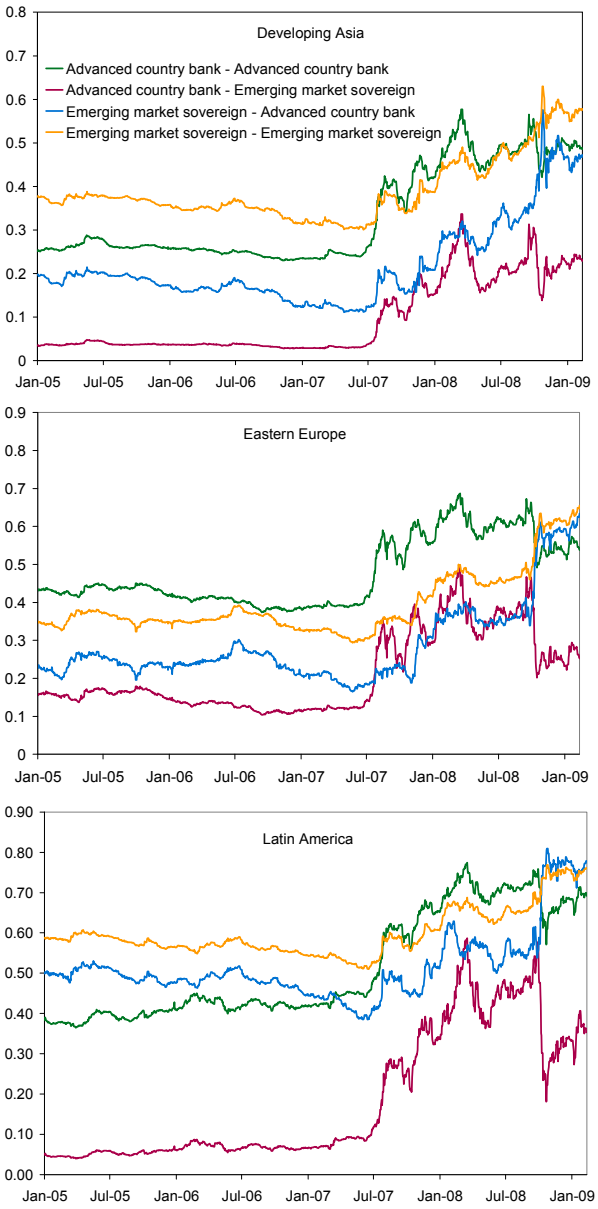
Figure 1.48. Default Probabilities Implied by Credit Default Swap Pricing



Source: IMF staff estimates.

Figure 1.49. Distress Dependence

(Average conditional probabilities for the region)



Source: IMF staff estimates.

Annex 1.4. Debt Restructuring in Systemic Crises[67]

This annex discusses the principles and options for debt restructuring in response to distress posed by systemic crises.

Principles of Debt Restructuring

Debt restructuring must be part of a comprehensive set of macroeconomic and sectoral policies. Such policies should include measures to stabilize the economic environment so that debtors, creditors, and investors can value transactions. In addition, a program must include an assessment of the scale and nature of corporate distress and a supporting legal, regulatory, and accounting environment.

The effectiveness of debt restructuring will be limited until progress has been made on a variety of critical fronts. First, progress in restructuring the financial sector is needed. Debt restructuring is, in part, about the allocation of losses between creditors and borrowers, and thus the ability of financial institutions to absorb losses must be known. Second, the legal framework should facilitate restructuring. Out-of-court settlements are typically the most effective approach, but a sound and effective bankruptcy framework is a necessary backdrop for the restructuring strategy. Third, the strategy developed by the authorities must be cast within a framework where loss allocation is seen as equitable to all participants

Restructuring Options in the Current Environment

The current global crisis differs from past cases. The roots of previous systemic crises lay primarily in the gradual impairment of banks' loan portfolios. In the current global crisis, in contrast, broad asset-quality deterioration was initially not the dominant concern, as the distress in the U.S. subprime market was seen as affecting only a subclass of structured products. Market concerns quickly broadened, however, to include all structured products, undermining the banks' "originate-and-distribute" funding model and culminating in serious financial constraints on corporate and household borrowers.

This evolution of the crisis has complicated normal debt restructuring options. Structured products remain in bank portfolios, limiting transparency and carrying the potential for further losses. In addition, the growing economic slowdown is putting pressures on households and corporate asset quality. Restructuring strategies for a variety of asset classes must be identified and implemented.

Restructuring Structured Products

Asset restructuring has become much more complex than in the past because of the reliance on securitization vehicles. In addition to traditional direct loan exposures, banks now also hold tranches of structured securities issued by such vehicles. When securitization structures are downgraded, the banks suffer writedowns in asset values. While banks can manage nonperforming loans, they are merely investors in the structured securities and have little legal rights to restructure the loans underlying these structured products. In addition, the securitization structures themselves have limited legal power to modify the contractual agreements of the underlying loans. While securitization structures are owners of the loans, the modification of securitized loans is only permissible if bondholders continue to be paid according to the original terms of the contract. In addition, securitized structures cannot sell delinquent loans, as typically envisaged in their operational frameworks, because of the absence of liquidity in loan markets.

Currently, resolution options are limited. Typically, the only option is to allow the securitization structure to fail, liquidate the assets, and allocate resources recovered in liquidation to the

[67]This annex was prepared by David Hoelscher.

bondholders in order of priority. Loan restructuring is not an alternative. In the current environment, the liquidation of assets is likely to result in significant discounts and large losses.

One option is to establish a publicly financed special-purpose vehicle (PSPV) as an instrument to remove structured products from bank portfolios. The PSPV, however, cannot just purchase tranches of structured securities and restructure underlying loans because it would only be a bondholder without creditor rights. Rather, to restructure loans, the PSPV would have to buy all assets of the securitization structures. Once it acquired such rights, it would be in a position to restructure underlying loans.

Pricing of either asset portfolios or structured securities is a key policy issue. Any pricing decision carries the risk of either overcompensation or undercompensation of the banks. In addition, the pricing policy will have implications for the restructuring strategy of banks. The pricing process, therefore, must be determined in the context of the overall financial sector strategy and be transparent. One approach would be to price all structured securities using common indices such as the CDX, LCDX, etc. At current prices, this would imply a loss of about 70 percent of the nominal value. Another approach would be to use the book value subject to review by a specialized accounting firm.

In late 2008, the Swiss government adopted a bank support program that entailed the creation of a new SPV to purchase UBS's distressed or illiquid assets. The SPV purchased assets at book value but will not try to reschedule underlying loans. It also provides long-term liquidity support to UBS, strengthening UBS's balance sheet by reducing risk-weighted assets. UBS retains the first loss position on the assets transferred through a capital participation in the vehicle. The central bank provided the SPV with a loan for the purchase of UBS's assets in an amount exceeding the value of current distressed or illiquid assets, and UBS with capital support equal to its equity participation in the vehicle.

Corporate Restructuring

Lessons from corporate debt have been drawn from a variety of cases in the 1990s, including Brazil, the Czech Republic, Indonesia, Korea, Malaysia, Mexico, Thailand, and Turkey.[68] Two broad approaches have been followed in such experiences:

- A voluntary private sector debt workout between banks and borrowers. In this case, debtors negotiate with a consortium of creditors to establish a mutually agreeable level of debt service and loan maturities.
- Governments take a central role in the restructuring process. The specific role will vary from case to case but is essential in a systemic crisis where insolvencies are large and private coordination difficult.

In voluntary private debt restructuring, debtors and creditors negotiate compatible rescheduling arrangements. While bank-led, government intervention may include orchestrating voluntary workouts, establishing guidelines, or adjusting tax and prudential rules that might otherwise impede finding a common solution. The creditors assess the debtor in terms of its financial strengths. The out-of-court settlement approach allows negotiated rescheduling. A critical feature is an effective insolvency framework, as all parties understand that the alternative to the out-of-court process is insolvency.

When insolvencies are numerous and coordination among creditors and borrowers difficult, the government may take a more direct role. A range of options exist for government intervention, including:

- *Government mediation.* Mediation between corporations and banks can help organize the restructuring process. The "London approach" is an example, based on principles that (1) banks maintain credit facilities and do not press for bankruptcy;

[68]For examples of these experiences and policy implications, see Pomerleano and Shaw (2005), Stone (2000), and Adams, Litan, and Pomerleano (2000).

(2) a comprehensive assessment is made of debtor viability; and (3) seniority of claims is recognized but there is an element of shared pain.

- *Government-financed incentive programs.* Financial incentives through such programs can be useful if corporate distress is systemic and market or regulatory failures inhibit restructuring. Such programs may involve insurance or compensation to creditors for lengthening debt maturities and grace periods, interest rate and exchange rate guarantees, and equity injections.
- *Restructuring director.* Appointment of a restructuring director may accelerate the pace of restructuring by defining the goals of restructuring, and marshaling and prioritizing government financial support.
- *Asset management corporations.* Governments may establish special agencies to work out distressed debt in a centralized fashion. Such institutions are useful when there is a large number of troubled corporations and a significant number of relatively homogeneous loans (Song, 2006; and Ingves, Seelig, and He, 2006). Asset management companies may be established to manage assets from intervened and resolved banks or, in limited cases, from open banks. In this latter case, the price for removing the assets is a critical policy issue. In principle, assets should be removed at their market value (or the best estimation of that value) and the banks recapitalized by private investors, a public recapitalization program, or a combination of both.

The global nature of the current crisis has made the restructuring difficult for at least two key reasons. First, corporations have borrowed from cross-border banks that operate in a wide range of jurisdictions where corporate law and in-court settlement frameworks differ, making coordination of debtors and cross-border creditors more difficult. Second, the holders of corporate debt are much more dispersed than in the past both because corporations have financed their activities by issuing bonds in international markets and because many corporate loans have been acquired by securitization structures, with each structure holding a small share of any single corporate's debt.

International coordination of governmental efforts may help to address these limitations. An international body may help by establishing standard guidelines or proposing standardized debt restructuring frameworks for financial institutions and corporates that are active across borders. Such guidelines could limit differences in international creditor treatment across jurisdictions. Moreover, an international body could act as a clearinghouse for information about the scope and holdings of corporate debt and arrange for coordinated negotiations among a wide range of creditors and debtors.

Household Debt Restructuring

During the current crisis, and in light of the deteriorating economy and massive job losses, household debt levels have increased significantly and may be unsustainable in many cases. The run-up in house prices fueled excessive leverage, while subsequent sharp declines left borrowers struggling with payments. Where foreign currency lending was prevalent, borrowers were also subject to the balance sheet effects of currency depreciation.

In such an economic environment, a government-sponsored household debt restructuring program may be necessary. Countries typically apply a combination of resolution strategies—with some more directed toward financial institutions and others more geared towards borrowers—and in the process often incur substantial fiscal costs. Household debt restructuring involves (1) facilitating voluntary loan workouts between banks and their borrowers by easing loan provisioning, and possibly by offering tax breaks for banks; and (2) recapitalizing financial institutions that are worth saving and facilitating exit of other financial institutions. In situations of large-scale household distress, such voluntary

workout programs can be complemented by loan subsidies or tax breaks for households and fiscal stimulus. Finally, in large-scale household distress situations where households default en masse on their loans, a well-designed debt restructuring program becomes an option. This can involve recapitalizing financial institutions worth saving and facilitating exit of others, and social support programs to restore households to financial health.

Annex 1.5. Methodology for Estimating Potential Writedowns[69]

The October 2008 GFSR estimated potential writedowns on U.S.-origin credit for global market participants over 2007–10. The methodology used to estimate those writedowns has been extended to include credit originated in Europe and Japan, as well as in emerging markets. Together with related analysis in the chapter, the estimates here provide a broader assessment of potential global bank writedowns.

Estimation of Global Writedowns on Credit Instruments

Writedowns on loans and securities originated in the United States are calculated based on a set of assets including residential and commercial real mortgages, consumer debt, and corporate debt.[70] For credit originated in Europe, we considered a similar set of instruments. For credit originated in Japan, we only examined consumer and corporate debt, as these assets are most significant from the perspective of potential writedowns for holders.

As in past GFSRs, writedowns on debt *securities* were measured as declines in market valuations of representative indexes or deals. Charge-offs for related loans were estimated using a regression type approach for the United States (Box 1.7). For European and Asian loan charge-offs, we used an alternative approach (discussed below), due to data limitations.

Securities

Writedowns on European residential securities were estimated by multiplying the change in spread on residential mortgage-backed securities (RMBS) deals (i.e., Italy, Netherlands, Spain, and the United Kingdom) by their average duration, and then weighting the results by size of issuance and rating. This results in an estimated 14 percent mark-to-market (MTM) loss rate altogether.[71] Writedowns on European commercial real estate and consumer debt were estimated from changes in spreads on commercial mortgage-backed securities (CMBS) and consumer (auto and credit card) debt, respectively. This resulted in estimated MTM loss rates of 17 percent and 7 percent, respectively. Corporate debt was priced using the Barclays Euro-Aggregate corporate index, which suggests a 5 percent loss since the beginning of the credit crisis. A similar approach was used to estimate writedowns on Japanese debt securities. MTM loss rates on Japanese corporates were estimated 2 percent, using the Barclays Asian corporate index.

Loans

For Europe, charge-off estimates were derived in the following manner. First, actual charge-

[69]This annex was prepared by Mustafa Saiyid.

[70]The set of instruments in this analysis has been broadened to include municipal loans to reflect potential deterioration tied to a deeper trough in the credit cycle than previously anticipated.

[71]Admittedly, this is a high figure for the overall residential securities market, but it is lower than that of U.S. nonagency residential debt, for which the MTM loss rate is estimated at 25 percent. It is also presumably being driven up by market concerns about structured products in general. The U.S. residential mortgage securities as a whole have an implied MTM loss rate of 13 percent, which is lowered by the size of guaranteed agency debt comprising more than two-thirds of the total.

offs on European loans, as reported by various banks, were used to establish a lower bound to the cumulative rate over 2007–10. Second, the ratio of MTM loss rates on European securities relative to those of the United States was used to establish a similar proportion for charge-off rates. For example, charge-off rates on European residential, commercial, and consumer loans were estimated to be roughly half those on U.S. loans. Third, loan charge-off rates were estimated to have a credit loss profile similar to that of the United States, but lagged by six to nine months.[72] For Japan, loan charge-offs over the course of the credit cycle were estimated to be no more than 2 percent on a cumulative basis, roughly consistent with the MTM decline in the valuation of corporate debt securities.

Global Writedowns

Applying the estimated MTM loss rates on debt securities and charge-off rates on loans to the outstanding amounts results in an estimated aggregate writedown of $4.1 trillion over 2007–10.[73]

Potential Writedowns for Banks and Their Regional Distribution

In order to account for important regional differences in the composition of bank portfolios, we use two separate sets of exposure matrices: (1) by type of assets held by banks, including, for example, residential mortgage or corporate debt; (2) by geographic origin, specifically for U.S., U.K., Europe excluding the United Kingdom, Japanese, and emerging market assets. These matrices are broken out further into exposure to loans and to securities (Tables 1.13–1.14).[74]

Table 1.13. Estimated Bank Portfolio Composition by Type of Asset
(In percent)

	U.S. Banks	U.K. Banks	Europe excluding U.K. Banks	Asian Banks[1]
Loan Exposures				
Consumer	17	12	13	20
Residential mortgage	52	23	25	26
Commercial mortgage	6	6	5	5
Corporate	15	49	43	27
Other	11	10	14	22
Total	100	100	100	100
Securities Exposures				
Consumer	4	6	5	2
Residential mortgage	42	24	19	5
Commercial mortgage	6	5	5	27
Corporate	32	27	27	60
Other	16	38	43	6
Total	100	100	100	100

Sources: Bank filings; and IMF staff estimates.
[1]Asian banks domiciled in Australia, Hong Kong, SAR, Japan, New Zealand, and Singapore.

These exposures are then multiplied with corresponding MTM loss rates (for securities) and charge-off rates (for loans) to obtain a matrix of potential writedown estimates by region. For asset classes where charge-off rates were not estimated, the applicable rate was assumed to be the same as for corporates broadly. For securities for which MTM rates were not estimated, the applicable rate was assumed to be zero—these are regarded as riskless.

[72]Roughly consistent with expected unemployment profiles of the United States and Europe.

[73]Actual writedowns taken by market participants globally over the course of the credit cycle will likely be higher because of losses on exposures to equities and to derivative instruments. Derivatives transfer risk from one market participant to another, and although losses net out to zero for the system as a whole, individual market participants would be expected to bear losses on one-sided bets. These losses and resulting potential writedowns are very difficult to quantify with existing public disclosure of exposure.

[74]The estimated exposure of banks in a region to various types of assets, (e.g., U.S. banks to consumer loans) is obtained from filings of a sample of 50 large (global) banks in the United States, Europe, and Japan. The estimated exposure of the banks in a region to loans and securities originated in different regions is derived from Table 9B on foreign claims of banks from the Bank for International Settlements.

Table 1.14. Estimated Bank Portfolio Composition by Origin of Assets
(In percent of total assets)

	U.S. Assets	U.K. Assets	Europe excluding U.K. Assets	Japanese Assets	Emerging Market Assets
U.S. banks	87	3	4	2	4
U.K. banks	15	64	12	3	6
Europe excluding U.K. banks	12	10	67	2	8
Asian banks[1]	10	5	7	76	3

Source: Bank for International Settlements, *Quarterly Review,* March 2009.
Note: Assets held in offshore centers have been reallocated to corresponding regions.
[1]Asian banks domiciled in Australia, Hong Kong, SAR, Japan, New Zealand, and Singapore.

An important modification to the MTM rates on bank holdings of securities is to account for banks holding higher-quality assets relative to the universe of securities. For bank security portfolios with exposure to European securities, the applicable MTM loss rate was assumed to be only half of the loss rate for the asset class universe. This roughly corresponds to the ratio of MTM declines on high- versus average-quality securities in European residential and consumer sectors. MTM loss rates applicable to bank holdings of securities in other regions are assumed to be closer to those for the overall asset class (95 percent of the average in the United States, 70 percent in United Kingdom, 50 percent in Asia).

Allocation of Potential Writedowns Between Different Market Participants

Potential writedowns for mature market banks estimated as described above are then used to allocate the remainder of global writedowns on the outstanding stock of loans and securities to other market participants, including insurers, government-sponsored enterprises, pension funds, and hedge funds. The allocation to insurers is based on their percentage share of writedowns thus far, while the allocation to other market participants is a residual of the process.

Results

Of estimated potential writedowns of $4.1 trillion on mature market credit for global market participants, banks are expected to suffer $2.5 trillion. In addition, global banks are expected to take an additional $340 billion of writedowns on exposure to emerging market assets, bringing the total to $2.8 trillion (Table 1.15). The proportion of bank writedowns to the total estimated for all market participants of 61 percent (= 2.5/4.1) is roughly the same as the actual bank share of writedowns reported by market participants. Regionally, Europe excluding U.K. banks are expected to suffer the bulk of potential writedowns, taking $1.11 trillion (39 percent of the total), compared with $1.05 trillion (37 percent) for U.S. banks. Banks in the United Kingdom and Asia (comprised of Japan, Australia, New Zealand, Hong Kong SAR, and Singapore) are estimated to take roughly similar-sized writedowns of $316 billion and $336 billion, respectively.

Although Europe excluding U.K. banks are expected to suffer a sizable portion of its writedowns on assets within the region, a substantial proportion of the total, 44 percent altogether, is borne on assets outside the region, mostly in the United States, and in emerging European markets. By comparison, U.S. banks are expected to suffer only 8 percent of writedowns on non-U.S. exposure. Similar to continental Europe, U.K. banks suffer 45 percent of writedowns on nondomestic assets. For banks in Asia, potential writedowns on U.S. assets (35 percent) are higher in dollar terms than on any other regional exposure. In each region, the contribution of potential writedowns from loans and securities is roughly the same in dollar terms, but implied loss rates are

somewhat higher on securities, reflecting more pronounced market concerns about potential cash flow losses than related loans would suggest.

Table 1.15. Estimated Regional Distribution of Bank Writedowns and Cumulative Loss Rates

	U.S. Assets		U.K. Assets		Europe excluding U.K. Assets		Asian Assets		Emerging Markets		Total	
	(US$ bn)	(Percent)	(US$ bn)	(Percent)	(US$ bn)	(Percent)	(US$ bn)	(Percent)	(US$ bn)	(Percent)	(US$ bn)	(Percent)
Writedowns on Assets												
U.S. Banks	966	9.3%	22	5.9%	24	4.6%	3	1.3%	35	6.9%	1,049	8.8%
U.K. Banks	72	7.5%	174	4.3%	30	3.9%	2	1.1%	37	9.9%	316	5.0%
Europe ex-U.K. Banks	198	7.0%	111	4.4%	622	3.9%	6	1.0%	172	8.5%	1,109	4.6%
Asian Banks	116	12.0%	33	6.8%	29	4.6%	141	2.0%	16	6.8%	337	3.5%
Total	1,352	8.9%	340	4.6%	705	3.9%	151	1.9%	261	8.2%	2,810	5.4%
Memo item:												
Assets												
U.S. Banks	10,364		369		509		191		507		11,940	
U.K. Banks	965		4,045		779		160		380		6,329	
Europe ex-U.K. Banks	2,839		2,500		16,151		600		2,034		24,124	
Asian Banks	968		483		639		7,195		241		9,526	
Total	15,136		7,397		18,078		8,146		3,162		51,919	

Sources: Bank of England; Bankscope; Federal Reserve, *Flow of Funds* ; and IMF staff estimates.
Note: Assets include only loans and securities and do not include fixed assets held by banks.

Box 1.7. Forecasts for Charge-Offs on U.S. Bank Loans

This box outlines the revised methodology for forecasting bank loan charge-off rates.

A general approach for modeling charge-off rates is described in the October 2008 GFSR (IMF, 2008b, Box 1.6). Charge-off rates for different loan types are modeled as dependent on a set of economic and financial variables. In order to better capture future turning points in the charge-off patterns, levels and log levels (rather than growth rates) are used for the explanatory variables—house prices, GDP, and consumption. Since a recent decline in bank lending standards (net balances) indicates a slower rate of tightening, the use of cumulative net balances for lending standards is warranted. This is to reflect that charge-offs continue to rise despite a slowdown in house price declines and a deceleration in the pace of tightening in lending standards. Despite the slower pace of deterioration, home equity is still declining and banks are becoming more reluctant to lend, pushing delinquency and charge-off rates higher. Furthermore, lags in the charge-off rate are not included in the final estimation equations. Although statistically significant, the high autocorrelation coefficients result in very persistent forecasts, failing to predict a turn in the cycle. Instead, with the forecasting goal in mind, the analysis relies only on the exogenous variables, which project an improvement in economic and financial conditions by 2011.

To deal with nonstationarity in the variables, the empirical Bayesian approach is employed. The estimation is carried out by running 10,000 Markov Chain Monte Carlo simulations using the Gibbs sampler package WinBUGS (Lunn and others, 2000). Convergence is obtained within 1,000 burn-in runs. The estimated coefficients in the presented equations are statistically significant at 5 percent. Lending standards are particular to each loan type.

Residential real estate: log (D_RRE) = 0.9095 + 0.0033*LS – 0.0026*HP, where *D_RRE* is the delinquency rate, *LS* is lending standards, *HP* is Case-Shiller house prices.

Commercial real estate: log(D_CRE) = 62.15 + 0.0032*LS – 7.153*log(C), where *D_CRE* is the delinquency rate, *C* is real private consumption.

Consumer loans: C_CL = 50.12 + 0.0055*LS – 5.347*log(GDP), where *C_CL* is the charge-off rate, *GDP* is real gross domestic product.

Commercial and industrial loans: C_CI = 26.24 + 0.0028*LS – 2.883*log(GDP), where *C_CI* is the charge-off rate.

Note: This box was prepared by Sergei Antoshin.

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CHAPTER 2

ASSESSING THE SYSTEMIC IMPLICATIONS OF FINANCIAL LINKAGES

Summary

The rise in the complexity and globalization of financial services has contributed to stronger interconnections or linkages. While more extensive linkages contribute to economic growth by smoothing credit allocation and allowing greater risk diversification, they also increase the potential for disruptions to spread swiftly across markets and borders. In addition, financial complexity has enabled risk transfers that were not fully recognized by financial regulators or by institutions themselves, complicating the assessment of counterparty risk, risk management, and policy responses. Thus the importance of assessing the systemic implications of financial linkages.

The current crisis has highlighted how systemic linkages can arise not just from financial institutions' solvency concerns but also from liquidity squeezes and other stress events. This chapter illustrates the type of methodologies that can provide some prospective metrics to facilitate discussions on systemic linkages and, specifically, the "too-connected-to-fail" problem, thereby contributing to enhanced systemically focused surveillance and regulation. By contrast, Chapter 3 presents other methodologies that examine systemic risk by looking at the conditions under which financial institutions experience simultaneous stressful events.

This chapter presents four complementary approaches to assess direct and indirect financial sector systemic linkages:

- The network approach, which tracks the reverberation of a credit event or liquidity squeeze throughout the banking system via direct linkages in the interbank market;
- The co-risk model, which exploits market data to assess systemic linkages among financial institutions under extreme events;
- The distress dependence matrix, which examines pairs of institutions' probabilities of distress, taking into account a set of other institutions; and
- The default intensity model, which measures the probability of failures of a large fraction of financial institutions due to both direct and indirect systemic linkages.

The chapter argues that, although each approach by itself has its limitations, together they represent a set of valuable surveillance tools and can form the basis for policies to address the too-connected-to-fail problem. More specifically, this chapter assists policymakers in two areas under current discussion:

- Perimeter of regulation. To maintain an effective perimeter of prudential regulation without stifling innovation, the tools provided in the chapter could help address questions such as whether to limit an institution's exposures, the desirability of capital surcharges based on systemic linkages, and the merits of additional liquidity regulations.
- Information gaps. The chapter also discusses the importance of filling existing information gaps on cross-market, cross-currency and cross-country linkages to refine analyses of systemic linkages. Closing information gaps would require improved data collection procedures and impose additional demands on financial institutions, but would be a far better alternative to waiting until a crisis ensues to obtain information as events unfold.

The expansion of large complex financial institutions that transcend national boundaries and engage in such activities as extensive interbank contracts, over-the-counter derivatives contracts, equity, bond, and syndicated loan issuance and trading activities globally has led to stronger interconnections, innovation, and growth. While tighter interdependencies can increase the efficiency of the global financial system by smoothing credit allocation and risk diversification, they have also increased the potential for cross-market and cross-border disruptions to spread swiftly. In addition, financial innovations have enabled risk transfers that were not fully recognized by financial regulators and institutions themselves, and have complicated the assessment of counterparty risk, risk management, and policy responses.

Although linkages across institutions have traditionally focused on solvency concerns, the current crisis reminds us of the relevance of liquidity spillovers, specifically that (1) interconnectedness means difficulties in rolling over liabilities may spill over to the financial system as a whole; and that (2) rollover risk associated with short-term liabilities is present not only in the banking sector but, equally importantly, in the nonbank financial sector.

Thus, it is essential to improve our understanding and monitoring of direct and indirect financial systemic linkages, including by strengthening techniques to assess systemic linkages, and thereby contribute to making systemic-focused supervision feasible. The goal is clear: we must lessen the risk that institutions become too connected to fail.[1]

This chapter presents four complementary approaches to assess financial sector systemic linkages and focuses on this definition of systemic risk:[2]

- *The network approach.* This approach relies primarily on institutional data to assess network externalities.[3] Network analysis, which can track the reverberation of a credit event or liquidity squeeze throughout the system, can provide important measures of financial institutions' resilience to the domino effects triggered by financial distress.
- *The co-risk model.* This methodology draws from market data, but focuses on assessing systemic linkages at an institutional level. Such linkages may arise from common risk factors such as similar business models or common accounting/valuation practices across institutions.
- *The distress dependence matrix.* This matrix is based on market data, but instead of looking at bilateral relationships as above, the pairwise conditional probabilities of distress presented are estimated using a composite time-varying multivariate distribution that captures linear (correlation) and nonlinear interdependence among a set of financial institutions.
- *The default intensity model.* Based on historical default data, this methodology focuses on the time-series properties of banking default data to assess systemic linkages. It measures the probability of failures of a large fraction of financial institutions (default clustering) due to both direct and indirect systemic linkages.

Each approach by itself has considerable limitations, but together the approaches provide an important set of surveillance tools and the basis for policies to address the too-connected-to-fail problem, one of the most pervasive ways

Note: This chapter was written by Jorge Chan-Lau, Marco A. Espinosa-Vega (team leader), Kay Giesecke, and Juan Solé. The authors would like to thank, without implicating, Art Rolnick and Ken Singleton for very useful discussions and comments and Baeho Kim for outstanding research assistance. Carolyne Spackman provided able research assistance. The authors thank e-MID, the Bank for International Settlements, and Moody's for access to their data.

[1]See Haldane (2009), Brunnermeier and others (2009), and Stern and Feldman (2004) for further discussions on the topic.

[2]See Chapter 3 for alternative concepts and measures of systemic risk.

[3]Given that we were unable to obtain disaggregated data on institutions' bilateral exposures, the illustration here of network analysis exploits historical aggregated data on banking systems. Thus, the results of the network analysis are intended to provide an illustration of this technique, rather than a pronouncement about the specific banking systems considered.

in which systemic risk manifests itself.[4] More specifically, this chapter helps to inform policymakers in three areas: assessing direct and indirect spillovers under extreme (tail) events; identifying information gaps to improve the precision of this analysis; and providing concrete metrics to assist in the reexamination of the perimeter of regulation.

The chapter also discusses the importance of filling existing *information gaps* on cross-market, cross-currency, and cross-country linkages. Closing information gaps would require, among other things, additional disclosures; access to micro-prudential data from supervisors (where these are institutionally separated from the authorities responsible for financial stability); more intensive contacts with private market participants; improving the comparability of cross-country data; more frequent updates of monitored financial variables; and improved information-sharing on a regular and ad hoc basis. Although these measures could impose additional demands on financial institutions, they are a far better alternative to waiting until a crisis ensues and having to scramble to obtain information as events unfold. It has become clear during the current crisis that much greater transparency on cross-institution and cross-market exposures was needed ex ante. Furthermore, globalization means that it is almost impossible for a country, by itself, to undertake effective surveillance of potentially systemic linkages. Therefore, enhancing our understanding and monitoring of global systemic linkages requires strong information-sharing agreements.

Because of difficulties in obtaining more disaggregated information at this stage, the chapter cannot make predictions about specific institutions or countries with important systemic linkages. The goal is not to provide benchmark figures of systemic linkages or to make forecasts about future developments. Rather, its key goal is to present methodologies that will enable inferences to be drawn about extreme tail events, such as the current crisis, and that can also provide a set of concrete metrics that could be used by the authorities before they can start any meaningful discussions, both domestically and globally, on the too-connected-to-fail problem.

The chapter also presents a brief overview of how some central banks assess systemic linkages, including by exploiting methodologies similar to those illustrated in this chapter. These methodologies are gaining traction in financial stability discussions, despite handicaps central banks have faced due to some important data limitations.

Four Methods of Assessing Systemic Linkages

This section presents four complementary approaches to assess financial sector systemic linkages: *the network approach,* which tracks the reverberation of a credit event or liquidity squeeze throughout the financial system; *the co-risk model,* which exploits market data to assess systemic linkages at an institution-by-institution level, conditioning on other economic information; *the distress dependence matrix,* which provides conditional probabilities of distress between two institutions taking account of their relation with other institutions; and *the default intensity model,* which measures the probability of failure of a large fraction of financial institutions (default clustering) due to both direct and indirect systemic linkages (Table 2.1).

The Network Approach

The recent financial crisis has underscored the notion that to ensure the stability of a financial system, it is not enough to focus on the safety and soundness of each particular institution. It is also necessary to account for the effect of the institution's linkages to other institutions, as actions geared to enhancing the soundness of

[4]This is precisely the type of approach Stern (2008) suggests: policymakers should more carefully consider information on systemic linkages ex ante in order to reduce the uncertainty they face when a large financial institution fails and to evaluate alternative response to such failures ex ante and ex post.

Table 2.1. Taxonomy of Financial Linkages Models

	Network Simulations[1]	Default Intensity Model[2]	Co-Risk Analysis[3]	Time-Varying Multivariate Density, Distress Dependence, and Tail Risk[4]
Implemented/ Calibrated using	Bank for International Settlements cross-border interbank exposures data.	Default data from Moody's Default Risk Service.	Five-year individual CDS spreads of financial institutions.	Individual CDS-PoDs and/or stock prices.[5]
Outputs	(1) Provides metric on domino effect induced by alternative distress events; (2) Identifies systemic linkages and vulnerable countries/institutions; (3) Quantifies potential capital losses at country/ institutional level; and (4) Can track potential contagion paths.	(1) Provides metric of potential banking failures due to direct and indirect systemic linkages; and (2) Provides probability measure of tail events.	(1) Estimates of unconditional and conditional credit risk measures for different quantiles (or "risk regimes"); and (2) Estimates of the effect on conditional credit risk induced by "source" institutions on "locus" institutions during stress regimes.	(1) Recovers multivariate density and thus common distress in the system: JPoD, BSI; (2) Distress dependence matrix; and (3) Probability of cascade effects triggered by a particular financial institution.
Advantages	(1) Allows identification of most systemic and vulnerable institutions within a system; and (2) Can be used to elaborate "risk maps" of contagion effects.	(1) Captures effects of direct and indirect linkages among financial institutions, as well as the regime-dependent behavior of their default rates; and (2) Very good predictive power.	(1) Captures institutions' codependence risk from direct and indirect linkages; and (2) Can be used to elaborate "risk maps."	(1) Able to use other PoDs; (2) Multiple outputs; (3) Includes linear and nonlinear dependence; and (4) Endogenous time-varying distress dependence.
Shortcomings	(1) Requires data on inter-institution exposures; and (2) Static modeling of institutional behavior.	Reduced form model.	Usefulness is undermined by factors that affect market efficiency.	CDS may overstate objective default probabilities.

Source: IMF staff.

Note: BSI = bank stability index; CDS = credit default swap; JPoD = joint probability of distress; PoD = probability of default.

[1]Chan-Lau, Espinosa, and Solé (2009a).

[2]Giesecke and Kim (2009).

[3]Chan-Lau, Espinosa, and Solé (2009b).

[4]Chan-Lau, Espinosa, and Solé (2009b); and Segoviano and Goodhart (2009). See also Chapter 3, "Market Perceptions of Risks of Financial Institutions."

[5]Model can use PoDs estimated from alternative methods, not only CDS spreads.

a particular institution may undermine the stability of the system as a whole. This is the case, for instance, when a fire sale of assets during a liquidity squeeze triggers spillovers across the whole financial system. The case of Northern Rock illustrates how a medium-sized institution faced with a liquidity squeeze can trigger negative network externalities.

Policymakers and regulators worldwide have become aware of the importance of proactively tracking potential systemic linkages. As pointed out in Allen and Babus (2008), for instance, network analysis is a natural candidate to aid with this challenge, as it allows the regulator to see beyond the immediate "point of impact" by tracking several rounds of spillovers likely to arise from direct financial linkages.[5]

[5]See Upper (2007) for an insightful survey of the network literature. While most of the network literature referenced in this chapter is of an applied nature, see Allen and Gale (2000) and Freixas, Parigir, and Rochet (2000) for some theoretical underpinnings of the

The starting point of any network analysis is the construction of a matrix of inter-institution exposures that includes gross exposures among financial institutions (domestically or cross-country). The main difficulties in creating a comprehensive, cross-border matrix include the fact that data may only be available to national supervisors and that some of the information is not collected or published on a systematic basis.[6] For instance, although banks typically report broad exposures to other institutions or countries, data on bilateral exposures are not publicly available and may be disclosed exclusively to financial regulators, and only upon request. In order to circumvent these limitations, researchers have often complemented the available data with interpolations or estimations by different methods.[7] Once an exposure matrix is in place, analysts simulate shocks to specific institutions and track the domino effect on other institutions in the network, as shown in Figure 2.1.

A Simple Interbank Exposure Model

To illustrate how network analysis is deployed to assess potential systemic interbank linkages, this chapter considers two shocks: (1) a credit event in which the initial default by an institution may trigger additional rounds of defaults, and (2) a credit-plus-funding event in which the default of an institution also causes a liquidity squeeze to those institutions funded by the defaulting institution (i.e., the credit shock is compounded by a funding shock). (See Box 2.1 for a detailed explanation of the simulation methodology).

Because individual institution exposure data are not available to the International Monetary Fund (IMF), the chapter uses cross-country bilateral exposures published in the Bank for International Settlements' (BIS) International Banking Statistics database for March 2008, which reflects the consolidated foreign exposures of BIS reporting banks.[8,9] The BIS compiles these data in two formats: (1) on an immediate *borrower basis,* and (2) on an ultimate *risk basis.* The former are consolidated by residency of the immediate borrower, whereas the latter are consolidated by residency of the ultimate obligor (i.e., the party that is ultimately responsible for the obligation in case the immediate borrower defaults).[10] We restrict our analysis to aggregate interbank credit exposures with a special focus on immediate borrower *basis* data for March 2008.[11]

network approach. In addition, Nier and others (2007) apply network theory to study contagion risk in simulated banking systems.

[6]It is for this reason that this literature has often developed at central banks and has focused on their respective domestic banking systems. See, for example, Boss and others (2004) and Elsinger, Lehar, and Summer (2006) for Austria; Degryse and Nguyen (2007) for Belgium; Furfine (2003) for the United States; Márquez-Diez-Canedo and Martínez-Jaramillo (2007) for Mexico; Memmel and Stein (2008) and Upper and Worms (2004) for Germany; Sheldon and Maurer (1998) and Müller (2006) for Switzerland; and Wells (2002) for the United Kingdom.

[7]Typically, researchers take as given a bank's total assets and liabilities in the interbank market, and assume that the bank spreads its interbank activities as evenly as possible among the rest of the institutions (in technical terms, this is known as maximizing the entropy of a bank's interbank positions). See Wells (2002) and Upper (2007) for discussions on estimating bilateral exposures.

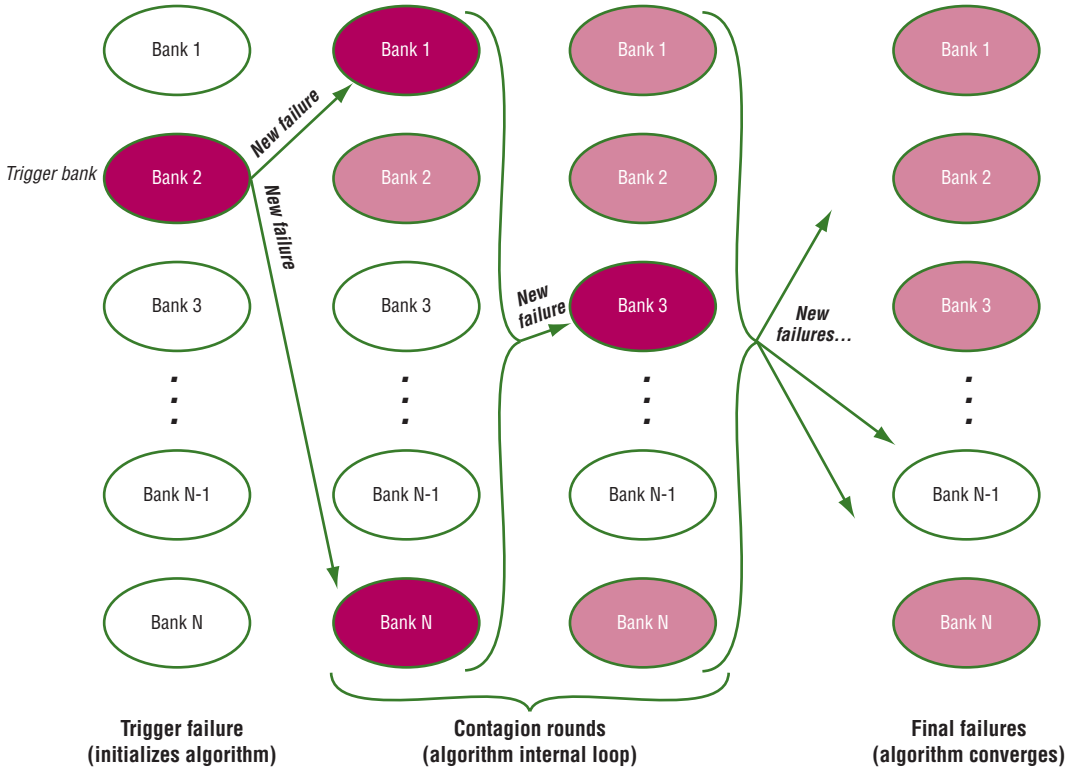
[8]Unfortunately, it was not possible to obtain a complete set of bilateral exposures between developed and emerging markets, and thus we were unable to analyze the feedback effects between developed and emerging markets. Countries for which a complete set of bilateral exposures was obtained are: Australia, Austria, Belgium, Canada, France, Germany, Ireland, Italy, Japan, the Netherlands, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States.

[9]Hattori and Suda (2007) also use BIS data to study the network topology of the international banking system from a historical perspective. However, their study does not assess contagion patterns.

[10]See McGuire and Wooldridge (2005) for a detailed description of these data, and McGuire and Tarashev (2008) for applications of the BIS statistics to monitor the international banking system.

[11]The analysis was also carried out using *ultimate risk basis* data, which aggregates credit risk transfers. The results obtained with these data are qualitatively similar to those obtained using immediate borrower basis data. However, using ultimate risk basis data for network simulations raises the question of how to treat the risk transfers of failed institutions. In other words, after each round of failures, the risk transfers present in the data may become moot, as the counterparty may be among the failed institutions. Thus, disaggregated data on risk transfers at an individual level would be required to conduct this exercise, and it is left for further research.

Figure 2.1. Network Analysis: A Diagrammatic Representation of Systemic Interbank Exposures



Source: IMF staff.
Note: This figure depicts the dynamics of the network analysis. Starting with a matrix of interbank exposures, the analysis consists of simulating shocks to a specific institution (the trigger bank) and tracking the domino effect to other institutions in the network.

Credit Shock and Transmission

To illustrate the analysis of a credit shock using network analysis, the chapter simulates the individual default (one-at-a-time) of each country's cross-border interbank claims and then tracks the domino effects triggered by this event. For simplicity, it is assumed that a country's banking losses are fully absorbed by its capital, and a country's banking sector is said to fail when its collective (aggregate) capital is not sufficient to fully cover the losses incurred under default of its cross-border interbank losses.

It is important to emphasize that this hypothetical experiment envisioning a country's banking system defaulting on its foreign exposures is extreme and highly unlikely.[12] In addition, the experiment does not consider risk transfers among banking sectors due to lack of data, and also because accounting for this pro-

[12]Given the lack of data disaggregated at an institutional level, for illustration purposes the simulations treat each banking system as a single institution. A possible extension is to assume that only a fraction of the banking system defaults.

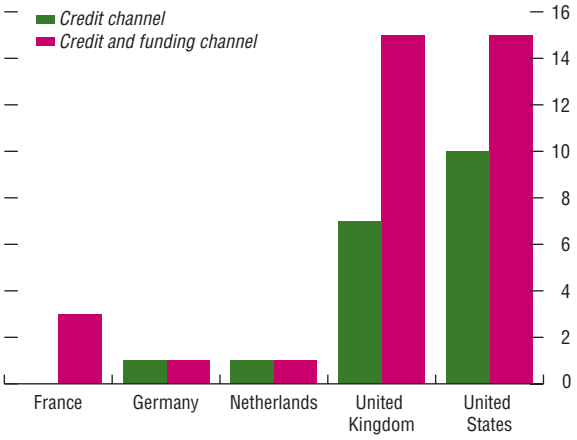
tection properly would require an analysis of the underlying counterparty risks, which is beyond the scope of this chapter. The main objective of this exercise is to provide an illustration of the value of network analysis for surveillance purposes; the analysis of further hypothetical experiments, with perhaps more realistic assumptions, is left for future work.

Simulation 1 Results

The first simulation focuses on the transmission of a pure credit shock assuming that all institutions are able to roll over their funding needs.[13] The results of these simulations are reported in Table 2.2. It is important to highlight that in addition to identifying potential failures, network analysis also helps in estimating the amount of capital losses after all aftershocks have taken place. Not surprisingly, given the size of the U.K. and U.S. banking sectors, what emerges from this exercise is that those two banking systems are the largest systemic players. As of March 2008, the hypothetical default of the U.K. and the U.S. systems on their interbank foreign claims would have led to losses—after all contagion rounds—of 44.6 and 80 percent, respectively, of the combined capital in our universe of banking systems.

The second and third columns in Table 2.2 indicate the number of induced failures and the number of contagion rounds (the aftershocks) triggered by each hypothetical failure. The failure of the U.K. banking system would trigger the downfall of seven additional banking systems in three rounds of contagion (see also Figure 2.2). Similarly, the failure of the U.S. banking system would trigger the failure of 10

Figure 2.2. Network Analysis: Number of Induced Failures



Sources: Bank of International Settlements; and IMF staff estimates.

[13]The simulations assume that the loss-given-default parameter equals 100 percent on impact. That is, when the credit event first materializes, banks are unable to recover any of their loans, as it takes time for secondary (and distress-debt) markets to price recently defaulted instruments. Thus, the simulation results should be interpreted as the on-impact transmission of systemic instability. In a similar vein, Wells (2002) argues that network studies should consider higher loss-given-default estimates than it is typically assumed, as banks typically face substantial uncertainty over recovery rates in the short run.

Box 2.1. Network Simulations of Credit and Liquidity Shocks

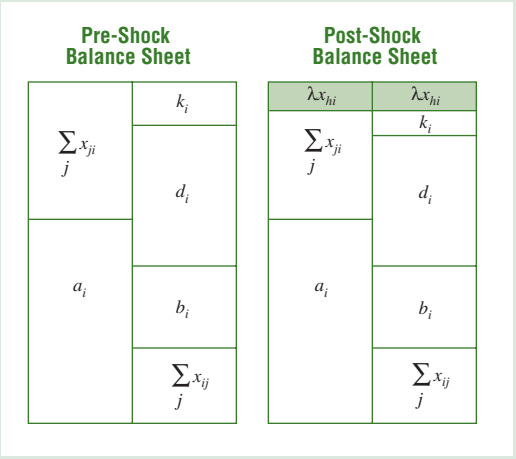
This box outlines the mechanics of the simulations of credit and liquidity shocks in the network model.

To assess the potential systemic implications of interbank linkages, a network of N institutions is considered. The analysis starts with the following stylized balance sheet identity of a financial institution:

$$\sum_j x_{ji} + a_i = k_i + b_i + d_i + \sum_j x_{ij}$$

where x_{ji} stands for bank i loans to bank j, a_i stands for bank i's other assets, k_i stands for bank i's capital, b_i are long-term and short-tem borrowing (excluding interbank loans), stands for bank i borrowing from bank j, and d_i stands for deposits.

To analyze the effects of a credit shock, the chapter simulates the individual default of each one of the N institutions in the network, and then tracks the domino effects resulting from each specific failure. More specifically, for



different assumptions of loss given default (denoted by the parameter λ), it is assumed that bank i's capital absorbs the losses on impact, and then we track the sequence of defaults triggered by this event. For instance, after taking into account the initial credit loss stemming from the default of institution h, the baseline balance sheet identity of bank i becomes:

$$a_i + \sum_j x_{ji} - \lambda x_{hi} = (k_i - \lambda x_{hi}) + b_i + d_i + \sum_j x_{ij}$$

and bank i is said to fail when its capital is

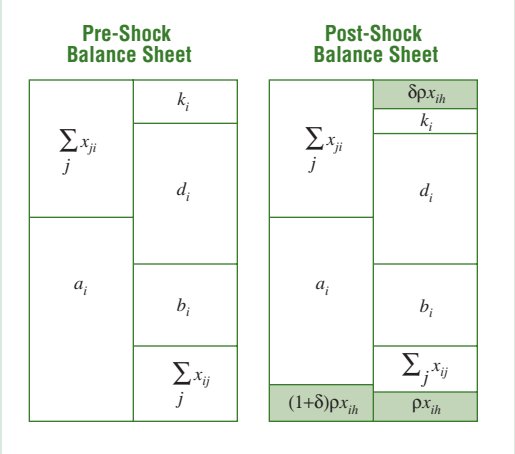
Note: Juan Solé prepared this box. For more details on the network model and the simulation algorithm, see Chan-Lau, Espinosa, and Solé (2009a)

additional banking systems in four rounds of contagion (Figure 2.2).

Interestingly, even when domino effects do not lead to systemic failures, network analysis provides a measure of the degree to which a financial system will be weakened by the transmission of financial distress across institutions (Table 2.3). For instance, an initial failure of Germany would produce a projected capital loss to Australian banks of only 0.2 percent of their initial capital, whereas the projected loss for Sweden would amount to 103 percent of initial capital, thus driving Swedish banks to hypothetical default.

The analysis can also help identify "vulnerable" spots. For example, while the United Kingdom and United States were identified as the most systemic systems (i.e., triggering the largest number of contagion rounds and highest capital losses), Belgium, the Netherlands, Sweden, and Switzerland are the banking systems with the highest hazard rates, defined as the number of times a banking system would have *hypothetically* failed (Table 2.2 and Figure 2.3).[14] In other words, the banking systems of these countries are severely affected in at least three of the 15 simulations in which they were not the trigger.

[14]This result is in line with the findings in Degryse and Nguyen (2007) and Manna (2004), who report that, among the euro area countries, Belgium and the Netherlands had some of the largest cross-border interbank deposits (around 30 percent for the Netherlands, and over 50 percent for Belgium).



insufficient to fully cover its losses (i.e., when $k_i - \lambda x_{hi} < 0$), (these losses are depicted in light green in the figure).[1]

To analyze the effects of a credit-and-funding shock scenario, it is assumed that institutions are unable to replace all the funding previously granted by the defaulted institutions, which, in turn, triggers a fire sale of assets. Thus, we study the situation where bank i is able to replace only a fraction $(1 - \rho)$ of the lost funding from bank h, and its assets trade at a discount (i.e., their market value is less that their book value), so that bank i is forced to sell assets worth $(1 + \delta)\rho x_{ih}$ in book value terms.[2] The chapter assumes that the funding-shortfall-induced loss, $\delta\rho x_{ih}$, is absorbed by bank i's capital (figure). Thus, the new balance sheet identity for institution i is given by

$$a_i + \sum_j x_j - (1+\delta)\,\rho x_{ih} = (k_j - \delta\rho x_{ih}) + b_i + d_i + \sum_j x_{ij} - \rho x_{ih}$$

In closing, network analysis allows to assess the domino effects of different types of shocks throughout the network of financial institutions.

[1]Subsequent rounds in the algorithm take into account the losses stemming from all failed institutions up to that point.

[2]An alternative way to see this is the following. Let ρx be the amount of funding that cannot be replaced. Let ρ^1 be the current market price for assets and let y be the quantity of assets sold. That is, $\rho^1 y = \rho x$. Suppose that these assets had been bought at a higher price ρ^0 thus $\rho x = \rho^1 y < \rho^0 y \equiv \rho x(1+\delta)$. Hence, it is possible to find a relationship between the parameter δ and the change in asset prices: $\delta = (p^0 - p^1)/p^1$, i.e., δ is a parameter reflecting the degree of distress in asset markets. Higher δ reflects higher distress in markets.

As illustrated in Figure 2.4, an additional advantage of network simulations is that the path of contagion can be tracked. Consider the case of a hypothetical default of the U.K.'s cross-border interbank loans. Figure 2.4 features the ensuing contagion path. The exercise shows that Belgium, Ireland, the Netherlands, and Switzerland are affected in the first round. The combination of these five defaults is systemic enough to bring down Germany in the second round of contagion. Notice that although Germany was able to survive the initial U.K. failure, it is not capable of resisting the combined hypothetical failure of these five banking systems. By the third and final round, France would have also become a casualty.

Credit-and-Funding Shock and Transmission

Under the credit-and-funding shock scenario, it is assumed that institutions are unable to replace all the funding previously granted by the defaulted institutions, thus triggering a fire sale of assets.[15] The extent to which a bank is able to replace an unforeseen drop in interbank funding will depend on liquidity conditions in the money market. During the present crisis, for instance, complexity and opacity in interbank activities have made banks reluctant to support troubled counterparties or institutions *perceived* to be going through similar events, even if they

[15]Furfine (2003), Nier and others (2007), and Müller (2006) also analyze liquidity shocks.

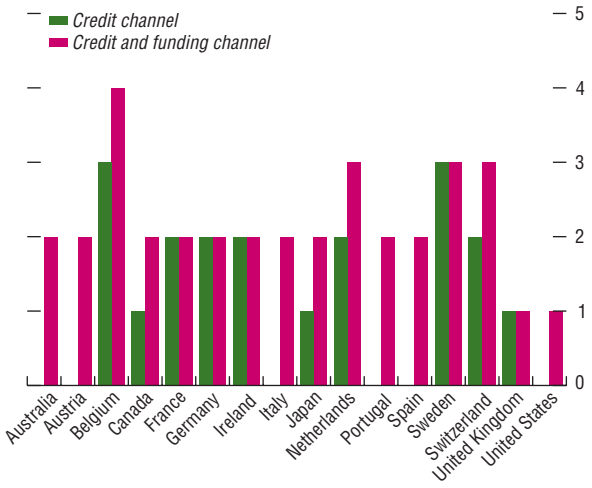
were not. Interbank operations are typically undertaken under the assumption of abundant instantaneous liquidity in money and capital markets. However, when liquidity is tight and in the absence of alternative sources of funding, a bank may be forced to sell part of its assets in order to restore its balance sheet identity. The chapter studies the situation where a banking system is able to replace only a fraction of the lost funding and its assets trade at a discount (i.e., their market value is less than their book value), so that a bank is forced to sell assets with higher book value than market value.[16]

Under this scenario, a financial institution's vulnerability not only stems from its direct credit exposures to other institutions, but also from its inability to roll over (part of) its funding in the interbank market, having to sell assets at a discount in order to reestablish its balance sheet identity.

Simulation 2 Results

This simulation considers the effects of a joint credit and liquidity shock assuming a 50 percent haircut in the fire sale of assets and a 65 percent rollover ratio of interbank debt (Table 2.4). The simulation is meant to represent, in an admittedly stylized fashion, the liquidity squeeze that followed the credit event that the subprime mortgage market problems in the United States represented. Considering scenarios that compound different types of distress allows regulators to identify new sources of systemic risk that were previously undetected. Notice, for instance, that in our simulations, the combination of shocks increases the systemic role played by France as a provider of liquidity

Figure 2.3. Network Analysis: Country-by-Country Vulnerability Level



Sources: Bank of International Settlements; and IMF staff estimates.

[16]Indirect linkages among financial institutions may arise when banks hold the same type of asset in their balance sheets. These linkages can represent an important source of systemic risk, as the forced sale of assets by some institutions may trigger a decline in the market value of the other institutions' portfolios. Models with this type of portfolio linkages can be found, for instance, in Cifuentes, Shin, and Ferrucci (2005); Elsinger, Lehar, and Summer (2006); Lagunoff and Schreft (2001); and de Vries (2005). The next section illustrates a methodology to study indirect linkages.

Table 2.2. Simulation 1 Results (Credit Channel)

Country	Failed Capital *(in percent of total capital)*	Induced Failures	Contagion Rounds	Absolute Hazard[1]	Hazard Rate[2]
Australia	0.9	0	0	0	0.0
Austria	1.7	0	0	0	0.0
Belgium	1.5	0	0	3	20.0
Canada	2.0	0	0	1	6.7
France	9.2	0	0	2	13.3
Germany	9.9	1	1	2	13.3
Ireland	1.8	0	0	2	13.3
Italy	8.2	0	0	0	0.0
Japan	8.1	0	0	1	6.7
Netherlands	4.2	1	1	2	13.3
Portugal	1.0	0	0	0	0.0
Spain	7.8	0	0	0	0.0
Sweden	0.6	0	0	3	20.0
Switzerland	1.6	0	0	2	13.3
United Kingdom	44.6	7	3	1	6.7
United States	80.3	10	4	0	0.0

Source: IMF staff calculations.

[1]Number of simulations in which that particular country fails.

[2]Percentage of failures as a percent of the number of simulations conducted.

in addition to its importance as a recipient of funding: France now induces three hypothetical defaults compared with none under the credit shock scenario. Similarly, the United Kingdom and the United States substantially increase their systemic profile.

Notice also that the addition of the funding channel significantly raises the vulnerability of all banking systems, as measured by the hazard rate. This fact may help explain why numerous studies in the network literature—which focus mostly on credit events—have found little source of concern for the systemic effects resulting from hypothetical credit events. Explicitly quantifying the implications of a liquidity squeeze can alter the picture on systemic failures. For example, in our simulations, the hazard rate for most countries increases several fold. Table 2.5

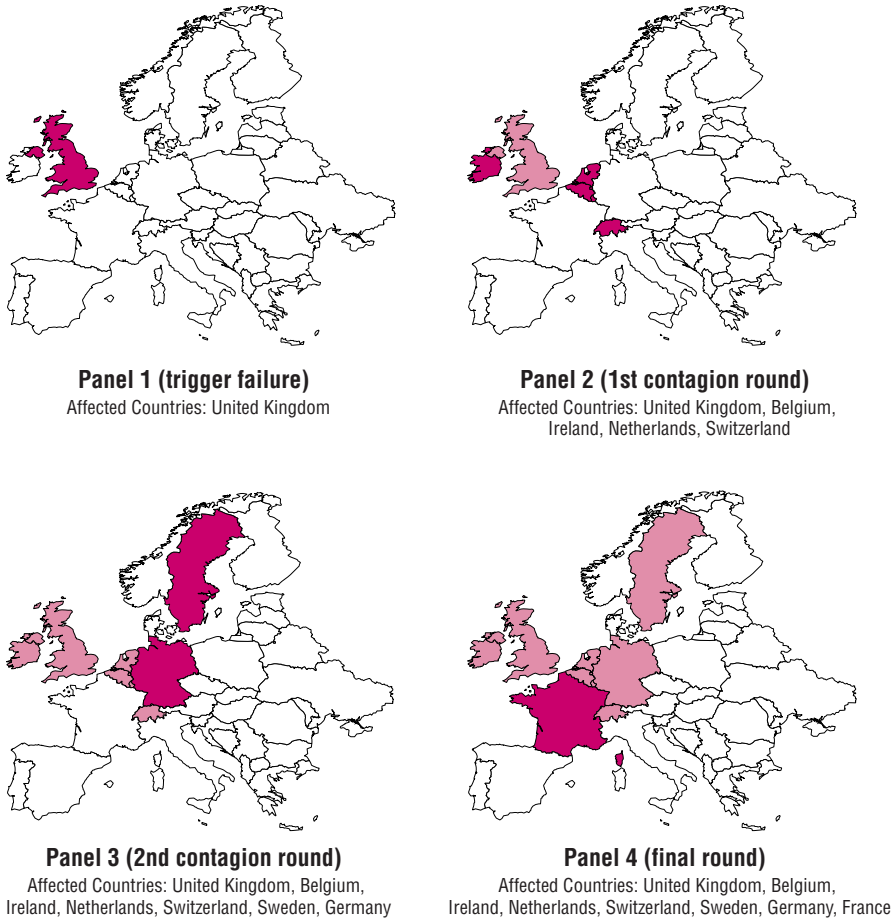
Table 2.3. Post-Simulation 1 Capital Losses

(Capital impairment in percent of pre-shock capital)

	Australia	Austria	Belgium	Canada	France	Germany	Ireland	Italy	Japan	Netherlands	Portugal	Spain	Sweden	Switzerland	United Kingdom	United States
Trigger Country																
Australia		–1.7	–5.1	–8.1	–5.6	–5.5	–4.4	–0.2	–6.1	–29.3	–0.4	–0.4	–5.2	–14.7	–8.0	–1.7
Austria	–0.5		–6.2	–1.0	–3.2	–11.0	–3.6	–13.3	–0.9	–3.4	–0.8	–0.5	–2.7	–10.0	–0.6	–0.2
Belgium	–3.4	–2.3		–1.9	–11.8	–5.1	–4.6	–1.7	–2.6	–45.4	–1.2	–1.7	–5.9	–11.5	–2.1	–0.7
Canada	0.0	–0.8	–3.6		–3.0	–3.9	–5.7	–0.2	–4.6	–12.3	–0.3	–0.2	–2.8	–10.7	0.0	–2.0
France	–8.6	–6.8	–78.5	–4.6		–23.0	–13.5	–6.8	–10.9	–57.6	–5.0	–6.6	–13.8	–61.0	–14.0	–2.5
Germany	–0.2	–33.5	–57.7	–6.6	–27.8		–26.6	–42.7	–16.4	–67.3	–6.2	–6.2	–103.0	–53.7	–7.8	–4.0
Ireland	–4.8	–4.9	–66.3	–7.5	–8.7	–20.2		–3.3	–4.1	–14.8	–3.7	–2.4	–6.9	–15.5	–10.7	–1.2
Italy	0.0	–14.2	–30.6	–1.4	–48.0	–23.7	–24.5		–5.6	–47.2	–4.2	–4.7	–4.1	–17.8	–4.3	–1.1
Japan	0.0	–0.2	–2.2	–2.0	–21.4	–9.0	–10.0	–0.5		–17.2	–0.1	–0.1	–0.7	–81.7	–6.0	–4.0
Netherlands	–8.3	–11.8	–154.3	–5.3	–25.9	–21.1	–13.7	–5.4	–9.0		–5.2	–8.4	–18.9	–36.8	–7.5	–2.8
Portugal	0.0	–1.4	–5.5	–0.2	–3.1	–4.5	–2.3	–0.8	–0.3	–4.8		–8.8	–0.9	–2.3	–1.0	–0.1
Spain	–1.5	–4.2	–27.3	–1.6	–19.4	–27.8	–16.6	–3.2	–3.3	–38.8	–25.3		–11.9	–10.2	–6.3	–1.4
Sweden	–0.2	–0.7	–2.1	–0.8	–1.9	–3.8	–2.8	–0.2	–1.4	–4.4	–0.3	–0.3		–5.5	–1.0	–0.4
Switzerland	–1.9	–5.7	–11.5	–1.1	–5.9	–6.6	–1.8	–1.8	–2.0	–7.1	–1.9	–0.8	–4.9		–1.5	–0.7
United Kingdom	–23.7	–79.6	–497.7	–72.2	–118.1	–152.8	–187.3	–70.5	–63.3	–302.5	–31.1	–60.4	–225.9	–352.1		–22.2
United States	–23.7	–92.2	–604.6	–254.3	–213.7	–237.6	–257.3	–76.7		–469.8	–38.4	–73.5	–288.9	–952.0	–105.9	

Source: IMF staff calculations.

Figure 2.4. Network Analysis: Contagion Path Triggered by the U.K. Failure



Panel 1 (trigger failure)
Affected Countries: United Kingdom

Panel 2 (1st contagion round)
Affected Countries: United Kingdom, Belgium, Ireland, Netherlands, Switzerland

Panel 3 (2nd contagion round)
Affected Countries: United Kingdom, Belgium, Ireland, Netherlands, Switzerland, Sweden, Germany

Panel 4 (final round)
Affected Countries: United Kingdom, Belgium, Ireland, Netherlands, Switzerland, Sweden, Germany, France

features the distribution of capital losses after all contagion rounds have taken place. The fact that countries may contribute to further contagion rounds because of their inability to roll over their funding needs points to the need to consider the merits of interconnectedness-based liquidity charges. These potential risk-based charges could be assessed to institutions shown to be weakened by hypothetical liquidity squeezes. These risk-based charges could also be used for setting up a liquidity emergency fund for financial institutions, as some have proposed.[17]

Summing Up

Our illustration of network analysis has highlighted its usefulness as a surveillance tool. For instance, this section has shown how it could track the reverberation of a credit event and a liquidity squeeze throughout the system. To be sure, the unfolding of a crisis will be a function of institutions' reactions and policy responses that could halt spillovers. Though not trivial, these elements can be added to the analysis going forward. Furthermore, although the chapter relied on aggregate BIS country

[17]Similarly, Perotti and Suarez (2009) argue that financial regulators should consider the establishment of mandatory liquidity charges to be paid to a regulator who is able to provide emergency funding and capital during a crisis.

Table 2.4. Simulation 2 Results (Credit and Funding Channel)

Country	Failed Capital (in percent of total capital)	Induced Failures	Contagion Rounds	Absolute Hazard[1]	Hazard Rate[2]
Australia	0.94	0	0	2	13.3
Austria	1.69	0	0	2	13.3
Belgium	1.48	0	0	4	26.7
Canada	2.00	0	0	2	13.3
France	15.02	3	3	2	13.3
Germany	9.89	1	1	2	13.3
Ireland	1.85	0	0	2	13.3
Italy	8.20	0	0	2	13.3
Japan	8.13	0	0	2	13.3
Netherlands	4.17	1	1	3	20.0
Portugal	1.03	0	0	2	13.3
Spain	7.84	0	0	2	13.3
Sweden	0.65	0	0	3	20.0
Switzerland	1.62	0	0	3	20.0
United Kingdom	100.00	15	5	1	6.7
United States	100.00	15	5	1	6.7

Source: IMF staff calculations.

[1]Number of simulations in which that particular country fails.

[2]Percentage of failures as a percent of the number of simulations conducted.

banking data, central banks should consider assessing individual banking and other nonbank financial intermediary data to conduct this type of analysis. The analysis should be expanded to better track the systemic implications of liquidity squeezes such as the one witnessed in this crisis, since funding difficulties can occur before balance sheet insolvency. The analysis can also be expanded by simulating multiple initial defaults, taking into account the currency composition of cross-border lending, and integrating factors such as the imperfect integration of global money markets, heterogeneous resolution regimes, problems with credit

Table 2.5. Post-Simulation 2 Capital Losses

(Capital impairment in percent of pre-shock capital)

	Australia	Austria	Belgium	Canada	France	Germany	Ireland	Italy	Japan	Netherlands	Portugal	Spain	Sweden	Switzerland	United Kingdom	United States
Trigger Country																
Australia		–1.8	–5.8	–8.1	–5.9	–5.5	–5.2	–0.2	–6.1	–29.9	–0.4	–0.4	–5.3	–15.1	–8.0	–1.7
Austria	–1.6		–7.1	–1.2	–3.6	–13.1	–5.2	–14.3	–1.0	–5.5	–1.6	–0.8	–3.4	–12.1	–1.2	–0.5
Belgium	–6.2	–4.2		–2.8	–16.2	–8.2	–23.2	–3.6	–2.7	–75.0	–3.9	–3.5	–7.5	–15.1	–5.9	–2.8
Canada	–6.0	–1.2	–4.5		–3.3	–4.3	–8.5	–0.3	–4.8	–13.2	–0.4	–0.4	–3.6	–11.2	–1.8	–6.9
France	–78.9	–37.4	–303.4	–25.6		–72.2	–75.1	–41.4	–38.2	–162.0	–30.2	–31.0	–60.0	–117.3	–47.4	–33.3
Germany	–20.4	–54.9	–69.6	–13.2	–36.2		–62.9	–52.2	–20.0	–87.7	–20.4	–18.0	–121.8	–67.6	–22.9	–13.6
Ireland	–7.8	–6.3	–68.3	–9.4	–9.7	–21.9		–5.2	–4.9	–17.0	–5.2	–3.8	–9.7	–16.2	–15.5	–2.5
Italy	–0.6	–36.8	–33.9	–1.7	–50.2	–36.9	–29.6		–5.8	–51.1	–6.5	–5.9	–5.1	–20.9	–6.0	–1.8
Japan	–18.5	–1.8	–7.1	–8.6	–24.8	–13.6	–16.3	–2.4		–24.0	–1.0	–1.3	–7.1	–85.1	–9.4	–12.9
Netherlands	–40.3	–15.5	–183.3	–12.0	–36.2	–30.6	–39.8	–12.7	–11.1		–12.3	–14.8	–26.9	–44.6	–17.0	–9.9
Portugal	–0.2	–1.6	–5.7	–0.3	–3.3	–4.7	–3.0	–1.0	–0.3	–5.4		–9.9	–1.1	–2.7	–1.2	–0.2
Spain	–2.6	–5.0	–30.5	–1.9	–21.4	–29.6	–20.2	–4.8	–3.3	–45.5	–48.7		–13.2	–11.6	–11.8	–2.7
Sweden	–1.4	–1.1	–3.0	–1.1	–2.3	–6.3	–3.7	–0.4	–1.5	–5.5	–0.5	–0.6		–6.2	–2.0	–0.9
Switzerland	–10.7	–9.0	–15.9	–4.1	–9.7	–9.6	–6.5	–3.0	–7.7	–12.4	–3.2	–1.6	–9.7		–7.4	–12.0
United Kingdom	–204.8	–178.8	–780.1	–305.8	–337.0	–366.4	–454.1	–142.4	–194.7	–708.4	–137.6	–126.8	–382.9	–1,061.8		–101.5
United States	–204.8	–178.8	–780.1	–305.8	–337.0	–366.4	–454.1	–142.4	–194.7	–708.4	–137.6	–126.8	–382.9	–1,061.8	–189.2	

Source: IMF staff calculations.

default swap (CDS) clearing mechanisms, and so on. Importantly, in this connection, when a crisis extends beyond one jurisdiction, the unraveling of defaults in multiple jurisdictions may become further complicated by the existence of several bankruptcy regimes that would impose additional constraints and difficulties.

The Co-Risk Model

The previous subsection featured a methodology well suited to analyze the systemic effects of financial institutions' direct linkages, such as those typically generated in the interbank market. However, from a financial stability and risk management perspective, it may be equally critical to assess direct and indirect financial linkages at an institutional level, which may arise from exposure to common risks factors such as the adoption of similar business models (e.g., similar risk management systems or portfolio holdings), common accounting practices across financial institutions, the market's perception of financial institutions' coincidence of fortunes, and other factors. One method to extract this information consists of tracking the market's perception, usually reflected in securities prices, of how the credit risk of one institution affects other institutions' credit risk. As pointed out by Brunnermeier and others (2009, p. 5), "It may be that the best way to assess the implications of endogenous risk is via new endogenous co-risk measures that measure the increase in overall risk after conditioning on the fact that one bank is in trouble."

The data at the core of most methodologies that estimate for co-risk (or co-movement) in the credit risk of financial institutions include institutions' CDS spreads, Moody's KMV expected default frequencies, corporate bond spreads, distance-to-default measures, and the value-at-risk (VaR) of their trading portfolio. Under efficient markets, co-movement of these variables should convey information on both direct and indirect linkages across financial institutions.

Importantly, the co-movements of financial institutions' risk measures do not exhibit a linear pattern. That is, they increase more than proportionally with the increase in the level of risk. Therefore, analysts rely on a number of nonlinear methodologies to estimate these co-movements.[18] One such methodology is extreme-value theory. Because of its focus on extreme (or tail) realizations, this methodology ignores the information content of a large portion of the data sample, a problem that becomes more acute the shorter the data sample.

This section presents an alternative to the use of explicit nonlinear models: quantile regression analysis. Most readers are familiar with standard regression analysis, which focuses exclusively on the mean relationship of the variables analyzed, and thus provides incomplete information about what transpires under distress periods (which, by definition, represent large deviations from the mean of the conditional distribution to a higher quantile (percentile). Quantile regression permits a more accurate estimation of the co-movements of financial institutions' risk factors (or co-risk estimates), taking into account their nonlinear relationship, according to the methodology described in Box 2.2.[19]

The data for this analysis were compiled for the period from July 1, 2003 to September 12, 2008 and consist of daily five-year-maturity CDS spreads.[20] Intuitively, when an institution's CDS spreads are in their 5th quantile (the left tail of their distribution), this suggests that these institutions are experiencing an extremely benign regime, and when the CDS spreads are at their 95th quantile (the right tail of their distribution), this suggests a distress regime. The U.S. institutions analyzed are AIG, Bank of America, Bear Stearns, Citigroup, Goldman Sachs, JP

[18]Regime-switching estimation is an alternative methodology to uncover risk measure co-movements, as shown in Chapter 3.

[19]For a detailed exposition of quantile regression techniques, see Koenker (2005), and for an intuitive exposition, see Koenker and Hallock (2001).

[20]CDS mid-price quotes were obtained from Bloomberg L.P. and Primark Datastream.

Box 2.2. Quantile Analysis

This box describes a technique that examines how the default risk of an institution is affected by the default risk of another institution, after controlling for common sources of risk.

In statistical terms, the goal is to learn $f(y|x,\beta)$, the conditional distribution of the default risk of institution y, given the default risk of institutions and common default risks, denoted by x and where θ represents a set of parameters that needs to be inferred. Ordinary least squares (OLS) is a useful technique to extract this information. However, OLS can only provide information about the *mean* relationship across institutions' default risk. Because this relationship is likely to be nonlinear, OLS has serious limitations.

Quantile regression is an alternative to other nonlinear models, or nonparametric models that can explain the apparent "nonlinearities" in the data. The nonlinearities of the data are, to a large extent, associated with the differential response of the dependent variable under seemingly "different" regimes, which can be associated with different quantiles. Quantile regression, first introduced by Koenker and Bassett (1978), extends the OLS intuition beyond the estimation of the mean of the conditional distribution $f(y|x,\beta)$. It allows the researcher to "slice" the conditional distribution at the quantile of interest, τ, and obtain the corresponding cross-section of the conditional distribution $f_\tau(y|x,\beta)$.

Quantile regression makes it possible to evaluate the response of the dependent variable within particular segments of the conditional distribution. Thus, in a quantile regression, the parameters are obtained by solving an optimization program that uses the entire sample. The parameters are obtained from the weighted minimization of the sum of residuals, $y_i - \xi(x_i,\beta)$, where the weights are given by the function ρ_τ,

$$\min_{\beta} \sum_{i}^{N} \rho_\tau(y_i - \xi(x_i,\beta)), \qquad (1)$$

where y is the dependent variable, $\xi(x_i,\beta)$ is a linear function with the parameters β associated with exogenous variables x_i, and $\rho_\tau(.)$ is a function that assigns weights to each observation depending on the given quantile. More specifically, the function assigns a weight equal to the quantile τ if the residual is positive and a weight equal to $\tau - 1$ if the residual is negative. The minimization can be solved using standard linear programming methods, and the covariance matrices are usually estimated using bootstrap techniques that are valid even if the residuals and explanatory variables are not independent (Koenker, 2005).

In this chapter, following Adrian and Brunnermeier (2008), the model specification below is estimated using quantile regression:

$$CDS_i = \alpha_\tau + \sum_{i}^{K} \beta_{\tau,i} R_i + \beta_{\tau,j} CDS_j,$$

where the credit default swap (CDS) spread of institution i, CDS_i, is expressed as a function of the CDS spread of institution j, CDS_j, after correcting for the effect of common aggregate risk factors (denoted by R_k), such as business cycle indicators and market volatility for different quantiles (τ). Therefore, the parameter estimates, $\beta_{\tau,j}$, provide a measure of how firm j affects the credit risk of firm i (directly and indirectly) at different quantiles.

Furthermore, it is also possible to use the quantile regression estimated for the 95th quantile, e.g., the quantile that is assured to correspond to a distress period, to estimate a conditional co-risk measure analogous to the conditional value-at-risk measure introduced by Adrian and Brunnermeier (2008):

$$\textit{Conditional CoRisk}(i,j) = 100 \times \left(\frac{\alpha_{95} + \sum_{i}^{K} \beta_{95,i} R_i + \beta_{95,i} CDS_j(95)}{CDS_i(95)} - 1 \right)$$

where $CDS_i(95)$ and CDS_j are the CDS spread of institutions i and j corresponding to the 95th percentile of their empirical sample respectively, and α_{95}, $\beta_{95,i}$, and $\beta_{95,j}$ are the parameters of the 95th quantile regression.

In closing, by using the quantile regression technique and the co-risk measures, the tails of the distributions of defaults of pairs of institutions can be examined without ignoring important data influencing this relationship.

Note: Jorge Chan-Lau prepared this box. For more details on the quantile regression, see Chan-Lau, Espinosa, and Solé (2009b).

Morgan, Lehman Brothers, Merrill Lynch, Morgan Stanley, Wachovia, and Wells Fargo; the European institutions are Fortis, Banque Nationale Paribas, Société Générale, Deutsche Bank, Commerzbank, BBVA, Banco Santander, Credit Suisse, UBS, Barclays, and HSBC; and the Japanese institutions are Mitsubishi, Mizuho, and Sumitomo.[21]

The set of independent variables include the following:

(1) A proxy for a general risk premium—computed as the difference between the daily return of the S&P 500 index and the three-month U.S. treasury bill. At least in the United States, there is evidence that an increase in this spread is associated with increases in economy-wide default risk (see Vassalou and Xing, 2004; and Chan-Lau, 2007);

(2) The slope of the U.S. yield curve—measured as the yield spread between the 10-year and the three-month U.S. treasury rates (as proxy for a business cycle indicator);

(3) A LIBOR spread—measured as the one-year Libor spread over one-year constant maturity U.S. treasury yield (the spread is usually regarded as a measure of the default risk in the interbank market);[22]

(4) A proxy for the severity of liquidity squeeze—measured as the yield spread between the three-month general collateral repo rate and the three-month U.S. treasury rate; and

(5) The implied volatility index (VIX) reported by the Chicago Board Options Exchange, a common proxy for general risk appetite.

Figure 2.5 shows a scatter plot for the CDS spreads of AIG and Lehman from July 2003 to March 14, 2008. Notice that the scatter plot reveals a nonlinear relationship across the CDS spreads, thus suggesting the need for a nonlinear estimation technique such as quantile regression to extract co-risk measures. Figure 2.5 also presents the result of the quantile regression fit for AIG's CDS spread as a function of Lehman's CDS spreads, controlling for aggregate risk factors, and for different quantile (or percentile) levels, namely, the 5th quantile, the 50th quantile, and the 95th quantile. It is important to note that the codependence between the CDSs of AIG and Lehman Brothers, or co-risk, varies according to the regime. The slope of the quantile regression line becomes steeper the more distressed the regime is and indicates that co-risk is stronger during distress periods, a finding supported by earlier empirical studies.[23]

Estimated quantile regressions can be used to calculate *conditional* co-risk measures, described in detail in Box 2.2. From a risk management and regulatory perspective, conditional co-risk measures are more informative than *unconditional* risk measures because they provide a market assessment of the *proportional increase* in a firm's credit risk induced, directly and indirectly, from its links to another firm. Furthermore, the more relevant conditional co-risk measures for regulatory and risk management purposes are the conditional co-risk measures under tail events. The measures presented here are estimated at the 95th quantile, which is a threshold commonly used in VaR analysis.

Figure 2.5 provides some intuition for how the conditional co-risk estimates reported in Table 2.6 were computed. Consider the case where Lehman Brothers' CDS spread was 293 basis points.[24] Plugging this value in the 95th quantile regression yields an estimated AIG CDS spread of 463 basis points. The observed

[21]For data availability reasons, slightly different institutions were chosen for analysis in Chapter 3.

[22]The use of the three-month LIBOR-OIS (overnight index swap) spread results in similar outcomes.

[23]These studies (deVries, Hartmann, and Straetmans, 2001; Longin and Solnik, 2001; and Chan-Lau Mathieson, and Yao, 2004) find that the co-movement among financial variables is stronger during distress periods than in normal periods. This stylized fact may be due to structural breaks and nonlinearities, or they may simply reflect interdependence (Forbes and Rigobon, 2002). While quantile regressions are not able to identify what factor underlies this stylized fact, they can still quantify the co-movement.

[24]The 95th percentile corresponds to the value of the observed CDS spreads such that 95 percent of the observations have lower values and 5 percent of the observations have higher values.

95th percentile CDS spread for AIG is only 225 basis points. With these elements, conditional co-risk measures can be obtained according to the formula in Box 2.2.

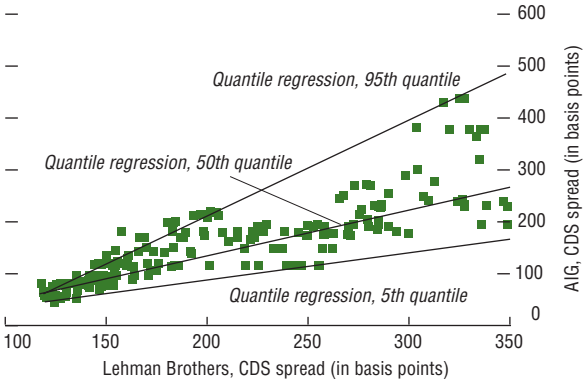
A subset of institutions is presented in Tables 2.6 and 2.7, in which the rows feature the percentage change in the conditional credit risk (i.e., increase in CDS spreads) *endured* by "locus" institutions and *induced* by "source" institutions listed in the columns, only when CDS spreads are high (at their 95th percent quantile). For instance, Table 2.6 shows that when Citigroup's CDS spreads were at their 95th percent quantile, this would have led to an increase of 135 percent in Bear Stearns' CDS spread. Similarly, the table shows that the credit risk of Lehman Brothers (listed in the sixth row in panel A) conditional on the risk of Citigroup (listed in the third column in panel A) is 103 percent higher than that corresponding to the 95th percentile of Lehman Brothers' own CDS distribution, as estimated by the quantile regression, and so on.

As mentioned earlier, this type of analysis represents a useful surveillance tool, as it reveals which institutions are perceived to be more connected to each other. Figure 2.6 presents a graphical representation of some of the results in Table 2.6. The numbers associated with the outgoing arrows state the conditional co-risk measure, calculated from the 95th quantile regression, between the source and locus institutions. For instance, the risk of Bear Stearns conditional on the risk of AIG is 248 percent higher than that corresponding to the 95th percentile Bear Stearn's *empirical distribution*.[25]

Back in March 2008, these results (Figure 2.6) would have suggested the need for closely monitoring AIG, Bear Stearns, and Lehman, given the markets' perception of the considerable extent to which these institutions were affected by the fortunes of many of those in the sample of U.S. financial institutions during tail events. Interestingly, Table 2.6 indicates that in March 2008, the conditional co-risks from AIG

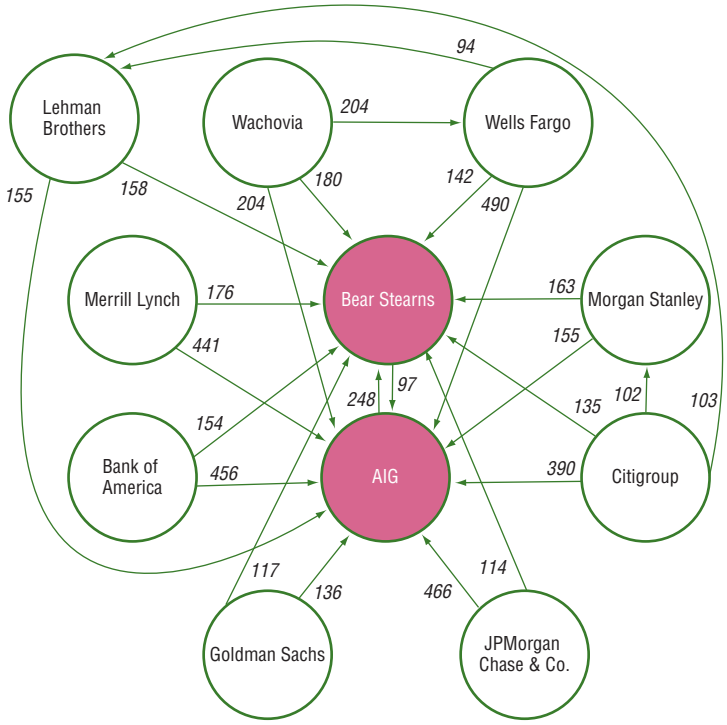
[25]Only conditional co-risk measures exceeding 90 percent are presented in the figure.

Figure 2.5. AIG and Lehman Brothers Default Risk Codependence



Sources: Bloomberg, L.P.; Primark Datastream; and IMF staff estimates.
Note: This figure contains a scatter plot of the relationship between Lehman Brothers and AIG credit default swap (CDS) spreads. It also shows the quantile regression fit for the 5th, 50th, and 95th quantiles. In addition to information on CDS spread data, quantile regression estimates include the effect of additional common risk factors. In order to obtain a two-dimensional figure, it is necessary to keep these additional variables constant. Therefore, this figure is an approximate 2-D representation of the quantile regressors.

Figure 2.6. A Diagrammatic Depiction of Co-Risk Feedbacks



Sources: Bloomberg, L.P.; Primark Datastream; and IMF staff estimates.
Note: This figure presents the conditional co-risk estimates between pairs of selected financial institutions. Only co-risk estimates above or equal to 90 percent are depicted. See Table 2.6 for further information.

and Lehman to the rest of the institutions in the sample were, on average (excluding Bear Stearns), 11 and 24 percent, respectively. And on September 12, 2008, these estimates jumped to 30 and 36 percent, respectively.

The Distress Dependence Matrix

In the method above, each pair of institutions is examined as a pair (conditioning on a set of other general variables) and then one institution's co-risk measure versus each of the others is averaged across the sample to see its connection to the "system." Another, more encompassing, method of examining the relationships between a group of institutions, and then focusing on pairs of institutions, accounts for the relationship between the group of institutions implicitly by estimating a multivariate distribution of their asset returns as a first step. This multivariate density can capture linear (correlation) and nonlinear interdependence among all the financial institutions (due to the direct and indirect links) and the changes over the economic cycle. A general model for doing so is discussed more generally in Chapter 3.[26] Having obtained

[26]This work was produced by Miguel Segoviano using methods developed in Segoviano and Goodhart (2009). As noted in Chapter 3, the distress dependence matrix is one of three complementary perspectives proposed to analyze financial stability.

Table 2.6. Conditional Co-Risk Estimates, March 2008

	Bank of America	Bear Stearns	Citigroup	Goldman Sachs	JPMorgan Chase & Co.	Lehman	Merrill Lynch
Bank of America		28	18	6	4	3	21
Bear Stearns	154		135	117	114	158	176
Citigroup	27	29		7	13	1	32
Goldman Sachs	91	31	86		40	31	81
JPMorgan Chase & Co.	16	39	24	12		15	35
Lehman	82	27	103	52	66		80
Merrill Lynch	25	13	25	22	29	12	
Morgan Stanley	92	25	102	35	73	32	92
Wachovia	85	14	58	31	112	18	96
Wells Fargo	10	25	13	9	4	9	10
AIG	456	97	390	136	466	155	441
Commerzbank	13	63	9	–3	8	1	10
HSBC	27	41	20	20	16	16	34

	Morgan Stanley	Wachovia	Wells Fargo	AIG	Commerzbank	HSBC	Average Vulnerability
Bank of America	8	20	18	3	41	36	17
Bear Stearns	163	180	142	248	96	80	147
Citigroup	6	31	35	3	46	41	23
Goldman Sachs	23	46	90	10	29	81	53
JPMorgan Chase & Co.	21	39	30	25	45	53	29
Lehman	76	60	94	37	102	138	76
Merrill Lynch	12	23	36	16	76	74	30
Morgan Stanley		50	79	7	107	125	69
Wachovia	17		76	20	227	167	80
Wells Fargo	3	8		10	36	35	15
AIG	155	204	490		617	584	358
Commerzbank	1	5	14	–6		7	9
HSBC	14	31	30	2	22		22

Source: IMF staff calculations.

Note: Each cell in the table reports the co-risk measure corresponding to the large complex financial institutions (LCFIs) listed in the rows (e.g., LCFI "A") and conditional on the LCFIs listed in the columns (e.g., LCFI "B"). The co-risk measure of A conditional on B is calculated as the percent difference between A's estimated credit default swap (CDS) spread and A's observed CDS spread at the 95th empirical percentile. The estimated CDS spread of A is obtained by using B's 95th empirical percentile CDS spread as an input in the 95th quantile regression of A on B. For instance, the co-risk measure of 39 percent for JPMorgan Chase & Co. conditional on Bear Stearns implies that the CDS spread of JPMorgan Chase & Co., at its 95th percentile value, increases by 39 percent if the CDS spread of Bear Stearns is at its 95th percentile value. The larger the co-risk measure, the more vulnerable is LCFI A to LCFI B.

this joint probability distribution of distress across a number of institutions, it is possible to then "slice" this multivariate distribution to estimate sets of pairwise conditional probabilities of distress. That is, it is possible to estimate the probability a financial institution experiencing distress conditional on another institution being in distress. We provide the collection of all such pairwise probabilities in the distress dependence matrix.

Table 2.8 shows the (pairwise) conditional probabilities of distress of the institution in the row, given that the institution in the column falls into distress, implicitly assuming the remaining institutions' distress probabilities are also relevant.[27] The matrix of bilateral distress dependencies can be computed daily to estimate how conditional probabilities of distress evolved. Three dates are chosen: a pre-crisis date (July 1, 2007); a month before (August 15, 2008); and then the day before Lehman Brothers filed for bankruptcy (September 12, 2008). As Table 2.8 indicates, distress dependencies signaled that the market expected that a default

[27]The methodology used to estimate these values is summarized in Box 3.4 in Chapter 3. See Segoviano and Goodhart (2009) for more details. Importantly, the bilateral distress dependence takes into account the distress probabilities (as derived from CDS contracts) of some 15 other financial institutions over time.

Table 2.7. Conditional Co-Risk Estimates, September 2008

	Bank of America	Citigroup	Goldman Sachs	JPMorgan Chase & Co.	Lehman	Merrill Lynch	Morgan Stanley
Bank of America		9	9	11	12	13	13
Citigroup	32		12	15	24	36	19
Goldman Sachs	93	71		50	49	97	35
JPMorgan Chase & Co.	18	9	6		17	22	18
Lehman	56	58	36	66		61	68
Merrill Lynch	20	16	17	25	16		20
Morgan Stanley	70	71	22	44	36	82	
Wachovia	59	41	23	44	22	76	31
Wells Fargo	15	18	14	14	15	21	18
AIG	262	209	58	206	92	255	97
Commerzbank	48	39	32	38	50	51	59
HSBC	69	53	46	52	64	76	14

	Wachovia	Wells Fargo	AIG	Commerzbank	HSBC	Average Vulnerability
Bank of America	16	8	13	24	19	13
Citigroup	36	31	30	11	16	24
Goldman Sachs	41	80	20	19	54	57
JPMorgan Chase & Co.	18	17	12	14	15	15
Lehman	38	53	55	73	67	56
Merrill Lynch	20	20	25	43	37	24
Morgan Stanley	40	48	14	41	50	46
Wachovia		39	35	61	60	46
Wells Fargo	17		17	21	21	18
AIG	131	255		189	215	189
Commerzbank	74	63	46		18	47
HSBC	31	30	66	21		49

Source: IMF staff calculations.

Note: Each cell in the table reports the co-risk measure corresponding to the large complex financial institutions (LCFIs) listed in the rows (e.g., LCFI "A") and conditional on the LCFIs listed in the columns (e.g., LCFI "B"). The co-risk measure of A conditional on B is calculated as the percent difference between A's estimated credit default swap (CDS) spread and A's observed CDS spread at the 95th empirical percentile. The estimated CDS spread of A is obtained by using B's 95th empirical percentile CDS spread as an input in the 95th quantile regression of A on B. For instance, the co-risk measure of 39 percent for JPMorgan Chase & Co. conditional on Bear Stearns implies that the CDS spread of JPMorgan Chase & Co., at its 95th percentile value, increases by 39 percent if the CDS spread of Bear Stearns is at its 95th percentile value. The larger the co-risk measure, the more vulnerable is LCFI A to LCFI B.

of Lehman would cause significant disruptions to the system. Specifically, the probability of default of any other bank conditional on Lehman falling into distress went from 22 percent on July 1, 2007 to 37 percent on September 12, 2008 (column-average Lehman). A similar effect in the system would have been caused by the distress of AIG, since the probability of default of any other bank conditional on AIG falling into distress went from 20 percent on July 1, 2007 to 34 percent on September 12, 2008 (column-average AIG). The results also suggest that up to a month before the Lehman event, distress dependencies were already signaling that a default of Lehman or AIG would have caused significant disruptions to the system. This is revealed by the probability of default of any other bank conditional on Lehman or AIG falling into distress, which increased significantly from 41 and 30 percent, respectively, on August 15, 2008 (column-average Lehman and AIG). These results are consistent with those found in the co-risk analysis.[28]

[28]Note that numbers in the two tables are not comparable, as in Table 2.5, it represents the percentage increase (above the 95th quantile regression line estimate) of the actual CDS spread for that pair of institutions on that date, while in Table 2.6 it represents the implied probability of distress of an institution relative to the remaining institutions on that date, given other assumptions of the model and the techniques involved.

Table 2.8. Distress Dependence Matrix

(Pairwise conditional probability of distress)

July 1, 2007	Citigroup	Bank of America	JPMorgan Chase & Co.	Wachovia	Washington Mutual	Goldman Sachs	Lehman Brothers	Merrill Lynch	Morgan Stanley	AIG	Row Average
Citigroup	1.00	0.09	0.08	0.08	0.05	0.06	0.06	0.06	0.06	0.05	0.16
Bank of America	0.08	1.00	0.22	0.21	0.08	0.08	0.07	0.09	0.09	0.11	0.20
JPMorgan Chase & Co.	0.10	0.33	1.00	0.23	0.09	0.14	0.12	0.14	0.12	0.11	0.24
Wachovia Bank	0.08	0.27	0.20	1.00	0.08	0.08	0.07	0.08	0.08	0.10	0.20
Washington Mutual	0.14	0.25	0.18	0.20	1.00	0.10	0.10	0.13	0.11	0.12	0.23
Goldman Sachs	0.13	0.20	0.23	0.16	0.08	1.00	0.27	0.23	0.26	0.13	0.27
Lehman Brothers	0.16	0.24	0.25	0.19	0.11	0.35	1.00	0.29	0.26	0.14	0.30
Merrill Lynch	0.15	0.26	0.27	0.19	0.13	0.28	0.26	1.00	0.26	0.15	0.30
Morgan Stanley	0.15	0.25	0.23	0.19	0.10	0.30	0.23	0.25	1.00	0.12	0.28
AIG	0.05	0.11	0.07	0.08	0.04	0.05	0.04	0.05	0.04	1.00	0.15
Column average	*0.20*	*0.30*	*0.27*	*0.25*	*0.17*	*0.24*	*0.22*	*0.23*	*0.23*	*0.20*	*0.23*

August 15, 2008	Citigroup	Bank of America	JPMorgan Chase & Co.	Wachovia	Washington Mutual	Goldman Sachs	Lehman Brothers	Merrill Lynch	Morgan Stanley	AIG	Row Average
Citigroup	1.00	0.32	0.32	0.23	0.13	0.28	0.23	0.23	0.25	0.21	0.32
Bank of America	0.20	1.00	0.42	0.24	0.09	0.24	0.17	0.19	0.21	0.19	0.30
JPMorgan Chase & Co.	0.18	0.37	1.00	0.20	0.07	0.25	0.17	0.18	0.20	0.15	0.28
Wachovia Bank	0.41	0.69	0.65	1.00	0.23	0.45	0.37	0.39	0.41	0.39	0.50
Washington Mutual	0.83	0.92	0.89	0.85	1.00	0.80	0.77	0.82	0.80	0.78	0.85
Goldman Sachs	0.21	0.28	0.34	0.19	0.09	1.00	0.28	0.26	0.32	0.18	0.31
Lehman Brothers	0.42	0.51	0.56	0.38	0.22	0.69	1.00	0.52	0.54	0.35	0.52
Merrill Lynch	0.39	0.52	0.58	0.37	0.21	0.61	0.48	1.00	0.53	0.35	0.50
Morgan Stanley	0.31	0.41	0.44	0.28	0.15	0.52	0.35	0.37	1.00	0.24	0.41
AIG	0.36	0.52	0.48	0.38	0.20	0.41	0.32	0.35	0.34	1.00	0.44
Column average	*0.43*	*0.55*	*0.57*	*0.41*	*0.24*	*0.53*	*0.41*	*0.43*	*0.46*	*0.39*	*0.44*

September 12, 2008	Citigroup	Bank of America	JPMorgan Chase & Co.	Wachovia	Washington Mutual	Goldman Sachs	Lehman Brothers	Merrill Lynch	Morgan Stanley	AIG	Row Average
Citigroup	1.00	0.20	0.19	0.14	0.07	0.17	0.13	0.14	0.16	0.11	0.23
Bank of America	0.14	1.00	0.31	0.18	0.05	0.16	0.10	0.13	0.15	0.11	0.23
JPMorgan Chase & Co.	0.13	0.29	1.00	0.16	0.05	0.19	0.11	0.14	0.16	0.09	0.23
Wachovia	0.34	0.60	0.55	1.00	0.17	0.36	0.27	0.31	0.34	0.29	0.42
Washington Mutual	0.93	0.97	0.95	0.94	1.00	0.91	0.88	0.92	0.91	0.89	0.93
Goldman Sachs	0.15	0.19	0.24	0.13	0.06	1.00	0.18	0.20	0.27	0.11	0.25
Lehman	0.47	0.53	0.58	0.43	0.25	0.75	1.00	0.59	0.62	0.37	0.56
Merrill Lynch	0.32	0.41	0.47	0.30	0.16	0.53	0.37	1.00	0.48	0.26	0.43
Morgan Stanley	0.21	0.28	0.29	0.19	0.09	0.40	0.22	0.27	1.00	0.14	0.31
AIG	0.50	0.66	0.59	0.53	0.29	0.54	0.43	0.49	0.47	1.00	0.55
Column average	*0.42*	*0.51*	*0.52*	*0.40*	*0.22*	*0.50*	*0.37*	*0.42*	*0.46*	*0.34*	*0.41*

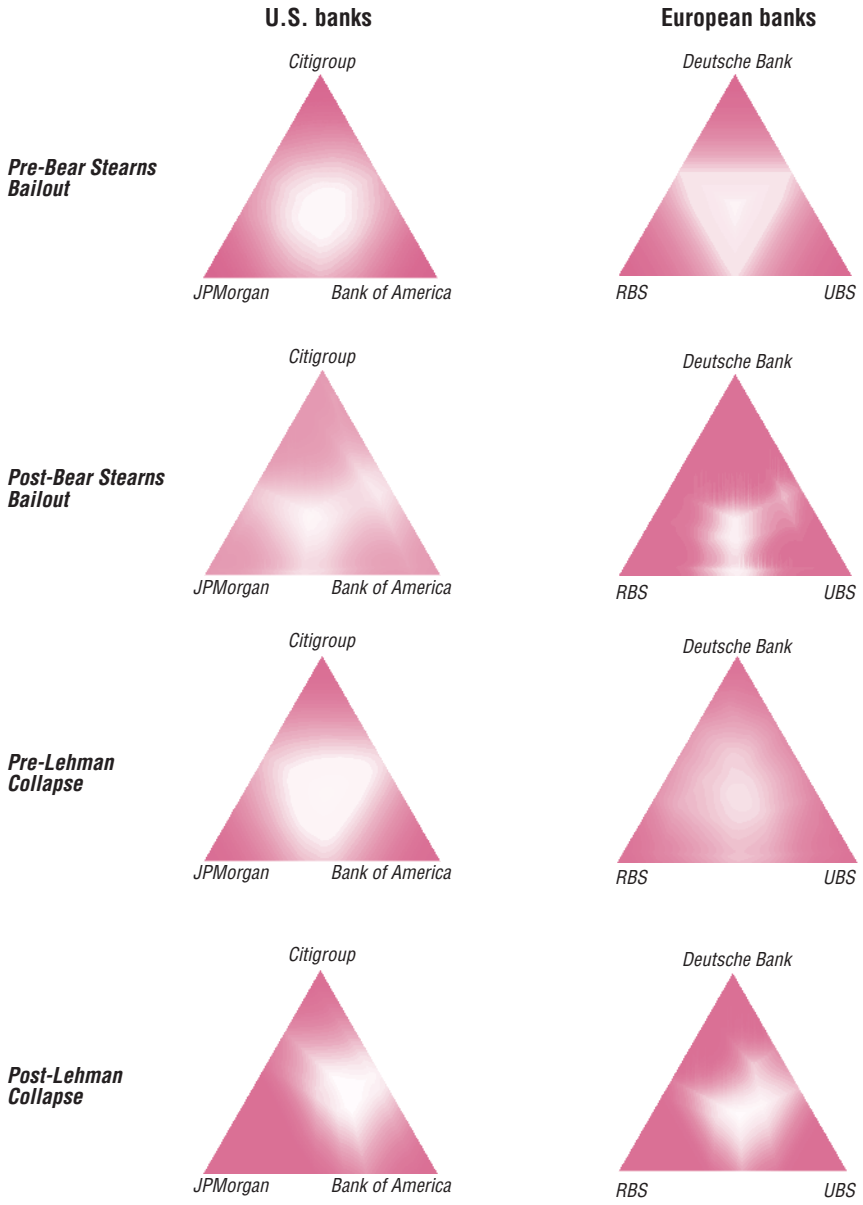
Sources: Bloomberg L.P.; and IMF staff estimates.

Note: This table shows the (pairwise) conditional probabilities of distress of the institution in the row, given that the institution in the column falls into distress.

Using equity options data and an alternative method for calculating multivariate distributions across groups of financial institutions (also featured in Chapter 3), a comparable exercise can provide a way to examine the relationship among two (or three) financial institutions at a time, against the backdrop of distress in a number of institutions.[29] As an example, the risk perception of the three largest banks in both the United States and Europe is shown to have become more intertwined as their exposure to

[29]This work was produced in an IMF working paper by Gray and Jobst (forthcoming).

Figure 2.7. U.S. and European Banks: Tail-Risk Dependence Devised from Equity Option Implied Volatility, 2006–08
(At-the-money, six months to expiration)



Note: The figure shows the trivariate extreme value dependence of implied volatility of equity options for U.S. and European banks.

large common shocks has increased (Figures 2.7 and 2.8).

It is important to note that it would be inappropriate to base policy on information contained in any one method, even though the analysis above can provide useful insight of how distress in a specific institution can affect other institutions and ultimately the stability of the system. Nonetheless, policymakers should use these in combination with

other concrete measures of systemic linkages to assist them in making decisions about individual institutions.

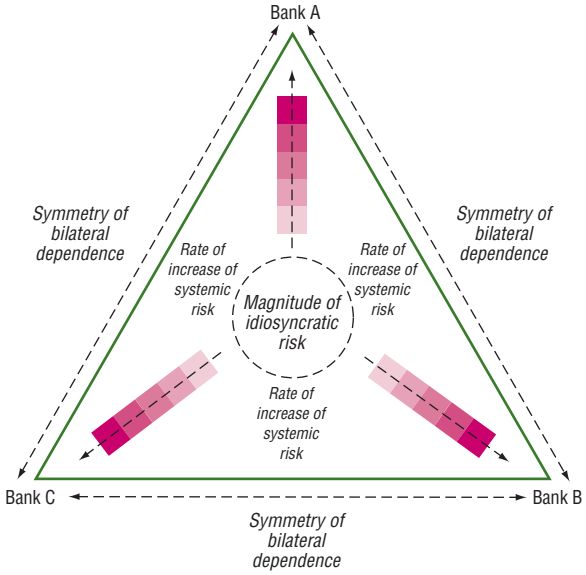
Finally, a levy of a capital surcharge based on the degree of interconnectedness could help align the incentives of the institutions' management with those of the authorities in charge of safeguarding financial stability. For example, regulators could have used the information in Figure 2.6 or Table 2.8 to approach AIG, Bear Stearns, and Lehman to request a capital surcharge based on their significant exposure to the fortunes to other financial institutions.[30] Furthermore, it also gives management incentives to reduce the institutions' vulnerabilities to other institutions. For instance, vulnerabilities can be reduced by reducing direct counterparty exposures with other institutions or by adopting trading and/or asset allocation strategies different from those of other institutions. By differentiating itself, a financial institution can avoid spillovers from negative market sentiment. Furthermore, the more different financial institutions are, the less vulnerable they are to herd behavior and to common shocks, which makes the financial system more resilient to a liquidity crisis (Persaud, 2003).

The Default Intensity Model

The previous two subsections presented methodologies to extract the implications of direct and indirect systemic linkages for the U.S. banking system. However, from a financial stability perspective, it may be equally critical to assess indirect financial linkages, including those to the broader economy. For example, the failure of Lehman Brothers illustrates how the collapse of an institution can trigger distress in other entities through the complex web of contract relationships. At some point, however, it is not just the knock-on effects of individual institutions

[30]The imposition of an "interconnectedness charge" is akin to the gross-up factor for the capital adequacy ratio suggested by Brunnermeier and others (2009).

Figure 2.8. Legend of Trivariate Dependence Simplex
(For Figure 2.7)



Box 2.3. Default Intensity Model Specification

This box presents a brief overview of the statistical default intensity model.

A sequence of economy-wide default times T_n represents the arrival times of defaults for the universe of Moody's-rated companies. The value N_t is the number of defaults that have occurred by time t. The conditional default rate or intensity, measured in defaults per year, is denoted by λ_t. We follow Giesecke and Kim (2009) and assume that the intensity evolves through time according to the continuous time equation,

$$d\lambda_t = K_t(c_t - \lambda_t)\,dt + dJ_t, \qquad (1)$$

where $\lambda_0 > 0$ is the value of the intensity at the beginning of the sample period, $K_t = K\lambda_{T_{N_t}}$ is the decay rate with which the intensity reverts to the level $c_t = c\lambda_{T_{N_t}}$ at t, and J is a response jump process given by

$$J_t = \sum_{n\geq 1} \max(\gamma, \delta\lambda_{T_n-})\, I(T_n \leq t), \qquad (2)$$

where $I(T_n \leq t) = 1$ if $T_n \leq t$ and 0 otherwise. The quantities $K > 0$, $c \in (0,1)$, $\delta > 0$, and $\gamma > 0$ are constant proportional factors, satisfying $c(1 + \delta) < 1$, to be estimated as described in Annex 2.1.

Equation (1) states that the default rate jumps whenever there is a default, reflecting the increase in the likelihood of further events. This specification incorporates the impact of a default on the surviving firms, which is channeled through direct and indirect systemic linkages. The magnitude of the jump depends on the intensity "just before" the event. This specification guarantees that the impact of an event increases with the default rate prevailing at the time of the event. Indeed, the impact of an event tends to be regime-dependent: it is often higher under generalized stress conditions. The parameter γ governs the minimum impact of an event. After the intensity is ramped up at an event, it decays exponentially to the level $c\lambda_{T_{N_t}}$ with rate $K\lambda_{T_{N_t}}$.

This model specification thus captures the regime-dependent behavior of default arrivals that can be estimated as described in Annex 2.1.

Note: Kay Giesecke prepared this box.

for the remaining institutions in the financial system that matter, but their interaction through their impact on the economy as a whole. This section features a reduced-form statistical model of the timing of banking default events drawn from Giesecke and Kim (2009), which is designed to capture the effects of direct and indirect systemic linkages among financial institutions, as well as the regime-dependent behavior of their default rates.[31]

The model is formulated in terms of a default rate, or "intensity." The details of the model are presented in Box 2.3. The default rate jumps at failure events, reflecting the increased likelihood of further events due to spillover effects. The magnitude of the jump is a function of the value of the default rate just before the event. This specification guarantees that the impact of an event increases with the default rate prevailing at the event, a property that is supported by empirical observation. Indeed, the impact of an event tends to be "regime-dependent:" it is often higher during a default clustering episode, when many firms are in a weak condition. The impact of an event dissipates over time.

This subsection estimates this model from historical default data spanning the period January 1,

[31]Future work could consider efforts to disentangle the effects of direct and indirect financial systemic linkages as performed in Azizpour and Giesecke (2008) for the nonfinancial U.S. corporate sector.

1970 to December 31, 2008, using the estimation procedure described in Annex 2.1. The data were obtained from Moody's Default Risk Service.[32]

To provide some intuition about the type of default event analyzed in this section, Figure 2.9 shows the annual number of U.S. economy-wide and banking-wide default events, along with the corresponding trailing 12-month default rate. Figure 2.9 features the dramatic rise in defaults of Moody's-rated banks during 2008. It is worth noting that while the absolute number of these defaults exceeds the number of events during the 1997–2001 "Internet bubble," it is still below the number of defaults witnessed in the early 1990s.

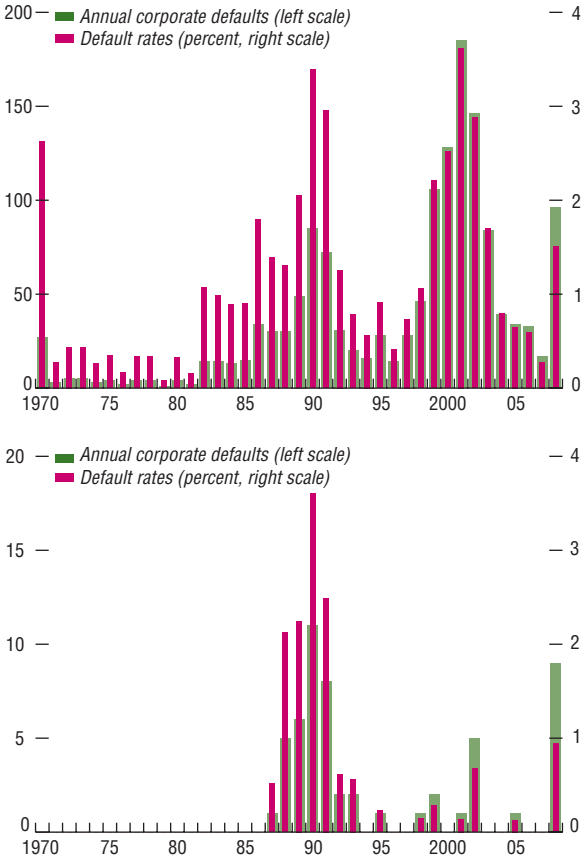
The first step in estimating the probability of systemic-banking events consists of estimating the economy-wide default model discussed in Box 2.3. As described in Giesecke and Kim (2009), this model quite accurately captures the clustering of the economy-wide default events as represented by the fitted intensity (Figure 2.10), thus suggesting the reliability of the model's out-of-sample forecasts.

Based on this model, we use a sampling approach described in Annex 2.1 to estimate the banking-wide default rate for the universe of Moody's rated issuers. Figure 2.10 depicts the time series of the quarterly one-year forecast of the banking-wide default distributions in the United States.

The tail of the forecasted distribution indicates the likelihood of systemic risk arising from both direct and indirect linkages. That is, a fat tail represents the likelihood of the failure

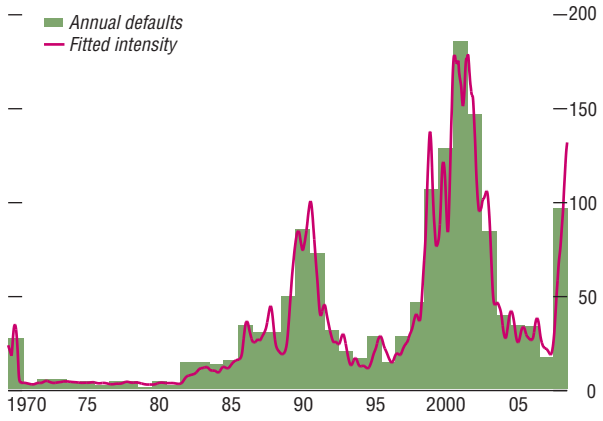
[32]For the purposes of this analysis, and according to Moody's default categories, a default event is defined as either (1) a missed or delayed disbursement of interest or principal, including delayed payments made within a grace period; (2) bankruptcy (as defined by Chapters 7, 10, and 11 of the U.S. commercial code), administration, legal receivership, or other legal blocks to the timely payment of interest or principal; or (3) a distressed exchange that occurs when (i) the issuer offers debt holders a new security or package of securities that amount to a diminished financial obligation; or (ii) the exchange had the apparent purpose of helping the borrower avoid default.

Figure 2.9. Annual Number of Corporate and Banking Defaults



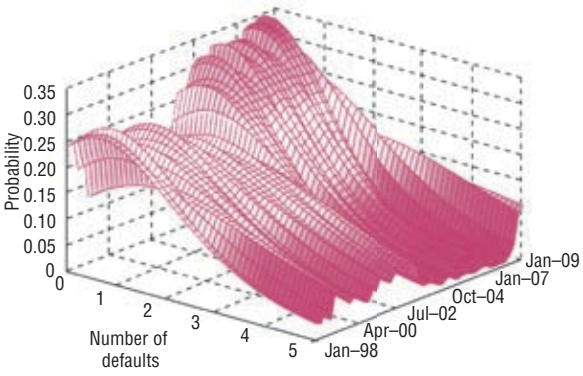
Source: Moody's Default Risk Service; and Giesecke and Kim (2009).
Note: Top panel shows annual number of default events in the universe of Moody's-rated U.S. corporate issuers, along with the trailing 12-month default rate. Bottom panel shows annual number of default events in the universe of Moody's-rated U.S. banking institutions, along with the trailing 12-month default rate.

Figure 2.10. Actual and Fitted Economy Default Rates
(Number of defaults)



Source: Moody's Default Risk Service; and Giesecke and Kim (2009).
Note: The figure shows the fitted economy-wide defaults, measured in events per year, versus the number of economy-wide defaults. The figure illustrates a good fit of the default timing model in replicating the time-series variation of economy-wide event times.

Figure 2.11. Default Rate Probability and Number of Defaults
(January 1998–January 2009)



Source: Giesecke and Kim (2009).
Note: The figure shows a time series of quarterly forecast one-year distributions of the number of defaults in the U.S. banking sector, estimated from the fitted model for the banking-wide default rate.

of a relatively large number of banking institutions. This measure of the degree of systemic risk increased sharply during 2008, and already exceeds the levels seen during the Internet bubble, suggesting a high probability of further banking failures (see the date axis in the bottom right corner of Figure 2.11).

The information contained in Figures 2.9 and 2.11 can be used to provide an indication of the potential future defaults that are still likely to take place as the current financial crisis continues to unfold. In particular, Figure 2.9 shows that the number of failures for the whole episode of the Internet bubble-burst was substantially higher than the number of defaults observed thus far. On the other hand, Figure 2.11 depicts a fatter tail (i.e., higher probability of a large number of defaults) for the current episode than for the Internet episode, thus indicating the high likelihood of further defaults in 2009 and beyond.

Finally, in order to provide a more precise metric of the potential system-wide and banking failures due to systemic linkages, the chapter considers the one-year 95 percent VaR of the distribution of default events for the economy at large and the banking sector to measure the number of Moody's-rated corporates and bank defaults that would occur with a 5 percent probability, normalized by the number of firms in the pool at the beginning of each year since 1998 (Figure 2.12). It transpires that during the 1998–2007 period the banking sector proved more stable than the economy as a whole. However, the sharp parallel increase in the economy-wide VaR and the bank-wide VaR suggests a break with the past feedback patterns, indicating that macro-financial linkages are now tighter, potentially complicating the policy response to the financial sector problems.

How Regulators Assess Systemic Linkages

Up to this point, the chapter has illustrated how four complementary methodologies could

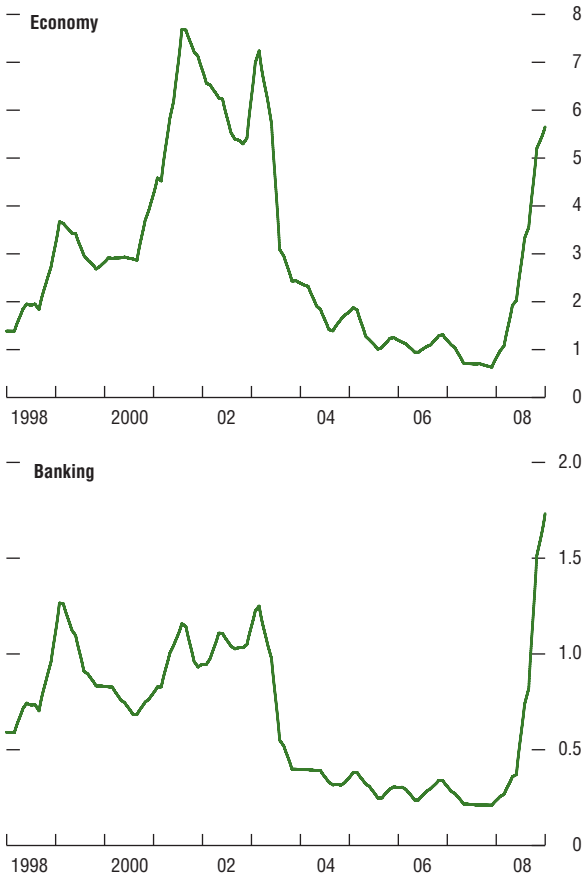
be deployed to assess systemic linkages. This section offers a brief overview of how some central banks rely on similar methodologies to assess systemic linkages, as a number of central banks have developed and implemented frameworks to assess cross-market and cross-institution systemic linkages. The stage of development of these methodologies varies across countries, with many only conducting such analyses on an ad hoc basis. Several central banks are working on integrating the results of different methodologies with each other and with their broader macro-financial stability assessments.

A number of central banks such as the National Bank of Belgium, Banco de México, Swiss National Bank, Deutsche Bundesbank, De Nederlandsche Bank, Oesterreichische Nationalbank, and the Bank of England conduct network analysis on a regular basis with a view to identifying institutions whose failure could have systemic implications. As mentioned in the previous section, the starting points of these analyses are banks' large exposures and interbank credit activities. Relying on interpolation techniques, central banks construct domestic (and in some instances cross-country) exposure matrices that are used to analyze a series of hypothetical market and credit stress events, similar to the ones illustrated in the previous section.

For instance, Banco de México uses daily interbank exposures on loans, deposits, securities, derivatives, and foreign exchange operations to construct an interbank exposure matrix and carry out contagion exercises computing the effect of spillovers on the capital adequacy ratios (CAR) of other banks (Figure 2.13). Thus, Banco de México is able to assess which institutions would see their CAR levels fall below specific thresholds as a result of systemic events.

Most countries rely on more than one methodology to assess systemic linkages and differ on the degree to which they integrate them with other approaches. For instance, the Central Bank of Austria (Oesterreichische

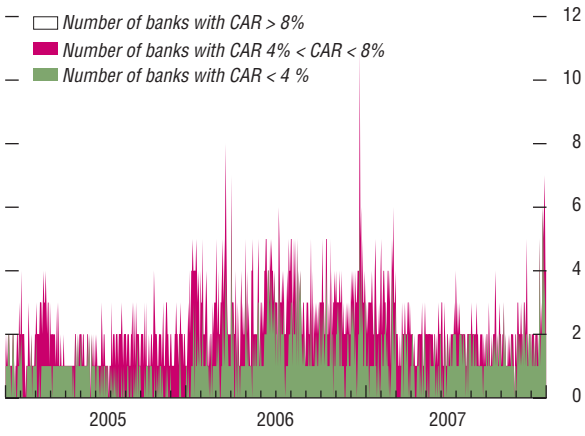
Figure 2.12. Quarterly One-Year-Ahead Forecast Value-at-Risk at 95 Percent Level
(In percent)



Source: Giesecke and Kim (2009).
Note: The figure shows the time series of quarterly estimates of the one-year-ahead 95 percent VaR forecast of the number of defaults in the U.S. economy and the banking sector, normalized by the number of firms in the pool at the beginning of the year.

Figure 2.13. Capital Adequacy Ratios (CAR) After Hypothetical Credit Shocks

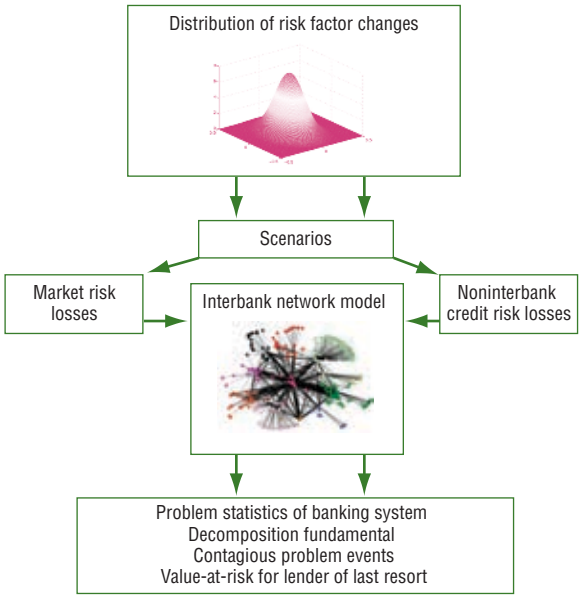
(Number of banks)



Source: Banco de México.

Note: These are hypothetical daily CARs resulting from a worst-case credit event scenario after all aftershocks are taken into account. The figure shows the number of banks up to 12 banks, but the full sample comprises 41 banks.

Figure 2.14. Basic Structure of the Systemic Risk Monitor Model



Source: Central Bank of Austria (OeNB).

Nationalbank) has developed the systemic risk monitor model, which combines individual and systemic aspects of banks' risk by integrating the impact of market and credit risk drivers for individual banks, and the risk of interbank contagion within the Austrian banking system (Figure 2.14).[33]

Similarly, the Monetary Authority of Singapore, Deutsche Bundesbank, and Banco de México combine detailed network analyses with an assessment of the risk implications of banks' common exposures to different variables and sectors (i.e., an analysis reminiscent of the assessment of indirect linkages featured in the previous section of this chapter). In addition, the analysis of banks' common exposure allows these regulators to conduct regular stress tests of their banking systems. De Nederlandsche Bank has developed cross-institution contagion models for both the banking and the insurance sectors. The latter allows for simulating the effects of insurer and reinsurer defaults on other institutions in the sector. De Nederlandsche Bank has also modeled the cross-sector correlations.

Some central banks have exploited the information extracted from their systemic linkages and codependence analyses to create several indicators of financial stability, such as the evolution of systemic risk under alternative loss-given-default (LGD) assumptions (carried out by the National Bank of Belgium), or the Deutsche Bundesbank's diversification index.

Finally, some central banks, like the Bank of England, incorporate their systemic linkages analysis into a more ambitious macro-financial framework. Specifically, the Bank of England is developing the risk assessment model for systemic institutions (RAMSI) to sharpen its assessment of institution-specific and system-wide vulnerabilities (Figure 2.15) (Aikman

[33]As far as interbank contagion is concerned, this method does not include cross-border exposures. However, the Central Bank of Austria is working on integrating foreign subsidiaries in the interbank network model.

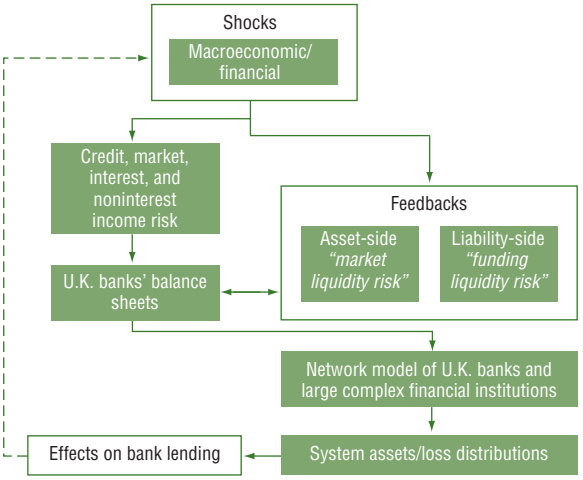
and others, forthcoming). RAMSI considers interbank linkages and macro-banking linkages by analyzing three areas of interconnectedness: funding feedbacks, asset fire sales, and a real sector-financial sector feedback loop. The analytical foundations of RAMSI draw from the stress testing literature—thus allowing the model to focus on credit risk—and from the network literature—thus enabling the model to consider the systemic effects of financial shocks.

Several central banks have indicated that key data limitations exist for their analyses, including the fact that off-balance-sheet linkages (domestic and cross-border) cannot always be included in their interbank exposures matrix. Also, many central banks lack a comprehensive data set due to limited disclosure on complex structured credit products, and the challenges of collecting information on nonbank financial intermediaries (investment banks, insurance companies, hedge funds) and inaccurate measures of risk transfers. Furthermore, lack of consistency in information disclosures complicates risk exposure assessments, both across institutions and products. Thus, there is a distinct need for those overseeing systemic stability to receive more on- and off-balance-sheet data, including enough to assess cross-institutional linkages.

In addition, large-exposure data are reported on a quarterly basis in some countries. Having to rely on quarterly data constitutes another limitation in a world in which the liquidity situation of a bank may deteriorate very rapidly. Finally, some central banks have had difficulties identifying the exact counterparty to a cross-border bank exposure. Typically, when there have been concerns about the potential risk stemming from this source, central banks have been able to identify it via additional communications with the relevant institution on an ad hoc basis.

Going forward, financial regulators should continue to develop ways to systematically collect and analyze these data. In addition, policymakers should give greater consideration to the

Figure 2.15. RAMSI Framework



Source: Bank of England.

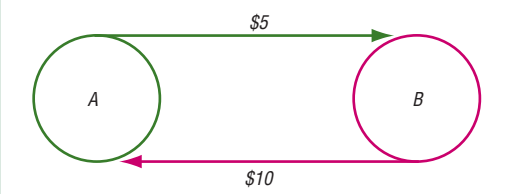
Box 2.4. Basics of Over-the-Counter Counterparty Credit Risk Mitigation

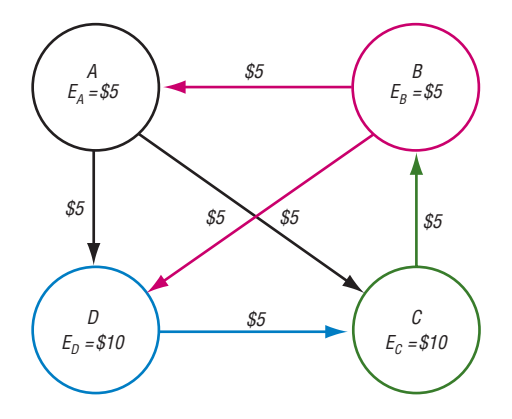
A central counterparty (CCP) reduces systemic counterparty credit risk by applying multilateral netting. This box discusses key tools of over-the-counter counterparty credit risk mitigation, including netting and the collateralization of residual net exposures, and explains how a CCP reduces systemic counterparty risks.

An over-the-counter (OTC) contract is exposed to counterparty default risk prior to the contract's expiration while it has a positive replacement value. In the absence of bilateral closeout netting, the maximum loss to a defaulted counterparty is equal to the sum of the individual contracts' positive replacement values. The first figure shows two bilateral contracts. A owes B $5 on one contract, and is owed $10 from B on the second one. A faces a $10 loss if B defaults.[1]

Closeout netting aggregates all exposures between the counterparties, under a default, and contracts with negative values can be used to offset those with positive values. Hence, the total exposure associated with all contracts covered by the particular master agreement is reduced to the maximum of the sum of the replacement values of all the contracts and zero. A loses $5 if B defaults.[2]

The second figure shows contracts across four counterparties, all of whom have bilateral master agreements with each other that include bilateral netting. The numbers on the arrows indicate the net bilateral flow (A, B, C, and D, clockwise from the top left corner), and the subscripted E indicates the maximum counterparty exposure for the counterparty. Thus, E_D = $10, because both A and B owe D $5. Each counterparty faces a maximum counterparty default-related loss of either $5 or $10. C loses $10 if both A and D fail, and D is vulnerable to the



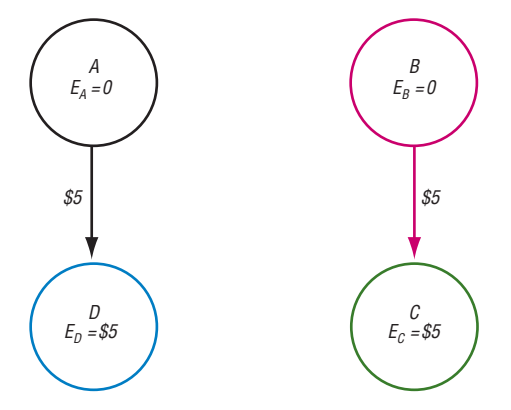


Note: John Kiff prepared this box.

[1]See Bliss and Kaufman (2006) for more detail on OTC derivative collateral and netting. The figure assumes that the counterparties have signed a master agreement with the appropriate closeout provisions that covers both transactions. If they had not, B could "cherry pick" A by defaulting on its obligation to pay the $10, but insisting that A still pay the $5. In this case, A loses $15.

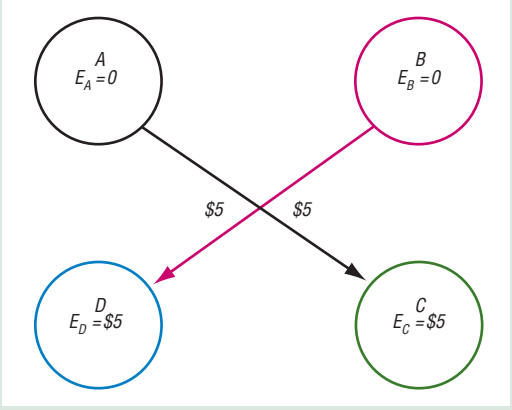
[2]The exposure can be further reduced by requiring counterparties to post collateral (cash and highly rated liquid securities) against outstanding exposures, usually based on the previous day's valuations. See CPSS (2007) and ISDA (2007) for a survey of recent OTC derivative counterparty credit risk exposure practices, including collateral policies. See CRMPG (2005, 2008) for guides to best practices.

hypothetical tail scenarios analyzed with these methodologies, lest they risk underestimating the probability of a tail event—a phenomenon that Haldane (2009) has dubbed "disaster myopia." Moreover, the global dimension of the current crisis underscores the need to assess these exposures from a cross-border perspective, which would require further coordination and data sharing by national regulators. For example, the BIS is well suited to extend its data collection exercises to these data. The IMF could also play a role by analyzing such data

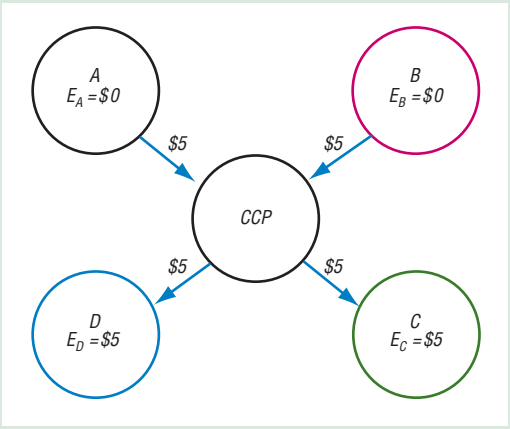


simultaneous default of A and B. Hence, A and B should each provision against $5 of potential counterparty credit losses, and C and D should each provision for $10, for a total of $30, even though the maximum potential loss among all four is only $10.

Multilateral netting, typically operationalized via "tear-up" or "compression" operations that eliminate redundant contracts, reduces both individual and system counterparty credit risk. In this case, it could eliminate four contracts, eliminate all of A's and B's counterparty credit risk exposure, and leave C and D with $5 of maximum potential individual losses. The third figure shows the two possible post-netting configurations. The leftmost configuration eliminates the circular B → A → C → B flow, and replaces the B → D → C flow with a more direct B → C flow. The rightmost configuration just needs to eliminate the circular B → A → D → C flow. Using such tear-up operations, Tri-Optima's TriReduce service eliminated about $30 trillion notional of credit default swap contracts in 2008.



A sound CCP takes the multilateral netting principle a step further, and reduces the likelihood of knock-on failures by requiring the participants to post margin, and by loss sharing among other clearinghouse members (see Box 2.5). Other typical arrangements include capital funds comprised of clearing member contributions and accumulated profits and transaction fee rebates (see Bliss and Steigerwald, 2006).



in the context of its bilateral and multilateral surveillance roles.[34]

It is also important to mention that the crisis has brought to the fore the need to complement

[34]Issing and Krahnen (2009), among others, have proposed the creation of a global database to generate and track a "global financial risks map." The methodologies presented earlier in this chapter provide a set of tools for the elaboration of such a global risks map. In particular, Figures 2.4 and 2.10 are examples of what such a map might look like.

Table 2.9. Summary of Various Methodologies: Limitations and Policy Implications

	Weaknesses/Conditions When Measure May Be Misleading	Policy Implications
Network Simulations[1]	Does not incorporate institutions' endogenous response to distress events. Data limitations may include lack of off-balance-sheet exposure information.	Help policymakers identify (1) institutions whose failure might trigger domino effects; and (2) institutions most vulnerable to shocks stemming from other institutions' failure. Allows elaboration of potential contagion paths following financial distress events.
Default Intensity Model[2]	Reduced form model.	Inform policymakers about the likelihood of tail event arising from both direct and indirect financial linkages.
Co-Risk Analysis[3]	Usefulness is undermined by factors that affect market efficiency.	Provide policymakers with information to identify not only how common risks are evolving, but where spillovers might most easily develop and how distress in a specific institution can affect other institutions.
Time-Varying Multivariate Density, Distress Dependence, and Tail Risk[4,5]	CDS may overstate objective default probabilities.	Provide policymakers with information to identify not only how common risks are evolving, but where spillovers might most easily develop and how distress in a specific institution can affect other institutions.

Source: IMF staff.
[1]Chan-Lau, Espinosa, and Solé (2009a).
[2]Giesecke and Kim (2009).
[3]Chan-Lau, Espinosa, and Solé (2009b).
[4]Segoviano and Goodhart (2009).
[5]Model can use probabilities of default estimated from alternative methods, not only credit default swap (CDS) spreads.

the ongoing stability analysis with key infrastructure changes. Among the most prominent efforts to mitigate over-the-counter counterparty credit risk has been the recent proposals for a central clearing party involving the netting and the collateralization of residual net exposures (Boxes 2.4 and 2.5). This effort has centered on CDS exposures, but could be extended to other over-the-counter products when enough standardization is present.

Policy Reflections

The current crisis reminds us that interconnectedness across institutions is present not only within the banking sector, but as importantly, with the nonbank financial sector (such as investment banking, hedge funds, etc.) Specifically, the liquidity problems have demonstrated that rollover risk can spill over to the whole financial system, thus requiring a better understanding and monitoring of both direct and indirect linkages.

This chapter presented four complementary methodologies to assess potential systemic linkages across financial institutions (Table 2.9). The chapter has argued that there is a need to deepen our understanding of these linkages and suggested how more refined versions of these complementary models could be used to strengthen surveillance and policy discussions such as the perimeter of regulation. The task is complicated by several factors: the difficulties in securing information on cross-institution exposures, especially across borders, due in part to confidentiality agreements; the imperfect integration of global money markets arising partly from heterogeneous resolution regimes; the difficulties in securing information on off-balance-sheet exposures and opacity in assessing counterparty risk; and problems with CDS markets, requiring clearing mechanisms.

The chapter has argued that in addition to the ongoing efforts to mitigate counterparty credit risk, including through the mutualization of counterparty risk in a clearing facility, more attention should be paid to the systemic implications of liquidity squeezes and other stress events. The goal of the chapter has not been to provide figures associated with some level of systemic linkages. Rather, a key goal has been to feature the type of specific methods that authorities could use to concretely discuss the too-connected-to-fail problem. The chapter helps to inform policy initiatives, including in the areas of information gaps and the perimeter of regulation.

Information gaps. The chapter illustrates the importance of gathering data and monitoring cross-market and cross-country linkages and how this could assist a country's supervisory and surveillance efforts.

- The chapter showed, for example, how information on systemic linkages could help with questions such as the merit of capital charges based on counterparty risk systemic linkages or of limiting an institution's exposures. For instance, the co-risk measures or the distress dependence matrix can be used to assess the relative importance of individual institutions and could form the basis for a higher capital charge or bilateral exposure limits. After all, market discipline is more likely to work when investors know that institutions will not be bailed out, which can only be credible when they are not too connected to fail.
- Globalization means that it is close to impossible for a country by itself to undertake effective surveillance of potentially cross-border systemic linkages. Therefore, enhancing our understanding and monitoring of global systemic linkages requires stronger information-sharing agreements.

Perimeter of regulations. The chapter also provides a potential approach to consider how to maintain an effective perimeter of prudential regulation without unduly stifling innovation and efficiency. The chapter illustrates how network models should allow regulators to see which institutions are affected in subsequent rounds of spillovers and thus determine relative levels of supervision. Such an assessment would have to be conducted at regular intervals, as the structure of the network is likely to change over time. Similarly, the co-risk models or the distress dependence relationships can help policymakers better regulate institutions, such as how to design capital surcharges to lessen the too-connected-to fail problem.

In sum, monitoring global systemic linkages will undoubtedly become increasingly relevant, and thus the development of reliable tools for this task should proceed expeditiously. Going forward, the IMF can and should assume a more prominent global financial surveillance role, but in addition to strengthening its understanding of systemic linkages, it will need to improve its gathering of relevant data. New information-sharing agreements on cross-border financial exposures (including regulated and unregulated products and institutions) could strengthen the capacity of IMF members to provide it with the relevant data. In principle, such agreements could operate on multilateral or bilateral bases and would ideally address both the domestic and cross-border dimensions. Information-sharing agreements will be effective to the extent that country authorities can collect additional data in order to monitor systemic risk. Such a data collection exercise should be prioritized based on a cost-benefit analysis but it should include at the very least, off-balance-sheet exposures and information on complex products.

Annex 2.1. Default Intensity Model Estimation[35]

This annex discusses the likelihood estimation of the default intensity model's parameters.

The vector parameter to estimate is denoted by $\theta = (k, c, \delta, \gamma, \lambda_0)$. The data consist of observations of economy-wide default times, T_n during the sample period $[0,\tau]$, which represents daily data from the time period January 1970 to

[35]Kay Giesecke prepared this annex.

Box 2.5. A Central Counterparty as a Mitigant to Counterparty Risk in the Credit Default Swap Markets

This box discusses key features of a well-designed central counterparty (CCP), aspects particular to a credit default swap (CDS) CCP, and the factors for choosing between multiple CCPs versus a single CCP.[1]

A CCP facilitates standardization and multilateral netting, increases liquidity, and can improve the availability of price information, increasing the ability to value CDS products, and ultimately serves to mitigate risk. A CCP for standardized CDS contracts can reduce operational risks, especially those inherent in over-the-counter trades, such as backlogs of outstanding confirmations and unwinding positions in case of default that can spread across multiple counterparties. In addition, the mutualization of risk among clearing members provided by a CCP reduces hedging costs by eliminating the need for hedging bilateral exposure.

The lack of transparency about the net counterparty exposure in the CDS market can inflate the public perception of counterparty risk. For example, if the market had known in advance that the settlement of Lehman swaps would amount to only $5.2 billion of net funding obligations in the CDS market, according to the Depository Trust and Clearing Corporation, instead of the hundreds of billions in notional that were speculated, the financial markets might not have seen the same degree of turmoil in the fall of 2008. Thus, greater insight into CDS trading activity could reduce the uncertainties characteristic of the recent crisis.

Risk Management: Margining, Collateral, and Membership Requirements

While a CCP mitigates counterparty risk, it also concentrates risk and requires extensive risk management systems. Consequently, a CCP's risk management processes, internal controls and operational risk procedures, and the adequacy of its back-up financial resources are key to ensuring that risks are contained. In addition, a CCP that clears CDS contracts should conduct stress tests with relevant shocks to its members.

A CCP typically uses *margining* as an instrument to reduce counterparty credit risk. *Initial margin*, the amount required to initiate a position, and *variation margin*, payments for the daily losses and payoffs for daily gains, are required to keep a position open. This allows payment flows to account for intra-day price movements and variation margin changes to account for end-of-day settling up, since variation margin is based on daily mark-to-market pricing; positions are liquidated if variation margin cannot be met. Riskier instruments should incorporate larger margins to account for the greater risk to which the CCP is exposed.

Margin requirements for less liquid instruments should incorporate the potential losses that might occur over a longer liquidation period following a default. Margining requirements should therefore account for risks of a particular product and elements such as sector risk and liquidity risk. The accurate calculation of margin requirements, or even an appropriate range of margin requirements, will be a key challenge to the new CDS CCPs due to the complexities in the pricing of these particular products.

Cash Settlement versus Physical Settlement in a CDS CCP

A CCP can facilitate settlement of contracts after an event of default. For credit derivatives contracts, there has been a decline of physical settlement in favor of cash settlement, and the use of ISDA auction protocols have become standard practice in credit events for the reasons cited below.

A feature of the CDS market is the settlement method in case of default, or credit event. With the occurrence of a credit event, there are two options for the settlement of CDS contracts—physical settlement or cash settlement.[2] In the

Note: Jodi Scarlata prepared this box.

[1]For further discussion, see CPSS (2004, 2007).

[2]A CDS credit event is a default event that results in payments by the protection seller to the protection buyer, concurrent with delivery requirements by the protection buyer. Typical credit events include bankruptcy of the reference entity or its failure to pay with respect to its bond or debt and, for some reference entities, restructuring.

case of *physical settlement*, the protection buyer delivers the debt obligation (the cash instrument) of the reference entity and in return is paid the par value by the protection seller. In *cash settlement*, the protection seller pays the protection buyer the difference between par value and the market value of the debt obligation of the reference entity. However, the growth of the CDS market has resulted in a much larger notional value of CDS contracts than the outstanding value of the debt obligations. Cash settlement avoids possible failure in physical delivery due to a shortage in deliverable cash instruments.[3]

In light of the concentration of risk in a CCP, a smoothly operating settlement system is crucial for reducing any potential systemic consequences. Central counterparties' use of cash settlement for CDS contracts would deter market manipulation and help avoid disruption in the settlement process. In March 2009, ISDA initiated its Auction Settlement Supplement and Protocol incorporating cash auctions into standard documentation for settling CDS contracts, i.e., "hardwiring" the ISDA settlement protocol into the contracts. While the ISDA-defined protocol provides for both auction and physical settlement, cash settlement can benefit by minimizing price distortions. However, maximizing participation in the industry standard settlement mechanism for all CDS contracts is crucial.

Multiple CCPs versus a Single Central Counterparty

The CDS CCP ventures based in the United States and Europe have engendered some debate as to the optimal number of central counterparties.[4] A single CCP would accomplish the largest reduction in systemic counterparty risk, benefit from economies of scale and a larger pool of counterparties and resource base, and limit opportunities for regulatory arbitrage and competitive distortions.[5] The resulting concentration of operational risk would necessitate strong risk management processes and oversight. The U.S. approach is to allow for multiple CCPs, allowing market forces to determine the optimal number of CCPs in order to assure clearing services are provided efficiently. However, there are concerns that such an approach will be a "race to the bottom," as each CCP fights for market share by economizing on risk management procedures, and lowering margining requirements and contributions to a guarantee fund.[6] From a cross-border perspective, the systemic importance of a single CDS central counterparty for a domestic economy might lead authorities toward retaining the CCP under national regulatory and supervisory oversight for the ability to control or mitigate the impact on domestic financial stability. National authorities might be reluctant to oversee a global entity where jurisdictional disputes may arise. Nevertheless, a global CDS CCP would mitigate the most overall counterparty risk. Thus, if a global CDS CCP is not established, then the development of separate CCPs should provide for the cross-border coordination of regulatory and supervisory frameworks to avoid regulatory arbitrage. These frameworks should ensure that linkages and clearing mechanisms are established across CCPs, without constraining the use of multiple-currency transactions. At present, there are various legislative, regulatory, and market proposals outstanding to deal with counterparty clearing organizations, which may affect issues such as the standardization and documentation of credit default swaps, and the responsibilities of counterparties and clearinghouse members, amongst others.

[3]To note, the notional amount of single-name CDS far exceeds notional of physical cash bonds and can be potentially distorting. Bank for International Settlements data show CDS notional outstanding of around $57 trillion at end-June 2008 versus a gross market value of underlying securities of only $3.2 trillion for the same period. Further, a physical settlement could result in a short squeeze, as protection buyers purchase bonds to deliver for settlement, bidding up the bond price and thereby offsetting the gains on the CDS protection.

[4]These include CME Clearing, Eurex Clearing, ICE Trust/ICE Clear Europe, and NYSE Liffe/LCH.Clearnet.

[5]See Duffie and Zhu (2009) for discussion.

[6]A guarantee fund compensates nondefaulting participants from losses suffered in the event of another participant's failure to meet its obligations to the CCP.

December 2008. The maximum likelihood problem for the default rate $\lambda = \lambda^{\theta}$ is given by

$$\underset{\theta \in \Theta}{\text{maximize}} \int_0^{\tau} (\log \lambda^{\theta}_s dNs - \lambda_s^{\theta} ds) \qquad (1)$$

where Θ is the set of admissible parameter vectors. For the model in Box 2.2, the likelihood in equation (1) can be calculated in closed form (see Giesecke and Kim, 2009).

The parameter estimates are as follows. The initial default rate at the beginning of the sample period in January 1970 is $\lambda_0 = 32.56$ events per year. At an event, the default rate jumps by $\delta = 0.13$ times the default rate just before the event. The minimum jump size is $\gamma = 0.59$ events per year. After an event, the default rate decays with time at rate $\kappa = 0.11$, to a level that is equal to $c = 0.018$ times the intensity at the previous event.

The model fits the event data. This is indicated by Figure 2.6, which contrasts the fitted intensity with the observed economy-wide defaults during the sample period. The fitted intensity replicates the substantial time-series variation of economy-wide event times. Giesecke and Kim (2009) provide formal statistical tests that can be used to assess the model's in- and out-of-sample fit.

The fitted model determines the conditional distribution of the number of economy-wide defaults during any future time period. This distribution is estimated by a Monte Carlo simulation of events. Here, arrivals over the forecast period are generated and used to calculate the corresponding empirical distribution. To obtain the distribution of events in a given sector, an additional step is needed: randomly assign a sector to each simulated economy-wide event time. A sector $s \in S = \{1,2,...12\}$ is selected with probability $Z(s) \Big/ \sum_{s \in S} Z(s)$, where

$$Z(s) = \sum_{n=1}^{N_\tau} \frac{1}{1 + \tau - T_n} I(S_n = s)$$

Here, N_τ is the number of defaults observed during the sample period and $S_n \in S$ is the observed sector of the nth defaulter. More weight is assigned to recent observations, i.e., events that occur closer to the end of the sample period. With this procedure, the predictive power of default events is exploited even when they are associated with firms outside of the given sector.

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CHAPTER 3

DETECTING SYSTEMIC RISK

Summary

The current crisis demonstrates the need for tools to detect systemic risks. Given that there are many facets and causes of such risks, this chapter presents a range of measures that can be used to discern when events become systemic. The chapter first reviews the standard financial soundness indicators' ability to highlight those financial institutions (FIs) that proved to be vulnerable in the current crisis. For the sample of global FIs examined, leverage ratios and return-on-assets proved the most reliable indicators, while capital asset ratios and nonperforming loan data lacked predictive power.

The chapter then proceeds to examine several techniques to analyze forward-looking market data for groups of FIs in order to detect whether and when systemic risks became apparent. Market-based measures that are able to capture tail risks seem to have given forward indications of impending stress for the overall financial system. Chapter 2 provides a slightly different approach to systemic risk by examining interlinkages, both direct and indirect, between selected FIs.

Finally, proxies for "market conditions" that influence (and reflect) the risks facing FIs are examined to capture other key factors, such as investors' risk appetite. The signaling capacity of these indicators is examined by detecting whether and when they moved from low, to medium, and to high volatility states, with the high state associated with systemic crisis. Several measures signaled periods during which the financial system suffered a systemic crisis.

The various techniques clearly identify major stress events, such as those associated with the merger of Bear Stearns and the failure of Lehman Brothers, as systemic. Some indicators, as early as February 2007, also signaled rising systemic pressures. However, advance notice of systemic stress was relatively brief and the extent to which some markets remained in high volatility states was somewhat short-lived. Hence, the use of a number of market-based indicators provides a more holistic picture.

Being able to identify systemic events at an early stage enhances policymakers' ability to take necessary exceptional steps to contain the crisis. In this regard, the chapter suggests enhancing stress tests and capital requirements to take account of the build-up of systemic risks. Some of the analysis presented could be a starting point to calibrate the risk contribution of FIs to overall systemic risk, thereby prompting additional regulatory capital and enhanced supervision to discourage practices that increase systemic risk.

In sum, although systemic events are difficult to predict, and may only become apparent concurrently in some cases, policymakers should monitor a wide range of market indicators tuned to systemic risk, and have comprehensive crisis plans in place to be implemented quickly if needed.

Systemic events are intrinsically difficult to anticipate, though once they have occurred it is easier to look back and agree that a disruption was, in fact, systemic. Because of the severity and reach of the current crisis, renewed attention on what constitutes a systemic crisis and whether it can be uncovered, early or even concurrently, has come to the fore. The task of identifying warnings of impending systemic crises has become increasingly complex as global financial markets have become highly integrated and hence systemic shocks can arise from and extend to outside national borders. Analyzing systemic risks is further hampered because there have been so few modern episodes of global systemic crises, particularly involving a core group of advanced economies. Even so, this chapter attempts to make inroads into this area by seeking to shed light on what constitute systemic events and by providing policymakers with tools that can be used to recognize systemic risks. Instead of attempting to offer a single methodology, a range of empirical approaches is examined in order to provide a more robust way of detecting systemic risks.[1]

The chapter focuses on measures of overall systemic risk derived from higher frequency market data, rather than the identification of underlying macroeconomic vulnerabilities based on data at lower frequencies. While the latter models are helpful in identifying the buildup of macroeconomic vulnerabilities, they are usually not very successful in predicting the actual timing of crises or how they spill over across global markets.[2] Thus, this chapter is intended to complement the more traditional macro-oriented exercises attempting to predict financial crises. In particular, it focuses on the role of financial market signals as indicators of overall systemic risks.

Specifically, the chapter seeks to answer the following questions:

- What were common factors among the financial institutions (FIs) that have required public intervention? Did traditional financial soundness indicators (FSIs) provide meaningful warnings?
- How can one determine which FIs are systemically important? Can one shed light on whether allowing Lehman Brothers to go bankrupt was or was not a policy "mistake" ex ante?
- What are early, or concurrent, indicators of systemic risk? When might their reliability be compromised?
- Can one determine when policymakers should enter and exit policies designed to contain systemic risk?

The chapter presents a series of "modules" to examine systemic risk from various perspectives. The chapter first looks at the "fundamental" characteristics of FIs based on the balance sheet data that are typically used by supervisors and regulators. This analysis is further expanded to review individual FIs from the markets' perspective based on credit default swap (CDS) spreads and equity option prices. Then groups of institutions are analyzed jointly, building from simple tools such as cluster analysis to more elaborate methods that look at the joint probability of various outcomes. The role of global market conditions is then analyzed to shed light on whether certain factors, such as proxies for investors' risk appetite, affect the incidence of systemic

Note: This chapter was written by a team comprised of Brenda González-Hermosillo (team leader), Christian Capuano, Dale Gray, Heiko Hesse, Andreas Jobst, Paul Mills, Miguel Segoviano, and Tao Sun. Yoon Sook Kim provided research support. The chapter also benefited from comments from Andrew Lo and Kenneth Singleton.

[1]The use of multiple approaches is also present in Chapter 2, where the perspective is to examine linkages across institutions or groups of institutions.

[2]Indeed, financial shocks (e.g., sudden stops in capital flows, the bursting of asset bubbles, etc.) often serve to reveal the unsustainability of macroeconomic imbalances. Macroeconomic imbalances can last many years before they result in crisis. For example, while the peak of the U.S. housing market was reached in mid-2005, the subprime crisis was not revealed until 2007. Similarly, while many developing countries had sustained large current account deficits for several years, it was not until late 2008 that some of them began to face financing constraints and dramatic pressures on their currencies.

risk.[3] Global market conditions are important in determining the market value of the FIs and thus both influence and also echo the risks of individual FIs.[4]

Based on the sample of FIs examined, the results suggest that traditional balance sheet data are only partially able to detect, ex ante, institutions at risk of failing. Although market-based indicators are largely coincident with events that have been deemed of systemic importance, notably the collapse of Lehman Brothers on September 15, 2008, some indicators are able to give some advanced signals of risks. And although it would have been difficult to know ex ante that larger disruptions were coming, markets showed signs that a regime change, a generalized breakdown of financial system functioning, occurred as early as late February 2007, when the price on the ABX (BBB) index began to decline and there was a significant correction in the Shanghai stock market that reverberated across emerging markets.[5,6] The various indicators examined suggest that letting Lehman collapse aggravated what appeared to be a global systemic financial crisis already in the making because Lehman's potential effects on other FIs were observable in several indicators.

The techniques examined show some success in revealing when the financial system is in a systemically elevated regime, providing some guidance about when policymakers should use the "systemic crisis" toolkit rather than policy tools meant to deal with individual institutions or markets. Similarly, these techniques can be used to determine when systemic risks subside, and thus provide guidance as to when to unwind guarantees and other supportive policies introduced during the systemic phase.

What Constitutes "Systemic" Risk?

"Systemic risk" is a term that is widely used, but is difficult to define and quantify. Indeed, it is often viewed as a phenomenon that is there "when we see it," reflecting a sense of a broad-based breakdown in the functioning of the financial system, which is normally realized, ex post, by a large number of failures of FIs (usually banks). Similarly, a systemic episode may simply be seen as an extremely acute case of financial instability, even though the degree and severity of financial stress has proven difficult, if not impossible, to measure.[7] Systemic risk is also defined by the breadth of its reach across institutions, markets, and countries.

A natural starting point to begin to investigate systemic events is by examining individual FIs and their interlinkages (the latter is the focus of Chapter 2). However, during systemic events, channels over and above the normal fundamental mechanisms that link FIs and asset markets during noncrisis periods can be important sources of contagion.[8] Contagious events,

[3]Other elements not directly considered in this chapter, such as the "shadow banking system" (e.g., hedge funds and special-purpose vehicles) are also likely captured by the various variables used to proxy for global market conditions.

[4]For example, low interest rates reduce the default risk of loans. Similarly, the value of securities and other assets, including derivatives, depend on market conditions such as overall volatility and global liquidity.

[5]The ABX (BBB) is an index based on credit default swaps written on subprime mortgages, investment grade tranches.

[6]Rosenblum and others (2008), Gorton (2008), and González-Hermosillo (2008) also identify end-February 2007 as a period when early signs of stress began to emerge in global markets prior to the time when the subprime crisis was clearly revealed in mid-2007. This correction reflected a reappraisal of market risks (see IMF, 2007, Box 1.5).

[7]Some recent attempts to measure the degree of severity of financial stress in a given country include Illing and Liu (2006). As well, Huang, Zhou, and Zhu (2008) develop a framework to assess the systemic risk of large U.S. financial institutions. However, most empirical analyses of multi-country financial crises rely on a binomial notion whereby the dependent variable takes the value of 1 during the known, ex post, crisis period or zero otherwise with no information about the actual severity of the crises (e.g., Kaminsky and Reinhart, 1999; Hardy and Pazarbasiouglu, 1999; Demirgüç-Kunt and Detragiache, 1998; Davis and Karim, 2008; and Weistroffer and Vallés, 2008).

[8]A body of literature on contagion examines these additional links. See, for example, Masson (1999); Dornbusch, Park, and Claessens (2000); and Dungey and

which can result from asymmetric information or uncertainty, generate changes in the normal behavior of prices and thus in the distribution of returns used for trading and risk management purposes, causing the distributions to be skewed and "fat-tailed" (that is, exhibit more downside than upside risk, the third moment or skewness; and more "risk" generally, the fourth moment or kurtosis). Also important in identifying systemic events are the underlying "market conditions" and the ability for events to further alter market conditions.[9] For example, when the level of market uncertainty (measured by the implicit volatility of assets) is high, then even a temporary shock can lead to defaults and generates significant aftershocks. Similarly when investors' risk appetite is low or global liquidity is tight, then even relatively small shocks can have large effects on global financial markets—and vice-versa.[10]

In this chapter, three basic concepts that underpin the measurement of systemic risk are used. First, several techniques apply the notion that interlinkages across institutions are important—including identifying groups of similarly exposed FIs and observing the effects of potential defaults of individual institutions on each other and the financial system as a whole.

Second, changes in the return distributions of FIs' assets and equity are examined during periods of stress to determine the additional risks in the "tails" of such distributions and how the "tails" of a multiple institution return distribution can provide more accurate measures of systemic risk.[11]

Lastly, the observation that general "market conditions" matter for the existence and propagation of risks through the financial system is used to examine periods of high vulnerability to shocks that may become systemic.

Since there are several concepts of systemic risk, it is natural to expect a collection of measures rather than a single all-encompassing index.[12] Moreover, by examining systemic risk with three complementary approaches, a more comprehensive and robust assessment can be made to guide policies, though not every method can be expected to signal the same intensity or nature of systemic risk.

"Fundamental" Characteristics of Intervened and Nonintervened Financial Institutions

Regulators and supervisors typically use a set of FSIs to assess the stability of their financial system. Indeed, the International Monetary Fund (IMF) has promoted their construction and collection over the last several years (see Annex 3.1).[13] As a starting point for the analysis of systemic risk, it is thus useful to examine whether traditional FSIs were able to discern institutions that would eventually require gov-

others (2005, 2006, 2007). Dungey and others (forthcoming) argue that the Long-Term Capital Management/Russian crisis in 1998 and the subprime crisis that began in mid-2007 have been the most contagious crises in the past decade, based on a sample of advanced and emerging economies in which credit and equity market daily data are modeled jointly across countries.

[9]For example, Brunnermeier and Pedersen (forthcoming) discuss liquidity spirals.

[10]Different measures of risk appetite are discussed in European Central Bank (2007) and González-Hermosillo (2008).

[11]These first two notions are also taken up in Chapter 2.

[12]Lo (2008), for example, considers that "systemic" risk should be measured by leverage, liquidity, correlation, concentration, sensitivities, and connectedness. The Group of Ten (2001) extends systemic events to include factors affecting the economy.

[13]Various studies have proposed early warning indicators of impending turmoil in banking systems (e.g., Demirgüç-Kunt and Detragiache, 1998, 1999, 2005; Hardy and Pazarbasioglu, 1999; González-Hermosillo, 1999; Hutchinson and McDill, 1999; Hutchinson; 2002; Rojas-Suarez, 2001; and European Central Bank, 2005). The IMF proposed sets of so-called "core" and "encouraged" FSIs (Sundararajan and others, 2002), encapsulated in the *Compilation Guide on Financial Soundness Indicators* (IMF, 2006), that have become essential for the macroprudential surveillance carried out by the IMF across countries. However, recent studies suggest that FSIs may not fully capture risks (e.g., Cihák and Schaeck, 2007; Poghosyan and Cihák, 2009; Bergo, 2002; and Sorge, 2004), suggesting that FSIs need to be complemented by other indicators, including market data.

Table 3.1. Selected Indicators on Fundamental Characteristics in Financial Institutions

	Nonintervened Banks		Intervened Commercial Banks		Intervened U.S. Investment Banks	
	1998:Q1–2008:Q1	2005:Q1–2007:Q2	1998:Q1–2008:Q1	2005:Q1–2007:Q2	1998:Q1–2008:Q1	2005:Q1–2007:Q2
Capital adequacy (in percent)						
Capital/assets	14.5	19.4	17.9***	20.3	17.3**	19.4
Common equity/assets	3.7	4.4	6.0***	5.7***	3.7	3.7**
Tier 1 capital/risk-weighted assets	4.9	10.8	8.1***	9.0	. . .	. . .
Tier 1 and 2 capital/risk-weighted assets	7.3	15.8	11.0***	12.5	. . .	. . .
Asset quality (in percent)						
Nonperforming loan ratio	2.3	2.3	1.4***	1.0**	n.a.	n.a.
Provision for loan losses/loans	0.1	0.1	0.2***	0.2***	n.a.	n.a.
Leverage						
Debt to common equity	7.5	7.6	8.1***	9.0***	13.3***	13.7***
Short-term debt[1]	0.4	0.5	0.7***	0.7***	0.7***	0.7***
Liquidity						
Loans/deposits	1.1	1.3	1.2	1.3	n.a.	n.a.
Loans/assets	0.6	0.5	0.5***	0.5***	n.a.	n.a.
Earning and profit (in percent)						
Return on assets	1.2	1.2	1.9***	1.6***	3.9***	4.3***
Return on equity	3.6	4.8	4.1	5.3	4.1	5.3
Stock market performance						
Price/earnings ratio	15.5	12.6	16.8	12.0	15.6	13.1
Earnings per share	0.6	1.0	0.6	0.9	1.3***	2.4***
Book value per share	14.8	21.7	14.1	18.3***	34.0***	50.5***

Sources: Thomson Reuters; and IMF staff estimates.

Note: A *t*-test is performed to determine whether two samples are likely to have come from the same two underlying populations that have the same mean. The intervened commercial banks and the U.S. investment banks are compared to the nonintervened banks. *, **, and *** represent the statistically significant differences at the 10, 5, and 1 percent levels, respectively.

[1]Short-term and other debt payable within one year.

ernment intervention from those that have not from a small sample of major institutions.[14]

The sample comprises 36 key commercial and investment banks across the world (Annex 3.2).[15] The advantage of focusing on FSIs is that they are readily available and some are widely used by financial regulators. However, these indicators are also reported at low frequencies, are generally static and backward-looking, and focus on an individual FI without much regard for the spillovers from other institutions. Table 3.1 divides the sample of FIs into nonintervened commercial banks, intervened commercial banks, and intervened investment banks during 1998:Q1–2008:Q1 (before the wave of government intervention) and 2005:Q1–2007:Q2 (before the start of current cycle and the beginning of the subprime crisis).

The results in Table 3.1 show the following:

- Capital adequacy ratios were unable to clearly identify institutions requiring intervention. In fact, contrary to the common belief that low capital adequacy ratios would signal weakness for a FI, all four capital adequacy ratios

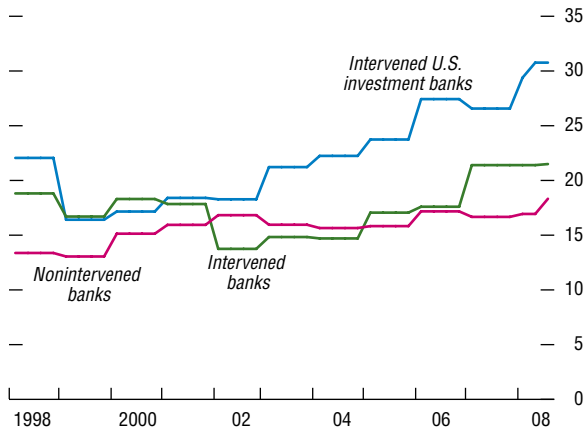
[14]In this chapter, intervened institutions are assumed to be those that have gone bankrupt, or that have received government capital injections or loans, or that have had assets purchased by government, or that have received official loans to facilitate a merger or acquisition. Central bank temporary liquidity injections are not considered to be a type of intervention. Intervened institutions and periods of intervention are detailed in Annex 3.3.

[15]The insurance companies were excluded from the analysis given their different business lines. The rationale for choosing these FIs is based on their systemic importance while keeping a balanced sample representative of the various regions around the world. Data constraints also played a role, as the sample chosen was limited to FIs for which balance sheet and market-based data were available.

examined for intervened commercial banks were significantly higher than (or similar to) the nonintervened commercial banks as a whole (Figure 3.1). There are, of course, regional differences among nonintervened commercial banks. During 2005:Q1–2007:Q2, the capital-to-assets ratio for nonintervened commercial banks in Asia and the euro area were higher than for intervened commercial banks. However this was not the case for FIs in the noneuro area. This suggests that regional differences can make direct comparisons problematic.[16]

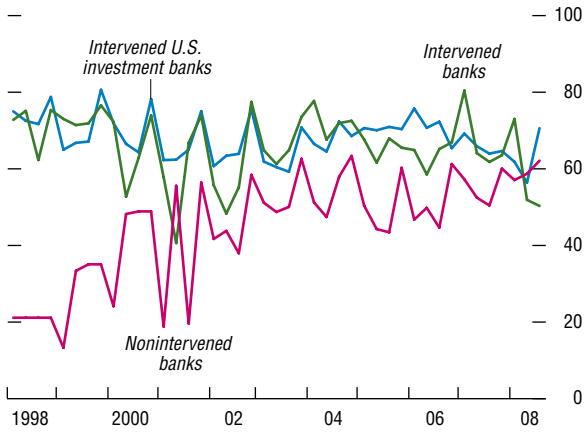
- Several basic indicators of leverage appear to be informative in identifying the differences in the institutions, although the reasons for this deserve further examination. The higher ratios of debt to common equity, and short-term debt to total debt in the intervened commercial banks and intervened investment banks, all indicate that these measures of leverage are especially informative about the differences (Figure 3.2).[17]
- Traditional liquidity ratios are not very indicative of the differences between intervened and nonintervened institutions. In part, this is because these liquidity ratios may not be able to fully measure wholesale funding risks.
- Asset quality indicators show a mixed picture. Similar to the capital adequacy ratios, the ratio of nonperforming loans (NPL) to total loans for the intervened commercial banks has been lower than for the nonintervened commercial banks, indicating that NPL ratios are not very reliable indicators of the deterioration in asset quality. However, the lower provisions for the loan-losses-to-total-loans ratio for the nonintervened commercial

Figure 3.1. Capital-to-Assets Ratio
(In percent)



Sources: Thomson Reuters; and IMF staff estimates.
Note: The ratios of nonintervened banks, intervened banks, and intervened U.S. investment banks are the average of all institutions in each category.

Figure 3.2. Ratio of Short-Term Debt to Total Debt[1]
(In percent)



Sources: Thomson Reuters; and IMF staff estimates.
Note: The ratios of nonintervened banks, intervened banks, and intervened U.S. investment banks are the average of all institutions in each category.
[1]Short-term and other debt payable within one year.

[16]The reasons that capital adequacy ratios are not always useful indicators of distress may reflect (1) difficulties in determining the actual riskiness of assets; (2) deficiencies in mark-to-market accounting practices; and (3) locating assets and contingent claims (e.g., derivatives) in off-balance-sheet vehicles where they can receive lower risk-weights.

[17]Short-term and other debt payable within one year.

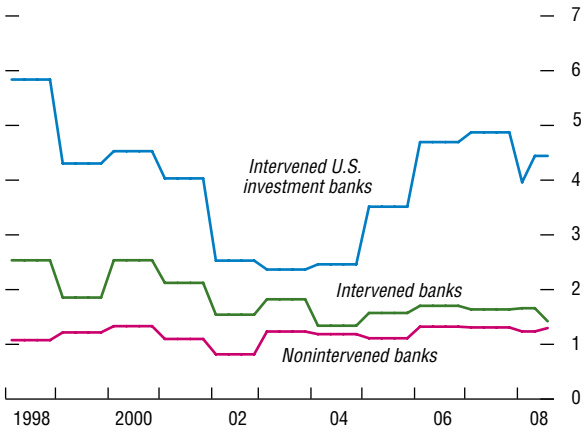
banks suggests that this is a better indicator than the NPL ratio.

- The standard measures of earnings and profits show a mixed picture. While return on assets (ROA) for the intervened institutions are much higher than those in the nonintervened commercial banks, suggesting that elevated risks are associated with higher returns, return on equity (ROE) has not captured any major differences between the FIs that were intervened or not (Figure 3.3). This contrast between the effectiveness in ROA and ROE may reflect the high leverage ratio of intervened FIs, which typically rely on higher levels of debt to produce profits.
- Stock market indicators are able to capture some differences. The price-to-earnings ratios, earning per share, and book value per share of the intervened investment banks have been generally higher than those in the nonintervened commercial banks, which suggest that the higher equity prices and earnings do not necessarily reflect healthier institutions, but perhaps concomitant higher risks.

This section finds that (1) risk-weighted capital adequacy ratios have generally not been informative in discerning financial firms that eventually required intervention (in fact, the intervened institutions sometimes had higher capital adequacy ratios than the nonintervened institutions); and (2) several indicators, such as the debt-to-common-equity ratio, short-term-debt-to-total-debt ratio, ROA and stock market indicators have been better at discerning the differences between intervened and the nonintervened institutions.

In conclusion, based on the sample of institutions examined, which notably includes U.S. investment banks, it would be useful to include indicators on leverage and more on stock market performance on the regulatory radar screen, since they could provide a starting point for a deeper analysis of vulnerable institutions. Also, the center-stage focus on regulatory capital adequacy ratios may need to be redefined, especially if it can be shown that FIs were able to shift risks to off-balance-sheet vehicles, which

Figure 3.3. Return on Assets
(In percent)



Sources: Thomson Reuters; and IMF staff estimates.
Note: The ratios of nonintervened banks, intervened banks, and intervened U.S. investment banks are the average of all institutions in each category.

receive lower risk weights, and thus the risks on the balance sheet are underrepresenting those of the FI. Though the analysis here has been partial and cursory, others have found similar issues with the application of FSIs, calling for further improvements (see footnote 13). For less sophisticated institutions and general financial sector analysis, the FSIs can still be useful to signal risks.

Market Perceptions of Risk of Financial Institutions

Financial soundness indicators, especially those based on accounting balance sheet data, have certain limitations: they fail to anticipate changes in market conditions and spillovers from other FIs, and tend to be static and backward looking. In particular, investment positions and bank loans that are apparently profitable at a given time can turn into large losses if market conditions deteriorate going forward. Moreover, in addition to general market conditions, asset prices may reflect how other FIs value similar assets. By contrast, these and other issues, including business objectives and the management quality of firms, are continuously monitored by markets and are reflected in their equity prices and CDS spreads, perhaps providing more sensitive assessments of the institutions' future prospects and their interactions.[18] This section investigates how markets perceive FIs, attempting to discern whether such market-based measures gave any advanced knowledge of the impending difficulties, or if they can be used to determine when the disruptions become systemic. The analysis that follows relies on market perceptions of the FIs' risk and starts with simple measures using individual institutions before moving to more sophisticated measures that account for the interactions among a number of FIs.

Brief Taxonomy of Credit Risk and Tail-Risk Models

The different tools to assess systemic risks by examining FI risks, both individually and collectively, are summarized in Table 3.2. One family of tools includes the contingent claims approach (CCA), which explicitly accounts for the inherent uncertainty in balance sheet components, and links the value of equity, assets, and debt in an integrated way.[19] Generally, this set of models takes the volatility of equity prices as the starting point and derives other risk measures from it.[20] This approach has been widely applied in the analysis of credit risk, as it permits the estimation of asset values and asset volatility (that are otherwise not directly observable), which are used to provide an equity market-based assessment of default risk (Box 3.1). The incorporation of uncertainty and asset volatility are important elements in risk analysis since uncertain changes in future asset values relative to promised payments on debt obligations ultimately drive default risk and credit spreads—important elements of credit risk analysis and, further, systemic risk.

Another set of tools uses equity options prices (or equivalently, their implied volatility) as starting points. Examining higher moments of equity options is critical to account for nonlinearities of

[18]These spreads are quoted as a spread over the equivalent maturity U.S. treasury securities for U.S. institutions. For institutions in various countries, they are a spread over the comparable government security. Note that all market-traded prices (CDS spreads, equity, and equity options) also contain a liquidity risk component—the risk that an investor may or may not be able to trade at a price close to the last traded price. Such risks rise during periods of stress.

[19]CCA is a generalization of the option pricing theory pioneered by Black-Scholes (1973) and Merton (1974). The approach is based on three principles: (1) the values of liabilities are derived from the value of assets; (2) liabilities have different characteristics (i.e., senior and junior claims); and (3) the value of assets follows a stochastic process.

[20]These include risk exposures in risky debt, probabilities of default, distance-to-distress, the present value of the expected loss (i.e., the value of the implicit put option), spreads on debt, and the sensitivity of the implicit options to the change in the underlying asset and other sensitivity measures.

Table 3.2. Taxonomy of Credit Risk Models

	Univariate Measures					Multivariate Measures	
	Accounting balance sheet	Merton contingent claims approach model	Moody's KMV	*Option*-iPoD[1]	CDS-based PoD	Higher moments and multivariate dependence[2]	Time-varying multivariate density distress dependence and tail risk[3]
Calibrated using	Accounting data	Historical equity volatility[4]	Historical equity volatility	Equity option data	CDS and recovery rate	Equity option data	Individual CDS-PoDs and/or stock prices[5]
Outputs for individual institutions	(1) Financial soundness indicators; and (2) Other ratios	(1) Implied asset distribution; (2) Implicit put option; and (3) Credit spreads	EDF and EDF-implied CDS	(1) Univariate probability density function; (2) PoD; and (3) Probability of default hitting leverage threshold	PoD	n.a.	n.a.
Multiple institutions	n.a.	n.a.	n.a.	n.a.	n.a.	(1) Recovers multivariate density; and (2) Dependence measures between institutions	(1) Recovers multivariate density and thus common distress in the system: JPoD, bank stability index; (2) Distress dependence matrix; and (3) Probability of cascade effects triggered by particular financial institution.
Advantages	Widely available	Simple way to measure and analyze credit risk	(1) Time-varying volatility; and (2) Provides EDFs that can be mapped to ratings	Accounts for deviations from log-normality and has model-determined default barrier	Measures map to disruptions in markets	(1) Appears to lead CDS; and (2) Generates systemic risk measures	(1) Able to use other PoDs; (2) Multiple outputs; (3) Includes linear and nonlinear dependence; and (4) Endogenous time-varying distress dependence
Shortcomings	(1) Static backward looking; and (2) Accounting definitions can differ across countries	(1) Constant asset volatility unrealistic; and (2) Assumed default barrier	Assumed default barrier	Requires options quoted at a variety of strikes not directly comparable with one-year default probability estimates	Uncertain recovery rate	Potentially affected by government capital injections or dilution	Drawbacks attached to the inputs (e.g., PoDs) would affect the output
Estimated in this chapter	"Fundamental" Characteristics of Intervened and Nonintervened Financial Institutions	Box 3.1	Box 3.1	Box 3.2	n.a.	Box 3.3	Box 3.4

Source: IMF staff.

Note: CDS = credit default swap; EDF = expected default frequency; JPoD = joint probability of default; *option*-iPoD = option-implied probability of default; PoD = probability of default. The literature on credit-risk modeling is large; see Lando (2004) and Gray and Malone (2008), among others, for an overview of popular models. The table describes the features of the models presented in the chapter. Enhanced contingent claims approach models include extensions of the Merton model to include time-varying volatility (like MKMV) and other extensions. Some equity option-based credit risk models, such as Hull, Nelken, and White (2004), explicitly use two or more equity options to calibrate higher moments of the underlying asset distribution. Other equity-option-based credit risk models, such as Zou (2003), and *option*-iPoD, calibrate the entire probability density function of the underlying asset.

[1]Capuano (2008).

[2]Gray and Jobst (forthcoming).

[3]Segoviano and Goodhart (2009).

[4]Model can use implied volatility from options.

[5]Model can use PoDs estimated from alternative methods, not only CDS spreads.

changes of default risk and thus provides a tool to observe when FIs' defaults may become systemic. The option-implied probability of default (*option*-iPoD), featured below, uses equity option prices to infer default probabilities on individual FIs, with the advantage that determining when

Box 3.1. Modeling Risk-Adjusted Balance Sheets: The Contingent Claims Approach

Forward-looking equity market information can be combined with balance sheet information to estimate risk-adjusted balance sheets that provide useful and timely indicators of default probability and credit risk.

The contingent claims approach (CCA) is a risk-adjusted balance sheet framework where equity and risky debt of a firm or financial institution derive their value from assets, which are uncertain. The total market value of assets at any time is equal to the market value of the claims on the assets, which is represented by equity, and risky debt maturing at time *T*:

Assets = Equity + Risky Debt

Asset values are uncertain and in the future may decline below the point where debt payments on scheduled dates cannot be made. In the CCA, the equity can be modeled and calculated as an implicit call option on the assets, with an exercise price equal to the promised debt payments, *B*, maturing in *T-t* periods. The risky debt is equivalent in value to default-free debt minus a guarantee against default. This guarantee can be calculated as the value of a put on the assets with an exercise price equal to *B:*

Risky Debt = Default-Free Debt – Debt Guarantee

In the CCA framework, the value of the equity can be computed as the value of an implicit call option and the value of the debt guarantee can be modeled as an implicit put option. The balance sheet components can be calibrated by using the value of market capitalization, the volatility of equity, and information from the balance sheet to define the "distress" or "default barrier." Using two equations and two unknowns, the implied asset level and implied asset volatility can be calculated. The credit risk indicators can be calculated, i.e., default probabilities, spreads, distance-to-distress. Robert C. Merton proposed the CCA framework and the simple model is known as the Merton model, where a constant volatility of assets is assumed.

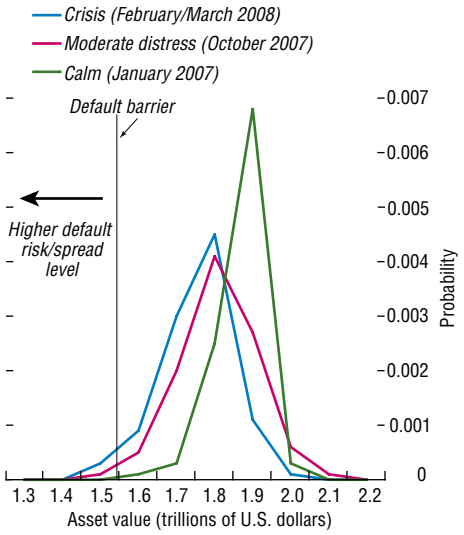
Example: Assuming that Assets = $100, volatility σ = 0.40 (40 percent), distress barrier *B* = $75, *T* = 1 (one year), then the value of the equity is $32.36, the value of risky debt is $67.63, and the credit spread is 534 basis points.

The Merton model has been extended in many directions, including models where the asset volatility is not constant. For example, information from equity options can be used. The figure shows the implied asset distribution (in billions of dollars) for Citigroup in January 2007 (calm period), October 2007 (moderate distress period), and February/March 2008 (crisis period). As can be seen, the left tail skew is very small in the calm period (credit default swap [CDS] spread was 12 bps), but it increases in the moderate distress period (CDS spread was 124 bps) and is even larger in the crisis period (CDS spread over 200 bps).

Moody's KMV is based on a CCA-type model.

Note: Dale Gray prepared this box.

Implied Asset Distribution: Citigroup



Sources: Bloomberg L.P.; Moody's KMV; and IMF staff estimates.

Note: Implied asset distribution from equity option prices from Bloomberg for three dates and the default barrier estimated by Moody's KMV.

the institution goes into default (the default barrier) is also derived within the model in line with the observation that the value of debt also moves with market conditions (Box 3.2). This is an advance over other models in which a default barrier is assumed to be fixed.

Two general methods are then employed to examine FI interdependence and thus the incidence of systemic risk. The first uses higher moments in equity and implied asset distributions calibrated from equity options. Equity option information can be used to calculate tail-risk indicators for individual institutions as well as between institutions. These tail risks encompass both the skewness and the kurtosis and thus adjust to stressful conditions. More accurate indicators of interdependence of FIs are obtained by "tail dependence" measures as compared to simple correlation measures (Box 3.3).[21]

The second method calculates a joint probability of distress (JPoD) among a group of FIs and then a banking stability index (BSI), which estimates the probability of default (PoD) of other FIs if one institution defaults. Instead of equity volatility or equity options, CDS spreads are used to calculate the PoD for individual institutions and as an input to the model, though the general technique could be applied using equity prices (Box 3.4). Once the JPoDs are estimated, there are three potential outputs: the BSI; a matrix of (pairwise) distress dependencies; and the probability of one or more FIs becoming distressed if a specific FI becomes distressed. Examples of the second application are discussed in Chapter 2, which presents a matrix of distress dependencies before the crisis and at different periods since the crisis began (Table 2.8). The third output, probability of cascade effects whereby the distress of a particular FI affects another, is presented below.

One disadvantage of using market data (CDS spreads and equity options) to infer PoDs (or other tail behavior) in the current period is the recent extension of government financial guarantees on FI debt, as this can transfer risk to the sovereign entity—thus sharing the credit risk of FIs with the other debt holders. For example, this alters the interpretation of CDS data for FIs.[22]

The use of several different tools and supervisory examinations to analyze similar FI risks is helpful because if the basic conclusions are the same, then policymakers will have more comfort in using the tools for their analysis of systemic risks. Moreover, since some tools may not be appropriate under certain conditions (e.g., when government guarantees are in place or when short-selling restrictions are imposed on equities), it is useful to know which techniques are still valid.

Measures of Risk Based on Individual Financial Institutions

Conditional Correlations and Cluster Analysis

A simple starting point for potential systemic connections among FIs is to use conditional correlations and cluster analysis. Observing how (or whether) these measures change over time may provide supervisors with information about which institutions' failures would affect others. Based on a sample of 45 individual FIs, equity returns are used to investigate the conditional correlations and clusters among them during various intervals beginning in January 2005.

[21]Although higher (Pearson) correlation coefficients are commonly used to measure potential spillover effects and systemic risks, these conventional correlations are inaccurate measures of dependence in the presence of skewed asset distributions and higher volatility. The standard correlation coefficient detects only linear dependence between two variables, making it ill-suited for the examination of systemic risk when extreme events occur jointly and in a nonlinear fashion.

[22]In principle, one reason to choose either equity-based information or CDS spreads to deduce PoDs would be if there were a lead-lag relationship showing one as providing default information earlier. Linear and nonlinear Granger causality tests suggest unidirectional Granger causality from stock returns to CDS changes, although there are no clear-cut dynamics in all sample cases (Baek and Brock, 1992; and Hiemstra and Jones, 1994).

The conditional correlation matrices are based on residual equity returns, which are free from world and local market effects and volatility.[23] Cluster analysis (also known as "look-alike groups") attempts to determine the natural grouping (a "class") that captures similarity or distance between observations. In particular, the analysis is used to determine groups of FIs where their residual equity returns behave in similar ways. These companies can then be considered to be "similar" institutions.[24] The drawback for both correlation and cluster analysis is that even after controlling for world and local market effects and volatility, the methodology may not fully capture nonlinear dependencies in the data.[25] Despite this (important) caveat, the conditional correlation and cluster analysis show a relatively higher degree of co-movements of most FIs during the stress periods than during normal periods.

Specifically, a comparison between different stress periods indicates the following:

Table 3.3. Correlations Among 45 Financial Institutions During Different Stress Periods

	Number of Coefficients within the Range	
Correlation coefficient values	0.5–0.6	>0.6
Post approval of the Troubled Assets Relief Program (October 3, 2008–December 31, 2008)	23	10
Lehman's collapse to the approval of the Troubled Assets Relief Program (September 15, 2008–October 2, 2008)	87	68
Rescue of Bear Stearns to Lehman's collapse (March 17, 2008–September 12, 2008)	73	52
Bankruptcy of two hedge funds of Bear Stearns to rescue of Bear Stearns (August 1, 2007–March 16, 2008)	41	19
Shanghai stock market correction to the bankruptcy of two hedge funds of Bear Stearns (February 27, 2005–July 31, 2007)	16	2
Before Shanghai stock market correction (January 3, 2005–February 26, 2007)	17	8

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

- The conditional correlations show that the highest correlations among FIs occurs in the period between Lehman's bankruptcy on September 15, 2008 and the approval of the Troubled Assets Relief Program (TARP) on October 2, 2008.[26] The period between the rescue of Bear Stearns and Lehman's collapse ranks second in the context of high correlations among institutions (Table 3.3).
- The average variance in three clusters or groupings of FIs rises from 1 in a normal period (before the Shanghai stock market correction) to 2.7 in the stress period (after the Lehman bankruptcy).
- The within-class variance in cluster 1, where most FIs are grouped together, is 86 percent higher during the stress period than during the normal period (Table 3.4).
- The tree diagrams in Figure 3.4 for the groups of FIs show the greater extent of cross-border co-movement and interconnections

[23]To concentrate on the extra correlation among these 45 institutions, three steps are taken to get residual returns. Specifically, first regress each institution's equity return on the return on the world equity index and the return on the relevant local equity index, respectively. Thus, the data is first purged by performing the following regression:

$$r_i = c + b_1 W_i + b_2 L_i + res_i$$

where the dependent variable r is the equity return for each of the institutions at time t, W represents the return on the MSCI world equity index and L represents the return on the relevant local equity MSCI index. Second, GARCH(1,1) models are performed to account for excess kurtosis and volatility clustering, resulting in new residual returns. Third, conditional correlations are estimated conditioned on negative MSCI world equity returns to capture more directly systemic risks.

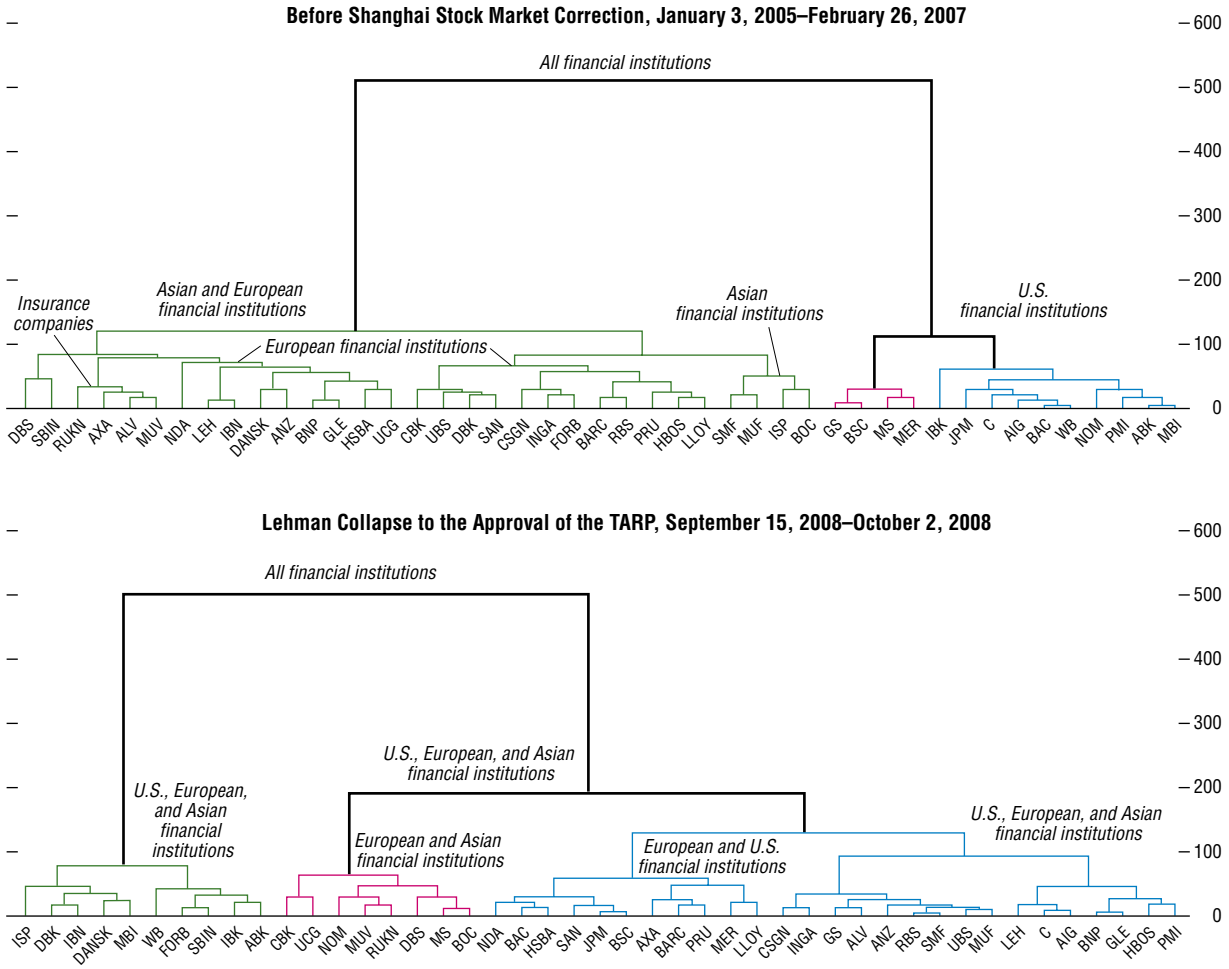
[24]Though many types of cluster analysis exist, the agglomerative hierarchical cluster analysis is the most popular. This approach combines FIs into groups of similar institutions. The algorithm initially views each observation as a separate group (giving N groups each of size 1). The closest two groups in terms of the Euclidean distance are then combined (giving N–2 groups of 1, and one group of 2). This process continues until all observations are combined into one group (of N financial institutions).

[25]As argued by Forbes and Rigobon (2002), correlation coefficient can be biased during periods of high volatility.

[26]The TARP is the U.S. government program to purchase assets and equity from financial institutions in order to strengthen the financial sector.

Figure 3.4. Dendogram

(Euclidean distance)



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

Note: A dendogram (tree diagram) is used to illustrate the arrangement of the clusters and determine groups of financial institutions whose residual equity returns behave in similar ways. These companies are considered to be similar institutions. Sample of 45 institutions, see Annex 3.2.

among FIs during the stress period.[27] During the normal period, FIs are mainly clustered based on geography and their primary line of business, as indicated by obvious divisions between the U.S. FIs (which are further divided into U.S. investment banks in the middle of the tree in magenta and U.S. commercial banks and insurance on the right-hand side of the tree in blue) and a combination of the insurance, European-Asian FIs (on the left-hand side of the tree in green). During the stressful period, however, FIs are clustered based completely on cross-border groupings. In particular, the FIs cleanly divide into the European-Asian group (in the middle of the tree in magenta), a smaller group of U.S.-

[27]The tree diagram (dendrogram) is used to illustrate the arrangement of the clusters produced by a clustering algorithm. It is applied here to determine groups of financial institutions where their residual returns (based on the same data as the conditional correlation analysis) behave in similar ways.

Table 3.4. Cluster Analysis

	Before Shanghai Stock Market Correction (January 3, 2005–February 26, 2007)			Lehman's Collapse to the Approval of the Troubled Assets Relief Program (September 15, 2008–October 2, 2008)		
Cluster[1]	1	2	3	1	2	3
Number of institutions	31	4	10	27	10	8
Within-cluster variance of residual returns	1.31	0.77	0.89	2.45	3.04	2.60
Average variance across clusters		0.99			2.70	

Sources: Bloomberg L.P.; and IMF staff estimates.
[1]Three clusters are determined automatically by the clustering algorithm.

European-Asian FIs (on the left-hand side of the tree in green) and a larger combination of U.S.-European-Asian FIs (on the right-hand side of the tree in blue). In the latter group, the bloc contains subgroups made up of U.S.-European institutions and U.S.-European-Asian groups.

In sum, although these techniques are fairly basic and have a number of caveats, they can be used to judge whether certain groups of institutions' returns are perceived as being more similar during periods of stress, and thus to determine the prospects for spillovers to the group in the case of a single institution's distress. Moreover, the tree diagrams can be used to provide a rough idea of which institutions are viewed by markets as having similar return characteristics and can show how these relations may change over time.

Option-iPoD

As noted earlier, and despite their broad use, analyses based simply on correlations are less than ideal when dealing with extreme downside movements, as fat tails tend to develop. Several models provide a more general approach by looking at the characteristics of the entire distribution of asset returns. A number of those models do this univariately (one firm at the time). As described in Table 3.2, an important shortcoming of these models is that they require the modeler to assume a specific value of debt, below which the institution will fail. This assumption is relaxed in the *option*-iPoD model as the default-barrier is determined within the model of univariate probability distributions.

Applied to five institutions during the current crisis, the *option*-iPoD model would have had provided some early warning signals of distress for some of the key FIs (Box 3.2). On several occasions prior to their respective "default events," the *option*-iPoD jumped by a multiplicative factor for several of the institutions that have required intervention.[28] Ex post, the pattern of warning signals suggested that Bear Stearns, Merrill Lynch, and Wachovia were perceived by markets as having a heightened chance of default before their difficulties were announced, although these signals were less severe for Lehman and Citigroup. Although the model does not give definitive signals for all five institutions examined, an estimated leverage ratio from the model shows that it diverged from the balance sheet measure of leverage well before each institution's "default event." This suggests that an estimate of the implied leverage may be one measure that better reflects the risks being undertaken by the firm on a real-time basis than other accounting-based ratios.

The models described above still suffer from the limitation that they focus on individual FIs without addressing how groups of FIs might be related to one another—the key component for systemic risks. The sections below relax those constraints by jointly examining groups of FIs.

[28]Default events are listed in Annex 3.3.

Box 3.2. *Option*-iPoD Measures of Risk Across Financial Institutions

This box introduces two new risk indicators based on the prices of equity-options.[1] The option-iPoD measures the probability of default, while the option-leverage measures the likelihood that the leverage ratio will cross a prespecified threshold. In the current crisis, these measures have performed well.

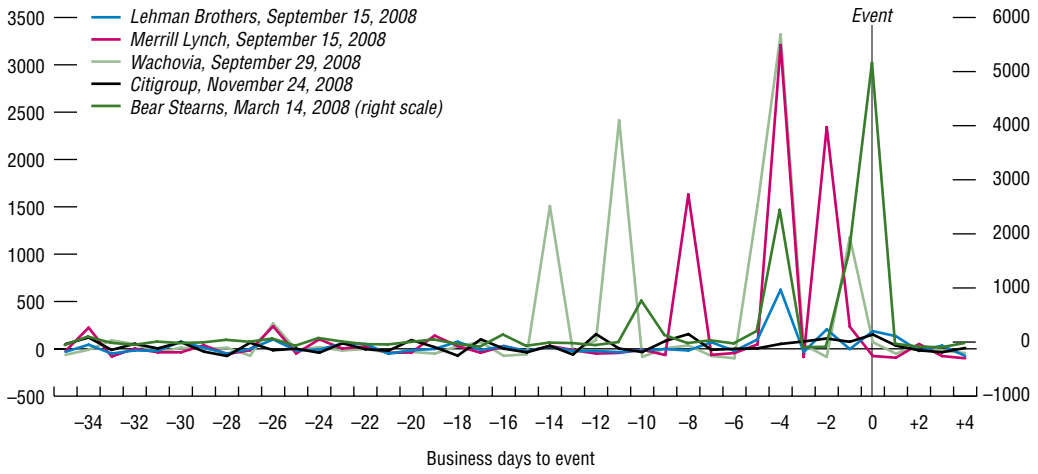
The methodology estimates the risk-neutral probability density function of the value of the assets of an individual institution, which is used to obtain the probability of default, the *option*-iPoD, and the expected development of balance sheet variables, such as assets, equity, and leverage.[2]

The probability density function allows one to compute the risk-neutral likelihood that the ratio of the estimated market value of assets to equity, the *option*-leverage, will cross a prespecified threshold. This likelihood can be interpreted as a forward-looking measure of capital-at-risk, and thus, together with *option*-iPoD, might become a useful tool in the supervision of financial institutions.

The added value of this methodology resides in the relaxation of two key assumptions, typically imposed in related structural credit-risk frameworks: a prespecified probability density function of the value of the assets and a prespecified default barrier, an assumed value below which the firm is expected to default. Following Kullback (1959) and Kullback and Leibler (1951), an optimization problem in which the current market prices of equity-options represent the problem's constraints is solved. As a consequence, a nonparametric density function is obtained that captures the well-documented deviations of asset prices from log-normality.[3]

Option-iPoD: An Indication of Impending Failure

(Percentage change with respect to the previous day)



Sources: Bloomberg, L.P.; and IMF staff estimates.
Note: *Option*-iPoD is the probability of default implied by option prices.

Note: Christian Capuano prepared this box.

[1]The methodology is developed in Capuano (2008).

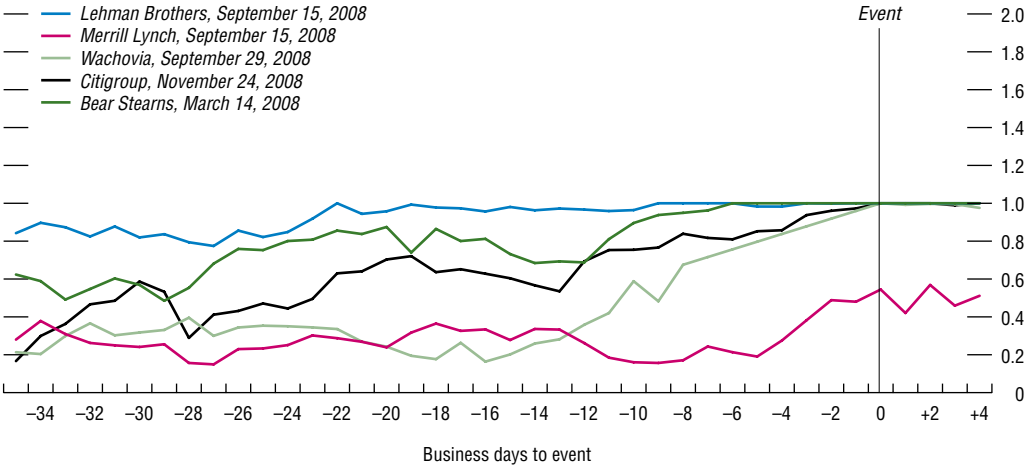
[2]Capuano (2008) describes how to extend the methodology to obtain useful output for risk management, such as an estimated credit-spread and the so-called Greek letters.

[3]This type of optimization problem is known as a minimum cross-entropy problem. Cover and Thomas (2006) discuss the statistical properties of cross-entropy, which, in intuitive terms, can be interpreted as a measure of relative distance between two probability density functions. Buchen and Kelly (1996) discuss a similar framework to extract a probability density function from equity options. Because of put-call parity, a well-known no-arbitrage relationship, researchers need to specify whether they want to use call or put prices (or a combination) as constraints.

Box 3.2 *(continued)*

Option-Leverage: A Forward-Looking Measure of Distress

(LIkelihood option-Leverage > 30)



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

Note: Option-leverage is the ratio of the estimated market value of assets to equity. Likelihood option-leverage > 40 for Bear Stearns and Lehman Brothers.

The economic structure of the model follows Merton (1974).[4] Most notably, instead of prespecifying a value for the default barrier—which is calibrated, in general, to the current value of on-balance-sheet liabilities—a key improvement over existing methodologies is to use the linear independence of the option-price constraints to treat the default barrier as a free parameter, and obtain a default barrier that is optimally estimated within the model.

Since financial institutions carry out extensive off-balance-sheet activities, an optimally estimated default barrier is particularly attractive for financial stability purposes because it allows one to estimate a market-implied capital structure, which in times of distress might be expected to significantly differ from the last reported balance sheet.

In order to investigate how this methodology has performed during the current financial crisis, a countdown to the event has been constructed—starting 35 business days prior to their collapse—for Bear Stearns, Lehman Brothers, Merrill Lynch, Wachovia, and Citigroup.[5]

For this purpose, the PoD implied by the price of equity options is estimated by focusing on the contract whose expiration was the closest to the day of the event. In addition, after optimally estimating the capital structure of the selected institutions, the likelihood that option-leverage would hit a prespecified threshold by the expiration of the option contract is computed.[6]

[4]In its simplest version, Merton (1974) postulates that the value of equity corresponds to the value of a call option contract written on the assets of the institution, with exercise (strike) price corresponding to the institution's on-balance-sheet liabilities.

[5]A robustness check would need to be conducted with an extended sample, including institutions that have not collapsed. In this sample, data availability on specific option contracts prevents the countdown to be further extended.

[6]While the selected thresholds cannot be directly compared with the Federal Deposit Insurance Corporation Tier 1 leverage ratio, which is based on Tier 1 capital, they nonetheless provide a useful insight on the current capital structure as perceived by the equity options market.

Box 3.2 *(concluded)*

In the selected episodes, *option*-iPoD has performed well (see figure). On several occasions prior to the event, and for all institutions, *option*-iPoD jumped up by a multiplicative factor. Ex post, the pattern of warning signals seems to have been particularly informative for Bear Stearns, Merrill Lynch, and Wachovia, while less so for Lehman Brothers and Citigroup.

The analysis of the likelihood that *option*-leverage will cross a specific threshold provides an economic interpretation of these events (see figure). During the countdown, the divergence between the reported balance sheet and the estimated capital structure of the selected institutions became more pronounced.

This appears particularly true for Bear Stearns and Lehman Brothers, suggesting that markets might have been aware of the significantly weaker liability structure of these investment banks and of the associated potential risks. Early during the countdown, this divergence also became evident for Citigroup and Wachovia.

In consideration of the forward-looking nature of this methodology, the proposed risk indicators appear to have been performing well during the current crisis, providing early warning signals of distress. When complemented with other market and nonmarket information, *option*-iPoD and *option*-leverage might become a useful tool for the daily surveillance of financial and nonfinancial institutions.

Measures of Risk Based on Groupings of Financial Institutions

The analysis based on market perceptions presented thus far, based on CDS and equity prices, has been for individual FIs. The sections that follow address these issues from an aggregate perspective by looking at measures based on CDS and equity prices for several groupings of global FIs. While a formal test of this dynamic relationship is not performed in this chapter, and is reserved for future work, the subsections present snapshots of how various potential measures of systemic risk appear to have coincided during the current crisis. Finally, the analysis is extended to include risks in emerging markets, as these countries were viewed by some as being "decoupled" during the earlier part of the crisis.

Tail Risks of Financial Institutions Based on Equity Options

As noted above, the notion of systemic risk requires moving away from traditional measures of correlation between different financial entities toward nonlinear, time-varying measures of dependence, particularly as financial markets become more integrated. In addition, standard correlations do not account for the variation over time in the degree of dependence, especially during episodes characterized by rising uncertainty about asset prices and illiquidity of overall financial markets. In times of stress, illiquid markets sap diversification opportunities contributing to increased correlation, making accurate estimates of the impact of higher volatility on asset prices difficult to interpret. For these reasons, the examination of tail dependencies is likely a better choice when attempting to discern systemic risks.

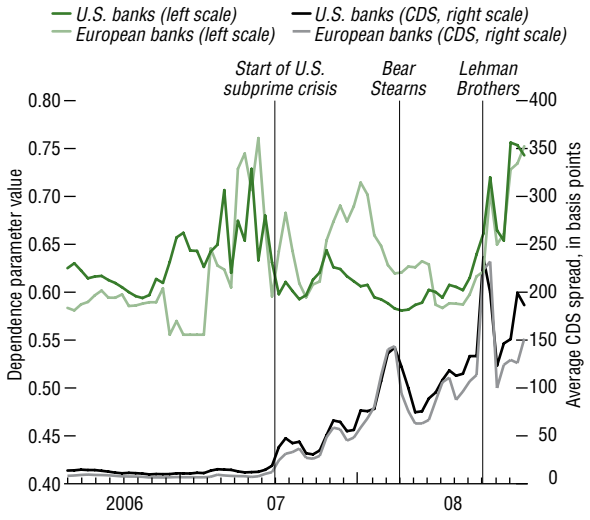
Since equity is the most junior contingent claim on the future asset performance of firms (equity holders are paid last from the firm's profits), equity derivatives contain forward-looking information of market participants' perceptions of downside risk. Moreover, the information content of prices has shifted from price levels to higher moments such as the variance, skewness, and kurtosis over the course of the crisis as investors reposition themselves in response to uncertainty and

information asymmetries (Kim and Verrecchia, 1997). Thus, this section uses implied volatilities from at-the-money equity options to examine simultaneous co-movements in the left-hand tails of the equity distribution as a measure of "tail dependence" and the magnitude of systemic risk.[29] Implied volatilities can, in principle, be more revealing of information pertinent to systemic risks than equity prices alone. More specifically, the combined probability of the average co-movement as well as very large negative shocks to several financial institutions can be estimated (Box 3.3).

The examination of multivariate dependence highlights two periods of high systemic risk induced by large tail events—the buildup prior to the subprime fallout (June 2007) and the largely coincident period associated with the collapse of Lehman Brothers (September 2008). Extreme co-movements of equity prices (Figure 3.5) did not follow but preceded the bailout of Bear Stearns. From a visual inspection, the results also seem to indicate that higher moments from equity price data may lead price data on credit-sensitive assets and implied default probabilities of CDS spreads, though more thorough analysis will need to be done to verify this claim.

These indicators also show that systemic risk has been increasing since February 2007. Average dependence among the global sample of banks and insurance companies (Core 1 and Core 2) increased by almost 30 percent, while joint tail risk declined by about the same order of magnitude (Figure 3.6), indicating that co-movements of *large* changes in equity volatility occur *more frequently*. This means that extremes (and aberrant swings in equity risk) have become the norm rather than the exception over the last year. As average dependence continues to increase above the historical trend, the

Figure 3.5. U.S. and European Banks: Joint Tail Risk of Implied Volatilities



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

Note: Sample period: 5/18/2005–12/31/2008 (946 obs.) of implied volatility derived from at-the-money equity put options of three banks in each the United States and Europe. Rolling window (one year) estimation with bi-monthly updating. The line shows the estimated joint tail dependence ("asymptotic tail behavior") based on a nonparametric specification of a trivariate extreme value distribution (logistic model) with a convex dependence function whose upper/lower limits are derived under complete dependence/independence. U.S. banks = Bank of America, Citibank, and JPMorgan Chase & Co. European banks = Deutsche Bank, Royal Bank of Scotland, and UBS. CDS = credit default swap.

[29]Note that the use of implied volatilities from out-of-the-money equity put options would be a superior input variable for our approach. Due to the lack of continuous prices on non-U.S. banks, we have chosen at-the-money options instead.

recent surge of tail risk (from historic lows)—together with the sharp increase in skewness and kurtosis—represents elevated systemic risks. In sum, these indicators of systemic risk appear to have detected rising, and now elevated, risk, potentially providing some advance notice for policymakers.

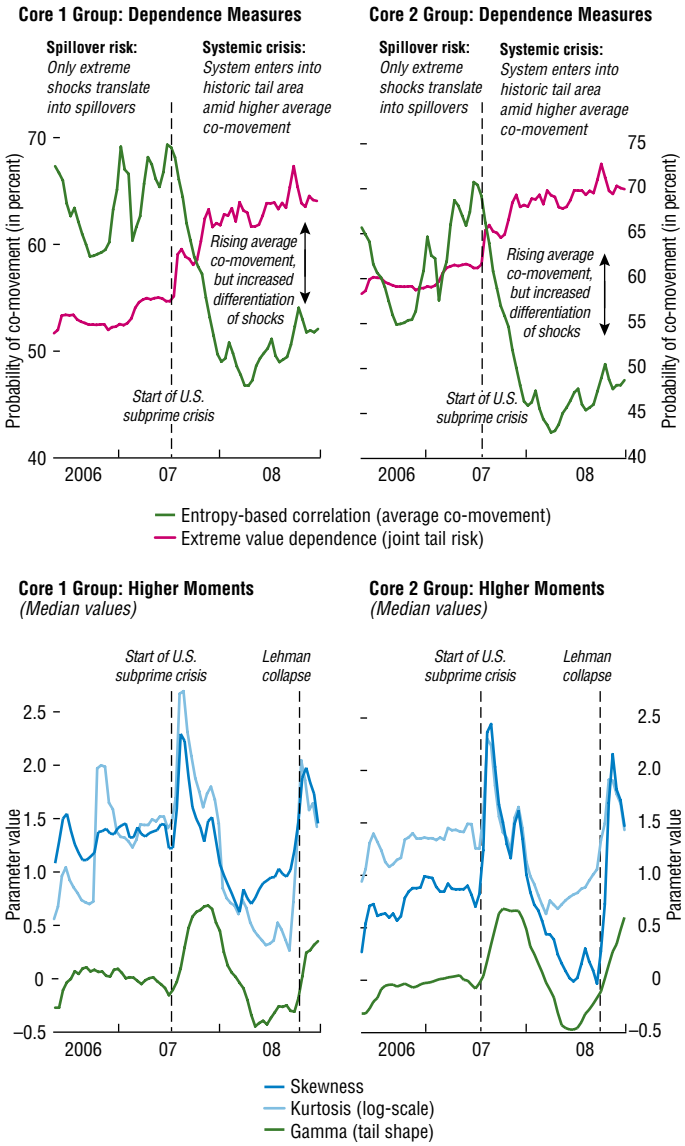
Common Distress in the System and Cascade Effects

This section models the joint distress among several specific groups of FIs using a slightly different technical approach than the one above (Segoviano and Goodhart, 2009). The joint statistical distribution of the implied asset values of a group of FIs—the financial system multivariate density (FSMD)—implicitly characterizes both the individual and joint asset value movements of a chosen portfolio of FIs (see Box 3.4).[30] The FSMD thus captures interdependence among the FIs' distress proxy variable (the probability of default), which captures the FIs' linear (correlations) and nonlinear distress dependence and their changes throughout the economic cycle, reflecting the fact that dependence increases in periods of distress—a key technical improvement over traditional risk models. Using the joint (multivariate) distribution, other measures of financial stability can be derived: (1) common distress of the financial institutions in a system; (2) distress between specific institutions; and (3) distress in the system resulting from distress in a specific institution.[31] The three measures represent an advantage over the analysis of any single one of them, since one can identify how risks

[30]The FSMD is recovered using a particular technique, the consistent information multivariate density optimizing (CIMDO) methodology (Segoviano, 2006), which is a nonparametric framework based on the cross-entropy approach (Kullback, 1959).

[31]The second measure—distress between specific institutions—is analyzed in Chapter 2. These conditional probabilities, summarized in a distress dependence matrix, should not only be seen as an indication of bilateral stress among FIs, since the overall dependencies across the institutions in the sample are included in the multivariate distribution from which the matrix is constructed.

Figure 3.6. Higher Moments and Multivariate Dependence of Implied Equity Volatility



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

Note: Estimates are based on implied volatility derived from at-the-money equity put options. Rolling window (one year) estimation with bi-monthly updating. The gamma parameter represents the shape parameter of the generalized extreme value distribution, estimated via the linear ratio of spacings method. The higher the tail shape parameter ("gamma"), the greater the univariate tail risk. The entropy-based correlation coefficient is based on the expected mutual information and the joint distribution of individual entropies of each constituent time-series vector. It represents the nonparametric estimate of general multivariate dependence. In contrast, the nonparametric estimate of multivariate extreme value dependence represents the joint tail risk of ordered maxima. For Core 1 and Core 2 Groups, see Annex 3.2.

Box 3.3. Higher Moments and Multivariate Dependence of Implied Volatilities from Equity Options as Measures of Systemic Risk

This box describes the use of equity options to evaluate the magnitude of systemic risk jointly posed by financial institutions based on a measure for the joint tail dependence across institutions and their average co-movement.

If firms are leveraged, the seniority of creditors implied by the capital structure suggests that equity is the most sensitive contingent claim on asset performance. Thus, we would expect equity prices in cash and derivatives markets to reflect even small changes in expectations of default risk.[1] This becomes even more important during times of stress, when the ability to use options as forward looking measures to hedge the downside risk of equity is more valuable (Gray and Jobst, forthcoming).

Recent research finds that if the volatility of equity prices is negatively skewed (left-tailed), so are the implied underlying asset distributions, which in turn are related to default risk (see Box 3.1). Thus, higher moments of equity price dynamics better account for nonlinearities of changes in default risk if large risk exposures become more frequent than suggested by the assumption of normal distributions. This means that accounting for higher moments of equity options can deliver important insights about significant changes in asset values of firms, which, in the presence of fat tails, results in a higher probability of default, and thus, higher spreads (Zou, 2003). Fat tails would indicate that market perception of severe downside equity risk has increased, and estimating economic capital based on volatility alone becomes unreliable, upsetting the basic tenets of the risk-based regulatory framework.

Since the concept of conventional correlation can give misleading information about systemic risks if distributions are skewed, it is important to use higher moments (derived from individual firms' equity options) to obtain nonlinear measures of dependence (Jobst, 2007a). Two models accounting for time-varying dependence are presented: (1) multivariate extreme value dependence (based on a limit law for joint asymptotic tail behavior); and (2) a dependence measure based on "entropy," which is a measure dispersion. While the former measures changes of joint tail risk, the latter delivers a nonparametric estimate of general multivariate dependence.

First, a nonparametric measure of joint tail dependence based on multivariate extreme value theory is defined in order to quantify the possibility of common extreme shocks (Coles, Heffernan, and Tawn, 1999; Poon, Rockinger, and Tawn, 2004; Stephenson, 2003; and Jobst, 2007b). As an integral part of this approach, this dependence structure links the univariate marginal distributions in a way that formally captures joint asymptotic tail behavior. Using the empirical distribution avoids problems associated with modeling specific parameters that may or may not fit these distributions well—a problem potentially exacerbated during stressful periods.[2] This method of measuring "tail dependence" is better suited to analyzing extreme linkages of multiple entities than the traditional (pairwise) correlation-based approach.

Second, average dependence in the multivariate case based on the concept of entropy is

Note: Dale Gray and Andy Jobst prepared this box.

[1]Since the capital structure of firms establishes a natural linkage between the cost of insuring against default risk (via credit default swap spreads), on one hand, and claims on future earnings (via equity), on the other, changes in expectations of future firm performance influence the market values of both.

[2]This approach is distinct from previous studies of joint patterns of extreme behavior. For instance, Longin (2000) derives point estimates of the extreme marginal distribution of a portfolio of assets based on the simple correlation between the series of individual maxima and minima. However, in the absence of a principled standard definition of order in a high-dimensional vectorial space, the simple aggregation of marginal extremes (without considering a dependence structure) does not necessarily concur with the joint distribution of the extreme marginal distributions. See also Embrechts, Lindskog, and McNeil (2003) regarding this issue.

investigated. Since the entropy of a set of variables is maximized if observed data are uniformly distributed, minimizing joint entropy indicates the maximum degree of dependence. In order to derive an overall measure of dependence between several variables (called "expected mutual information"), the effects of lower dependences are eliminated from the sum of both the overall entropy and the individual entropy of each financial institution's univariate marginal distribution by subtracting all joint entropies that do not include all variables (Preuss, 1980; and Theil, 1969). A scaled entropy-based measure of dependence (called "entropy correlation") can then be computed based on the reciprocal of the marginal contribution of each univariate entropy to the expected mutual information and analyzed. This method is suitable to extend the concept of "average dependence" to the multivariate case.

In the chapter, both models are applied to the implied volatilities of at-the-money equity put options of all financial institutions in our samples (Core 1 and 2). Our main findings confirm that both models yield complementary findings that provide comprehensive and timely information about the magnitude of systemic risk and possible developments going forward.

are evolving and which groups of institutions or a single institution may suffer from the distress of another. This methodology can be flexibly implemented, since the PoDs of individual FIs represent the input variables, which can be estimated using alternative approaches. Although in this exercise we used PoDs derived from CDS spreads, it would be straightforward to replace these input variables. This approach is also used to analyze the joint risks across banks in advanced economies and emerging market sovereigns for countries where such banks have large exposures (see Annex 1.3 in Chapter 1).

Common distress in the system: JPoD and BSI.

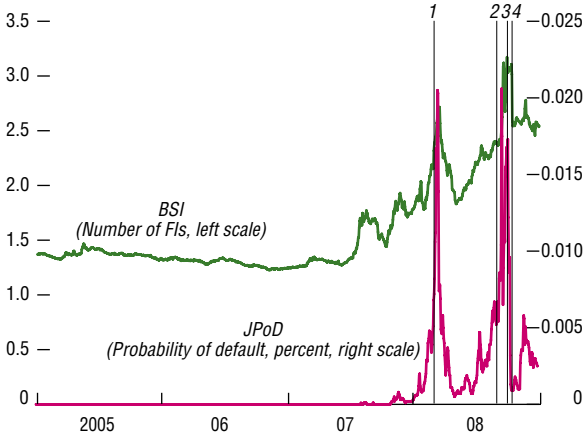
Two variables are employed to analyze common distress: the JPoD, and the BSI. These show larger and nonlinear increases in distress for groups of FIs than for the individual component FIs.[32] Estimations of the JPoD and the BSI are performed from January 1, 2005 to December 31, 2008 and include major U.S., European, and Asian banks, which were grouped in alternative ways in Annex 3.2. The JPoD variable measures the joint probability of default of all the institutions in the sample, and the BSI measures the expected number of other institutions that would fall into distress if a specific institution were to default.

The results indicate that distress in one FI is associated with a high probability of distress elsewhere. Moreover, movements in the JPoD and BSI coincide with events that were considered by the markets to be particularly disruptive on specific dates (Figure 3.7). Risks also vary by the geographical location and business line of the FI in the various groups (Figure 3.8). Distress dependence across FIs rises during times of crisis, indicating that systemic risks, as implied by the JPoD and the BSI, can rise faster than idiosyncratic (individual) risks. Figure 3.9 shows that this is the case—daily percentage changes of the JPoD are larger than daily percentage changes of the average of individual PoDs. This empirical fact provides evidence that in times of distress, not only do individual PoDs increase, but so does distress dependence. Therefore, measures of financial stability that are based on averages or indices could be misleading.

Cascade effects. Another use of the joint probability distribution is the probability of cascade effects, which examines the likelihood that one or more FIs in the system become distressed given that a specific FI becomes distressed. It is a useful indicator to quantify the systemic importance of a specific FI, since it provides a direct

[32]See Segoviano and Goodhart (2009) for definitions.

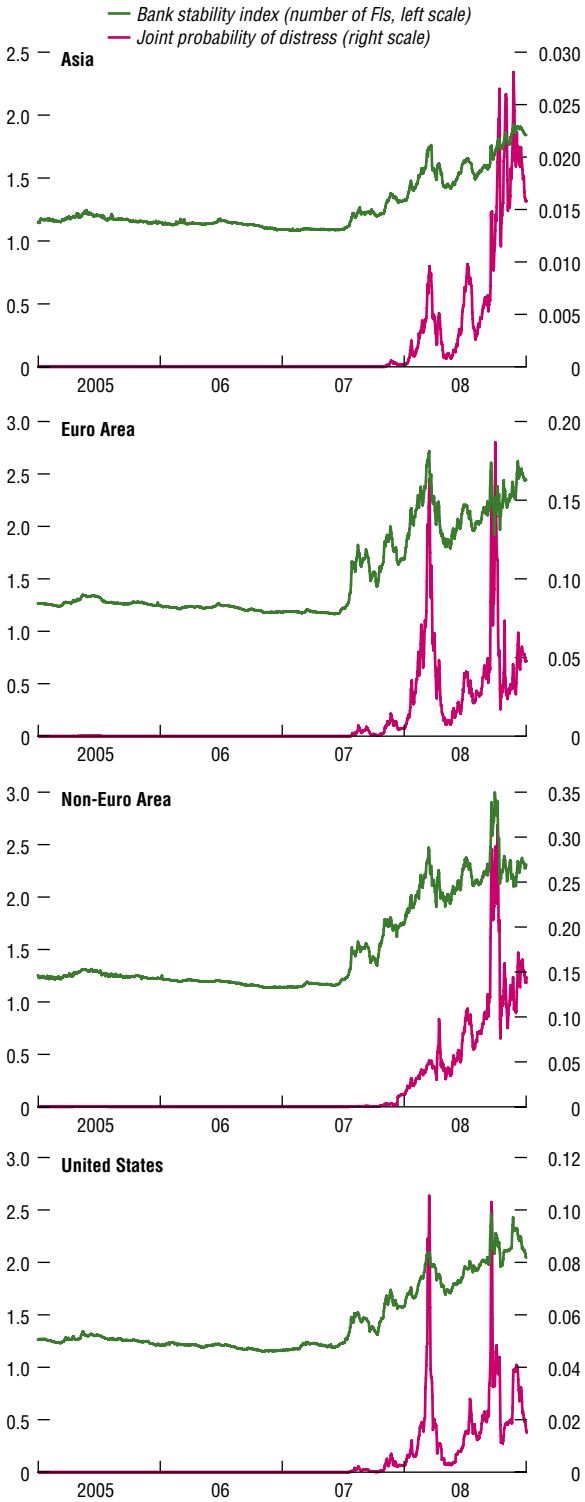
Figure 3.7. Joint Probability of Distress (JPoD) and Banking Stability Index (BSI): Core 2 Group



Sources: Bloomberg L.P.; and IMF staff estimates.
Note: FIs = financial institutions. TARP = Troubled Assets Relief Program. For Core 2 Group, see Annex 3.2.

1. Bear Stearns episode (3/11/08)
2. Lehman bankruptcy and AIG bailout (9/15-16/08)
3. TARP bill failure (9/30/08)
4. Global central bank intervention (10/8/08)

Figure 3.8. Joint Probability of Distress and Banking Stability Index: By Geographic Region



Sources: Bloomberg L.P.; and IMF staff estimates.
Note: For financial institutions in each region, see Annex 3.2.

measure of its effect on the system as a whole. As an example, the probability of cascade effects is estimated given that Lehman or AIG became distressed. These probabilities reached 97 percent and 95, respectively, on September 12, 2008, signaling a possible "domino" effect in the days after Lehman's collapse (Figure 3.10). Note that the probability of cascade effects for both institutions had already increased by August 2007, well before Lehman collapsed.

Identifying Systemic Risks Through Regime Shifts

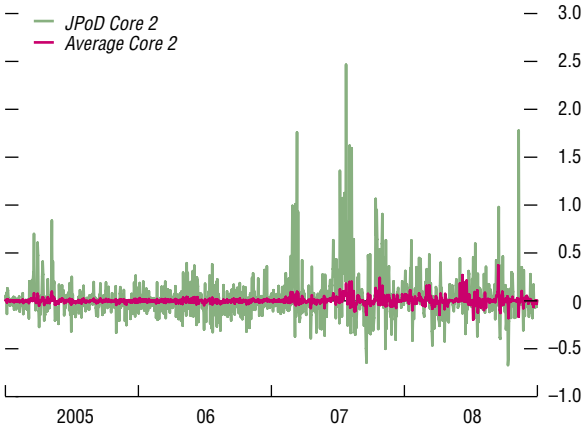
The next objective is to examine when the JPoD and the BSI, as aggregate measures of FIs' stability, switch from low- and medium-volatility regimes into a high one, and vice-versa (Hesse and Segoviano, forthcoming). Remaining in the high-volatility regime could indicate that the crisis has become systemic. From this perspective, the BSI is of particular interest, in that it measures the expected number of distressed institutions given that at least one institution becomes distressed.

The univariate Markov-Switching autoregressive conditional heteroskedacticity (SWARCH) model developed by Hamilton and Susmel (1994) is used.[33] The models are based on daily data in first differences from January 1, 2006, to December 31, 2008. Figure 3.11 (first panel) shows the SWARCH model using the BSI measure for the Core 1 group of banks (United States, Europe, and Asia) and the probability of being in the high-volatility state. The results show the following:

- After the beginning of the subprime crisis, the model only oscillates between the high and medium states, while the precrisis period was characterized by a low-volatility regime.

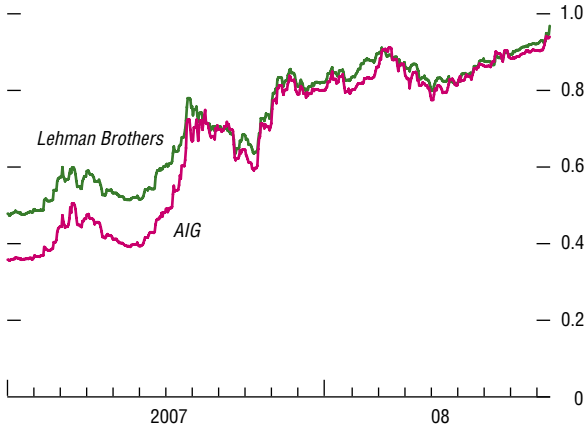
[33]This model allows for a time-varying variance and state-dependent ARCH parameters—features that are present in the types of financial data underpinning the BSI and JPoD. Moreover, the technique allows the data to determine the transition across the regimes rather than the researcher making an ad hoc determination.

Figure 3.9. Daily Percentage Change: Joint and Average Probability of Distress, Core 2 Group



Sources: Bloomberg L.P.; and IMF staff estimates.
Note: JPoD = Joint probability of distress. For Core 2 institutions, see Annex 3.2.

Figure 3.10. Probability of Cascade Effects



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

Box 3.4. The Consistent Information Multivariate Density Optimizing Approach

This box provides details about how the financial system multivariate density (FSMD) is obtained from the data, demonstrating the advantages of the consistent information multivariate density optimizing (CIMDO) technique relative to other more traditional ones.

The FSMD embeds the banks' distress dependence structure, characterized by the CIMDO-copula function (Segoviano, forthcoming), which captures linear (correlations) and nonlinear distress dependence among the financial institutions in the system, and their changes throughout the economic cycle, reflecting the fact that dependence increases in periods of distress. These are key technical improvements over traditional risk models, which usually account only for linear dependence that is assumed to remain constant over the cycle or a fixed period of time.[1]

Empirically, the CIMDO methodology is a tool to recover the FSMD and hence to acquire the joint relationships across the individual financial institutions at the portfolio level. As such, it requires as inputs (exogenous variables), measures of the probabilities of default (PoDs) of individual financial institutions that represent the financial system, which can be estimated using alternative approaches; for example, the structural approach, option prices and credit default swap (CDS) spreads. The underlying data for use in the CIMDO approach is important, as the results are a reflection of the input data. Athanasopoulou, Segoviano, and Tieman (forthcoming) present an extensive empirical analysis of different versions of the structural approach and the CDS approaches to assess their estimates of the PoD. Our analysis shows that while no approach is free of issues, the CDS-PoDs appear to be a good distress signal. For this reason, the FSMD in this paper uses CDS-PoDs. However, further statistical analysis to improve the estimation of individual PoDs is ongoing. Thus, if a better approach is found, it is straightforward to replace the chosen PoDs with another set.

The CIMDO starts with a formal, parameterized distribution of the financial institutions' input data (a prior) and then arrives at a final distribution (the posterior) by imposing constraints that assure that the overall multivariate distribution contains marginal probability densities that satisfy the constraints associated with the PoDs of each of the constituent financial institutions. CIMDO-recovered distributions outperform the most commonly used parametric multivariate densities in the modeling of portfolio risk under the probability integral transformation criterion (a measure of how well densities approximate the underlying data). This is because when recovering multivariate distributions through the CIMDO approach, the available information embedded in the constraints is used to adjust the "shape" of the multivariate density. This appears to allow the distribution to more closely adapt to the changes in entire distribution over time, but particularly in the tail of the distribution, relative to other approaches, which adjust the "shape" of parametric distributions via fixed sets of parameters.

Once the CIMDO density is estimated, its copula function is recovered. Note that this is an inverse approach to the standard copula modeling, which first chooses and parameterizes the copula function and then "couples" marginals to define multivariate densities. Indeed, the standard approach to model parametric copula functions is difficult to implement, since modelers have to deal with the choice, proper specification, and calibration of the copula functions. In contrast, the CIMDO methodology does not require the modeler to choose ex ante a copula function to define distress dependence; that is,

Note: Miguel Segoviano prepared this box.

[1]This paper shows that the structural approach produces, at times, estimates that appear inconsistent with actual default probabilities due to problems related to lack of liquidity in certain markets and generalized risk aversion in times of distress. Credit default swaps-probabilities of default also appeared to be affected by these problems, and at times they overshoot. However, although the magnitude of the moves may occasionally be unrealistic, the direction is usually a good distress signal.

the form of the copula function is defined by the data. Thus, the CIMDO-copula provides key improvements and avoids drawbacks implied by the use of standard parametric copulas as it incorporates, endogenously, changes in distress dependence and avoids the imposition of constant correlation parameters.

However, the CIMDO-copula maintains the benefits of the copula approach to model dependence: first, it describes linear and nonlinear dependencies among the variables described by the CIMDO-density; and second, it characterizes the dependence structure along the entire domain of the CIMDO-density. Nevertheless, the dependence structure characterized by the CIMDO-copula appears to be more robust in the tail of the density, where our main interest lies, that is, to characterize tail risk dependence.

By recovering the FSMD, which embeds financial institutions' distress dependence, Segoviano and Goodhart (2009) can produce three measures that allow policymakers to examine different aspects of systemic risk. This permits policymakers to identify not only how common risks are evolving, but also where distress might most easily develop and how distress in a specific institution can affect other institutions, thus enabling them to make an assessment of the stability of the financial system.

- The model enters the high-volatility state in late July 2007—the beginning of the subprime crisis—and the variations into and out of this state are mostly coincident with the periods in which there are large central bank interventions and new policy initiatives, and unsurprisingly, the Lehman closure.
- In two cases of the five variations examined (Figure 3.11, panels 2 and 3) there is a movement into the high-volatility state in late February 2007. As discussed before, this corresponds to the sharp Shanghai stock market correction as well as the first abrupt ABX (BBB) price decline of subprime mortgages.[34]
- There are some differences in 2008 between U.S. investment banks and European banks (Figure 3.11, panels 4 and 5). The latter appear to be in the high-volatility state most of the time, which could be explained by the higher variance of their BSI.

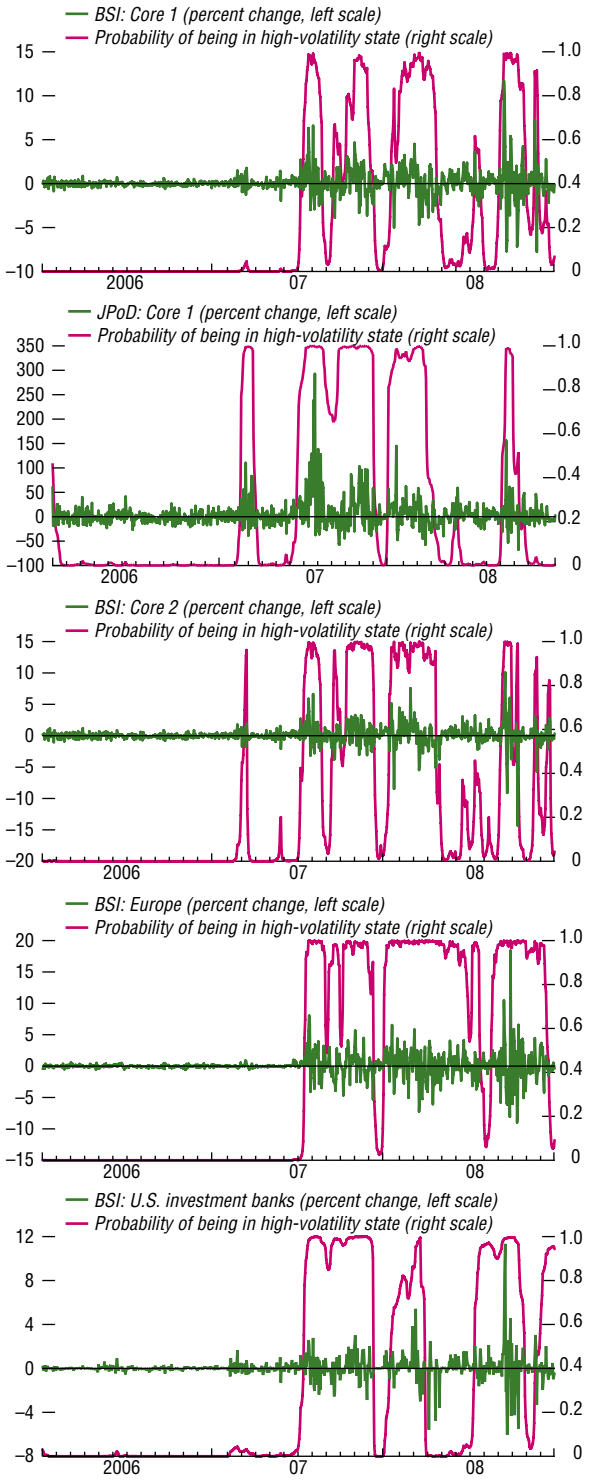
Overall, the SWARCH models are useful analytical tool to discern when aggregate measure of FIs' stability (in this case, the BSI and JPoD) switch volatility regimes. Persistent high-volatility states such as the first months of the subprime crisis, the months surrounding the Bear Stearns rescue, and the Lehman episode suggest that the financial system had entered a systemic crisis, while until Lehman's collapse, many commentators thought the crisis was contained. Of course, this method should not be used in isolation but be complemented by other systemic risk indicators. While the JPoD and BSI indicators measure different attributes of systemic risk, i.e., the joint probability of distress versus the conditional expectation of distress probability, it is reassuring that the main crisis events are picked up by both data series. For some of the events studied, notably the February 2007 episode, the threshold of volatility only stays in the high mode for a short period of time, making it difficult, ex ante, to tell whether the financial system was going to remain in this elevated volatility state and whether it had thus entered a systemic crisis.

[34]These two events were roughly coincident. While it is difficult to prove whether they were related events, they appear be consistent with the rebalancing portfolios by investors with high-yield positions.

Role of Global Market Conditions During Episodes of Stress

This section examines how various proxies for global market conditions can influence the

Figure 3.11. Markov-Regime Switching ARCH Model: Joint Probability of Distress and Banking Stability Index



Sources: Bloomberg L.P.; and IMF staff estimates.
Note: JPoD = joint probability of distress; BSI = banking stability index. For Core 1 and Core 2 groups, see Annex 3.2.

incidence of systemic risk.[35] As noted above, the value of assets on the books of FIs are highly dependent on the underlying financial environment—such factors as the interest rate environment (low or high) or the level of risk appetite—and, as such, global market conditions are thus important in determining their market value and ultimately the strength or weakness of financial institutions and the probability of a systemic episode.

Markov-Regime Switching Analysis

Markov-regime switching techniques take an integrated approach to analyzing financial stress. The SWARCH model of Hamilton and Susmel (1994) is particularly well-suited for the purpose since it differentiates between different volatility states (e.g., low, medium, and high), derived from the time-varying nature of volatility that occurs in many high-frequency financial variables, particularly during times of stress.[36]

A SWARCH model of the euro-U.S. dollar forex swap reveals that the variable moves from a low- to a medium-volatility regime in the beginning of August 2007 before entering the high-volatility state right after the Lehman collapse in September 2008, remaining there until the end of November 2008 (Figure 3.12). Many non-U.S. banks, especially European ones, faced a shortage of U.S. dollar funding for their conduits and structured investment vehicles from the summer of 2007 onward. As the interbank market for dollar funding dried up due to heightened counterparty and liquidity risks, these banks increasingly engaged in foreign exchange swap arrangements, (Baba, Packer, and Nagano, 2008), leading to higher volatility.[37] The move of the forex swap into the

[35]See González-Hermosillo and Hesse (forthcoming).

[36]Univariate SWARCH models are adopted here with variables in first differences to account for the nonstationarity of the variables. The mean equation is an AR(1) process and the variance is time-varying with the ARCH parameters being state dependent.

[37]In particular, both euro and sterling were used as the funding currencies for the dollar foreign exchange swaps. The spillovers from the interbank market to the foreign exchange swap market led to a situation whereby

high-volatility state on September 15, 2008 reflects the sharp increase in counterparty risk after the Lehman failure, a sizable dollar shortage with margins and haircuts increasing across the board, and the breakdown of the LIBOR market.

Turning to the VIX, Figure 3.13 shows the results of a daily SWARCH model from 1998 to end-2008.[38] The probability of being in the high-volatility state varies considerably, spiking during previously identified episodes of instability. Indeed, the findings show the switch to the high-volatility regime in late February 2007 when the Chinese stock market corrected sharply and the first round of ABX (BBB) price declines occurred, suggesting a potential warning sign of systemic fragilities. The Lehman event then triggered a rapid movement of the VIX into the high-volatility regime, where it remained until the end of the sample period. Since the beginning of the subprime crisis, the VIX has only oscillated between the medium- and high-volatility regimes, in contrast to the predominantly low-volatility regime predominant during 2003–07.

The SWARCH model is also estimated for the three-month TED spread (Figure 3.14).[39] This indicator of short-term bank credit risk moved decidedly into a high-volatility regime during the summer of 2007 and persisted there for much of 2008.

Several of the measures examined (the VIX index and the TED spread) also pick up other periods of stress in global financial markets, such

Figure 3.12. Euro-Dollar Forex Swap

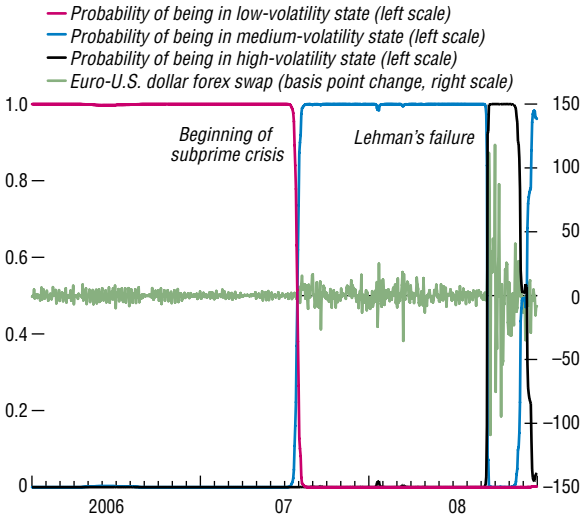
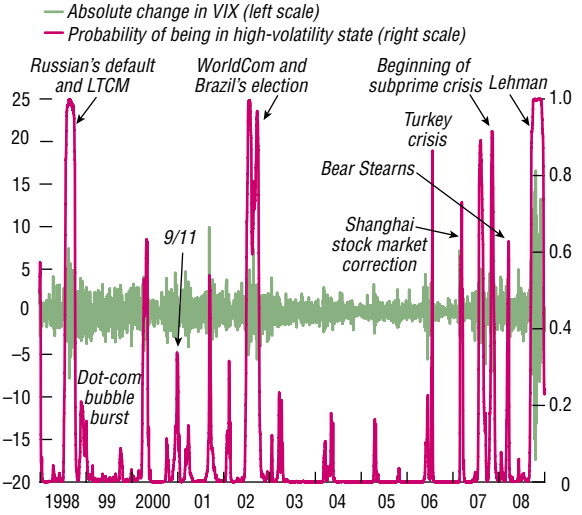


Figure 3.13. Markov-Switching ARCH Model of VIX



Sources: Bloomberg, L.P.; and IMF staff estimates.
Note: ARCH = autoregressive conditional heteroskedasticity; LTCM = Long-Term Capital Management; VIX = Chicago Board Options Exchange volatility index.

foreign exchange swap prices deviated from that implied by covered interest parity conditions. With the turbulence becoming more persistent, many non-U.S. financial institutions also increasingly engaged in the longer-term foreign exchange swaps. This episode especially highlighted the international interconnectedness of banks' funding requirements through foreign exchange swap markets and their impaired liquidity.

[38]The VIX, the Chicago Board Options Exchange volatility index, is a measure of the implied volatility of S&P 500 index options over the next 30 days and calculated from a weighted average of option prices. The model based on VIX is estimated in first differences due to nonstationarity. This suggests that it may be useful to examine higher than second moments in the probability density function.

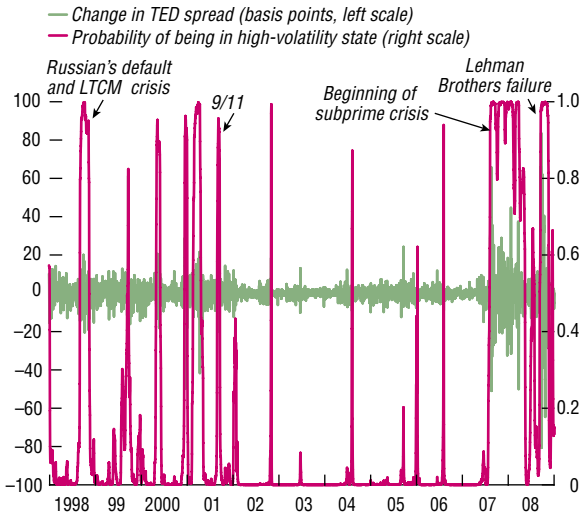
[39]The TED spread is the difference between the three-month LIBOR and the three-month treasury bill rate.

as Russia's default and Long-Term Capital Management crisis in August/September 1998, the liquidity shock of 9/11, and other episodes of crisis in emerging markets as well as the dotcom bubble and the WorldCom scandal.[40] While the recent persistence of the high-volatility period for the TED spread is unprecedented over the past decade, that for the VIX is not, suggesting a greater relative stress in credit markets during this crisis episode.

The analysis is extended to include the interaction of risks with emerging markets that, as discussed in Chapter 1, have been a key link during the latter stages of the crisis. In particular, the interconnection between financial markets in advanced economies and emerging markets is examined in Box 3.5. The results show that problems in advanced economies readily spilled over into emerging markets as investors sought the safest and most liquid global assets. Similarly, an extension of the approach in Box 3.4 is used to examine cross-country vulnerabilities between emerging market sovereigns and specific banks in advanced economies with a large regional presence in those countries (see Annex 1.3 in Chapter 1), finding such spillovers increased dramatically throughout the crisis.

While not integrated with the measures in the sections above, the regime-shifting model can add to the assessment of systemic risks by overlaying the results to see if multiple measures demonstrate high levels of volatility simultaneously (Figure 3.15). The results show that the global market indicators examined here sometimes do not remain in the high-volatility state for long, with some exceptions such as the TED spread. This suggests they should be used in combination with other tools to help policymakers detect systemic crises.

Figure 3.14. Markov-Switching ARCH Model of TED Spread



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

Note: ARCH = autoregressive conditioned heteroskedasticity; LTCM = Long-Term Capital Management; TED = the spread between the three-month LIBOR and treasury bill rates.

[40]Robustness tests were performed by estimating the model prior to the Lehman collapse. It also signaled a high probability of being in a high-volatility state over this period. It is worth noting that several relevant data series (such as CDS) did not exist prior to the early 2000s.

Policy Implications

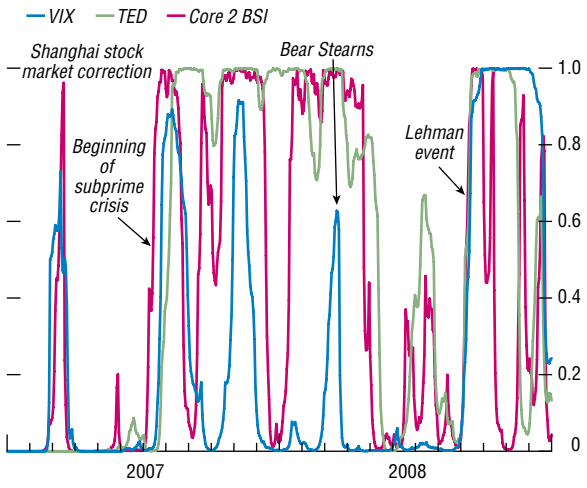
For those responsible for safeguarding financial stability, monitoring measures of systemic stress is now critical. This crisis has highlighted the dangers of focusing supervisory practices and risk management simply on ensuring that individual institutions are adequately capitalized and individually capable of surviving reasonable stress events. The current crisis has demonstrated that a systemic approach is now urgently needed, since complex financial systems can potentially amplify the actions of single firms to a degree that can have damaging collective effects. Indeed, a seemingly well-capitalized and liquid institution can nevertheless become distressed through the actions of its peers, a "run" by wholesale creditors, or even contagious declines of equity values.

The issue now facing authorities is not *whether* to attempt to identify systemic risks, but how best to do so in an interconnected global financial system with incomplete information. This chapter has reviewed and developed both balance sheet and market-based indicators to assess the degree to which they gave some degree of forewarning of either a particular institution's impending failure, or of severe knock-on effects. Some of the advanced techniques presented here are new and therefore more analysis is needed before a definitive judgment as to the optimal set of measures can be made. Indeed, given the complexity of the nature of systemic risks, it would be prudent to use various techniques and measures in order to arrive at robust results. A number of recommendations flow from the results.

Financial Soundness Indicators

Mixed results were found regarding the standard FSIs' ability to highlight those firms that proved to be vulnerable. Basic leverage ratios were most reliable, while capital-to-asset ratios (including risk-adjusted ratios) and nonperforming loan data proved of little

Figure 3.15. Markov-Switching ARCH Model of VIX, TED Spread, and Core 2 BSI
(Probability of being in a high-volatility state)



Sources: Bloomberg L.P.; and IMF staff estimates.
Note: BSI = banking stability index. For Core 2 group, see Annex 3.2.

Box 3.5. Spillovers to Emerging Markets: A Multivariate GARCH Analysis

This box examines the financial interlinkages between advanced and emerging market countries during the financial crisis.

Although standard correlations are typically flawed methods of examining spillovers and the potential for systemic risks to spread, a dynamic conditional correlation (DCC) generalized autoregressive conditional heteroskedasticity (GARCH) model by Engle (2002) can be used to avoid many of the pitfalls.[1] To examine the interlinkages between advanced and emerging market countries, the model is applied for the sample period 2003–08 (Frank and Hesse, forthcoming). A few pertinent variables are used in order to analyze the co-movements: the three-month U.S. LIBOR-OIS (overnight index swap) spread, proxying for funding liquidity and general stress in the interbank market segment; the S&P 500 as well as bond spreads; and stock market and credit default swap (CDS) measures for some selected emerging market countries or indices.

The findings suggest that implied correlations between the LIBOR spread and Emerging Markets Bond Index Plus (EMBI+) bond spreads of Asian, European, and Latin American countries sharply increase after the subprime crisis (see first panel of figure). In addition, the Chinese stock market correction in February 2007 led to a temporary spike of the correlation measures from 0.20 to almost 0.50. The Lehman collapse caused the largest increase of co-movements between these variables. Similarly, according to the second panel of the figure, the relationship between the S&P 500 and the EMBI+ regional bond spreads encounters a potential break during the Chinese episode, then correlations increase from the beginning of the subprime crisis and reach their peak after the Lehman failure. In terms of regional differences, it appears that the magnitude of co-movements between the S&P 500 and the EMBI spread for Latin American countries dominates the other regional spreads.

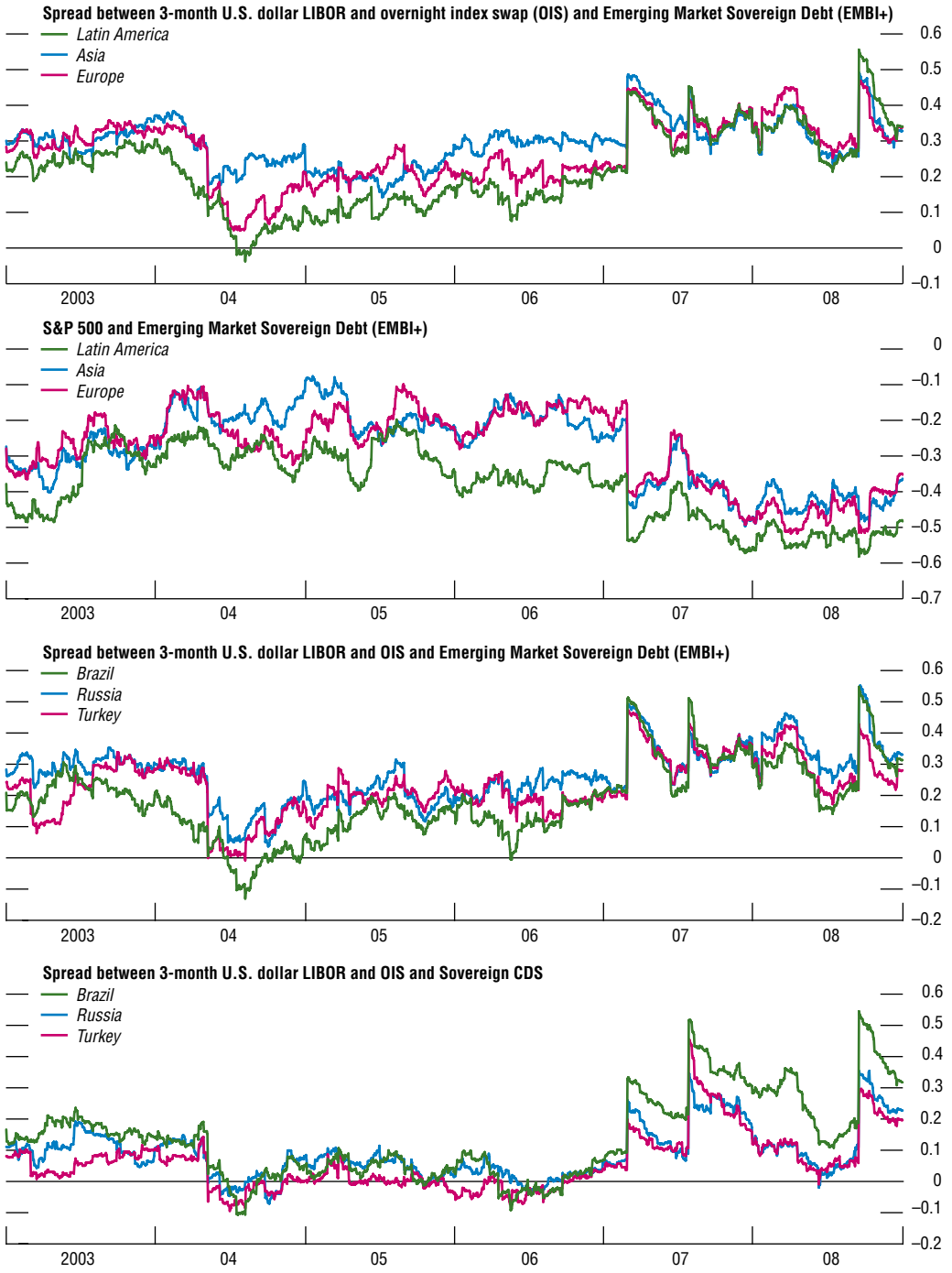
The third and fourth panels of the figure examine possible individual country interlinkages. The LIBOR spread is related to sovereign bond and sovereign CDS spreads of the emerging market countries of Brazil, Russia, and Turkey. As before, the Chinese episode in February 2007 is evident and so are the subprime and the Lehman collapse in increasing correlation magnitude order. The Bear Stearns rescue in March 2008 also becomes visible, with co-movements sharply reversing their downward trend prior to that.

Overall, the findings from the DCC GARCH models indicate that the notion of possible decoupling (in the financial markets) had been misplaced. It is true that emerging market stock markets reached their peak in November 2007 and later, but interlinkages between funding stress and equity markets in advanced economies and emerging market financial indicators were highly correlated and have seen sharp increases during specific crisis moments. Given the interconnectedness of global financial markets, investors' increase in global risk aversion from problems in advanced economies rapidly spilled over into emerging market countries, as investors sought to pull out from those countries and only invest into the safest and most liquid assets in their home countries such as government bonds.

Note: Heiko Hesse prepared this box.

[1]The variables in the daily DCC multivariate GARCH framework are in first differences to account for nonstationarity during the crisis period. In addition, the S&P 500 is included in order to account for common shocks. The models are extended to account for explicit structural breaks using Capiello, Engle, and Sheppard (2006). Using the same methodology, Frank, González-Hermosillo, and Hesse (2008) examine the transmission of liquidity spillovers across asset markets in the United States during the subprime crisis.

Implied Correlations from Dynamic Conditional Correlation Model



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

predictive power. In the current crisis, key vulnerabilities have been unanticipated due to off-balance-sheet exposures and lenders' dependence on wholesale funding. Indeed, many "failed" institutions still met regulatory minimum capital requirements. However, FSIs are still helpful in assessing individual and systemic vulnerabilities when reliable market data may not be available—particularly in less-developed financial markets—as they can provide both an indication of rising vulnerabilities and a check when other information reveals weaknesses. For countries with more sophisticated sources of information, FSIs could be usefully reevaluated, perhaps refocusing them on basic leverage ratios and ROA as a proxy for risk-taking. Of course, FSIs should be complemented by other measures and systemic stress tests, and be broadened to better capture off-balance-sheet exposures and liquidity mismatches.

Market-Based Indicators

Low equity volatility and tight credit and CDS spreads were symptoms of, and contributors to, strong risk appetite prior to February 2007. As such, indicators derived from market data generally provided coincident, rather than forward-looking, indications of the break in sentiment and transition to a systemic crisis. However, some measures illustrated above (Table 3.5) are successful in providing an indication of how vulnerable a group of FIs is to the default of any one FI, and hence provide some signal of how "systemic" an individual default can be. Such indicators complement those showing the degree of interconnectedness among FIs (Chapter 2).

Moreover, some indicators, especially those derived from implied volatility from equity options, seem to have given more reliable forward signals of impending banking system and individual institution stress (Figure 3.10). Nevertheless, the signs of increasing volatility priced into bank equity options provided only a few months' notice that systemic risks were rising, and further work is needed to confirm that such forewarnings were timelier than CDS spreads.

Volatility Regime Indicators

There is also evidence that observing shifts in volatility regimes using some measures of systemic risk can be helpful in detecting the degree to which the financial system is suffering a systemic event. However, in some cases this signal proves to be relatively short-lived. Nonetheless, regime-switching indicators can show moves to medium- and high-volatility states and hence can be used to assess the degree of current fragility and uncertainty. Such indicators may also be useful in establishing whether and when a systemic crisis is subsiding, particularly if the low-volatility state persists, and thus when the withdrawal supportive crisis measures can be safely considered.

Policy Messages

The findings in this chapter point to a number of broad policy messages:

- *Collect and publish more, relevant data.* While publicly available market indicators for FIs (equity and options prices, CDS spreads) can yield useful indicators of systemic stress, alternative signals are probably being missed because other relevant data are not being collected or published by supervisors in a systematic fashion. Most notably, bank FSIs would become more useful with the inclusion of off-balance-sheet exposures in a standardized manner; the state of market liquidity could be assessed more easily with the publication of volumes and bid-ask spreads in credit markets; and systemic interconnections could be properly assessed through the collection and aggregation of individual cross-border counterparty exposures. Overall levels of leverage—potentially including for hedge funds—would provide information on the potential vulnerability of a financial system to shocks.
- *Diversify information sources and have a comprehensive plan in place for systemic events.* Some

Table 3.5. Summary of Various Methodologies: Limitations and Policy Implications

	Weaknesses/Conditions When Measure May Be Misleading	Policy Implications
Accounting balance sheet	When nonlinearity likely; feedback effects present; forward-looking requirements; high-frequency; multiple-institutions.	Should include indicators on leverage and stock market performance for individual financial institutions.
Conditional correlation matrices and cluster analysis	When nonlinearity likely.	Help policymakers gauge the co-movements and interconnections among financial institutions on a frequent basis.
Option-iPoD	When equity-options are not available; subject to distortions from government injections of capital.	Help policymakers monitor default-risk and the distance to specific leverage thresholds of individual financial institutions at a daily frequency. Can be used to perform stress tests.
Higher moments and multivariate dependence	Variations in data frequency and estimation window might require adjustments to the calibration algorithm of tail dependence when extremes are rare.	Provide policymakers with an indication of both nonlinear and time-varying linkages between financial institutions at different magnitudes of common shocks.
Multivariate time-varying distress dependence	Depends on the inputs used in the methodology. If credit default swap used, subject to distortions from government guarantees.	Provide policymakers with information to identify not only how common risks are evolving, but where spillovers might most easily develop and how distress in a specific institution can affect other institutions.
Markov-regime switching	Does not accommodate multivariate settings.	Provides useful information about status of systemic risk when certain variables (e.g., bank stability indicators or global market variables), change their volatility (or mean) states. The techniques are readily available and could be updated on a frequent basis.
DCC GARCH models	Cannot make causal statements and does not elucidate feedback effects.	Can help policymakers to gauge the extent of co-movements between domestic and global (foreign) market conditions in normal as well as stressful periods.

Source: IMF staff.

market-based indicators—using higher moments of FIs' equity prices—did give a few months' notice of rising systemic risks prior to July 2007. However, it would have been difficult to know at the time whether these signals were prescient. In general, policymakers should not depend on receiving unambiguous signals of impending systemic crisis from market prices, and they should be complemented with other indicators of potential stress (including FSIs and macroeconomic vulnerabilities). Comprehensive policies that are clearly communicated can serve to reduce uncertainty and would be helpful in improving overall market conditions. The relatively short notice of systemic crisis, and high degree of noise in some signals, mean that policymakers should rely on a number of tools and measures to arrive at a robust assessment of when systemic risks are bound to materialize. In particular, stress tests that take into account systemic effects and interconnections should be implemented. Moreover, a comprehensive and coordinated crisis preparedness plan needs to be in place *before* systemic events are detected.

- *Take care when interpreting market signals during the crisis.* If supervisors and central bankers are planning to use market-based data to assess systemic risk, it is important that they recognize that policy interventions themselves may affect their informational content. For instance, prohibitions on short selling or other impediments to the free flow of information into prices are likely to distort signals given by market prices. Similarly, the introduction of government guarantees for bank debt can alter the informational content of FIs' CDS spreads and equity prices (Box 3.6). As such, market-based indicators may only

contain relatively unbiased information about systemic risk in the early phases of a crisis, prior to policy actions. Further work on the indicators, to control for policy responses so that their informational content remains intact, is needed.

- *Charge for contributions to systemic risk through higher capital requirements.* Some of the analysis presented here allows for the calibration of the contribution of individual institutions to systemic risk, providing a starting point for additional regulatory capital to be required to penalize practices that add to systemic risk giving due attention to potential procyclicality. In addition, indicators of distress could also be used to adduce the appropriate perimeter of regulation, or intensity of supervision, thereby allowing institutions whose failure is unlikely to cause distress to others to be less intensively supervised.

Conclusions

Although every measure of systemic risk has limitations to some degree, and indeed all models are by nature simplifications of the complexity of the real world, this chapter discusses various tools that can be used to shed light on potential systemic events. Thus far, financial sector regulation and supervision have focused on the risk of failure of each financial institution in isolation. The analysis presented here suggests that regulators should take into account the risk of *both* individual and systemic failures. Indeed, some proposals have begun to surface on how to account for systemic risks in prudential regulation (e.g., Acharya, 2009; and Pedersen and Roubini, 2009). Some of these proposals rely on the assumption that correlation among FIs is a good proxy for detecting systemic risks. As discussed in this chapter, measures based solely on asset return correlations are constrained in their ability to detect (and address) systemic risks, since they fail to capture the "fat-tailed" nature and constant changes in the probability distribution of asset returns of key FIs, which are characteristic of systemic crises. This suggests that prudential norms based on simple return correlations will be insufficient to capture systemic risk, and supervisors will need to broaden their approaches. The results presented in this chapter suggest that authorities need to diversify their sources of information and the tools used to detect systemic risk.

Box 3.6. The Transformation of Bank Risk into Sovereign Risk—The Tale of Credit Default Swaps

In the fall of 2008, the introduction of government guarantees on bank liabilities prompted a decline in bank credit default swap (CDS) spreads, making the spreads less informative and increasing costs to the government. In several countries with large banking systems this has also led to a convergence of sovereign and bank CDS spreads, which can result in feedback effects between sovereign and bank spreads.

In 2008–09, a number of developed-country governments provided financial guarantees on bank liabilities, which prompted a sharp decline in bank CDS spreads, as default risk was transferred to the sovereign. This has had several consequences.

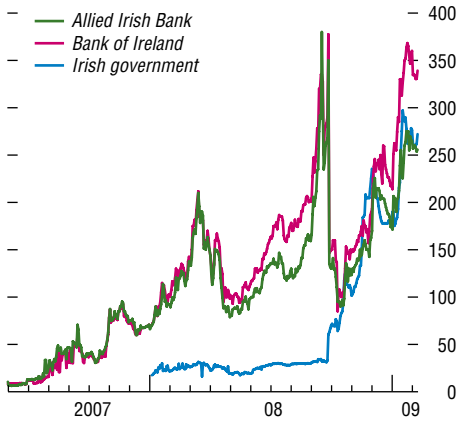
First, information from bank CDS on default risk becomes less informative as government intervention distorts the interpretation of credit market signals. Using information from equity markets in a contingent claims approach (CCA) model may provide a more accurate view on whether bank risk is increasing or subsiding. From a systemic point of view it may be desirable to shift focus to the joint probability of banks falling below certain "minimum" capital or "prompt corrective action" thresholds rather than a joint probability of default (since the government is insuring liability holders against the costs of default).

Second, potential costs to the government of the guarantees have led to a rise in sovereign CDS spreads. This is particularly true where the financial system is large compared with the government's balance sheet or GDP. The banks' credit spreads depend on (1) retained risk, which is low given the application of government guarantees and assurances of continuing support; and (2) the government sovereign credit spread, since investors view the banks' creditworthiness as dependent on that of the sovereign guarantor. (The CCA model assumes that the government's contingent liability—the value of the explicit or implicit sovereign guarantee—is a fraction α of the total P_F implied put option to the financial sector. The remainder, $(1-\alpha)P_F$, is credit risk remaining in the debt and deposits of the financial sector, as described in Gray, Merton, and Bodie, 2008.) Thus, bank credit spreads should be equal to or greater than sovereign spreads.

In Ireland, after financial guarantees were granted to banks, their CDS spreads declined and converged toward that of the sovereign.

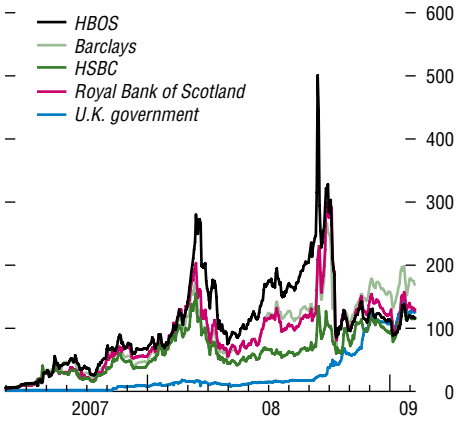
Note: Dale Gray prepared this box.

Irish Banks and Sovereign Five-Year Credit Default Swap Spreads
(In basis points)



Source: Bloomberg L.P.

U.K. Banks and Sovereign Five-Year Credit Default Swap Spreads
(In basis points)



Source: Bloomberg L.P.

Box 3.6 *(concluded)*

A similar pattern was evident in the United Kingdom, after financial guarantees were introduced for new bank-issued debt (see figure).

This inter-relationship of spreads could lead to a destabilizing feedback process where both bank and sovereign CDS spreads increase in response to shocks to bank assets and/or to the sovereign's revenue potential. In some situations (as in Iceland), this vicious cycle can escalate to a point where the inability of the government to provide sufficient credible guarantees to banks leads to a simultaneous systemic financial and sovereign debt crisis. On the other hand, improvement in bank and sovereign balance sheets can lead to a virtuous cycle as bank and sovereign spreads decline. Countries in a currency union do not have the option to use the exchange rate as an independent policy tool to restore macroeconomic stability. In such circumstances, the potential for sovereign default needs to be contained through measures to limit the downside risk of exposure to the banking system and fiscal measures to restore credibility.

Annex 3.1. Financial Soundness Indicators

Core Set	
Deposit-taking institutions' capital adequacy	Regulatory capital to risk-weighted assets Regulatory Tier 1 capital to risk-weighted assets
Asset quality	Nonperforming loans to total gross loans Nonperforming loans net of provisions to capital Sectoral distribution of loans to total loans Large exposures to capital
Earnings and profitability	Return on assets Return on equity Interest margin to gross income Noninterest expenses to gross income
Liquidity	Liquid assets to total assets (liquid asset ratio) Liquid assets to short-term liabilities
Sensitivity to market risk	Duration of assets Duration of liabilities Net open position in foreign exchange to capital
Encouraged Set	
Deposit-taking institutions	Capital to assets Geographical distribution of loans to total loans Gross liability position in financial derivatives to capital Trading income to total income Personnel expenses to noninterest expenses Spread between highest and lowest interbank rate Customer deposits to total (noninterbank) loans Foreign currency-denominated loans to total loans Foreign currency-denominated liabilities to total liabilities Net open position in equities to capital
Market liquidity	Average bid-ask spread in the securities market Average daily turnover ratio in the securities market
Nonbank financial institutions	Assets to total financial system assets Assets to GDP
Corporate sector	Total debt to equity Return on equity Earnings to interest and principal expenses Corporate net foreign exhange exposure to equity Number of applications for protection from creditors
Households	Household debt to GDP Household debt service and principal payments to income
Real estate markets	Real estate prices Residential real estate loans to total loans Commercial real estate loans to total loans

Source: Sundararajan and others (2002).

Annex 3.2. Groups of Selected Financial Institutions

Core Groups		Regions		Insurance Companies
Core 1	**Core 2**	**Europe**	**Asia/United States**	
Australia & New Zealand Banking Group	AIG	**Euro area**	**Asia**	AIG (AIG)
Bank of America	Ambac Financial	Intesa Sanpaolo (ISP)	Australia & New Zealand Banking Group (ANZ)	Allianz (ALV)
Bank of China	Bank of America	BNP Paribas (BNP)	Bank of China (BOC)	Ambac Financial (ABK)
Citigroup	Citigroup	Commerzbank (CBK)	DBS Group (DBS)	AXA (AXA)
Deutsche Bank	Deutsche Bank	Deutsche Bank (DBK)	ICICI Bank (IBN)	MBIA (MBI)
Goldman Sachs	Goldman Sachs	Fortis (FORB)	Industrial Bank of Korea (IBK)	Munich Re (MUV)
HSBC	HSBC	ING Group (INGA)	Mitsubishi UFJ Financial (MUF)	PMI (PMI)
Industrial Bank of Korea	JPMorgan Chase & Co.	Santander Hispano Group (SAN)	Nomura (NOM)	Prudential Plc (PRU)
JPMorgan Chase & Co.	Lehman Brothers	Société Generale (GLE)	State Bank of India (SBIN)	Swiss Re (RUKN)
Lehman Brothers	Merrill Lynch	UniCredito (UCG)	Sumitomo Mitsui Financial (SMF)	
Merrill Lynch	Morgan Stanley			
Mitsubishi UFJ	Royal Bank of Scotland	**Non-euro area**	**United States**	
Morgan Stanley	Swiss Re	Barclays (BARC)	Bank of America (BAC)	
Royal Bank of Scotland	UBS	Credit Suisse (CSGN)	Bear Stearns (BSC)	
UBS	Wachovia	Danske (DANSK)	Citigroup (C)	
Wachovia		HBOS (HBOS)	Goldman Sachs (GS)	
		HSBC (HSBA)	JPMorgan Chase & Co. (JPM)	
		LloydsTSB (LLOY)	Lehman Brothers (LEH)	
		Nordea (NDA)	Merrill Lynch (MER)	
		Royal Bank of Scotland (RBS)	Morgan Stanley (MS)	
		UBS (UBS)	Wachovia (WB)	

Annex 3.3. List of Intervened Financial Institutions

Date(s) of Intervention	Country	Institution
Intervened institutions - banks		
9/29/2008	United States	Wachovia
9/29/2008	Belgium/Netherlands/ Luxembourg	Fortis
10/3/2008	Belgium/Netherlands	Fortis
10/13/2008	United Kingdom	Royal Bank of Scotland, HBOS, LloydsTSB
10/16/2008	Switzerland	UBS
10/19/2008	Netherlands	ING Group
10/28/2008	United States	JPMorgan Chase & Co.
10/28/2008	United States	Bank of America
11/24/2008	United States	Citigroup
1/8/2009	Germany	Commerzbank
1/19/2009	United Kingdom	Royal Bank of Scotland
Intervened institutions - investment banks		
3/14/2008	United States	Bear Stearns
9/15/2008	United States	Lehman Brothers
9/15/2008	United States	Merrill Lynch
10/28/2008	United States	Goldman Sachs
10/28/2008	United States	Morgan Stanley
Intervened institutions - insurance companies		
9/16/2008	United States	AIG

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ANNEX

SUMMING UP BY THE ACTING CHAIR

The following remarks by the Acting Chair were made at the conclusion of the Executive Board's discussion of the Global Financial Stability Report *on March 30, 2009.*

Executive Directors observed that global financial stability has deteriorated further since the issuance of the September 2008 *Global Financial Stability Report* (GFSR), and broadly supported the staff's recommendations to mend financial systems. Shrinking economic activity has placed pressure on balance sheets of financial institutions as asset values have continued to decline, discouraging lending to households and corporations. The crisis, which originated in the advanced countries, has now spread to emerging market countries. The adverse feedback between economic activity and the financial sector has intensified and become more entrenched. These developments necessitate stronger policy responses and careful consideration of their cross-border implications. Directors stressed the importance of clear messages that integrate the conclusions of the GFSR and *World Economic Outlook* analyses.

With global economic activity contracting, macroeconomic risks have heightened, albeit not uniformly, alongside credit risks. Uncertainty about losses in financial institutions and the value of troubled assets continues to plague the financial systems in most advanced countries, leading to their inability to attract private capital, necessitating, in several cases, government infusions. Financial systems in these economies remain under severe stress. The deteriorating outlook for the household and corporate sectors is taking a toll on balance sheets, including for financial institutions. The retrenchment from foreign markets, particularly from emerging markets, is outpacing the overall deleveraging process, and is expected to yield a deep and long-lasting global credit crunch. Breaking this downward spiral requires strong political commitment and further enhancement of international cooperation. Encouraging signs have recently been in evidence.

Directors endorsed the report's main findings that further policy actions are needed to: (1) continue to provide liquidity; (2) recapitalize weak, but viable, systemically important financial institutions; and (3) deal with troubled assets on banks' balance sheets. Such actions would assist in smoothing the necessary deleveraging process, reduce uncertainties, and facilitate the continued provision of credit to the real economy. Directors acknowledged that policymakers have already undertaken significant and unprecedented actions in these three areas, but agreed that additional actions are needed reflecting varying country circumstances and policy responses to date. Directors highlighted the difficulty, especially given current high uncertainties, in estimating writedowns and recapitalization needs, calling for balanced and considered assessments.

Directors agreed that the differences in the problems faced by banking systems and the degree to which they have bad assets will help determine the most appropriate approach for a country. It is crucial to choose an approach; ensure that it is adequately funded; implement it in a clear manner; and coordinate with other countries the underlying principles to be applied when valuing the assets and determining the share of losses to be borne by the public sector. Some Directors noted that the Japanese experience of the 1990s suggests that troubled assets are best dealt with a "bad bank" or a stand-alone entity wholly owned by the govern-

ment. Others considered that private/public partnerships, like the one recently proposed by the United States Treasury, could work if properly structured to provide incentives for sufficient private involvement, while maintaining a suitable return for taxpayers and appropriate oversight to ensure that the policy objectives are met. A few Directors suggested that temporary government ownership may be necessary in some instances, but only with the intention of restructuring the financial institution for privatization as rapidly as possible.

Directors emphasized that financial support packages should fully take into account the transfer of financial risks from the private sector to the public sector—both the government and central bank. Combined with longer-term pressures from aging populations, fiscal stimulus and financial support packages could significantly increase public debt, raising in some cases market concerns about fiscal sustainability. Directors therefore stressed the importance of credible, medium-term strategies of fiscal consolidation. In light of fiscal pressures, a few Directors also suggested that private sector participation in bank recapitalization should be further encouraged to the extent feasible.

Directors generally supported the report's recommendation to expand the perimeter of prudential regulation to encompass all systemically important financial institutions, including nonbank financial intermediaries. Some Directors also saw merit in the staff's recommendation to include "financial stability" in the mandates of central banks, regulators, and supervisors, noting that macro-prudential oversight should be better integrated with financial supervision. Directors concurred with staff about the need to strengthen the global financial infrastructure to lower systemic risk from counterparty exposure—such as by credit default swap clearing mechanisms. At the same time, a few Directors stressed that a single global clearing facility would not necessarily be the optimal outcome for credit default swap markets.

Directors expressed concern at the widening impact of the global financial crisis on emerging market countries, while recognizing the significant differences both across and within regions. Some Directors considered staff analysis for emerging markets too pessimistic, while many Directors viewed it as insufficiently differentiated. Emerging European economies have been hardest hit, reflecting some countries' large domestic and external imbalances and excessive credit growth. External refinancing risks for banks and nonfinancial corporations in some emerging market countries are of particular concern, as are household exposures to foreign currency mortgages. Directors noted that advanced country sovereign borrowing, as well as their debt guarantees to financial entities, might serve to crowd out financing demands from emerging markets, while home country bias in some policy actions could exacerbate the credit crunch in foreign markets.

Directors agreed that, to the extent that domestic central banks are unable to supply the needed foreign exchange for refinancing, advanced country central banks, the IMF, and other international organizations could play a useful role through their various swap lines and other facilities. In particular, Directors stressed the crucial role being played by the IMF and recent Fund efforts to modernize its lending toolkit, including the new Flexible Credit Line, to revamp conditionality, and to expand its lending capacity. They also noted the contributions being made in Europe by the doubling in the European Union's balance of payments assistance facility and the EBRD/EIB/IBRD support to regional banks.

Given the global reach of the crisis and the prevalence of cross-border issues, the effect of national policies can be strengthened if implemented in a coordinated and cooperative fashion among affected countries. Cross-border coordination can ensure a more consistent approach and help avoid regulatory arbitrage, competitive distortions, and financial protectionism. The specific design of policies would appropriately vary from country to country, but policymakers should avoid policies, such as the

favoring of domestic over foreign lending, that could lead to distortions.

Directors saw the staff's analytical work provided in Chapters 2 and 3 as demonstrating the key role that the IMF can play in global financial surveillance, especially identifying systemic risks and detecting potential crises. The tools discussed in those chapters may provide the basis to examine systemic risks more analytically, particularly those arising from financial linkages and networks. Directors agreed on the need to strengthen the monitoring and understanding of direct and indirect financial linkages in part to identify systemically important financial institutions and shed light on the "too-connected-to fail" problem. Recognizing that these techniques require further development before they could provide policy direction, Directors encouraged additional research and data collection, including off-balance-sheet exposures.

Directors underlined the potential contribution of the work in Chapter 3 for the IMF's surveillance role, particularly its early warning exercise and efforts to strengthen the Fund's oversight of advanced economies and major financial centers. The ability to detect when a financial disturbance becomes a systemic crisis would provide a means of determining when certain policy tools designed to contain the crisis may be best employed. Some Directors also underscored that every measure of systemic risk has limitations to some degree; they noted that the analysis would have been able to pick up early signals of the current episode of systemic distress using market prices, but agreed with staff that it would be difficult to distinguish false from real alarms ex ante. Nonetheless, such signals could be used to prompt more direct investigation of the nature of the problem. Directors supported the notion that certain market prices, such as equity options and credit default swap spreads, could be helpful indicators in providing the basis for an assessment of "tail risks"—those risks that often precede or accompany systemic crises.

STATISTICAL APPENDIX

This statistical appendix presents data on financial developments in key financial centers and emerging markets. It is designed to complement the analysis in the text by providing additional data that describe key aspects of financial market developments. These data are derived from a number of sources external to the IMF, including banks, commercial data providers, and official sources, and are presented for information purposes only; the IMF does not, however, guarantee the accuracy of the data from external sources.

Presenting financial market data in one location and in a fixed set of tables and charts, in this and future issues of the GFSR, is intended to give the reader an overview of developments in global financial markets. Unless otherwise noted, the statistical appendix reflects information available up to February 25, 2009.

Mirroring the structure of the chapters of the report, the appendix presents data separately for key financial centers and emerging market countries. Specifically, it is organized into three sections:

- Figures 1–14 and Tables 1–9 contain information on market developments in key financial centers. This includes data on global capital flows, and on markets for foreign exchange, bonds, equities, and derivatives as well as sectoral balance sheet data for the United States, Japan, and Europe.
- Figures 15 and 16, and Tables 10–21 present information on financial developments in emerging markets, including data on equity, foreign exchange, and bond markets, as well as data on emerging market financing flows.
- Tables 22–27 report key financial soundness indicators for selected countries, including bank profitability, asset quality, and capital adequacy.

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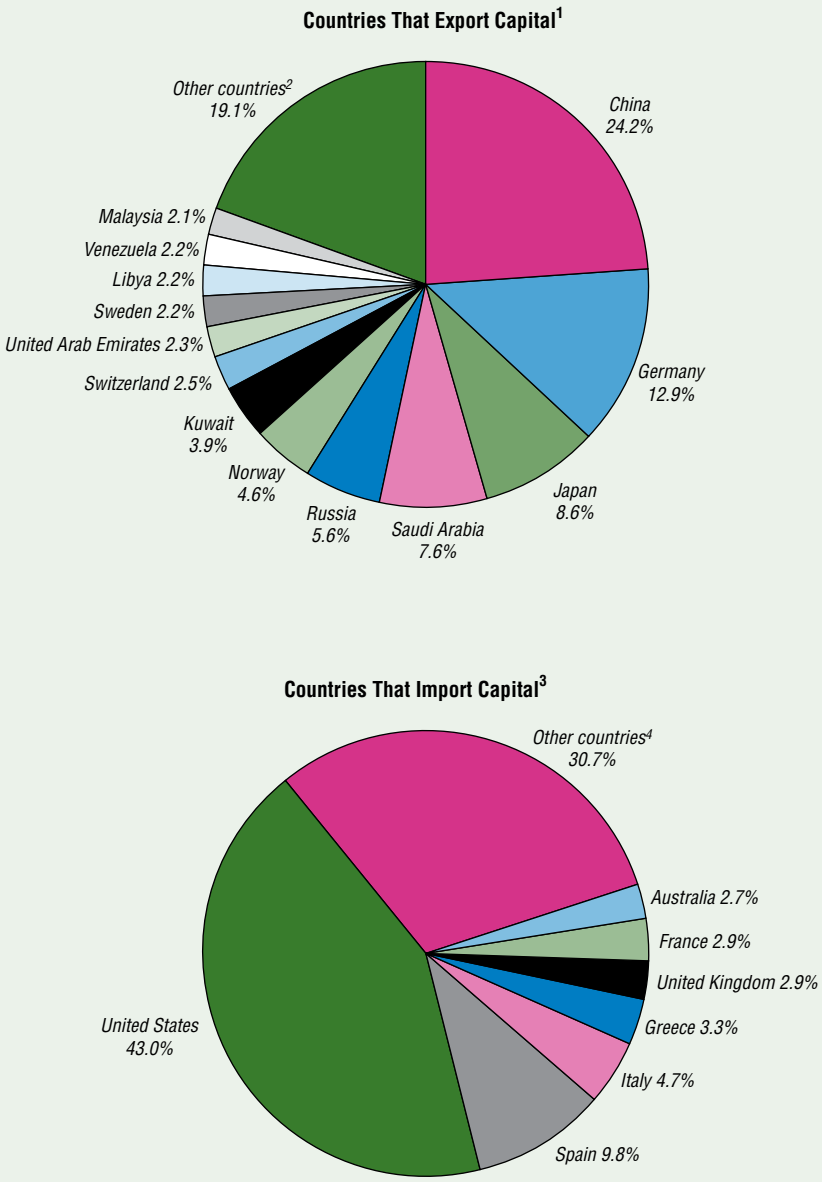
Financial Soundness Indicators

Figure 1. Major Net Exporters and Importers of Capital in 2008



Source: IMF, World Economic Outlook database as of April 16, 2009.

[1]As measured by countries' current account surplus (assuming errors and omissions are part of the capital and financial accounts).

[2]Other countries include all countries with shares of total surplus less than 2.1 percent.

[3]As measured by countries' current account deficit (assuming errors and omissions are part of the capital and financial accounts).

[4]Other countries include all countries with shares of total deficit less than 2.7 percent.

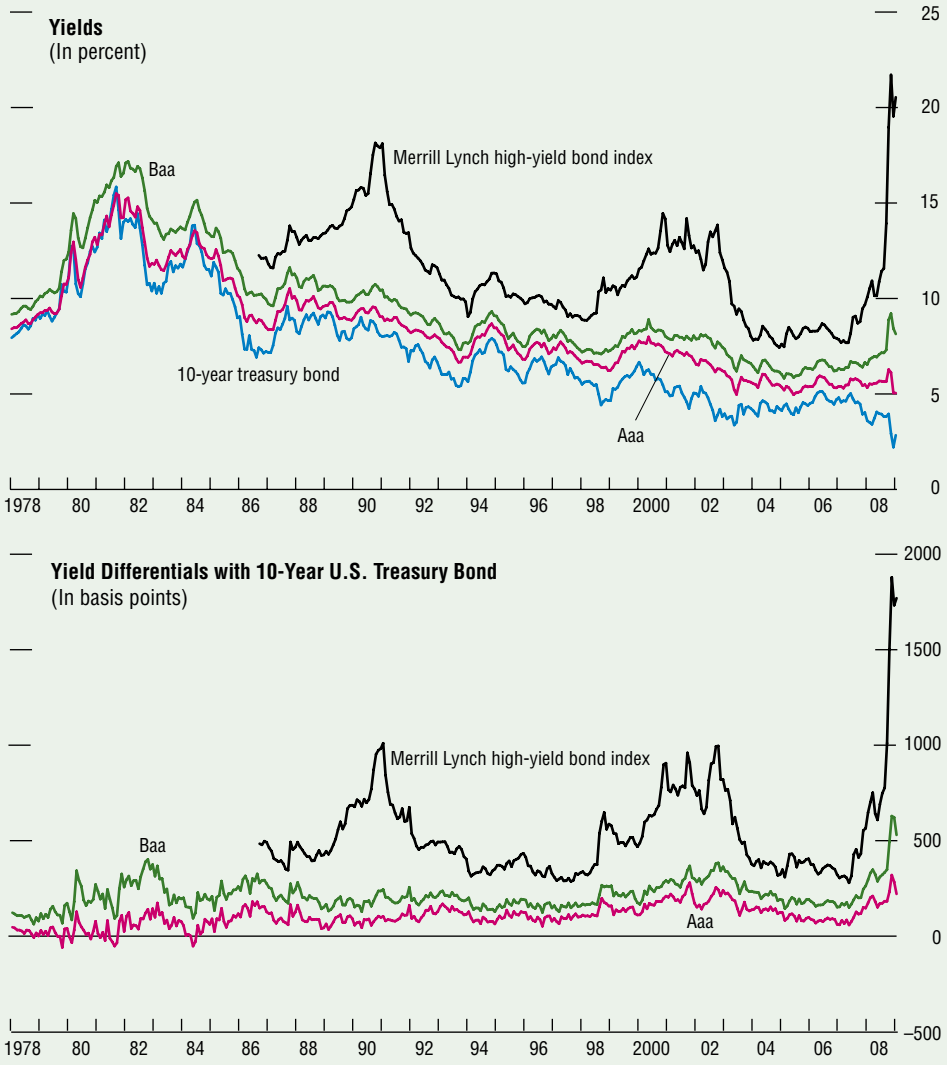
Figure 2. Exchange Rates: Selected Major Industrial Countries

(Weekly data)

Sources: Bloomberg L.P.; and the IMF Global Data System.
Note: In each panel, the effective and bilateral exchange rates are scaled so that an upward movement implies an appreciation of the respective local currency.
[1]Local currency units per U.S. dollar except for the euro area and the United Kingdom, for which data are shown as U.S. dollars per local currency.
[2]2000 = 100; constructed using 1999–2001 trade weights.

Figure 3. United States: Yields on Corporate and Treasury Bonds

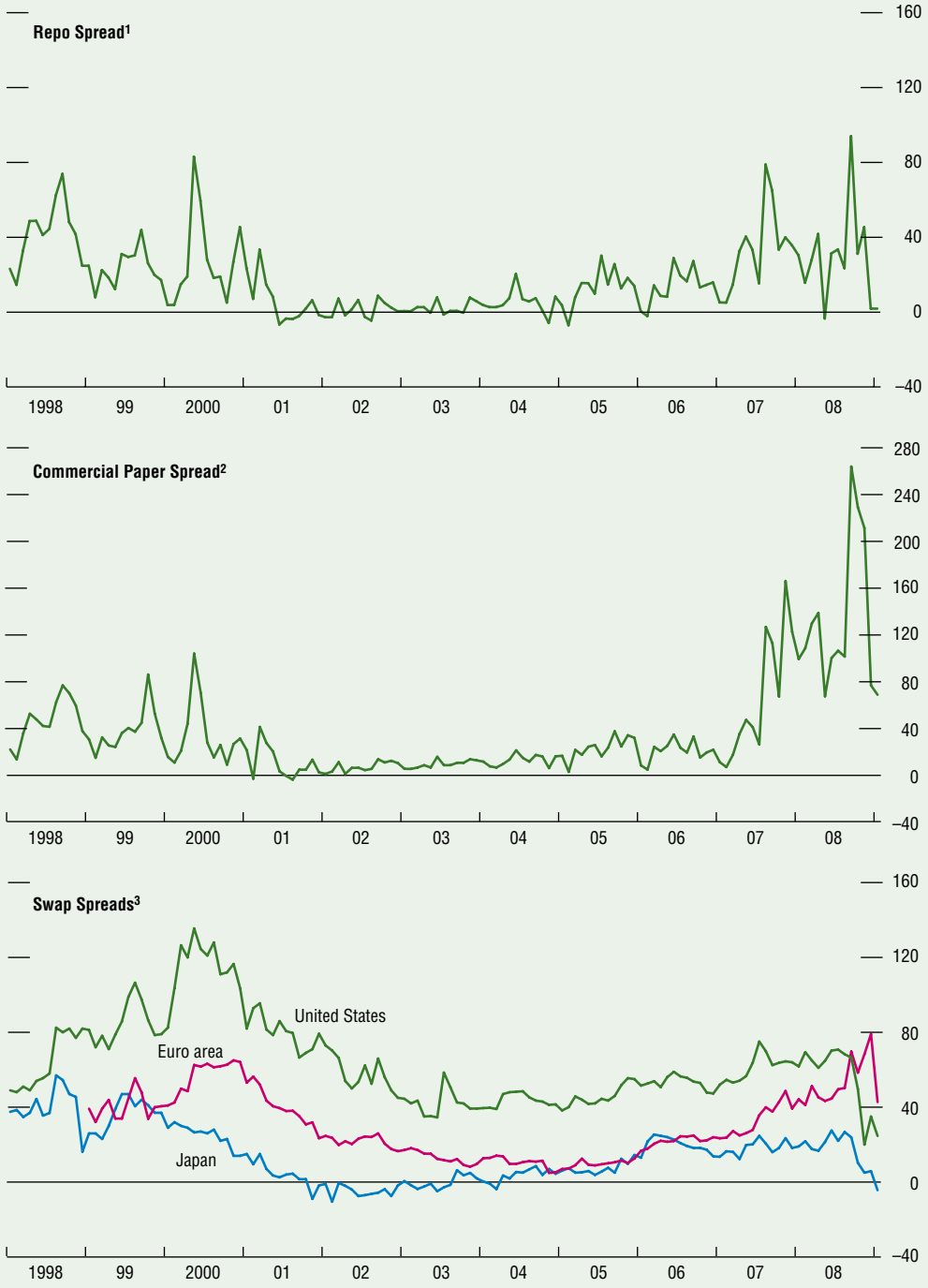
(Monthly data)



Sources: Bloomberg L.P.; and Merrill Lynch.

Figure 4. Selected Spreads

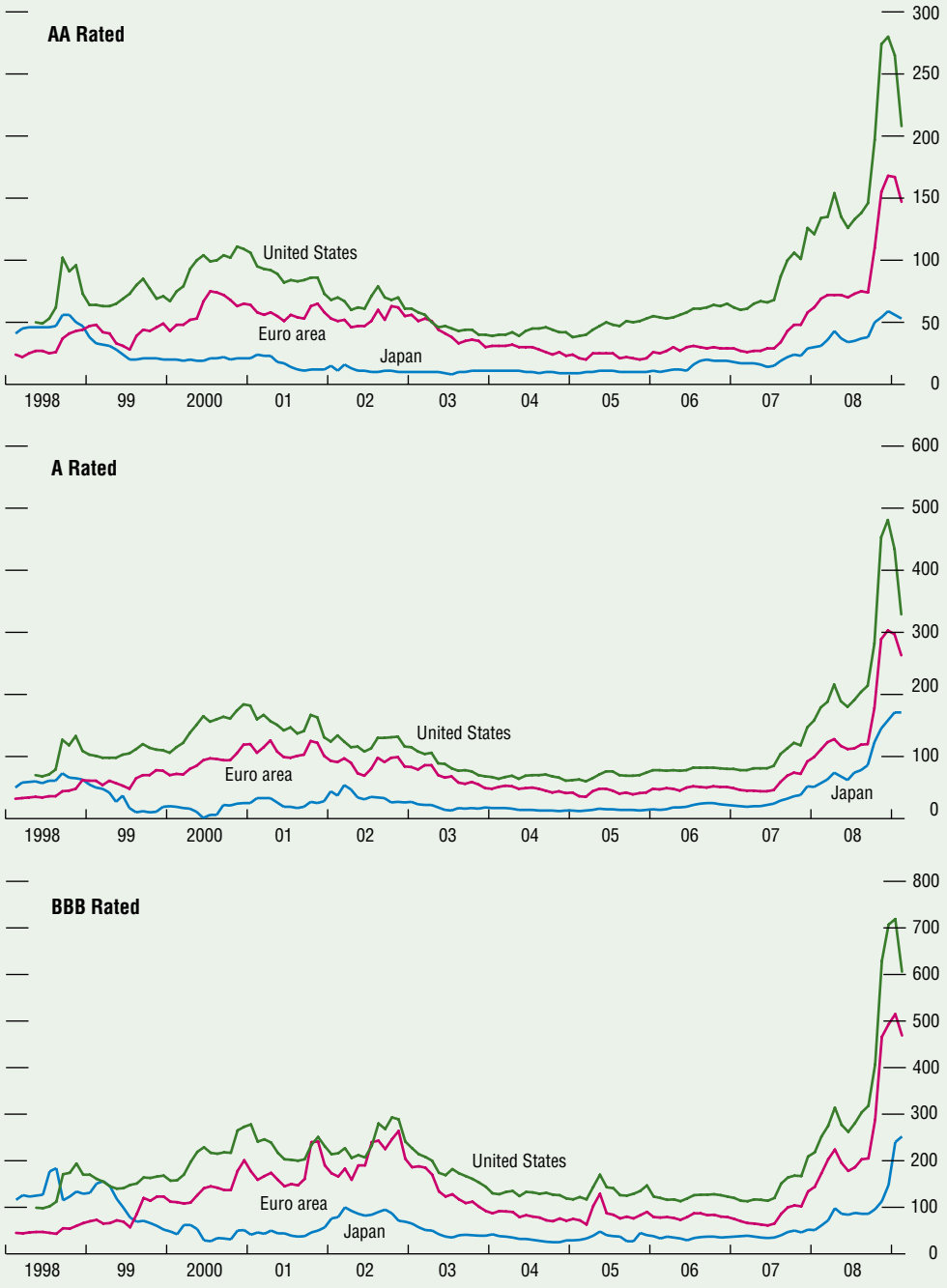
(In basis points; monthly data)



Sources: Bloomberg L.P.; and Merrill Lynch.
[1]Spread between yields on three-month U.S. treasury repo and on three-month U.S. treasury bill.
[2]Spread between yields on 90-day investment-grade commercial paper and on three-month U.S. treasury bill.
[3]Spread over 10-year government bond.

Figure 5. Nonfinancial Corporate Credit Spreads

(In basis points; monthly data)



Source: Merrill Lynch.
Note: Option-adjusted spread.

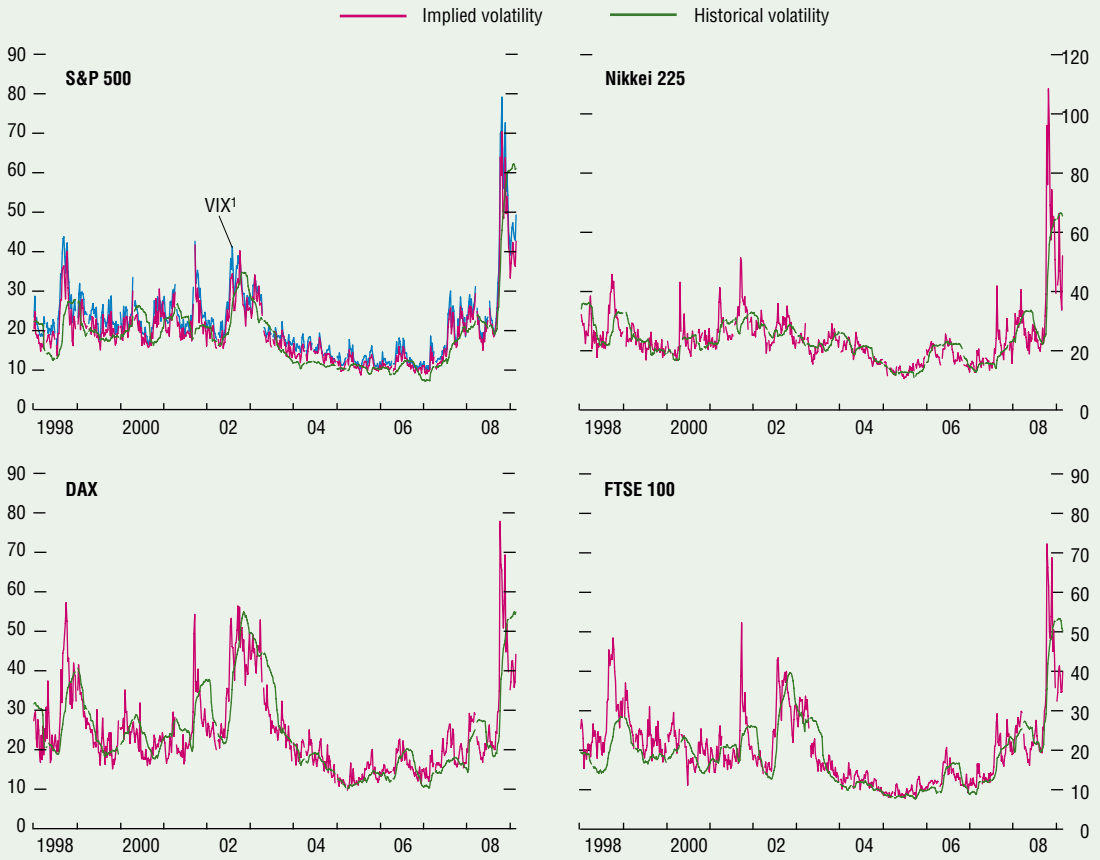
Figure 6. Equity Markets: Price Indices

(January 1, 1990 = 100; weekly data)

Source: Bloomberg L.P.

Figure 7. Implied and Historical Volatility in Equity Markets

(Weekly data)



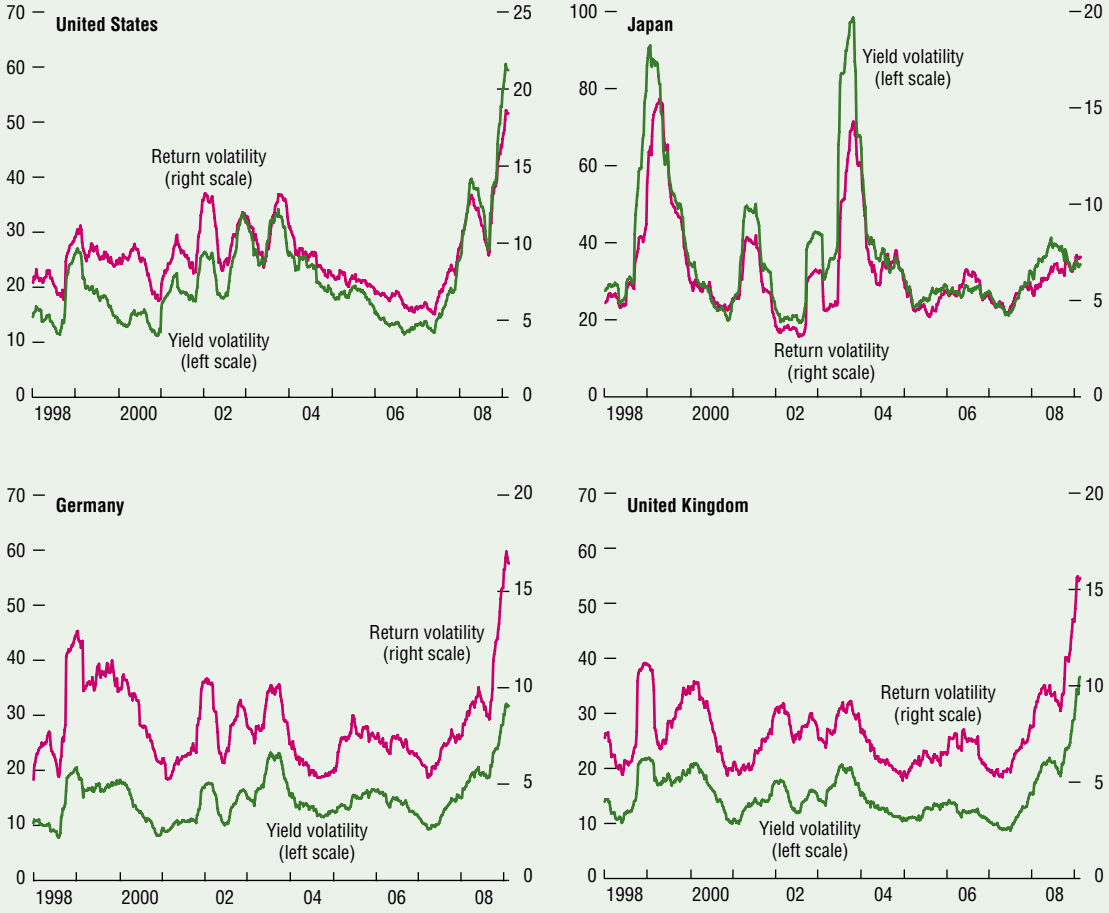
Sources: Bloomberg L.P.; and IMF staff estimates.

Note: Implied volatility is a measure of the equity price variability implied by the market prices of call options on equity futures. Historical volatility is calculated as a rolling 100-day annualized standard deviation of equity price changes. Volatilities are expressed in percent rate of change.

[1]VIX is the Chicago Board Options Exchange volatility index. This index is calculated by taking a weighted average of implied volatility for the eight S&P 500 calls and puts.

Figure 8. Historical Volatility of Government Bond Yields and Bond Returns for Selected Countries[1]

(Weekly data)



Sources: Bloomberg L.P.; and Datastream.

[1]Volatility calculated as a rolling 100-day annualized standard deviation of changes in yield and returns on 10-year government bonds. Returns are based on 10-plus-year government bond indices.

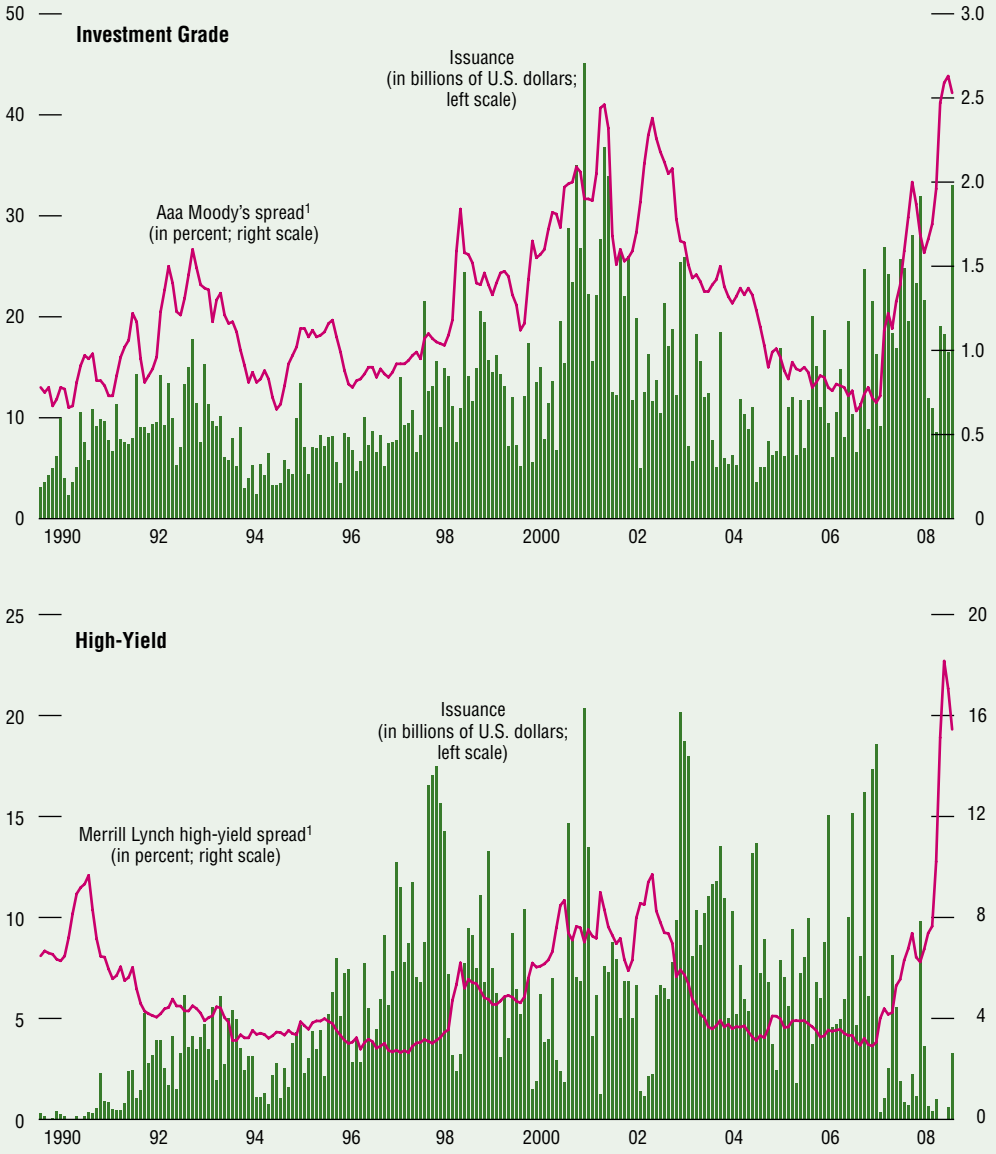
Figure 9. Twelve-Month Forward Price/Earnings Ratios

Source: I/B/E/S.

Figure 10. Flows into U.S.-Based Equity Funds

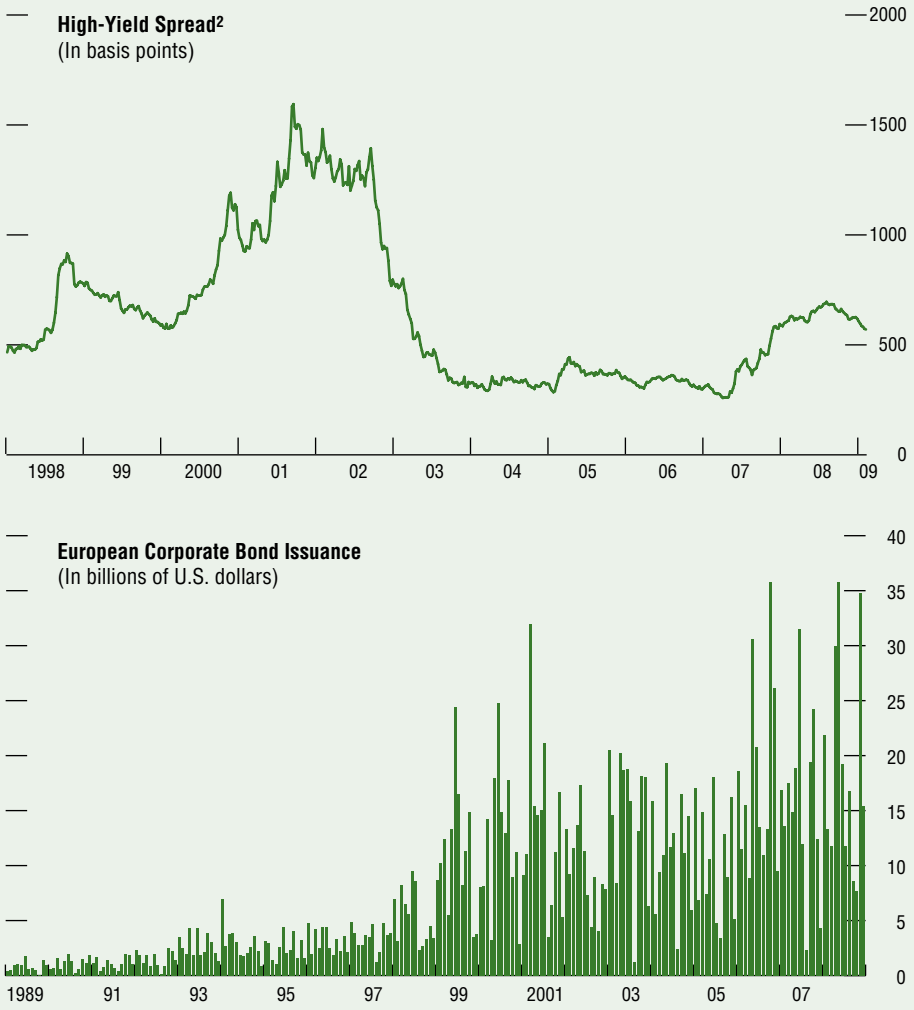
Sources: Investment Company Institute; and Datastream.
[1]In billions of U.S. dollars.

Figure 11. United States: Corporate Bond Market



Sources: Board of Governors of the Federal Reserve System; and Bloomberg L.P.
[1]Spread against yield on 10-year U.S. government bonds.

Figure 12. Europe: Corporate Bond Market[1]

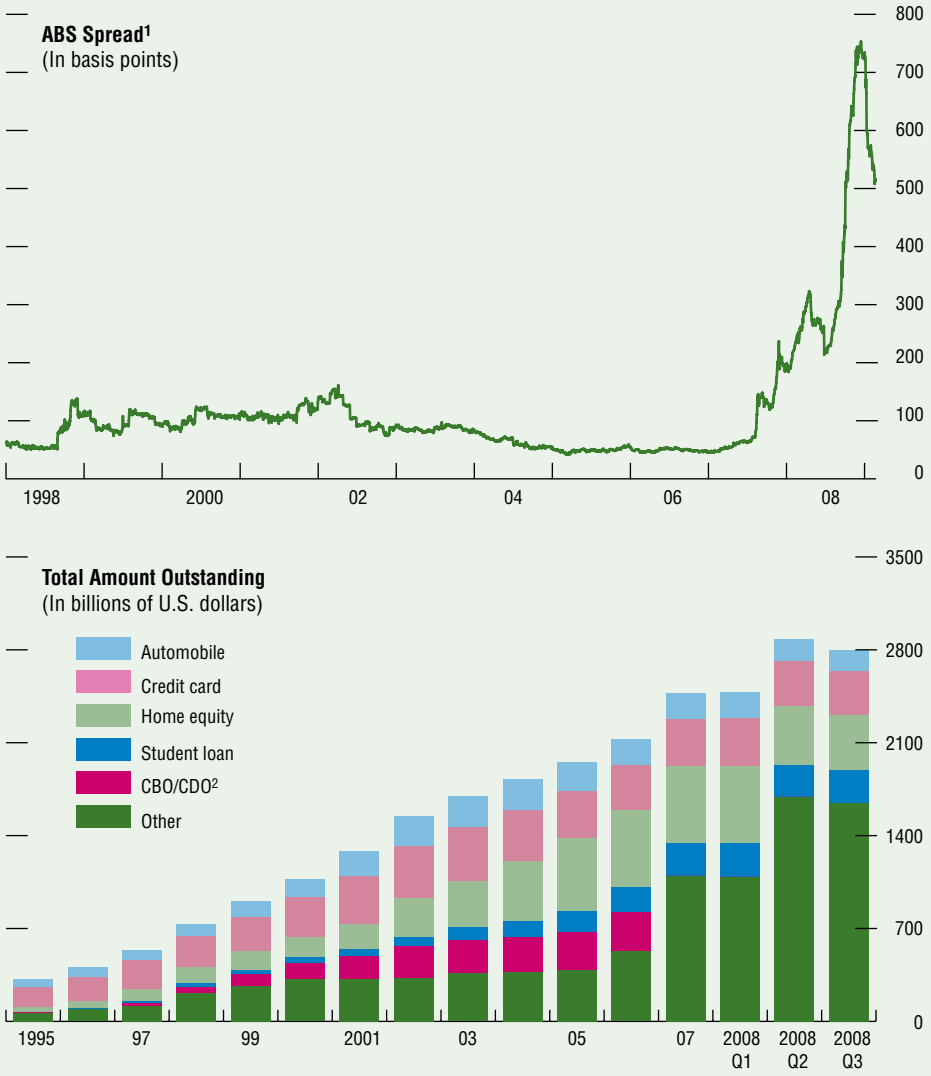


Sources: DCM Analytics; and Datastream.
[1]Nonfinancial corporate bonds.
[2]Spread between yields on a Merrill Lynch High-Yield European Issuers Index bond and a 10-year German government benchmark bond.

Figure 13. United States: Commercial Paper Market[1]

Source: Board of Governors of the Federal Reserve System.
[1]Nonfinancial commercial paper.
[2]Difference between 30-day A2/P2 and AA commercial paper.

Figure 14. United States: Asset-Backed Securities



Sources: Merrill Lynch; Datastream; and the Securities Industry and Financial Markets Association.
[1]Merrill Lynch AAA Asset-Backed Master Index (fixed rate) option-adjusted spread.
[2]Collateralized bond/debt obligations; from 2007 onward, CBO/CDO amount outstanding is included in Other.

Table 1. Global Capital Flows: Inflows and Outflows[1]

(In billions of U.S. dollars)

	Inflows										
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
United States											
Direct investment	105.6	179.0	289.4	321.3	167.0	84.4	63.8	146.0	112.6	242.0	237.5
Portfolio investment	333.1	187.6	285.6	436.6	428.3	427.6	550.2	867.3	832.0	1,126.9	1,145.1
Other investment	265.7	54.2	167.2	280.4	187.5	283.2	244.4	519.9	302.7	692.3	675.0
Reserve assets	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total capital flows	704.4	420.8	742.2	1,038.2	782.9	795.2	858.3	1,533.2	1,247.3	2,061.1	2,057.7
Canada											
Direct investment	11.5	22.7	24.8	66.1	27.7	22.1	7.2	–0.7	27.2	62.8	111.8
Portfolio investment	11.7	16.6	2.7	10.3	24.2	11.9	14.1	41.8	7.8	27.9	–32.5
Other investment	28.0	5.4	–10.8	0.8	7.8	5.1	12.3	–3.9	29.8	30.8	56.8
Reserve assets	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total capital flows	51.2	44.8	16.6	77.2	59.7	39.0	33.6	37.1	64.8	121.5	136.0
Japan											
Direct investment	3.2	3.3	12.3	8.2	6.2	9.1	6.2	7.8	3.2	–6.8	22.2
Portfolio investment	79.2	56.1	126.9	47.4	60.5	–20.0	81.2	196.7	183.1	198.6	196.6
Other investment	68.0	–93.3	–265.1	–10.2	–17.6	26.6	34.1	68.3	45.9	–89.1	48.9
Reserve assets	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total capital flows	150.4	–34.0	–125.9	45.4	49.1	15.7	121.5	272.8	232.3	102.6	267.7
United Kingdom											
Direct investment	37.5	74.7	89.3	122.2	53.8	25.5	27.6	57.3	177.4	146.1	197.8
Portfolio investment	43.7	35.2	171.3	268.1	59.1	74.3	172.8	162.2	243.8	283.3	415.6
Other investment	322.2	110.5	87.1	365.1	346.6	92.7	387.9	779.8	898.3	686.3	1,428.8
Reserve assets	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total capital flows	403.4	220.3	347.8	755.3	459.5	192.6	588.3	999.4	1,319.5	1,115.7	2,042.2
Euro area											
Direct investment	. . .	. . .	216.3	416.3	199.8	185.0	153.2	121.4	189.2	258.7	391.0
Portfolio investment	. . .	. . .	305.1	268.1	318.3	298.4	383.3	520.0	682.4	1,008.8	891.7
Other investment	. . .	. . .	198.4	340.3	238.1	59.9	198.0	355.8	798.7	881.8	1,255.8
Reserve assets	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total capital flows	. . .	. . .	719.8	1,024.7	756.3	543.2	734.5	997.1	1,670.3	2,149.3	2,538.5
Emerging Markets and Developing Countries[2]											
Direct investment	191.4	186.7	212.0	212.0	227.9	190.1	203.8	276.4	374.2	464.0	532.5
Portfolio investment	146.4	38.1	107.6	96.8	16.0	–7.8	91.8	138.6	213.2	347.2	474.8
Other investment	138.3	–122.6	–88.7	2.1	–56.6	3.3	124.1	200.4	170.9	362.7	967.6
Reserve assets	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total capital flows	476.1	102.3	230.8	310.9	187.3	185.6	419.7	615.4	758.3	1,173.9	1,974.9

Sources: IMF, International Financial Statistics and World Economic Outlook databases as of April 16, 2009.

[1]The total net capital flows are the sum of direct investment, portfolio investment, other investment flows, and reserve assets. "Other investment" includes bank loans and deposits.

[2]This aggregate comprises the group of Other Emerging Market and Developing Countries defined in the World Economic Outlook, together with Hong Kong SAR, Israel, Korea, Singapore, and Taiwan Province of China.

Outflows										
1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
–104.8	–142.6	–224.9	–159.2	–142.4	–154.5	–149.6	–316.2	–36.2	–241.2	–333.3
–116.9	–130.2	–122.2	–127.9	–90.6	–48.6	–123.1	–177.4	–257.5	–499.0	–294.6
–262.8	–74.2	–165.6	–273.1	–144.7	–87.9	–54.3	–510.1	–267.0	–513.9	–661.9
–1.0	–6.7	8.7	–0.3	–4.9	–3.7	1.5	2.8	14.1	2.4	–0.1
–485.5	–353.8	–504.1	–560.5	–382.6	–294.7	–325.4	–1,000.9	–546.6	–1,251.7	–1,289.9
–23.1	–34.1	–17.3	–44.5	–36.2	–26.8	–23.6	–42.6	–29.7	–39.3	–54.0
–8.6	–15.1	–15.6	–43.0	–24.4	–18.6	–13.8	–18.9	–44.1	–69.2	–42.8
–16.2	9.4	10.2	–4.2	–10.7	–7.9	–14.2	–7.1	–16.6	–31.0	–55.1
2.4	–5.0	–5.9	–3.7	–2.2	0.2	3.3	2.8	–1.3	–0.8	–3.9
–45.4	–44.8	–28.5	–95.4	–73.4	–53.2	–48.4	–65.8	–91.7	–140.3	–155.8
–26.1	–24.6	–22.3	–31.5	–38.5	–32.0	–28.8	–31.0	–45.4	–50.2	–73.5
–47.1	–95.2	–154.4	–83.4	–106.8	–85.9	–176.3	–173.8	–196.4	–71.0	–123.5
–192.0	37.9	266.3	–4.1	46.6	36.4	149.9	–48.0	–106.6	–86.2	–260.8
–6.6	6.2	–76.3	–49.0	–40.5	–46.1	–187.2	–160.9	–22.3	–32.0	–36.5
–271.6	–75.8	13.4	–168.0	–139.2	–127.7	–242.3	–413.6	–370.8	–239.4	–494.2
–60.9	–122.8	–202.5	–246.3	–61.8	–50.3	–65.6	–93.9	–80.8	–89.5	–275.5
–85.0	–53.2	–34.3	–97.2	–124.7	1.2	–58.4	–259.2	–273.6	–256.6	–179.7
–277.8	–22.9	–68.7	–374.4	–250.8	–108.5	–420.9	–596.1	–926.2	–707.9	–1,483.8
3.9	0.3	1.0	–5.3	4.5	0.6	2.6	–0.4	–1.7	1.3	–2.6
–419.8	–198.6	–304.5	–723.2	–432.9	–157.0	–542.4	–949.6	–1,282.3	–1,052.7	–1,941.6
. . .	. . .	–348.8	–413.7	–298.0	–163.8	–165.4	–205.1	–459.7	–448.0	–552.0
. . .	. . .	–341.7	–385.3	–255.0	–163.2	–318.3	–428.1	–512.4	–667.8	–585.1
. . .	. . .	–30.2	–165.8	–243.6	–220.7	–284.1	–392.5	–689.8	–907.1	–1,157.8
. . .	. . .	11.6	16.2	16.4	–3.0	32.8	15.6	22.9	–2.6	–6.0
. . .	. . .	–709.2	–948.7	–780.1	–550.7	–735.1	–1,010.1	–1,639.1	–2,025.5	–2,300.8
–41.7	–44.0	–54.6	–100.6	–52.1	–49.7	–42.7	–130.2	–145.4	–262.3	–332.3
–110.8	–10.0	–44.1	–105.8	–110.1	–90.0	–129.7	–170.5	–263.8	–528.6	–511.2
–134.4	33.3	–59.7	–131.5	43.2	14.6	–140.3	–198.4	–261.1	–415.0	–782.3
–90.0	–28.4	–100.3	–139.8	–132.7	–191.3	–360.6	–501.9	–585.7	–751.7	–1,257.8
–376.8	–49.1	–258.7	–477.7	–251.7	–316.4	–673.3	–1,001.0	–1,256.0	–1,957.6	–2,883.5

Table 2. Global Capital Flows: Amounts Outstanding and Net Issues of International Debt Securities by Currency of Issue and Signed International Syndicated Credit Facilities by Nationality of Borrower

(In billions of U.S. dollars)

	2004	2005	2006	2007	2008 Q1	2008 Q2	2008 Q3
Amounts outstanding of international debt securities by currency of issue							
U.S. dollar	4,905.2	5,378.8	6,390.4	7,539.4	7,724.8	8,120.7	8,161.1
Japanese yen	530.1	471.7	486.9	577.6	664.8	641.3	657.1
Pound sterling	979.5	1,061.3	1,446.4	1,704.6	1,723.0	1,871.4	1,845.0
Canadian dollar	112.4	146.6	177.9	266.2	264.5	288.6	285.0
Swedish krona	20.9	23.2	34.3	46.7	50.8	56.0	50.0
Swiss franc	227.9	208.6	253.6	301.5	343.5	340.2	318.5
Euro	6,209.2	6,306.2	8,301.2	10,531.0	11,428.3	11,864.0	10,789.2
Other	284.9	354.4	454.4	610.7	654.4	704.0	635.2
Total	13,270.2	13,950.7	17,545.2	21,577.6	22,854.2	23,886.2	22,741.1
Net issues of international debt securities by currency of issue							
U.S. dollar	368.9	473.6	1,011.7	1,149.0	185.4	395.8	40.4
Japanese yen	26.9	3.8	19.4	67.2	6.5	16.1	8.3
Pound sterling	132.1	197.6	221.2	226.8	30.9	144.1	152.9
Canadian dollar	25.5	29.4	32.1	51.1	9.0	21.7	3.8
Swedish krona	3.4	6.2	7.0	9.4	0.4	5.7	1.0
Swiss franc	12.7	13.1	28.0	24.4	1.7	4.8	4.9
Euro	917.6	985.9	1,200.7	1,148.9	109.1	466.2	28.4
Other	52.2	86.9	79.2	106.4	30.2	31.4	7.1
Total	1,539.3	1,796.5	2,599.4	2,783.2	373.2	1,085.8	246.7
Signed international syndicated credit facilities by nationality of borrower							
All countries	1,346.8	1,725.1	2,064.0	2,667.4	437.6	482.1	424.5
Industrial countries	1,192.5	1,489.4	1,722.1	2,181.4	361.4	367.0	314.5
Of which:							
United States	643.1	700.7	778.3	1,041.4	117.3	171.0	147.5
Japan	31.9	27.6	52.0	54.7	16.1	6.6	8.8
Germany	87.2	84.3	133.0	118.6	10.5	11.4	12.1
France	67.9	112.5	101.1	146.7	35.2	33.1	15.0
Italy	21.3	40.8	38.9	35.3	0.9	17.0	3.8
United Kingdom	123.7	158.3	189.4	252.3	86.0	34.5	26.5
Canada	22.0	40.2	61.5	82.0	14.4	10.7	8.3

Source: Bank for International Settlements.

Table 3. Selected Indicators on the Size of the Capital Markets, 2007

(In billions of U.S. dollars unless noted otherwise)

	GDP	Total Reserves Minus Gold[1]	Stock Market Capitalization	Debt Securities			Bank Assets	Bonds, Equities, and Bank Assets[2]	Bonds, Equities, and Bank Assets[2] *(In percent of GDP)*
				Public	Private	Total			
World	54,840.9	6,449.1	65,105.6	28,629.3	51,585.8	80,215.1	95,768.5	241,089.3	439.6
European Union	15,741.1	279.7	14,730.9	8,778.3	19,432.3	28,210.5	48,462.0	91,403.5	580.7
Euro area	12,220.6	172.1	10,040.1	7,606.4	15,397.8	23,004.2	35,097.1	68,141.5	557.6
North America	15,243.6	100.5	22,108.8	7,419.2	24,491.9	31,911.1	13,851.9	67,871.8	445.2
Canada	1,436.1	41.0	2,186.6	823.3	763.6	1,586.9	2,657.8	6,431.3	447.8
United States	13,807.6	59.5	19,922.3	6,595.9	23,728.3	30,324.2	11,194.1	61,440.6	445.0
Japan	4,384.4	952.8	4,663.8	7,147.7	2,066.0	9,213.7	10,086.9	23,964.3	546.6
Memorandum items:									
EU countries									
Austria	371.2	10.7	236.4	217.3	438.4	655.6	615.9	1,508.0	406.2
Belgium	459.0	10.4	404.4	506.7	547.5	1,054.2	2,324.4	3,783.0	824.1
Denmark	310.5	32.5	290.9	93.3	613.9	707.2	1,082.4	2,080.6	670.1
Finland	246.2	7.1	359.1	130.1	121.7	251.8	303.4	914.3	371.3
France	2,593.8	45.7	2,737.1	1,447.2	2,923.8	4,370.9	10,230.4	17,338.4	668.5
Germany	3,320.9	44.3	2,105.2	1,700.3	3,902.3	5,602.7	6,600.1	14,308.0	430.8
Greece	312.8	0.6	265.0	453.8	134.0	587.8	513.0	1,365.7	436.7
Ireland	261.2	0.8	143.9	58.9	518.6	577.5	1,630.7	2,352.1	900.4
Italy	2,117.5	28.4	1,072.5	2,019.0	2,183.9	4,202.9	4,336.0	9,611.5	453.9
Luxembourg	49.7	0.1	166.1	0.0	94.6	94.6	1,347.6	1,608.3	3,234.4
Netherlands	777.2	10.3	574.5	315.6	1,698.4	2,014.0	3,869.0	6,457.6	830.8
Portugal	223.7	1.3	147.2	174.0	269.9	443.9	280.4	871.5	389.5
Spain	1,440.0	11.5	1,799.8	580.0	2,564.1	3,144.2	2,979.4	7,923.4	550.2
Sweden	453.8	27.0	576.9	168.6	493.1	661.6	694.3	1,932.8	425.9
United Kingdom	2,803.4	49.0	3,851.7	913.5	2,928.0	3,841.5	11,655.0	19,348.2	690.2
Emerging market countries[3]	17,270.8	4,034.7	20,950.2	5,001.3	2,795.6	7,796.9	18,258.1	47,005.2	272.2
Of which:									
Asia	7,680.4	2,138.8	13,782.7	2,645.8	1,826.9	4,472.7	11,620.2	29,875.6	389.0
Latin America	3,641.0	445.2	2,292.2	1,456.5	628.6	2,085.1	2,260.8	6,638.1	182.3
Middle East	1,557.8	312.6	1,275.9	39.5	84.3	123.8	1,335.6	2,735.3	175.6
Africa	1,101.7	289.5	1,181.7	89.0	78.9	168.0	864.5	2,214.2	201.0
Europe	3,289.9	848.6	2,417.6	770.4	176.9	947.3	2,177.0	5,541.9	168.5

Sources: World Federation of Exchanges; Bank for International Settlements; International Monetary Fund, International Financial Statistics (IFS) and World Economic Outlook database as of April 16, 2009; ©2003 Bureau van Dijk Electronic Publishing-Bankscope; and Standard & Poor's Emerging Markets Database.

[1]Data are from IFS.

[2]Sum of the stock market capitalization, debt securities, and bank assets.

[3]This aggregate comprises the group of Other Emerging Market and Developing Countries defined in the World Economic Outlook, together with Hong Kong SAR, Israel, Korea, Singapore, and Taiwan Province of China.

Table 4. Global Over-the-Counter Derivatives Markets: Notional Amounts and Gross Market Values of Outstanding Contracts[1]

(In billions of U.S. dollars)

	Notional Amounts					Gross Market Values				
	End-June 2006	End-Dec. 2006	End-June 2007	End-Dec. 2007	End-June 2008	End-June 2006	End-Dec. 2006	End-June 2007	End-Dec. 2007	End-June 2008
Total	**370,178**	**414,845**	**516,407**	**595,341**	**683,725**	**9,949**	**9,691**	**11,140**	**15,813**	**20,353**
Foreign exchange	**38,127**	**40,271**	**48,645**	**56,238**	**62,983**	**1,136**	**1,266**	**1,345**	**1,807**	**2,262**
Forwards and forex swaps	19,407	19,882	24,530	29,144	31,966	436	469	492	675	802
Currency swaps	9,696	10,792	12,312	14,347	16,307	535	601	619	817	1,071
Options	9,024	9,597	11,804	12,748	14,710	165	196	235	315	388
Interest rate[2]	**262,526**	**291,582**	**347,312**	**393,138**	**458,304**	**5,445**	**4,826**	**6,063**	**7,177**	**9,263**
Forward rate agreements	18,117	18,668	22,809	26,599	39,370	25	32	43	41	88
Swaps	207,588	229,693	272,216	309,588	356,772	4,840	4,163	5,321	6,183	8,056
Options	36,821	43,221	52,288	56,951	62,162	580	631	700	953	1,120
Equity-linked	**6,782**	**7,488**	**8,590**	**8,469**	**10,177**	**671**	**853**	**1,116**	**1,142**	**1,146**
Forwards and swaps	1,430	1,767	2,470	2,233	2,657	147	166	240	239	283
Options	5,351	5,720	6,119	6,236	7,520	523	686	876	903	863
Commodity[3]	**6,394**	**7,115**	**7,567**	**8,455**	**13,229**	**718**	**667**	**636**	**1,899**	**2,209**
Gold	456	640	426	595	649	77	56	47	70	68
Other	5,938	6,475	7,141	7,861	12,580	641	611	589	1,829	2,142
Forwards and swaps	2,188	2,813	3,447	5,085	7,561	. . .	. . .	. . .	. . .	. . .
Options	3,750	3,663	3,694	2,776	5,019	. . .	. . .	. . .	. . .	. . .
Credit default swaps	**20,352**	**28,650**	**42,580**	**57,894**	**57,325**	**294**	**470**	**721**	**2,002**	**3,172**
Single-name instruments	13,873	17,879	24,239	32,246	33,334	186	278	406	1,143	1,889
Multi-name instruments	6,479	10,771	18,341	25,648	23,991	109	192	315	859	1,283
Unallocated	**35,997**	**39,740**	**61,713**	**71,146**	**81,708**	**1,685**	**1,609**	**1,259**	**1,788**	**2,301**
Memorandum items:										
Gross credit exposure[4]	n.a.	n.a.	n.a.	n.a.	n.a.	2,032	2,036	2,672	3,256	3,859
Exchange-traded derivatives	38,127	40,271	48,645	56,238	62,983	. . .	. . .	. . .	. . .	. . .

Source: Bank for International Settlements.

[1]All figures are adjusted for double-counting. Notional amounts outstanding have been adjusted by halving positions vis-à-vis other reporting dealers. Gross market values have been calculated as the sum of the total gross positive market value of contracts and the absolute value of the gross negative market value of contracts with nonreporting counterparties.

[2]Single-currency contracts only.

[3]Adjustments for double-counting are estimated.

[4]Gross market values after taking into account legally enforceable bilateral netting agreements.

Table 5. Global Over-the-Counter Derivatives Markets: Notional Amounts and Gross Market Values of Outstanding Contracts by Counterparty, Remaining Maturity, and Currency[1]

(In billions of U.S. dollars)

	Notional Amounts					Gross Market Values				
	End-June 2006	End-Dec. 2006	End-June 2007	End-Dec. 2007	End-June 2008	End-June 2006	End-Dec. 2006	End-June 2007	End-Dec. 2007	End-June 2008
Total	**370,178**	**414,845**	**516,407**	**595,341**	**683,725**	**9,949**	**9,691**	**11,140**	**15,813**	**20,353**
Foreign exchange	**38,127**	**40,271**	**48,645**	**56,238**	**62,983**	**1,136**	**1,266**	**1,345**	**1,807**	**2,262**
By counterparty										
With other reporting dealers	15,306	15,532	19,173	21,334	24,845	368	438	455	594	782
With other financial institutions	15,123	16,023	19,144	24,357	26,775	471	521	557	806	995
With nonfinancial customers	7,698	8,716	10,329	10,548	11,362	297	307	333	407	484
By remaining maturity										
Up to one year[2]	29,579	30,270	36,950	40,316	43,639	. . .	. . .	. . .	. . .	. . .
One to five years[2]	5,851	6,702	8,090	8,553	10,701	. . .	. . .	. . .	. . .	. . .
Over five years[2]	2,697	3,299	3,606	7,370	8,643	. . .	. . .	. . .	. . .	. . .
By major currency										
U.S. dollar[3]	31,791	33,755	40,513	46,947	52,152	969	1,069	1,112	1,471	1,838
Euro[3]	15,344	16,037	18,280	21,806	25,963	472	509	455	790	1,010
Japanese yen[3]	9,536	9,490	10,602	12,857	13,616	243	325	389	371	433
Pound sterling[3]	5,217	6,135	7,770	7,979	8,377	148	197	174	260	280
Other[3]	14,366	15,124	20,125	22,888	25,858	439	431	561	723	963
Interest rate[4]	**262,526**	**291,582**	**347,312**	**393,138**	**458,304**	**5,445**	**4,826**	**6,063**	**7,177**	**9,263**
By counterparty										
With other reporting dealers	114,826	127,432	148,555	157,245	188,982	2,221	1,973	2,375	2,774	3,554
With other financial institutions	114,930	125,708	153,370	193,107	223,023	2,516	2,223	2,946	3,786	4,965
With nonfinancial customers	32,770	38,441	45,387	42,786	46,299	708	630	742	617	745
By remaining maturity										
Up to one year[2]	90,755	104,098	132,402	127,601	153,181	. . .	. . .	. . .	. . .	. . .
One to five years[2]	101,909	110,314	125,700	134,713	150,096	. . .	. . .	. . .	. . .	. . .
Over five years[2]	69,861	77,170	89,210	130,824	155,028	. . .	. . .	. . .	. . .	. . .
By major currency										
U.S. dollar	88,115	97,430	114,371	129,756	149,813	2,120	1,661	1,851	3,219	3,601
Euro	103,461	111,791	127,648	146,082	171,877	2,299	2,300	2,846	2,688	3,910
Japanese yen	32,581	38,113	48,035	53,099	58,056	463	297	364	401	380
Pound sterling	19,071	22,238	27,676	28,390	38,619	291	311	627	430	684
Other	19,298	22,009	29,581	35,811	39,939	273	257	375	439	689
Equity-linked	**6,782**	**7,488**	**8,590**	**8,469**	**10,177**	**671**	**853**	**1,116**	**1,142**	**1,146**
Commodity[5]	**6,394**	**7,115**	**7,567**	**8,455**	**13,229**	**718**	**667**	**636**	**1,899**	**2,209**
Credit default swaps	**20,352**	**28,650**	**42,580**	**57,894**	**57,325**	**294**	**470**	**721**	**2,002**	**3,172**
Unallocated	**35,997**	**39,740**	**61,713**	**71,146**	**81,708**	**1,685**	**1,609**	**1,259**	**1,788**	**2,301**

Source: Bank for International Settlements.

[1]All figures are adjusted for double-counting. Notional amounts outstanding have been adjusted by halving positions vis-à-vis other reporting dealers. Gross market values have been calculated as the sum of the total gross positive market value of contracts and the absolute value of the gross negative market value of contracts with nonreporting counterparties.

[2]Residual maturity.

[3]Counting both currency sides of each foreign exchange transaction means that the currency breakdown sums to twice the aggregate.

[4]Single-currency contracts only.

[5]Adjustments for double-counting are estimated.

Table 6. Exchange-Traded Derivative Financial Instruments: Notional Principal Amounts Outstanding and Annual Turnover

	1997	1998	1999	2000	2001	2002
			(In billions of U.S. dollars)			
Notional principal amounts outstanding						
Interest rate futures	7,586.7	8,031.4	7,924.9	7,907.8	9,269.6	9,955.6
Interest rate options	3,639.9	4,623.5	3,755.5	4,734.2	12,492.8	11,759.5
Currency futures	42.3	31.7	36.7	74.4	65.6	47.0
Currency options	118.6	49.2	22.4	21.4	27.4	27.4
Stock market index futures	210.9	291.6	346.9	377.5	344.2	365.7
Stock market index options	808.7	947.4	1,510.6	1,149.2	1,560.5	1,687.9
Total	12,407.1	13,974.8	13,597.0	14,264.6	23,760.1	23,843.1
North America	6,347.9	7,395.1	6,930.6	8,168.6	16,188.6	13,706.4
Europe	3,587.3	4,397.1	4,008.9	4,198.0	6,141.8	8,801.5
Asia-Pacific	2,235.7	1,882.5	2,407.8	1,611.8	1,318.4	1,206.0
Other	236.2	300.1	249.7	286.2	111.2	129.1
			(In millions of contracts traded)			
Annual turnover						
Interest rate futures	701.6	760.0	672.7	781.2	1,057.5	1,152.1
Interest rate options	116.8	129.7	118.0	107.7	199.6	240.3
Currency futures	73.6	54.5	37.1	43.5	49.0	42.6
Currency options	21.1	12.1	6.8	7.0	10.5	16.1
Stock market index futures	115.9	178.0	204.9	225.2	337.1	530.6
Stock market index options	178.2	195.0	322.5	481.5	1,148.2	2,235.5
Total	1,207.1	1,329.3	1,362.0	1,646.0	2,801.9	4,217.2
North America	463.5	530.0	462.8	461.3	675.6	912.2
Europe	482.8	525.9	604.7	718.6	957.7	1,075.1
Asia-Pacific	126.9	170.9	207.7	331.3	985.1	2,073.1
Other	134.0	102.5	86.8	134.9	183.4	156.7

Source: Bank for International Settlements.

					2008		
2003	2004	2005	2006	2007	Q1	Q2	Q3
			(In billions of U.S. dollars)				
13,123.7	18,164.9	20,708.7	24,476.2	26,769.6	26,793.6	26,874.2	23,308.1
20,793.8	24,604.1	31,588.2	38,116.4	44,281.7	45,393.2	46,905.0	45,053.0
79.9	103.5	107.6	161.4	158.5	164.1	175.9	145.3
37.9	60.7	66.1	78.6	132.7	193.5	190.6	180.3
549.4	635.3	784.1	1,045.4	1,131.6	1,160.5	1,583.9	1,432.9
2,160.4	2,954.7	4,005.3	5,528.5	6,625.0	6,610.4	7,088.0	6,865.9
36,745.0	46,523.3	57,259.9	69,406.6	79,099.1	80,315.2	82,817.7	76,985.6
19,461.4	27,538.5	35,856.5	41,514.3	42,514.6	37,762.1	41,332.4	38,235.6
15,407.1	16,308.6	17,973.4	23,217.1	30,568.0	36,691.5	36,156.7	33,495.6
1,659.9	2,426.9	3,004.5	4,049.6	4,971.0	4,786.0	4,049.0	4,323.3
216.5	249.3	425.5	625.6	1,045.5	1,075.7	1,279.6	931.2
			(In millions of contracts traded)				
1,576.8	1,902.6	2,110.4	2,621.2	3,076.6	820.9	695.3	641.5
302.3	361.0	430.8	566.7	663.3	198.6	155.7	139.7
58.8	83.7	143.0	231.1	353.1	102.1	117.4	131.6
14.3	13.0	19.4	24.3	46.4	17.4	16.5	14.9
725.8	804.5	918.7	1,233.7	1,930.2	608.6	513.8	633.1
3,233.9	2,980.1	3,139.8	3,177.5	3,815.6	852.5	899.1	1,229.7
5,911.8	6,144.9	6,762.1	7,854.4	9,885.2	2,600.0	2,397.7	2,790.4
1,279.8	1,633.6	1,926.8	2,541.8	3,146.5	881.1	746.8	786.2
1,346.5	1,412.7	1,592.9	1,947.4	2,560.2	816.1	688.0	763.0
3,111.6	2,847.6	2,932.4	2,957.1	3,592.5	751.9	811.9	1,095.0
174.0	251.0	310.0	408.1	586.0	150.9	151.1	146.2

Table 7. United States: Sectoral Balance Sheets

(In percent)

	2002	2003	2004	2005	2006	2007
Corporate sector						
Debt/net worth	50.8	48.7	45.7	43.7	42.5	42.6
Short-term debt/credit market debt	30.9	27.8	28.0	27.5	27.9	30.2
Interest burden[1]	14.4	11.8	8.6	7.8	7.7	8.1
Household sector						
Net worth/assets	82.2	82.6	82.5	82.5	82.1	81.2
Equity/total assets	21.4	25.0	25.3	25.0	26.8	26.9
Equity/financial assets	35.0	39.9	40.8	41.0	42.7	41.7
Net worth/disposable personal income	520.6	572.2	600.4	633.3	638.9	600.6
Home mortgage debt/total assets	12.2	12.2	12.4	12.8	13.1	13.1
Consumer credit/total assets	4.0	3.7	3.5	3.3	3.2	3.3
Total debt/financial assets	29.1	27.9	28.2	28.7	28.6	29.1
Debt-service burden[2]	13.4	13.6	13.6	14.1	14.3	14.4
Banking sector[3]						
Credit quality						
Nonperforming loans[4]/total loans	1.5	1.2	0.9	0.8	0.8	1.3
Net loan losses/average total loans	1.1	0.9	0.7	0.6	0.4	0.6
Loan-loss reserve/total loans	1.9	1.8	1.5	1.3	1.2	1.4
Net charge-offs/total loans	1.1	0.9	0.6	0.6	0.4	0.6
Capital ratios						
Total risk-based capital	12.8	12.8	12.6	12.3	12.4	12.2
Tier 1 risk-based capital	10.0	10.1	10.0	9.9	9.8	9.4
Equity capital/total assets	9.2	9.2	10.1	10.3	10.2	10.2
Core capital (leverage ratio)	7.8	7.9	7.8	7.9	7.9	7.6
Profitability measures						
Return on average assets (ROA)	1.3	1.4	1.3	1.3	1.3	0.9
Return on average equity (ROE)	14.5	15.3	13.7	12.9	13.0	9.1
Net interest margin	4.1	3.8	3.6	3.6	3.4	3.4
Efficiency ratio[5]	55.8	56.5	58.0	57.2	56.3	59.2

Sources: Board of Governors of the Federal Reserve System, *Flow of Funds;* Department of Commerce, Bureau of Economic Analysis; Federal Deposit Insurance Corporation; and Federal Reserve Bank of St. Louis.

[1]Ratio of net interest payments to pre-tax income.

[2]Ratio of debt payments to disposable personal income.

[3]FDIC-insured commercial banks.

[4]Loans past due 90+ days and nonaccrual.

[5]Noninterest expense less amortization of intangible assets as a percent of net interest income plus noninterest income.

Table 8. Japan: Sectoral Balance Sheets[1]

(In percent)

	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008
Corporate sector							
Debt/shareholders' equity (book value)	146.1	121.3	121.5	101.7	98.2	97.1	98.4
Short-term debt/total debt	39.0	37.8	36.8	36.4	35.3	34.1	35.8
Interest burden[2]	27.8	22.0	18.4	15.6	15.2	16.2	19.2
Debt/operating profits	1,370.0	1,079.2	965.9	839.9	820.4	798.6	1,018.2
Memorandum item:							
Total debt/GDP[3]	100.9	90.9	96.4	85.7	89.8	83.3	89.8
Household sector							
Net worth/assets	84.4	84.5	84.6	84.9	85.0	. . .	. . .
Equity	3.5	4.9	5.7	8.7	8.8	. . .	. . .
Real estate	34.6	32.9	31.4	29.9	29.6	. . .	. . .
Net worth/net disposable income	725.2	728.5	723.0	738.7	742.1	. . .	. . .
Interest burden[4]	5.1	4.9	4.8	4.6	4.7	4.8	. . .
Memorandum items:							
Debt/equity	448.2	317.6	268.4	174.5	170.1	. . .	. . .
Debt/real estate	45.1	47.0	49.0	50.6	50.6	. . .	. . .
Debt/net disposable income	134.2	133.2	131.5	131.6	130.6	. . .	. . .
Debt/net worth	18.5	18.3	18.2	17.8	17.6	. . .	. . .
Equity/net worth	4.1	5.8	6.8	10.2	10.3	. . .	. . .
Real estate/net worth	41.0	38.9	37.1	35.2	34.8	. . .	. . .
Total debt/GDP[3]	79.4	77.5	76.1	76.3	75.4	. . .	. . .
Banking sector[5]							
Credit quality							
Nonperforming loans[6]/total loans	7.4	5.8	4.0	2.9	2.5	2.4	2.5
Capital ratio							
Stockholders' equity/assets	3.3	3.9	4.2	4.9	5.3	4.5	4.2
Profitability measures							
Return on equity (ROE)[7,8]	–19.5	–2.7	4.1	11.3	8.5	6.1	3.0

Sources: Ministry of Finance, *Financial Statements of Corporations by Industries;* Cabinet Office, Economic and Social Research Institute, *Annual Report on National Accounts;* Japanese Bankers Association, *Financial Statements of All Banks;* and Financial Services Agency, *The Status of Nonperforming Loans*.

[1]Data are fiscal year beginning April 1. Stock data on households are only available through FY2006.

[2]Interest payments as a percent of operating profits.

[3]Revised due to the change in GDP figures.

[4]Interest payments as a percent of disposable income.

[5]Data refer to end-September 2008.

[6]Nonperforming loans are based on figures reported under the Financial Reconstruction Law.

[7]Net income as a percentage of stockholders' equity (no adjustment for preferred stocks, etc.).

[8]For FY 2008, the figure is estimated by doubling the net income in the first half of FY2008 (from April to September 2008).

Table 9. Europe: Sectoral Balance Sheets[1]

(In percent)

	2000	2001	2002	2003	2004	2005	2006	2007
Corporate sector								
Debt/equity[2]	67.8	72.4	73.8	71.4	69.6	71.1	76.0	79.8
Short-term debt/total debt	37.5	36.9	37.4	33.9	33.8	36.3	37.2	38.8
Interest burden[3]	18.3	19.5	18.4	16.9	16.9	17.3	17.5	17.1
Debt/operating profits	315.8	322.0	326.2	318.8	320.0	340.4	376.3	405.7
Memorandum items:								
Financial assets/equity	1.5	1.6	1.4	1.4	1.4	1.5	1.6	1.7
Liquid assets/short-term debt	73.7	76.7	70.2	84.2	94.4	97.6	96.1	98.5
Household sector								
Net worth/assets	84.3	83.7	83.6	83.7	83.9	84.5	84.3	84.4
Equity/net worth	15.8	13.8	11.0	11.6	11.6	12.3	12.2	11.9
Equity/net financial assets	40.8	37.4	32.7	34.1	34.1	34.9	34.9	34.2
Interest burden[4]	5.7	5.4	5.4	5.2	5.3	5.1	5.2	5.9
Memorandum items:								
Nonfinancial assets/net worth	59.8	61.9	65.9	65.7	65.9	64.6	64.9	65.2
Debt/net financial assets	47.3	49.7	54.8	53.0	52.7	48.2	48.1	48.3
Debt/income	94.7	94.9	97.5	100.3	105.5	106.2	109.1	112.1
Banking sector[5]								
Credit quality								
Nonperforming loans/total loans	3.0	2.9	2.5	2.3	2.4	2.1	2.4	2.2
Loan-loss reserve/nonperforming loans	82.1	80.8	81.5	73.0	68.1	81.5	73.1	75.9
Loan-loss reserve/total loans	2.5	2.4	2.4	2.4	2.4	1.8	1.7	1.7
Capital ratios								
Equity capital/total assets	4.3	3.3	3.1	2.9	3.8	3.9	3.9	3.9
Capital funds/liabilities	6.9	6.8	5.4	5.0	5.7	5.5	5.6	5.9
Profitability measures								
Return on assets, or ROA (after tax)	0.8	0.5	0.4	0.5	0.5	0.5	0.6	0.4
Return on equity, or ROE (after tax)	18.3	11.2	9.0	11.3	13.5	12.5	14.8	11.4
Net interest margin	1.5	1.4	1.6	1.5	1.1	1.0	0.9	0.9
Efficiency ratio[6]	66.4	68.2	69.0	73.1	64.8	62.9	60.5	64.9

Sources: ©2003 Bureau van Dijk Electronic Publishing-Bankscope; and IMF staff estimates.

[1]GDP-weighted average for France, Germany, and the United Kingdom, unless otherwise noted.

[2]Corporate equity adjusted for changes in asset valuation.

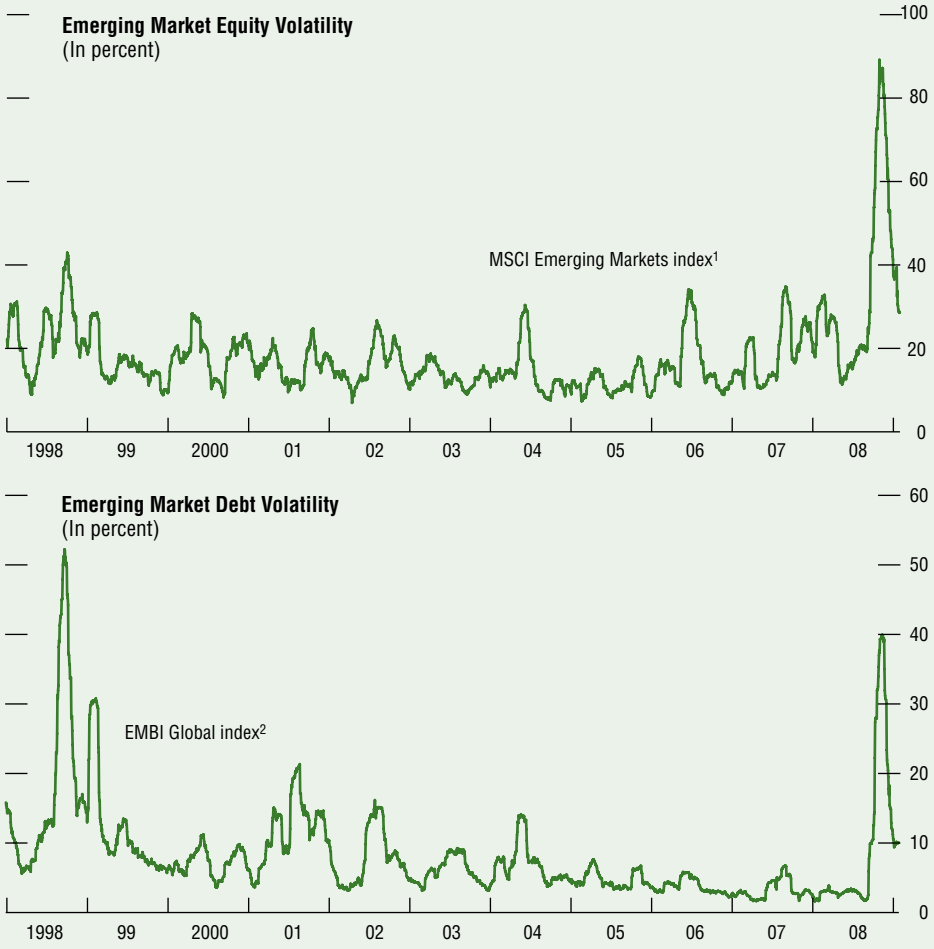
[3]Interest payments as a percent of gross operating profits.

[4]Interest payments as a percent of disposable income.

[5]Fifty largest European banks. Data availability may restrict coverage to less than 50 banks for specific indicators.

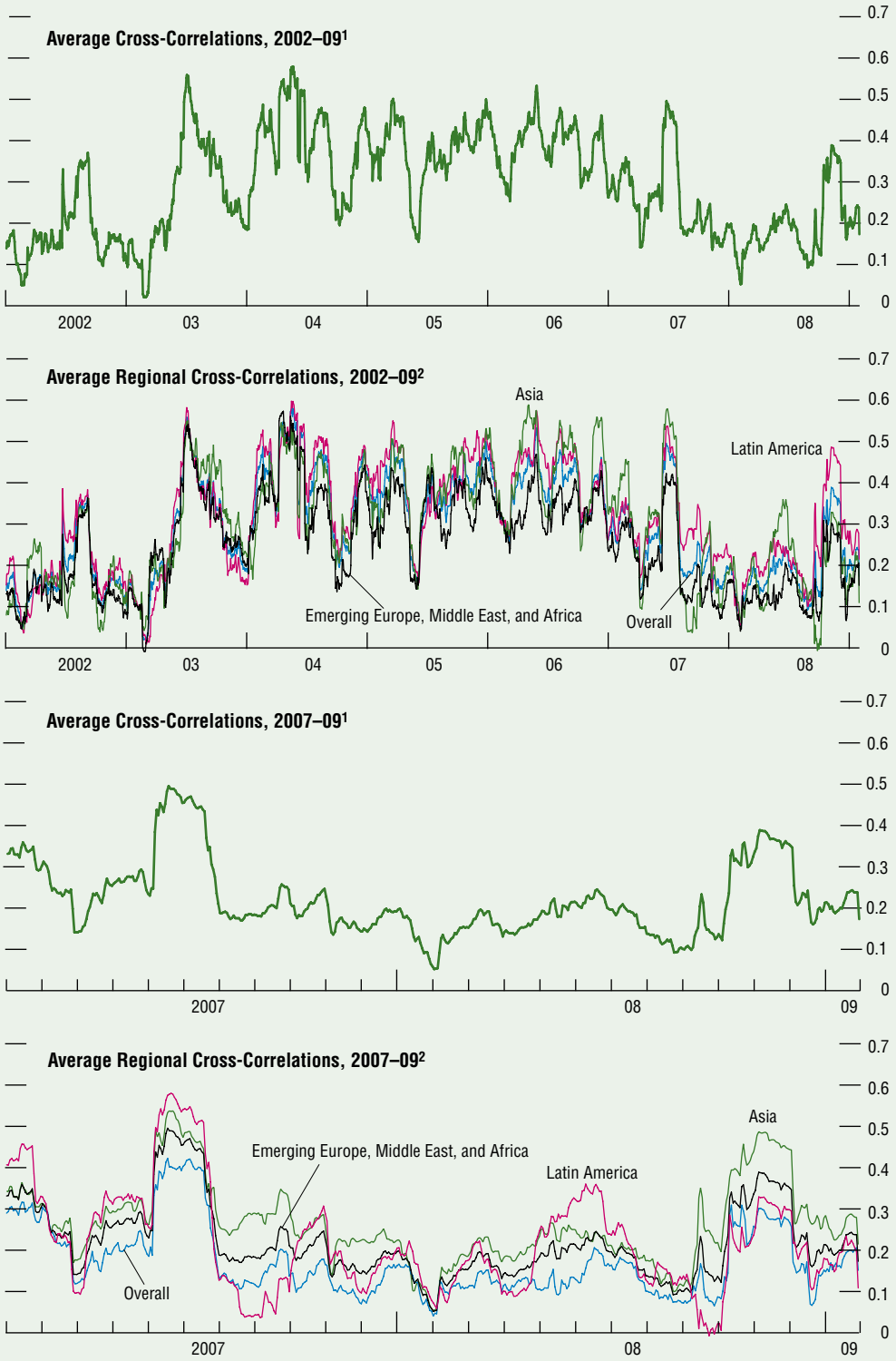
[6]Cost-to-income ratio.

Figure 15. Emerging Market Volatility Measures



Sources: Morgan Stanley Capital International; JPMorgan Chase & Co.; and IMF staff estimates.
[1]Data utilize the MSCI Emerging Markets index in U.S. dollars to calculate 30-day rolling volatilities.
[2]Data utilize the EMBI Global total return index in U.S. dollars to calculate 30-day rolling volatilities.

Figure 16. Emerging Market Debt Cross-Correlation Measures



Sources: JPMorgan Chase & Co.; and IMF staff estimates.
[1]Thirty-day moving simple average across all pair-wise return correlations of 20 constituents included in the EMBI Global.
[2]Simple average of all pair-wise correlations of all markets in a given region with all other bond markets, regardless of region.

Table 10. Equity Market Indices

	2008				End of Period						12-Month High	12-Month Low	All-Time High[1]	All-Time Low[1]
	Q1	Q2	Q3	Q4	2003	2004	2005	2006	2007	2008				
World	**1,437.4**	**1,402.1**	**1,182.4**	**920.2**	**1,036.3**	**1,169.3**	**1,257.8**	**1,483.6**	**1,588.8**	**920.2**	**1,588.8**	**771.5**	**1,682.4**	**423.1**
Emerging Markets	**1,104.6**	**1,087.1**	**786.9**	**567.0**	**442.8**	**542.2**	**706.5**	**912.7**	**1,245.6**	**567.0**	**1,249.7**	**454.3**	**1,338.5**	**175.3**
Latin America	**4,316.1**	**4,751.5**	**3,186.4**	**2,077.7**	**1,100.9**	**1,483.6**	**2,150.0**	**2,995.7**	**4,400.4**	**2,077.7**	**5,195.4**	**1,659.2**	**5,195.4**	**185.6**
Argentina	3,120.7	4,187.7	2,341.9	1,304.0	933.6	1,163.0	1,857.1	3,084.1	2,918.8	1,304.0	4,187.7	1,078.6	4,187.7	152.6
Brazil	3,648.3	4,292.5	2,652.1	1,638.2	802.0	1,046.6	1,569.4	2,205.4	3,867.2	1,638.2	4,727.6	1,286.5	4,727.6	84.1
Chile	1,972.2	1,714.7	1,534.3	1,130.9	800.6	997.3	1,180.7	1,492.4	1,802.8	1,130.9	2,036.2	996.4	2,057.9	183.0
Colombia	590.0	607.1	551.6	447.9	108.6	245.0	495.7	549.8	619.3	447.9	734.0	341.3	734.0	41.2
Mexico	6,288.2	5,947.3	4,806.2	3,356.8	1,873.1	2,715.6	3,943.6	5,483.3	5,992.1	3,356.8	6,559.5	2,639.7	6,775.7	308.9
Peru	1,306.7	1,320.9	860.1	719.3	344.1	343.4	441.3	671.4	1,248.7	719.3	1,445.7	443.8	1,488.3	73.5
Venezuela	163.4	163.4	163.4	163.4	103.8	151.0	107.4	174.1	163.4	163.4	163.4	163.4	278.4	56.1
Asia	**439.0**	**396.7**	**301.3**	**235.8**	**206.4**	**231.6**	**286.2**	**371.5**	**513.7**	**235.8**	**513.8**	**187.7**	**571.9**	**104.1**
China	64.8	61.7	45.8	40.8	25.4	25.2	29.2	52.1	84.9	40.8	84.9	27.2	137.2	12.9
India	487.9	390.3	334.0	233.6	166.4	193.7	262.3	390.6	668.9	233.6	694.2	198.1	694.2	71.2
Indonesia	633.8	597.4	436.2	287.5	162.8	235.3	264.9	449.3	677.6	287.5	737.0	204.6	894.5	42.6
Korea	375.8	346.9	262.7	193.1	163.6	196.2	302.8	336.7	437.5	193.1	437.5	138.1	491.3	29.0
Malaysia	367.9	331.8	269.7	231.3	196.9	220.2	216.9	288.6	408.6	231.3	438.3	209.2	458.4	54.2
Pakistan	205.7	149.6	94.2	46.1	84.5	91.8	143.6	141.2	187.1	46.1	211.7	46.1	211.7	25.3
Philippines	296.2	221.7	226.1	167.9	113.8	141.2	169.4	263.2	363.4	167.9	364.0	145.8	697.6	76.4
Taiwan Province of China	309.5	276.2	198.5	150.8	217.9	232.1	239.8	278.8	294.0	150.8	333.9	130.0	529.3	108.7
Thailand	273.3	238.4	181.9	132.8	176.6	169.5	177.7	189.7	267.4	132.8	293.5	110.2	651.7	44.0
Europe, Middle East, & Africa	**403.4**	**423.8**	**300.5**	**198.2**	**163.9**	**222.7**	**300.3**	**364.4**	**458.2**	**198.2**	**468.8**	**159.7**	**473.8**	**80.8**
Czech Republic	825.7	905.6	662.4	455.5	166.4	293.8	421.5	546.5	828.9	455.5	929.2	343.6	929.2	54.4
Egypt	1,383.9	1,227.8	880.8	591.7	129.7	283.7	722.1	829.2	1,284.0	591.7	1,468.8	464.1	1,468.8	61.3
Hungary	981.7	1,004.7	800.9	427.1	352.9	661.8	765.0	1,003.0	1,137.4	427.1	1,137.4	324.9	1,304.8	77.3
Israel	249.9	277.6	233.9	182.4	141.4	167.4	209.3	194.4	264.0	182.4	284.4	172.5	284.4	67.6
Jordan	246.9	286.3	248.5	162.5	113.4	180.4	309.8	209.1	252.9	162.5	303.1	150.8	362.2	52.6
Morocco	697.5	668.0	520.3	453.6	174.0	204.7	222.5	361.9	521.2	453.6	703.4	408.3	703.4	99.4
Poland	1,442.9	1,303.1	1,079.5	657.5	471.1	747.1	903.9	1,223.4	1,501.2	657.5	1,501.2	547.1	1,671.9	98.2
Russia	1,359.5	1,492.8	815.8	397.0	461.1	479.9	813.4	1,250.3	1,536.4	397.0	1,641.5	344.4	1,641.5	30.6
South Africa	429.9	445.8	367.3	305.1	216.6	304.7	377.9	443.1	508.3	305.1	523.2	204.4	578.2	98.3
Turkey	461.2	442.8	439.9	275.0	231.8	321.0	486.6	441.7	751.1	275.0	751.1	194.1	789.8	66.1
Sectors														
Energy	985.1	1,141.6	718.4	437.0	287.4	349.0	548.6	760.0	1,154.2	437.0	1,255.4	342.9	1,255.4	81.7
Materials	645.9	654.1	422.3	314.2	250.1	265.0	325.4	442.1	657.9	314.2	750.5	247.5	750.5	98.5
Industrials	290.9	246.0	181.1	130.6	98.9	128.0	156.1	210.7	351.1	130.6	351.6	96.4	403.8	52.6
Consumer discretionary	439.4	403.5	329.8	229.8	233.8	292.3	381.1	422.6	490.9	229.8	491.1	190.9	527.8	74.1
Consumer staple	313.3	307.3	252.3	209.6	118.6	147.0	197.0	266.2	330.2	209.6	336.1	166.2	343.1	80.4
Health care	437.0	442.6	416.2	375.2	272.5	290.8	393.3	356.3	458.8	375.2	476.4	332.0	476.4	83.3
Financials	351.0	326.7	263.7	194.1	138.8	187.9	240.6	328.8	424.0	194.1	424.3	151.1	473.0	74.6
Information technology	220.8	204.5	154.0	111.4	149.6	161.5	209.1	231.8	231.5	111.4	244.4	92.7	300.0	73.1
Telecommunications	295.6	272.7	219.9	180.7	100.8	131.6	158.9	218.0	328.0	180.7	328.0	140.9	343.2	62.9
Utilities	330.2	333.3	265.1	214.5	127.2	149.8	197.0	282.1	379.2	214.5	385.1	170.2	389.1	63.1

Table 10 ***(continued)***

	Period on Period Percent Change									
	2008				End of Period					
	Q1	Q2	Q3	Q4	2003	2004	2005	2006	2007	2008
World	–9.5	–2.5	–15.7	–22.2	30.8	12.8	7.6	18.0	7.1	–42.1
Emerging Markets	–11.3	–1.6	–27.6	–27.9	51.6	22.4	30.3	29.2	36.5	–54.5
Latin America	–1.9	10.1	–32.9	–34.8	67.1	34.8	44.9	39.3	46.9	–52.8
Argentina	6.9	34.2	–44.1	–44.3	98.5	24.6	59.7	66.1	–5.4	–55.3
Brazil	–5.7	17.7	–38.2	–38.2	102.9	30.5	50.0	40.5	75.3	–57.6
Chile	9.4	–13.1	–10.5	–26.3	79.7	24.6	18.4	26.4	20.8	–37.3
Colombia	–4.7	2.9	–9.1	–18.8	59.0	125.7	102.3	10.9	12.6	–27.7
Mexico	4.9	–5.4	–19.2	–30.2	29.8	45.0	45.2	39.0	9.3	–44.0
Peru	4.6	1.1	–34.9	–16.4	88.4	–0.2	28.5	52.1	86.0	–42.4
Venezuela	0.0	0.0	0.0	0.0	33.6	45.4	–28.9	62.2	–6.2	0.0
Asia	–14.5	–9.6	–24.0	–21.7	47.1	12.2	23.5	29.8	38.3	–54.1
China	–23.7	–4.7	–25.7	–11.0	80.3	–0.8	15.9	78.1	63.1	–51.9
India	–27.1	–20.0	–14.4	–30.1	65.5	16.5	35.4	49.0	71.2	–65.1
Indonesia	–6.5	–5.8	–27.0	–34.1	60.0	44.5	12.6	69.6	50.8	–57.6
Korea	–14.1	–7.7	–24.3	–26.5	33.2	20.0	54.3	11.2	30.0	–55.9
Malaysia	–10.0	–9.8	–18.7	–14.2	23.1	11.8	–1.5	33.1	41.5	–43.4
Pakistan	9.9	–27.3	–37.0	–51.1	28.9	8.6	56.5	–1.7	32.5	–75.4
Philippines	–18.5	–25.2	2.0	–25.7	44.5	24.1	19.9	55.4	38.0	–53.8
Taiwan Province of China	5.3	–10.8	–28.1	–24.0	36.7	6.5	3.3	16.3	5.4	–48.7
Thailand	2.2	–12.8	–23.7	–27.0	115.4	–4.0	4.8	6.8	40.9	–50.3
Europe, Middle East, & Africa	–12.0	5.1	–29.1	–34.0	51.2	35.8	34.9	21.3	25.8	–56.7
Czech Republic	–0.4	9.7	–26.9	–31.2	31.6	76.6	43.5	29.6	51.7	–45.1
Egypt	7.8	–11.3	–28.3	–32.8	140.8	118.8	154.5	14.8	54.8	–53.9
Hungary	–13.7	2.3	–20.3	–46.7	20.8	87.5	15.6	31.1	13.4	–62.4
Israel	–5.3	11.1	–15.7	–22.0	55.7	18.4	25.0	–7.1	35.8	–30.9
Jordan	–2.4	16.0	–13.2	–34.6	55.3	59.1	71.7	–32.5	20.9	–35.8
Morocco	33.8	–4.2	–22.1	–12.8	23.8	17.6	8.7	62.6	44.0	–13.0
Poland	–3.9	–9.7	–17.2	–39.1	29.9	58.6	21.0	35.3	22.7	–56.2
Russia	–11.5	9.8	–45.3	–51.3	70.3	4.1	69.5	53.7	22.9	–74.2
South Africa	–15.4	3.7	–17.6	–16.9	8.8	40.7	24.0	17.3	14.7	–40.0
Turkey	–38.6	–4.0	–0.7	–37.5	88.2	38.5	51.6	–9.2	70.0	–63.4
Sectors										
Energy	–14.6	15.9	–37.1	–39.2	76.2	21.4	57.2	38.5	51.9	–62.1
Materials	–1.8	1.3	–35.4	–25.6	36.8	6.0	22.8	35.9	48.8	–52.2
Industrials	–17.1	–15.4	–26.4	–27.9	60.1	29.5	22.0	35.0	66.6	–62.8
Consumer discretionary	–10.5	–8.2	–18.3	–30.3	68.4	25.0	30.4	10.9	16.2	–53.2
Consumer staple	–5.1	–1.9	–17.9	–17.0	34.4	24.0	34.0	35.1	24.1	–36.5
Health care	–4.8	1.3	–6.0	–9.8	60.5	6.7	35.2	–9.4	28.8	–18.2
Financials	–17.2	–6.9	–19.3	–26.4	40.7	35.4	28.1	36.7	28.9	–54.2
Information technology	–4.6	–7.4	–24.7	–27.7	43.9	8.0	29.5	10.9	–0.1	–51.9
Telecommunications	–9.9	–7.8	–19.4	–17.8	38.7	30.5	20.8	37.2	50.4	–44.9
Utilities	–12.9	1.0	–20.5	–19.1	75.7	17.8	31.5	43.2	34.4	–43.4

Table 10 *(concluded)*

	2008				End of Period						12-Month High	12-Month Low	All-Time High[1]	All-Time Low[1]
	Q1	Q2	Q3	Q4	2003	2004	2005	2006	2007	2008				
Developed Markets														
Australia	873.2	903.1	656.2	476.4	441.1	558.6	628.7	799.0	998.8	476.4	1,021.7	377.1	1,127.4	176.2
Austria	2,947.3	3,057.3	1,790.5	1,015.9	1,158.5	1,960.2	2,411.0	3,248.9	3,273.2	1,015.9	3,460.2	797.1	3,661.2	606.1
Belgium	2,074.4	1,625.9	1,107.7	696.5	1,150.6	1,606.0	1,696.4	2,260.7	2,141.6	696.5	2,191.4	573.9	2,496.2	497.6
Canada	1,804.2	1,993.6	1,552.4	1,030.9	853.2	1,028.2	1,302.2	1,512.9	1,930.1	1,030.9	2,128.3	835.8	2,144.6	304.7
Denmark	5,991.2	5,915.9	4,356.3	3,129.8	2,252.3	2,899.8	3,551.2	4,859.4	6,036.6	3,129.8	6,380.6	2,615.7	6,380.6	708.5
Finland	873.6	738.9	537.4	429.2	450.9	468.5	534.3	679.3	985.1	429.2	985.1	355.0	1,329.0	33.2
France	2,084.3	1,958.8	1,585.5	1,253.2	1,243.0	1,445.6	1,558.1	2,051.6	2,275.1	1,253.2	2,275.1	1,007.6	2,350.4	422.2
Germany	2,219.3	2,116.1	1,681.0	1,330.0	1,160.9	1,327.5	1,429.8	1,902.1	2,520.7	1,330.0	2,520.7	1,043.1	2,538.9	467.9
Greece	872.1	743.8	582.3	341.2	382.8	540.7	609.2	801.7	1,036.1	341.2	1,047.0	305.4	1,053.1	157.5
Hong Kong SAR	8,054.7	7,639.1	5,840.4	4,696.9	4,536.1	5,479.0	5,741.7	7,249.8	9,966.9	4,696.9	9,977.3	3,796.0	10,589.5	1,427.6
Ireland	431.8	352.2	201.9	120.4	296.5	412.6	393.1	565.4	441.8	120.4	454.6	110.0	606.8	105.3
Italy	576.4	527.7	408.6	312.8	391.2	503.0	496.6	636.0	653.0	312.8	653.0	262.3	689.7	132.0
Japan	2,772.7	2,838.5	2,318.9	2,108.2	2,144.4	2,460.1	3,053.0	3,208.3	3,034.4	2,108.2	3,115.7	1,791.1	4,132.1	1,385.4
Netherlands	2,720.4	2,433.1	1,898.9	1,458.6	1,606.5	1,753.2	1,939.4	2,486.8	2,922.6	1,458.6	2,922.6	1,214.4	3,070.7	558.3
New Zealand	129.1	109.8	89.5	67.4	107.3	139.3	134.5	147.9	153.9	67.4	155.1	57.5	178.7	49.5
Norway	3,891.6	4,313.3	2,551.5	1,512.6	1,332.3	1,993.4	2,392.2	3,386.3	4,348.9	1,512.6	4,992.1	1,190.4	4,992.1	534.0
Portugal	203.2	169.2	137.8	108.5	115.8	141.1	134.8	193.3	234.0	108.5	234.3	90.9	246.4	66.0
Singapore	3,895.5	3,795.2	2,918.0	2,125.4	1,820.2	2,163.1	2,395.8	3,399.8	4,212.7	2,125.4	4,225.4	1,815.0	4,664.3	893.9
Spain	810.5	733.0	601.6	492.7	388.1	486.8	494.4	716.0	864.0	492.7	864.0	379.1	909.2	101.2
Sweden	6,509.9	5,662.9	4,372.4	3,276.0	3,360.9	4,503.2	4,867.9	6,839.0	6,746.0	3,276.0	6,958.9	2,620.6	8,152.0	737.9
Switzerland	4,126.2	3,857.7	3,345.7	2,899.6	2,480.4	2,821.8	3,241.1	4,079.3	4,237.3	2,899.6	4,291.2	2,340.4	4,449.8	527.2
United Kingdom	1,406.8	1,381.5	1,080.7	787.7	1,006.1	1,162.4	1,205.6	1,521.5	1,593.4	787.7	1,593.4	690.2	1,737.3	425.9
United States	1,254.8	1,222.8	1,105.6	854.4	1,045.4	1,137.4	1,180.6	1,336.3	1,390.9	854.4	1,390.9	708.8	1,493.0	273.7
					Period on Period Percent Change									
Developed Markets														
Australia	–12.6	3.4	–27.3	–27.4	8.5	26.6	12.5	27.1	25.0	–52.3	. . .	. . .	. . .	. . .
Austria	–10.0	3.7	–41.4	–43.3	28.5	69.2	23.0	34.8	0.7	–69.0	. . .	. . .	. . .	. . .
Belgium	–3.1	–21.6	–31.9	–37.1	8.7	39.6	5.6	33.3	–5.3	–67.5	. . .	. . .	. . .	. . .
Canada	–6.5	10.5	–22.1	–33.6	24.6	20.5	26.7	16.2	27.6	–46.6	. . .	. . .	. . .	. . .
Denmark	–0.8	–1.3	–26.4	–28.2	22.4	28.8	22.5	36.8	24.2	–48.2	. . .	. . .	. . .	. . .
Finland	–11.3	–15.4	–27.3	–20.1	–2.9	3.9	14.0	27.1	45.0	–56.4	. . .	. . .	. . .	. . .
France	–8.4	–6.0	–19.1	–21.0	14.6	16.3	7.8	31.7	10.9	–44.9	. . .	. . .	. . .	. . .
Germany	–12.0	–4.7	–20.6	–20.9	33.2	14.4	7.7	33.0	32.5	–47.2	. . .	. . .	. . .	. . .
Greece	–15.8	–14.7	–21.7	–41.4	35.8	41.2	12.7	31.6	29.2	–67.1	. . .	. . .	. . .	. . .
Hong Kong SAR	–19.2	–5.2	–23.5	–19.6	31.9	20.8	4.8	26.3	37.5	–52.9	. . .	. . .	. . .	. . .
Ireland	–2.3	–18.4	–42.7	–40.4	16.0	39.2	–4.7	43.9	–21.9	–72.7	. . .	. . .	. . .	. . .
Italy	–11.7	–8.5	–22.6	–23.5	12.2	28.6	–1.3	28.1	2.7	–52.1	. . .	. . .	. . .	. . .
Japan	–8.6	2.4	–18.3	–9.1	21.6	14.7	24.1	5.1	–5.4	–30.5	. . .	. . .	. . .	. . .
Netherlands	–6.9	–10.6	–22.0	–23.2	3.6	9.1	10.6	28.2	17.5	–50.1	. . .	. . .	. . .	. . .
New Zealand	–16.1	–14.9	–18.5	–24.7	19.6	29.8	–3.5	10.0	4.0	–56.2	. . .	. . .	. . .	. . .
Norway	–10.5	10.8	–40.8	–40.7	38.1	49.6	20.0	41.6	28.4	–65.2	. . .	. . .	. . .	. . .
Portugal	–13.2	–16.7	–18.6	–21.3	15.9	21.9	–4.5	43.4	21.0	–53.6	. . .	. . .	. . .	. . .
Singapore	–7.5	–2.6	–23.1	–27.2	31.4	18.8	10.8	41.9	23.9	–49.5	. . .	. . .	. . .	. . .
Spain	–6.2	–9.6	–17.9	–18.1	28.3	25.4	1.5	44.8	20.7	–43.0	. . .	. . .	. . .	. . .
Sweden	–3.5	–13.0	–22.8	–25.1	32.9	34.0	8.1	40.5	–1.4	–51.4	. . .	. . .	. . .	. . .
Switzerland	–2.6	–6.5	–13.3	–13.3	18.4	13.8	14.9	25.9	3.9	–31.6	. . .	. . .	. . .	. . .
United Kingdom	–11.7	–1.8	–21.8	–27.1	14.4	15.5	3.7	26.2	4.7	–50.6	. . .	. . .	. . .	. . .
United States	–9.8	–2.5	–9.6	–22.7	26.8	8.8	3.8	13.2	4.1	–38.6	. . .	. . .	. . .	. . .

Data are provided by Morgan Stanley Capital International. Regional and sectoral compositions conform to Morgan Stanley Capital International definitions.
[1]From 1990 or initiation of the index.

Table 11. Foreign Exchange Rates

(Units per U.S. dollar)

	2008				End of Period						12-Month High	12-Month Low	All-Time High[1]	All-Time Low[1]
	Q1	Q2	Q3	Q4	2003	2004	2005	2006	2007	2008				
Emerging Markets														
Latin America														
Argentina	3.17	3.03	3.13	3.45	2.93	2.97	3.03	3.06	3.15	3.45	3.01	3.47	0.98	3.86
Brazil	1.75	1.60	1.90	2.31	2.89	2.66	2.34	2.14	1.78	2.31	1.56	2.51	–	3.95
Chile	435.24	527.89	552.11	638.50	592.75	555.75	512.00	533.38	497.95	638.50	429.55	682.75	295.18	759.75
Colombia	1,831.30	1,913.50	2,192.16	2,248.58	2,780.00	2,354.75	2,286.50	2,240.00	2,018.00	2,248.58	1,655.03	2,404.75	689.21	2,980.00
Mexico	10.64	10.31	10.94	13.67	11.23	11.15	10.63	10.82	10.91	13.67	9.86	13.90	2.68	13.90
Peru	2.75	2.96	2.98	3.13	3.46	3.28	3.42	3.20	3.00	3.13	2.69	3.14	1.28	3.65
Venezuela	2,147.30	2,147.30	2,147.30	2,147.30	1,598.00	1,918.00	2,147.30	2,147.30	2,147.30	2,147.30	2,147.30	2,147.30	45.00	2,147.50
Asia														
China	7.01	6.85	6.85	6.83	8.28	8.28	8.07	7.81	7.30	6.83	6.81	7.30	4.73	8.73
India	40.12	43.04	46.96	48.80	45.63	43.46	45.05	44.26	39.42	48.80	39.27	50.29	16.92	50.29
Indonesia	9,229.00	9,228.00	9,506.00	11,120.00	8,420.00	9,270.00	9,830.00	8,994.00	9,400.00	11,120.00	9,060.00	12,650.00	1,977.00	16,650.00
Korea	990.30	1,046.05	1,206.85	1,259.55	1,192.10	1,035.10	1,010.00	930.00	936.05	1,259.55	935.37	1,514.00	683.50	1,962.50
Malaysia	3.19	3.27	3.44	3.47	3.80	3.80	3.78	3.53	3.31	3.47	3.13	3.64	2.44	4.71
Pakistan	62.70	68.40	78.25	79.10	57.25	59.43	59.79	60.88	61.63	79.10	61.32	83.80	21.18	83.80
Philippines	41.74	44.96	47.05	47.52	55.54	56.23	53.09	49.01	41.23	47.52	40.27	49.94	23.10	56.46
Taiwan Province of China	30.38	30.35	32.21	32.79	33.96	31.74	32.83	32.59	32.43	32.79	30.00	33.55	24.48	35.19
Thailand	31.44	33.44	33.86	34.74	39.62	38.92	41.03	35.45	29.80	34.74	29.35	35.76	23.15	55.50
Europe, Middle East, & Africa														
Czech Republic	15.98	15.16	17.38	19.22	25.71	22.42	24.55	20.83	18.20	19.22	14.43	20.66	14.43	42.17
Egypt	5.45	5.34	5.44	5.49	6.17	6.09	5.74	5.71	5.53	5.49	5.28	5.59	3.29	6.25
Hungary	165.14	149.41	171.82	190.10	208.70	181.02	212.97	190.29	173.42	190.10	143.50	217.75	90.20	317.56
Israel	3.56	3.35	3.46	3.78	4.39	4.32	4.61	4.22	3.86	3.78	3.23	4.03	1.96	5.01
Jordan	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.64	0.72
Morocco	10.13	10.08	9.27	9.47	10.08	11.09	11.94	11.70	10.43	9.47	9.20	10.63	7.75	12.06
Poland	2.22	2.13	2.41	2.97	3.73	3.01	3.25	2.90	2.47	2.97	2.03	3.09	1.72	4.71
Russia	23.49	23.44	25.64	29.40	29.24	27.72	28.74	26.33	24.63	29.40	23.16	29.58	0.98	31.96
South Africa	8.09	7.82	8.29	9.53	6.68	5.67	6.33	7.01	6.86	9.53	6.74	11.57	2.50	12.45
Turkey	1.32	1.23	1.27	1.54	1.41	1.34	1.35	1.42	1.17	1.54	1.15	1.73	0.00	1.77
Developed Markets														
Australia[2]	0.91	0.96	0.79	0.70	0.75	0.78	0.73	0.79	0.88	0.70	0.98	0.60	0.98	0.48
Canada	1.03	1.02	1.06	1.22	1.30	1.20	1.16	1.17	1.00	1.22	0.98	1.30	0.92	1.61
Denmark	4.72	4.73	5.29	5.33	5.91	5.49	6.30	5.65	5.11	5.33	4.67	5.98	4.67	9.00
Euro area[2]	1.58	1.58	1.41	1.40	1.26	1.36	1.18	1.32	1.46	1.40	1.60	1.25	1.60	0.83
Hong Kong SAR	7.78	7.80	7.77	7.75	7.76	7.77	7.75	7.78	7.80	7.75	7.75	7.82	7.70	7.83
Japan	99.69	106.21	106.11	90.64	107.22	102.63	117.75	119.07	111.71	90.64	87.24	111.64	80.63	159.90
New Zealand[2]	0.79	0.76	0.67	0.58	0.66	0.72	0.68	0.70	0.77	0.58	0.82	0.52	0.82	0.39
Norway	5.10	5.09	5.86	6.95	6.67	6.08	6.74	6.24	5.44	6.95	4.96	7.22	4.96	9.58
Singapore	1.38	1.36	1.44	1.43	1.70	1.63	1.66	1.53	1.44	1.43	1.35	1.53	1.35	1.91
Sweden	5.94	6.01	6.92	7.83	7.19	6.66	7.94	6.85	6.47	7.83	5.84	8.37	5.09	11.03
Switzerland	0.99	1.02	1.12	1.07	1.24	1.14	1.31	1.22	1.13	1.07	0.98	1.23	0.98	1.82
United Kingdom[2]	1.98	1.99	1.78	1.46	1.79	1.92	1.72	1.96	1.98	1.46	2.03	1.44	2.11	1.37

Table 11 ***(concluded)***

	Period on Period Percent Change									
	2008				End of Period					
	Q1	Q2	Q3	Q4	2003	2004	2005	2006	2007	2008
Emerging Markets										
Latin America										
Argentina	–0.6	4.7	–3.4	–9.2	14.7	–1.4	–1.9	–1.0	–2.8	–8.8
Brazil	1.5	9.2	–15.8	–17.7	22.4	8.9	13.7	9.4	20.0	–23.1
Chile	14.4	–17.6	–4.4	–13.5	21.5	6.7	8.5	–4.0	7.1	–22.0
Colombia	10.2	–4.3	–12.7	–2.5	3.1	18.1	3.0	2.1	11.0	–10.3
Mexico	2.5	3.2	–5.7	–20.0	–7.6	0.7	4.8	–1.7	–0.8	–20.2
Peru	9.0	–7.1	–0.7	–4.8	1.5	5.6	–4.1	7.1	6.6	–4.4
Venezuela	0.0	0.0	0.0	0.0	–13.1	–16.7	–10.7	0.0	0.0	0.0
Asia										
China	4.1	2.3	0.1	0.3	0.0	0.0	2.6	3.4	7.0	6.9
India	–1.8	–6.8	–8.3	–3.8	5.2	5.0	–3.5	1.8	12.3	–19.2
Indonesia	1.9	0.0	–2.9	–14.5	6.3	–9.2	–5.7	9.3	–4.3	–15.5
Korea	–5.5	–5.3	–13.3	–4.2	–0.5	15.2	2.5	8.6	–0.6	–25.7
Malaysia	3.5	–2.2	–5.0	–0.9	0.0	0.0	0.5	7.1	6.7	–4.6
Pakistan	–1.7	–8.3	–12.6	–1.1	1.7	–3.7	–0.6	–1.8	–1.2	–22.1
Philippines	–1.2	–7.1	–4.4	–1.0	–3.5	–1.2	5.9	8.3	18.9	–13.2
Taiwan Province of China	6.7	0.1	–5.8	–1.8	2.0	7.0	–3.3	0.7	0.5	–1.1
Thailand	–5.2	–6.0	–1.2	–2.5	8.8	1.8	–5.1	15.7	19.0	–14.2
Europe, Middle East, & Africa										
Czech Republic	13.9	5.4	–12.8	–9.5	16.9	14.7	–8.7	17.9	14.4	–5.3
Egypt	1.6	2.1	–1.9	–1.0	–25.1	1.3	6.1	0.5	3.2	0.7
Hungary	5.0	10.5	–13.0	–9.6	7.6	15.3	–15.0	11.9	9.7	–8.8
Israel	8.3	6.2	–3.1	–8.5	8.0	1.6	–6.1	9.2	9.3	2.0
Jordan	0.0	0.1	–0.1	–0.1	0.1	0.0	0.1	–0.1	0.0	0.0
Morocco	2.9	0.5	8.8	–2.1	–2.7	–9.2	–7.1	2.0	12.3	10.1
Poland	11.4	4.3	–11.7	–18.9	2.6	24.0	–7.2	11.8	17.5	–16.8
Russia	4.9	0.2	–8.6	–12.8	9.3	5.5	–3.6	9.2	6.9	–16.2
South Africa	–15.2	3.5	–5.6	–13.0	28.2	18.0	–10.5	–9.7	2.1	–28.0
Turkey	–11.6	8.0	–3.4	–17.6	17.7	4.7	–0.6	–4.7	21.1	–24.0
Developed Markets										
Australia	4.3	5.0	–17.3	–11.3	33.9	3.8	–6.1	7.6	11.0	–19.7
Canada	–2.6	0.4	–4.0	–12.7	21.2	7.9	3.4	–0.3	16.8	–18.1
Denmark	8.2	–0.2	–10.6	–0.6	19.8	7.8	–12.9	11.5	10.5	–4.0
Euro area	8.2	–0.2	–10.6	–0.9	20.0	7.6	–12.6	11.4	10.5	–4.2
Hong Kong SAR	0.2	–0.2	0.4	0.2	0.4	–0.1	0.2	–0.3	–0.3	0.6
Japan	12.1	–6.1	0.1	17.1	10.8	4.5	–12.8	–1.1	6.6	23.2
New Zealand	2.6	–3.0	–12.1	–13.5	25.0	9.5	–4.8	3.0	8.8	–24.4
Norway	6.7	0.1	–13.2	–15.7	4.1	9.6	–9.8	8.1	14.7	–21.8
Singapore	4.7	1.2	–5.3	0.4	2.1	4.2	–1.9	8.4	6.5	0.7
Sweden	8.9	–1.2	–13.1	–11.7	20.9	8.0	–16.2	15.9	5.9	–17.4
Switzerland	14.1	–2.7	–9.0	5.0	11.7	8.7	–13.2	7.7	7.5	6.1
United Kingdom	–0.1	0.4	–10.6	–18.0	10.9	7.4	–10.2	13.7	1.3	–26.5

Source: Bloomberg L.P.

[1]High value indicates value of greatest appreciation against the U.S. dollar; low value indicates value of greatest depreciation against the U.S. dollar. "All-Time" refers to the period since 1990 or initiation of the currency.

[2]U.S. dollars per unit.

Table 12. Emerging Market Bond Index: EMBI Global Total Returns Index

	2008				End of Period						12-Month High	12-Month Low	All-Time High[1]	All-Time Low[1]
	Q1	Q2	Q3	Q4	2003	2004	2005	2006	2007	2008				
EMBI Global	**411**	**408**	**387**	**364**	**283**	**316**	**350**	**384**	**409**	**364**	**398**	**348**	**418**	**63**
Latin America														
Argentina	97	93	70	47	67	81	83	126	112	47	114	36	194	36
Brazil	636	651	624	670	390	446	505	580	633	670	672	496	672	68
Chile	204	199	200	205	162	172	177	185	197	205	208	183	208	98
Colombia	313	315	305	308	201	228	256	283	309	308	327	239	327	70
Dominican Republic	187	187	175	120	99	126	156	184	198	120	198	105	198	83
Ecuador	834	862	687	220	464	562	636	561	811	220	889	201	889	61
El Salvador	159	158	151	122	110	123	134	152	165	122	165	105	165	95
Mexico	390	382	373	379	284	308	333	353	377	379	395	297	395	58
Panama	691	694	667	639	452	511	567	637	691	639	712	509	712	56
Peru	641	639	604	601	431	485	514	591	633	601	667	474	667	52
Uruguay	181	186	174	162	97	129	151	177	188	162	192	119	192	38
Venezuela	546	565	468	338	393	484	562	634	563	338	586	308	638	59
Asia														
China	299	295	297	314	241	253	260	271	289	314	314	267	314	98
Indonesia	160	150	143	131	. . .	121	133	154	159	131	161	90	161	90
Malaysia	248	244	244	244	194	207	215	224	240	244	253	210	253	64
Philippines	428	411	419	403	261	280	337	394	425	403	436	306	436	81
Vietnam	119	110	108	99	. . .	. . .	101	112	117	99	120	77	120	77
Europe, Middle East, & Africa														
Bulgaria	729	720	709	646	578	630	643	676	713	646	746	596	746	80
Egypt	175	176	175	178	140	150	155	161	171	178	179	165	179	87
Hungary	168	168	170	149	142	144	148	153	168	149	176	131	176	97
Iraq	124	130	120	81	. . .	. . .	. . .	102	115	81	136	64	136	64
Lebanon	240	250	252	249	177	195	212	215	236	249	255	197	255	99
Pakistan	120	110	67	57	160	107	112	123	111	57	121	49	160	49
Poland	385	375	377	373	290	312	327	340	373	373	388	332	388	71
Russia	619	614	562	494	426	475	538	568	607	494	627	438	627	26
Serbia[1]	121	122	112	82	. . .	. . .	108	117	121	82	125	76	125	76
South Africa	371	373	360	357	297	323	337	349	373	357	379	287	379	99
Tunisia	164	162	161	159	127	138	143	149	160	159	166	149	166	98
Turkey	384	368	379	383	279	307	336	356	392	383	401	274	401	91
Ukraine	380	362	316	172	289	310	334	353	372	172	386	171	386	100
Latin America	**373**	**375**	**350**	**331**	**252**	**285**	**316**	**354**	**372**	**331**	**383**	**266**	**383**	**62**
Non-Latin America	**482**	**471**	**456**	**425**	**342**	**374**	**413**	**443**	**476**	**425**	**486**	**347**	**486**	**72**

Table 12 ***(concluded)***

	Period on Period Percent Change									
	2008				End of Period					
	Q1	Q2	Q3	Q4	2003	2004	2005	2006	2007	2008
EMBI Global	**0.6**	**–0.8**	**–5.0**	**–6.0**	**25.7**	**11.7**	**10.7**	**9.9**	**6.3**	**–10.9**
Latin America										
Argentina	–12.7	–4.7	–24.4	–33.1	19.1	19.8	2.7	51.3	–11.1	–57.9
Brazil	0.5	2.3	–4.2	7.4	69.8	14.3	13.2	14.8	9.1	5.8
Chile	3.7	–2.2	0.3	2.7	8.3	6.0	3.2	4.1	6.4	4.5
Colombia	1.3	0.4	–3.1	0.8	19.4	13.2	12.4	10.7	9.1	–0.5
Dominican Republic	–5.3	–0.2	–6.3	–31.2	–15.3	27.2	24.1	18.0	7.3	–39.0
Ecuador	2.9	3.3	–20.3	–67.9	101.5	21.1	13.2	–11.8	44.6	–72.9
El Salvador	–3.3	–0.9	–4.2	–19.0	11.9	11.5	8.8	14.1	8.0	–25.6
Mexico	3.4	–1.9	–2.4	1.7	11.6	8.6	8.1	6.0	6.9	0.7
Panama	–0.1	0.6	–4.0	–4.2	14.4	13.0	11.1	12.3	8.5	–7.6
Peru	1.2	–0.2	–5.4	–0.6	26.6	12.6	6.0	14.8	7.1	–5.1
Uruguay	–3.6	2.4	–6.1	–7.2	55.6	34.0	16.3	17.3	6.6	–14.0
Venezuela	–3.0	3.6	–17.2	–27.8	39.9	23.2	16.1	12.8	–11.2	–39.9
Asia										
China	3.4	–1.3	0.4	5.7	4.5	5.1	3.0	4.1	6.7	8.4
Indonesia	1.0	–6.1	–4.9	–8.3	. . .	. . .	9.7	15.9	3.0	–17.3
Malaysia	3.2	–1.8	0.2	–0.1	10.7	6.6	3.7	4.3	7.4	1.4
Philippines	0.8	–4.1	2.0	–3.7	13.4	7.1	20.6	16.8	7.9	–5.1
Vietnam	1.4	–7.3	–1.3	–8.7	. . .	. . .	. . .	10.6	4.5	–15.3
Europe, Middle East, & Africa										
Bulgaria	2.2	–1.2	–1.6	–8.9	10.2	8.9	2.1	5.1	5.6	–9.5
Egypt	2.6	0.4	–0.7	1.8	14.4	6.8	3.8	3.8	5.9	4.2
Hungary	0.1	–0.2	1.4	–12.4	3.7	1.2	2.8	3.7	9.4	–11.2
Iraq	7.4	4.8	–7.1	–33.0	. . .	. . .	. . .	. . .	12.4	–29.9
Lebanon	1.5	4.3	1.0	–1.4	19.5	9.9	8.7	1.6	9.9	5.3
Pakistan	7.9	–7.6	–39.4	–15.4	–0.2	–33.3	4.5	10.3	–10.0	–48.8
Poland	3.0	–2.5	0.5	–1.0	3.7	7.5	5.0	3.8	9.9	–0.1
Russia	2.1	–0.9	–8.6	–12.0	22.4	11.5	13.3	5.5	6.9	–18.5
Serbia[1]	–0.2	1.4	–8.8	–27.0	. . .	. . .	. . .	8.3	3.7	–32.6
South Africa	–0.5	0.4	–3.5	–0.8	9.6	8.8	4.3	3.7	6.8	–4.3
Tunisia	2.1	–1.2	–0.7	–1.1	13.3	8.7	3.7	3.8	7.8	–0.9
Turkey	–2.1	–4.2	3.0	1.0	30.8	10.0	9.5	6.1	10.2	–2.3
Ukraine	2.4	–5.0	–12.6	–45.6	19.8	7.2	7.7	5.9	5.2	–53.8
Latin America	**0.1**	**0.7**	**–6.9**	**–5.3**	**33.0**	**13.4**	**10.9**	**11.9**	**5.2**	**–11.1**
Non-Latin America	**1.2**	**–2.3**	**–3.2**	**–6.7**	**17.7**	**9.2**	**10.6**	**7.2**	**7.5**	**–10.7**

Source: JPMorgan Chase & Co.

[1]Data prior to 2006 refer to Serbia and Montenegro.

Table 13. Emerging Market Bond Index: EMBI Global Yield Spreads

(In basis points)

	2008				End of Period						12-Month High	12-Month Low	All-Time High[1]	All-Time Low[1]
	Q1	Q2	Q3	Q4	2003	2004	2005	2006	2007	2008				
EMBI Global	**324**	**308**	**442**	**724**	**403**	**347**	**237**	**171**	**255**	**724**	**339**	**168**	**1,631**	**151**
Latin America														
Argentina	581	614	953	1,704	5,485	4,527	504	216	410	1,704	1,965	410	7,222	185
Brazil	283	227	333	429	459	376	308	190	220	429	688	178	2,451	138
Chile	176	177	223	343	90	64	80	84	151	343	393	151	393	52
Colombia	258	221	318	498	427	332	244	161	195	498	741	156	1,076	95
Dominican Republic	489	463	671	1,605	1,141	824	378	196	281	1,605	1,785	281	1,785	122
Ecuador	662	596	1,001	4,731	799	690	661	920	614	4,731	5,069	538	5,069	436
El Salvador	296	285	384	854	284	245	239	159	199	854	928	199	928	99
Mexico	193	194	275	434	201	174	143	115	172	434	627	147	1,149	89
Panama	244	218	305	539	324	274	239	146	184	539	648	162	769	114
Peru	223	199	310	509	325	239	257	118	178	509	653	142	1,061	95
Uruguay	343	294	412	685	636	388	298	185	243	685	907	243	1,982	133
Venezuela	661	596	959	1,864	586	403	313	183	523	1,864	1,887	490	2,658	161
Asia														
China	154	137	191	228	58	57	68	51	120	228	333	120	364	39
Indonesia	329	381	490	762	. . .	244	269	153	275	762	1,143	275	1,143	136
Malaysia	144	153	194	370	100	78	82	66	119	370	487	114	1,141	65
Philippines	273	303	324	546	415	457	302	155	207	546	797	207	993	132
Vietnam	283	368	404	747	. . .	. . .	190	95	203	747	1,101	203	1,101	89
Europe, Middle East, & Africa														
Bulgaria	221	204	302	674	177	77	90	66	153	674	725	128	1,679	42
Egypt	258	201	333	385	131	101	58	52	178	385	458	107	646	20
Hungary	163	134	174	504	28	32	74	58	84	504	568	84	568	–29
Iraq	545	474	594	1,282	. . .	. . .	. . .	526	569	1,282	1,398	430	1,398	376
Lebanon	594	469	514	794	421	334	246	395	493	794	1,204	439	1,204	111
Pakistan	562	687	1,600	2,112	. . .	233	198	154	535	2,112	2,222	516	2,225	138
Poland	112	115	169	314	76	69	62	47	67	314	401	67	410	17
Russia	208	197	388	805	257	213	118	99	157	805	915	146	7,063	87
Serbia[1]	389	332	526	1,224	. . .	. . .	238	186	304	1,224	1,351	291	1,351	134
South Africa	271	232	364	562	152	102	87	84	164	562	805	164	805	50
Tunisia	214	197	320	464	146	91	81	83	140	464	656	140	656	48
Turkey	348	384	391	534	309	264	223	207	239	534	887	239	1,196	168
Ukraine	376	467	868	2,771	258	255	184	172	303	2,771	2,774	303	2,774	125
Latin America	**347**	**313**	**470**	**746**	**518**	**415**	**272**	**180**	**275**	**746**	**914**	**268**	**1,532**	**157**
Non-Latin America	**297**	**303**	**409**	**699**	**248**	**239**	**179**	**159**	**227**	**699**	**880**	**227**	**1,812**	**142**

Table 13 ***(concluded)***

	Period on Period Spread Change									
	2008				End of period					
	Q1	Q2	Q3	Q4	2003	2004	2005	2006	2007	2008
EMBI Global	**70**	**–16**	**134**	**282**	**–322**	**–56**	**–110**	**–66**	**84**	**470**
Latin America										
Argentina	171	33	339	751	–857	–958	–4,023	–288	194	1,294
Brazil	63	–56	106	96	–1,001	–83	–68	–118	30	209
Chile	25	1	46	120	–86	–26	16	4	67	192
Colombia	63	–37	97	180	–206	–95	–88	–83	34	303
Dominican Republic	208	–26	208	934	642	–317	–446	–182	85	1,324
Ecuador	48	–66	405	3,730	–1,002	–109	–29	259	–306	4,117
El Salvador	97	–11	99	470	–127	–39	–6	–80	40	655
Mexico	21	1	81	159	–128	–27	–31	–28	57	262
Panama	60	–26	87	234	–122	–50	–35	–93	38	355
Peru	45	–24	111	199	–284	–86	18	–139	60	331
Uruguay	100	–49	118	273	–592	–248	–90	–113	58	442
Venezuela	138	–65	363	905	–545	–183	–90	–130	340	1,341
Asia										
China	34	–17	54	37	–26	–1	11	–17	69	108
Indonesia	54	52	109	272	. . .	. . .	25	–116	122	487
Malaysia	25	9	41	176	–112	–22	4	–16	53	251
Philippines	66	30	21	222	–107	42	–155	–147	52	339
Vietnam	80	85	36	343	. . .	. . .	. . .	–95	108	544
Europe, Middle East, & Africa										
Bulgaria	68	–17	98	372	–114	–100	13	–24	87	521
Egypt	80	–57	132	52	–194	–30	–43	–6	126	207
Hungary	79	–29	40	330	–24	4	42	–16	26	420
Iraq	–24	–71	120	688	. . .	. . .	. . .	. . .	43	713
Lebanon	101	–125	45	280	–355	–87	–88	149	98	301
Pakistan	27	125	913	512	–271	. . .	–35	–44	381	1,577
Poland	45	3	54	145	–109	–7	–7	–15	20	247
Russia	51	–11	191	417	–221	–44	–95	–19	58	648
Serbia[1]	85	–57	194	698	. . .	. . .	. . .	–52	118	920
South Africa	107	–39	132	198	–98	–50	–15	–3	80	398
Tunisia	74	–17	123	144	–127	–55	–10	2	57	324
Turkey	109	36	7	143	–387	–45	–41	–16	32	295
Ukraine	73	91	401	1,903	–413	–3	–71	–12	131	2,468
Latin America	**72**	**–34**	**157**	**276**	**–463**	**–103**	**–143**	**–92**	**95**	**471**
Non-Latin America	**70**	**6**	**106**	**290**	**–196**	**–9**	**–60**	**–20**	**68**	**472**

Source: JPMorgan Chase & Co.

[1]Data prior to 2006 refer to Serbia and Montenegro.

Table 14. Emerging Market External Financing: Total Bonds, Equities, and Loans[1]

(In millions of U.S. dollars)

						2008			
	2004	2005	2006	2007	2008	Q1	Q2	Q3	Q4
Total	**325,729.6**	**454,640.3**	**540,183.9**	**716,401.2**	**446,540.0**	**106,919.3**	**182,687.3**	**109,730.3**	**47,203.1**
Africa	**12,715.3**	**12,435.3**	**15,985.5**	**30,584.6**	**9,369.0**	**440.5**	**5,931.8**	**2,215.0**	**781.6**
Algeria	307.9	489.3	2.0	411.0	1,738.0	—	1,738.0	—	—
Angola	2,900.0	3,122.7	91.9	74.6	—	—	—	—	—
Botswana	28.4	—	—	—	—	—	—	—	—
Burkina Faso	—	11.0	—	14.5	—	—	—	—	—
Cameroon	48.0	30.0	—	—	—	—	—	—	—
Cape Verde	—	—	—	13.0	—	—	—	—	—
Central African Republic	—	—	—	305.5	—	—	—	—	—
Côte d'Ivoire	—	—	—	—	45.0	—	45.0	—	—
Djibouti	40.0	—	—	—	—	—	—	—	—
Ethiopia	40.0	—	—	—	100.2	—	100.2	—	—
Gabon	22.0	—	34.4	1,000.0	600.0	—	600.0	—	—
Ghana	850.0	706.5	860.0	1,464.3	1,000.0	—	—	1,000.0	—
Kenya	135.1	64.0	330.1	10.0	277.0	—	183.0	25.0	68.9
Lesotho	—	—	—	19.7	—	—	—	—	—
Malawi	4.8	—	—	—	—	—	—	—	—
Mali	288.9	—	—	180.9	110.4	110.4	—	—	—
Mauritius	—	99.3	180.0	—	29.0	9.0	—	20.0	—
Morocco	803.5	1.9	158.7	1,721.0	472.6	—	196.9	275.7	—
Mozambique	422.4	—	38.8	—	834.0	—	825.5	8.5	—
Namibia	—	50.0	100.0	—	97.6	—	87.6	10.0	—
Nigeria	875.0	874.0	640.0	4,884.3	223.5	—	155.0	—	68.5
Senegal	10.0	—	31.6	—	—	—	—	—	—
Seychelles	—	—	200.0	30.0	—	—	—	—	—
South Africa	5,324.8	6,265.9	12,700.7	19,797.5	2,799.5	31.1	1,549.6	750.9	468.0
Sudan	31.0	—	—	—	—	—	—	—	—
Tanzania	—	136.0	—	—	446.1	270.0	—	—	176.1
Togo	—	—	—	—	125.0	—	—	125.0	—
Tunisia	583.6	579.9	24.7	403.4	402.0	—	402.0	—	—
Uganda	—	—	12.6	—	—	—	—	—	—
Zambia	—	—	505.0	255.0	20.0	20.0	—	—	—
Zimbabwe	—	4.8	75.1	—	48.9	—	48.9	—	—
Asia	**152,357.9**	**189,506.2**	**221,832.9**	**296,076.5**	**184,195.5**	**60,284.7**	**55,610.2**	**45,057.6**	**23,242.8**
Bangladesh	176.8	16.7	106.6	57.5	65.4	65.4	—	—	—
Brunei Darussalam	—	—	—	—	505.0	—	—	505.0	—
Cambodia	—	—	96.3	220.0	—	—	—	—	—
China	25,661.6	38,804.6	50,039.4	74,700.7	29,053.1	11,729.7	8,406.4	7,163.8	1,753.1
Fiji	—	—	150.0	—	—	—	—	—	—
Hong Kong SAR	19,291.2	19,997.7	25,697.6	23,277.6	15,410.1	2,621.3	4,964.0	6,339.3	1,485.6
India	13,301.1	21,660.0	29,534.4	58,005.3	37,206.4	15,478.7	8,231.2	8,240.2	5,256.4
Indonesia	4,115.3	5,193.3	8,432.4	8,106.2	13,776.6	3,963.4	6,064.4	1,574.7	2,174.2
Korea	31,016.0	47,668.6	38,677.3	59,505.2	34,284.3	11,700.1	14,312.3	4,546.5	3,725.3
Lao P.D.R.	210.0	1,000.0	—	—	592.0	—	—	—	592.0
Macao SAR	382.0	729.0	3,692.7	4,531.4	646.5	180.0	—	466.5	—
Malaysia	7,977.8	6,154.6	7,686.8	7,068.3	5,260.2	786.0	599.7	3,462.0	412.5
Marshall Islands	—	24.0	170.0	1,069.3	204.0	—	204.0	—	—
Mongolia	—	30.0	6.0	85.0	6.8	—	4.0	2.8	—
Nepal	—	—	—	—	15.0	5.0	—	10.0	—
Pakistan	970.0	739.2	3,260.0	2,158.3	885.2	240.0	255.4	42.4	347.4
Papua New Guinea	—	—	—	1,024.3	—	—	—	—	—
Philippines	6,358.4	6,194.8	7,041.8	6,319.0	3,066.0	570.8	862.7	698.4	934.1
Singapore	11,949.3	14,546.2	19,680.4	19,640.0	20,437.9	5,912.8	6,511.6	6,242.1	1,771.5
Sri Lanka	135.0	383.0	129.8	755.0	538.7	—	343.7	25.0	170.0
Taiwan Province of China	26,558.0	19,085.0	22,189.9	24,404.2	18,012.1	6,300.9	3,102.7	5,068.4	3,540.1
Thailand	4,141.3	6,310.8	4,784.1	2,494.2	2,570.4	136.7	1,236.4	458.5	738.9
Vietnam	114.0	968.8	457.4	2,655.2	1,659.5	594.0	511.7	212.0	341.8
Europe	**70,203.9**	**103,724.6**	**127,543.6**	**161,433.3**	**124,175.4**	**21,806.3**	**62,904.3**	**26,527.2**	**12,937.7**
Albania	—	—	—	—	78.1	35.7	—	—	42.4
Belarus	21.4	32.0	338.6	302.8	327.0	43.0	149.0	135.0	—
Bulgaria	1,099.9	1,103.7	1,727.1	1,360.0	1,415.0	438.3	300.5	676.1	—
Croatia	2,737.4	1,263.7	1,896.7	2,786.6	1,413.1	—	656.2	756.9	—
Cyprus	1,178.4	1,189.9	3,660.6	3,098.7	3,236.0	65.4	1,470.7	439.6	1,260.2
Czech Republic	4,066.2	4,001.1	2,181.4	4,262.7	8,424.7	1,289.0	5,697.7	1,237.8	200.2
Estonia	1,181.4	692.8	470.9	299.2	328.9	178.8	117.7	32.5	—
Faroe Islands	—	85.3	273.9	431.2	217.4	—	217.4	—	—
Gibraltar	—	1,897.1	2,371.7	994.9	—	—	—	—	—

Table 14 ***(concluded)***

	2004	2005	2006	2007	2008	2008 Q1	2008 Q2	2008 Q3	2008 Q4
Europe *(continued)*									
Hungary	9,260.2	9,341.7	7,328.7	5,330.8	9,103.9	1,808.5	6,063.7	1,053.2	178.4
Latvia	881.6	516.1	1,457.4	1,614.7	1,824.9	1,115.8	23.4	46.5	639.2
Lithuania	986.0	1,219.9	1,292.0	1,645.3	213.3	15.0	93.5	—	104.9
Macedonia, FYR	66.0	176.5	—	14.4	—	—	—	—	—
Malta	242.7	—	256.0	—	218.7	—	—	218.7	—
Moldova	7.0	13.1	—	—	171.3	—	—	63.0	108.3
Montenegro	—	—	0.8	21.4	6.4	—	—	—	6.4
Poland	5,259.3	16,391.7	8,246.7	7,252.0	9,400.5	1,168.2	5,943.8	284.1	2,004.5
Romania	1,116.7	2,611.0	747.2	1,129.1	1,890.0	183.9	1,410.1	158.8	137.2
Russia	22,121.2	37,003.7	59,165.4	84,535.9	60,879.9	7,869.7	32,839.4	14,713.8	5,457.0
Serbia[2]	213.4	1,252.6	60.2	568.6	243.3	7.8	220.8	14.6	—
Slovak Republic	1,319.0	711.5	1,210.7	1,354.2	—	—	—	—	—
Slovenia	1,321.9	1,887.3	1,837.8	4,537.7	3,828.9	1,532.3	1,918.8	42.5	335.3
Turkey	14,506.9	18,999.6	27,641.6	31,220.1	16,104.3	5,070.8	3,972.1	5,401.1	1,660.3
Ukraine	2,617.1	3,334.4	5,378.1	8,672.9	4,849.8	984.1	1,809.3	1,253.0	803.4
Middle East and Central Asia	**33,909.9**	**63,510.7**	**102,259.9**	**96,694.7**	**70,926.2**	**11,084.3**	**31,652.0**	**25,255.0**	**2,934.9**
Armenia	—	1.3	30.0	19.1	11.0	11.0	—	—	—
Azerbaijan	1,217.2	400.2	183.8	315.7	116.6	13.6	57.0	31.0	15.0
Bahrain	1,888.6	2,913.9	3,825.7	6,170.1	445.0	370.0	55.0	20.0	—
Egypt	1,465.0	3,426.1	4,379.6	5,471.8	6,695.3	1,852.6	3,802.4	368.0	672.3
Georgia	—	11.1	220.8	341.6	649.6	100.0	500.0	3.7	45.9
Iran, I.R. of	2,419.4	1,928.8	142.5	—	—	—	—	—	—
Iraq	—	107.8	2,877.0	—	—	—	—	—	—
Israel	3,977.9	5,113.0	3,518.4	2,662.2	2,468.9	717.9	1,401.1	198.4	151.6
Jordan	199.4	—	60.0	180.0	—	—	—	—	—
Kazakhstan	6,376.2	8,199.1	16,655.7	18,049.7	11,137.1	222.9	4,544.0	4,911.4	1,458.8
Kuwait	1,788.2	4,445.0	5,346.6	1,919.9	3,146.8	1,005.7	1,355.0	656.1	130.0
Kyrgyz Republic	—	2.0	—	—	7.4	—	0.8	6.6	—
Lebanon	5,382.8	2,558.0	6,040.0	2,420.0	3,203.2	875.0	1,763.2	500.0	65.0
Libya	—	—	—	38.0	—	—	—	—	—
Oman	1,328.6	3,320.6	3,430.2	3,580.7	950.6	450.0	96.0	404.6	—
Qatar	2,042.7	10,768.5	10,527.9	14,700.6	11,318.1	838.2	3,588.5	6,511.4	380.0
Saudi Arabia	2,749.6	5,791.0	9,115.5	7,110.6	7,232.5	52.0	4,505.6	2,674.9	—
Syrian Arab Republic	—	—	—	—	80.0	—	80.0	—	—
Tajikistan	5.2	1.2	—	2.0	16.7	—	—	16.7	—
United Arab Emirates	3,041.0	14,519.5	35,901.2	33,712.7	21,008.9	4,575.4	7,481.2	8,952.2	—
Uzbekistan	28.0	3.6	4.9	—	16.4	—	—	—	16.4
Yemen Arab Republic	—	—	—	—	2,422.2	—	2,422.2	—	—
Latin America	**56,542.5**	**85,463.4**	**72,562.0**	**131,612.1**	**57,874.0**	**13,303.4**	**26,589.0**	**10,675.5**	**7,306.1**
Argentina	1,790.0	20,663.0	3,343.6	10,049.5	1,301.4	1,036.4	265.0	—	—
Bolivia	—	54.0	—	—	100.0	100.0	—	—	—
Brazil	16,669.8	27,486.0	31,219.4	72,969.1	30,343.1	6,741.7	14,282.8	7,557.3	1,761.2
Chile	7,956.8	6,808.6	6,009.9	3,743.2	5,680.4	692.0	2,771.0	400.0	1,817.5
Colombia	1,628.4	3,063.3	5,036.1	7,879.4	1,991.7	1,750.0	202.0	39.7	—
Costa Rica	334.2	91.7	1.7	31.1	185.0	—	165.0	20.0	—
Cuba	69.8	1.9	—	—	—	—	—	—	—
Dominican Republic	140.5	284.4	779.8	657.9	479.6	100.0	—	379.6	—
Ecuador	—	759.0	19.1	104.0	—	—	—	—	—
El Salvador	340.2	454.5	1,326.6	—	—	—	—	—	—
Guatemala	439.3	365.0	—	15.0	—	—	—	—	—
Haiti	—	—	134.0	—	—	—	—	—	—
Honduras	119.0	4.6	—	—	113.6	—	—	113.6	—
Jamaica	905.3	1,466.6	1,076.1	1,275.0	450.0	—	450.0	—	—
Mexico	19,930.0	14,104.2	16,341.9	17,678.9	10,147.9	2,252.0	2,653.2	1,815.4	3,427.3
Nicaragua	22.0	—	—	—	—	—	—	—	—
Paraguay	—	—	—	—	98.8	18.8	80.0	—	—
Peru	1,388.2	2,583.9	1,489.9	5,724.4	2,330.0	610.0	1,070.0	350.0	300.0
St. Lucia	—	—	—	—	—	—	—	—	—
Trinidad and Tobago	415.0	100.0	2,708.0	955.4	—	—	—	—	—
Uruguay	—	1,061.2	2,700.0	1,148.3	2.6	2.6	—	—	—
Venezuela	4,394.0	6,111.3	376.1	9,381.0	4,650.0	—	4,650.0	—	—

Source: Data provided by the Bond, Equity and Loan database of the International Monetary Fund sourced from Dealogic.

[1]External public syndicated issuance, excluding bilateral deals.

[2]Data prior to 2006 refer to Serbia and Montenegro.

Table 15. Emerging Market External Financing: Bond Issuance[1]

(In millions of U.S. dollars)

						2008			
	2004	2005	2006	2007	2008	Q1	Q2	Q3	Q4
Total	**128,346.9**	**179,506.6**	**163,124.6**	**184,910.3**	**106,012.3**	**18,986.1**	**59,929.7**	**21,411.0**	**5,685.4**
Africa	**2,250.1**	**3,170.0**	**4,898.9**	**13,243.3**	**1,532.8**	**—**	**513.6**	**551.2**	**468.0**
Gabon	—	—	—	1,000.0	—	—	—	—	—
Ghana	—	—	—	950.0	—	—	—	—	—
Morocco	—	—	—	671.3	—	—	—	—	—
Nigeria	—	—	—	525.0	—	—	—	—	—
Seychelles	—	—	200.0	30.0	—	—	—	—	—
South Africa	1,696.5	2,681.4	4,698.9	9,813.6	1,532.8	—	513.6	551.2	468.0
Tunisia	553.6	488.6	—	253.4	—	—	—	—	—
Asia	**44,566.9**	**44,502.1**	**41,705.3**	**47,324.3**	**28,285.1**	**6,150.0**	**14,465.1**	**6,230.1**	**1,439.9**
China	4,362.0	3,858.2	1,110.0	2,144.2	2,055.3	—	300.0	1,755.3	—
Fiji	—	—	150.0	—	—	—	—	—	—
Hong Kong SAR	3,316.8	4,626.9	3,595.8	5,122.6	2,457.2	449.0	817.6	1,168.6	22.1
India	3,199.8	2,118.3	2,644.2	7,549.4	1,407.5	157.5	1,250.0	—	—
Indonesia	1,363.6	2,817.3	2,000.0	1,750.0	4,200.0	2,000.0	2,200.0	—	—
Korea	17,717.7	17,953.7	18,345.6	22,250.3	14,745.2	3,223.9	7,586.9	2,516.5	1,417.8
Malaysia	1,975.0	1,184.1	2,076.2	918.6	439.7	—	—	439.7	—
Mongolia	—	—	—	75.0	—	—	—	—	—
Pakistan	500.0	—	1,050.0	750.0	—	—	—	—	—
Philippines	4,446.7	3,900.0	4,623.2	1,000.0	350.0	—	—	350.0	—
Singapore	5,727.9	4,245.7	4,750.5	4,498.8	2,103.9	319.6	1,784.4	—	—
Sri Lanka	100.0	—	—	500.0	—	—	—	—	—
Taiwan Province of China	457.4	806.0	304.7	—	2.4	—	2.4	—	—
Thailand	1,400.0	2,241.8	1,055.0	765.4	523.8	—	523.8	—	—
Vietnam	—	750.0	—	—	—	—	—	—	—
Europe	**33,016.7**	**52,290.5**	**50,649.5**	**60,476.1**	**45,821.8**	**7,246.1**	**27,048.7**	**9,861.3**	**1,665.6**
Belarus	—	—	2.5	19.4	3.0	3.0	—	—	—
Bulgaria	10.0	383.4	220.8	—	—	—	—	—	—
Croatia	1,654.3	—	384.9	746.4	—	—	—	—	—
Cyprus	1,178.4	1,135.5	1,694.9	2,427.8	1,662.6	—	352.3	50.0	1,260.2
Czech Republic	2,546.7	1,345.2	907.4	2,168.9	4,564.3	144.9	3,182.4	1,237.0	—
Estonia	958.5	426.6	—	38.0	—	—	—	—	—
Gibraltar	—	—	—	900.8	—	—	—	—	—
Hungary	5,002.1	7,351.4	6,900.9	4,088.2	5,281.3	1,466.1	3,470.8	344.4	—
Latvia	528.4	123.1	266.1	—	607.6	607.6	—	—	—
Lithuania	811.2	778.6	1,241.6	1,484.2	104.9	—	—	—	104.9
Macedonia, FYR	—	176.5	—	—	—	—	—	—	—
Poland	3,545.2	11,851.5	4,693.5	4,111.0	3,785.1	473.8	3,311.3	—	—
Romania	—	1,197.0	—	—	1,162.5	—	1,162.5	—	—
Russia	7,150.8	15,365.7	20,804.6	30,190.3	22,063.2	923.4	14,609.3	6,229.9	300.5
Serbia	—	1,018.5	—	165.2	—	—	—	—	—
Slovak Republic	1,188.7	—	1,208.8	1,354.2	—	—	—	—	—
Slovenia	67.3	156.5	—	1,614.8	1,477.3	1,477.3	—	—	—
Turkey	6,060.1	8,875.0	9,209.9	7,132.2	4,150.0	2,150.0	500.0	1,500.0	—
Ukraine	2,315.0	2,105.9	3,113.5	4,035.0	960.0	—	460.0	500.0	—

Table 15 ***(concluded)***

	2004	2005	2006	2007	2008	2008 Q1	2008 Q2	2008 Q3	2008 Q4
Middle East and Central Asia	**14,783.4**	**18,576.9**	**35,156.1**	**25,327.1**	**12,810.6**	**1,844.3**	**7,157.5**	**3,808.8**	**—**
Azerbaijan	—	—	5.0	100.0	49.6	13.6	26.0	10.0	—
Bahrain	665.6	1,296.7	1,120.0	1,767.7	350.0	350.0	—	—	—
Egypt	—	1,250.0	—	1,803.5	—	—	—	—	—
Georgia	—	—	—	200.0	500.0	—	500.0	—	—
Iraq	—	—	2,700.0	—	—	—	—	—	—
Israel	2,250.0	1,177.9	1,500.0	—	1,335.3	250.0	1,000.0	85.3	—
Jordan	145.0	—	—	—	—	—	—	—	—
Kazakhstan	3,225.0	2,850.0	7,055.8	8,808.6	3,575.0	—	3,575.0	—	—
Kuwait	500.0	500.0	1,137.0	575.0	305.7	305.7	—	—	—
Lebanon	5,382.8	1,780.0	5,741.6	2,300.0	3,138.2	875.0	1,763.2	500.0	—
Oman	250.0	—	25.0	—	—	—	—	—	—
Qatar	665.0	2,250.0	3,040.0	—	—	—	—	—	—
Saudi Arabia	—	1,800.0	2,913.8	—	—	—	—	—	—
United Arab Emirates	1,700.0	5,672.4	9,917.9	9,772.4	3,556.8	50.0	293.3	3,213.4	—
Latin America	**33,729.7**	**60,967.1**	**30,714.8**	**38,539.5**	**17,562.0**	**3,745.7**	**10,744.8**	**959.7**	**2,111.9**
Argentina	1,290.0	18,984.4	1,745.5	3,400.9	65.0	—	65.0	—	—
Brazil	9,716.4	17,769.0	12,303.9	9,916.9	6,734.7	1,245.7	5,054.0	435.0	—
Chile	2,350.0	900.0	1,100.0	250.0	99.8	—	99.8	—	—
Colombia	1,545.4	2,435.5	3,177.6	3,133.7	1,039.7	1,000.0	—	39.7	—
Costa Rica	310.0	—	—	—	—	—	—	—	—
Dominican Republic	—	196.6	550.0	430.0	—	—	—	—	—
Ecuador	—	650.0	—	—	—	—	—	—	—
El Salvador	286.5	375.0	625.0	—	—	—	—	—	—
Guatemala	380.0	200.0	—	—	—	—	—	—	—
Jamaica	809.0	1,050.0	880.0	625.0	350.0	—	350.0	—	—
Mexico	11,384.2	9,165.1	6,207.2	6,341.4	4,472.9	1,500.0	526.0	335.0	2,111.9
Peru	1,298.2	2,155.0	445.0	4,449.0	150.0	—	—	150.0	—
Trinidad and Tobago	100.0	100.0	980.7	900.0	—	—	—	—	—
Uruguay	—	1,061.2	2,700.0	342.6	—	—	—	—	—
Venezuela	4,260.0	5,925.3	—	8,750.0	4,650.0	—	4,650.0	—	—

Source: Data provided by the Bond, Equity and Loan database of the International Monetary Fund sourced from Dealogic.

[1]External public syndicated issuance, excluding bilateral deals.

Table 16. Emerging Market External Finance: Equity Issuance[1]

(In millions of U.S. dollars)

						2008			
	2004	2005	2006	2007	2008	Q1	Q2	Q3	Q4
Total	**49,026.4**	**85,434.7**	**124,918.9**	**202,345.4**	**54,254.4**	**13,484.4**	**31,403.2**	**6,897.1**	**2,469.6**
Africa	**2,742.4**	**1,189.0**	**4,010.6**	**8,980.1**	**1,389.4**	**31.1**	**893.5**	**395.9**	**68.9**
Algeria	—	—	2.0	—	—	—	—	—	—
Central African Republic	—	—	—	305.5	—	—	—	—	—
Ghana	—	—	—	9.8	—	—	—	—	—
Kenya	—	—	—	—	252.0	—	183.0	—	68.9
Morocco	800.9	—	133.3	1,049.7	472.6	—	196.9	275.7	—
Namibia	—	—	—	—	87.6	—	87.6	—	—
Nigeria	—	—	—	692.8	—	—	—	—	—
South Africa	1,910.5	1,184.2	3,800.2	6,922.3	528.3	31.1	377.1	120.2	—
Sudan	31.0	—	—	—	—	—	—	—	—
Zimbabwe	—	4.8	75.1	—	48.9	—	48.9	—	—
Asia	**36,755.3**	**62,997.1**	**79,715.7**	**98,512.5**	**28,091.0**	**11,719.1**	**11,149.6**	**3,493.0**	**1,729.0**
Bangladesh	—	16.7	23.0	39.9	—	—	—	—	—
Cambodia	—	—	96.3	220.0	—	—	—	—	—
China	13,763.8	23,188.4	40,517.1	47,829.3	12,755.5	4,783.9	5,076.1	1,619.7	1,275.8
Hong Kong SAR	3,704.6	4,076.6	6,054.9	5,657.3	2,085.0	114.6	1,794.3	138.8	37.3
India	5,023.5	8,571.0	11,009.0	19,080.6	5,867.1	4,610.5	1,052.8	176.4	27.4
Indonesia	849.3	1,334.2	675.9	2,674.5	2,327.2	269.9	1,678.1	379.2	—
Korea	5,314.4	12,606.7	7,313.7	6,114.5	2,232.4	1,146.4	724.1	—	361.8
Macao SAR	—	—	1,316.8	581.3	466.5	—	—	466.5	—
Malaysia	964.7	672.3	559.4	1,790.9	660.0	650.0	—	10.0	—
Pakistan	—	—	922.2	793.4	109.3	—	109.3	—	—
Papua New Guinea	—	—	—	1,024.3	—	—	—	—	—
Philippines	47.0	740.2	1,515.7	2,226.8	201.0	75.8	125.2	—	—
Singapore	2,601.1	3,996.7	4,362.5	4,197.0	30.7	—	3.9	—	26.7
Sri Lanka	—	55.5	—	—	3.7	—	3.7	—	—
Taiwan Province of China	3,388.5	7,171.6	3,543.4	4,861.4	846.0	61.4	82.2	702.4	—
Thailand	1,098.4	567.2	1,805.8	819.9	416.6	6.7	409.9	—	—
Vietnam	—	—	—	601.4	90.0	—	90	—	—
Europe	**5,559.5**	**10,660.2**	**18,152.0**	**36,664.2**	**7,727.3**	**188.7**	**6,903.2**	**37.2**	**598.3**
Bulgaria	—	93.5	85.7	—	—	—	—	—	—
Croatia	—	—	220.0	1,377.6	—	—	—	—	—
Cyprus	—	54.4	999.9	19.6	28.4	—	28.4	—	—
Czech Republic	174.4	295.1	287.3	278.0	2,516.1	—	2,515.2	0.9	—
Estonia	—	266.2	21.5	216.1	—	—	—	—	—
Faroe Islands	—	—	67.7	225.1	—	—	—	—	—
Gibraltar	—	1,897.1	437.5	94.1	—	—	—	—	—
Hungary	884.7	48.8	—	191.8	—	—	—	—	—
Lithuania	—	51.2	—	—	15.0	15.0	—	—	—
Poland	964.7	1,249.8	1,503.0	407.3	1,151.6	96.6	456.7	0.0	598.3
Romania	—	—	172.5	116.9	—	—	—	—	—
Russia	2,554.9	6,458.2	13,165.4	29,596.8	2,850.3	—	2,848.5	1.8	—
Slovak Republic	—	88.8	1.9	—	—	—	—	—	—
Slovenia	—	—	—	231.4	248.9	—	248.9	—	—
Turkey	980.8	—	1,164.3	2,576.6	—	—	—	—	—
Ukraine	—	157.1	25.3	1,332.9	917.0	77.1	805.4	34.5	—
Middle East and Central Asia	**1,783.2**	**5,303.8**	**7,988.6**	**11,854.3**	**4,484.2**	**371.0**	**3,391.1**	**648.8**	**73.3**
Bahrain	—	87.2	420.5	266.4	—	—	—	—	—
Egypt	141.0	686.8	483.7	592.1	483.6	—	483.6	—	—
Georgia	—	—	159.8	—	100.0	100.0	—	—	—
Israel	1,357.9	1,894.7	921.6	1,459.2	679.1	91.6	401.1	113.1	73.3
Kazakhstan	—	1,548.2	4,303.6	5,030.4	219.9	152.9	67.0	—	—
Kuwait	260.7	—	—	—	1,642.0	—	1,141.0	501.1	—
Lebanon	—	778.0	248.4	—	—	—	—	—	—
Oman	23.6	148.4	—	—	34.6	—	—	34.6	—
Qatar	—	—	234.8	171.4	900.0	—	900.0	—	—
Saudi Arabia	—	—	—	41.8	—	—	—	—	—
United Arab Emirates	—	160.5	1,216.2	4,293.0	425.0	26.6	398.4	—	—
Latin America	**2,186.0**	**5,284.6**	**15,052.0**	**46,334.2**	**12,562.6**	**1,174.5**	**9,065.8**	**2,322.3**	**—**
Argentina	—	—	987.1	1,422.7	—	—	—	—	—
Brazil	1,830.5	3,782.8	11,177.1	38,474.6	10,435.4	1,174.5	6,938.6	2,322.3	—
Chile	105.5	598.1	742.9	317.7	—	—	—	—	—
Colombia	—	—	54.2	3,365.7	—	—	—	—	—
Mexico	250.1	903.8	1,513.8	2,111.1	2,127.2	—	2,127.2	—	—
Peru	—	—	576.9	642.6	—	—	—	—	—

Source: Data provided by the Bond, Equity and Loan database of the International Monetary Fund sourced from Dealogic.

[1]External public syndicated issuance, excluding bilateral deals.

Table 17. Emerging Market External Financing: Loan Syndication[1]

(In millions of U.S. dollars)

						2008			
	2004	2005	2006	2007	2008	Q1	Q2	Q3	Q4
Total	**148,356.3**	**189,699.0**	**252,140.3**	**329,145.6**	**286,273.3**	**74,448.8**	**91,354.3**	**81,422.1**	**39,048.1**
Africa	**7,722.8**	**8,076.3**	**7,076.0**	**8,361.2**	**6,446.8**	**409.4**	**4,524.7**	**1,268.0**	**244.6**
Algeria	307.9	489.3	—	411.0	1,738.0	—	1,738.0	—	—
Angola	2,900.0	3,122.7	91.9	74.6	—	—	—	—	—
Botswana	28.4	—	—	—	—	—	—	—	—
Burkina Faso	—	11.0	—	14.5	—	—	—	—	—
Cameroon	48.0	30.0	—	—	—	—	—	—	—
Cape Verde	—	—	—	13.0	—	—	—	—	—
Côte d'Ivoire	—	—	—	—	45.0	—	45.0	—	—
Djibouti	40.0	—	—	—	—	—	—	—	—
Ethiopia	40.0	—	—	—	100.2	—	100.2	—	—
Gabon	22.0	—	34.4	—	600.0	—	600.0	—	—
Ghana	850.0	706.5	860.0	504.5	1,000.0	—	—	1,000.0	—
Kenya	135.1	64.0	330.1	10.0	25.0	—	—	25.0	—
Lesotho	—	—	—	19.7	—	—	—	—	—
Malawi	4.8	—	—	—	—	—	—	—	—
Mali	288.9	—	—	180.9	110.4	110.4	—	—	—
Mauritius	—	99.3	180.0	—	29.0	9.0	—	20.0	—
Morocco	2.6	1.9	25.4	—	—	—	—	—	—
Mozambique	422.4	—	38.8	—	834.0	—	825.5	8.5	—
Namibia	—	50.0	100.0	—	10.0	—	—	10.0	—
Nigeria	875.0	874.0	640.0	3,666.5	223.5	—	155.0	—	68.5
Senegal	10.0	—	31.6	—	—	—	—	—	—
South Africa	1,717.8	2,400.3	4,201.6	3,061.6	738.5	—	659.0	79.5	—
Tanzania	—	136.0	—	—	446.1	270.0	—	—	176.1
Togo	—	—	—	—	125.0	—	—	125.0	—
Tunisia	30.0	91.2	24.7	150.0	402.0	—	402.0	—	—
Uganda	—	—	12.6	—	—	—	—	—	—
Zambia	—	—	505.0	255.0	20.0	20.0	—	—	—
Asia	**71,035.7**	**82,007.0**	**100,411.9**	**150,239.7**	**127,819.3**	**42,415.6**	**29,995.5**	**35,334.5**	**20,073.9**
Bangladesh	176.8	—	83.6	17.6	65.4	65.4	—	—	—
Brunei Darussalam	—	—	—	—	505.0	—	—	505.0	—
China	7,535.7	11,757.9	8,412.3	24,727.2	14,242.3	6,945.9	3,030.3	3,788.9	477.3
Hong Kong SAR	12,269.8	11,294.2	16,046.8	12,497.7	10,867.9	2,057.6	2,352.1	5,031.9	1,426.2
India	5,077.8	10,970.7	15,881.2	31,375.3	29,931.8	10,710.6	5,928.4	8,063.8	5,229.0
Indonesia	1,902.4	1,041.8	5,756.5	3,681.7	7,249.4	1,693.5	2,186.2	1,195.5	2,174.2
Korea	7,983.9	17,108.2	13,017.9	31,140.5	17,306.7	7,329.7	6,001.3	2,030.0	1,945.7
Lao P.D.R.	210.0	1,000.0	—	—	592.0	—	—	—	592.0
Macao SAR	382.0	729.0	2,375.9	3,950.1	180.0	180.0	—	—	—
Malaysia	5,038.1	4,298.2	5,051.2	4,358.8	4,160.5	136.0	599.7	3,012.3	412.5
Marshall Islands	—	24.0	170.0	1,069.3	204.0	—	204.0	—	—
Mongolia	—	30.0	6.0	10.0	6.8	—	4.0	2.8	—
Nepal	—	—	—	—	15.0	5.0	—	10.0	—
Pakistan	470.0	739.2	1,287.8	614.9	775.9	240.0	146.1	42.4	347.4
Philippines	1,864.7	1,554.6	902.9	3,092.2	2,515.0	495.0	737.5	348.4	934.1
Singapore	3,620.4	6,303.7	10,567.4	10,944.2	18,303.3	5,593.2	4,723.3	6,242.1	1,744.8
Sri Lanka	35.0	327.5	129.8	255.0	535.0	—	340.0	25.0	170.0
Taiwan Province of China	22,712.1	11,107.4	18,341.9	19,542.8	17,163.7	6,239.6	3,018.1	4,366.0	3,540.1
Thailand	1,642.9	3,501.8	1,923.3	908.8	1,630.0	130.0	302.7	458.5	738.9
Vietnam	114.0	218.8	457.4	2,053.8	1,569.5	594.0	421.7	212.0	341.8
Europe	**31,627.7**	**40,773.9**	**58,742.1**	**64,293.1**	**70,626.3**	**14,371.6**	**28,952.3**	**16,628.7**	**10,673.7**
Albania	—	—	—	—	78.1	35.7	—	—	42.4
Belarus	21.4	32.0	336.1	283.5	324.0	40.0	149.0	135.0	—
Bulgaria	1,089.9	626.8	1,420.6	1,360.0	1,415.0	438.3	300.5	676.1	—
Croatia	1,083.1	1,263.7	1,291.9	662.6	1,413.1	—	656.2	756.9	—
Cyprus	—	—	965.7	651.3	1,545.0	65.4	1,090.0	389.6	—
Czech Republic	1,345.1	2,360.8	986.8	1,815.8	1,344.3	1,144.1	—	—	200.2
Estonia	222.9	—	449.4	45.1	328.9	178.8	117.7	32.5	—
Faroe Islands	—	85.3	206.2	206.1	217.4	—	217.4	—	—
Gibraltar	—	—	1,934.2	—	—	—	—	—	—
Hungary	3,373.4	1,941.4	427.8	1,050.9	3,822.6	342.4	2,593.0	708.8	178.4
Latvia	353.2	393.0	1,191.3	1,614.7	1,217.3	508.2	23.4	46.5	639.2

Table 17 *(concluded)*

	2004	2005	2006	2007	2008	2008 Q1	2008 Q2	2008 Q3	2008 Q4
Europe *(continued)*									
Lithuania	174.8	390.2	50.4	161.2	93.5	—	93.5	—	—
Macedonia, FYR	66.0	—	—	14.4	—	—	—	—	—
Malta	242.7	—	256.0	—	218.7	—	—	218.7	—
Moldova	7.0	13.1	—	—	171.3	—	—	63.0	108.3
Montenegro	—	—	0.8	21.4	6.4	—	—	—	6.4
Poland	749.4	3,290.4	2,050.2	2,733.7	4,463.8	597.8	2,175.8	284.1	1,406.1
Romania	1,116.7	1,414.0	574.7	1,012.2	727.5	183.9	247.5	158.8	137.2
Russia	12,415.5	15,179.7	25,195.4	24,748.9	35,966.4	6,946.3	15,381.6	8,482.1	5,156.4
Serbia	213.4	234.1	60.2	403.4	243.3	7.8	220.8	14.6	—
Slovak Republic	130.3	622.7	—	—	—	—	—	—	—
Slovenia	1,254.6	1,730.8	1,837.8	2,691.6	2,102.7	55.0	1,669.9	42.5	335.3
Turkey	7,466.0	10,124.6	17,267.4	21,511.3	11,954.3	2,920.8	3,472.1	3,901.1	1,660.3
Ukraine	302.1	1,071.4	2,239.3	3,305.0	2,972.8	907.0	543.8	718.5	803.4
Middle East and Central Asia	**17,343.2**	**39,630.0**	**59,115.2**	**59,513.2**	**53,631.4**	**8,869.0**	**21,103.4**	**20,797.4**	**2,861.6**
Armenia	—	1.3	30.0	19.1	11.0	11.0	—	—	—
Azerbaijan	1,217.2	400.2	178.8	215.7	67.0	—	31.0	21.0	15.0
Bahrain	1,223.0	1,530.0	2,285.2	4,136.0	95.0	20.0	55.0	20.0	—
Egypt	1,324.0	1,489.3	3,895.9	3,076.1	6,211.7	1,852.6	3,318.8	368.0	672.3
Georgia	—	11.1	61.0	141.6	49.6	—	—	3.7	45.9
Iran, I.R. of	2,419.4	1,928.8	142.5	—	—	—	—	—	—
Iraq	—	107.8	177.0	—	—	—	—	—	—
Israel	370.0	2,040.4	1,096.8	1,203.0	454.6	376.3	—	—	78.3
Jordan	54.4	—	60.0	180.0	—	—	—	—	—
Kazakhstan	3,151.2	3,800.9	5,296.4	4,210.7	7,342.2	70.0	902.0	4,911.4	1,458.8
Kuwait	1,027.5	3,945.0	4,209.6	1,344.9	1,199.1	700.0	214.1	155.0	130.0
Kyrgyz Republic	—	2.0	—	—	7.4	—	0.8	6.6	—
Lebanon	—	—	50.0	120.0	65.0	—	—	—	65.0
Libya	—	—	—	38.0	—	—	—	—	—
Oman	1,055.0	3,172.2	3,405.2	3,580.7	916.0	450.0	96.0	370.0	—
Qatar	1,377.7	8,518.5	7,253.1	14,529.2	10,418.1	838.2	2,688.5	6,511.4	380.0
Saudi Arabia	2,749.6	3,991.0	6,201.7	7,068.8	7,232.5	52.0	4,505.6	2,674.9	—
Syrian Arab Republic	—	—	—	—	80.0	—	80.0	—	—
Tajikistan	5.2	1.2	—	2.0	16.7	—	—	16.7	—
United Arab Emirates	1,341.0	8,686.6	24,767.1	19,647.3	17,027.1	4,498.9	6,789.5	5,738.8	—
Uzbekistan	28.0	3.6	4.9	—	16.4	—	—	—	16.4
Yemen Arab Republic	—	—	—	—	2,422.2	—	2,422.2	—	—
Latin America	**20,626.9**	**19,211.7**	**26,795.2**	**46,738.4**	**27,749.4**	**8,383.3**	**6,778.4**	**7,393.5**	**5,194.2**
Argentina	500.0	1,678.6	611.0	5,226.0	1,236.4	1,036.4	200.0	—	—
Bolivia	—	54.0	—	—	100.0	100.0	—	—	—
Brazil	5,122.9	5,934.3	7,738.3	24,577.6	13,173.0	4,321.5	2,290.2	4,800.0	1,761.2
Chile	5,501.3	5,310.6	4,166.9	3,175.5	5,580.7	692.0	2,671.2	400.0	1,817.5
Colombia	83.0	627.8	1,804.4	1,380.0	952.0	750.0	202.0	—	—
Costa Rica	24.2	91.7	1.7	31.1	185.0	—	165.0	20.0	—
Cuba	69.8	1.9	—	—	—	—	—	—	—
Dominican Republic	140.5	87.8	229.8	227.9	479.6	100.0	—	379.6	—
Ecuador	—	109.0	19.1	104.0	—	—	—	—	—
El Salvador	53.8	79.5	701.6	—	—	—	—	—	—
Guatemala	59.3	165.0	—	15.0	—	—	—	—	—
Haiti	—	—	134.0	—	—	—	—	—	—
Honduras	119.0	4.6	—	—	113.6	—	—	113.6	—
Jamaica	96.3	416.6	196.1	650.0	100.0	—	100.0	—	—
Mexico	8,295.7	4,035.4	8,620.9	9,226.4	3,547.9	752.0	—	1,480.4	1,315.5
Nicaragua	22.0	—	—	—	—	—	—	—	—
Paraguay	—	—	—	—	98.8	18.8	80.0	—	—
Peru	90.0	429.0	468.0	632.9	2,180.0	610.0	1,070.0	200.0	300.0
St. Lucia	—	—	—	—	—	—	—	—	—
Trinidad and Tobago	315.0	—	1,727.3	55.4	—	—	—	—	—
Uruguay	—	—	—	805.7	2.6	2.6	—	—	—
Venezuela	134.0	186.0	376.1	631.0	—	—	—	—	—

Source: Data provided by the Bond, Equity and Loan database of the International Monetary Fund sourced from Dealogic.

[1]External public syndicated issuance, excluding bilateral deals.

Table 18. Equity Valuation Measures: Dividend-Yield Ratios

						2008		
	2003	2004	2005	2006	2007	Q1	Q2	Q3
Composite	**2.28**	**2.29**	**2.28**	**2.14**	**1.56**	**1.78**	**2.13**	**3.13**
Asia	**1.97**	**2.20**	**2.42**	**1.88**	**1.32**	**1.51**	**2.08**	**3.12**
Europe/Middle East/Africa	**2.41**	**2.00**	**1.76**	**2.36**	**1.82**	**2.06**	**2.20**	**3.36**
Latin America	**3.26**	**3.24**	**3.07**	**2.56**	**1.99**	**2.22**	**2.18**	**3.00**
Argentina	1.37	0.98	1.20	1.21	1.20	1.19	0.76	1.32
Bahrain	2.27	1.19	1.77	4.16	3.80	5.52	5.37	6.12
Brazil	4.23	4.24	3.98	3.38	2.00	2.34	2.29	3.51
Chile	2.95	4.62	2.99	2.07	2.40	2.81	2.79	3.64
China	2.31	1.82	2.56	1.29	0.70	0.91	1.75	2.15
Colombia	5.89	5.44	1.38	1.96	1.89	1.83	2.10	2.86
Czech Republic	5.04	4.19	1.42	3.71	2.67	2.99	3.69	4.83
Egypt	4.94	1.45	1.54	2.29	1.76	1.80	2.31	3.96
Hungary	0.91	1.73	2.05	1.83	3.04	2.95	1.04	2.82
India	1.74	1.70	1.25	1.07	0.71	0.81	1.07	1.72
Indonesia	3.42	3.35	2.74	2.18	1.87	2.07	2.29	3.63
Israel	1.20	1.83	1.58	2.55	2.64	2.72	2.66	2.88
Jordan	2.40	1.49	2.19	1.06	1.48	2.32	1.26	1.44
Korea	2.08	2.25	1.70	1.49	1.30	1.09	1.61	2.26
Kuwait	. . .	. . .	. . .	2.97	3.01	3.60	4.36	4.59
Malaysia	3.02	3.50	4.33	3.72	3.38	4.63	4.92	5.83
Mexico	2.12	1.85	2.18	1.24	2.20	2.19	2.31	2.90
Morocco	4.65	2.71	3.61	2.22	1.85	1.60	2.64	2.86
Nigeria	4.11	3.70	3.14	2.29	1.47	1.21	1.77	2.47
Oman	5.38	3.32	2.15	4.64	3.25	4.93	4.75	3.53
Pakistan	7.47	6.98	2.50	3.96	3.25	3.39	4.71	8.42
Peru	2.83	3.10	3.45	3.83	3.65	3.59	3.62	5.24
Philippines	2.12	1.79	2.63	2.00	2.28	3.79	4.51	4.49
Poland	1.43	1.20	2.48	3.36	2.66	3.10	2.25	4.40
Qatar	. . .	. . .	. . .	1.69	2.31	2.74	2.12	2.36
Russia	1.78	1.21	1.07	1.83	0.53	0.63	0.70	1.34
Saudi Arabia	2.58	2.05	1.25	2.65	2.18	2.82	2.51	2.80
South Africa	3.96	3.09	3.09	2.77	3.33	2.96	3.38	4.34
Sri Lanka	3.64	4.67	2.47	1.77	2.28	3.11	3.75	4.43
Taiwan Province of China	1.47	2.67	3.39	3.06	3.03	3.02	3.14	6.43
Thailand	1.64	2.24	3.05	4.51	3.81	4.00	4.04	5.31
Turkey	1.15	2.97	1.81	2.19	1.96	2.63	3.71	3.43
United Arab Emirates	. . .	. . .	. . .	2.12	1.27	1.37	1.95	2.58
Venezuela	9.86	12.28	6.27	5.71	. . .	. . .	. . .	. . .

Source: Standard & Poor's Emerging Market Database.

Table 19. Equity Valuation Measures: Price-to-Book Ratios

						2008		
	2003	2004	2005	2006	2007	Q1	Q2	Q3
Composite	**1.96**	**1.86**	**2.65**	**2.73**	**3.67**	**3.21**	**3.11**	**1.89**
Asia	**2.06**	**1.78**	**2.11**	**2.43**	**3.69**	**3.09**	**2.76**	**1.68**
Europe/Middle East/Africa	**1.86**	**2.21**	**3.91**	**3.26**	**3.91**	**3.54**	**3.75**	**2.67**
Latin America	**1.83**	**1.58**	**2.30**	**2.91**	**3.27**	**3.12**	**3.21**	**1.66**
Argentina	1.99	2.16	2.50	4.09	3.23	3.49	4.23	2.57
Bahrain	2.02	2.02	2.73	2.23	3.56	3.48	3.62	2.83
Brazil	1.79	1.93	2.16	2.68	3.30	3.09	3.29	1.38
Chile	1.87	0.55	1.93	2.43	2.54	2.41	2.46	2.1
China	2.55	2.03	1.81	3.12	6.26	4.59	3.91	1.45
Colombia	0.94	1.58	2.41	1.78	1.82	1.55	1.55	1.5
Czech Republic	0.99	1.58	2.35	2.39	3.12	2.80	2.95	2.48
Egypt	2.08	4.38	9.08	5.85	8.60	7.58	6.63	4.84
Hungary	2.00	2.78	3.08	3.08	3.24	2.64	2.46	2.26
India	3.50	3.31	5.15	4.89	7.90	5.79	4.95	4.77
Indonesia	1.62	2.75	2.50	3.35	5.57	5.10	5.23	3.92
Israel	2.61	2.58	3.00	3.48	4.37	3.79	3.98	3.44
Jordan	2.08	2.99	6.24	3.30	4.39	4.28	5.35	4.68
Korea	1.57	1.25	1.95	1.74	2.18	2.00	1.94	1.24
Kuwait	. . .	. . .	4.64	4.52	6.37	6.94	6.70	5.53
Malaysia	1.71	1.93	1.67	2.08	2.51	2.17	1.97	1.71
Mexico	2.02	2.51	2.88	3.84	3.58	3.64	3.25	2.47
Morocco	1.70	2.06	2.92	3.11	4.34	5.03	4.81	4.29
Nigeria	2.52	3.19	5.36	5.22	11.98	15.94	13.94	11.88
Oman	1.50	1.80	2.28	2.19	4.01	4.49	5.02	3.74
Pakistan	2.25	2.63	3.51	3.17	4.66	5.13	4.08	2.86
Peru	1.80	1.56	2.17	3.47	5.95	5.77	6.59	4.23
Philippines	1.06	1.35	1.73	1.92	2.76	2.27	1.64	1.78
Poland	1.76	2.04	2.53	2.52	2.84	2.43	2.15	2.01
Qatar	. . .	. . .	8.80	2.73	3.79	3.96	5.14	3.98
Russia	1.18	1.18	2.19	2.53	2.82	2.40	2.78	1.33
Saudi Arabia	3.56	6.50	14.54	7.57	9.95	8.49	8.33	6.84
South Africa	2.06	2.52	2.98	3.80	4.38	4.38	4.26	3.79
Sri Lanka	1.63	1.93	2.56	2.41	1.85	1.75	1.58	1.3
Taiwan Province of China	2.18	1.94	1.93	2.36	2.56	2.56	2.31	1.76
Thailand	2.84	2.03	2.06	1.85	2.46	2.41	2.14	1.63
Turkey	2.64	1.74	2.13	1.95	2.78	2.00	1.82	1.89
United Arab Emirates	. . .	. . .	9.98	3.07	4.69	4.30	4.58	3.52
Venezuela	1.10	1.18	0.72	2.59	. . .	. . .	. . .	. . .

Source: Standard & Poor's Emerging Market Database.

Table 20. Equity Valuation Measures: Price/Earnings Ratios

						2008		
	2003	2004	2005	2006	2007	Q1	Q2	Q3
Composite	**21.7**	**16.5**	**18.9**	**17.7**	**23.4**	**20.6**	**19.7**	**11.69**
Asia	**30.3**	**16.8**	**17.9**	**18.0**	**26.9**	**22.6**	**20.4**	**11.79**
Europe/Middle East/Africa	**18.0**	**18.6**	**25.2**	**18.7**	**22.6**	**20.7**	**21.1**	**15.24**
Latin America	**13.3**	**12.8**	**12.2**	**15.2**	**17.2**	**16.5**	**16.8**	**8.45**
Argentina	21.1	27.7	11.1	18.0	13.6	14.8	17.9	10.87
Bahrain	21.3	21.5	31.7	14.3	20.3	20.5	21.3	16.62
Brazil	10.0	10.6	10.7	12.7	16.6	15.5	16.5	6.98
Chile	24.8	17.2	15.7	24.2	22.3	21.1	21.6	18.59
China	28.6	19.1	13.9	24.6	50.5	37.1	31.7	9.68
Colombia	13.0	19.2	28.8	21.9	21.8	18.6	18.6	16.32
Czech Republic	10.8	25.0	21.1	20.0	26.5	23.8	25.1	20.86
Egypt	11.7	21.8	30.9	20.2	30.2	26.6	23.1	16.63
Hungary	12.3	16.6	13.5	13.4	14.0	11.4	10.6	9.76
India	20.9	18.1	19.4	20.1	31.6	23.2	19.8	18.88
Indonesia	39.5	13.3	12.6	20.1	31.7	29.0	29.7	22.26
Israel	75.6	39.7	20.0	25.3	31.5	27.3	28.6	24.76
Jordan	20.7	30.4	57.1	20.8	28.0	27.3	33.6	29.41
Korea	30.2	13.5	20.8	12.8	16.4	15.1	14.7	9.33
Kuwait	. . .	. . .	21.5	21.1	29.7	32.4	31.3	25.8
Malaysia	30.1	22.4	15.0	21.7	20.1	17.4	15.8	13.67
Mexico	17.6	15.9	14.2	18.6	17.2	17.4	15.5	10.95
Morocco	25.2	24.6	22.4	22.5	30.4	35.3	33.7	30.09
Nigeria	18.5	23.5	20.7	24.1	58.4	77.8	68.0	57.95
Oman	15.2	14.2	15.8	13.1	23.1	25.9	28.9	21.56
Pakistan	9.5	9.9	13.1	10.8	15.3	16.8	13.4	9.43
Peru	13.7	10.7	12.0	15.7	20.9	20.3	23.6	13.86
Philippines	21.1	14.6	15.7	14.4	17.7	14.5	11.1	12.02
Poland	–353.0	39.9	11.7	13.9	15.6	13.3	11.7	10.97
Qatar	. . .	. . .	48.7	15.9	21.7	22.6	29.3	22.73
Russia	19.9	10.8	24.1	16.6	18.4	15.6	16.6	8.16
Saudi Arabia	27.2	50.6	104.8	52.0	70.1	59.8	58.7	48.17
South Africa	11.5	16.2	12.8	16.6	18.7	18.7	18.3	16.15
Sri Lanka	15.0	18.1	23.6	15.4	12.1	11.5	10.4	8.57
Taiwan Province of China	55.7	21.2	21.9	25.6	27.9	27.9	25.1	19.18
Thailand	16.6	12.8	10.0	8.7	11.7	11.4	10.2	7.77
Turkey	14.9	12.5	16.2	17.2	25.2	18.1	16.5	17.18
United Arab Emirates	. . .	. . .	54.7	13.4	19.7	18.0	19.2	14.32
Venezuela	14.4	6.0	5.1	13.1	. . .	. . .	. . .	. . .

Source: Standard & Poor's Emerging Market Database.

Table 21. Emerging Markets: Mutual Fund Flows

(In millions of U.S. dollars)

									2008		
	2001	2002	2003	2004	2005	2006	2007	2008	Q1	Q2	Q3	Q4
Bonds	–444	606	3,153	1,947	5,729	6,233	4,295	–14,718	492	174	–4,254	–17,631
Equities	–1,781	–1,512	8,500	2,784	21,706	22,441	40,827	–39,490	–20,045	7,742	–20,685	–6,502
Global	–67	–2,082	2,119	–5,348	3,148	4,209	15,223	–9,114	–6,638	247	–5,850	3,127
Asia	–768	817	5,148	5,609	6,952	16,790	16,405	–19,587	–12,065	2,238	–5,551	–4,208
Europe/Middle East/Africa	–327	65	857	2,185	7,587	–1,877	–953	–4,929	157	2,756	–4,468	–3,374
Latin America	–619	–312	376	338	4,020	3,319	10,153	–5,860	–1,499	2,501	–4,816	–2,046

Source: Emerging Portfolio Fund Research, Inc.

Table 22. Bank Regulatory Capital to Risk-Weighted Assets

(In percent)

	2003	2004	2005	2006	2007	2008	Latest
Latin America							
Argentina	14.5	14.0	15.3	16.8	16.9	16.8	November
Bolivia	15.3	14.9	14.7	13.3	12.6	13.7	December
Brazil	18.8	18.6	17.9	18.9	18.7	16.6	October
Chile	14.1	13.6	13.0	12.5	12.2	12.1	December
Colombia	13.0	14.2	14.7	13.1	13.6	13.4	December
Costa Rica[1]	16.5	19.1	14.4	16.5	12.9	13.2	December
Dominican Republic	8.8	14.0	12.5	12.4	13.9	15.8	December
Ecuador[2]	14.9	14.5	14.4	14.8	15.7	. . .	November
El Salvador	12.8	13.4	13.5	13.8	13.8	14.6	November
Guatemala	15.6	14.5	13.7	13.6	13.8	13.7	December
Mexico[3]	14.4	14.1	14.5	16.3	15.9	15.3	September
Panama	17.6	17.8	16.3	15.8	13.6	13.7	August
Paraguay[4]	20.9	20.5	20.4	20.1	16.8	16.2	December
Peru	13.3	14.0	12.0	12.5	11.7	11.8	November
Uruguay[5]	18.1	21.7	22.7	16.9	17.8	16.7	December
Venezuela	25.1	19.2	15.5	14.3	12.1	13.4	December
Emerging Europe							
Albania	28.5	21.6	18.6	18.1	17.1	17.5	September
Belarus	26.0	25.2	26.7	24.4	19.3	16.5	September
Bosnia and Herzegovina	20.3	18.7	17.8	17.7	17.1	15.8	December
Bulgaria	22.0	16.6	15.3	14.5	13.9	14.9	December
Croatia[6]	16.5	16.0	15.2	14.4	16.9	15.3	September
Czech Republic	14.5	12.6	11.9	11.5	11.5	12.9	September
Estonia	14.5	13.4	11.7	13.2	14.8	18.3	September
Hungary	11.8	12.4	11.6	11.0	10.4	11.1	December
Israel	10.3	10.8	10.7	10.8	11.1	. . .	September
Latvia	11.7	11.7	10.1	10.2	11.1	11.8	December
Lithuania[7]	13.3	12.4	10.3	10.7	10.9	12.9	December
Macedonia, FYR[8]	25.8	23.0	21.3	18.3	17.0	15.0	September
Moldova	31.6	31.4	27.0	27.9	29.1	32.2	December
Montenegro	. . .	31.3	27.8	21.3	17.1	15.6	September
Poland	13.8	15.4	14.5	13.2	12.1	11.6	September
Romania[9]	21.1	20.6	21.1	18.1	12.7	11.9	September
Russia	19.1	17.0	16.0	14.9	15.5	14.5	September
Serbia	31.1	27.9	26.0	24.7	27.9	22.0	December
Slovak Republic	22.4	18.7	14.8	13.0	12.4	11.3	September
Slovenia	11.5	11.8	10.6	11.1	11.2	11.2	June
Turkey	30.9	28.8	24.2	22.1	19.0	17.7	November
Ukraine	15.2	16.8	15.0	14.2	13.9	13.6	September
Western Europe							
Austria[10]	14.5	12.4	11.8	11.8	12.7	11.7	June
Belgium	12.8	13.0	11.5	11.9	11.2	12.9	September
Denmark	13.8	13.4	13.2	13.8	12.3	. . .	December
Finland[11]	18.7	19.1	17.2	15.1	15.4	13.5	June
France	11.9	11.5	11.4	10.9	10.1	. . .	December
Germany	13.4	13.2	12.2	12.5	12.9	. . .	December
Greece	12.0	12.8	13.2	12.2	11.2	10.4	March
Iceland	12.3	12.8	12.8	15.1	12.1	. . .	December
Ireland[12]	13.9	12.6	12.0	10.9	. . .	. . .	December
Italy[13]	11.4	11.6	10.6	10.7	10.4	. . .	December
Luxembourg[14]	17.1	17.5	16.3	14.9	13.9	15.4	September
Malta	. . .	21.3	20.4	22.0	23.2	. . .	December
Netherlands	12.3	12.3	12.6	11.9	13.2	13.5	March
Norway	12.4	12.2	11.9	11.2	11.7	11.4	September
Portugal[15]	10.0	10.4	11.3	11.0	10.2	. . .	December
Spain	12.6	12.3	12.0	11.9	11.4	11.3	June
Sweden[16]	9.9	10.1	10.1	10.0	10.3	10.2	December
Switzerland	12.4	12.6	12.4	13.4	12.5	. . .	June
United Kingdom	13.0	12.7	12.8	12.9	12.6	. . .	December
Asia							
Bangladesh	8.4	8.8	7.3	8.3	10.0	9.5	June
China	–5.9	–4.7	2.5	4.9	8.4	8.2	March
Hong Kong SAR	15.3	15.4	14.9	15.2	13.4	14.3	March
India[17]	12.7	12.9	12.8	12.3	12.3	13.0	March
Indonesia	22.3	19.4	19.3	21.3	19.3	16.8	November
Korea	11.1	12.1	13.0	12.8	12.3	10.9	September

Table 22 ***(concluded)***

	2003	2004	2005	2006	2007	2008	Latest
Asia *(continued)*							
Malaysia	13.8	14.4	13.7	13.5	13.2	12.6	December
Philippines[18]	17.4	18.4	17.6	18.1	15.7	15.5	June
Singapore	17.9	16.2	15.8	15.4	13.5	14.3	September
Thailand	13.4	12.4	13.2	13.8	14.8	15.3	December
Middle East & Central Asia							
Armenia	33.8	32.3	33.7	34.9	30.1	27.2	September
Egypt	11.1	11.4	13.8	14.7	14.8	14.9	March
Georgia	20.3	18.8	17.5	20.6	16.0	13.9	December
Jordan	15.9	17.8	17.6	21.4	20.8	17.6	June
Kazakhstan	16.9	15.3	14.9	14.8	14.2	14.7	November
Kuwait	18.4	17.3	21.3	21.8	18.5	16.0	September
Lebanon	22.3	21.2	22.9	25.0	24.0	. . .	December
Morocco	9.6	10.5	11.5	12.3	10.6	10.7	June
Oman	17.6	17.6	18.1	17.2	15.9	. . .	December
Pakistan	8.5	10.5	11.3	12.7	13.2	11.8	September
Saudi Arabia	19.4	17.8	17.8	21.9	20.6	. . .	December
Tunisia	9.3	11.6	12.4	11.3	11.0	. . .	December
United Arab Emirates	18.6	16.9	17.0	16.7	14.4	13.3	June
Sub-Saharan Africa							
Gabon	19.9	22.3	19.8	17.8	14.3	19.6	September
Ghana	9.3	13.9	16.2	15.8	15.7	13.9	September
Kenya	17.3	16.6	16.4	16.5	18.0	18.1	November
Lesotho	. . .	22.0	25.0	19.0	14.0	15.0	September
Mozambique	17.0	18.7	16.0	12.5	14.2	14.3	June
Namibia	14.8	15.4	14.6	14.2	15.7	15.8	September
Nigeria	17.8	14.7	17.8	22.6	21.0	22.0	September
Rwanda	14.6	10.5	9.2	7.2	11.3	12.3	September
Senegal	11.7	11.9	11.1	13.1	13.6	13.4	October
Sierra Leone	27.3	38.1	35.7	33.3	35.0	41.1	June
South Africa	12.4	14.0	12.7	12.3	12.8	12.5	June
Swaziland	14.0	14.0	15.0	20.0	23.0	. . .	June
Uganda	16.9	20.5	18.3	18.0	19.5	19.8	September
Other							
Australia	10.0	10.4	10.4	10.4	10.2	10.9	September
Canada	13.4	13.3	12.9	12.5	12.1	12.7	September
Japan[19]	11.1	11.6	12.2	13.1	12.9	12.3	September
United States[20]	13.0	13.2	12.9	13.0	12.8	12.5	September

Sources: National authorities; and IMF staff estimates.

Note: Due to differences in national accounting, taxation, and supervisory regimes, FSI data are not strictly comparable across countries.

[1]Banking sector excludes offshore banks.

[2]Private banks.

[3]Commercial banks.

[4]IMF staff estimates.

[5]In 2006, the Central Bank of Uruguay changed the methodology for calculating the regulatory capital ratio, changing the weights and adding a factor to the denominator to account for market risk. Therefore, regulatory capital ratios are smaller in 2006 and 2007, compared to previous years. The data exclude the state mortgage bank.

[6]From 2006 the data have been revised.

[7]The data exclude foreign bank branches.

[8]From end–2007 the calculation of the ratio is based on a revised methodology.

[9]Break in the data series starting in 2003. The National Bank of Romania amended the capital adequacy requirements effective January 1, 2007 to be consistent with EU minimum requirements and Basel II. The former 12 percent capital adequacy ratio and 8 percent Tier 1 ratio were substituted by a new 8 percent solvency ratio.

[10]Starting in 2004 data reported on a consolidated basis.

[11]Break in the data series starting in 2003.

[12]Domestic banks.

[13]Consolidated reports for banking groups and individual reports for banks not belonging to groups.

[14]End-year data for 2007; annual average for previous years.

[15]For 2005–06 the figures are for the sample of institutions that are already complying with IAS, accounting as of December 2004 for about 87 percent of the usual aggregate considered.

[16]Data for the four large banking groups.

[17]For the end of the fiscal year, i.e., March of the following calendar year.

[18]On a consolidated basis.

[19]For the end of the fiscal year, i.e., March of the following calendar year; for major banks.

[20]All FDIC-insured institutions.

Table 23. Bank Capital to Assets

(In percent)

	2003	2004	2005	2006	2007	2008	Latest
Latin America							
Argentina	11.9	11.8	12.9	13.4	13.1	12.6	November
Bolivia	12.1	11.5	11.3	10.0	9.6	9.3	December
Brazil	9.6	10.1	9.8	9.9	9.9	9.5	October
Chile	7.3	7.0	6.9	6.8	6.7	6.3	December
Colombia	11.6	12.1	12.3	12.0	12.1	12.2	December
Costa Rica[1]	11.3	9.4	9.7	10.3	10.1	10.4	December
Dominican Republic[2]	8.4	9.4	9.7	10.1	9.5	9.5	December
Ecuador[3]	8.8	8.5	8.4	8.7	8.5	10.3	December
El Salvador	9.4	9.7	10.1	10.7	11.8	12.7	December
Guatemala	9.0	8.9	8.5	8.2	9.2	10.3	December
Mexico[4]	10.0	10.2	11.5	13.2	14.4	13.7	September
Panama[5]	12.2	13.2	12.8	12.0	13.7	11.9	December
Paraguay	9.5	10.5	11.0	12.5	11.6	11.2	December
Peru	9.3	9.8	7.7	9.5	8.8	8.7	November
Uruguay[6]	7.2	8.3	8.6	9.8	10.5	8.9	December
Venezuela	14.3	12.5	11.6	8.8	8.3	8.8	December
Emerging Europe							
Albania	4.7	4.8	5.4	5.9	5.8	6.5	September
Belarus	. . .	19.0	19.0	17.9	16.0	13.0	September
Bosnia and Herzegovina	17.0	15.7	14.4	13.8	13.1	. . .	September
Bulgaria	13.1	10.2	7.4	7.3	7.7	8.5	December
Croatia	8.9	8.6	9.0	10.3	12.5	13.9	September
Czech Republic[7]	5.7	5.2	5.4	6.0	5.7	5.7	September
Estonia	11.3	9.8	8.6	8.4	8.6	9.0	September
Hungary	8.3	8.5	8.2	8.3	8.2	8.0	December
Israel	5.3	5.5	5.6	5.9	6.2	. . .	September
Latvia	8.4	8.0	7.6	7.6	7.9	7.4	December
Lithuania[8]	9.8	8.7	7.2	7.1	7.3	7.6	December
Macedonia, FYR	. . .	. . .	. . .	. . .	. . .	. . .	
Moldova[9]	19.7	18.3	15.7	16.7	16.3	17.0	December
Montenegro	. . .	20.4	15.3	10.4	8.0	8.1	September
Poland[10]	8.3	8.0	7.9	7.8	8.1	8.2	September
Romania[11]	10.9	8.9	9.2	8.6	7.3	6.6	October
Russia	14.6	13.3	12.7	12.4	13.3	13.2	September
Serbia	22.5	18.8	16.0	15.6	17.1	20.5	December
Slovak Republic	8.9	7.7	9.7	8.0	10.6	10.4	September
Slovenia	8.3	8.1	8.5	8.4	8.4	8.3	September
Turkey[12]	13.7	14.4	12.9	11.3	13.0	11.7	June
Ukraine	12.3	13.8	12.4	13.3	12.5	13.0	September
Western Europe							
Austria	4.9	4.9	4.8	5.2	6.5	6.2	June
Belgium	3.1	3.1	2.7	3.3	4.1	3.4	September
Denmark	5.9	5.7	5.7	6.2	5.7	. . .	December
Finland	10.9	9.6	9.9	9.8	8.3	7.4	September
France	6.9	6.6	5.8	6.0	5.5	5.5	May
Germany	4.2	4.0	4.1	4.3	4.3	. . .	December
Greece[13]	6.9	5.3	5.9	6.7	6.6	6.2	March
Iceland[14]	7.1	7.1	7.4	7.8	6.9	. . .	December
Ireland	5.2	4.9	4.7	4.3	4.5	4.1	May
Italy	6.4	6.4	6.9	6.9	6.4	. . .	December
Luxembourg[15]	5.8	5.5	5.3	5.0	4.6	4.5	September
Malta	. . .	7.9	6.8	8.6	. . .	. . .	December
Netherlands	4.3	3.9	4.2	3.0	3.3	3.5	March
Norway	5.9	5.9	5.1	4.9	4.7	4.2	December
Portugal[16]	5.8	6.2	5.8	6.2	6.2	. . .	December
Spain	5.7	5.7	6.0	6.0	6.3	5.9	June
Sweden[17]	5.0	4.3	3.9	4.0	4.0	4.7	December
Switzerland	5.7	5.3	5.1	4.9	. . .	. . .	December
United Kingdom	9.8	9.6	9.1	8.9	. . .	. . .	December
Asia							
Bangladesh	3.2	2.7	2.6	4.0	6.5	5.9	June
China[18]	3.8	4.0	4.4	5.1	5.8	6.1	December
Hong Kong SAR	10.6	10.8	11.8	11.2	12.0	. . .	November
India[19]	5.7	5.9	6.4	6.6	6.4	. . .	March
Indonesia	10.4	9.3	7.9	7.9	9.8	9.7	November
Korea[20]	7.0	8.0	9.3	9.2	9.0	8.3	September

Table 23 ***(concluded)***

	2003	2004	2005	2006	2007	2008	Latest
Asia *(continued)*							
Malaysia	8.5	8.2	7.7	7.6	7.5	8.5	December
Philippines	13.1	12.6	12.0	11.7	11.7	10.7	June
Singapore[21]	10.7	9.6	9.6	9.6	9.2	8.5	September
Thailand	7.4	8.0	8.9	8.9	9.5	. . .	December
Middle East & Central Asia							
Armenia	18.1	17.8	21.5	22.9	22.5	22.5	September
Egypt	4.9	5.4	5.4	5.5	5.1	5.1	March
Georgia	26.5	22.0	18.8	21.2	20.4	17.1	December
Jordan	6.4	7.2	8.2	10.7	10.6	10.1	June
Kazakhstan[22]	9.0	13.1	13.0	13.2	15.2	12.1	November
Kuwait	10.7	12.1	12.7	11.7	12.0	11.6	September
Lebanon	6.9	6.8	7.5	9.1	8.1	8.1	June
Morocco	7.6	7.6	7.7	7.4	6.9	7.4	June
Oman	12.6	12.9	13.7	13.2	14.1	. . .	December
Pakistan	5.4	6.5	7.6	9.4	10.9	10.2	September
Saudi Arabia	8.8	8.0	8.8	9.3	9.9	. . .	December
Tunisia	7.6	7.5	7.7	. . .	. . .	. . .	December
United Arab Emirates	11.4	11.1	11.4	11.1	9.4	10.6	June
Sub-Saharan Africa							
Gabon	13.1	13.2	11.1	10.2	7.0	10.7	September
Ghana	12.0	12.5	13.0	11.9	11.8	. . .	February
Kenya	11.8	11.9	12.1	12.4	12.6	11.4	May
Lesotho	17.0	16.9	14.6	. . .	. . .	. . .	December
Mozambique	9.0	9.5	8.0	6.1	6.4	7.3	June
Namibia	8.3	8.8	7.8	7.5	7.9	. . .	December
Nigeria	9.6	9.9	12.4	14.7	16.3	15.3	March
Rwanda	8.9	10.1	9.4	9.2	. . .	. . .	April
Senegal	7.8	7.7	7.6	8.3	8.3	8.6	October
Sierra Leone[9]	. . .	12.7	10.3	17.0	16.7	18.6	June
South Africa	8.0	8.2	7.9	7.9	7.9	. . .	December
Swaziland	13.7	22.4	22.9	. . .	. . .	. . .	December
Uganda	8.6	10.3	10.3	10.9	10.3	12.2	September
Other							
Australia[9]	5.2	5.1	5.2	4.9	4.9	4.2	September
Canada	4.7	4.4	4.4	5.7	5.5	5.8	September
Japan[23]	3.9	4.2	4.9	5.3	4.5	4.2	September
United States[24]	9.2	10.3	10.3	10.5	10.3	9.6	September

Sources: National authorities; and IMF staff estimates.

Note: Due to differences in national accounting, taxation, and supervisory regimes, FSI data are not strictly comparable across countries.

[1]Banking sector excludes offshore banks.

[2]Commercial banks.

[3]Private banks. Total assets include contingencies.

[4]All deposit takers.

[5]General licensed banks.

[6]The data exclude the state mortgage bank.

[7]Total own funds.

[8]Capital is defined as bank shareholders' equity and foreign bank branches' funds received from the head office.

[9]Tier 1 capital to total assets.

[10]The data exclude foreign bank branches.

[11]Break in the data series starting in 2003. The National Bank of Romania amended the capital adequacy requirements effective January 1, 2007 to be consistent with EU minimum requirements and Basel II. The former 12 percent capital adequacy ratio and 8 percent Tier 1 ratio were substituted by a new 8 percent solvency ratio.

[12]Break in the data series in 2007.

[13]Data on a nonconsolidated basis. From 2004 in accordance with IFRS.

[14]Commercial banks and six largest savings banks (five largest savings banks from 2006 due to a merger of two banks).

[15]End-year data for 2006 and 2007; annual average for previous years.

[16]For 2005–06 the figures are for the sample of institutions that are already complying with IFRS, accounting as of December 2004 for about 87 percent of the usual aggregate considered. Data on accounting basis, consolidated.

[17]Data for the four large banking groups.

[18]Banking institutions (policy banks, state-owned commercial banks, joint stock commercial banks, city commercial banks, rural commercial banks, urban credit cooperatives, rural credit cooperatives, postal savings, foreign banks, and nonbank financial institutions).

[19]For the end of the fiscal year, i.e., March of the calendar year.

[20]Tier 1 capital to total risk-weighted assets.

[21]Shareholders' funds to total assets.

[22]For 2003 Tier 1 capital to total assets.

[23]For the end of the fiscal year, i.e., March of the following calendar year; for all banks.

[24]All FDIC-insured institutions.

Table 24. Bank Nonperforming Loans to Total Loans

(In percent)

	2003	2004	2005	2006	2007	2008	Latest
Latin America							
Argentina	17.7	10.7	5.2	3.4	2.7	2.5	November
Bolivia	16.7	14.0	11.3	8.7	5.6	4.3	December
Brazil	4.1	2.9	3.5	3.5	3.0	2.9	October
Chile	1.6	1.2	0.9	0.8	0.8	0.9	December
Colombia	6.8	3.3	2.7	2.6	3.3	4.0	December
Costa Rica[1]	1.7	2.0	1.5	1.5	1.2	1.4	December
Dominican Republic	9.0	7.4	5.9	4.5	5.0	3.8	December
Ecuador	7.9	6.4	4.9	3.3	3.6	2.5	December
El Salvador[2]	2.8	2.4	2.0	1.9	2.1	2.9	December
Guatemala	6.5	7.1	4.2	4.6	5.8	2.4	December
Mexico[3]	3.2	2.5	1.8	2.0	2.7	2.5	September
Panama[4]	2.5	1.8	1.8	1.4	1.3	1.4	December
Paraguay	20.6	10.8	6.6	3.3	1.3	1.2	December
Peru[5]	14.8	9.5	6.3	4.1	2.7	2.2	November
Uruguay[6]	14.3	4.7	3.6	1.9	1.1	0.2	December
Venezuela	7.7	2.8	1.2	1.1	1.2	2.3	December
Emerging Europe							
Albania	4.6	4.2	2.3	3.1	3.4	4.1	September
Belarus	3.7	2.8	1.9	1.2	0.7	0.6	September
Bosnia and Herzegovina	8.4	6.1	5.3	4.0	3.0	3.1	December
Bulgaria	3.2	2.0	2.2	2.2	2.1	2.4	December
Croatia	8.9	7.5	6.2	5.2	4.8	4.8	September
Czech Republic	4.9	4.1	4.3	3.6	2.7	3.1	September
Estonia	0.4	0.3	0.2	0.2	0.4	1.6	September
Hungary	2.6	2.7	2.5	2.5	2.5	2.9	December
Israel	2.6	2.5	2.3	1.9	1.7	. . .	September
Latvia	1.4	1.1	0.7	0.4	0.4	2.2	December
Lithuania[7]	2.4	2.2	0.6	1.0	1.0	1.1	March
Macedonia, FYR[8]	22.1	17.0	15.0	11.2	7.5	6.6	September
Moldova	6.4	6.9	5.3	4.4	3.7	5.2	December
Montenegro	. . .	5.2	5.3	2.9	3.2	4.5	September
Poland[8]	21.2	14.9	11.0	7.4	5.2	4.4	September
Romania	8.3	8.1	8.3	7.9	9.7	9.8	June
Russia	5.0	3.8	3.2	2.6	2.5	2.5	September
Serbia[9]	24.1	22.2	23.8	4.1	3.8	5.3	December
Slovak Republic	3.7	2.6	5.0	3.7	2.5	2.9	September
Slovenia	3.7	3.0	2.5	2.5	1.8	1.6	June
Turkey	11.5	6.0	4.8	3.8	3.5	3.3	November
Ukraine[10]	28.3	30.0	19.6	17.8	13.2	14.5	September
Western Europe							
Austria	3.0	2.7	2.6	2.1	1.7	. . .	December
Belgium[11]	2.6	2.3	2.0	1.7	1.1	1.5	September
Denmark	0.8	0.7	0.4	0.3	0.3	. . .	December
Finland[12]	0.5	0.4	0.3	0.3	0.4	0.4	June
France[13]	4.8	4.2	3.5	3.0	2.7	. . .	December
Germany	5.2	4.9	4.0	3.4	2.7	. . .	December
Greece	7.0	7.0	6.3	5.4	4.5	4.7	March
Iceland[14]	2.1	0.9	1.1	0.8	. . .	. . .	December
Ireland	0.9	0.8	0.7	0.7	. . .	. . .	December
Italy[15]	6.7	6.6	5.3	4.9	4.6	. . .	December
Luxembourg[16]	0.5	0.3	0.2	0.2	0.2	. . .	December
Malta	. . .	6.5	3.9	2.8	1.8	. . .	December
Netherlands	2.0	1.5	1.2	0.8	. . .	. . .	December
Norway[17]	1.6	1.0	0.7	0.6	0.5	0.8	December
Portugal[18]	2.4	2.0	1.5	1.2	1.3	. . .	December
Spain[19]	1.0	0.8	0.8	0.7	0.9	3.2	November
Sweden[20]	1.2	0.9	0.7	0.6	0.5	1.0	December
Switzerland	1.3	0.9	0.5	0.3	. . .	. . .	December
United Kingdom	2.5	1.9	1.0	0.9	0.9	. . .	December

Table 24 ***(continued)***

	2003	2004	2005	2006	2007	2008	Latest
Asia							
Bangladesh	22.1	17.6	13.6	13.2	14.0	13.0	June
China[21]	20.4	12.8	9.8	7.5	6.7	2.5	December
Hong Kong SAR[22]	3.9	2.3	1.4	1.3	0.9	1.0	September
India[23]	8.8	7.2	5.2	3.3	2.5	2.3	March
Indonesia[24]	6.8	4.5	7.6	6.1	4.1	3.5	November
Korea[22]	2.6	1.9	1.2	0.8	0.7	1.1	December
Malaysia	13.9	11.7	9.6	8.5	6.5	5.1	September
Philippines[25]	16.1	14.4	10.3	7.5	5.8	5.2	June
Singapore	6.7	5.0	3.8	2.8	1.5	1.4	September
Thailand	13.5	11.9	9.1	8.4	7.9	6.5	December
Middle East & Central Asia							
Armenia	5.4	2.1	1.9	2.5	2.4	3.9	September
Egypt	24.2	23.6	24.8	18.2	19.3	16.5	March
Georgia	7.4	6.2	3.8	2.5	2.6	12.8	December
Jordan	15.5	10.3	6.6	4.3	4.1	4.0	June
Kazakhstan[26]	. . .	4.3	3.3	2.4	2.7	6.5	November
Kuwait	6.1	5.3	5.0	3.9	3.2	3.1	September
Lebanon	12.8	10.6	9.1	6.8	4.8	3.7	June
Morocco	18.7	19.4	15.7	10.9	7.9	6.8	June
Oman	12.5	9.9	6.5	4.6	3.2	...	December
Pakistan	17.0	11.6	8.9	6.9	7.2	8.4	September
Saudi Arabia[27]	5.4	2.8	1.9	2.0	2.1	...	December
Tunisia	24.0	23.7	20.9	19.0	17.3	...	December
United Arab Emirates	14.3	12.5	8.3	6.3	2.9	2.5	June
Sub-Saharan Africa							
Gabon	13.9	16.0	14.1	10.7	7.6	7.9	September
Ghana	18.3	16.1	13.0	7.9	8.7	7.6	June
Kenya	34.9	29.3	25.6	21.3	10.9	8.4	November
Lesotho	...	1.0	2.0	2.0	1.7	3.5	September
Mozambique	14.4	6.4	3.8	3.3	2.6	0.9	June
Namibia	3.9	2.4	2.3	2.6	2.8	3.2	September
Nigeria	20.5	21.6	18.1	8.8	8.4	6.1	September
Rwanda	52.0	29.9	31.1	28.0	18.5	10.6	December
Senegal	13.3	12.6	11.9	16.8	18.6	19.3	October
Sierra Leone	7.4	16.5	26.8	27.8	31.7	32.2	June
South Africa[28]	2.4	1.8	1.5	1.1	1.4	2.6	June
Swaziland	2.0	3.0	2.0	3.6	6.4	8.4	June
Uganda	7.2	2.2	2.3	2.9	4.1	3.7	September
Other							
Australia[29]	0.3	0.2	0.2	0.2	0.2	0.5	September
Canada	1.2	0.7	0.5	0.4	0.7	1.1	September
Japan[30]	5.2	2.9	1.8	1.5	1.5	1.5	September
United States[31]	1.1	0.8	0.7	0.8	1.4	2.3	September

Sources: National authorities; and IMF staff estimates.

Note: Due to differences in national accounting, taxation, and supervisory regimes, FSI data are not strictly comparable across countries.

[1]Banking sector excludes offshore banks.

[2]Official definition based on past-due loans.

[3]Commercial banks.

[4]Banking system.

[5]Nonperforming loans include restructured and refinanced loans.

[6]The data exclude the state mortgage bank.

[7]From end–2005 nonperforming loans are loans with payments overdue past 60 days. Until 2004 they are defined as loans in "substandard," "doubtful," and "loss" loan categories.

[8]Includes only loans to the nonfinancial sector.

[9]Break in the time series starting in 2006. Prior to 2006, assets classified in risk categories C, D, and E. From 2006, loans overdue past 90 days.

[10]The increase in nonperforming loans in 2003 reflects a revision in the official definition.

[11]Unconsolidated data.

[12]Net of provisions.

Table 24 ***(concluded)***

[13]Gross doubtful debts. A break in the data series starting in 2006.

[14]Commercial banks and six largest savings banks. 2005–06 figures are for the largest banks.

[15]Banking groups. For the 2002–04 period, nonperforming loans include only substandard and bad loans. For the 2005–06 period, the aggregate includes also loans overdue past 180 days.

[16]Nonperforming large exposures to total loans. End-year data for 2007; annual average for previous years.

[17]For 2005–06 the figures are for the sample of institutions that are already complying with IFRS, accounting as of December 2004 for about 87 percent of the usual aggregate considered.

[18]On a consolidated basis. Nonperforming loans are defined as credit to customers overdue.

[19]Doubtful exposures to other resident sectors over total lending to other resident sectors.

[20]Data for the four large banking groups.

[21]Major commercial banks (state-owned commercial banks and joint stock commercial banks).

[22]Loans classified as "substandard," "doubtful," and "loss."

[23]For the end of the fiscal year, i.e., March of the following calendar year.

[24]Reported nonperforming loan ratio for commercial banks.

[25]The data exclude IBL.

[26]Loans overdue past 60 days and other qualified loans.

[27]Gross nonperforming loans to net loans.

[28]Break in the series in 2008. With the implementation of Basel II in January 2008, the term "nonperforming loans" was replaced by "impaired advances," which resulted in a technical increase in the ratio. Impaired advances are advances for which the bank has raised specific credit impairment.

[29]Impaired assets to total assets. Figures exclude loans in arrears that are covered by collateral.

[30]For the end of the fiscal year, i.e., March of the following calendar year; for major banks.

[31]All FDIC-insured institutions.

Table 25. Bank Provisions to Nonperforming Loans

(In percent)

	2003	2004	2005	2006	2007	2008	Latest
Latin America							
Argentina	79.2	102.9	124.5	129.9	129.6	130.9	November
Bolivia	74.0	84.3	81.1	90.7	92.6	89.5	December
Brazil	171.8	214.5	179.8	179.9	181.8	170.9	October
Chile	130.9	165.5	177.6	198.5	210.4	181.6	December
Colombia	98.1	149.7	166.9	153.6	134.5	115.3	October
Costa Rica[1]	145.9	122.6	153.0	162.2	180.5	148.0	December
Dominican Republic	65.6	112.9	123.5	142.0	134.5	128.3	March
Ecuador[2]	127.3	119.0	143.7	182.7	199.8	215.9	December
El Salvador	129.8	132.3	126.7	116.4	120.0	110.4	December
Guatemala	. . .	. . .	43.2	39.6	42.7	73.2	December
Mexico	167.1	201.8	232.1	207.4	169.2	184.0	March
Panama[3]	150.3	149.4	116.2	128.5	143.1	120.0	December
Paraguay	54.8	54.6	57.7	59.1	78.2	77.7	December
Peru	67.1	68.7	80.3	100.3	131.6	146.7	November
Uruguay[4]	91.4	106.8	118.8	218.6	93.3	269.0	June
Venezuela	103.7	130.2	196.3	229.1	175.7	122.5	December
Emerging Europe							
Albania	. . .	. . .	. . .	. . .	. . .	. . .	
Belarus	29.9	32.4	48.4	51.3	61.5	60.9	September
Bosnia and Herzegovina	. . .	. . .	. . .	. . .	. . .	37.8	December
Bulgaria[5]	50.0	48.5	45.3	47.6	. . .	. . .	September
Croatia[6]	60.6	62.3	60.0	56.8	54.4	50.3	September
Czech Republic[7]	76.7	69.4	61.6	57.7	56.4	56.3	September
Estonia	214.5	276.9	215.0	153.6	. . .	. . .	November
Hungary	47.3	51.3	54.4	53.9	58.1	80.3	December
Israel	. . .	. . .	. . .	. . .	. . .	. . .	
Latvia	89.4	99.1	98.8	116.6	129.8	92.6	December
Lithuania	. . .	. . .	. . .	. . .	. . .	. . .	
Macedonia, FYR	. . .	. . .	. . .	. . .	. . .	. . .	
Moldova	87.6	85.5	98.9	117.3	113.8	94.2	December
Montenegro	. . .	77.3	67.4	78.8	73.6	63.7	September
Poland	53.4	61.3	61.6	57.8	. . .	. . .	September
Romania[8]	12.6	16.1	14.4	18.2	25.7	27.8	June
Russia[9]	118.0	139.5	156.3	159.3	144.0	140.0	September
Serbia	54.0	58.9	47.8	. . .	. . .	. . .	September
Slovak Republic	85.8	86.4	85.1	105.9	95.1	89.1	September
Slovenia	81.0	80.1	80.6	84.3	. . .	. . .	December
Turkey	88.6	88.1	89.8	90.8	88.4	81.6	November
Ukraine	22.3	21.1	25.0	23.1	26.3	26.0	September
Western Europe							
Austria[10]	68.0	70.8	71.5	75.3	76.4	. . .	December
Belgium[11]	52.8	54.2	51.6	50.8	48.0	64.0	September
Denmark	63.0	66.0	75.7	. . .	. . .	. . .	December
Finland	77.7	78.5	85.8	. . .	. . .	. . .	December
France[12]	59.6	61.3	63.8	62.9	61.4	. . .	December
Germany	. . .	. . .	65.4	71.4	77.3	. . .	December
Greece	49.9	51.4	61.9	60.9	. . .	. . .	June
Iceland[13]	77.5	80.9	112.9	99.6	84.1	. . .	December
Ireland	96.8	85.4	73.5	56.3	. . .	. . .	December
Italy[14]	. . .	. . .	. . .	46.0	49.5	. . .	December
Luxembourg	. . .	. . .	. . .	. . .	. . .	. . .	
Malta	. . .	. . .	. . .	. . .	. . .	. . .	
Netherlands[15]	73.8	69.2	65.5	56.0	. . .	. . .	December
Norway	96.8	124.7	109.3	74.2	67.0	50.8	December
Portugal[16]	73.0	83.4	79.0	83.9	75.7	. . .	December
Spain[17]	263.8	322.1	255.5	272.2	214.6	71.9	November
Sweden[18]	73.9	78.9	84.7	78.5	79.9	. . .	December
Switzerland	89.9	90.9	116.0	122.6	. . .	. . .	December
United Kingdom[19]	69.8	61.5	54.0	54.6	. . .	. . .	December

Table 25 ***(continued)***

	2003	2004	2005	2006	2007	2008	Latest
Asia							
Bangladesh	18.3	18.9	25.3	26.3	42.3	52.5	June
China[20]	19.7	14.2	24.8	34.3	39.2	115.3	December
Hong Kong SAR	. . .	. . .	. . .	. . .	. . .	. . .	
India[21]	46.4	56.6	60.3	58.9	56.1	52.6	March
Indonesia[22]	112.4	110.8	68.6	78.3	87.7	98.5	August
Korea	84.0	104.5	131.4	175.2	199.1	155.4	September
Malaysia[23]	53.1	55.0	59.1	64.6	77.3	86.9	September
Philippines	51.5	58.0	73.8	75.0	81.5	84.1	June
Singapore	64.9	73.6	78.7	89.5	115.6	119.9	September
Thailand	72.8	79.8	83.7	82.7	86.5	. . .	December
Middle East & Central Asia							
Armenia	34.3	77.0	70.7	64.3	66.6	50.1	September
Egypt	57.0	60.2	61.5	76.2	74.6	89.9	March
Georgia	48.1	64.2	55.6	50.9	49.7	47.1	December
Jordan[24]	37.0	45.0	53.5	54.0	49.0	48.2	June
Kazakhstan[25]	. . .	64.4	104.9	102.7	60.2	80.0	December
Kuwait	77.7	82.5	107.2	95.8	92.0	84.7	September
Lebanon	46.3	46.1	50.2	54.4	56.6	57.4	June
Morocco	54.9	59.3	67.1	71.2	75.2	77.0	June
Oman	59.8	75.3	72.7	102.8	107.6		December
Pakistan	63.9	71.6	76.8	79.0	85.3	79.0	September
Saudi Arabia	128.2	175.4	202.8	182.3	142.9	. . .	December
Tunisia	43.1	45.8	47.4	49.2	53.8	. . .	December
United Arab Emirates	88.5	94.6	95.7	98.2	100.0	101.5	June
Sub-Saharan Africa							
Gabon	53.9	53.6	55.5	57.4	59.8	67.5	September
Ghana	. . .	. . .	. . .	. . .	. . .	. . .	
Kenya	79.2	102.9	115.6	115.6	. . .	. . .	September
Lesotho	. . .	. . .	. . .	. . .	. . .	. . .	
Mozambique	. . .	. . .	. . .	. . .	. . .	. . .	
Namibia	. . .	95.2	85.3	90.3	77.2	. . .	December
Nigeria	76.4	96.2	81.0	59.5	. . .	. . .	December
Rwanda	58.4	60.2	56.7	. . .	. . .	. . .	December
Senegal	75.3	75.7	75.4	52.0	53.8	50.1	October
Sierra Leone[26]	. . .	43.1	10.3	59.7	44.5	40.3	June
South Africa	54.2	61.3	64.3	. . .	. . .	. . .	December
Swaziland	. . .	. . .	. . .	. . .	. . .	. . .	
Uganda	76.5	97.8	103.8	74.4	71.8	99.8	September
Other							
Australia	131.8	182.9	203.0	202.5	183.7	87.2	September
Canada	43.5	47.7	49.3	55.3	42.1	34.7	September
Japan[27]	29.9	31.2	28.1	28.8	26.4	24.9	September
United States[28]	140.4	168.1	155.0	135.0	93.1	84.7	September

Sources: National authorities; and IMF staff estimates.

Note: Due to differences in national accounting, taxation, and supervisory regimes, FSI data are not strictly comparable across countries.

[1]Banking sector excludes offshore banks.

[2]Private banks.

[3]General licensed banks.

[4]The data exclude the state mortgage bank.

[5]Provisions to nonstandard loans.

[6]From 2006 the data have been revised.

[7]Allowance for individually assessed financial assets divided by receivables on investment portfolio classified as "substandard," "doubtful," and "loss."

[8]Nonperforming loans reflect unadjusted exposure to loans classified as "substandard," "doubtful," and "loss." The steady level of nonperforming loans in the face of growing credit partly reflects Romania's relatively conservative classification and provisioning requirements.

[9]Change in definition in 2004; not strictly comparable with previous years.

[10]2006 data cover two of the large banks only; not strictly comparable with previous years.

[11]Unconsolidated data.

[12]Coverage of doubtful loans to customers by provisions.

Table 25 *(concluded)*

[13]Data for large banking groups. Break in the data series in 2006.
[14]Banking groups.
[15]Data for large banking groups.
[16]For 2005–06 the figures are for the sample of institutions that are already complying with IFRS, accounting as of December 2004 for about 87 percent of the usual aggregate considered. On a consolidated basis. Nonperforming loans are defined as credit to customers overdue.
[17]Allowances and provisions to doubtful exposures.
[18]Data for the four large banking groups.
[19]Data for large banking groups. Break in the data series in 2006.
[20]Major commercial banks. Break in 2008; data cover all commercial banks.
[21]For the end of the fiscal year, i.e., March of the following calendar year.
[22]Write-off reserve on earning assets to classified earning assets.
[23]General, specific, and interest-in-suspense provisions.
[24]Provisions to classified loans net of interest in suspense.
[25]Provisions to nonperforming loans.
[26]Break in the data series in 2006.
[27]For the end of the fiscal year, i.e., March of the following calendar year; coverage of nonperforming loans by provisions for all banks.
[28]All FDIC-insured institutions.

Table 26. Bank Return on Assets

(In percent)

	2003	2004	2005	2006	2007	2008	Latest
Latin America							
Argentina	–3.0	–0.5	0.9	1.9	1.5	1.6	November
Bolivia	0.3	–0.1	0.7	1.3	1.9	1.7	December
Brazil[1]	2.0	2.2	2.9	2.7	2.9	2.0	October
Chile	1.3	1.2	1.3	1.3	1.1	1.2	December
Colombia	1.9	2.7	2.7	2.5	2.4	2.4	December
Costa Rica[1,2]	2.1	2.0	2.5	2.5	1.3	1.5	December
Dominican Republic	–0.1	1.9	1.8	1.9	2.5	1.7	December
Ecuador[3]	1.1	1.2	1.5	2.0	1.9	1.7	December
El Salvador	1.1	1.0	1.2	1.5	1.2	1.2	December
Guatemala	1.1	1.3	1.6	1.2	1.6	1.7	December
Mexico[1,4]	1.6	1.8	2.7	3.1	2.7	1.8	September
Panama[1,5]	2.1	2.3	2.1	1.7	2.0	2.2	December
Paraguay	0.4	1.7	2.1	3.0	2.8	3.5	December
Peru	1.1	1.2	2.2	2.2	2.5	2.5	November
Uruguay[6]	–1.1	–0.1	0.7	1.2	2.8	1.8	December
Venezuela	6.2	5.9	3.7	3.0	2.6	2.5	December
Emerging Europe							
Albania	1.2	1.3	1.4	1.4	1.6	1.3	September
Belarus	1.5	1.5	1.3	1.7	1.7	1.7	September
Bosnia and Herzegovina	0.4	0.7	0.7	0.9	0.9	0.5	December
Bulgaria	2.4	2.1	2.0	2.2	2.4	2.1	December
Croatia	1.6	1.7	1.6	1.5	1.6	1.8	September
Czech Republic	1.2	1.3	1.4	1.2	1.3	1.3	September
Estonia[1]	1.7	2.1	2.0	1.7	2.6	2.0	September
Hungary	1.5	2.0	2.0	1.8	1.4	1.5	December
Israel	0.7	1.0	1.1	1.0	1.3	. . .	September
Latvia	1.4	1.7	2.1	2.1	2.0	0.3	December
Lithuania[7]	1.2	1.3	1.1	1.5	2.0	1.2	December
Macedonia, FYR[8]	0.5	0.6	1.2	1.8	1.8	1.9	September
Moldova	4.4	3.7	2.8	3.4	3.9	3.5	December
Montenegro	. . .	–0.3	0.8	1.1	0.7	0.3	September
Poland	0.5	1.4	1.6	1.7	1.7	1.7	September
Romania[9]	2.7	2.5	1.9	1.7	1.3	1.4	June
Russia[10]	2.6	2.9	3.2	3.2	3.0	1.6	September
Serbia	–0.3	–1.2	1.1	1.7	1.7	2.1	December
Slovak Republic	1.2	1.2	1.2	1.3	1.1	0.9	September
Slovenia[11]	1.0	1.1	1.0	1.3	1.4	1.1	September
Turkey	2.3	2.3	1.7	2.5	2.8	2.2	November
Ukraine	1.0	1.1	1.3	1.6	1.5	1.3	September
Western Europe							
Austria[12]	0.3	0.6	0.6	0.7	0.7	0.7	June
Belgium	0.4	0.5	0.5	0.7	0.4	–1.0	September
Denmark	1.2	1.2	1.3	1.3	1.0	. . .	December
Finland	0.7	0.8	0.9	1.0	1.2	0.8	June
France	0.4	0.5	0.6	0.7	0.4	. . .	December
Germany	–0.1	0.1	0.3	0.3	0.2	. . .	December
Greece	0.6	0.4	0.9	0.8	1.0	0.7	March
Iceland	1.3	1.8	2.3	2.6	1.5	. . .	December
Ireland[1]	0.9	1.1	0.8	0.8	. . .	. . .	December
Italy	0.5	0.6	0.7	0.8	0.8	. . .	December
Luxembourg[13]	0.6	0.7	0.7	0.9	0.8	0.7	September
Malta	. . .	1.4	1.4	1.3	1.0	. . .	December
Netherlands	0.5	0.4	0.4	0.4	0.6	. . .	December
Norway	0.6	0.9	0.9	0.8	0.8	0.5	December
Portugal[14]	0.8	0.8	0.9	1.0	1.0	. . .	December
Spain	0.9	0.9	0.9	1.0	1.1	1.0	June
Sweden[15]	0.5	0.6	0.7	0.7	0.7	0.6	December
Switzerland[16]	0.7	0.8	0.9	0.9	. . .	. . .	December
United Kingdom[1]	0.6	0.7	0.8	0.5	0.4	. . .	December

Table 26 ***(continued)***

	2003	2004	2005	2006	2007	2008	Latest
Asia							
Bangladesh[17]	0.5	0.7	0.6	0.8	0.9	1.2	June
China[18]	0.3	0.5	0.6	0.7	1.0	. . .	June
Hong Kong SAR[19]	1.9	1.7	1.7	1.7	1.9	2.0	March
India[20]	1.0	0.8	0.9	0.7	0.9	1.0	March
Indonesia[1]	2.6	3.5	2.5	2.6	2.8	2.6	November
Korea[21]	0.2	0.9	1.3	1.1	1.1	. . .	December
Malaysia[1]	1.3	1.4	1.4	1.3	1.5	1.6	July
Philippines[1]	1.1	0.9	1.1	1.3	1.3	1.1	June
Singapore	1.0	1.2	1.2	1.4	1.4	. . .	September
Thailand	0.6	1.2	1.4	0.8	0.1	. . .	December
Middle East & Central Asia							
Armenia[1]	2.7	3.2	3.1	3.6	3.4	2.9	September
Egypt	0.5	0.6	0.5	0.8	0.9	. . .	March
Georgia[1]	3.9	1.9	3.0	2.7	1.9	–2.6	December
Jordan	0.7	1.1	2.0	1.7	1.6	0.9	June
Kazakhstan[1]	2.0	1.2	1.6	1.4	2.6	0.6	November
Kuwait	2.0	2.5	3.0	3.2	3.4	3.2	September
Lebanon	0.7	0.7	0.7	0.9	1.0	0.7	June
Morocco	–0.2	0.8	0.5	1.3	1.5	1.4	June
Oman	0.3	1.9	2.7	2.7	2.1	. . .	December
Pakistan[1]	1.9	1.8	2.8	3.1	2.2	2.0	September
Saudi Arabia[1]	2.2	2.5	3.4	4.0	2.8	. . .	December
Tunisia	0.6	0.4	0.5	0.7	0.9	. . .	December
United Arab Emirates	2.3	2.1	2.7	2.2	2.0	2.2	June
Sub-Saharan Africa							
Gabon	0.7	2.8	2.6	2.5	2.7	. . .	December
Ghana[1]	6.2	4.5	3.0	3.3	2.9	2.8	June
Kenya	2.3	2.1	2.4	2.8	3.0	2.8	November
Lesotho	. . .	3.0	2.0	2.0	2.6	2.4	September
Mozambique	1.2	1.4	1.8	3.5	3.5	2.7	September
Namibia	3.6	2.1	3.5	1.5	3.5	3.2	September
Nigeria	1.7	3.1	0.9	1.6	2.1	2.4	September
Rwanda	1.4	0.6	0.9	1.6	1.3	1.9	September
Senegal	1.8	1.8	1.8	1.6	1.6	. . .	December
Sierra Leone	10.5	9.9	8.1	5.8	3.1	1.8	June
South Africa	0.8	1.3	1.2	1.4	1.4	1.8	June
Swaziland	4.0	2.9	3.1	5.9	2.9	3.6	June
Uganda	4.5	4.3	3.6	3.4	3.9	3.4	September
Other							
Australia[22]	1.6	1.1	1.0	1.0	1.0	0.9	June
Canada	0.7	0.8	0.7	1.0	0.9	1.3	September
Japan[23]	–0.1	0.2	0.5	0.4	0.2	0.3	March
United States[24]	1.4	1.3	1.3	1.3	0.8	0.3	September

Sources: National authorities; and IMF staff estimates.

Note: Due to differences in national accounting, taxation, and supervisory regimes, FSI data are not strictly comparable across countries.

[1]Before tax.

[2]Banking sector excludes offshore banks.

[3]Private banks.

[4]Commercial banks.

[5]General licensed banks.

[6]The data exclude the state mortgage bank.

[7]Net income before extraordinary items and taxes to average total assets.

[8]Adjusted for unallocated provisions for potential loan losses.

[9]Break in the data series starting in 2003.

[10]Not annualized.

[11]Before extraordinary items and taxes.

[12]Starting in 2004 data reported on a consolidated basis.

[13]Income before provisions and before taxes to total assets.

Table 26 ***(concluded)***

[14]For 2005–06 the figures are for the sample of institutions that are already complying with IFRS, accounting as of December 2004 for about 87 percent of the usual aggregate considered.

[15]Data for the four large banking groups. The data refer to a four-quarter moving average for the assets. The profit is accumulated over four quarters and adjusted.

[16]Income before provisions and taxes to total assets.

[17]In early 2008, following the corporatization of the state-owned commercial banks, goodwill assets were created for three of these banks equal to their accumulated losses.

[18]2007 figure is net income to end-of-period assets.

[19]Net interest margin, not comparable with the other indicators in the table.

[20]For the end of the fiscal year, i.e., March of the following calendar year.

[21]Excludes earnings from sale of equity stakes.

[22]Gross profits until 2003; return on assets after taxes from 2004.

[23]For the end of the fiscal year, i.e., March of the following calendar year; all banks. The denominator of the ratio uses end-period total assets.

[24]All FDIC-insured institutions.

Table 27. Bank Return on Equity

(In percent)

	2003	2004	2005	2006	2007	2008	Latest
Latin America							
Argentina	–22.7	–4.2	7.0	14.3	11.0	13.5	November
Bolivia	2.8	–1.2	6.4	13.3	21.2	20.3	December
Brazil[1]	21.1	22.1	29.5	27.3	28.9	20.4	October
Chile	16.7	16.7	17.9	18.6	16.2	18.9	December
Colombia	17.1	23.0	22.1	20.2	19.5	20.0	December
Costa Rica[1,2]	17.2	16.7	20.1	18.7	13.4	13.6	December
Dominican Republic[3]	20.6	25.4	22.4	21.7	28.0	28.0	December
Ecuador[4]	14.7	16.5	18.5	23.1	21.4	20.0	December
El Salvador	11.5	10.9	11.8	14.6	11.3	7.5	December
Guatemala	12.2	14.0	19.1	15.1	16.9	16.3	December
Mexico[1,3]	16.1	17.2	24.4	26.2	19.9	12.8	September
Panama[5]	16.9	16.7	15.7	13.3	15.7	15.5	December
Paraguay	4.5	18.3	22.6	31.7	34.7	31.4	December
Peru	10.7	11.6	22.2	23.9	27.9	30.6	November
Uruguay[6]	–15.3	–0.9	7.6	12.7	27.7	10.3	December
Venezuela	44.0	45.2	32.2	31.6	32.4	28.6	December
Emerging Europe							
Albania	19.5	21.1	22.2	20.2	20.7	16.3	September
Belarus	8.4	7.8	6.8	9.6	10.7	12.0	September
Bosnia and Herzegovina	3.4	5.8	6.2	8.5	8.9	4.8	December
Bulgaria	22.7	19.6	21.4	25.0	24.8	23.1	December
Croatia[7]	14.1	16.1	15.1	12.7	10.9	10.9	September
Czech Republic	23.8	23.3	25.2	22.5	24.4	23.7	September
Estonia	14.1	20.0	21.0	19.8	30.0	21.4	September
Hungary	19.3	25.3	24.7	24.0	18.1	17.7	December
Israel	14.1	17.9	19.4	17.6	22.0	. . .	September
Latvia	16.7	21.4	27.1	25.6	24.2	4.6	December
Lithuania[8]	11.8	13.5	13.8	21.4	27.3	16.1	December
Macedonia, FYR[9]	2.3	3.1	7.5	12.3	15.0	16.5	September
Moldova	19.7	17.8	15.4	20.5	24.0	19.9	December
Montenegro	. . .	–1.2	4.2	6.8	6.2	3.5	September
Poland	5.8	16.9	20.6	22.5	22.4	22.2	September
Romania	20.0	19.3	15.4	13.6	11.5	15.9	June
Russia[10]	17.8	20.3	24.2	26.3	22.7	12.1	September
Serbia	–1.2	–5.3	6.7	10.0	10.2	10.6	December
Slovak Republic[11]	10.8	11.9	16.9	16.6	16.6	13.9	September
Slovenia[12]	11.9	12.5	13.8	15.1	16.3	13.7	September
Turkey	16.0	16.4	11.8	19.8	21.6	17.9	November
Ukraine	7.6	8.4	10.4	13.5	12.7	10.9	September
Western Europe							
Austria[13]	7.0	14.8	14.8	16.9	16.8	14.8	June
Belgium	13.6	15.8	18.5	22.4	13.2	–28.3	September
Denmark	20.8	21.2	22.2	21.9	17.3	. . .	December
Finland	11.3	12.4	10.1	11.1	14.3	10.9	June
France	8.5	10.6	11.8	15.5	9.8	. . .	December
Germany	–1.5	1.9	9.2	7.5	4.7	. . .	December
Greece	8.9	6.4	15.9	12.8	14.8	11.2	March
Iceland[14]	22.1	30.9	41.7	39.1	22.4	. . .	December
Ireland[1]	17.8	20.7	19.6	19.1	. . .	. . .	December
Italy	7.4	9.3	9.7	11.4	9.7	. . .	December
Luxembourg[15]	8.9	9.9	10.5	16.5	15.1	8.0	September
Malta	. . .	13.2	14.3	11.7	10.7	. . .	December
Netherlands	14.8	16.8	15.4	15.4	18.7	. . .	December
Norway	9.6	14.6	18.0	17.0	16.1	12.1	December
Portugal[16]	13.9	12.8	16.8	16.9	15.2	. . .	December
Spain	13.9	14.7	16.8	19.6	19.7	16.8	June
Sweden[17]	12.3	14.6	17.4	18.0	17.0	14.4	December
Switzerland[18]	11.7	14.3	18.0	17.7	. . .	. . .	December
United Kingdom[1]	8.6	10.9	11.8	8.9	6.2	. . .	December

Table 27 ***(continued)***

	2003	2004	2005	2006	2007	2008	Latest
Asia							
Bangladesh[19]	9.8	13.0	12.4	14.1	13.8	21.3	June
China[20]	...	13.7	15.1	14.8	19.9	...	June
Hong Kong SAR[21]	17.8	20.3	19.1	...	...	...	December
India[22]	18.8	20.8	13.3	12.7	13.2	12.5	March
Indonesia	26.6	34.5	26.4	30.2	25.7	26.0	August
Korea	3.4	15.2	18.4	14.6	14.6	...	December
Malaysia[1]	15.6	16.7	16.7	16.2	19.7	...	December
Philippines	8.5	7.1	8.8	10.6	10.8	9.6	June
Singapore[23]	8.7	11.6	11.2	13.7	12.9	11.9	September
Thailand	10.3	16.8	14.2	8.8	7.3	...	December
Middle East & Central Asia							
Armenia[1]	14.4	18.4	15.5	15.9	15.0	13.1	March
Egypt	9.8	10.6	9.6	14.3	15.6	...	March
Georgia[1]	15.0	7.9	15.1	15.7	9.7	–12.6	December
Jordan	...	13.1	20.9	15.0	12.6	8.2	June
Kazakhstan	14.2	11.5	16.6	14.6	18.2	1.1	December
Kuwait	18.6	20.9	22.9	27.1	28.1	27.8	September
Lebanon	10.9	9.3	11.0	10.1	12.1	8.3	June
Morocco	–2.0	10.9	6.3	17.4	20.6	19.0	June
Oman	1.7	12.9	16.6	18.1	14.7	...	December
Pakistan[1]	36.4	29.4	38.2	35.2	22.6	19.8	September
Saudi Arabia	25.9	31.7	38.5	43.4	28.5	25.7	March
Tunisia	7.6	5.1	6.5	7.7	9.0	...	December
United Arab Emirates	16.4	18.6	22.5	18.2	22.0	21.1	June
Sub-Saharan Africa							
Gabon	5.7	21.3	21.1	23.5	32.3	...	December
Ghana[1]	32.7	35.5	25.0	27.4	26.2	26.0	June
Kenya	23.2	22.0	25.0	28.6	27.5	27.5	November
Lesotho	...	27.0	15.0	27.0	31.6	31.7	September
Mozambique	16.3	18.7	27.4	55.4	47.7	33.2	September
Namibia	43.2	24.2	45.6	19.9	44.9	39.4	September
Nigeria	19.8	27.4	7.1	10.4	13.1	13.9	September
Rwanda	31.1	7.4	11.2	16.5	12.5	15.4	September
Senegal	22.1	17.6	15.8	14.6	15.3	...	December
Sierra Leone	67.1	32.9	28.0	17.0	10.3	7.0	June
South Africa	11.6	16.2	15.2	18.3	18.1	17.5	June
Swaziland	29.0	20.0	19.7	52.0	15.1	14.4	June
Uganda	43.2	37.8	29.6	28.3	31.4	25.4	September
Other							
Australia[24]	24.2	16.0	14.7	16.8	18.1	17.0	June
Canada	14.7	16.7	14.9	20.9	16.1	28.9	September
Japan[25,26]	–2.7	4.1	11.3	8.5	6.1	3.0	September
United States[27]	15.0	13.2	12.7	12.3	7.8	3.3	September

Sources: National authorities; and IMF staff estimates.

Note: Due to differences in national accounting, taxation, and supervisory regimes, FSI data are not strictly comparable across countries.

[1]Before tax.

[2]Banking sector excludes offshore banks.

[3]Commercial banks.

[4]Private banks.

[5]General licensed banks.

[6]The data exclude the state mortgage bank.

[7]From 2006 the data have been revised.

[8]Capital is defined as bank shareholders' equity and foreign bank branches' funds received from the head office. Net income before extraordinary items and taxes.

[9]Adjusted for unallocated provisions for potential loan losses.

[10]Not annualized.

[11]The data for 2007 exclude foreign branches.

[12]Before extraordinary items and taxes.

Table 27 *(concluded)*

[13]From 2004 on a consolidated basis.

[14]Commercial banks and six largest savings banks (five largest savings banks from 2006 due to a merger of two banks).

[15]Net after tax income to total regulatory capital.

[16]For 2005–06 the figures are for the sample of institutions that are already complying with IFRS, accounting as of December 2004 for about 87 percent of the usual aggregate considered.

[17]Data for the four large banking groups.

[18]Gross profits.

[19]In early 2008, following the corporatization of the state-owned commercial banks, goodwill assets were created for three of these banks equal to their accumulated losses.

[20]2007 figure is net income to end-of-period equity.

[21]2005 figure on a domestic consolidation basis; not strictly comparable with previous years.

[22]For the end of the fiscal year, i.e., March of the following calendar year.

[23]Local banks.

[24]Gross profits until 2003; return on equity after taxes from 2004.

[25]For the end of the fiscal year, i.e., March of the following calendar year; all banks. The denominator of the ratio uses end-period data.

[26]For FY2008, the figure is estimated by doubling the net income in the first half of FY2008 (from April to September 2008).

[27]All FDIC-insured institutions.

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