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. Although global financial stability has improved, the current report highlights how risks have changed over the last six months, traces the sources and channels of financial distress, and provides a discussion of policy proposals under consideration to mend the global financial system.

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

Contributors to this report also include Sergei Antoshin, Chikako Baba, Alberto Buffa di Perrero, Alexandre Chailloux, Phil de Imus, Joseph Di Censo, Randall Dodd, Marco Espinosa-Vega, Simon Gray, Ivan Guerra, Alessandro Gullo, Vincenzo Guzzo, , Kristian Hartelius, Geoffrey Heenan, Silvia Iorgova, Hui Jin, Andreas Jobst, Charles Kahn, Elias Kazarian, William Kerry, John Kiff, Annamaria Kokenyne, Vanessa Le Lesle, Isaac Lustgarten, Andrea Maechler, Kazuhiro Masaki, Rebecca McCaughrin, Paul Mills, Ken Miyajima, Sylwia Nowak, Jaume Puig, Christine Sampic, Manmohan Singh, Juan Solé, Tao Sun, Narayan Suryakumar, and Morgane de Tollenaere. Martin Edmonds, Oksana Khadarina, Yoon Sook Kim, and Marta Sanchez Sache provided analytical support. Shannon Bui, Nirmaleen Jayawardane, Juan Rigat, and Ramanjeet Singh were responsible for word processing. 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, standards setters, financial consultants, and academic researchers. The report reflects information available up to March 2010 unless otherwise indicated.

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 April 5, 2010. 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.

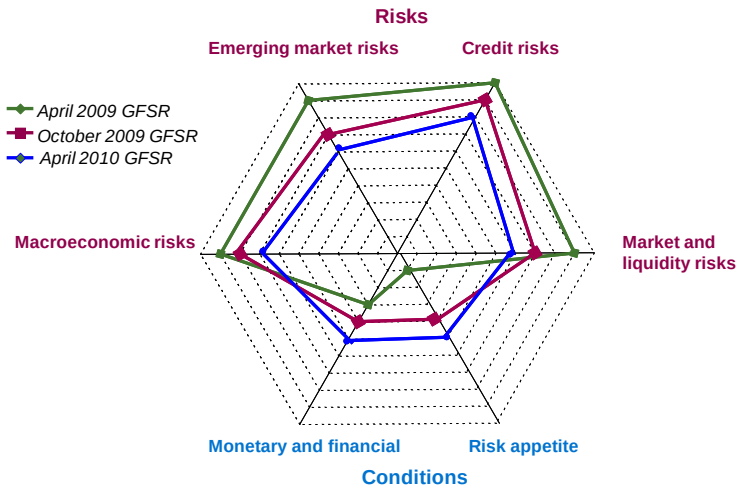
CHAPTER 1

RESOLVING THE CRISIS LEGACY AND MEETING NEW CHALLENGES TO FINANCIAL STABILITY

A. How Has Global Financial Stability Changed?

The health of the global financial system has improved since the October 2009 Global Financial Stability Report (GFSR), as illustrated in our global financial stability map (Figure 1.1).[1] However, risks remain elevated due to the still-fragile nature of the recovery and the ongoing repair of balance sheets. Concerns about sovereign risks could also undermine stability gains and take the credit crisis into a new phase, as nations begin to reach the limits of public sector support for the financial system and the real economy.

Figure 1.1. Global Financial Stability Map



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

Macroeconomic risks have eased as the economic recovery takes hold, aided by policy stimulus, the turn in the inventory cycle, and improvements in investor confidence. The baseline forecast in the *World Economic Outlook* (WEO) for global growth in 2010 has been raised significantly since October, following a sharp rebound in production, trade, and a range of leading indicators. The

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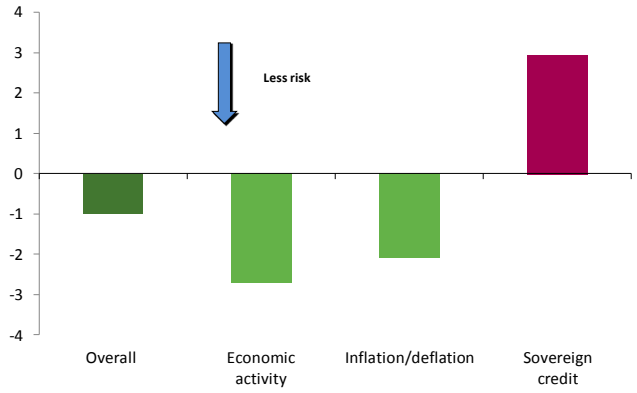
Note: This chapter was written by a team led by Peter Dattels and comprised of Sergei Antoshin, Alberto Buffa di Perrero, Phil de Imus, Joseph Di Censo, Alexandre Chailloux, Martin Edmonds, Simon Gray, Ivan Guerra, Vincenzo Guzzo, Kristian Hartelius, Geoffrey Heenan, Silvia Iorgova, Hui Jin, Matthew Jones, William Kerry, Vanessa Le Lesle, Andrea Maechler, Rebecca McCaughrin, Paul Mills, Ken Miyajima, Christopher Morris, Jaume Puig, Narayan Suryakumar, and Morgane de Tollenaere.

[1] Annex 1.1 details how indicators that compose the rays of the map in Figure 1.1 are measured and interpreted. The map provides a schematic presentation that incorporates a degree of judgment, serving as a starting point for further analysis.

Figure 1.2. Macroeconomic Risks in the Global Financial Stability Map
(Changes in notches since October 2009 GFSR)

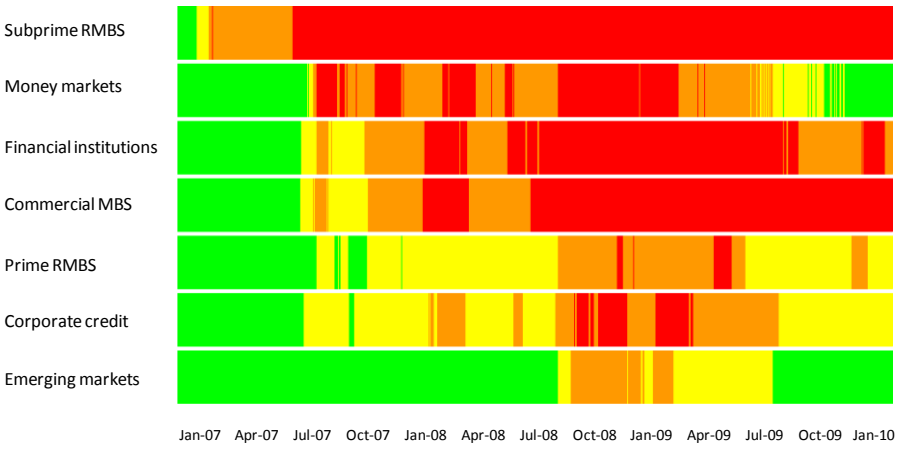


recovery is expected to be multi-speed and fragile, with many advanced economies that are coping with structural challenges recovering more slowly than emerging markets. The improving growth outlook has reduced dangers of deflation, while inflation expectations remain contained as output gaps remain large in many advanced economies. In contrast, the need to address the consequences of the credit bubble has led to sharply higher sovereign risks amid a worsened trajectory of debt burdens (Figure 1.2).

With markets less willing or able to support leverage—be it on bank or government balance sheets—sovereign credit risk premiums have more recently widened across mature economies with fiscal vulnerabilities. Longer-run solvency concerns have, in some cases, telescoped into short-term strains in funding markets that can be transmitted to banking systems and across borders. The management of sovereign credit and financing risks therefore carries important consequences for financial stability in the period ahead (see Section B).

Quantitative- and credit-easing policies, extraordinary liquidity measures, and government-guaranteed funding programs have helped improve the functioning of short-term money markets and allowed a tentative recovery in some securitization markets. As a result, *monetary and financial conditions* have eased further, as market-based indicators of financial conditions largely reversed the sharp tightening seen earlier in the crisis. This has been accompanied by a decline in *market and liquidity risks* as asset prices have continued to recover across a range of asset classes (Figure 1.3).

Figure 1.3. The Crisis Remains in Some Markets as Others Return to Stability



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 2003-06 (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 4-9, and red greater than 9.
MBS = mortgage-backed security; RMBS = residential mortgage-backed security.

Supported by these more benign financial conditions, private sector *credit risks* have improved. Our estimates of global bank writedowns have declined to $2.3 trillion from $2.8 trillion in the October 2009 GFSR, reducing aggregate banking system capital needs. However, pockets of capital deficiency remain in segments of some countries' banking systems, especially where exposures to commercial real estate are high. Banks face new challenges due to the slow progress in stabilizing their funding and the likelihood of more stringent future regulation, leading them to reassess business models as well as raise further capital and make their balance sheets less risky. Distress may resurface in banks that have remained dependent on central bank funding and government guarantees (see Section C).

The overall credit recovery will likely be slow, shallow, and uneven. The pace of tightening in bank lending standards has slowed, but credit supply is likely to remain constrained as banks continue to delever. Private credit demand is likely to rebound only weakly as households restore their balance sheets. Ballooning sovereign financing needs may bump up against limited lending capacity, potentially helping to push up interest rates (see Section D) and increasing funding pressures on banks. Policy measures to address supply constraints may therefore still be needed in some economies.

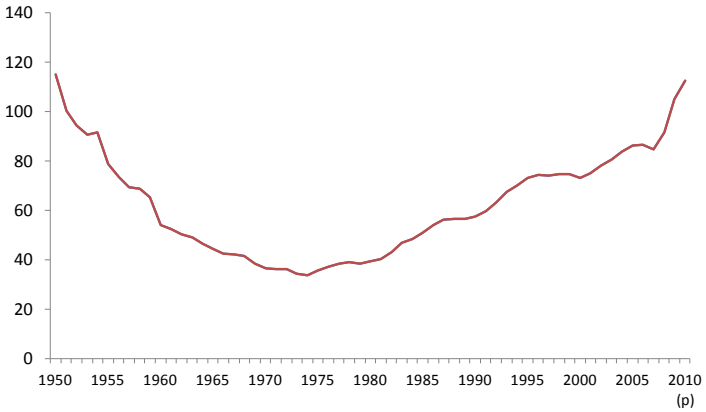
Emerging market risks have continued to ease. Capital is flowing to Asia (excluding Japan) and Latin America, attracted by strong growth prospects, appreciating currencies, and rising asset prices, and pushed by low interest rates in major advanced economies, as *risk appetite* continues to recover. Rapid improvements in emerging market assets have started to give rise to concerns that capital inflows could lead to inflationary pressure or asset price bubbles. So far there is only limited evidence of stretched valuations—with the exception of some local property markets. However, if current conditions of high external and domestic liquidity and rising credit growth persist, they are conducive to over-stretched valuations arising in the medium term (see Section E).

B. Could Sovereign Risks Extend the Global Credit Crisis?

The crisis has led to a deteriorating trajectory for debt burdens and sharply higher sovereign risks. With markets less willing to support leverage—be it on bank or sovereign balance sheets—and with liquidity being withdrawn as part of policy exits, new financial stability risks have surfaced. Initially, sovereign credit risk premiums increased substantially in the major economies most hit by the crisis. More recently, spreads have widened in some highly indebted economies with underlying vulnerabilities, as longer-run public solvency concerns have telescoped into strains in sovereign funding markets that could have cross-border spillovers. The subsequent transmission of sovereign risks to local banking systems and feedback through the real economy threatens to undermine global financial stability.

The crisis has increased sovereign risks and exposed underlying vulnerabilities. The higher budget deficits resulting from the crisis have pushed up sovereign indebtedness, while lower potential growth has worsened debt dynamics. For example, G-7 sovereign debt levels as a proportion of GDP are nearing 60-year highs (Figure 1.4). Higher debt levels have the potential for spillovers across financial systems, and to impact on financial stability. Some sovereigns have also been vulnerable to refinancing pressures that could telescope medium-term solvency concerns into short-term funding challenges (Figure 1.5).

Figure 1.4. Sovereign Debt to GDP in the G-7
(In percent)



Source: IMF, *World Economic Outlook* database.
Note: Average using PPP GDP weights.

Figure 1.5. Sovereign Risks and Spillover Channels

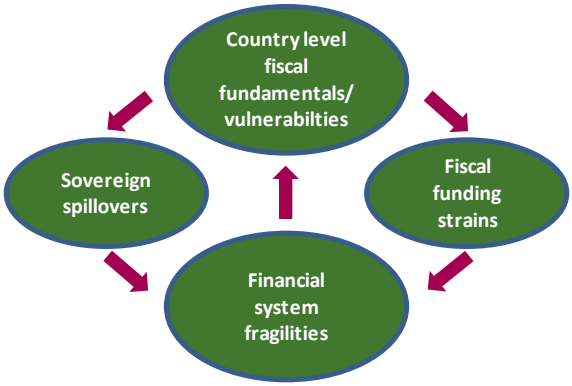


Table 1.1 shows a range of vulnerability indicators for advanced economies that captures their current fiscal position, reliance on external funding, and banking system linkages to the government sector.[2] It features not only economies that had credit booms and subsequent busts, but also those whose underlying vulnerabilities have come into greater focus, and which are perceived as having less flexibility—economically or politically—to address mounting debt burdens.[3,4]

[2] Reliance on foreign bank financing is measured by the consolidated claims on an immediate borrower basis of Bank for International Settlements (BIS) reporting banks on the public sector as a proportion of GDP.

[3] It should be noted that near-term risks associated with Japan's elevated public debt are low due to a number of Japan-specific features, including high domestic savings, low foreign participation in the public debt market, strong home bias, and stable institutional investors (Tokuoka, 2010).

[4] For a more in-depth review of fiscal vulnerabilities, see IMF (2010b).

Table 1.1. Sovereign Market and Vulnerability Indicators

(Percent of GDP, unless otherwise indicated)

	Sovereign CDS Spreads (bps)[1,2]		10-year Swap Spreads (bps)[1,3]		Sovereign Credit Rating/Outlook[1]		Fiscal and Debt Fundamentals				External Funding		Banking System Linkages		
	5 year	CDS Curve Slope (5yr - 1yr)		Change since 9/30/2009	(notches above speculative grade/outlook)[4]	Rating Actions (since 6/30/07)[5]	Gen. Govt. Structural Deficit[6,7] FY2010 (p)	Gross Gen. Govt. Debt[6,8,9] FY2010 (p)	Net Gen. Govt. Debt[6,8,10] FY2010 (p)	Gen. Govt. Securities < 1 yr. remaining maturity[11]	Gen. Govt. Debt Held Abroad[12]	Current Account Balance[6,13] 2010 (p)	Depository Institutions' claims on Gen. Govt.[14] (percent of 2009 GDP)	Depository Institutions' claims on Gen. Govt.[14] (percent of dep. inst. consolidated assets)	BIS Reporting Banks' Consolidated Claims on Public Sector[15]
Australia	38	14	-39	23	9/Stable	None	4.9	19.8	5.4	3.9	4.3	-3.5	2.3	1.2	2.7
Austria	58	28	18	3	10/Stable	None	4.3	70.7	60.5	6.1	58.5	1.8	15.1	4.0	13.2
Belgium	58	33	24	5	9/Stable	None	4.3	100.1	91.1	22.6	65.0	-0.5	21.3	6.2	19.0
Canada	n.a.	n.a.	-24	-14	10/Stable	None	3.0	82.3	31.8	14.1	14.1	-2.6	18.6	8.9	4.6
Czech Republic	69	34	63	-58	5/Stable	2 up/0 down	3.7	37.6	n.a.	5.1	9.6	-1.7	14.3	12.4	5.9
Denmark	34	22	-16	3	10/Stable	None	1.7	51.2	3.1	4.4	17.9	3.1	8.2	1.7	6.2
Finland	25	19	8	3	10/Stable	None	1.9	49.9	n.a.	12.0	35.9	2.0	4.7	2.0	9.6
France	50	24	13	8	10/Stable	None	4.6	84.2	74.5	17.2	48.7	-1.9	18.5	4.6	8.0
Germany	33	16	-17	6	10/Stable	None	3.8	76.7	68.6	15.8	40.3	5.5	20.6	6.7	11.8
Greece	427	-223	381	282	3/Neg	0 up/6 down	8.9	124.1	104.3	15.9	99.0	-9.7	17.5	8.5	32.3
Iceland	412	-134	n.a.	n.a.	0/Neg	0 up/11 down	4.8	119.9	77.2	n.a.	n.a.	5.4	n.a.	n.a.	18.1
Ireland	155	26	119	0	8/Neg	0 up/5 down	7.9	78.8	47.8	3.3	47.2	0.4	5.8	0.6	9.0
Israel	112	60	-5	0	5/Stable	3 up/0 down	-0.1	77.5	72.8	n.a.	14.5	3.9	4.7	7.1	1.1
Italy	125	20	66	13	7/Stable	None	3.5	118.6	116.0	24.5	56.4	-2.8	29.4	11.9	20.0
Japan	66	54	-6	8	8/Neg	None	7.5	227.3	121.7	48.7	13.7	2.8	69.3	21.8	1.9
Korea	82	32	43	-33	5/Stable	1 up/0 down	-1.4	33.3	n.a.	3.2	3.0	1.6	6.8	4.2	4.0
Netherlands	34	22	6	3	10/Stable	None	5.2	64.2	46.0	16.2	46.2	5.0	10.8	2.8	8.9
New Zealand	46	14	3	42	9/Neg	None	2.0	31.3	3.4	4.9	12.9	-4.6	5.6	2.8	5.9
Norway	19	13	-68	-25	10/Stable	None	7.3	53.6	-153.6	12.1	27.5	16.8	n.a.	n.a.	11.9
Portugal	160	32	102	65	7/Neg	0 up/2 down	7.1	85.9	81.6	13.0	60.2	-9.0	10.2	3.2	23.0
Slovak Republic	60	41	-67	34	6/Stable	2 up/0 down	4.7	37.3	n.a.	3.5	12.6	-1.8	19.3	21.7	5.9
Slovenia	53	37	-65	-31	8/Stable	None	4.4	35.2	n.a.	n.a.	19.6	-1.5	11.0	7.3	6.2
Spain	130	38	55	23	9/Neg	0 up/1 down	7.3	66.9	57.5	12.4	26.9	-5.3	20.6	6.3	7.2
Sweden	35	23	-12	7	10/Stable	None	0.8	43.1	-16.2	4.2	19.3	5.4	4.2	1.4	6.2
Switzerland	45	22	-46	2	10/Stable	None	0.3	39.8	39.2	4.6	3.8	9.5	n.a.	n.a.	5.0
United Kingdom	77	40	17	43	10/Neg	None	7.6	78.2	71.6	6.6	17.9	-1.7	5.1	1.1	3.6
United States	42	16	2	17	10/Stable	None	9.2	92.6	66.2	17.9	24.7	-3.3	8.2	5.5	2.7

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

(p) = projected

[1] As of April 9, 2010.

[2] CDS contracts are denominated in U.S. dollars, except for the Czech Republic, Iceland and United States, which are denominated in euros.

[3] Swap spreads are shown here as government yields minus swap yields, the opposite of market convention.

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

[5] Sum of rating actions (excluding credit watches and outlook changes) for long term foreign currency debt ratings by the Fitch, Moody's and Standard & Poor's agencies.

[6] Based on projections for 2010 from the April 2010 *World Economic Outlook* (WEO). Please see Box A1 in the WEO for a summary of the policy assumptions underlying the fiscal projections.

[7] On a national income accounts basis. The structural budget deficit is defined as the actual budget deficit (surplus) minus the effects of cyclical deviations from potential output. Because of the margin of uncertainty that attaches to estimates of cyclical gaps and to tax and expenditure elasticities with respect to national income, indicators of structural budget positions should be interpreted as broad orders of magnitude. Moreover, it is important to note that changes in structural budget balances are not necessarily attributable to policy changes but may reflect the built-in momentum of existing expenditure programs. In the period beyond that for which specific consolidation programs exist, it is assumed that the structural deficit remains unchanged. Calculated as a percentage of projected potential 2010 GDP. Figure for Norway is the nonoil structural deficit as a proportion of mainland potential GDP. For other country-specific details see footnotes of Table B.7. of April 2010 WEO.

[8] As a percentage of projected fiscal year 2010 GDP.

[9] Gross general government debt consists of all liabilities that require payment or payments of interest and/or principal by the debtor to the creditor at a date or dates in the future. This includes debt liabilities in the form of SDRs, currency and deposits, debt securities, loans, insurance, pensions and standardized guarantee schemes, and other accounts payable.

[10] Net general government debt is calculated as gross debt minus financial assets corresponding to debt instruments. These financial assets are: monetary gold and SDRs, currency and deposits, debt securities, loans, insurance, pension, and standardized guarantee

[11] Sum of domestic and international government securities (excluding central bank domestic obligations) with less than one year outstanding maturity as compiled by the BIS, divided by WEO projection for 2010 GDP.

[12] Most recent data for externally held general government debt (from Joint External Debt Hub) divided by 2009 GDP. New Zealand data from Reserve Bank of New Zealand.

[13] As a percentage of projected 2010 GDP.

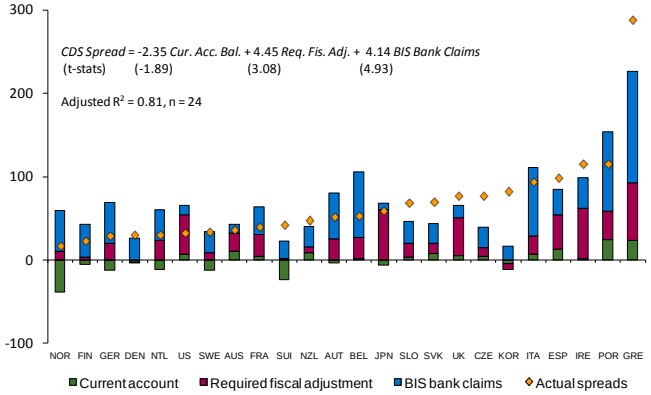
[14] Includes all claims of depository institutions (excluding the central bank) on general government. UK figures are for claims on the public sector. Data are for end-2009 or latest available.

[15] BIS Reporting banks' international claims on the public sector on an immediate borrower basis for third quarter 2009, as a percentage of 2009 GDP.

The crisis has driven up market prices of sovereign risk.

The vulnerabilities outlined in Table 1.1 are being priced in to market assessments of sovereign risk. A cross-sectional regression over 24 countries indicates that higher current account deficits and greater required fiscal adjustment are correlated with higher sovereign credit default swap (CDS) spreads (Figure 1.6).[5] In addition, BIS reporting banks' consolidated cross-border claims on each country's public sector as a proportion of GDP help to explain spreads, especially for those countries with wider spreads.[6]

Figure 1.6. Contributions to Five-Year Sovereign Credit Default Swap Spreads
(In basis points)

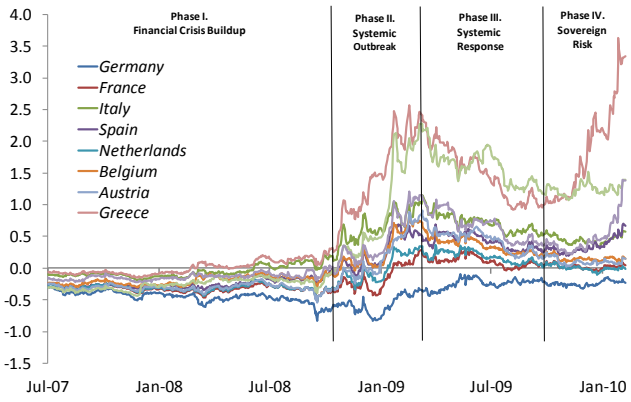


Sources: Bank for International Settlements; and IMF staff estimates.

Sovereign risks have come to the fore in the euro zone.

The global financial crisis triggered several phases of unprecedented volatility in European government bond and swap markets (Figure 1.7).[7] To chart the evolving nature of risk transmission among euro zone sovereigns, a model of swap spreads was estimated that takes account of joint probabilities of default, global risk aversion, and fiscal fundamentals (Box 1.1).

Figure 1.7. The Four Stages of the Crisis
(Ten-year sovereign swap spreads, in percent)



Source: Bloomberg L.P.

[5] Estimates of required fiscal adjustment are drawn from IMF (2010c). These estimates are based on illustrative scenarios, in which the structural primary balance is assumed to improve gradually from 2011 until 2020; thereafter, it is maintained constant until 2030. Specifically, the estimated adjustment provides the primary balance path needed to stabilize debt at the end-2012 level if the respective debt-to-GDP ratio is less than 60 percent; or to bring the debt-to-GDP ratio to 60 percent in 2030. The scenarios for Japan are based on its net debt, and assume a target of 80 percent of GDP. For Norway, maintenance of primary surpluses at their projected 2012 level is assumed. The analysis is illustrative and makes some simplifying assumptions: in particular, beyond 2011, an interest rate–growth rate differential of 1 percent is assumed, regardless of country-specific circumstances.

[6] As of early March, the regression significantly under-predicted Greek spreads, which arguably reflected heightened liquidity concerns and policy uncertainty not captured in the model.

[7] Swaps are used as a numeraire to compare sovereign credit risk across multiple countries. Swap spreads refer to the yield differential between a specific maturity government bond and the fixed rate on an interest-rate swap with an equivalent tenor.

Box 1.1. Explaining Swap Spreads and Measuring Risk Transmission among Euro Zone Sovereigns[1]

What factors most affected swap spreads during the four phases of the crisis (see diagram) and how did sovereign risk transmission evolve during these phases? A model of swaps spreads based on measures of sovereign risk, global risk aversion, and country-specific fiscal fundamentals was estimated to shed light on this question (Annex 1.10). The first figure summarizes the results of the model. It shows that during the initial phase of the crisis, the increase in global risk aversion helped lower swap spreads in core sovereigns as investors sought the relative safety of these bonds. However, as the crisis progressed, spreads widened in other sovereigns, driven by worsening fundamentals and spillovers. In recent months, spreads have continued to widen in those countries with the greatest fiscal pressures.

Financial Crisis Buildup (July 2007 - September 2008)

Core sovereigns (France, Germany) supported by increase in risk aversion and flight to quality, while spreads widened for other sovereigns

↓

Systemic Outbreak (October 2008 - March 2009)

Countries with financial system and other concerns (Austria, Belgium, Ireland, Netherlands) come to the fore

↓

Systemic Response (April 2009 - October 2009)

Policy actions to support banks leads to reduction in risk aversion; benefits noncore sovereigns and swap spreads narrow

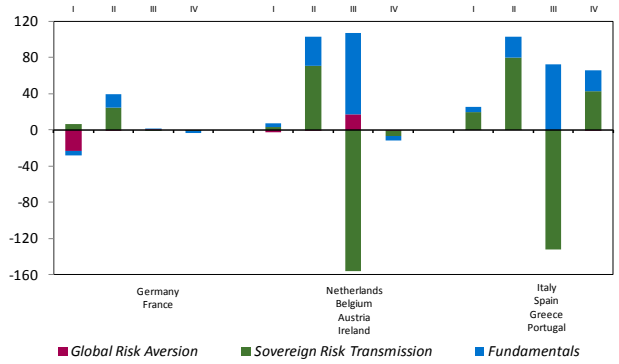
↓

Sovereign Risk (November 2009 - present)

Countries with fiscal concerns (Greece, Italy, Portugal, Spain) increasing source of spillovers

Contributions to Swap Spreads by Crisis Phase

(Average of changes in swap spreads in basis points)



Source: IMF staff estimates.

Sovereign risk transmission between two countries was derived from sovereign CDS spreads using the methodology developed by Segoviano (2006). Essentially, this measure represents the probability of distress in one sovereign given the distress in another. In order to determine whether the nature of risk transfer had changed, these joint probability of distress were averaged over each of the four phases of the crisis that are defined in the diagram.

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[1]This box was prepared by Carlos Caceres, Vincenzo Guzzo, and Miguel Segoviano.

Box 1.1 *(concluded)*

Contributions to Euro Area Distress Dependence, October 2008 - March 2009

(Percentage point contribution to total distress probability)

		Contribution From:										
		Germany	France	Italy	Spain	Netherlands	Belgium	Austria	Greece	Ireland	Portugal	Total
Contribution to:	Germany		9.9	12.0	11.1	13.7	9.4	15.8	8.4	11.1	8.7	100
	France	7.7		11.8	9.7	17.4	8.9	18.0	7.8	11.4	7.3	100
	Italy	6.3	8.6		10.8	14.7	8.9	19.2	9.9	13.9	7.8	100
	Spain	6.5	8.6	13.3		14.3	8.5	18.6	9.0	14.1	7.1	100
	Netherlan	6.9	10.1	13.3	11.5		10.6	17.3	8.9	12.3	9.0	100
	Belgium	6.1	8.1	11.3	9.2	14.8		19.0	9.4	14.5	7.5	100
	Austria	5.7	7.9	14.1	12.6	11.4	10.6		11.8	14.4	11.5	100
	Greece	5.3	7.0	12.8	10.5	11.0	9.5	18.4		16.1	9.3	100
	Ireland	5.4	7.2	13.3	11.6	11.7	10.5	18.2	12.5		9.6	100
	Portugal	5.8	7.6	11.6	9.0	12.8	8.4	21.0	9.8	13.8		100
	Total[1]	5.6	7.4	11.4	9.6	12.2	8.5	16.7	8.8	12.3	7.7	100

Source: IMF staff estimates.

[1] Weighted average percentage point contribution to all other countries.

During the systemic outbreak phase of the crisis (see first table), the main sources of risk transfer—shown by the sum of the percentage contributions in the last row—were Austria, Ireland, Italy, and the Netherlands. In other words, the euro zone members that faced the greatest concerns regarding their exposures to Eastern Europe, domestic financial systems (e.g., Ireland), or general fiscal conditions (in the case of Italy) transmitted the most sovereign risk to other countries.

In contrast, during the latest sovereign risk phase (see second table), Greece, Portugal, and, to a lesser extent, Spain and Italy became the main contributors to inter-sovereign risk transfer, reflecting the shift in market concerns from financial sector vulnerabilities to fiscal vulnerabilities.

Contributions to Euro Area Distress Dependence, October 2009 - February 2010

(Percentage point contribution to total distress probability)

		Contribution From:										
		Germany	France	Italy	Spain	Netherlands	Belgium	Austria	Greece	Ireland	Portugal	Total
Contribution to:	Germany		12.0	11.1	13.4	4.8	7.4	6.9	19.8	6.2	18.3	100
	France	5.6		13.4	14.8	6.0	8.1	7.7	18.2	8.0	18.3	100
	Italy	4.0	10.4		16.4	3.3	6.8	7.2	24.2	7.2	20.5	100
	Spain	4.3	10.2	14.4		3.3	7.0	7.4	23.9	8.4	21.1	100
	Netherlands	4.5	13.2	10.2	12.2		8.0	5.3	22.1	3.3	21.2	100
	Belgium	4.3	10.3	10.9	12.9	4.6		7.6	22.6	8.1	18.8	100
	Austria	3.7	8.7	10.8	12.5	3.0	7.0		26.5	6.0	21.8	100
	Greece	4.1	7.5	14.2	15.7	4.2	7.8	10.5		15.7	20.3	100
	Ireland	3.1	7.7	9.9	12.8	2.0	6.8	5.9	31.3		20.6	100
	Portugal	4.2	8.5	13.7	15.7	4.6	7.4	10.0	23.6	12.3		100
	Total[1]	3.7	8.3	11.0	12.7	3.4	6.5	7.0	21.4	8.1	18.0	

Source: IMF staff estimates.

[1] Weighted average percentage point contribution to all other countries.

In the early stages of the crisis, the increase in global risk aversion benefited core sovereigns such as France and Germany, while spreads widened for sovereigns (Figure 1.7) perceived to be more risky. After Lehman's collapse, the countries that weighed adversely on other sovereigns were those that had financial systems that were hit hard by the financial crisis (Austria, Ireland, and the Netherlands). As sovereigns stepped in with public balance sheets to support banks, there was a general narrowing of swap spreads as fears of systemic crisis subsided and global risk aversion fell. However, more recently, the source of spillovers has shifted to economies with weaker fiscal outlooks and financial strains, with these tensions most evident in Greece.

The recent turmoil in the euro zone also demonstrated how weak fiscal fundamentals coupled with underlying vulnerabilities can manifest themselves as short-term financing strains.

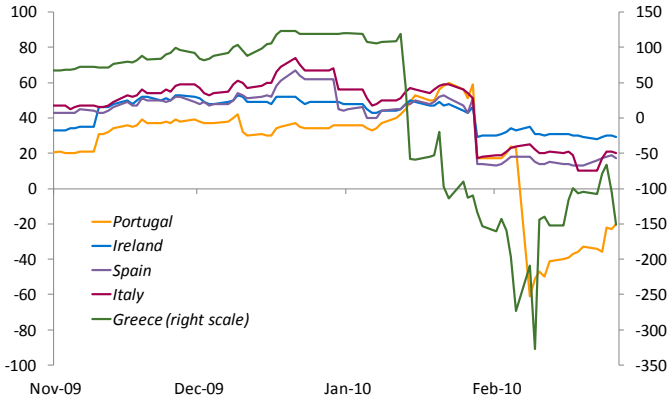
In the presence of outsized deficits and an unsustainable debt trajectory, heavy reliance on external demand for government obligations and large concentrated debt rollover requirements can shorten the timeline for addressing solvency challenges. Unlike local demand sources, nonresident buyers are naturally more attuned to sovereign risk and inclined to step back from further purchases in times of market stress. A debt profile with concentrated maturities also introduces "trigger dates" around which policymakers must navigate. These hurdles can constrain policy options and increase the likelihood of standoffs developing between the government and investors demanding higher risk premiums. Ultimately, an unresolved solvency crisis amid high near-term refinancing needs and political uncertainty could limit access to public debt capital markets.

Financial channels can amplify sovereign risks.

Insufficient collateral requirements for sovereign counterparties in the over-the-counter (OTC) swap market can transmit emerging concerns about the credit risk of a sovereign to its counterparties. In contrast to most corporate clients, dealer banks often do not require highly rated sovereign entities to post collateral on swap arrangements.[8] Dealers may attempt to create synthetic hedges for this counterparty risk by selling assets that are highly correlated with the sovereign's credit profile, sometimes using short CDS (so-called "jump-to-default" hedging).

This hedging activity from uncollateralized swap agreements can put heavy pressure on the sovereign CDS market as well as other asset classes. For instance, heavy demand for jump-to-default hedges can quickly push up the price of short-dated CDS protection. With bond dealers also trying to offset some of the sovereign risk in their government bond inventory, many European sovereign CDS curves departed from their normal upward sloping configuration to significant flattening or outright inversion (Figure 1.8). Greece's sovereign CDS curve inverted in

Figure 1.8. Sovereign Credit Default Swap Curve Slopes
(Five-year credit default swap spread minus one-year, in basis points)



Source: Bloomberg L.P.

[8] Collateral requirements represent the most commonly used mechanism for mitigating credit risk associated with swap arrangements by offsetting the transaction's mark-to-market exposure with pledged assets.

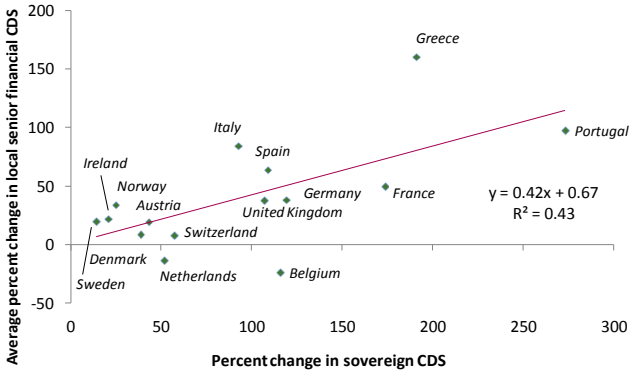
mid-January as the funding crisis accelerated and jump-to-default hedging demand increased; Portugal's CDS curve inverted two weeks later. These pressures can easily spill over into the domestic bond market and push yields higher.

Yet sovereign CDS markets are still sufficiently shallow, especially in one-year tenors, that a large gross notional swap exposure may prompt a dealer to look to other, more liquid asset classes for a potential hedge for its exposure to sovereigns.[9] Proxies such as corporate credit, equities, or even currencies are commonly used, putting pressure on other asset classes. If swap arrangements with sovereigns were adequately collateralized, there would be no need for such defensive hedges and there would be less potential for volatility to spread from swaps to other markets.[10] However, steps to reduce transmission channels should avoid interfering with efficient market functioning and good risk management practices. Thus, recent proposals to ban "naked" CDS exposures could be counter-productive, as this presupposes that regulators can arrive at a working definition of legitimate and illegitimate uses of these products (see Section F) (Annex 1.2).

Sovereign crises can widen and cross borders as they spread to the banking system.

Due to the close linkages between the public sector and domestic banks, deteriorating sovereign credit risk can quickly spill over to the financial sector (Figure 1.9). On the asset side, an abrupt drop in sovereign debt prices generates losses for banks holding large portfolios of government bonds. On the liability side, bank wholesale funding costs generally rise in concert with sovereign spreads, reflecting the longstanding belief that domestic institutions cannot be less risky than the sovereign. In addition, the perceived value of government guarantees to the banking system will erode when the sovereign comes under stress, thus raising funding costs still higher. Multiple sovereign downgrades could precipitate increased haircuts on government securities or introduce collateral eligibility concerns for central bank or commercial repos.[11]

Figure 1.9. Sovereign Risk Spilling over to Local Financial Credit Default Swaps, October 2009 to February 2010



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

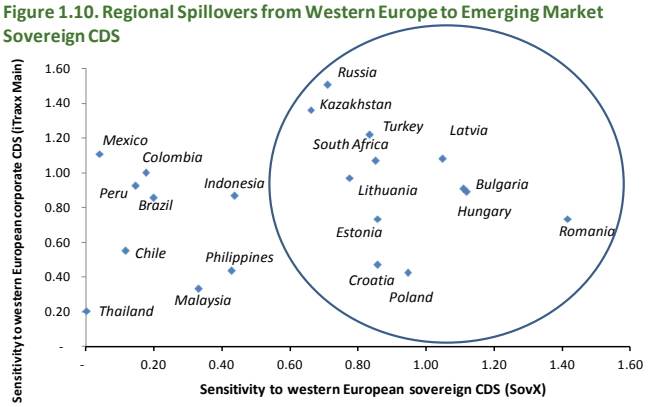
[9] Gross sovereign default protection is $2 trillion in notional value, just 6 percent of the $36 trillion global government bond market. The more relevant net exposure (true economic transfer in case of default) represents only 0.5 percent of government debt, at $196 billion notional amount.

[10] There is also potential for stricter collateral requirements among dealers, and between dealers and monoline insurers, and highly rated corporates and banks.

[11] Bank earnings also potentially suffer from heightened sovereign credit risk. Sovereign ratings downgrades can increase banks' risk-weighting for government debt holdings; fiscal and monetary tightening can lead to asset quality deterioration; and higher taxes can directly reduce bank profitability.

Financial sector linkages can transmit one country's sovereign credit concerns to other economies. As higher domestic government borrowing in a country crowds out private lending, multinational banks may withdraw from cross-border banking activities. Likewise, other economies that are heavily reliant on international debt borrowing or on banks from countries under significant sovereign stress could be viewed as susceptible to financial sector instability. Figure 1.10 illustrates these linkages by showing how some countries in Eastern Europe have proven more sensitive to changes in Western European sovereign credit risk.

Figure 1.10. Regional Spillovers from Western Europe to Emerging Market Sovereign CDS



Sources: Deutsche Bank; and IMF staff estimates.
Note: Sensitivities of sovereign CDS captured by regression betas estimated from daily spread changes between Oct. 2009 to Feb. 2010 in joint regression, using the iTraxx Main index and a reweighted SovX-Western Europe index that matches geographic profile of iTraxx Main.

Thus, the skillful management of sovereign risks is essential for maintaining financial stability and preventing an unnecessary extension of the crisis.

C. The Banking System: Legacy Problems and New Challenges

The global banking system is coping with the legacy of the crisis and with the prospect of further challenges from the deleveraging process. Improving economic and financial market conditions have reduced expected writedowns and bank capital positions have improved substantially. But some segments of country banking systems remain poorly capitalized and face significant downside risks. Slow progress on stabilizing funding and addressing weak banks could complicate policy exits from extraordinary support measures, and the tail of weak institutions in some countries risks having "zombie banks" that will act as a dead weight on growth. Banks must reassess business models, raise further capital, shrink assets, and make their balance sheets less risky. Policymakers will need to ensure that this next stage of the deleveraging process unfolds smoothly and leads to a safe, competitive, and vital financial system.

Since the October 2009 GFSR, total estimated bank writedowns and loan provisions between 2007 and 2010 have fallen from $2.8 trillion to $2.3 trillion. Of this amount, around two-thirds ($1.5 trillion) had been realized by the end of 2009 (Table 1.2 and Figure 1.11). As explained in that previous GFSR, these estimates are subject to considerable uncertainty and considerable range of error.[12] The sources of this uncertainty include the data limitations, measurement errors from consolidation, cross-country variations, changes in accounting standards, and uncertainty associated with our assumptions about exogenous variables. Differences between writedowns projected and realized reflect a number of factors, including the future path of delinquencies, differences in

[12] See Box 1.1. of the October 2009 GFSR.

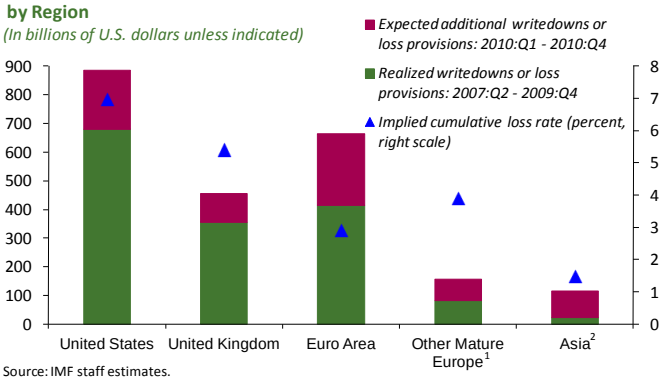
accounting conventions and reporting lags across regions, and the pace of loss recognition. In the current environment of near-zero interest rates, banks also face strong incentives to extend maturities and prevent delinquent loans from being reported as nonperforming.[13]

Expected writedowns from loans have declined with the improved economic outlook, but further deterioration lies ahead.

For U.S. banks, estimated loan writedowns and provisions for 2007–10 were revised down by $66 billion to $588 billion after growth turned positive and house prices stabilized in the second half of 2009 (Table 1.2). Nevertheless, serious mortgage delinquencies and foreclosures continue to rise, as unemployment persists at a high level and almost one-quarter of mortgage borrowers have negative housing equity. Loan charge-off rates are expected to peak between 2009 and 2011 depending on the asset class (Figure 1.12).

Figure 1.11. Realized and Expected Writedowns or Loss Provisions for Banks by Region

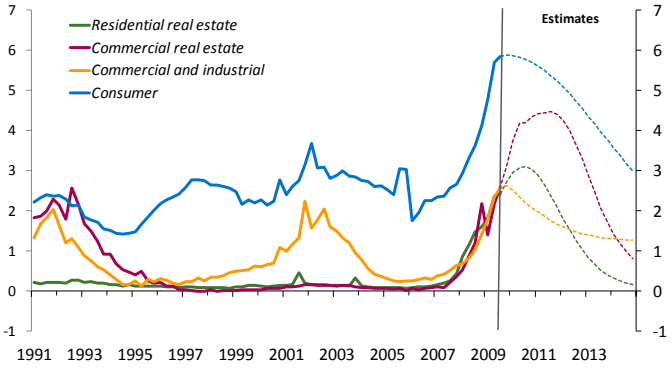
(In billions of U.S. dollars unless indicated)



Source: IMF staff estimates.
[1]Includes Denmark, Iceland, Norway, Sweden, and Switzerland.
[2]Includes Australia, Hong Kong SAR, Japan, New Zealand, and Singapore.

Figure 1.12. U.S. Loan-Charge-Off Rates

(In percent of total loans)



Sources: Federal Reserve; and IMF staff estimates.

For euro area banks, improvements in GDP growth and unemployment forecasts have brought down estimated total loan writedowns and provisions by $38 billion to $442 billion since the October 2009 GFSR. Total loan loss provisions are now expected to have peaked at 1 percent in 2009 and decline to 0.7 percent this year. Corporates in the euro area proved more resilient than expected as they adjusted their capital expansion/working capital requirements, and reduced labor costs through the use of flexible working arrangements. Larger corporates also issued record amounts of debt in capital markets.

[13] Differences in the speed of realization of writedowns or loss provisions between the euro area and the United States may reflect a lag in the credit cycle in the euro area; the higher proportion of securities on U.S. banks' balance sheets; accounting differences between International Financial Reporting Standards (IFRS) and U.S. Generally Accepted Accounting Principles (U.S. GAAP); time lags between data collection and publication by national supervisors; and differences in the frequency of reporting.

Table 1.2. Estimates of Global Bank Writedowns by Domicile, 2007-10

	Estimated Holdings (billions of U.S. dollars)	Estimated Writedowns October 2009 GFSR (billions of U.S. dollars)	Estimated Writedowns April 2010 GFSR (billions of U.S. dollars)	Implied Cumulative Loss Rate October 2009 GFSR (percent)	Implied Cumulative Loss Rate April 2010 GFSR (percent)	Share of Total Writedowns April 2010 GFSR (percent)
U.S. Banks						
Loans						
Residential mortgage	2,981	230	204	7.7	6.8	23.0
Consumer	1,115	195	180	17.5	16.2	20.4
Commercial mortgage	1,114	100	87	9.0	7.8	9.8
Corporate	1,104	72	65	6.6	5.9	7.4
Foreign[1]	1,745	57	53	3.3	3.0	5.9
Total for Loans	8,059	654	588	8.1	7.3	66.5
Securities						
Residential mortgage	1,495	189	166	12.7	11.1	18.8
Consumer	142	0	0	0.0	0.0	0.0
Commercial mortgage	196	63	48	32.0	24.5	5.4
Corporate	1,115	48	17	4.3	1.5	1.9
Governments	580	0	0	0.0	0.0	0.0
Foreign[1]	975	71	66	7.3	6.7	7.4
Total for Securities	4,502	371	296	8.2	6.6	33.5
Total for Loans and Securities	**12,561**	**1,025**	**885**	**8.2**	**7.0**	**100.0**
U.K. Banks						
Loans						
Residential mortgage	1,636	47	27	2.9	1.6	5.9
Consumer	423	66	64	15.7	15.1	14.0
Commercial mortgage	344	39	41	11.2	12.1	9.1
Corporate	1,828	83	63	4.5	3.4	13.8
Foreign[1]	2,514	261	203	10.4	8.1	44.6
Total for Loans	6,744	497	398	7.4	5.9	87.5
Securities						
Residential mortgage	225	27	11	12.0	5.0	2.5
Consumer	58	4	2	7.4	2.8	0.4
Commercial mortgage	51	12	8	23.5	15.0	1.7
Corporate	258	25	7	9.5	2.7	1.5
Governments	360	0	0	0.0	0.0	0.0
Foreign[1]	672	39	29	5.8	4.4	6.4
Total for Securities	1,625	107	57	6.6	3.5	12.5
Total for Loans and Securities	**8,369**	**604**	**455**	**7.2**	**5.4**	**100.0**
Euro Area Banks						
Loans						
Residential mortgage	4,530	47	44	1.0	1.0	6.6
Consumer	675	27	25	4.0	3.8	3.8
Commercial mortgage	1,272	40	37	3.1	2.9	5.6
Corporate	5,018	85	79	1.7	1.6	11.9
Foreign[1]	4,500	282	256	6.3	5.7	38.4
Total for Loans	15,994	480	442	3.0	2.8	66.4
Securities						
Residential mortgage	966	130	104	13.5	10.8	15.7
Consumer	271	5	8	1.9	2.8	1.1
Commercial mortgage	264	62	40	23.5	15.0	6.0
Corporate	1,316	22	0	1.7	0.0	0.0
Governments	2,146	0	0	0.0	0.0	0.0
Foreign[1]	1,943	113	72	5.8	3.7	10.8
Total for Securities	6,907	333	224	4.8	3.2	33.6
Total for Loans and Securities	**22,901**	**814**	**665**	**3.6**	**2.9**	**100.0**
Other Mature Europe Banks[2]						
Loans						
Total for Loans	3,241	165	134	5.1	4.1	86.0
Total for Securities	729	36	22	4.9	3.0	14.0
Total for Loans and Securities	**3,970**	**201**	**156**	**5.1**	**3.9**	**100.0**
Asian Banks[3]						
Loans						
Total for Loans	6,150	97	84	1.6	1.4	73.5
Total for Securities	1,728	69	30	4.0	1.8	26.5
Total for Loans and Securities	**7,879**	**166**	**115**	**2.1**	**1.5**	**100.0**
Total for all Bank Loans	40,189	1,893	1,647	4.7	4.1	72.4
Total for all Bank Securities	15,491	916	629	5.9	4.1	27.6
Total for Loans and Securities	**55,680**	**2,809**	**2,276**	**5.0**	**4.1**	**100.0**

Sources: Bank of International Settlements (BIS); Bank of Japan; European Securitzation Forum; Keefe, Bruyette & Woods; U.K. Financial Services Authority; U.S. Federal Reserve; and IMF staff estimates.

Note: Domicile of a bank refers to its reporting country on a consolidated basis, which includes branches and subsidiaries outside the reporting country. Bank holdings are as of the October 2009 GFSR publication. Mark-to-market declines in securities pricing are as of January 2010.

[1]Foreign exposures of regional banking systems are based on BIS data on foreign claims. The same country proportions are assumed for both bank holdings of loans and securities. For each banking system, the proportion of exposure to domestic credit categories is assumed to apply to overall stock of foreign exposure.

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

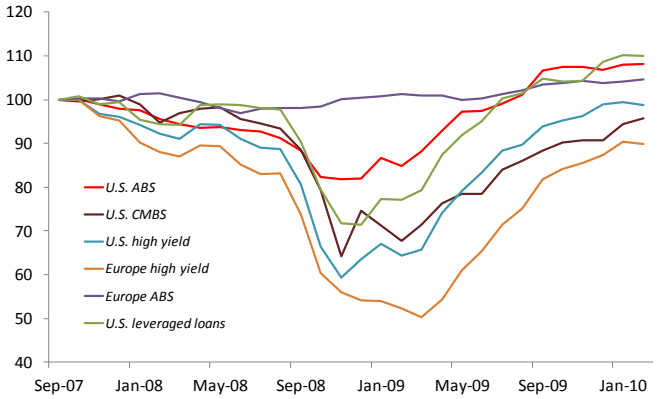
[3]Includes Australia, Hong Kong SAR, Japan, New Zealand, and Singapore.

For U.K. banks, estimated loan loss provisions have been revised down by $99 billion to $398 billion, reflecting improvements in expected losses on residential mortgages. The projected mortgage loss provision rate for the first half of 2009 (1.9 percent) is significantly below that projected in the October 2009 GFSR (2.7 percent). However, commercial real estate has deteriorated more rapidly than anticipated with peak-to-trough price declines of more than 40 percent now expected, notwithstanding some signs of a recent uptick in prices in some segments.[14]

Financial healing and market normalization have led to a substantial improvement in securities prices, further pushing down overall writedown estimates.

Estimated global securities writedowns in banks have dropped by $287 billion to $629 billion as a result of improvements in market pricing of liquidity and risk premia across the range of corporate, consumer, and real estate securities held by banks (Figure 1.13). The largest reduction in writedowns is in corporate securities, while improvements in real-estate-related securities were more uneven. For example, in the United States, prices of (private label) residential mortgage-backed securities (RMBS) remain under pressure. In Europe, top-rated U.K. RMBS prices recovered strongly in the latter half of 2009, but Spanish RMBS markets reflect the weak housing market.

Figure 1.13. Global Securities Prices
(Rebased, Q3 2007 = 100)



Sources: Barclays Captial; European Securitization Forum; Markit; and IMF staff estimates.

In aggregate, bank capital positions have improved substantially . . .

Capital ratios of aggregate banking systems have improved substantially since the October 2009 GFSR (Table 1.3). Banks have continued to raise private capital, and in some cases a pick-up in earnings in 2009 has helped to bolster capital. Projected writedowns are mostly covered by earnings for the aggregate banking system.

Table 1.3. Aggregate Bank Writedowns and Capital
(In billions of U.S. dollars, unless otherwise shown)

	United States (ex-GSEs)	Euro Area	United Kingdom	Other Mature Europe [1]
Total reported writedowns (to end-2009: Q4)[2]	680	415	355	82
Total capital raised (to end-2009: Q4)	329	256	222	55
Tier 1/RWA capital ratios (at end-2009), in percent	11.3 (+1.5)	9.1 (+1.1)	11.5 (+2.3)	8.5 (+0.3)

Source: IMF staff estimates.
Note: Capital raising includes government injections net of repayments. Capital ratios reflect those repayments. Figures in parentheses reflect percentage point changes since end-2008. All figures are under local accounting conventions and regulatory regimes, making direct comparisons between countries/regions impossible.

GSE = Government-sponsored enterprise. Tier 1 = Tier 1 capital; RWA = Risk-weighted Assets

[1] Denmark, Iceland, Norway, Sweden, and Switzerland.

[2] Reported writedowns do not include estimated writedowns on loans for 2009.

[14] New loans became more leveraged in the run-up to the crisis (often nonamortizing) and, as leases terminate in the next few years, many owners are unlikely to find new tenants.

. . . but some segments of country banking systems remain poorly capitalized and face significant downside risks.

The aggregate picture masks considerable differentiation within segments of banking systems, and there are still pockets where capital is strained; where risks of further asset deterioration are high; and/or which suffer from chronically weak profitability.

In the United States, real estate exposures still represent a significant downside risk. The regional banks with heavy exposure to real estate need to raise capital (Table 1.4).[15] Some 12 institutions have commercial real estate (CRE) exposure in excess of four times tangible common equity.[16] In addition, the mortgage government-sponsored enterprises (GSEs) already received $128 billion of capital from the Treasury as of end-2009 and analysts' estimates of total capital likely to be needed stretch up to $300 billion, highlighting that in the United States a substantial proportion of mortgage credit risk and capital shortfall has been transferred to the government by placing the GSEs under conservatorship.[17]

Table 1.4. United States: Bank Writedowns and Capital
(In billions of U.S. dollars, unless otherwise shown)

	Four largest banks (by assets)	Investment/ processing banks	Regional banks	Other banks[1]
Tier1/RWA at end-2009 (in percent)	10.6	14.9	11.5	10.3
Expected Writedowns (Q1:2010 - Q4:2011)	228	1	47	161
Gross Drain on Capital[2] (Q1:2010 - Q4:2011)	5	0	6	26
Tier 1 Capital at end-2009	514	143	120	353

Source: IMF staff estimates.
Note: RWA = risk-weighted assets.
[1]Other banks include consumer, small (between $10 billion -$100 billion in assets), foreign and other banks (including those with less than $10 billion in assets).
[2]Drain on capital = - (Net pre-provision earnings - writedowns - taxes - dividends). Gross drain aggregates only those banks with a capital drain.

Further pressure on real estate markets may lie ahead. The "shadow housing inventory" continues to rise as lenders retain ownership of foreclosed property and forbear on seriously delinquent borrowers (as shown by the rising gap between 90-day+ delinquencies and foreclosure starts in Figure 1.14). The ending of foreclosure moratoria, house purchase tax incentives, and the Federal Reserve's agency MBS purchases could trigger another drop in housing prices.[18] In addition, a mortgage principal modification program (or the passage of so-called "cramdown" legislation)

[15] Foreign institutions operating in the United States are generally lightly capitalized and reliant on capital support from foreign parents. A move toward requiring more localized capital holdings by foreign operations from regulators would entail substantial capital injections from their parents (principally European banks).

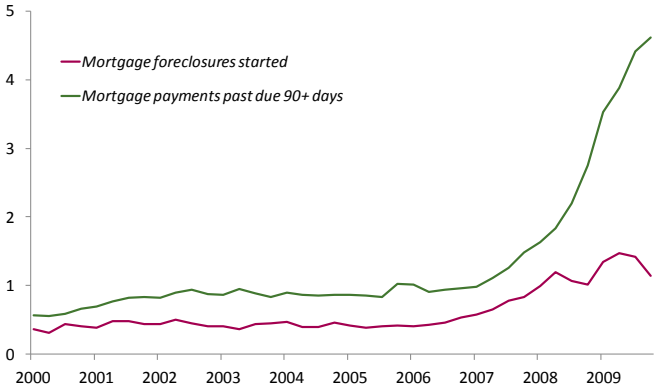
[16] $1.4 trillion of CRE loans are due to roll over in 2010–14, almost half of which are now in negative equity (Azarchs and Mattson, 2010; Congressional Oversight Panel, 2010).

[17]This does not include the likely recapitalization of the Federal Housing Administration (FHA), whose reserves are well below the 2 percent level mandated by Congress. While it has tightened some lending standards for low-quality borrowers and raised insurance fees, the FHA is caught between the objectives of propping up the housing market and rebuilding its reserves.

[18] The backlog of 5 million foreclosures (and short-sales) now represents one year's total sales. The U.S. Treasury Home Affordable Modification Program (HAMP) is rapidly qualifying mortgage borrowers for trial payment modifications, but these are proving slow to convert into permanent modifications, and the program shows little sign of fundamentally changing housing market dynamics.

would precipitate significant additional losses on both first- and second-lien loans, prompting further RMBS downgrades.[19]

Figure 1.14. U.S. Mortgage Market
(In percent of total mortgage loans, seasonally adjusted)



Source: Mortgage Bankers Association.

Concerns in real estate lending also present a challenge in some euro area economies. In Spain, the most vulnerable loans are to property developers, as nonperforming loans and repossessions of troubled real assets have increased sharply over the last two years. Problem assets comprised of nonperforming loans and repossessions are projected to rise further, although reserves and earnings provide substantial cushions against potential losses. Overall, our conclusion is that, in Spain, a small gross drain on capital is expected in both commercial and savings banks under the baseline, despite severe economic deterioration. Under our adverse scenario, the gross drain on capital could reach €5 billion and €17 billion at commercial and savings banks, respectively (see Table 1.5 and Annex 1.3). These estimates are subject to considerable uncertainty and are relatively small in relation to both overall banking system capital and, importantly, the funds set aside under the resolution and recapitalization program set up by the government under the Fund for the Orderly Restructuring of Banks (FROB) of €99 billion. So far, three restructuring plans have been approved under the FROB involving a total of eight savings banks. The existing FROB scheme is currently scheduled to expire by June 2010. It is therefore important that the comprehensive resolution and restructuring processes financed through the FROB be under way before that date.

Table 1.5. Spain: Bank Writedowns and Capital
(In billions of euros, unless otherwise shown)

	Commercial banks	Savings banks	Commercial banks	Savings banks
	Baseline Scenario		*Adverse-Case Scenario*	
Tier 1/RWA Ratio at Q2 2009[1] (in percent)	8.9	9.0	8.9	9.0
Expected Writedowns, 2010-12[2]	1	3	26	33
Net Drain on Capital, 2010-12[3]	-51	-36	-15	2
Gross Drain on Capital, 2010-12[4]	1	6	5	17
Tier 1 Capital at Q2 2009[1]	99	78	99	78

Source: IMF staff estimates.
Note: RWA = risk-weighted assets; for details refer to Annex 1.3.
[1]Latest available official data.
[2]Includes potential losses from non-performing loans, repossessed real assets, and securities.
[3]Net drain = - (net pre-provision earnings - writedowns). A negative sign denotes capital surplus.
[4]Gross drain aggregates only those banks with a drain on capital.

While the overall health of German banks has improved since the peak of the crisis, banks may still face substantial writedowns on both their loan books and securities holdings, and the pace of realization has been uneven across the different categories of banks. Among main banking

[19] Monoline insurers that have guaranteed RMBS may be forced into bankruptcy if losses continue to mount. Counterparties with unhedged, unwritten-off positions to those monolines, or those unable to replace hedges, would face additional market losses.

categories, Landesbanken have the highest loan writedown rate.[20] Commercial banks, Landesbanken, and other banks still hold relatively large amounts of structured products, which results in particularly high writedown rates on their overall securities holdings. Strong capital positions at end-2009 and advanced writedown realization by commercial banks ensure their adequate capitalization (Table 1.6 and Annex 1.4). In contrast, Landesbanken, other banks, and, to a lesser degree also savings banks, are yet to incur a substantial part of total estimated writedowns and are projected to have a net drain on capital. Raising additional capital could prove particularly difficult for the Landesbanken, many of which remain structurally unprofitable and thus vulnerable to further distress. The impending withdrawal of the government's support measures could intensify these vulnerabilities, stressing the need for expedited consolidation and recapitalization in this sector.

Table 1.6. Germany: Bank Writedowns and Capital
(In billions of U.S. dollars, unless otherwise shown)

	Commercial Banks	Landesbanken and Savings Banks	Other Banks[1]
Tier 1/RWA Ratio at end-2009[2] (in percent)	11.0	7.9	8.3
Expected Writedowns, Q1:2010-Q4 2010[3]	-3	47	21
of which, Loans:	19	27	4
of which, Securities	-22	20	16
Net Drain on Capital, Q1:2010-Q4:2010[4]	-27	22	14
Tier 1 Capital at end-2009 [2]	184	155	45

Source: IMF staff estimates.
Note: Foreign-exchange rate assumed at 1EUR=1.4USD; RWA = risk-weighted assets; for details refer to Annex 1.4.
[1]Other banks include credit co-operatives.
[2]Tier 1 capital levels for 2009 are estimated.
[3]A negative sign denotes a write-up.
[4]Net drain on capital = - (net pre-provision earnings - writedowns - taxes - dividends). A negative sign denotes capital surplus.

Central and eastern European banking systems should be able to absorb the near-term peak in nonperforming loans, but are very vulnerable to weaker economic growth.

All banking systems remain susceptible to downside economic scenarios and this is especially so in central and eastern Europe (CEE). Nonperforming loan (NPL) ratios appear likely to peak during 2010 in the region (see Box 1.2), and banks appear sufficiently capitalized to absorb the baseline increase. However, another acceleration in NPL formation, were a weaker economic scenario to unfold, would leave banks significantly weakened and ill-prepared to absorb losses. As experience from previous crises shows, NPL ratios typically remain elevated for several years after the onset of a crisis, and coverage ratios of loss provisions to NPLs have already fallen to an average of about 65 percent in the CEE region, from pre-crisis levels of about 90 percent.[21]

[20] Landesbanken are regionally oriented. Their ownership is generally divided between the respective regional savings banks associations, on the one hand, and the respective state governments and related entities, on the other. The relative proportions of ownership vary from institution to institution.

[21] The NBER Debt Enforcement Database (Djankov and others, 2008), based on an international survey of bankruptcy attorneys, indicates that the average recovery rate on corporate NPLs in the CEE region should be around 35 percent, with significantly lower recovery rates for some countries. Market estimates of recovery rates on mortgages in the region range between 40 and 80 percent, depending on the extent to which real estate prices have declined and how well the debt collection process functions.

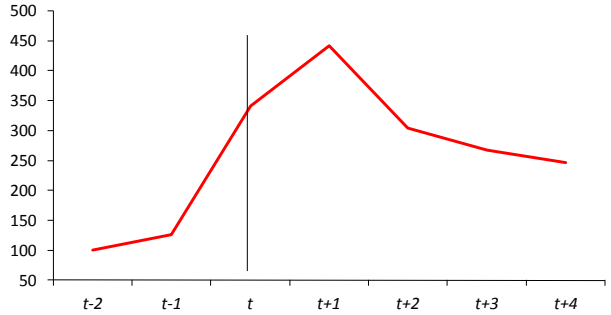
Box 1.2. Nonperforming Loans in Central and Eastern Europe: Is This Time Different?[1]

At what levels and when could nonperforming loan ratios be expected to peak in central and eastern Europe, based on experience from previous economic downturns?

Nonperforming loans (NPLs) have increased substantially in the central and eastern Europe (CEE) region since the onset of the global financial crisis. This box presents a top-down framework for assessing the deterioration in bank asset quality and analyzing NPLs under different scenarios, based on historical experience in emerging markets.[2]

The estimation sample consists of annual data between 1994 and 2008 for Asian and Latin American countries, as well as South Africa and Turkey.[3] The data reveal that emerging market NPL ratios tend to rise rapidly in a crisis, and remain more than twice as high as before the initial shock for more than four years (first figure). The technical details on the data and the estimations are given in Annex 1.6.

Historical Dynamics of Emerging Market NPL Ratios around Large Increases in Year *t*



Source: IMF staff estimates.
Note: Average of indices for Argentina, Chile, Colombia, Dominican Republic, Indonesia, Malaysia, Philippines, Turkey, and Uruguay.

Nonperforming loans in the CEE region have developed largely in line with patterns observed in previous emerging market downturns.

Simulations for the CEE region starting in 2008 indicate that bank asset quality has developed largely as would be expected based on historical experience in emerging markets, considering the size of the GDP shocks that hit the CEE region.[4] The model-based projections fairly accurately predict the increase in NPL ratios across subregions in the CEE region during 2009, with

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[1]This box was prepared by Kristian Hartelius.

[2]The approach taken is to estimate coefficients for the relationship between GDP growth, exchange rate movements, and the ratio of NPLs to total loans for countries outside the CEE region, and then project NPL ratios for the CEE region based on those coefficients. The approach has the advantage of overcoming data limitations in NPL time series for the CEE region, which are often too short to capture full credit cycles. The approach cannot be expected to deliver very precise country-level forecasts, but can serve as a useful complement to country-specific, bottom-up stress tests.

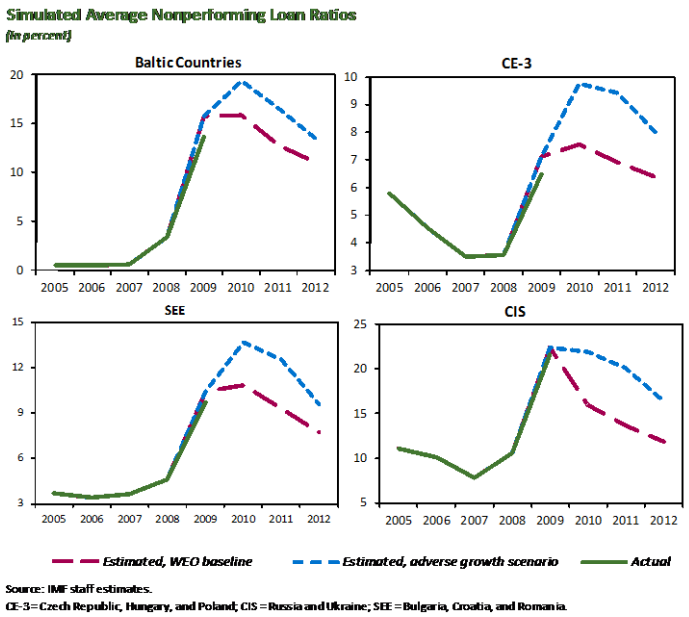
[3]The countries included in the estimation sample are Argentina, Chile, Colombia, the Dominican Republic, Indonesia, Malaysia, Mexico, Peru, the Philippines, South Africa, Taiwan Province of China, Thailand, Turkey, Uruguay, and Venezuela.

[4]Although foreign bank ownership and foreign currency lending reached extreme levels in the CEE region in the run-up to the current crisis, they were also important elements in many emerging market crises in the past two decades, which enables the model to explain the European data relatively well.

the largest increase predicted in the Baltic countries and the smallest in the CE-3 countries (second figure).[5] However, the model simulations envisage sharp currency depreciations in response to the large negative GDP shocks that have hit most countries in the CEE region. This explains why the model overpredicts the increase in NPL ratios, especially in the Baltic countries, as CEE exchange rates have successfully been stabilized on the back of international policy coordination and financial backstops.[6]

Simulations suggest that NPL ratios will peak during 2010 in most CEE countries under the WEO baseline scenario for GDP growth.

The simulations indicate that most of the increase in NPL ratios have occurred during 2009, but suggest that bank asset quality will improve only gradually in 2011 for most countries, even if GDP growth recovers during 2010 as projected in the *World Economic Outlook* (WEO). In the Commonwealth of Independent States (CIS), the simulations suggest a decline in the NPL ratio by the end of 2010 on the back of a more vigorous projected economic recovery. However, loans that have been restructured may turn up in the official NPL statistics with a delay, when interest rates are normalized and rolling over of NPLs becomes more costly in terms of interest revenue forgone, which could mean that reported asset quality in the CIS may also continue to deteriorate in 2010.



In a weaker growth scenario, NPL ratios would continue to increase substantially in 2010.

In an adverse scenario where GDP is 4 percentage points lower than the WEO baseline in 2010 and 2 percentage points lower in 2011, the simulations indicate that NPL ratios would increase by around one-third during 2010 in all subregions except the CIS, and would remain elevated in 2011.

[5]The group labeled Baltics comprises Estonia, Latvia, and Lithuania. The group labeled CE-3 comprises the Czech Republic, Hungary, and Poland. The group labeled SEE comprises Bulgaria, Croatia, and Romania, and the group labeled CIS comprises Russia and Ukraine. There is considerable variation in NPL ratios within these groupings, as detailed in Table 24 of the Statistical Appendix.

[6]As noted in Annex 1.6, the model predictions fit the Baltic data better, when controlling for actual exchange rate developments.

While banks are still coping with legacy problems, they now face significant challenges ahead, suggesting the deleveraging process is far from over.

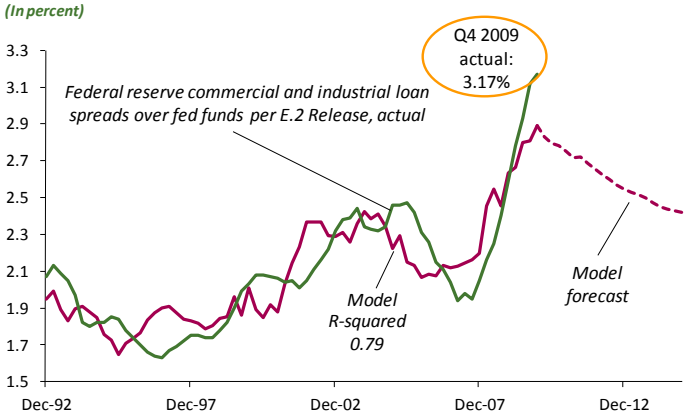
Deleveraging has so far been driven mainly from the asset side as deteriorating assets have hit both earnings and capital. Going forward, however, it is likely to be influenced more by pressures on the funding or liability side of bank balance sheets, and as new regulatory rules act to reduce leverage and raise capital and liquidity buffers.

The new regulatory proposals—enhanced Basel II and proposed revisions to the capital adequacy framework—point in the direction in which banks must adjust. The proposals will greatly improve the quality of the capital base, strengthen its ability to absorb losses, and reduce reliance on hybrid forms of capital. The quantitative impact study that will help calibrate the new rules is ongoing and final rules are to be published before end-2010, with a view to implementation by 2012. The outcome seems likely to be significant pressure for increases in the quality of capital, a further de-risking of balance sheets, and reductions in leverage. Once known—and possibly earlier—markets will re-rate banks on their perceived ability to achieve the new standards. Prudent bank management should therefore continue to build buffers of high-quality capital now in anticipation of the more demanding standards.

Few banks can expect retained earnings alone to lift them to the new capital standards . . .

Some banks are confident that they will be able to raise prices to maintain their recent high returns on equity, but history suggests they may struggle to do so. To assess this, U.S. bank lending rates were regressed on a number of macroeconomic and structural variables.[22] The results suggest that the wide margins and pricing power banks have enjoyed in recent quarters is likely to dissipate as the yield curve flattens Figure 1.15).

Figure 1.15. Banks' Pricing Power - Actual and Forecast
(In percent)



Sources: Federal Reserve; Federal Deposit Insurance Corporation; and IMF staff estimates.

For the few banks that have significant capital markets operations, investment banking revenues are unlikely to provide the bonanza they did in 2009, as interest rates and exceptional liquidity conditions normalize and competition returns. Some corporate issuance in 2009 was precautionary to take advantage of low historical rates, and is unlikely to be repeated. The decline is

[22] Using quarterly Federal Reserve and Federal Deposit Insurance Corporation (FDIC) data covering the period from 1992–2009, an equation of the form:

$$S = 1.2 + 0.096\ (0.000)\ steepness + 2.36\ (0.000)\ conc - 0.048\ (0.001)\ credgrowth$$

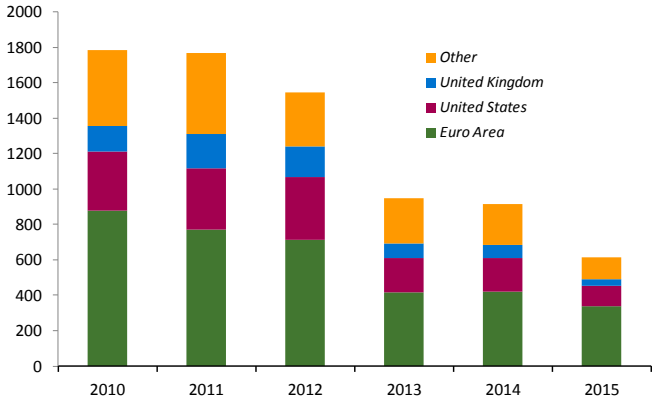
explained 79 percent of the movement, where S is the spread over the Fed Funds rate; *steepness* is the steepness of the U.S. Treasury yield curve between three months and 10 years; *conc* is an index of U.S. banking system concentration constructed from FDIC data, *credgrowth* is the growth of credit to the private sector as shown in Figure 1.30, and the figures in parentheses after each coefficient indicate significance after applying Newey-West autocorrelation correction.

unlikely to be fully offset by a rise in mergers and acquisition activity. At the same time, the move to central counterparty clearing of many contracts that were previously traded over the counter (at relatively wide spreads) could put downward pressure on one important revenue stream for the larger banks.

. . . and funding pressures are set to mount, pushing up costs.

The April 2009 GFSR cautioned that large banks generally needed to extend the maturity of their debt. However, they have seemingly been deterred by the historically high spreads at which they would issue, and the availability of ample, cheap central bank funding. The wall of refunding needs is now bearing down on banks even more than before, with nearly $5 trillion of bank debt due to mature in the coming 36 months (Figure 1.16). This will coincide with heavy government issuance and follow the removal of central bank emergency measures. In addition, banks will have to refinance securities they structured and pledged as collateral at various central bank liquidity facilities that are ending.

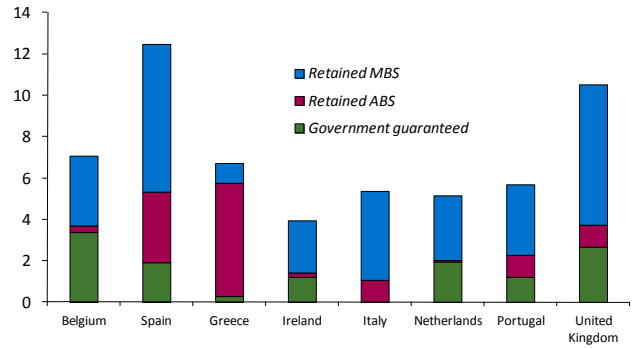
Figure 1.16. Bank Debt Rollover by Maturity Date
(In billions of U.S. dollars)



Source: Moody's.

Banks must move further to reduce their reliance on wholesale markets, particularly short-term funding, as part of the deleveraging process. The investor base for bank funding instruments has been permanently impaired as structured investment vehicles (SIVs) and conduits have collapsed, and banks are significantly less willing to fund one another unsecured. Central banks have provided a substitute with their liquidity facilities, but extraordinary support is set to be scaled back over time. This could put pressure on spreads, and particularly in those markets where the large retained securities portion of bank assets highlights the continuing disruption of mortgage securitization markets (Figure 1.17). However, a significant portion of these securities are being funded through the Bank of England and European Central Bank facilities. In contrast, the U.S. Federal Reserve has purchased securities outright—largely through the quantitative-easing program—and has thus assisted banks through a more durable asset transfer process (Annex 1.8).

Figure 1.17. Government Guaranteed Bank Debt and Retained Securitization
(As a percent of national banking system deposits)



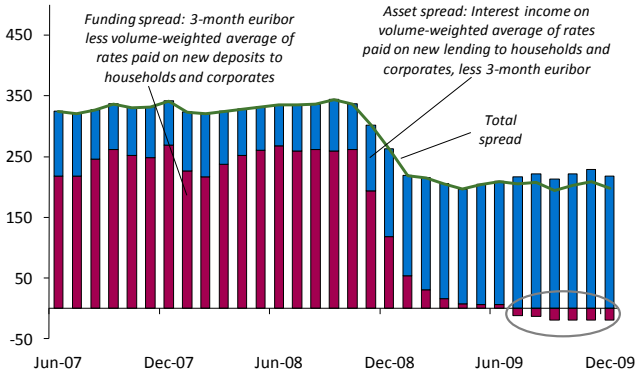
Sources: Autonomous Research; European Central Bank; and IMF staff estimates.
ABS = asset-backed security; MBS = mortgage-backed security.

If banks fail to shrink their assets to reduce their need for funding or do not issue sufficient longer-term wholesale funding, they will inevitably be competing for the limited supply of deposit funding.[23]

[23] See Autonomous Research, 2009.

Indeed, there are already signs that deposit funding is becoming more expensive. The funding spread—the difference between the LIBOR market and what banks pay for deposits—is already heavily negative in the United States and United Kingdom. Even in the euro area, where the funding spread has typically been a positive 175 basis points in normal times, it has now turned negative (Figure 1.18). As a result, even though spreads on assets have widened further in recent months, bank top-line profitability is under pressure in all these regions.[24]

Figure 1.18. Euro Area Banking Profitability
(In basis points, on volume-weighted new business, excluding overdrafts)



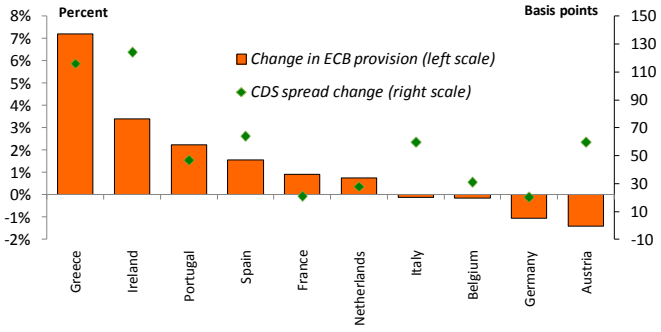
Sources: Autonomous Research; and IMF staff estimates.

Slow progress on stabilizing funding and addressing weak banks could complicate policy exits from extraordinary support measures.

The planned exit from extraordinary liquidity measures may be complicated by the need for banks generally to extend the maturity of their liabilities and by the presence of a tail of weak banks in the system. Although LIBOR-overnight index swap (OIS) spreads have narrowed, there are ample other signs that money markets have yet to return to normal functioning. The contributions of LIBOR and EURIBOR panel banks to their respective benchmarks remain more dispersed than before the crisis; credit lines for medium-sized banks, and banks that required substantial public support, have generally not yet been reinstated; and turnover in the repo market for any collateral other than higher-rated sovereign paper remains low.

Although substantially improved, there are lingering signs that some institutions remain dependent on central bank liquidity facilities. National central bank data (Figure 1.19) indicate that a number of euro area banks have increased their reliance on European Central Bank (ECB) funding over recent quarters, suggesting their demand is to meet genuine funding needs rather than simply to finance attractive carry trades. Some widening of both financial and sovereign CDS spreads is likely as the withdrawal of extraordinary ECB measures draws nearer. In the United States, borrowing at the Federal Reserve's discount window has fallen steadily but remains well above pre-crisis levels.[25]

Figure 1.19. Net European Central Bank Liquidity Provision and Credit Default Swap Spreads
(Changes 12/31/2006 to 10/31/2009)



Sources: Bloomberg L.P.; and euro area national central banks.
Note: Net liquidity provisions are expressed as a percent of bank total assets, while the diamonds reflect the change in sovereign credit default swap (CDS) spreads between December 31, 2006 and October 31, 2009.

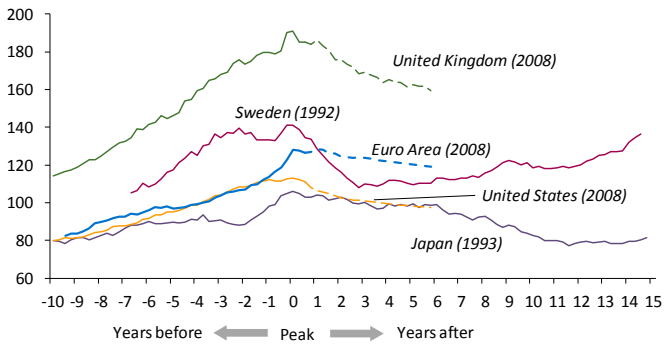
[24] In the euro area, the total spread on new business is at roughly half its level of a year ago.

[25] In February, the Federal Open Market Committee decided to increase the rate charged to banks borrowing at the discount window by 25 basis points to 0.75 percent.

What does this mean for financial policies?

The consequence of these deleveraging forces will be to highlight the extent of overcapacity in the financial system as costs rise, push up competition for stable funding sources, and intensify pressure on weak business models (Figure 1.20). Thus, policy will need to ensure that this next stage of the deleveraging process unfolds smoothly and ends in a safe, vital, and more competitive financial system. This will include addressing too-important-to-fail institutions in order to ensure fair pricing power throughout the financial system and to guard against rising concentration as the size of financial systems shrinks (see Annex 1.5).

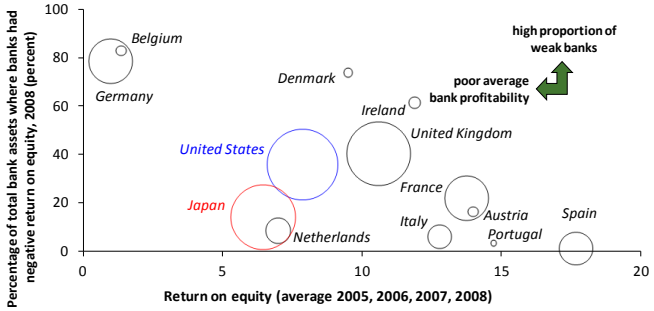
Figure 1.20. Bank Credit to the Private Sector
(In percent of nominal GDP)



Sources: Haver Analytics; and IMF staff estimates.
Note: Dashed lines are estimates. Year of credit peak in parentheses.

The viability of weaker segments of banking systems is likely to come into question given new regulations, deleveraging forces, and the withdrawal of extraordinary central bank support facilities. In a number of countries, a significant part of the banking system lacks a viable business model, or suffers from chronic unprofitability. In the case of the European Union, the need for rationalization of the sector can be seen in the striking variability of banking returns (Figure 1.21). The German system, for example, suffers from weak overall profitability, and a large tail of unprofitable banks—primarily the nation's Landesbanken. Moreover, care will be needed to ensure that too-important-to-fail institutions in all jurisdictions do not use the funding advantages their systemic importance gives them to consolidate their positions even further.

Figure 1.21. Bank Return on Equity and Percentage of Unprofitable Banks, 2008
(In percent)

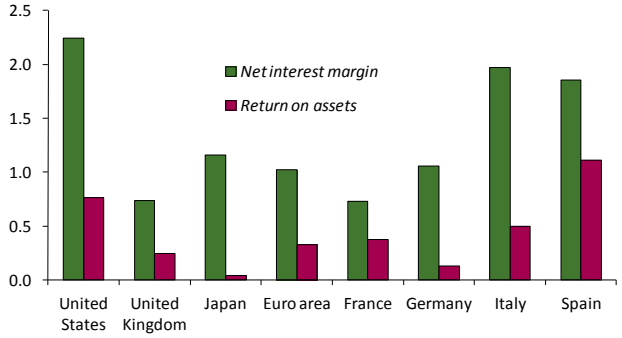


Sources: Bankscope; EU Banking Supervision Commission; Federal Deposit Insurance Corporation; and IMF staff estimates.
Note: Size of chricle corresponds to relative size of bank loan stock at end-2008. Return on equity is as defined by the Banking Supervision Committee (BSC) of the European System of Central Banks in each of its reports. Some countries were reporting under national accounting standards in the earlier BSC reports. For United States and Japan, return on equity is net income divided by total equity according to FDIC and Bankscope data respectively.

If excess banking capacity is maintained, the costs are felt across the whole economy and are not just limited to support costs faced by taxpayers. Weak banks normally compete aggressively for deposits (on the back of risk-insensitive and underpriced deposit insurance), wholesale funding, and scarce lending opportunities, so squeezing margins for the whole system. Unless tightly constrained, institutions that are either government-owned, or have explicit or implicit government backing, have also demonstrated in many cases a tendency to invest in risky assets of which they have little experience—some of the German Landesbanken being only the latest examples—so adding to systemic risks and the likelihood of future bailouts.

Japan presents a telling example of the challenges banks face in a crowded sector amid low growth and muted or negative inflation. The exceedingly low nominal rates leave banks increasingly pressed to maintain profitability. Over the past 20 years, the average return on bank assets has been negative, partly owing to the disposal of nonperforming loans after the bubble burst. Low returns on assets make it hard for banks to rely on loan revenues to absorb credit losses, and volatility in the values of equity holdings leads to large fluctuations in bank profits (Figure 1.22). Tangible equity at the largest banks is low, and is likely to be put under further pressure by the latest Basel proposals. Options for improving profitability—taking greater market risks, offshore expansion, higher lending margins, or balance sheet shrinkage—all have their difficulties, both economically and politically. Thus, improving profitability is a critical challenge for Japanese banks.

Figure 1.22. Banking System Profitability Indicators
(In percent, average 2001-08)



Sources: Bankscope; and IMF staff estimates.
Note: Different industry structures and accounting conventions make comparison across countries/regions difficult.

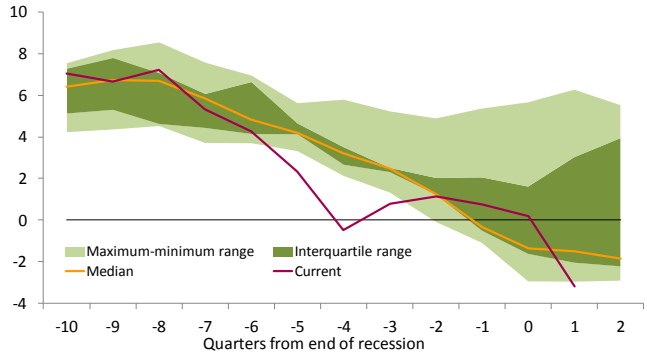
D. Risks to the Recovery in Credit

The credit recovery will be slow, shallow, and uneven. Credit supply remains constrained as banks continue to repair balance sheets. Notwithstanding the weak recovery in private credit demand, ballooning sovereign needs may bump up against supply. Policy measures to address capacity constraints, along with the management of fiscal risks, should help to relieve pressures on the supply and demand for credit.

Credit availability is likely to remain limited . . .

Two years ago, the GFSR described the possibility that credit growth might drop to near zero in the major economic areas affected by the crisis, as has now happened. For example, in the United States, real credit growth has fallen sharply when compared with past recessions (Figure 1.23).[26]

Figure 1.23. Real Nonfinancial Private Sector Credit Growth in the United States
(In percent, year-on-year)

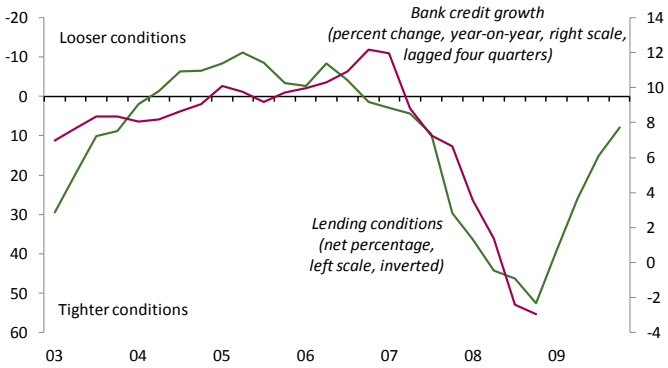


Sources: Haver Analytics; National Bureau of Economic Research; and IMF staff estimates.
Note: The chart compares recent real nonfinancial private sector credit growth to that in past recessions, from 1970 to 2001. Past recession dates are from the National Bureau of Economic Research. For this chart, the end of the recent recession is assumed to be 2009 Q3, the first quarter of positive growth.

[26] In Japan, total bank credit growth did not increase to the same extent as in the United States and Europe during the pre-crisis period, and, by the same token, has not experienced as significant a credit withdrawal. For this reason Japan is not included in our credit projections.

The last few rounds of bank lending surveys, however, have indicated that lending conditions are tightening at a slower pace, and in some sectors have already begun to register an outright easing. Figure 1.24 indicates that credit growth has lagged lending conditions by around four quarters, suggesting that the worst of the credit contraction may be over. Nevertheless, as discussed in Section C, it is likely that bank credit will continue to be weak as balance sheets remain under strain and funding pressures increase. Banks' reluctance to lend is evident in still-elevated borrowing costs and strict lending terms (for example, stringent covenants and short maturities) in some sectors.

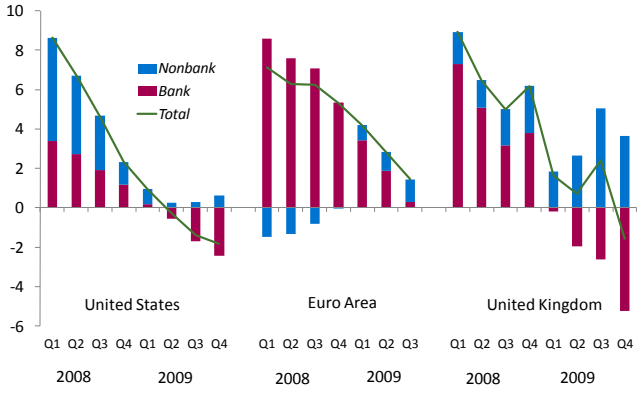
Figure 1.24. Average Lending Conditions and Growth in the Euro Area, United Kingdom, and United States



Sources: Haver Analytics; central bank lending surveys; and IMF staff estimates.

Companies have increasingly drawn on nonbank sources of credit in recent quarters as banks have tightened credit supply (Figure 1.25).[27] However, nonbank credit has only provided a partial substitute for bank lending and total credit growth has fallen. In general, in addition to households, small and medium-sized enterprises (SMEs) tend to be largely reliant on bank lending and so still face credit constraints. Furthermore, the supply of credit that has been available from central banks during the crisis is set to wane this year.[28] Central bank commitments imply under $400 billion of securities purchases in the euro area, United Kingdom, and United States, in total, compared with around $1.9 trillion in 2009. So even though we expect nonbank capacity to increase over the next two years, as economies start to recover, total credit supply, including bank lending, is set to recover slowly (Figure 1.26).

Figure 1.25. Contributions to Growth in Credit to the Nonfinancial Private Sector
(In percent, year-on-year)



Sources: Haver Analytics; and IMF staff estimates.

[27] The nonbank sector—primarily insurance companies, pension funds, mutual funds, and foreign central bank reserve managers—plays an important role in supplying credit to the economy, for example through purchases of corporate and government debt securities. There are two main channels through which this can occur. First, a portion of households' and companies' savings can provide credit, either directly through investments in debt securities or indirectly through investments made on their behalf by asset managers. The second channel occurs through foreign investment in debt issued in the economy.

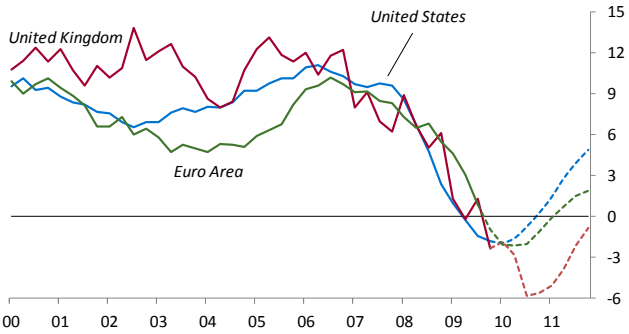
[28] Annex 1.8 discusses the impact of large-scale asset purchase programs on the cost of credit.

. . . and sovereign needs are set to dominate credit demand . . .

Sovereign issuance surged in 2009 to record levels in all three regions as crisis-related interventions and fiscal stimulus packages led to an unprecedented increase in government borrowing requirements (Figure 1.27). Government borrowing will remain elevated over the next two years, with projected financing needs for both the euro area and the United Kingdom well above previous expectations in the October 2009 GFSR. Burgeoning public sector demand risks crowding out private sector credit if funds are diverted to public sector securities. In addition, as discussed in Section B, a rise in sovereign risk premia could raise private sector borrowing costs.

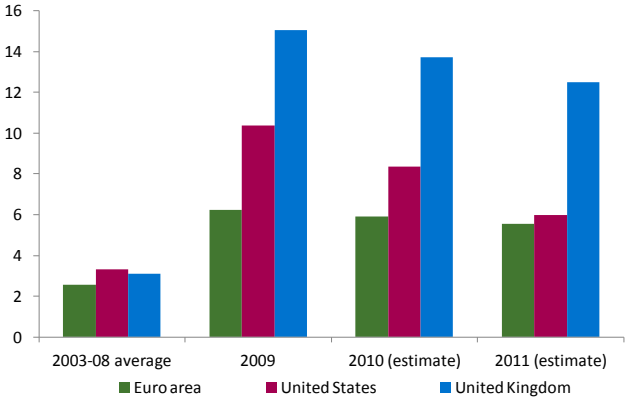
Notwithstanding these risks, private sector demand growth is likely to remain subdued as households and corporates restore balance sheets. The need for private sector deleveraging varies across region and sector (Figure 1.28). For instance, in the United States, households are at the beginning of the deleveraging process, while

Figure 1.26. Nonfinancial Private Sector Credit Growth
(In percent, year-on-year)



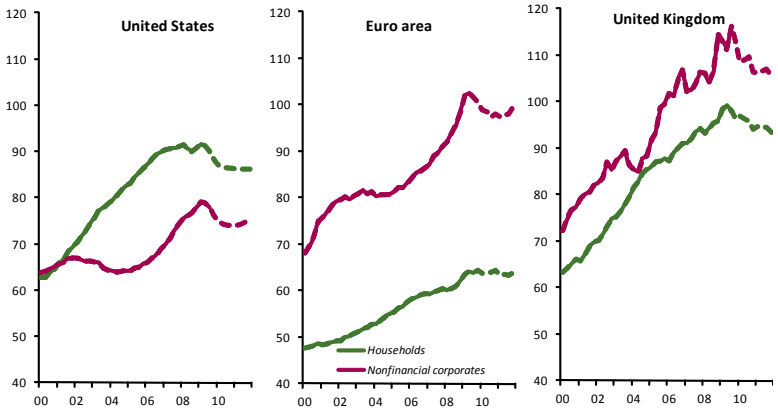
Sources: Haver Analytics; and IMF staff estimates.
Note: The dotted lines show projected credit growth. If credit demand is estimated to exceed capacity, after meeting sovereign borrowing needs, then credit is assumed to be constrained by available capacity, including the impact of government and central bank policies.

Figure 1.27. Total Net Borrowing Needs of the Sovereign Sector
(In percent of GDP)



Sources: National authorities; and IMF staff estimates.

Figure 1.28. Credit to GDP
(In percent)



Source: IMF staff estimates.
Note: The dashed lines represent forecasts.

nonfinancial companies have less of a need to reduce leverage. By contrast, in the euro area and the United Kingdom, nonfinancial corporate debt as a share of GDP is much higher, having experienced a rapid run-up during the pre-crisis period. This, together with the increase in household leverage, means that the United Kingdom's nonfinancial private sector debt, at over 200 percent of GDP, is one of the highest among mature economies.[29]

. . . which is likely to result in financing gaps.

Updating the analysis of credit demand and capacity in the October 2009 GFSR suggests that ex ante financing gaps will remain in place for all three regions in 2010 (Table 1.7).[30] There is some uncertainty around our estimates for both credit demand and capacity, so the size of the financing gap, which is the difference between these two estimates, is approximate. Nevertheless, the work is useful in highlighting the relative size of the ex ante financing gaps. As in the October 2009 GFSR, the analysis suggests that the United Kingdom could have the largest gap (around 9 percent of GDP over 2010–11) as weak bank capacity struggles to keep up with surging sovereign issuance. We expect smaller financing gaps in the euro area in 2010 (around 2 percent of GDP), and a similar gap in the United States in 2010, which is closed by remaining central bank commitments to purchase securities.[31]

At face value, ex ante financing gaps imply that ex post either borrowing needs to be scaled back to equalize the lower supply, or that market interest rates will need to rise. Any increases in interest rates, however, are unlikely to be uniform, and certain sectors, such as SMEs and less creditworthy borrowers, may face higher borrowing costs. In particular, given the surge in public sector borrowing and expected deleveraging by the banking sector, upward pressure on interest rates is likely to result.

Policy action could help to relieve these pressures. For example, the authorities should carefully assess the implications of their policy actions and exit strategies, as well as their timing, on the quantity of credit available to support the economic recovery. The implementation of measures to manage fiscal risks and limit rises in public sector credit demand, along with policies to address weaknesses in the banking system—such as strengthening securitization markets, as discussed in the October 2009 GFSR—should also be considered. There is the possibility that central bank support measures, including purchases of securities, may still be needed in some cases to offset the retrenchment in credit capacity.

---

[29] McKinsey Global Institute (2010) estimates. Only Spain's nonfinancial private sector leverage ratio is higher, at 221 percent of GDP, which compares with 193 percent in Switzerland, 174 percent in the United States, 163 percent in Japan, 154 percent in France, 138 percent in Canada, 128 percent in Germany, and 121 percent in Italy.

[30] The ex ante financing gap is the excess of projected financing needs of the public and private nonfinancial sectors relative to the estimated credit capacity of the banks and the nonbank financial sector. There can only be an ex ante gap, as ex post, a rise in interest rates and/or credit rationing will bring credit demand and supply into balance.

[31] Annex 1.7 explains the methodology used to estimate the financing gap and compares the latest projections for 2010 with those in the October 2009 GFSR.

Table 1.7. Projections of Credit Capacity for and Demand from the Nonfinancial Sector

	2010		2011	
	Amount	Growth	Amount	Growth
Euro Area				
Total credit capacity available for the nonfinancial sector	540	2.8	900	4.6
Total credit demand from the nonfinancial sector	690	3.5	1,040	5.1
Credit surplus (+)/shortfall (-) to the nonfinancial sector	-150		-140	
Memo: Central bank and government committed purchases[1]	30		-	
Credit surplus (+)/shortfall (-) in percentage of GDP	*-2*		*-1*	
United Kingdom				
Total credit capacity available for the nonfinancial sector	50	1.3	180	4.7
Total credit demand from the nonfinancial sector	200	5.1	300	7.4
Credit surplus (+)/shortfall (-) to the nonfinancial sector	-150		-120	
Memo: Central bank and government committed purchases[1]	10		-	
Credit surplus (+)/shortfall (-) in percentage of GDP	*-10*		*-8*	
United States				
Total credit capacity available for the nonfinancial sector	1,720	5.2	2,450	7.1
Total credit demand from the nonfinancial sector	2,000	5.8	2,500	6.8
Credit surplus (+)/shortfall (-) to the nonfinancial sector	-280		-50	
Memo: Central bank and government committed purchases[1]	360		-	
Credit surplus (+)/shortfall (-) in percentage of GDP	*-2*		*0*	

Source: IMF staff estimates.

Note: Amount is in billions of local currency units rounded to the nearest ten. Growth is in percent.

[1]This includes committed purchases of debt issued by both public and private sectors, which is considered to be extra credit capacity provided by central banks and governments for the whole nonfinancial sector.

E. Assessing Capital Flows and Bubble Risks in the Post-Crisis Environment[32]

Prospects for strong growth, appreciating currencies, and rising asset prices are pulling capital flows into Asia-Pacific (excluding Japan) and Latin American countries, while push factors—particularly low interest rates in major advanced economies—are also key. Against this backdrop, this section assesses the drivers of recent portfolio capital flows, and both the near- and medium-term prospects of systemic asset price bubbles forming. It finds no evidence of systematic bubbles in advanced and emerging market economies and across asset classes in the near term. However, if the current environment of low interest rates, abundant liquidity, and capital flows persists, history suggests that bubbles could form in the medium term. Moreover, vigilance is warranted given that it is notoriously difficult to identify such financial imbalances ex ante.[33]

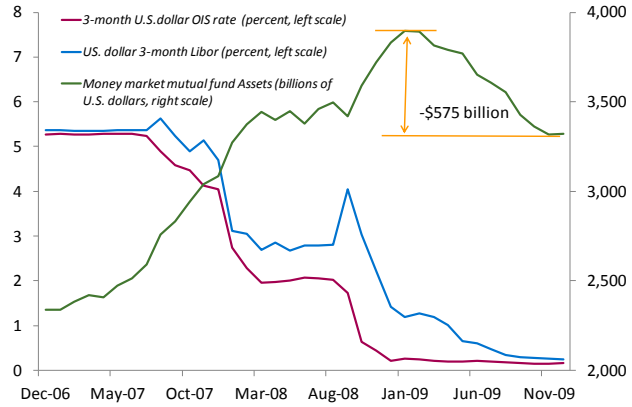
[32] Chapter 4 provides an overview of the global liquidity expansion, its effects on receiving countries, and options available to policymakers in response to surges in capital inflows. The chapter also discusses the effectiveness of different types of capital controls.

[33] Borio and Lowe (2002) discuss these challenges, and offer a preliminary empirical investigation of the factors that can increase the vulnerability of the financial system, using a small set of useful indicators of asset prices, credit, and investment.

Last year saw a welcome recovery in portfolio capital flows toward emerging markets and other advanced economies. "Pull factors" such as relative growth differentials, appreciating currencies, and rising asset prices are driving the resurgence. The flows have been targeted to countries perceived by investors to have better cyclical and structural growth prospects, like Brazil, China, India, and Indonesia, as well as their trading and financial partners, including commodity exporters.

However, "push factors," such as low interest rates in major advanced economies and much-improved funding market conditions, are also key drivers of capital flows.[34] Low policy rates have encouraged investors to shift their precautionary cash holdings into riskier assets. For example, U.S. money market mutual fund assets have fallen by over half a trillion dollars since March 2009, as central bank policy and operations helped to put downward pressure on broader money market interest rates and risk premiums (Figure 1.29).

Figure 1.29. Low Short-Term Interest Rates are Driving Investors Out of Cash



Sources: Bloomberg L.P.; and Investment Company Institute.
Note: OIS = overnight indexed swap.

When taken together, these push and pull factors may create a conducive environment for future asset price appreciation, and this, in turn, has heightened concerns about asset price bubbles forming. The surge in portfolio inflows also raises concerns about vulnerabilities to sudden stops, once global monetary and liquidity conditions are tightened or if risk appetite were to diminish.

Although portfolio flows were strong in 2009, other capital flows, which include cross-border bank lending, and direct investments have not recovered to the same extent. This reflects the persistent deleveraging by mature market banks and the still tepid desire by firms for cross-border mergers and acquisitions and green field development. For example, the nonportfolio, non-FDI (foreign direct investment) category of the capital accounts of Brazil, Korea, and Russia remained negative in the data available for 2009, and FDI remains subdued in Korea and Russia.[35]

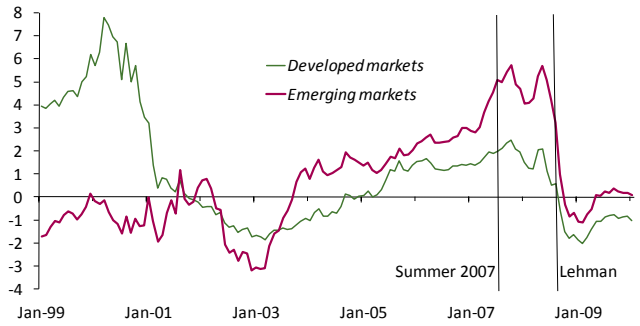
[34] This reflects the extraordinarily low monetary policy rates of the G-4 central banks (Bank of England, Bank of Japan, ECB, and Federal Reserve) and their generous liquidity providing operations, which has led to low interest rates, money market risk premiums, and excess liquidity. Chapter 4 finds strong links between global liquidity expansion and asset prices in capital flow recipient countries.

[35] Bank lending is recovering more slowly than portfolio flows. There was a 24 percent decline in the gross issuance of emerging markets' and other advanced economies' syndicated loans in 2009, and a still-negative net change in combined exposures of BIS reporting banks to countries in Europe, the Middle East, and Africa. In contrast, BIS exposures to Latin America and Asia increased in the third quarter of 2009 (the latest available data), after falling sharply during the height of the crisis.

Further flows could emerge as the crisis has led investors to reconsider the balance of risk and return in emerging and other advanced economies.

The crisis has altered perceptions about risk and return in mature relative to emerging markets. Perceptions of sovereign credit risks have moved in favor of emerging markets and some other advanced economies, primarily due to unfavorable debt dynamics in the major advanced economies and southern Europe (see Section B). In contrast, the average credit rating of issuers in JPMorgan's Emerging Market Bond Index improved to the lowest investment grade rating during the crisis, reflecting upgrades to some emerging market sovereigns, notably Brazil. Additionally, emerging market equities continued to register higher volatility-adjusted returns than developed markets during and after the fall of 2008 (Figure 1.30).

Figure 1.30. Emerging Market Returns Better on a Volatility-Adjusted Basis
(In percent)



Sources: Bloomberg L.P.; MSCI Barra; and IMF staff estimates.
Note: Volatility-adjusted returns = three-year rolling log returns / three-year historical standard deviation of returns.

The favorable performance of emerging market assets relative to mature market assets has prompted growing interest by global investors in raising their asset allocations to emerging markets and other advanced economies. For example, retail investors and hedge funds are adding to their emerging market portfolios in the near term, facilitated by the increasing development of exchange-traded funds (ETFs) targeting emerging markets broadly and countries like Brazil and China.[36] In debt markets, the outstanding stock of emerging market debt has grown to over $7 trillion, compared to under $2 trillion in the mid- to late 1990s, and benchmark bond indices are garnering greater acceptance by institutional investors.[37]

However, recent surveys indicate that institutional investors' home bias has only changed in a gradual fashion over the years.[38] Some estimate that emerging market equities account for just 5 to 9 percent of global equity exposures, far lower than their share of global market capitalization of 12 percent, and the 27 percent share implied by a GDP-weighted global equity index.[39] Nevertheless, even small shifts in portfolio allocations could translate into significant capital inflows to emerging markets and other advanced economies. They also could add to market volatility and test an

[36] In 2009, global ETF assets with dedicated exposure to emerging market equities increased 130 percent, compared to 24 and 52 percent, respectively, for North American and European equities, according to Blackrock, one of the leading provider of ETFs.

[37] See Peiris (2010) and CGFS (2007). Also, JPMorgan estimates that total assets under management benchmarked to its family of emerging market debt indices increased 19 percent in 2009 to about $280 billion.

[38] Studies by MSCI Barra indicate that home bias has only gradually been reduced over the last decade. Most institutional investors tend to partition domestic from international equity allocations, with few using a more global approach to asset allocation.

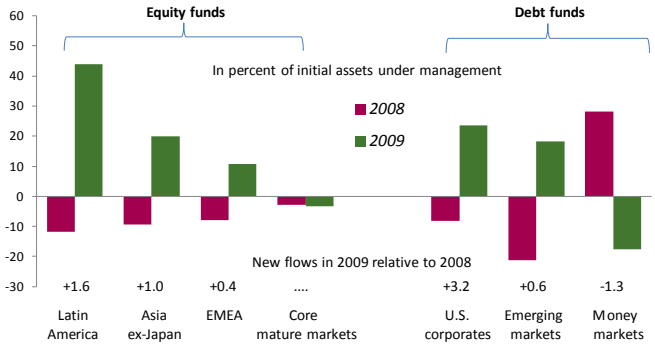
[39] According to MSCI's all-country world investable and GDP-weighted indices.

individual market's capacity to absorb inflows, especially if flows are concentrated in particular asset classes or in a short period of time.

Portfolio flows have rebounded strongly. . .

Strong portfolio equity flows into emerging markets and other advanced economies in 2009 primarily reflect a recovery trade from the deep retrenchment in 2008 as shown by the green bars in Figure 1.31. However, Latin America was the only region where 2009 inflows exceeded 2008 outflows by a wide margin as shown by the higher ratio of net flows. In general, regions viewed as having lower growth prospects and structural challenges are receiving smaller inflows. For example, equity funds with exposure to Europe, the Middle East, and Africa recovered less than one-half of the outflows in 2008, and funds continued to flow out of major advanced economy equity funds. Within these broad regions, however, some countries have experienced a rapid surge in portfolio inflows; for example, Brazil was responsible for a large portion of flows to Latin America.

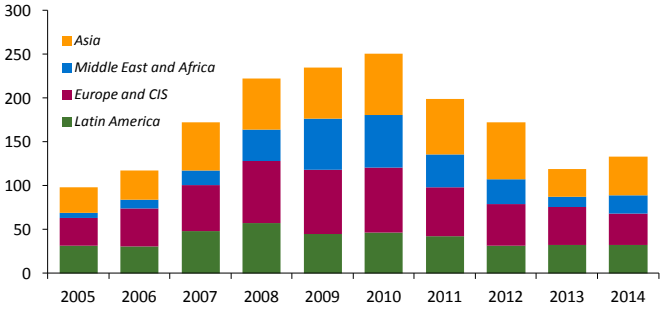
Figure 1.31. Cumulative Retail Net Flows to Equity and Debt Funds



Sources: Emerging Portfolio Fund Research, Inc.; Investment Company Institute; and IMF staff estimates.
Note: Numbers underneath bars represent ratio of net flows in 2009 to those in 2008. "+"("-") when net inflows turned positive (negative) in 2009 from negative (positive) in 2008. EMEA represents Europe, Middle East, and Africa. Core mature markets include Japan, United States, and Western Europe. U.S. corporate represents inflows into U.S. mutual funds investment primarily in corporate debt.

Investor flows into global corporate and emerging market external bonds and notes have also been strong in 2009, reflecting the reopening of global credit markets and an expected compression in credit spreads after extreme default scenarios were priced in at the height of the crisis.[40] Inflows into U.S. investment-grade and high-yield funds in 2009 were multiples above their 2008 outflows, but those to emerging market debt funds had not yet fully recovered. Even though emerging market external debt issuance reached a record of over $200 billion, part of this issuance was required to meet the large refinancing needs that were highlighted in the October 2009 GFSR. Indeed, emerging market corporates and banks still face refinancing needs of about $450 billion for foreign-currency-denominated debt over the next two years, with a concentration of maturities this year (Figure 1.32).

Figure 1.32. Refinancing Needs for Emerging Market and Other Advanced Economies Remain Significant
(In billions of U.S. dollars)



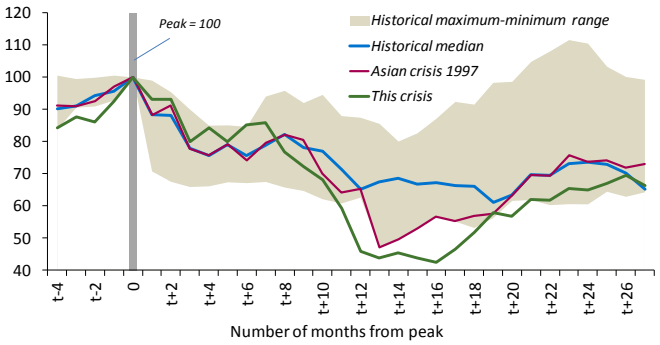
Sources: Bloomberg L.P., and IMF staff estimates.
Notes: Repayment of principal and coupon on bonds and principal only on foreign currency loans. Asia = China, India, Indonesia, Malaysia, Korea; Latin America= Argentina, Brazil, Chile, Mexico; Europe and CIS = Hungary, Kazakhstan, Poland, Russia, Turkey, Ukraine; Middle East and Africa = South Africa, United Arab Emirates. CIS = Commonwealth of Independent States.

[40] At the height of the crisis, for example, investment-grade corporate bonds were trading at credit spreads that only previously had been priced into high-yield bonds, and overall credit spreads were affected by the stress in market functioning, which elevated trading liquidity risk premiums.

. . . but have portfolio flows caused asset prices to reach excessive valuations?

Compared with prior crisis episodes, asset prices have moved along a broadly similar recovery path (Figure 1.33). For example, the price of emerging market equities in real terms has recovered to the median level of historical correction episodes. Also, the depth of the trough and the pace of recovery during the Asian crisis were similar to those during the current crisis.

Figure 1.33. Emerging Market Real Equity Prices : Historical Corrections
(Pre-correction peak = 100)



Sources: Bloomberg L.P.; and IMF staff estimates.
Note: Median, max, and min based on five correction episodes following peaks in July 1990, August 1994, July 1997 (Asian crisis), February 2000, and March 2002, but excluding this crisis that started in October 2007, and are based on the MSCI Emerging Markets Index.

A few asset classes have attracted particular attention—equity and property prices, local sovereign yield, and external sovereign credit spreads—but we find little evidence that bubbles have formed in these segments in the near term (Table 1.8).[41] The table is not meant to be a definitive predictor of a bubble in an individual market or across markets, but rather to be a useful tool to compare valuations across time and countries in order to make a preliminary identification of potential hot spots that bear deeper investigation.[42] For advanced economies, equity valuations are within historical norms.[43] Forward-looking valuations are generally below the peaks prior to the collapse of Lehman Brothers as well as the bursting of the U.S. tech bubble in 2000. There are also few signs of overvaluation in local sovereign debt markets (with the exception of Japan), including in mature economies, where official bond purchase programs have been pursued after controlling for monetary and financial conditions.[44]

[41] We assess equity valuations based on forward- and backward-looking price multiples as well as a dividend discount model, which relies on longer-term expectations of earnings and real yields. Several valuation ratios were used to assess property price valuation, while different econometric approaches were employed to gauge valuation of fixed-income assets. Mature market valuations are also assessed, as emerging market assets often trade in close relation.

[42] We acknowledge that historical and cross-country comparisons may ineffectively capture the current state of a particular market given structural changes in markets over time and differences in market structures between countries. Moreover, Table 1.8 does not include all the factors that may contribute to the formation of financial imbalances, such as measure of credit, financial system liquidity, or investment.

[43] Forward-looking price-to-earnings ratios of Ireland appear elevated due largely to sharp downward revisions in earnings projections.

[44] To assess the value of local sovereign debt in selected mature and emerging economies, local government yields have been modeled using a set of standard domestic factors representing monetary policy stance, fiscal conditions, and economic activity, as well as external factors. It does not use domestic savings or the microstructure of specific bond markets as explanatory variables, which may be particularly relevant for some countries like Japan. See Tokuoka (2010).

Table 1.8. Asset Class Valuations

(Z score)

	Equity			Residential Real Estate		Local Sovereign Yield	Local Corporate Credit	External Sovereign Credit
	Backward-looking	Forward-looking						
		Shorter horizon	Longer horizon	Price to rent	Price to income			
Asia								
Australia	-0.3	0.0	-2.1	1.9	1.5	-0.1	...	...
China	0.6	-0.1	...	1.9	-1.4	...	...	...
Hong Kong SAR	0.3	0.6	...	2.1	2.0	...	...	...
India	0.8	0.7	...	0.2	0.4	-1.0	...	...
Indonesia	1.1	0.2	...	-1.3	-1.3	-0.6	...	-0.5
Japan	-1.8	-1.1	-2.6	-1.9	-2.0	1.6	...	...
Korea	0.6	-0.6	...	0.6	-0.8	-0.6	...	...
Malaysia	0.0	-0.4	...	-1.8	-0.9	0.5	...	0.2
Philippines	-0.2	0.0	...	-0.9	-1.3	0.8	...	0.2
Thailand	-0.1	...	...	-2.7	-2.3	-0.5	...	...
Taiwan Province of China	-0.2	-0.8	...	0.3	-1.0	...	...	...
Europe, Middle East and Africa								
Austria	-1.0	-0.7	-0.1	-1.2	-0.3	...	0.4	...
Belgium	0.4	0.3	-0.3	1.0	1.4	...	0.4	...
Czech Republic	-0.4	-0.8	...	0.6	1.6	-0.2	...	...
Denmark	0.4	0.2	...	1.5	1.0	...	...	...
France	-1.8	-0.7	-1.1	2.2	1.7	0.0	0.4	...
Germany	-0.7	-1.0	-1.3	-1.7	-1.6	0.1	0.4	...
Greece	-0.4	-1.4	...	-1.9	-0.7	0.9	0.4	...
Hungary	-0.2	0.0	...	...	-1.1	0.6	...	-1.3
Ireland	-0.9	2.1	0.9	1.1	0.8	-0.7	0.4	...
Israel	0.0	-0.6	...	-0.6	1.0	...	...	...
Italy	-1.0	-1.0	-0.6	1.0	0.6	-0.7	0.4	...
Netherlands	0.0	-0.4	-1.0	1.5	1.4	...	0.4	...
Norway	-0.4	-0.5	...	1.9	1.3	...	...	...
Poland	-0.8	0.1	...	-0.4	-1.0	-0.7	...	-0.2
Portugal	-1.3	-0.4	...	...	...	-0.5	0.4	...
Russia	-0.2	-0.4	...	-1.1	-0.3	-2.9	...	0.5
South Africa	0.1	0.2	...	-0.1	0.2	-1.1	...	0.7
Spain	-0.9	-0.9	0.2	1.5	1.4	0.7	0.4	...
Sweden	-0.1	0.0	0.2	2.6	0.8	...	...	...
Switzerland	-0.8	-0.6	0.9	...	...	...	...	...
Turkey	-0.1	0.3	...	...	...	1.4	...	0.3
United Kingdom	-0.4	-0.8	-0.9	1.1	1.4	-0.2	...	...
Americas						...		
Argentina	0.1	...	...	-1.5	-0.4	-0.3	...	...
Brazil	0.8	1.8	...	...	...	0.1	...	0.1
Canada	-0.5	-0.2	0.4	1.9	1.3	-0.2	...	...
Chile	1.3	0.7	...	...	...	-1.7	...	0.4
Colombia	1.2	1.9	...	-2.0	1.5	-0.7	...	0.0
Mexico	0.4	1.2	...	...	...	...	...	0.3
Peru	0.7	0.2	...	...	...	-2.4	...	0.7
United States	-0.6	-0.6	-0.1	1.3	-0.4	0.5	1.8	...

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

Note: A z score represents the deviation of latest observation from either the period average or model value expressed in the number of standard deviations. Green signifies less than 1.5 standard deviations above, orange 1.5-2 standard deviations above, and red greater than 2 standard deviations above. Backward-looking equity valuation is calculated as the unweighted average of z scores of dividend yield and price to book. Forward-looking equity valuation represents z score of 12-month forward price to earnings (shorter horizon) and z score of dividend discount model estimates (longer horizon). Valuation of local sovereign yields, local corporate spreads, and external sovereign spreads are based on z score of the deviation from econometric model value. For methodologies see Annex 1.9.

In credit markets, the narrowing of spreads appears to be consistent with macroeconomic fundamentals and reduced risk aversion in Europe, though the extent of credit spread compression is somewhat greater than model predictions in the United States. Emerging market sovereign external credit spreads appear broadly consistent with fundamentals. In the foreign exchange markets, the recent pick-up in cross-border financial flows to emerging economies has not led to substantial

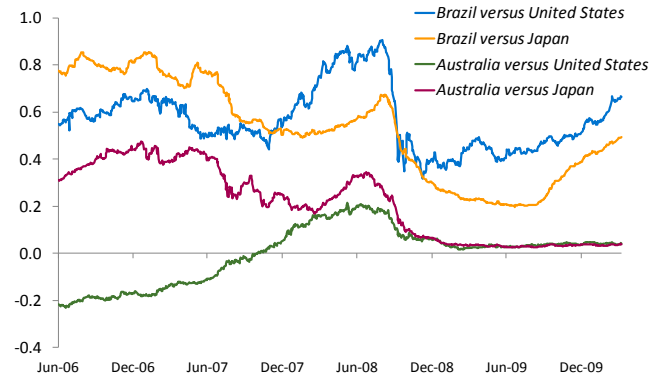
changes in real effective exchange rates, as countries have generally preferred to build up reserves in response to inflows.[45]

There are some valuation hotspots in a few countries that have attracted significant portfolio investment. For example, in two Latin American countries, 12-month forward price-to-earnings ratios exceed historical averages by 1.5 standard deviations or more. There are also signs that property prices may be stretched in some Asia-Pacific countries with price-to-rent and/or price-to-income ratios 1.5 or more standard deviations beyond historical averages.[46] Box 1.3 takes a closer look at the Asia-Pacific real estate markets, where housing prices and transaction volumes have surged to very high levels. However, these are primarily occurring in the high-end market.

Rising asset prices and portfolio flows have coincided with some pick-up in leverage.

The financial flows in 2009, especially to emerging markets and other advanced economies, have primarily been attributed to portfolio reallocation by unlevered institutional and retail investors. Leveraged investors, such as hedge funds, remain smaller and less leveraged than before the financial crisis, but they have recouped a significant amount of their crisis-related losses in 2009. With $2.1 trillion under management at the end of 2009, the hedge fund universe has returned to three-quarters of its pre-crisis peak.

Figure 1.34. The Incentives for Foreign Currency Carry Trades are Recovering



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

Additionally, the available evidence suggests that the incentives for "carry trade" have increased steadily over the past year, but they are yet to reach the high levels of 2006 and 2008. For Australia, carry trade indicators have not changed significantly since late 2008 (Figure 1.34).[47] Furthermore, mature market banks' willingness to lend is only gradually improving, and the growth of domestic bank credit in most emerging market and other advanced economies is only beginning to turn around. The exception is in China, where credit growth soared through mid-2009 and remains at a fast pace, although decelerating (Figure 1.35).

[45] See the April 2010 WEO for a more detailed discussion of exchange rates.

[46] A cautionary note, these real estate ratios can also be driven by larger relative movements in the denominator not just the numerator, and high ratios may also still reflect the high valuation built up between 2003 and 2007 that is still in the process of correction. So, it is key to analyze real estate markets at a country-specific level. In the context of Table 1.8, the indicators allow us to make comparisons across countries and guide us to where further analysis may be required.

[47] The carry trade indicator used is the difference between one-year swap rates between the investment and funding currencies, divided by the one-year volatility implied in exchange rate options. This attempts to capture both expectations of short-term rates in a forward horizon and changes in pricing of risk and risk appetite in the currency market.

Box 1.3. Asian Residential Real Estate Markets: Bubble Trouble?[1]

Asian real estate markets rebounded quickly in the second half of 2009 from their 2008 downturn, distinguishing this region from the other parts of the world (first figure). While much of the world continued to grapple with the housing bust, housing prices and transaction volumes recovered in certain eastern Asian economies (notably China, Hong Kong SAR, Korea, and Singapore) and closely linked advanced economies (Australia and New Zealand).[2] In particular, prices for high-end properties in major metropolitan areas exceeded their 2008 peaks, gradually spilling over to the broader market. This development echoes the rally in other risky assets such as regional equities and bonds.

The rebound has been mainly driven by unprecedented policy measures to mitigate the impact of the global financial crisis and the ensuing return of risk appetite. First, mortgage rates are at historical lows as central banks around the globe have cut policy rates. Second, reviving real estate loan growth helped pull the markets out of the trough (second figure), especially in China. Third, governments in China and Korea introduced housing-related tax initiatives in late 2008 to revive domestic real estate markets. Finally, capital inflows have played an important role. In Singapore, foreigners and companies accounted for 12.5 percent of the third-quarter home purchases in 2009, rising from 8 percent in the previous quarter. In Hong Kong SAR, an influx of buyers from mainland China pushed prices up, especially for luxury apartments.

Metrics of affordability are mixed, but on balance suggest that valuations risk becoming stretched (third and fourth figures). Although the average price-to-income index for the east Asian economies has risen only modestly, the price-to-rent index is elevated. As typically happens in housing bubbles, many purchasers may have been buying in the expectation of price appreciation, rather than simply for dwelling purposes.

The booming Asian real estate markets may pose risks to financial stability as banks are increasingly vulnerable to a price correction (fifth figure).[3] In addition, because the majority of mortgage loans in Asian economies carry floating rates, the widely anticipated rate hikes in the region will increase the burden on household balance sheets.[4] Moreover, as many municipal budgets in China tend to rely heavily on revenue from land sales, a real estate market downturn may put their fiscal situation into question.[5]

In light of these potential risks, authorities in the region have taken measures to cool real estate markets, including tighter requirements on mortgage lending, increasing land supply, and re-imposition of higher transaction taxes. The average loan-to-value ratio of new mortgage loans in Hong Kong SAR has dropped significantly from its peak in June, and banks in mainland China have

[1]Prepared by Deniz Igan and Hui Jin. Heejin Kim provided data support.

[2] India does not appear to exhibit the same dynamics; housing market conditions remain soft in most regions.

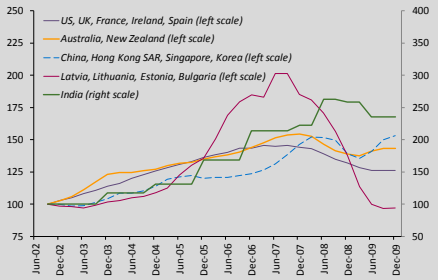
[3] It should be noted that these economies are only modestly levered with an average 45 percent mortgage-to-GDP ratio, compared to the 77 percent average of the advanced economies in the first figure. In addition, bank exposures to the property sector generally remain within regulatory limits. However, the increasing exposure to real estate is a worrisome trend.

[4] This applies more to China and Korea given the heterogeneity of monetary policy mandates in different Asian economies.

[5]Revenue from land sales in 2009 was estimated to be about one- third of total revenue in major cities in China.

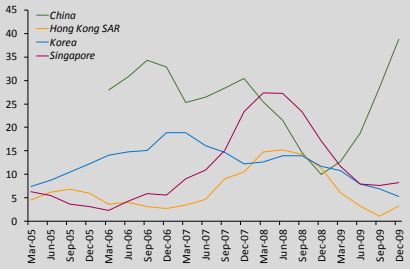
Box 1.3 *(concluded)*

Real House Prices



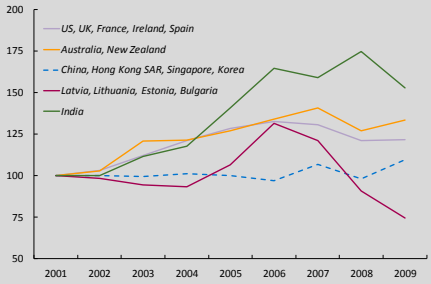
Sources: OECD; Global Property Guide; and national authorities.
Note: The indices started in June 2002.

Real Estate Loan Growth
(In percent, year-on-year)



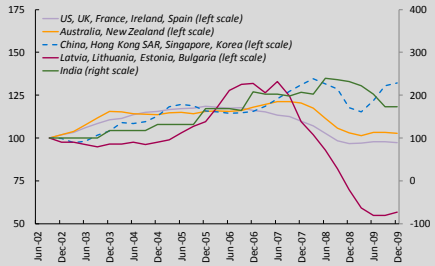
Sources: CEIC; national authorities; and IMF staff estimates.

Price-to-Income Ratio Indices



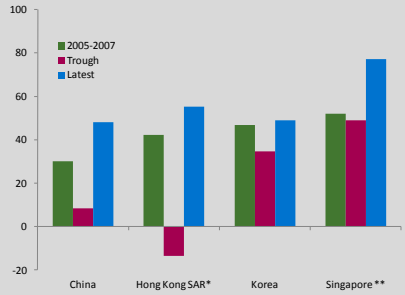
Sources: OECD; and national authorities.
Note: The indices started in 2001.

Price-to-Rent Ratio Indices



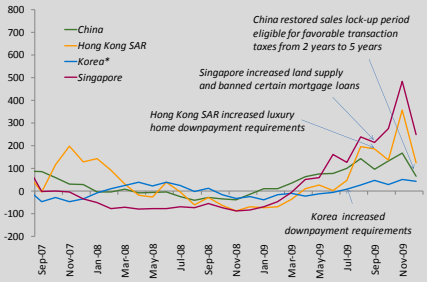
Sources: OECD; and national authorities.
Note: The indices started in September 2007.

Real Estate Loans as a Portion of Net New Bank Lending
(In percent)



Sources: CEIC; national authorities; and IMF staff estimates.
Note: Real estate loans include construction loans and mortgages. Trough was in 2008 for Korea and Singapore and in 2009Q1 for China and Hong Kong SAR. Latest was in 2009Q3 for Korea and 2009Q4 for other economies.
* Net new bank lending in Hong Kong SAR was negative in 2009, real estate loans in the year are presented as a share of quarterly average of 2008 net new bank lending.
** Net new bank lending in Singapore was negative in the first quarter of 2009, data for this quarter represent real estate loans as a share of quarterly average of 2009 net new bank lending.

Transaction Value Growth in Response to Measures to Cool the Real Estate Market
(In percent, year-on-year)



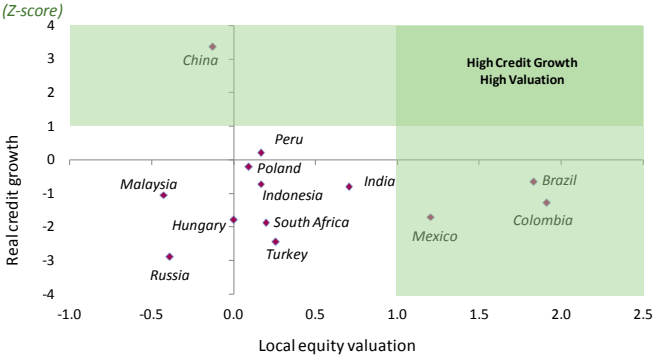
Sources: CEIC; national authorities; and IMF staff estimates.
Note: Measures shown in the figure are the first major cooling policies announced by these Asian economies.
*Korean data represent units of transactions.

started to tighten their mortgage criteria. Furthermore, growth rates of transaction values in these booming markets all slowed down sharply in December (sixth figure). However, the declines may have been contaminated by seasonality close to the year-end, and transactions had accelerated earlier as buyers rushed to take advantage of the stimulus measures before their expiration. Therefore, the full-fledged effects of the cooling measures are still to be seen in the coming quarters. The authorities may also need to fine-tune their policies in response to new market developments to maintain a delicate balance between leaning against housing bubbles and ensuring a solid economic recovery.

What could put asset prices on a bubble trajectory?

Although there is only limited evidence of stretched valuations across countries in the near term, current conditions could give rise to potential for bubbles to form in the medium term. Typically, for bubbles to have a systemic impact requires substantial overvaluation in several risk assets for a protracted period that is supported by excessive leverage, often in the form of concentrated bank lending (see Box 1.4). Indeed, the abundant liquidity that remains within advanced country banking systems, if unlocked, has the potential to boost the prices of risk assets, unless carefully monitored and controlled.

Figure 1.35. Real Domestic Credit Growth and Equity Valuation
(Z-score)



Sources: IMF, *International Financial Statistics* database; and IMF staff estimates.
Note: Credit growth is 12-month moving average of year-on-year growth of real credit to the private sector (or other sectors). Deflated by CPI index. Historical data go back up to early -1980s. Equity valuation is 12-month price/earnings ratios in February. Historical data go back up to late-1980s.

Expansionary financial conditions could fuel asset price inflation, potentially setting off an upward cycle of asset prices and credit through a financial accelerator mechanism.[48] The challenge of managing the consequences of capital flows is particularly acute for countries with limited exchange rate flexibility. Such regimes may exacerbate the impact of capital flows on local liquidity conditions, while attracting inflows on expectations of future currency appreciation.[49]

Policymakers have responded to the rising capital flows, but continued vigilance is needed as current conditions remain supportive of further inflows. Governments have started to lean against increasing asset price pressures by beginning to remove some of the support to the financial system with the aim of reining in high credit growth. Thus, close monitoring and a variety of macroprudential actions are warranted to help ensure that leverage and concentration do not reach excessive levels. Chapter 4 discusses the policy options and previous experience in addressing capital inflows. It notes that there have been varying degrees of success with different types of measures and controls to mitigate their impact on asset prices and inflation.

[48] Higher global liquidity tends to boost equity inflows to emerging markets and domestic asset valuation, particularly when the receiving country's exchange rate regime is not flexible. See Chapter 4.

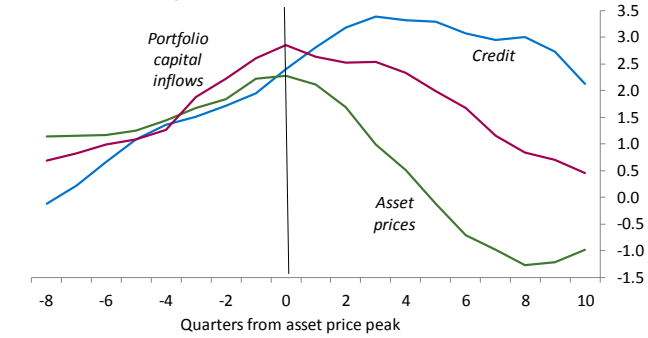
[49] N'Diaye (2009) examines the impact of U.S. monetary policy and operation on Hong Kong SAR.

Box. 1.4. Could Conditions in Emerging Markets Be Building a Bubble?[1]

There is a growing body of literature that suggests banking crises often result from the build-up of financial imbalances.[2] These imbalances develop over a number of years through a simultaneous boom in asset prices and credit. Rapid credit growth *alone* or the development of an asset price bubble *by itself* may not create vulnerabilities. It is the *coexistence* of credit and asset price booms that increase the likelihood of future financial stress. This is because at some point, if the boom turns to bust, the economy will be left saddled with large debts backed by assets with falling value. As the recent crisis has shown, a vicious circle of falling asset prices and reductions in leverage can form, potentially leading to widespread instability in the financial system. Such a financial crisis is likely to be associated with a deep and protracted slowdown in economic activity, particularly if there is distress in the banking sector.[3]

One common way of assessing the development of imbalances is to create a set of indicators that measure the deviation of key variables from their trend. This method is used to capture the cumulative process whereby imbalances build up steadily over time. The first figure shows that in the years before past episodes of financial stress, a strong increase in credit relative to its trend was associated with a rise in asset prices and growth in portfolio capital inflows. Interestingly, credit appears to stay at a high level even after asset prices have started to fall sharply. This may be because only a small proportion of loans will mature or default at any point in time, so the level of credit will decline relatively slowly. It could also reflect companies drawing down previously agreed precautionary credit lines, as happened during the 2007–09 global financial crisis.

Asset Prices, Credit and Capital Flows in Past Crises
(In standard deviations from mean)



Sources: Haver Analytics; national authorities; and IMF staff estimates.
Note: The chart shows the average deviation in real asset prices, real private credit and real cumulative capital flows for developed countries in the early 1990s and around the 2007-9 Global Credit Crisis, as well as for south-east Asian countries (excluding Japan) around the 1997 crisis. The data shown are a four quarter moving average of a z-score calculated over the period 1991-2005.

More recently, there is some evidence to suggest that asset price pressures may be building in some emerging markets. The second figure shows the deviation in trend for credit, portfolio capital inflows, and asset prices in Brazil, Russia, India, and China. This shows that, following the latest

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[1]This box was prepared by William Kerry.

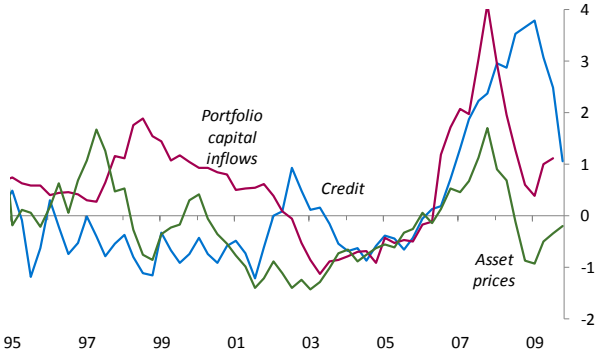
[2]See Borio and Lowe (2002); Borio and Drehmann (2008); Alessi and Detken (2009); and Gerdesmeier, Reimers, and Roffia (2009).

[3]Chapter 4 of the October 2008 WEO discusses this in more detail.

Box 1.4 *(concluded)*

boom and bust where all three series rose and fell sharply, there has been a resumption of a build-up in capital flows, particularly in China and India. In addition, credit did not fall back as sharply as the other two indicators in 2008 and remains high relative to trend, albeit lower than the peak in 2008. If credit remains at this level and if portfolio flows continue to build, this could create conditions in which asset prices could boom and, over time, potentially lead to the development of financial system vulnerabilities.

Asset Prices, Capital Flows, and Credit in Brazil, Russia, India, and China
(In standard deviations from mean)



Sources: Haver Analytics; national authorities; and IMF staff estimates.
Note: The chart shows the deviation in the series from their estimated trend The series are the average for Brazil, Russia, India and China, where figures are available. All data are in real terms. The figures are shown as a z-score calculated over the period 1991-2005.

F. Policy Implications

The health of the global financial system has improved, and the world has avoided a full-blown depression. However, risks remain elevated due to the still-fragile nature of the recovery and the ongoing repair of balance sheets. Attention has shifted toward sovereign risks that could undermine stability gains and take the credit crisis into a new phase, as we begin to reach the limits of public sector support for the financial system and the real economy. Bank funding pressures are emerging as the key risk from the ongoing deleveraging process, and may replace capital as the dominant constraint to the normalization of credit. To maintain the momentum in the reduction of systemic risks, and to prepare for exits from extraordinary policy support, further action is required of policymakers in several key areas.

Careful management of sovereign risks is essential for financial stability in the period ahead.

Sovereign risks have been transformed in a number of important ways. As the public sector stepped in to support financial institutions, distinctions between sovereign and private liabilities have been blurred and public exposure to private risks has increased. Channels of transmission among weaker mature sovereign credits have been revealed. Regional and global financial stability could be threatened if sovereign shocks are transmitted to banking systems and across borders. Thus, deteriorating fiscal fundamentals need to be credibly addressed.

In most cases, the success of ambitious fiscal adjustment that is required to reduce government debt to sustainable levels will depend on securing broad political support. Plans for medium-term fiscal consolidation should be developed and made public, including contingency measures if the deterioration in public finances is greater than predicted. Where necessary, these should be combined with a strengthening of fiscal institutions and improvement in public debt management frameworks. Other structural reforms to improve external competitiveness and growth prospects may also be necessary. Major economies, in particular, should be vigilant in maintaining medium-term fiscal discipline to avoid the risks of ratings downgrades and higher interest rates, which could spill over to other countries as well as increase funding costs for domestic banks and corporates.

Even as these reforms are implemented, risks will remain high in the short term and countries will remain susceptible to macroeconomic shocks and shifts in market sentiment. Immediate steps should therefore be taken to reduce the potential for the telescoping of longer-term sovereign credit risks into short-term financing concerns. This can be avoided through improved debt management practices, such as lengthening the maturity of public debt, to reduce near-term pressures. This will provide additional time for medium-term structural reforms to take effect.

In addition, authorities should endeavor to mitigate the transmission of sovereign risk through financial markets, for example by reducing the distortions from ratings triggers in statutory guidelines, and by strengthening collateral policies for OTC derivative exposures. However, steps to reduce transmission channels should avoid interfering with efficient market functioning and good risk management practices. Thus, recent proposals to ban "naked" CDS exposures could be counterproductive, as this presupposes that regulators can arrive at a working definition of legitimate and illegitimate uses of these products. A general definition of "naked shorts" remains elusive for both market participants and regulators, reflecting the wide spectrum of activity that can constitute naked positions, ranging from hedging activity to outright speculation. Even though sovereign CDS may at times influence underlying bond markets, particularly during periods of distress, banning "naked shorts" would be ineffective and difficult to enforce. A prohibition against the use of certain derivatives may simply transfer selling pressure to related cash market instruments, such as government bonds, equities, or foreign exchange, and make hedging of exposures more costly and complex.

The focus of policymakers should be on improving already-existing CDS data sources to monitor markets, and on continuing to strengthen the market's operational infrastructure. Policymakers should push to move bilateral OTC derivative contracts on to central counterparties (CCPs), and to advocate more consistent and uniform collateral practices on bilateral contracts. This would reduce the need to use sovereign CDSs as synthetic hedges against private sector counterparty risk, and possibly reduce volatility in the sovereign CDS market. These reforms would also promote global financial stability, while allowing market mechanisms to determine the ultimate usage of sovereign CDS. Chapter 3 discusses the role that CCPs can play in making OTC markets safer.

Policymakers need to ensure that this next stage of the deleveraging process unfolds smoothly and results in a safer, competitive, and vital financial system.

Bank deleveraging has been driven mainly from the asset side thus far, as mounting losses have prompted banks to reduce exposures to riskier assets. Going forward, however, the deleveraging process will be dominated by pressures on the funding or liability side of bank balance sheets. New regulatory rules will act to reduce leverage and raise capital and liquidity buffers. While the key banking systems most affected by the crisis likely now have sufficient capital, in aggregate, to meet expected future losses, there is significant variation across individual institutions within these systems. Some have a weak tail of thinly capitalized institutions that are highly dependent on cheap central bank funding. These impaired institutions compete for funding with more profitable and better-capitalized institutions, thereby squeezing margins and limiting the ability of healthier banks to finance their loan portfolios. If left unaddressed, this could ultimately act as a brake on the recovery of credit.

Going forward, funding pressures are likely to intensify for banks, as the wall of shorter-duration debt issued during the crisis matures, as banks compete with sovereigns to issue longer-dated debt, as central banks reduce their extensive liquidity support—thereby returning lower-quality collateral to banks—and as banks compete more aggressively for deposits to meet new liquidity

requirements. Swift resolution of nonviable institutions and restructuring of those with a commercial future is thus a vital component of the deleveraging process. This will help to ensure that once public support measures are removed, a healthy core of viable financial institutions remains, able to withstand normal competitive forces and resume lending. Measures to restructure and resolve weak institutions also facilitate the withdrawal of extraordinary support measures and the normalization of central bank liquidity facilities. The sooner weakened institutions recognize losses and are either resolved, restructured, or recapitalized by existing or new investors, the sooner the financial system can return to health.[50] Continuing to strengthen the capital base will also help prepare the financial system for timely implementation of the more stringent requirements of the new enhanced Basel II regime and other changes to the capital adequacy framework. At the same time, greater clarity is needed in defining the new financial system framework, including financial sector taxation, to give banks more certainty over their future business models. These measures will need to be taken in conjunction with addressing the issue of "too-important-to-fail" institutions, to solve moral hazard problems, and to restore healthy and fair competition.

Policies may still be needed to ensure adequate flows of credit to the private sector.

Credit availability is likely to remain limited as banks continue to reduce leverage. Notwithstanding the weak recovery in private credit demand as households restore balance sheets, ballooning sovereign financing needs may bump up against supply constraints and exacerbate funding pressures, further constraining credit supply. Accordingly, measures to strengthen the recovery of safer securitization markets may be necessary (see the October 2009 GFSR). Furthermore, targeted support to ensure adequate lending to the SME sector may be warranted in some economies. There is the possibility that central bank support measures, including purchases of securities, may still be needed to offset the retrenchment in credit capacity by the bank and nonbank sectors in selected cases.

The necessity of further deleveraging in a number of countries can make the task of exiting from extraordinary support and liquidity measures a delicate one. In general, policymakers should seek to implement coherent and credible exit strategies once normalcy has returned to financial markets. Unnecessary delay risks private sector institutions becoming dependent on official support, distortions in market prices, and an undermining of central bank credibility regarding price stability. However, premature withdrawal risks jeopardizing economic recovery by exacerbating the deleveraging process. Policymakers need to formulate exit strategies suitable to their economic circumstances—coordinated where necessary across fiscal, monetary, and regulatory authorities—and credibly communicate them to market participants. The withdrawal of financial sector support can be facilitated by using built-in market incentives (e.g., a rising premium charged for guarantees) and the judicious use of termination dates.

[50] Too little competition can be as damaging as too much: a balance needs to be struck in which competition is sufficient to deliver innovative and competitive financial services that support growth, but is not so intense that it depresses returns for the entire financial sector. In general, "zombie banks"—those that have lost their commercial raison d'être, but are kept in existence for political reasons or by regulatory forbearance—engage in little innovation that is supportive of growth, but depress profits for the sector, and ultimately threaten financial stability.

Emerging market policymakers will need to deploy a wide range of policy tools to address the challenges arising from capital inflows.

The strong rebound in emerging market portfolio inflows, while welcome, is leading to concerns over inflationary pressures or asset price bubbles in receiving countries. Although there is only limited evidence at this time of stretched valuations across countries—with the exception of some local property markets—current conditions of high external and domestic liquidity and rising credit growth have the potential to stoke inflation and give rise to bubbles over a multi-year horizon. In addition to macro-policy adjustment (including measures supporting exchange rate appreciation), possible policy tools include liquidity management operations to mop up domestic liquidity; prudential tools to restrict banks' ability to fuel a credit boom and restrict a build-up of excessive leverage; and measures to target specific asset prices and markets. Chapter 4 discusses the use of capital controls as part of the macroprudential policy mix.

Addressing too-important-to-fail banks is critical for restoring market discipline and insulating sovereign balance sheets.

Excess capacity in the financial system and significant concentration of power in "too-important-to-fail" institutions remain to be addressed as the financial system undergoes further deleveraging. Market discipline and fair competition will be supported by addressing the significant advantages in funding markets enjoyed by too-important-to-fail institutions.[51] This is critical to avoid even greater concentration as the financial system shrinks.[52] Importantly, to protect sovereign balance sheets and to reduce the risks of recurrence, such institutions must have adequate capital and liquidity buffers plus robust risk management systems and capacities. Policymakers must also reduce the potential and actual moral hazard associated with too-important-to-fail institutions.

There have been a number of policy instruments proposed to address the problem (see Box 1.5) but little consensus on which are most advantageous. Available options range from higher capital requirements linked to systemic importance, to imposing limits on the size and scope of institutions, with regulatory authorities tailoring their approach to reflect specific country circumstances. Whatever option is chosen, the simple metric of effectiveness will be whether too-important-to-fail institutions reduce their contribution to systemic risk and do so in a matter that is internationally consistent. The window of opportunity for real reform of too-important-to-fail institutions is rapidly closing, so policymakers should take bold steps to ensure this topic stays on the reform agenda, and meaningful progress is made.

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[51] U.S. data highlight that the largest banks generally entered the crisis will the lowest capital ratios while enjoying a lower cost of funding, suffered the greatest losses, and enjoyed the most government support and subsidy. Crisis mergers have meant that the top four banks have sharply increased their asset size relative to GDP and other bank assets (see Annex 1.5). Through the higher credit ratings arising from perceived government support, the five largest U.K. banks are calculated to have benefited by a total of £55 billion per year during 2007–09 just from preferential wholesale funding rates (Haldane, 2010).

[52] In the European Union, the Commission's Competition Directorate is requiring banks as a condition of significant state aid to cancel or defer coupons on preferred shares and hybrid instruments and dispose of banking units and subsidiaries to reduce concentration and encourage entry into banking markets. While not fully addressing the too-important-to-fail problem, this process goes some way toward redressing the moral hazard consequent upon crisis assistance. The absence of a similar process in the United States, Japan, and Switzerland leaves such sovereigns more exposed to contingent liabilities from more concentrated banking systems than otherwise.

Box 1.5. Proposals to Address the Problem of Too-Important-to-Fail Financial Institutions

"Too-important-to-fail" (TITF) firms are those believed to be so large, interconnected, or critical to the workings of the wider financial system or economy that their disorderly failure would impose significant costs on third parties. This status engenders expectations that, if failure were to loom, the authorities would be forced to prevent the collapse of these institutions, thereby shielding creditors from loss, reducing borrowing costs, and encouraging additional leveraged risk-taking by TITF firms. The policy response to the financial crisis—entailing selective bailouts favoring TITF firms and assisted mergers—has exacerbated this already-serious moral hazard problem in the United States and Europe. Proposals made by the Basel Committee on increased capital for market risk and liquidity requirements and improvements to clearing infrastructure (see Chapter 3) would reduce systemic risk across the financial sector. In addition, a range of policy responses has been suggested to address the specific issue of TITF institutions and is under consideration by the Financial Stability Board:

- *Tougher supervisory standards for TITF firms.* An element in the U.S. administration's proposal for systemic firms is for regulators to require tougher minimum capital, liquidity, and risk management requirements, effectively under Pillar 2 of the Basel framework. This has the advantage of flexibility but relies on regulators identifying sources of systemic risk accurately while maintaining robust independence from TITF firms.
- *Resolution mechanisms (TITF insolvency regimes; "living wills").* The crisis highlighted the absence of legal powers in many jurisdictions to intervene in, or wind up, troubled TITF institutions in an orderly way outside standard bankruptcy procedures. Such mechanisms are vital to give credibility to the threat of failure. Requiring the preparation of "living wills" by TITF firms would force their boards to understand the complexities of their legal structures while providing some assistance to regulators in insolvency. Unless a robust cross-border resolution regime for TITF firms can be implemented, jurisdictions may seek the safer option of resolving subsidiaries they host rather than allow cross-border branching of TITF entities.
- *Additional capital requirements linked to systemic risks.* In addition to the higher levels of better quality capital for internationally active banks proposed by the Basel Committee, additional requirements could be calibrated to penalize firms' attributes that make them TITF and thus internalize the costs these institutions impose on the system. Chapter 2 illustrates how systemic-risk-based capital surcharges can be made operational. Such requirements should be set to motivate TITF firms to divest activities and shrink assets to raise their return on equity, while favoring new entrants and greater competition.
- *Taxes or levies to pay for costs of resolving TITF entities.* While initially intended to "claw back" the costs of crisis bailout, such taxes could be used to encourage TITF firms to reduce systemic risks. To fully address the problem, such taxes or levies would need to be calibrated to exceed the cost of capital benefit that TITF firms derive from their status. Policymakers should ensure that in the event of a failing TITF firm, there is appropriate burden-sharing so that shareholders lose their investment, unsecured creditors incur losses through haircuts, and management is replaced.

Box 1.5 *(concluded)*

- *Limits on market share or asset size.* To confine TITF firms to a manageable size for crisis management and competition purposes, additional capital requirements and leverage ratios could be combined with caps on relative market share (as with the United States' 10 percent limit on insured deposits), balance sheet size, or counterparty exposures. Such basic rules of thumb prevent TITF firms arbitraging risk-based measures and recognize the need to cap sovereign risk posed by the failure of any one firm.
- *Restrictions on activities.* Some recent proposals have included the exclusion of own-account proprietary trading from all institutions with access to deposit insurance and lender-of-last-resort facilities (to address existing conflicts of interest, moral hazard, and skewed competition—the "Volcker rule"). To avoid unintended consequences, "proprietary trading" would need to be carefully defined to exclude market-making, hedging, and client-driven trading activities.

Annex 1.1. Global Financial Stability Map: Construction and Methodology[53]

The further improvements in global financial stability and underlying conditions are illustrated in our global financial stability map (Figure 1.1). The changes in indicators are highlighted in Figure 1.36 and the specific indicators used are noted in Table 1.9. The rest of this annex outlines key features of the global financial stability map (GFSM) and reviews its experience through the crisis.

The global financial stability map (GFSM) was designed to assess the risks and conditions that impact financial stability.[54] The GFSM is intended to provide a summary, graphical representation of the IMF's assessment of financial stability, capturing a diverse range of potential sources of instability, contagion among different segments of financial markets, and nonlinearities in the underlying factors. The philosophy underpinning the GFSM is that financial stability cannot be distilled into a single indicator, and is better understood by separating the underlying risks and conditions that could give rise to a systemic threat. The aim is to extract diagnostically useful information from economic and financial metrics, supplemented by judgment based on market intelligence and the IMF's assessment of risks.

The GFSM tracks four broad risks and two underlying conditions considered relevant for financial stability and the IMF's remit in supporting financial stability.

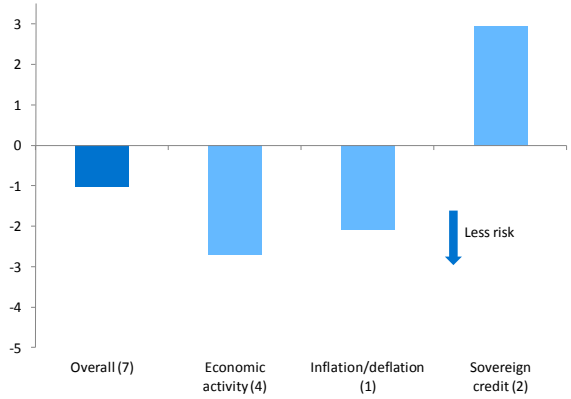
[53] This annex was prepared by Peter Dattels, Ken Miyajima, Rebecca McCaughrin, and Jaume Puig (see Dattels and others, forthcoming).

[54] The GFSM was first introduced in the April 2007 GFSR.

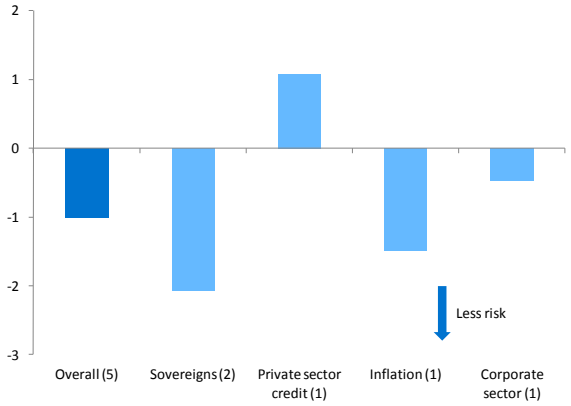
Figure 1.36. All Risks to Global Financial Stability and Its Underlying Conditions Have Improved

(In notch changes since the October 2009 GFSR)

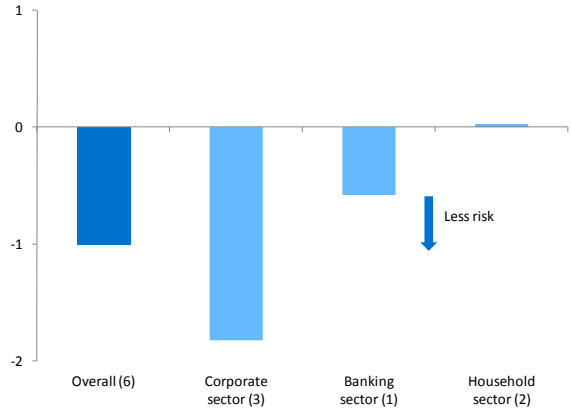
Macroeconomic risks receded as economic activity recovered and deflationary pressures eased; but fiscal concerns increased



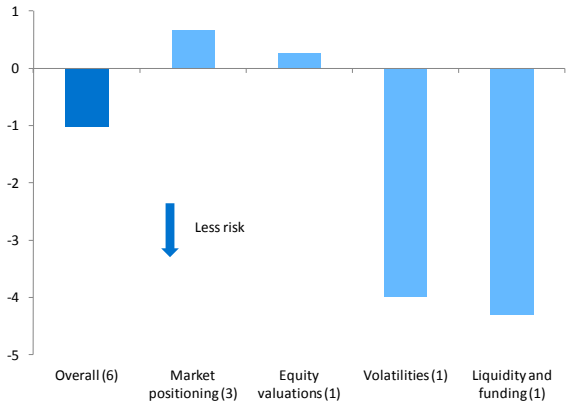
Emerging market risks fell supported by better fundamentals, but domestic credit growth continued to decelerate



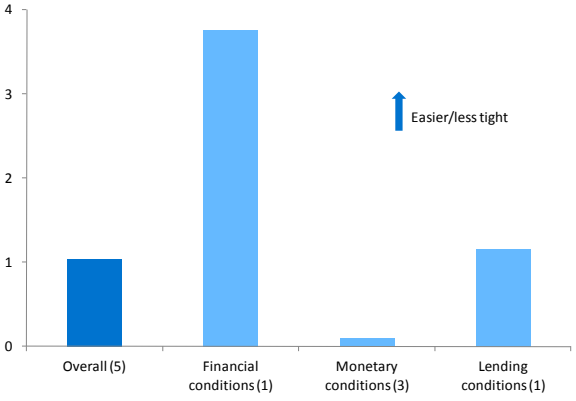
Credit risks eased benefiting from macro-financial linkages, but remain high as households need to delever



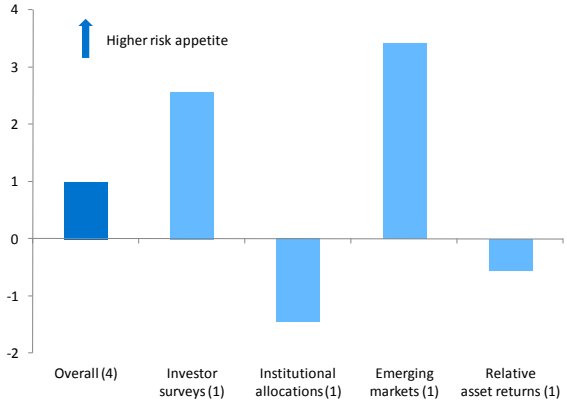
Market and liquidity risks eased as liquidity conditions improved and volatility declined



Monetary and financial conditions improved as markets rallied and monetary policy remained supportive



Risk appetite increased on increased risk-taking relative to benchmark and appetite for emerging market assets



Note: Overall notch changes are the simple average of notch changes in individual indicators. The number next to each legend indicates the number of individual indicators within each sub-category of risks and conditions. For lending standards, a positive value represents a slower pace of tightening or faster pace of easing.

Macroeconomic risks affect financial stability through various channels—three elements are captured here. The global growth outlook underpins income—the borrower's ability to pay and overall market perceptions of credit risk. Inflation/deflation risk can destabilize fixed-income markets and impact real debt burdens and is thus a source of financial stability risk. Sovereign risk results from unsustainable fiscal paths, and rising debt burdens can be a significant source of financial instability, potentially culminating in a sovereign default.

Emerging market risks capture underlying fundamentals in emerging markets—and are therefore closely related to macroeconomic risks described above, but conceptually separate as they focus only on emerging markets—and vulnerabilities to external shocks. Indicators include models that translate economic, financial, and political variables into a sovereign external credit risk spread. Underlying indicators of credit and inflation performance capture risks related to financial policies and are leading indicators of future vulnerabilities. Market perceptions of corporate credit risks are also included.

Credit risks measure credit stress in household and corporate balance sheets. Indicators attempt to capture risks in both banking and nonbanking systems. Risks in core financial institutions and contagion are assessed using models based on credit derivatives. Pressures in corporate debt markets are captured using delinquency rates and expected defaults. Market risks assess the potential for heightened pricing risks that could result in spillovers and/or mark-to-market losses, while liquidity risks measure stress in funding markets as well as liquidity conditions in secondary markets. These indicators highlight potential for vulnerabilities that arise from excessive leverage—risks that markets might correct abruptly and risks that a liquidity or funding crisis could spill over and impact markets more broadly, including credit risks.

Monetary and financial conditions gauge the stance of monetary policy and the cost and availability of funding. Measures include short-term real interest rates, as well as estimates of excess liquidity. The willingness and capacity of banks to lend is a key input as is the market-based indicator of financial conditions.

Risk appetite gauges the willingness of investors to increase (or shed) risk. Such "animal spirits" can greatly influence spread developments as well as market and liquidity risks. Gauges of risk appetite include survey- and market-based measures of risk appetite, as well as normalized flows into emerging markets.

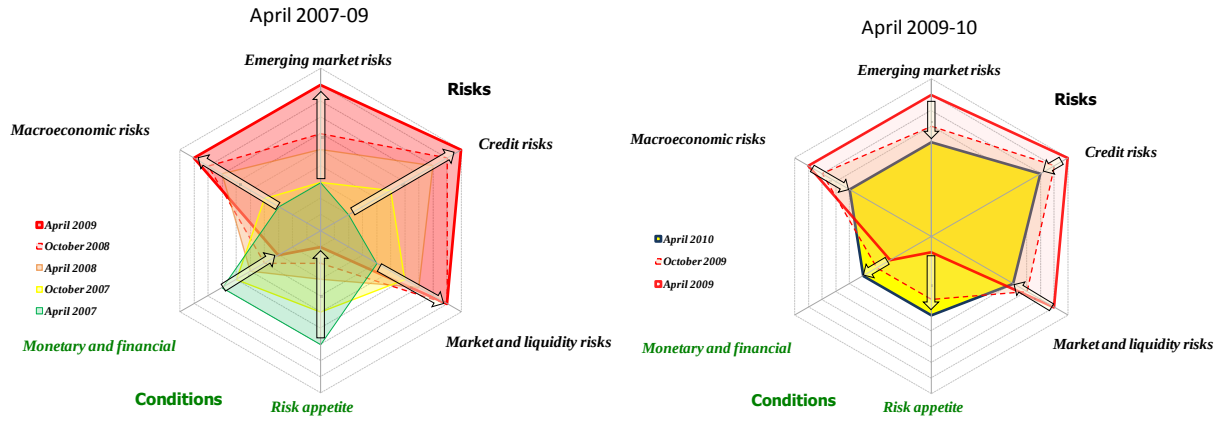
The choice of specific indicators to assess these risks and conditions is guided by their relevance and various practical considerations. The indicators within each ray of the GFSM should be sufficient to capture potential sources of risk, but limited in number to avoid overlaps and canceling out of pertinent indicators. The indicators should be sufficiently forward-looking to have predictive powers for a 6-24 month window. A balance of economic, market-based, and survey-based indicators, as well price and quantity measures is sought to achieve these aims (Table 1.9). The indicators should be of relatively high frequency and have sufficient history to provide enough information through (in)stability cycles. The reliability of the indicators is periodically assessed and adjustments are made so that the GFSM adequately captures underlying risks and conditions at any given time.

Current conditions and risks are summarized in a scale of 0 to 10, with higher values signifying higher risks and easier conditions relative to their respective historical norms. Assessments

of the contemporaneous values of the indicators are made relative to their own history in terms of percentile rankings.[55] To construct the GFSM, we first determine the percentile rank of the current level of each subindicator relative to its history.[56] The individual indicator rankings are aggregated into each of the six rays of the GFSM using equal weights. Judgment and technical adjustment are often used to attach greater importance to a particular set of indicators based on risks considered to be most relevant at a given time. In particular, technical adjustment is used when events that surpass historical experience raise (lower) some associated risk or condition indicators to the highest (lowest) level. The final choice of positioning on the GFSM represents the best judgment of IMF staff.

The GFSM tracked broad developments well during the global financial crisis that culminated in 2009 (Figure 1.37).[57]

Figure 1.37. Evolution of the Global Financial Stability Map, 2007-09



Source: IMF staff estimates.
Note: Away from the center signifies higher risks, easier monetary and financial conditions, and higher risk appetite.

Monetary and financial conditions: The GFSM signaled very easy conditions from 2003 to 2006, suggesting the potential for a build-up of large imbalances ahead of the crisis. The pairing of relatively easy monetary and financial conditions and high levels of risk appetite reinforced this signal.

Risk appetite: This set of indicators captured the rise in levels of risk appetite in the run-up to the crisis, as well as the sharp contraction in risk appetite from very high levels ahead of the crisis.

Macroeconomic risks: Indicators signaled exceedingly low perceptions of risks at the onset of the crisis, and captured deteriorating conditions throughout the crisis as well.

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[55] The GFSM raises early warning signals when risks are excessively low and conditions loose, gauged against historical norms. During crises, the GFSM generally captures the worsening of risks and conditions contemporaneously (Dattels and others, forthcoming).

[56] Moving averages are often used for higher frequency data to extract the trend and identify inflection points.

[57] The description of the GFSM's results before its introduction in the April 2007 GFSR is based on a reconstruction of the model's results with past observations for the indicators used in the October 2009 GFSR (see also Dattels and others, forthcoming).

Table 1.9. Global Financial Stability Map Indicators

Monetary and Financial	
Monetary conditions	G-7 real short rates
	G-3 excess liquidity
	Growth in official reserves
Financial conditions	Financial conditions index
Lending conditions	G-3 lending conditions
Risk Appetite	
Investor survey	Merill Lynch investor risk appetite survey
Institutional allocations	State Street investor confidence index
Emerging market assets	Emerging market fund flows
Relative asset returns	Global risk appetite index[1]
Macroeconomic Risks	
Economic activity	*World Economic Outlook* global growth risks
	G-3 confidence indices
	OECD leading indicators
	Implied global trade growth
Inflation/deflation	Global breakeven inflation rates
Sovereign credit	Mature market sovereign CDS spreads
	Advanced country general government balance[2]
Emerging Market Risks	
Sovereigns	Fundamental EMBIG spread
	Sovereign credit quality
Private sector credit growth	GDP-weighted credit growth
Inflation	Median inflation volatility
Corporate sector	Corporate spreads
Credit Risks	
Corporate sector	Global corporate bond index spread
	Credit quality composition of corporate bond index
	Speculative-grade corporate default rate forecast
Banking sector	Banking stability index
Household sector	Consumer and mortgage loan delinquencies
	Household balance sheet stress
Market and Liquidity Risks	
Market positioning	Hedge fund estimated leverage
	Net noncommercial positions in futures markets
	Common component of asset returns
Equity valuations	World implied equity risk premia
Volatilities	Composite volatility measure
Funding and liquidity	Funding and market liquidity index

Source: IMF staff estimates. For a detailed description of each indicator, see Annex 1.1. of October 2009 GFSR.

[1]The Credit Suisse GRAI introduced in the April 2010 GFSR is the slope of a cross-sectional regression of mature and emerging market country equity and government bond excess returns over cash as the dependent variable, and 12-month volatilities of these assets as the independent variable.

[2]This indicator introduced in the April 2010 GFSR is the GDP-weighted average of WEO projections of advanced country general government balances in 2010 and 2011.

Emerging market risks: These indicators suggested very low perceptions of risks in 2005–07, and a realization of risks only in late 2008 following the collapse of Lehman Brothers. This reflected the fact that the crisis originated in mature markets and the relatively resilient position of emerging markets was only threatened once the financial crisis spread to cross-border funding channels and the real economy.

Credit risks: Perception of risks increased from very low levels prior to the global financial crisis, signaling rising risks of a credit bubble and strains at the core of the financial system.

Market and liquidity risks: This set of indicators tracked the rise in risks to financial stability throughout the crisis period, reaching its highest level after the collapse of Lehman Brothers. Some of the subindicators on market positioning also pointed to increased high risk-taking ahead of the crisis in mid-2007.

Annex 1.2. Assessing Proposals to Ban "Naked Shorts" in Sovereign CDS[58]

Strains in Greek government bond markets have been partly blamed on speculative positioning through buying sovereign CDS protection. This has highlighted the need for further investigation and led to a discussion of the merits of a ban on "naked shorts." Even though sovereign CDS may at times influence underlying bond markets, particularly during periods of distress, banning "naked shorts" would be ineffective and difficult to enforce. In addition, "naked shorts" may be hard to define and such bans may hamper legitimate financial activity. Instead, transparency and collateral practices in CDS markets could be substantially improved to reduce risks.

After a decade of static market share relative to the broader CDS market, sovereign CDS underwent a rapid expansion in 2009 and into 2010. Gross sovereign CDS notional leapt 31 percent (versus a 4 percent increase in total CDS gross outstanding) (Table 1.10). The more relevant sovereign net notional exposure increased 23 percent compared with a 10 percent contraction in total net notional positions.[59] The number of sovereign CDS contracts also grew more than twice as fast as the entire market.

Table 1.10. Ten Largest Sovereign CDS Referenced Countries
(In billions of U.S. dollars, as of February 5, 2010)

	Gross Notional		Net Notional	
	Outstanding (dollar billions)	Year-on-Year Growth (percent)	Outstanding (dollar billions)	Year-on-Year Growth (percent)
Italy	223.8	35	24.8	40
Spain	102.0	46	14.5	23
Germany	61.5	47	12.9	27
Brazil	141.5	28	11.6	16
Portugal	60.1	105	9.4	72
Austria	41.5	80	9.4	87
Greece	79.8	99	8.8	24
France	44.8	76	8.6	45
Mexico	104.0	44	6.4	37
Ireland	34.2	77	6.0	36
Total sovereign	2,174.3	31	196.1	23
Total CDS	15,026.7	4	1,281.4	-10

Sources: The Depository Trust & Clearing Corporation; and IMF staff estimates.

Sovereign CDS has unlikely exerted a significant influence on government bond markets, for Greece or other sovereigns . . .

The size of the sovereign CDS market and amount of net protection sold are negligible compared to government debt outstanding. For the market as a whole, gross sovereign default protection is $2 trillion in notional value, just 6 percent of the $36 trillion global government

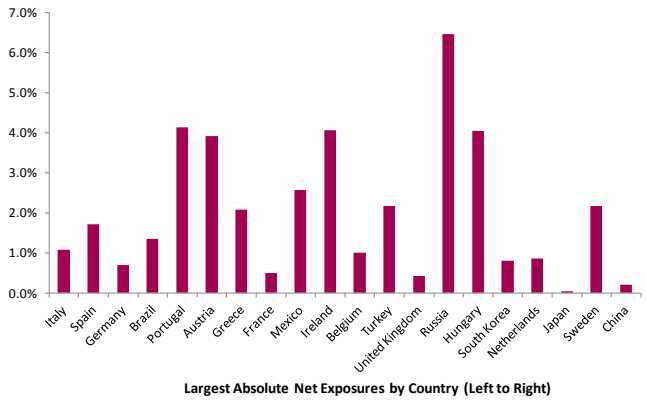
[58] Prepared by Joe Di Censo and Manmohan Singh.

[59] Gross notional is the sum of CDS contracts bought. The aggregate net notional exposures shown herein reflect the net amount of protection bought for all net purchasers of CDS. This net exposure represents the maximum economic transfer in the event of default.

bond market. By contrast, corporate CDS are roughly equivalent in size to the global corporate bond market.

Net exposure represents only 0.5 percent of government debt, at $196 billion notional amount. Among the 20 largest sovereign CDS markets, the share of net notional CDS outstanding to government debt averages 2 percent and does not exceed 7 percent in any country (Figure 1.38).

Figure 1.38. Net Notional CDS Outstanding as a Share of Total Government Debt
(In percent)

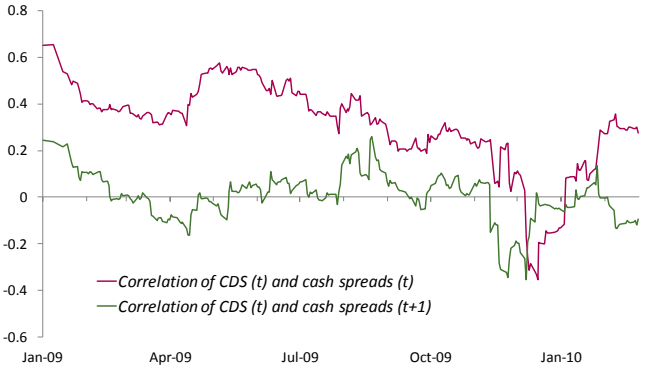


Sources: Bank for International Settlements; The Depository Trust & Clearing Corporation; and IMF staff estimates.

Could the tail (CDS spreads) wag the dog (bond yield spreads)?

In normal market conditions, CDS tend to move in tandem with bond yield spreads, as arbitrage conditions link the bond and derivatives markets.[60] But in periods of funding stress and poor bond liquidity, CDS can decouple from bond yield spreads and might even lead the bond market. A simple test is to ask whether changes in sovereign CDS today influence—i.e., are correlated positively with—bond yield spreads tomorrow (Figure 1.39). In the case of Greece, the correlation of both instruments with changes one or more days ahead was generally nil or slightly negative, except during the peak points of the crisis as bond market liquidity evaporated.[61,62]

Figure 1.39. Correlation of Daily Changes in Five-Year Greek CDS and Bond Yield Spreads
(In rolling 60-day periods)



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

Sovereign CDS markets can be prone to distortions because of relatively shallow liquidity. For instance, banks often attempt to create synthetic hedges for counterparty risk to sovereigns due to low (or nonexistent) collateral requirements. When looking for assets that are highly correlated with the sovereign's credit profile, banks resort to short-term CDS (so-called "jump-to-default"

[60] In this discussion, the bond yield spread refers to the yield differential between Greek government debt and equivalent maturity German bunds.

[61] In contrast, contemporaneous changes in Greek CDS and cash spreads were positively correlated (0.27).

[62] The difficulty of shorting bonds in order to sell CDS protection and arbitrage the bond-derivative basis suggests that CDS may actually "pull" bond yield spreads tighter, rather than "push" them wider. Assuming risk neutrality, any CDS premium should equal the cash credit spread of a par fixed-coupon bond of the same maturity. If the CDS spread exceeded the credit yield spread, an investor could sell CDS in the derivatives market and synthetically replicate that position by shorting a par fixed-coupon bond (on the same reference entity with the same maturity as the swap's tenor) and invest the proceeds in a like-maturity risk-free security. In reality, shorting bonds is difficult. So CDS moving the cash market wider is less likely than the reverse scenario of bond yield spreads "pulling" CDS tighter.

hedging). This hedging activity from uncollateralized swap agreements can distort the sovereign CDS market as well as other asset classes. For instance, heavy demand for jump-to-default hedges can quickly push up the price of short-dated CDS protection and cause sovereign CDS curves to invert, as happened in Greece and Portugal. These pressures can easily spill over into the domestic bond market and contribute to higher bond yields, especially for new debt issues.

The influence of sovereign CDS on government bond markets, minor in normal conditions and possibly greater under periods of stress, cannot be separated from the inefficacy of an outright ban on "naked shorts." As discussed later in the policy section, more productive reforms would be using already-existing CDS data sources to monitor markets and continuing to improve the market's operational infrastructure.

"Naked shorts" in sovereign CDS should not be banned.

Some argue that the very premise of CDS as a financial insurance product is inherently flawed and should be more tightly regulated. Buyers of CDS protection do not need an "insurable interest" to acquire protection (promoting adverse incentives) and nonbank sellers are not regulated or required to hold loss reserves (false sense of protection). In other words, CDS is an insurance-like product without insurance-like supervision.

This debate fails to consider an asset in the broader portfolio context and the nature of economic exposure. The correlation of risk factors defines economic exposure, not just ownership of a specific asset. As such, a portfolio manager may have an "insurable interest" in shorting an asset because of the portfolio's risk exposures, even if that asset is not included in the portfolio. Sovereign CDS is not only "credit insurance," but another tradable instrument in the risk management tool kit.

Speculation or hedging?

Recent activity in CDS relates more to concerns about counterparty or broad portfolio hedging than to sovereign default credit protection for holders of the underlying government bonds.

Counterparty hedging: As mentioned above, large banks generally do not require highly rated sovereign entities to post collateral for swap arrangements, introducing a significant unhedged counterparty exposure.[63]

Hedging country corporate exposure: Bank risk managers often aggregate individual corporate credit risks into acceptable country exposures that necessitate mitigation if breached. Sovereign CDS can offset those exposures by providing country-level risk diversification.

Proxy hedging: Investors also use sovereign CDS as a hedge against existing equity or corporate bond positions. This proxy hedge introduces basis risk (the sovereign's profile could improve as the corporate's worsens), but may be preferable due to greater liquidity or cheaper cost. Market sources cited such proxy hedgers as significant buyers of Greek sovereign CDS because individual Greek bank CDS were less liquid.

Hedging portfolio liquidity and market risk: A risk manager may desire to reduce daily portfolio value-at-risk (VaR) by looking for an uncorrelated macro hedge to the underlying debt or

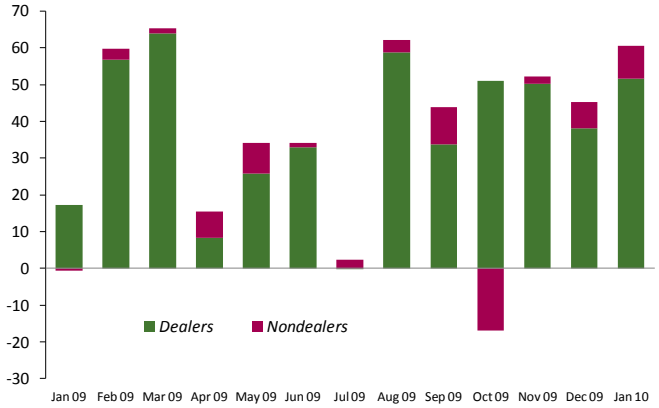
[63] Collateral requirements represent the most commonly used mechanism for mitigating credit risk associated with swap arrangements by offsetting the transaction's mark-to-market exposure with pledged assets. Yet most sovereigns and foreign provinces/municipalities do not post collateral. This practice is due primarily to the lack of legal clarity surrounding enforcement of collateral rights against sovereigns.

equity positions. Buying short-dated sovereign CDS protection could accomplish that objective much in the same way as a long gold position reflects a safe-haven bet.

Macro hedging and speculation: Macro funds are reportedly turning to sovereign CDS to express directional views on economic fundamentals and offset overall portfolio risk, especially via the new sovereign CDS indices. Yet since the launch of the iTraxx SovX last year, the overall index has traded between 2–8 bps tighter than the intrinsic spread of the 15 underlying sovereigns CDS. This negative basis points to demand for individual-name CDS remaining stronger than demand for tradable sovereign CDS indices, suggesting that macro hedging is not a major mover of sovereign CDS markets.

Dealers represent about 90 percent of the sovereign CDS market and are net sellers of credit protection, according to the Depository Trust & Clearing Corporation (DTCC): By implication, this means that investors (real money and hedge funds) are net buyers of protection. Trading motivations cannot be entirely discerned from the DTCC classifications, but most dealer flows likely relate to hedging as part of market making activities. From a risk management perspective and business rationale, dealers are less inclined to take large directional bets in CDS. Nondealers generated just 15 percent of January's trading in sovereign CDS and even less in November-December (Figure 1.40).

Figure 1.40. Sovereign CDS Volumes, January 2009 to January 2010
(In billions of U.S. dollars)



Source: The Depository Trust & Clearing Corporation.

A "naked shorts" ban would not work.

The current discussion of a ban for "naked shorts" in sovereign CDS presupposes that regulators can arrive at a working definition of legitimate and illegitimate uses of these products. A general definition of "naked shorts" remains quite elusive for both market participants and regulators, reflecting the wide spectrum of activity that can constitute covered versus naked positions.

An outright ban on "naked shorts" in sovereign CDS would also be ineffective and inconsistent with wider ramifications for financial markets.

Not effective: Given that most sovereign CDS flows likely reflect hedging activity, an outright ban would merely prompt substitution to another asset correlated with sovereign risk. The most direct method would be to short the underlying bond, simply transferring more pressure to the cash market. Alternatively, to the extent that proxies are available (such as local equities, corporate CDS, or currency), pressure is transmitted to related markets, such as Greek bank equities or CDS. The short-selling bans on bank equities seemed to provide little relief to bank share prices.

Easily circumvented: "Creative" financial engineering could replicate default protection in another form. Alternatively, CDS business can be rerouted offshore or to dealers in another regulatory jurisdiction.

Inconsistent regulatory practice: Treating sovereign CDS differently than corporate CDS or any defensive derivative strategy introduces regulatory inconsistencies. After all, why consider sovereign CDS differently than corporate CDS or shorting bonds overall?

Section F explores appropriate measures for greater sovereign CDS transparency and mechanisms to reduce banks' reliance on them for hedging purposes.

Annex 1.3. Assessment of the Spanish Banking System[64]

This annex attempts to estimate the impact of the financial crisis on the Spanish banking sector, looking separately at commercial banks and savings banks (cajas). We find that the overall Spanish banking system under our baseline case is likely to withstand consequences of the crisis, despite severe economic deterioration. Under our adverse case scenario, three years of earnings are projected to cover future losses for the commercial banking sector, leaving the capital base intact, but the savings banking sector is projected to have a net drain on capital. Furthermore, the country's banking system is highly differentiated in terms of holdings of bad loans and distressed real assets. After accounting for this cross-bank differentiation, small gross drain on capital is expected in both commercial and savings banks under the baseline. Under our adverse case scenario, gross drain on capital is estimated at €5 billion for commercial banks and €17 billion for savings banks. These estimates compare against Tier 1 capital of €99 billion and €78 billion for commercial and savings banks, respectively.

The pace of house price deterioration and the extent of broad economic downturn in Spain have been more severe than in the euro area, on average. These developments have led many commentators to question whether the Spanish banking sector's provisions are sufficient to withstand potential losses.

The analysis is divided in two parts: in the first part we estimate the net impact of current and expected losses of Spanish commercial and savings banks on their earnings stream over the 2010–12 period under our baseline and adverse-case scenarios; in the second part, we examine cross-bank differentiation in terms of real asset repossessions and assess what share of the system may need additional capital.[65]

The first part of the analysis benefitted from collaboration with the Bank of Spain. Spain has pioneered the use of dynamic provisions since 2000 to mitigate credit procyclicality. This helped Spanish credit institutions to accumulate a significant buffer of loan loss provisions by the beginning of the crisis.[66] Box 1.6 explains how losses from nonperforming loans are forecasted.

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[64] The annex was prepared by Sergei Antoshin and Narayan Suryakumar. This annex draws extensively upon Alessandro Giustiniani "The Spanish Banking Sector" (SM/09/40, February 12, 2009) and subsequent works.

[65] The three-year horizon corresponds to the period over which most of loans are completely written off under the Spanish accounting rules. Mortgages are written off over six years, which leaves the possibility of using earnings after 2012 to absorb losses.

[66] See IMF, "Spain—Staff Report for the 2008 Article IV Consultation," SM/09/34, Box 1.

Box 1.6. Estimating Potential Losses from Nonperforming Loans for Spain[1]

In this exercise, we assume that potential losses are equal to flows of provisions in 2010–12, which are computed as flows of provisions in 2010 plus expected losses after 2010. In turn, expected losses after 2010 are estimated as *additional* provisions after 2010 that are necessary to cover expected losses in excess of accumulated loan loss reserves as of 2010:

Expected Losses after 2010 = *NPL in 2010* x *LGD - Stock of Provisions in 2010*,

where *NPL* is the stock of nonperforming loans, and *LGD* is the cumulative loss given default ratio over the next two years. Drain on capital is calculated as potential losses minus future earnings in 2010–12.

We forecast nonperforming loans based on business cycle variables, loan costs, and house prices. GDP and the unemployment rate are used as business cycle indicators, the 12-month euro LIBOR is used for loan costs because it is a common benchmark for mortgages and other loans, and house prices are an indicator for the mortgage and the construction sectors. The dependent variable is obtained using the logit transformation: $npl \equiv \mathrm{LN}(NPL/(1 - NPL))$.

Since the dependent variable has a unit root, the regression is estimated in first differences.[2] Real GDP growth is ultimately removed from the regression, because of its collinearity with the unemployment rate and house prices. As a result, the following specifications (1) and (2) are obtained for commercial banks and savings banks, respectively.

$$\mathrm{D}.npl\_c = 0.0474*\mathrm{L2.D}.U + 0.0326*\mathrm{L8.D}.I - 0.0171*\mathrm{L5.D}.H \quad (1)$$
t-statistic 3.19 2.02 -2.84

$$\mathrm{D}.npl\_s = 0.0412*\mathrm{L2.D}.U + 0.0312*\mathrm{L8.D}.I - 0.0124*\mathrm{L5.D}.H \quad (2)$$
t-statistic 2.80 1.94 -2.09

where D. is the first difference operator, L. is the lag operator, *npl_c* and *npl_s* are NPLs for commercial and savings banks using the logit transformation above, *U* is the unemployment rate, *I* is the LIBOR rate, *H* is yearly changes in house prices. The constants are suppressed due to their insignificance. The regressions are estimated over 1987:Q4–2009:Q4. Forecasts for 2010 are produced using WEO data for the unemployment rate, while the LIBOR and house prices work with lags based on historical values.

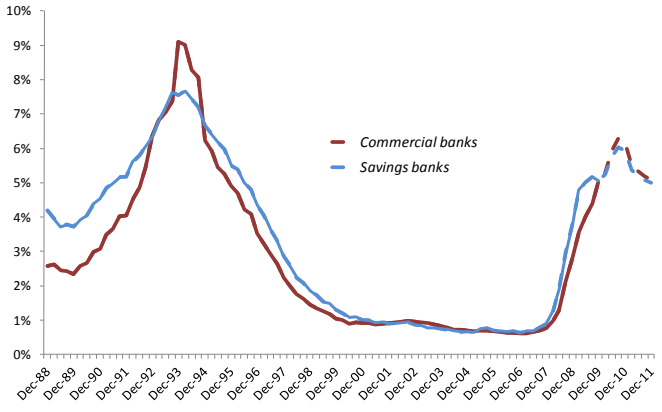
[1]The box was prepared by Sergei Antoshin.

[2]The difference form also implies inertia of NPLs in levels.

NPLs at commercial and savings banks are projected to peak at 6.3 percent and 6 percent, respectively, in 2010:Q3, and then come down to 5.1 percent and 5 percent, respectively, by the end of 2011 (Figure 1.41). The outcomes of forecasts using equations (1) and (2) are dependent on lag specifications. For example, for commercial banks, the selection of different lags resulted in the peak

values between 5.5 percent and 7.4 percent, and the presented specification roughly corresponds to our median forecast. The forecasted peaks in NPLs in 2010 are lower than those in the previous crisis episode in 1993–94, because of much lower interest rates during this crisis (5.3 percent in 2008 vs. 14.3 percent in 1992) and lower unemployment rates (18.8 percent in 2009 vs. 24.6 percent in 1994). The econometric approach does not capture an additional risk factor related to private leverage, which has dramatically increased over the 10 years of credit boom. Another weakness of the econometric approach comes from the use of historical data which predicts a higher peak for NPLs at commercial banks, based on the historical experience and slowing NPLs at savings banks in 2009.[67]

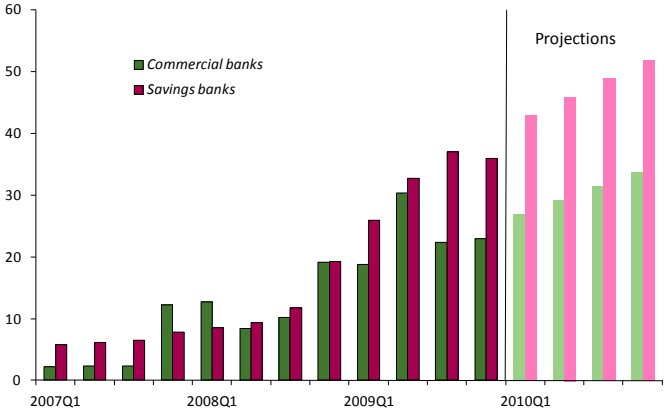
Figure 1.41. Spain: Nonperforming Loans
(In percent of total loans)



Source: IMF staff estimates.

The assumptions about the loss given default ratio (LGD) are derived from previous studies and analyst estimates. The baseline scenario is based on 25 percent LGDs for both commercial banks and savings banks, which correspond to internal estimates of downturn LGDs according to the Bank of Spain's assessment and are in line with other euro area average LGDs.[68] Losses on securities' holdings are estimated at €4 billion for commercial banks and €1 billion for savings banks.[69]

Figure 1.42. Spain: Real Asset Repossessions
(In billions of euros)



Source: IMF staff estimates.

[67] As the analysis below shows, we view real asset repossessions as an additional risk factor affecting future losses. When NPLs and repossessions are combined, the share of problem assets in percent of total loans is higher for savings banks.

[68] The above assumptions often correspond to lower bounds of market estimates.

[69] The methodology for estimating securities' losses is consistent with the approach to the euro area outlined in the previous GFSRs and is based on securities' holdings provided by the Bank of Spain. All of the estimated losses are expected to originate from holdings of foreign securities. The relatively small loss figure can be attributed to the strong improvement in corporate securities prices over the past year and the marginal exposure of both the commercial and savings banks to toxic assets. Banks' holdings of retained asset-backed securities and are treated as loans because Spanish banks have retained nearly all the asset-backed and mortgage-backed securities they have originated over the past two years, in order to use them as collateral in tapping ECB facilities.

We also consider the effect of repossessed real assets (Figure 1.42).[70] Over the last two years, given the ailing state of the real estate and the construction sectors, Spanish banks have increased the use of debt-for-property swaps to manage their credit portfolios efficiently, trying to maximize asset value recovery. This practice helps banks in managing of their credit risk portfolios and minimizes losses, provided that property prices stabilize in the medium term and banks can sell those assets at their book value. However, if house price deterioration continues, banks under pressure may need to sell properties within a short period of time, resulting in substantial losses.

Estimates of banks' acquired or repossessed real estate assets vary significantly. Our own estimates are €22 billion and €37 billion for commercial banks and savings banks, respectively, in 2009Q3.[71] Our time series on repossessions are augmented by the Bank of Spain's estimates of €23 billion and €36 billion for 2009Q4. Repossessions surged over the last two years, adding €11 billion of troubled real assets in 2009 to the balance sheet of commercial banks and €21 billion for savings banks. We project that the pace of increases in repossessions will slow in 2010 to €10 billion for commercial banks and to €20 billion for savings banks. LGDs for repossessed assets are subject to a high degree of uncertainty because the distribution of repossessed assets by type is unknown for the overall system and because it is not likely that banks will recognize losses by selling these assets within the next three years. Since repossessed assets include land and unfinished construction with very high expected loss rates, we assume LGDs of 40 percent and 45 percent, which correspond to lower bounds of market estimates. Spanish banks are required to set aside provisions for repossessed assets, to account for the possible loss in value of that asset depending on the number of years that is maintained on the balance sheet before it is finally realized. We use the Bank of Spain's estimates for stock of provisions for repossessions: €6 billion for commercial banks and €7 billion for savings banks.

Based on the forecasted NPLs and repossessions, and the assumed LGDs, expected losses in excess of end-2009 stock of loan loss provisions are computed in Table 1.11 Under the baseline scenario, stock of provisions at commercial and savings banks exceed expected losses by €10 billion and €12, respectively (line (6) in Table 1.11). Repossessions add €7 billion and €15 billion in expected losses after accounting for provisions for commercial and savings banks, respectively (line (12) in Table 1.11).

Pre-provision net earnings are expected to decline 10 percent each year during 2010-12, due to a sharp fall in interest income, funding pressures in the medium term, and slowing deposit growth. Despite these declines, banks' earnings stream over the next 3 years will be sufficient to cover those expected losses. In sum, under our baseline scenario, loan loss reserves and earnings are sufficient to fully absorb expected losses for the overall commercial banking and the savings banking sectors.

[70] This part of the analysis benefitted from the use of data on Spanish banks from Analistas Financieros Internationales. All estimates are those of the authors..

[71] Repossessions of real assets are calculated as flows between 2007:Q2 and 2009:Q3 for the sum of item 9 "Activos no corrientes en venta," item 13.2 "Inversiones inmobiliarias," and item 16.1 "Existencias" from the Consolidated Balance Sheets for commercial banks and savings banks, obtained from the banking associations.

Table 1.11. Spain: Baseline and Adverse-Case Scenarios
(In billions of euros, unless otherwise shown)

			Commercial banks	Savings banks	Commercial banks	Savings banks
			Baseline Scenario		*Adverse-Case Scenario*	
(1)	Total loans		798	882	798	882
(2)	Stock of NPL in 2010/2011 [1]		50	53	62	62
(3)	Loan Loss Reserves		23	26	21	23
(4)	LGD for NPLs (percent)		25	25	45	45
(5)	Expected losses from NPL	(2)*(4)	-13	-13	-28	-28
(6)	Loan Loss Reserves - Loan Losses	(3)+(5)	10	12	-7	-5
(7)	Losses from Securities		-4	-1	-4	-1
	Adding repossessions					
(8)	Repossessions in 2010/2011 [1]		31	48	36	56
(9)	Reserves for repossessions		6	7	6	7
(10)	LGD for repossessions (percent)		40	45	55	60
(11)	Expected losses from repossessions	(8)*(10)	-13	-22	-20	-34
(12)	Repossession Reserves - Losses	(9)+(11)	-7	-15	-14	-27
(13)	Total Reserves - Total Losses	(6)+(7)+(12)	-1	-3	-26	-33
(14)	Pre-provision earnings in 2010-2012		52	39	41	31
(15)	**Net drain on capital** [2]	-(13)-(14)	**-51**	**-36**	**-15**	**2**
(16)	*Memo:* Tier 1 capital (Q2 2009)		99	78	99	78

Source: IMF staff estimates.

[1] 2010 for the baseline; 2011 for the adverse case.

[2] Net drain on capital = - (net pre-provision earnings - writedowns). A negative sign denotes capital surplus.

Our adverse-case scenario corresponds to a double-dip case, with the unemployment rate climbing to 24.5 percent in 2011 (as during the last crisis period in 1994) and house prices falling a further 15 percent year-on-year in 2010. (The impact of the LIBOR will take effect only in 2012 due to the lag structure of the estimated forecasting equation.) Under these circumstances, NPLs are forecasted to peak in 2011 at 7.8 percent and 7.1 percent for commercial and savings banks, respectively. LGDs for nonperforming loans are assumed at 45 percent for both commercial and savings banks, respectively, and LGDs for repossessed properties are at 55 percent and 60 percent, respectively. The assumed LGDs correspond to upper bounds of analysts' estimates under downturn scenarios. Pre-provision net earnings are expected to drop 25 percent in 2010, 15 percent in 2011, and 15 percent in 2012. We also assume that banks will set aside 10 percent of the current stock of provisions. Under these assumptions, the remaining stock of provisions and earnings at commercial banks are still sufficient to cover future losses. However, the savings banking sector is projected to have net drain on capital of €2 billion (line (15) in Table 1.11).

The results from the first part of the analysis correspond to the overall banking sectors and ignore a high level of differentiation in terms of real asset repossessions and NPLs across banks. In the second part of the analysis, we attempt to estimate what portion of the system may need capital under the baseline and the adverse-case scenarios. We base our analysis on differentiation in repossessions across banks and extend the same level of differentiation on banks' NPLs which are

Table 1.12. Spain: Calculations of Cutoff Rates for Banks with Drain on Capital
(In percent of total loans, unless otherwise shown)

			Commercial banks	Savings banks	Commercial banks	Savings banks
			Baseline Scenario		*Adverse-Case Scenario*	
(1)	Total loans		100	100	100	100
(2)	Stock of NPL in 2010/2011 [1]		9.3	7.7	9.2	7.4
(3)	Loan Loss Reserves		2.9	2.9	2.6	2.6
(4)	LGD for NPLs (percent)		50	45	50	45
(5)	Expected losses from NPL	(2)*(4)	-4.6	-3.5	-4.6	-3.4
(6)	Reserves - Losses	(3)+(5)	-1.8	-0.6	-2.0	-0.7
(7)	Losses from Securities		-0.5	-0.1	-0.5	-0.1
	Adding repossessions					
(8)	**Repossessions in 2010/2011** [1]		**8.5**	**8.4**	**5.7**	**6.4**
(9)	Reserves for repossessions		0.8	0.8	0.8	0.8
(10)	LGD for repossessions (percent)		60	55	60	55
(11)	Expected losses from repossessions	(8)*(10)	-5.1	-4.6	-3.4	-3.5
(12)	Repossession Reserves - Losses	(9)+(11)	-4.3	-3.9	-2.6	-2.7
(13)	Total Reserves - Total Losses	(6)+(7)+(12)	-6.6	-4.5	-5.2	-3.6
(14)	Pre-provision earnings in 2010-2012		6.5	4.4	5.1	3.5
(15)	Drain on capital [2]	-(13)-(14)	0.2	0.1	0.1	0.1
(16)	**Gross drain on capital (€ bn)** [3]		**1**	**6**	**5**	**17**
(17)	*Memo:* Tier 1 capital (end-2009, € bn)		99	78	99	78

Source: IMF staff estimates.

[1] 2010 for the baseline; 2011 for the adverse case.

[2] Drain on capital = - (net pre-provision earnings - writedowns).

[3] Gross drain aggregates only those banks with a drain on capital.

often unavailable on an individual bank basis, especially for savings banks. NPLs for individual banks are expected to grow twice as slowly as repossessions for the overall system, using the same level of differentiation as in 2009:Q3.[72] Individual banks' earnings are assumed to grow at the same rate as the system under the baseline. Table 1.12 shows that the cutoff rates for repossessions in 2010 in percent of customer loans for banks that are projected to have drain on capital are 8.5 percent for commercial banks and 8.4 percent for savings banks in 2010 under the baseline (line (8) in Table 1.12). Gross drain on capital is estimated at €1 billion and €6 billion for commercial and savings banks, respectively, under the baseline (line (16) in Table 1.12). The larger drain on capital for savings banks compared to commercial banks can be explained by weaker earnings of savings banks and a greater proportion of savings banks with very large amounts of repossessions.

Under the adverse case scenario, the cutoff rates for repossessions for banks with drain on capital are lower, so larger portions of the sectors are expected to come under pressure. Gross drain on capital is estimated at €5 billion and €17 billion for commercial and savings banks, respectively

[72] The assumption is based on repossessions being viewed as the overall risk factor which can also be extended to some degree (in our case, 50 percent) to NPLs. In other words, banks use both repossessions and NPLs to manage credit risks. However, a counterargument can be made that banks that bring real assets onto balance sheets effectively reduce their NPLs. The results of the exercise are likely to change under the inverse relationship assumption, generating a lower estimate for the impact on capital.

(line (16) in Table 1.12). These capital drain amounts—€5 billion for commercial banks and €17 billion for savings banks—can be interpreted as capital required to bring the respective Tier 1 capital ratios back to the levels at end-2009, assuming that risk-weighted assets remain constant in 2010.

Main Implications

Our conclusion is that a small gross drain on capital is expected in both commercial and savings banks under the baseline, despite severe economic deterioration. Under our adverse scenario, gross drain on capital could reach €5 billion and €17 billion at commercial and savings banks, respectively. These estimates are subject to considerable uncertainty and are relatively small in relation to both overall banking system capital, and importantly, the funds set aside under the resolution and recapitalization program set up by the government under the FROB of €99 billion. So far, three restructuring plans have been approved under the FROB involving a total of eight savings banks. The existing FROB scheme is currently scheduled to expire by June 2010. It is therefore important that the comprehensive resolution and restructuring processes financed through the FROB be under way before that date.

Annex 1.4. Assessment of the German Banking System[73]

This annex provides an assessment of potential writedowns on loans and securities, and estimates drains on capital for three major categories of German banks. The results of the exercise show that commercial banks have recognized most of the estimated total writedowns and appear to be adequately capitalized. In contrast, Landesbanken and savings banks, and other banks are yet to record a substantial part of total estimated writedowns, and are expected to have a net drain on capital.

Our estimation of potential losses and the impact on capital benefited from collaboration with the Bundesbank. The analysis focuses on the three main banking sectors: commercial banks, Landesbanken[74] and savings banks, and other banks. The exercise consists of three parts: econometric forecasting of loan losses, sample-based estimation of securities' writedowns, and the calculation of the impact on capital.

The estimates of losses on loans and securities for the three banking sectors are summarized in the first table. Two sets of assumptions pertaining to the uncertainty in prices of collateralized debt obligation (CDO) securities are presented.[75] Our loss estimates for the baseline case show that total bank writedowns for 2007–10 may reach a combined $314 billion. Under the adverse case assumptions, the writedowns are estimated at $338 billion for the overall banking system (Table 1.13).

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[73] This annex was prepared by Sergei Antoshin and Narayan Suryakumar.

[74] Landesbanken are regionally oriented. Their ownership is generally divided between the respective regional savings banks associations on the one hand and the respective state governments and related entities on the other. The relative proportions of ownership vary from institution to institution.

[75] CDO prices are characterized by the highest loss rates across security classes and have a significant impact on the overall estimates of losses on securities. In our baseline case, we assume that loss rates for CDOs are 50 percent, while in the adverse case, they are assumed at 70 percent.

Table 1.13. Estimates of German Bank Writedowns by Sector, 2007-10
(In billions of U.S. dollars, unless otherwise shown)

	Estimated Holdings	Estimated Writedowns (Baseline)	Estimated Writedowns (Adverse case)	Implied Cumulative Loss Rate (Baseline, in percent)	Implied Cumulative Loss Rate (Adverse, in percent)
Commercial Banks					
Total for Loans	1,765	66	66	3.7	3.7
Total for Securities[1]	346	66	77	19.2	22.3
Total for Loans and Securities	**2,111**	**132**	**143**	**6.2**	**6.8**
Landesbanken and Savings Banks					
Total for Loans	1,806	102	102	5.7	5.7
Total for Securities	663	41	49	6.1	7.3
Total for Loans and Securities	**2,470**	**143**	**151**	**5.8**	**6.1**
Other Banks					
Total for Loans	557	17	17	3.1	3.1
Total for Securities [2]	148	22	27	14.9	18.1
Total for Loans and Securities	**705**	**39**	**44**	**5.6**	**6.3**
All Banks					
Total for Loans	4,128	185	185	4.5	4.5
Total for Securities	1,157	129	152	11.2	13.2
Total for Loans and Securities	**5,286**	**314**	**338**	**5.9**	**6.4**

Note: Totals may not exactly match sum due to rounding.
[1] Securities holdings include RMBS, CMBS, CDOs, Consumer ABS, Corporate and Government securities. Loss rates for the RMBS securities average 28 percent, and those for CDO holdings range between 50-70 percent. Given the uncertainty in loss rates for CDOs, we use a range instead of an absolute level. We categorize the lower bound of this range as our baseline scenario and the upper bound as an adverse case, reflecting the CDO price uncertainty.
[2] Other banks include credit co-operatives, a bank currently under government support and two other banks

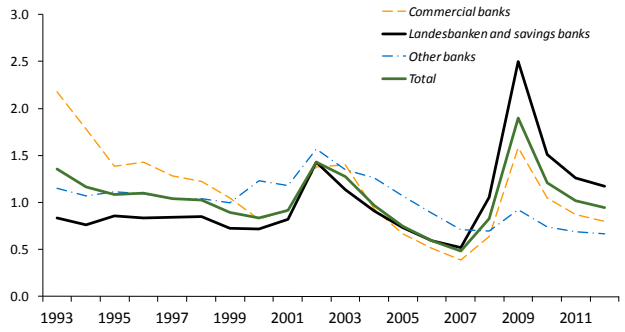
Among the three banking categories, the Landesbanken and savings banks group has the highest loan loss rate, owing largely to the large losses that occurred at the Landesbanken. Landesbanken hold 50 percent of the second sector's total loans and are characterized by relatively higher loan loss rates. Securities losses are driven by significant holdings of RMBS and CDO securities, which comprise between 50–70 percent of all structured products held by the three categories. Within the Landesbanken and savings banks group, securities losses are mostly attributed to Landesbanken which hold over 90 percent of structured products and represent 60 percent of total securities holdings in the sector. As further analysis shows, it is the variability in the pace of recognition of these losses that results in different outcomes for the adequacy of capitalization.

Loan Loss Estimation

The methodology for loan loss estimation using dynamic panels for the three groups of banks is described in detail in Box 1.7. The forecasts are obtained assuming that bank-specific

variables are constant and using WEO projections for GDP growth and the market-based forward yield curve slope (Figure 1.43). The overall loan loss rate is estimated to have peaked in 2009 at 2 percent and is projected to decline to 1.3 percent in 2010.[76] The 2009 peaks of loan loss rates for commercial and savings banks have exceeded the previous peaks in 2002–03, due to their high sensitivity to GDP growth. Figure 1.44 shows how these provision rates translate into euro losses.

Figure 1.43. Germany: Loan Loss Rates
(In percent of total loans; population-based)

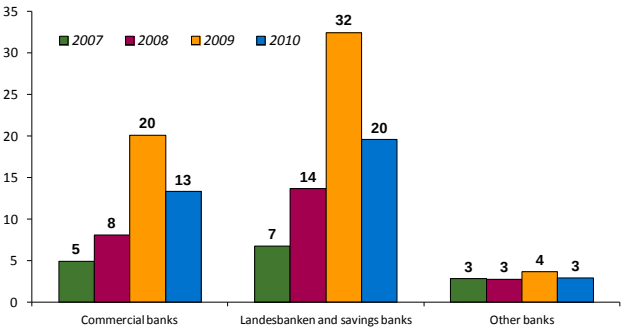


Source: IMF staff estimates.

Securities Writedowns

The estimation methodology for securities losses in Germany is similar to that for the euro area described in the previous GFSRs.[77] The data on holdings of securitized assets was obtained from the central bank's quarterly survey of 18 major banks, and accounted for over 90 percent of all such holdings by German credit institutions. The survey data was broken down into the following asset categories[78]: RMBS, CMBS, Consumer ABS, CDOs, and other securitized products. In order to determine securities' loss rates, we used the CMBS and RMBS price indices from the European Securitisation forum and the euro area Aggregate Corporate benchmark index for corporate securities.

Figure 1.44. Germany: Loan Losses
(In billions of euros)



Source: IMF staff estimates.

[76] The ratio of the overall loss rate in 2009 to the overall loss rate in 2008 is 3.3, which is similar to the respective ratio for our sample of German listed banks whose 2009 loan loss provisions are already publicly available.

[77] The aggregated balance sheet data, including the composition of the securities holdings, the profit and loss accounts, and capital bases for the different banking categories were obtained from the Bundesbank.

[78] The proportion of structured products to total securities holdings is roughly 60 percent for commercial banks, 65 percent for other banks, and 18 percent for Landesbanken and savings banks.

Box 1.7. Loan Loss Estimation for Germany[1]

The data used for loan loss estimation are from supervisory annual reports. The approach to estimation was broadly similar to the one described in the 2009 Bundesbank's *Financial Stability Review* with modifications to the estimation equation and separate procedures for three banking sectors: commercial banks, Landesbanken and savings banks, and other banks.

The sample used for estimation consists of 117 commercial banks (in 2008) representing 83 percent of total assets in the data set, 440 Landesbanken and savings banks (99.6 percent of total assets), and 1,060 other banks (97 percent of total assets), with the sample of annual observations for 1993–2008.

In order to capture bank-level differentiation in cross-section and time variations, we regress the loan loss rates on its lags, banks' total assets (size effect), the nonperforming loan ratio (a proxy for credit risk), the lending ratio (total loans to total assets), real GDP growth and its lags, the unemployment rate and its lags, and the slope of the yield curve. The final representations are presented below.

For commercial banks:

$$LN(LLRATE_{it}) = 0.2961*L.LN(LLRATE_{it}) - 0.2237*LN(SIZE_{it}) + 0.2255*LN(NPL_{it})$$
t-statistic 18.7 -12.1 26.2

$$- 11.206*DGDP_t + 3.421$$
-13.2 8.0

For Landesbanken and savings banks:

$$LN(LLRATE_{it}) = 0.2267*L.LN(LLRATE_{it}) + 0.1797*LN(SIZE_{it}) + 0.2903*LN(NPL_{it})$$
t-statistic 20.5 10.9 31.7

$$+ 0.1575*LN(LR_{it}) - 11.473*DGDP_t - 6.762$$
3.7 -23.5 -17.5

For other banks:

$$LN(LLRATE_{it}) = 0.2014*L.LN(LLRATE_{it}) + 0.07795*LN(SIZE_{it}) + 0.3277*LN(NPL_{it})$$
t-statistic 31.9 6.3 60.1

$$- 4.626*DGDP_t + 0.0132*DIFF\_YIELD_t - 4.331,$$
-11.6 2.3 -16.1

where $LN(LLRATE_{it})$ is the log of the loan loss rate for bank i at time t, L. is the lag operator, $LN(SIZE_{it})$ is the log of total assets, $LN(NPL_{it})$ is the log of NPLs in percent of total loans, $LN(LR_{it})$ is the log of the total loans-to-total assets ratio, $DGDP_t$ is GDP growth, and $DIFF\_YIELD_t$ is the slope of the yield curve (10-year minus 1-year). The unemployment rate was insignificant when included together with GDP, and was removed from the final specifications.

[1]The box was prepared by Sergei Antoshin.

Expected Writedowns, Earnings, and Capital Requirements

Based on supervisory annual reports and our estimates for loans losses for 2009, banks will report $261 billion in writedowns by end- 2009 (Table 1.14). Commercial banks had a Tier 1 capital ratio of 11 percent, the highest among the sectors. The pace of loss recognition has varied considerably across the three categories. While commercial banks have recognized all combined losses on loans and securities, Landesbanken and savings banks are likely to face an additional $47 billion in losses in 2010, and the other banking category is expected to record a further $21 billion.[79]

Table 1.14. Germany: Bank Capital, Earnings, and Writedowns
(In billions of U.S. dollars, unless otherwise shown)

	Commercial Banks	Landesbanken and Savings Banks	Other Banks [1]	Total
Estimated Capital Positions at end-2009				
Total Reported and Estimated Writedowns at end-2009[2]	140	100	21	261
Tier1/RWA at end 2009, in percent	11.0	7.9	8.3	8.6
Scenario bringing forward expected earnings and Writedowns (Q1:Q4 2010)				
Expected Writedowns (Q1:Q4 2010) [3] (1)	-3	47	21	..
of which, Loans:	19	27	4	..
of which, Securities	-22	20	16	..
Expected net retained earnings through 2010 (2)	24	25	6	..
Net Drain on Capital [4] (3) = (1) - (2)	-27	22	14	36
Tier 1 capital at end 2009 [5]	184	155	45	200

Source: IMF staff estimates.
Note: Foreign-exchange rate assumed: 1EUR=1.4USD
[1] Other banks include credit co-operatives.
[2] The reported loan losses include estimates for 2009, while that for securities are as reported in Sept 2009
[3] Writedowns for securities are averages of our baseline and adverse case estimates. A negative sign indicates a write-up.
[4] Capital surpluses in one sector are not included in the total capital drain for the banking system.
[5] Tier 1 capital levels for 2009 are estimated. Tier 1 capital for the overall system excludes the Tier 1 capital for sectors that have a capital surplus.

Banks' earnings recovered in 2009, supported by the steep yield curve, reviving credit markets, and extensive government support measures. Going forward, interest income is expected to reverse these gains in 2010, due to shrinking lending margins. We assume that net interest income will decline 10 percent in 2010, given a significant flattening of the yield curve. Non-interest income and expenditures are expected to remain relatively stable, in line with the long-term trend.

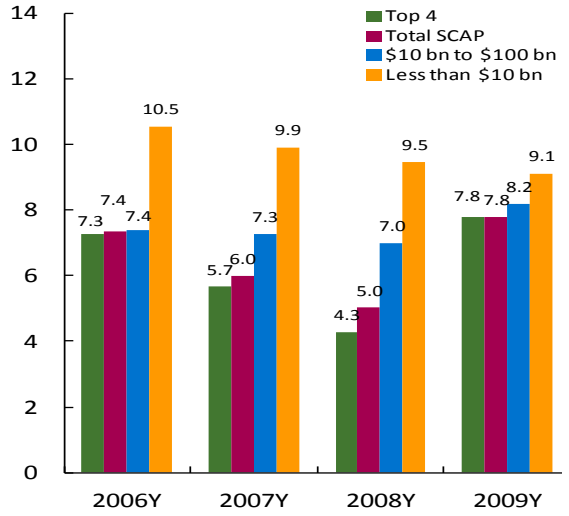
For commercial banks, strong capital positions at end-2009 and faster loss recognition are expected to have a positive effect on capital levels and ratios in 2010. In contrast, Landesbanken and savings banks are projected to have sizable losses in 2010, leaving them with a net drain on capital of $22 billion. A larger portion of the drain resides in Landesbanken. Other banks are expected to have a net drain of $14 billion. These capital drain amounts—$22 billion for Landesbanken and savings banks and $14 billion for other banks—can be interpreted as capital required to bring the respective Tier 1 capital ratios back to the levels at the end of 2009, assuming that risk-weighted assets remain constant in 2010.

[79] The remaining securities losses for savings and other banks are assumed to be recognized through the profit and loss account in 2010. Given that banks need not mark-to-market their entire securities portfolio, our assumption on the impact on earnings and capital is a conservative one.

Annex 1.5. United States: How Different Are "Too-Important-To-Fail" U.S. Bank Holding Companies (BHCs)?

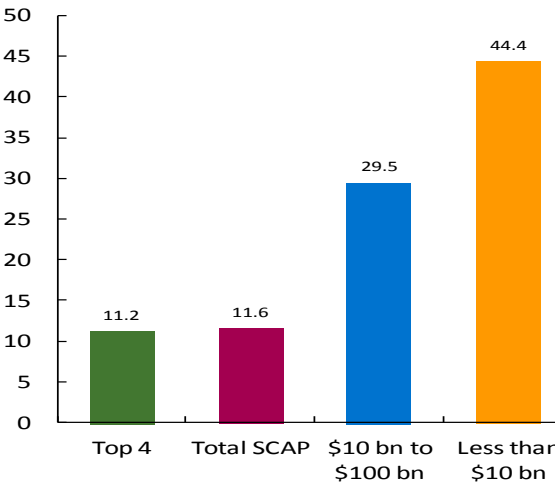
The largest BHCs came into the crisis with the lowest capital buffers...

Tier 1 Common Equity To Risk-Weighted Assets
(In percent)



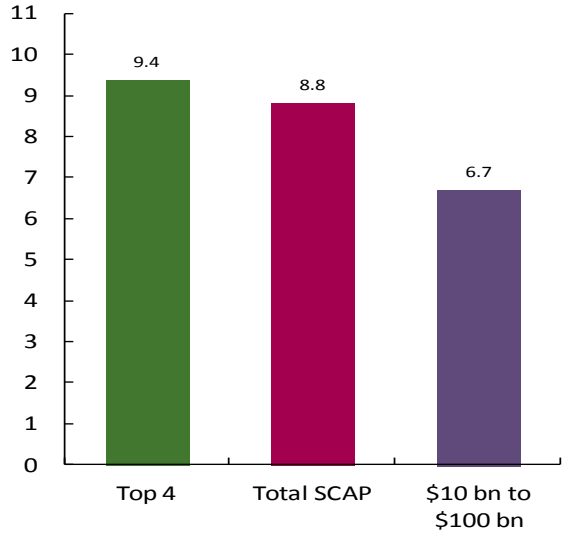
... and the lowest reliance on customer deposits as a funding source…

Customer Deposits To Total Liabilities
(In percent)



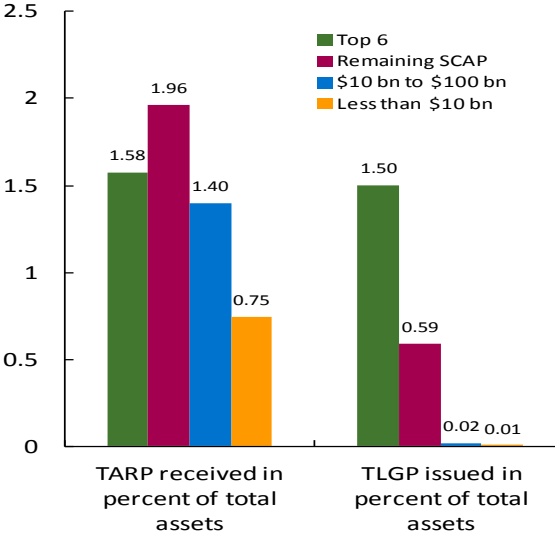
...but experienced the largest cumulative losses during the crisis…

2007:Q4-2009:Q3 Cumulative Net Charge-offs To Total Loans *(In percent)*



... and required the most government support.

TARP And TLGP Support
(In percent of total assets)

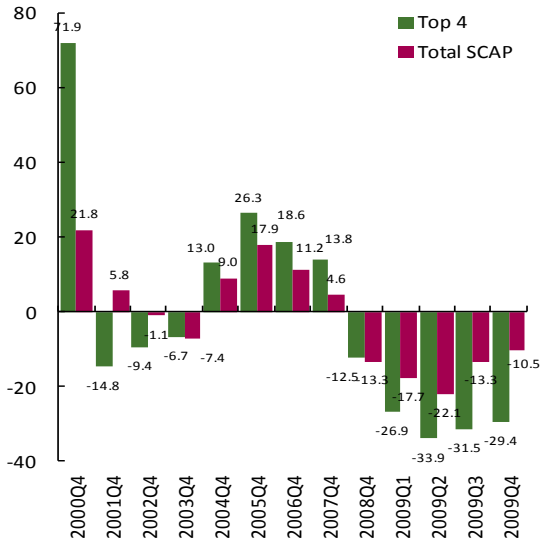


Sources: SNL Financials; and IMF staff estimates.
Notes: SCAP - Supervisory Capital Assessment Program. TARP - Troubled Asset Relief Program. TLGP – Temporary Liquidity Guarantee Program. This annex was prepared by Andrea Maechler and Geoffrey Noah.

The largest firms faced also lower funding costs…

Cost Of Funds

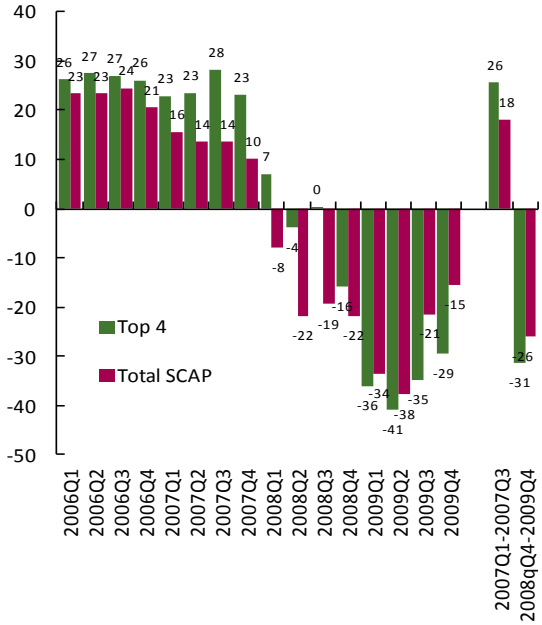
(In percentage change from industry-wide average)



… that acted like a "subsidy" …

Tax (Subsidy)

(In billions)



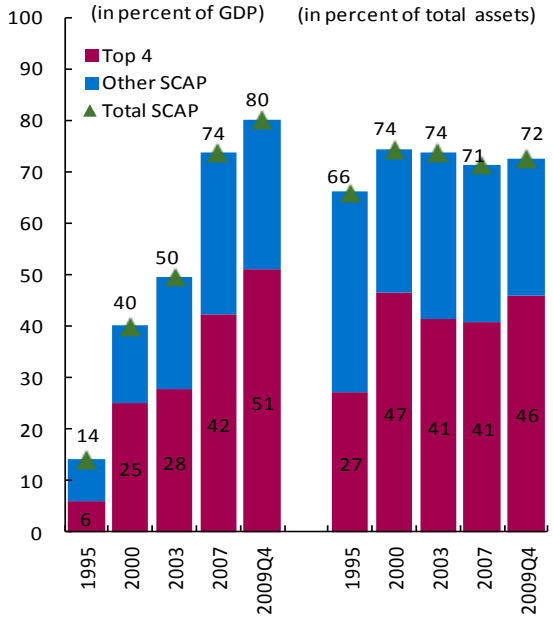
… and helped boost profits…

Quarterly Net BHC Income To Total Assets

(In percent)

… while gaining in asset market share.

Share Of Total Bank Assets



Sources: SNL Financials; and IMF staff estimates.
Notes: SCAP - Supervisory Capital Assessment Program.

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CHAPTER 2

SYSTEMIC RISK AND THE REDESIGN OF FINANCIAL REGULATION

Summary

The recent financial crisis has triggered a rethinking of the supervision and regulation of systemic connectedness. While there is a clear need to take a multipronged approach to systemic risk, and a flood of regulatory reform proposals has ensued, there is considerable uncertainty about how those proposals can be practically applied. Thus, this chapter aims to contribute to the debate on systemic-risk-based regulation in two ways. First, it presents a methodology to compute and smooth a systemic-risk-based capital surcharge. Second, it formally examines whether a mandate, by itself, to explicitly oversee systemic risk, as envisioned in some recent proposals, is likely to be successful in mitigating it.

Systemic-Risk-Based Surcharges

While not necessarily endorsing the adoption of systemic-based capital surcharges, the first part of the chapter presents a methodology to calculate such surcharges. Underpinning this methodology is the notion that these surcharges should be commensurate with the large negative effects that a financial firm's distress may have on other financial firms—their systemic interconnectedness.

The chapter presents two approaches to implement this methodology:

- A ***standardized approach*** under which regulators assign systemic risk ratings to each institution and then assess a capital surcharge based on this rating.
- A ***risk-budgeting approach,*** which borrows from the risk management literature and determines capital surcharges in relation to an institution's additional contribution to systemic risk and its own probability of distress.

Regulatory Architecture

The chapter also argues that an important missing ingredient from most architecture reform proposals is the analysis of regulators' incentives—including regulatory forbearance incentives to keep institutions afloat when they should be unwound—that will likely vary across the alternative ways the regulatory functions could be allocated.

In particular, the chapter shows how adding a systemic risk monitoring mandate to the regulatory mix without a set of associated policy tools does not alter the basic regulator's incentives at the heart of some of the regulatory shortcomings leading to this crisis. In fact, in the absence of concrete methods to formally limit the ability of financial institutions to become systemically important in the first place—regardless of how regulatory functions are allocated—regulators are still likely to be more forgiving with systemically important institutions than with those that are not.

For this reason, it is necessary to consider more direct methods to address systemic risks, such as instituting systemic-risk-based capital surcharges, applying levies that are related to institutions' contribution to systemic risk, or perhaps even limiting the size of certain business activities. Which measures are finally chosen will have a significant impact on the financial sector.

A wide range of official, academic, and private sector financial reform initiatives have surfaced in response to the recent global financial crisis. These include the establishment of a specialized supervisor of systemically important firms, refinements in the lender-of-last-resort principles, new funding liquidity and leverage restrictions for banks, and capital surcharges based on an institution's likely contribution to systemic risk.

Several of these proposals suggest that regulations guiding the risk management practices of financial institutions are in need of significant improvements and, more specifically, that the focus on the stability of a financial institution in isolation needs to be reassessed. The proposals also suggest that prudential reform efforts need to be supported by an overhaul of the current structure of financial regulation.

The introduction of capital charges based on an institution's contribution to systemic risk is one regulatory proposal that has attracted attention, and the chapter illustrates how this can be done. Although the chapter does not necessarily endorse the adoption of such charges, it illustrates how they can be made operational and at the same time correct for the procyclicality of these charges, thereby countering a critique often leveled against the current set of Basel II capital charges—and one that the Basel Committee on Banking Supervision is now addressing forcefully.

The adoption of capital surcharges and related regulatory measures is likely to represent an additional burden on the financial sector at a time when capital is scarce, and should thus be implemented carefully so as to ensure the availability of adequate credit to support the recovery. Moreover, to fully assess the desirability of surcharges, their costs need to be contrasted against the benefit of lowering systemic risk and the desirability of other measures.

At the financial regulatory architecture level, one of the most prominent proposals is the creation of a systemic risk regulator that would focus on the macroprudential monitoring of the financial system as a whole. This responsibility could be carried out either by new regulators or existing regulators with a new focus. While the benefits of strengthening oversight of systemic risk are considerable, implementation of such oversight may not be straightforward, as it will require close coordination and clear delineation of responsibilities between the new and existing (or systemic and nonsystemic) supervisory bodies. This chapter therefore suggests some key principles that need to be borne in mind in implementing the oversight of systemic risk. It shows that under an expanded mandate to oversee systemic risks, regulators will tend to exercise more forbearance against systemically important institutions than nonsystemically important ones. This suggests that, regardless of how regulatory functions are arranged, regulators' toolkits will need to be augmented to mitigate systemic risks.

It is worth noting that there is no one definition of systemic risk, which this chapter defines as the large losses to other financial institutions induced by the failure of a particular institution due to its interconnectedness.[1]

Implementing Systemic-Risk-Based Capital Surcharges

Calls for more and higher-quality capital were the first natural reaction to the crisis. In time, these calls have been shaped into more concrete proposals (Box 2.1 and Table 2.1). One proposal is the introduction of systemic-risk-based capital charges. However, certain challenges will need to be confronted in order to ensure the effective operationalization of these surcharges. In particular, if one views systemic risk as the systemic linkages that are likely to arise from the complex web of contract relationships across financial institutions, then a practical way to estimate institutions' interconnectedness and their corresponding contribution to systemic risk is required. In addition, systemic-risk-based capital charges have the potential to be procyclical, as they will increase in economic downturns (when systemic risk is likely to be higher) and decrease during booms (when systemic risk

Note: The authors of this chapter are Marco A. Espinosa-Vega (team leader), Juan Solé, and Charles M. Kahn. Special thanks to Rafael Matta for outstanding research support and Jean Salvati for his help in adapting the CreditRisk+ model. Yoon Sook Kim provided data management assistance.

[1]See Chapters 2 and 3 of the April 2009 *Global Financial Stability Report* (IMF, 2009) for a more complete discussion of various definitions of systemic risk.

Table 2.1. Comparison of Some Methodologies to Compute Systemic-Risk-Based Charges

Methodology/Proposal	Authors	Data Requirements	Pros	Cons
Proposals to design capital surcharges based on inter-bank correlations of returns	Acharya (2009)	Data on banks' returns	Based on easily accessible market data.	Data may be unreliable under tail events and/or not representative of underlying fundamentals during stress periods. Charges could be procyclical. Does not take into account second-round contagion effects.
Proposals to design capital surcharges based on measures of institutions' and markets' degree of "exuberance"	Bank of England (2009)	Economic activity indicators, credit default swaps (CDS), equity prices, real estate prices	Capital surcharge displays anticyclical behavior.	May be difficult to estimate institutions' and markets' degree of exuberance on an ongoing basis. Does not take into account second-round contagion effects.
Proposals to design capital surcharges based on co-movements of banks' risks (e.g., co-value-at-risk; Adrian and Brunnermeier, 2008)	Brunnermeier and others (2009) and Chan-Lau (forthcoming)	CDS and equity data	Based on easily accessible market data.	Data may be unreliable under tail events and/or not representative of underlying fundamentals during stress periods. Charges could be procyclical. Does not take into account second-round contagion effects.
Two alternative approaches to design capital surcharges	This report and Espinosa-Vega and Solé (forthcoming)	Data on interbank exposures and balance sheet information	Gives the regulator the choice between a refined and a practical approach. Relies on data available to financial regulators. Takes into account second-round contagion effects.	Intensive data requirements (interbank exposures).
Tax based on over-the-counter (OTC) payables in derivative markets	Singh (2010)	Data on payables in OTC derivatives	Based on off-balance-sheet data. Includes netted exposures, measuring the potential systemic interconnectedness of these contracts more accurately.	Tax would only be based on banks' OTC derivative payables. Does not increase institutions' capital base. Does not take into account second-round contagion effects.

Source: IMF staff.

is likely to subside). In fact, most of the proposed approaches in Table 2.1 suffer from this issue.

This chapter contributes to the debate on the merits and feasibility of systemic-risk-based capital surcharges by presenting two approaches of a methodology to compute these charges. The methodology is not meant to be prescriptive. Instead, the goal is to contribute to the discourse on the design of prudential regulation based on each institution's contribution to systemic risk.[2] The chapter also illustrates that smoothing the charge through time could lessen the degree of procyclicality potentially associated with systemic capital charges, though it does not address the existing procyclicality of Basel II capital charges. The proposed methodology comprises the following steps:

(1) Tracking financial institutions' portfolios through the credit cycle;

(2) Estimating each institution's spillover effects following a stress event, at each point in the cycle, based on network analysis; and

(3) Computing capital surcharges as a function of an institution's systemic risk profile according to two alternative approaches: a "standardized" approach and a more refined approach that borrows from the risk management literature and that is dubbed "risk-budgeting" approach.

In addition, a smoothing technique is applied to the risk-budgeting approach to lessen its procyclical profile.

To demonstrate these ideas and provide the intuition, every step of the proposed methodology is illustrated by means of examples. The rest of this section explains in detail each of these steps as applied to a selected number of hypothetical banks.

[2]See Bank of England (2009) for an insightful discussion of some of the issues involved in the operationalization of systemic capital surcharges.

Box 2.1. Proposals for Systemic Risk Prudential Regulations

This box presents a critical review of some recent proposals to reform prudential regulation so as to curb the negative effects of financial system linkages.

Proposals in the U.S. House of Representatives and Senate put forward broad criteria to identify the degree of an institution's systemic risk, including the sources and term structure of funding, the extent of leverage, relationships with other financial firms, and concentration. However, the way in which these criteria would be unified and used to identify the degree of an institution's systemic risk has not been spelled out. Furthermore, the proposals focus entirely on firm-specific data without taking account of indirect financial linkages arising from market perceptions of common risk exposures or the influence of general market conditions. It is also unclear what type of prudential measures would be put in place to limit these firms' systemic risk contributions.[1,2]

The U.K. Financial Services Authority (FSA, 2009) has put forward an idea that size, interconnectedness, and markets' perception of common exposures are recognized as key elements in determining a financial firm's degree of systemic importance. As in the United States, the FSA has not detailed the way these criteria would be used to identify the degree of an institution's systemic risk. However, U.K. proposals (FSA and the Bank of England[3]) have been forceful in calling for a *continuous approach* to identify and limit these firms' systemic risk contributions. That is, U.K. proposals call for tying the stringency of prudential requirements to the degree of financial firms' contributions to systemic risk. By contrast, an alternative *binary approach* in which regulators set static cutoff thresholds, whereby some firms would be considered of systemic importance and others would not, would leave room for regulatory arbitrage and increased moral hazard. Also, the Bank of England (2009) has provided an illustrative methodology for implementing capital surcharges that take into account each firm's marginal contribution to systemic risk.

Cross-Border Spillovers

The FSA has suggested the need to design capital surcharges for globally active financial groups as a function of their business risk profile (e.g., the extent of their trading and wholesale activities) and organizational structure (subjecting globally integrated groups to group-wide prudential surcharges). The rationale behind the idea is that penalizing integrated groups would encourage conventional commercial banking activities carried out through local subsidiaries, which are viewed as being better regulated by supervisors in the host countries. However, as with the proposals to identify financially important firms, the details are sketchy.

Liquidity Regulation

Compared to capital regulations, liquidity regulations are still in an early stage of discussion. Little work has been done on measuring a firm's contribution to systemic liquidity risk. Recently, the Basel Committee recommended a standardized approach to estimate the amount of liquid assets banks must hold, regardless of their systemic risk profile. The FSA is the first major regulator to introduce tighter liquidity standards for financial firms following the crisis. The FSA now requires banks to perform stress tests by taking account of three types of liquidity stress—idiosyncratic, market-wide, and a combination of the two—to determine the fraction of easily redeemable assets they would need to have to meet potential outflows of funds over certain periods.

Note: The author of this box is Kazuhiro Masaki.

[1]U.S. House of Representatives, *Wall Street Reform and Consumer Protection Act of 2010* (H.R.4173).

[2]U.S. Senate Committee on Banking, Housing, and Urban Affairs, *Restoring American Financial Stability Act of 2009* (see chairman's marked text, March 2010).

[3]Paul Tucker, Barclays Annual Lecture, October 2009.

Tracking Institutions' Portfolios through the Credit Cycle

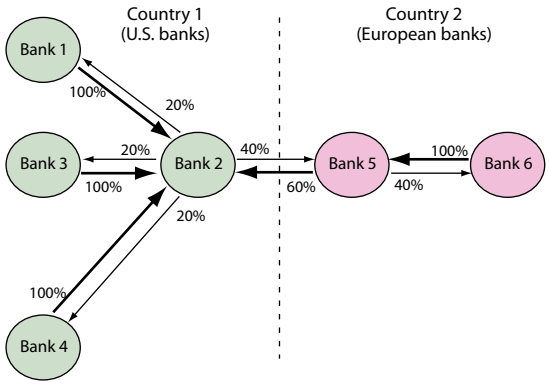
The chapter considers the portfolios of six hypothetical financial institutions, four of them mimicking important features of the U.S. banking system and two representing stylized features of European banks—in terms of the size, composition, and quality of their portfolios. More specifically, the six prototypical institutions are constructed from the end-2006 balance sheet and financial statements of a sample of representative large and internationally active U.S. and

European banks.[3] The composition of the portfolios analyzed was inspired by information on U.S. and European institutions' annual reports and the U.S. Securities and Exchange Commission's 10-K filings.

The portfolios that are analyzed comprise securities, mortgages, and interbank assets. The size of the securities and mortgage portfolios was designed to represent the weighted average of the portfolios of the selected institutions, respectively. In terms of relative size, securities portfolios for U.S. banks were designed to be close to 20 percent larger than European banks, while the mortgage portfolios for U.S. banks were designed to be, on average, around 115 percent larger. Finally, regarding the quality of the securities portfolios, the chapter follows Gordy (2000) and Peura and Jokivuolle (2004)—who exploit the results from internal Federal Reserve Board surveys of large banking organizations—and considers four possible portfolio quality classifications (high, average, low, and very low). These portfolios are far from a full characterization of the U.S. and European banking systems and are constructed simply for pedagogical purposes.

Interbank exposures are a key element to assess network spillovers. In the absence of detailed interbank exposure data, the chapter assumes the network structure depicted in Figure 2.1. This particular configuration was inspired by a seemingly similar structure reported by several authors (e.g., Boss and others, 2004; Müller, 2006; and Upper and Worms, 2004), which consists of a few large banks that are highly interconnected, and a larger number of smaller banks that are connected to the rest of the network (mostly) through one of the larger banks.[4] The network includes a different number of banks from two different jurisdictions (i.e., four U.S. institutions and two European institutions) to illustrate several cross-border systemic risk issues that need to be addressed.[5]

Figure 2.1. Network Structure of Cross-Border Interbank Exposures



Source: IMF staff calculations.

Note: Percentage number indicates interbank exposure in percent of lending bank's total interbank exposure. The origin of the arrows denotes the lending bank and the end of the arrow denotes the borrowing bank; the thickness of the arrows is proportional to the value of the bilateral exposure.

[3]December 2006 was selected to obtain balance sheets that reflect a pre-crisis period without the influence of the fallout of the crisis.

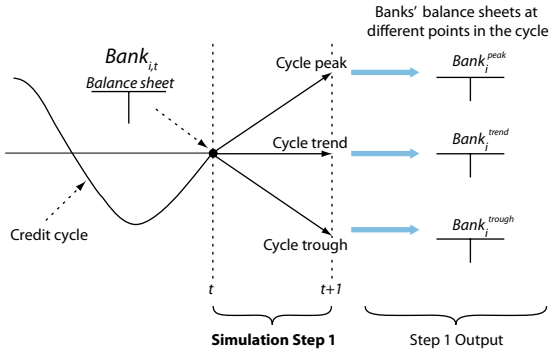
[4]Notice that Figure 2.1 depicts only the flows within the network of the representative U.S. and European institutions. In reality, these institutions have connections to other institutions outside this network, which were excluded for simplicity.

[5]Note, however, that the number of institutions chosen is for illustrative purposes and does not represent a characterization of the relative size of the U.S. and European banking systems. The chapter assumes that U.S. bank holdings of interbank assets are

In particular, the subsection on *cross-border issues* illustrates how capital surcharges calibrated from a global perspective could differ from those calibrated from an individual country perspective.

In addition to a static view of firms' portfolios, it is essential to track their evolution through the credit cycle for two key reasons: first, to assess how network spillovers—and, hence, systemic risk—evolve with economic conditions; and second, to evaluate the potential procyclicality of systemic-based capital surcharges. This step would be straightforward for those regulators with access to comprehensive historical data. However, in the absence of such data, the chapter simulates the evolution of the institutions' portfolios at different points in a stylized credit cycle and the corresponding capital adequacy requirements based on the Basel II capital adequacy requirements as shown in Figure 2.2.

Figure 2.2. Simulation Step 1: Illustration of the Evolution of Banks' Balance Sheets at Different Points in the Cycle



Source: IMF staff calculations.

Assessing Institutions' Potentially Systemic Linkages

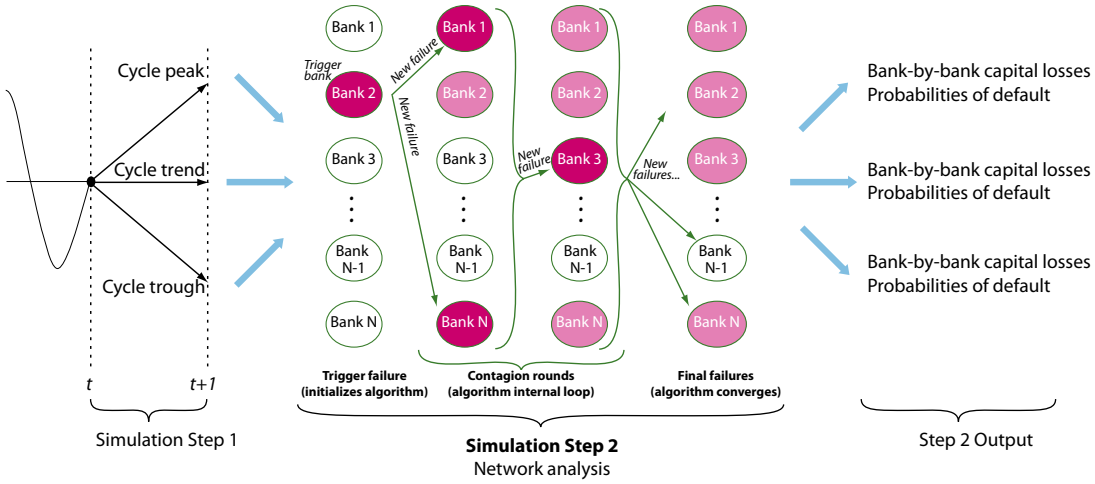
Although research on measuring institutions' systemic linkages is still in its infancy, important breakthroughs have been accomplished recently.[6] Broadly speaking, these methodologies can be divided into (1) those that rely primarily on market data (such as equity, option prices, and credit default swap spreads) and (2) those that rely on institutional data (such as balance sheets and interbank exposures data). In practice, regulators are likely to draw on a combination of those methodologies. However, for brevity, this chapter focuses on network analysis, which relies on institutional data, to assess potentially systemic linkages.[7] Although the analysis is applicable to any set

equivalent in size to 3 to 10 percent of their portfolios of securities plus mortgages, whereas European banks hold the equivalent of 15 percent of their securities plus mortgage portfolios in interbank assets. This assumption is in line with the observation that European banks tend to hold more interbank assets (as a proportion of total assets) than U.S. banks (see Upper, 2007).

[6]Recent advances can be found in BIS (2009), IMF (2009), and IMF/BIS/FSB (2009), among others. This chapter exploits the network methodology described in IMF (2009, Chapter 2); other methodologies, such as the contingent claims approach (Gray and Jobst, 2009), co-value-at-risk (Adrian and Brunnermeier, 2009), co-risk (Chan-Lau, forthcoming), and Shapely values (Tarashev, Borio, and Tsatsaronis, 2009)—or, indeed, a combination of these measures (e.g., an indicator-based approach)—could be used instead.

[7]In particular, the chapter uses a network model to track the spread of credit shocks throughout the network of banks. Thus, starting with a matrix of interbank exposures, the analysis con-

Figure 2.3. Simulation Step 2: Illustration of Contagion Effects at Different Points in the Credit Cycle



Source: IMF staff calculations.

of financial institutions, the analysis takes the evolution of banks' portfolios as inputs, and uses a network model to estimate the potential systemic distress that hypothetical institution-by-institution interbank defaults would induce at different points in the cycle (Figure 2.3). For the purpose of this exercise, institutions are defined to be in distress when their capital adequacy ratio falls below 4 percent, because many supervisors focus on this ratio as a trigger for the deployment of early intervention measures. The contagion effects, in turn, are measured in terms of system-wide *after-shock* capital losses.

Two Approaches to Compute Capital Surcharges

In addition to the information on the spillover effects, the network analysis can be used to estimate each institution's post-shock probabilities of default. This subsection illustrates how this information is used to calculate a systemic-risk-based capital surcharge according to two alternative approaches: a standardized approach and a more refined risk-budgeting approach. Importantly, both approaches move away from a *binary* characterization of systemic importance, a move advocated by, for example, the U.K. proposals (Box 2.1).

- Standardized approach: Regulators assign systemic risk ratings based on the amount of system-wide capital impairment that a hypothetical default of each institution would bring to bear on the financial system. Institutions with higher systemic risk rating are assessed higher capital surcharges.
- Risk-budgeting approach: Borrows from the risk management literature and determines capital surcharges as a function of an institution's marginal contribution to systemic risk and its own probability of distress.

As the section illustrates, the risk-budgeting approach delivers more refined estimates of the surcharges. However, given that the standardized approach starts from the same basic information as the risk-budgeting approach and both approaches deliver the same policy implications, the standardized approach may be a suitable alternative from a practical perspective. Moreover, despite its more modest modeling requirements, the standardized approach also meets the criteria being discussed. For instance, U.S. Treasury proposes that "capital requirements [for systemic institutions] should reflect the large negative externalities associated with the financial distress...of each firm" (U.S. Department of the Treasury, 2009, p. 24).

sists of simulating the default of a specific institution and tracking the domino effect to other institutions. See IMF (2009) and Espinosa-Vega and Solé (forthcoming) for a detailed explanation of the network model used for the simulations.

Example of the Standardized Approach

To illustrate how the standardized approach would work in practice, consider the case of a regulator instituting three possible systemic-risk ratings, according to the system-wide capital impairment that each institution's default would bring to bear on the others: Tier 1 (T1) for institutions deemed most systemic, Tier 2 (T2) for the second tier of systemic institutions, and nonsystemic (NS) for all other institutions.[8] Each of these rating categories would be associated with a predetermined capital surcharge—perhaps to be agreed upon in international forums. For illustrative purposes, in our example these charges are arbitrarily set to 4 percent of risk-weighted assets for T1 institutions, 2 percent for T2 institutions, and nil for nonsystemic institutions.

Table 2.2 presents the ratings assigned to each bank in our example based on the system-wide capital losses they would inflict on the financial system at different points in a stylized credit cycle. Since the goal is to lessen the probability of tail-risk scenarios, the regulator would identify the highest systemic risk rating assigned to each institution over the cycle and base the capital surcharge on that rating. For instance, Bank 6 obtains a T2 rating at the peak and trend points of the cycle, and a T1 rating in the cycle trough. In this case, Bank 6 would be assigned an overall systemic risk rating of T1, reflecting the fact that in a worst-case scenario this bank would be highly systemic. The ultimate systemic risk ratings for all banks are presented in Table 2.3.

It is important to note that the identification of an institution's systemic importance under this approach is sensitive not only to its spillovers, but also to its relative size and the stage of the credit cycle. These three factors—spillovers, size, and the stage of the business cycle—are in line with the factors that were noted in IMF/BIS/FSB (2009) as important in identifying potential systemic institutions (Box 2.2). For example, Bank 4 obtains its worst rating at the cycle peak since, during a boom, this bank's capital would grow to represent a fraction of the banking system's capital base above the threshold established to become a T2 institution (i.e., Bank 4 represents 20.3 percent of the banking system's capital versus the T2-threshold of 20 percent). Therefore, although its failure would not cause severe distress in other institutions (third column of Table 2.2), its demise would represent a significant capital loss for the sys-

[8]In our example, the systemic rating scale is as follows: a bank is assigned the rating nonsystemic if the capital of those institutions in distress as a consequence of its default is below 20 percent of the capital of all banks (both distressed and nondistressed); the rating Tier 2 (T2) is assigned if the capital of the distressed institutions is between 20 and 35 percent of the capital of all banks; and the rating Tier 1 (T1) if the capital of the distressed institutions is above 35 percent of the capital of all banks. Notice that in this example the systemic rating scale contains only three categories, but that in practice the standardized approach certainly allows for multiple (if not a continuum of) charges. Moreover, our choice of cutoffs is arbitrary.

Table 2.2. System-Wide Capital Impairment Induced by Each Institution at Different Points in the Credit Cycle and Associated Systemic Risk Ratings

	Simulation at Peak of Cycle		
Trigger Failure	Capital of Distressed Institutions *(in percent of system's capital)*	Number of Distressed Institutions Due to Contagion	Cyclical Rating
Bank 1	14.7	0	NS
Bank 2	85.3	4	T1
Bank 3	19.7	0	NS
Bank 4	20.3	0	T2
Bank 5	28.4	1	T2
Bank 6	28.4	1	T2
	Simulation at Trend of Cycle		
Trigger Failure	Capital of Distressed Institutions *(in percent of system's capital)*	Number of Distressed Institutions Due to Contagion	Cyclical Rating
Bank 1	15.0	0	NS
Bank 2	85.0	4	T1
Bank 3	19.5	0	NS
Bank 4	19.9	0	T2
Bank 5	28.4	1	T2
Bank 6	28.4	1	T2
	Simulation at Trough of Cycle		
Trigger Failure	Capital of Distressed Institutions *(in percent of system's capital)*	Number of Distressed Institutions Due to Contagion	Cyclical Rating
Bank 1	16.4	0	NS
Bank 2	83.6	4	T1
Bank 3	18.8	0	NS
Bank 4	18.6	0	NS
Bank 5	83.6	4	T1
Bank 6	83.6	4	T1

Source: IMF staff estimates.

Note: Systemic rating scale is as follows: nonsystemic (NS) if capital of distressed institutions is below 20 percent of capital of all banks; Tier 2 (T2) if capital of distressed institutions is between 20 and 35 percent of capital of all banks; Tier 1 (T1) if capital of distressed institutions is above 35 percent of capital of all banks. An institution is considered in distress when its capital falls below 4 percent of its risk-weighted assets.

Table 2.3. Capital Surcharges Based on the Standardized Approach

	Systemic-Risk Rating	Systemic-Risk Capital Surcharge
		(Percent of risk weighted assets)
Bank 1	NS	0.0
Bank 2	T1	4.0
Bank 3	NS	0.0
Bank 4	T2	2.0
Bank 5	T1	4.0
Bank 6	T1	4.0

Source: IMF staff estimates.

Note: T1 indicates institutions that are deemed to be highly systemic (Tier 1); T2 indicates institutions that are deemed to be relatively systemic (Tier 2); NS indicates institutions that are deemed nonsystemic.

tem as a whole.[9] Note also that Bank 2, at the center of the network, contributes the most to the loss of capital in the banking system (some 80 plus percent), showing the importance of spillovers.

By assigning and fixing the highest systemic-risk rating and corresponding surcharge through the cycle, the regulator removes the procyclicality of these charges. There are, of course, alternative ways of implementing a standardized approach. For example, the regulator could decide to impose a surcharge as a function of the frequency with which an institution is classified as Tier 1. This suggests potential advantages of implementing a more refined approach.

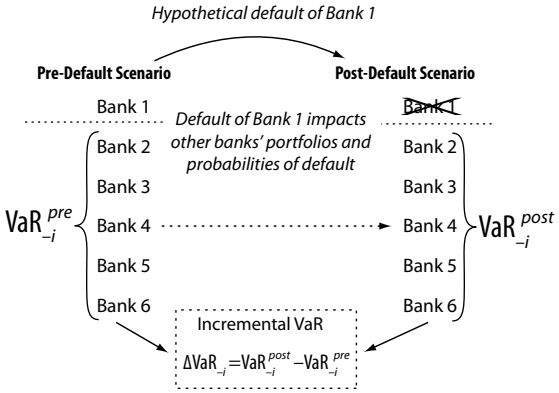
Example of the Risk-Budgeting Approach

The risk-budgeting approach is based on the estimates of an institution's marginal contribution to systemic risk. More specifically, under this approach, an institution's capital surcharge is determined as a function of its probability of default and its incremental credit value-at-risk (VaR)—defined as the increase in the system's VaR (i.e., the monetary losses that would be incurred in the system) brought about by the institution's default on its interbank exposures (Figure 2.4).[10]

[9]Bank 4 does not induce severe distress in other institutions because the relative size of its only connection to the network (i.e., through Bank 2) is not large enough to bring down Bank 2.

[10]VaR "summarizes the worst loss over a target horizon that will not be exceeded with a given level of confidence" (Jorion, 2007, p. 17). See also Chapter 7 of Jorion (2007) for a general introduction to incremental VaR, and Garman (1996, 1997) and Mina (2002) for examples of applications to asset management.

Figure 2.4. An Illustration of the Computation of Incremental Value-at-Risk for Bank 1



Source: IMF staff calculations.

Note: To estimate the systemic risk externalities induced by institution *i*'s default to the rest of the institutions in the sample, the chapter estimates the subsample's *pre*- and *post*- institution *i*'s default value-at-risk (VaR).

Box 2.2. Assessing the Systemic Importance of Financial Institutions, Markets, and Instruments

This box summarizes the high-level guidelines developed by the International Monetary Fund (IMF), Financial Stability Board (FSB), and Bank for International Settlements (BIS) for identifying systemically important institutions, markets, and instruments developed in response to a request from the leaders of the G-20.

At the London Summit on April 2, 2009, the G-20 leaders issued a "Declaration on Strengthening the Financial System" and called on the IMF, FSB, and BIS to develop guidelines on how national authorities can assess the systemic importance of financial institutions, markets, and instruments. The guidelines focused on institutions' activities, regardless of their legal charter. The main objective is to ensure that systemically important institutions, markets, and instruments are subject to an appropriate degree of oversight and regulation, reducing the scope for regulatory arbitrage. The guidelines were welcomed by the G-20 finance ministers and central bank governors at their November 2009 meeting. The report's main conclusions can be summarized as follows:

- *The concept of what constitutes systemic relevance.* Systemic risk is intimately related to financial stability and would be defined as a risk of disruption to financial services that (1) is caused by an impairment of all or parts of the financial system and (2) has the potential to have a serious adverse effect on economic activity. Assessments will need to depend on evolving economic and financial conditions, and would involve a high degree of judgment.
- *The criteria for determining systemic importance.* The report proposed criteria that include (1) the volume of financial services provided by the individual component of the financial system; (2) elements that are critical to the working of the financial system because there are no close substitutes; and (3) interlinkages between the elements where individual failure has repercussions by propagating stress. Potential vulnerabilities, including the degree of complexity of financial institutions, leverage, and maturity mismatches, should also be taken into account, as well as the capacity of the financial system to handle failures should they occur. Certain criteria will be both qualitative and quantitative. The assessment of the systemic importance of markets presents more conceptual challenges than that of institutions, but the criteria of size, substitutability, and interconnectedness remain relevant.
- *A toolbox of measures and techniques to operationalize the assessment of systemic risk.* These would range from fairly simple measures and indicators of size, substitutability, and interconnectedness to more sophisticated tools that measure interconnectedness through network analysis and co-movement in the performance of different components, as well as stress testing to take account of state dependency. Implementation will depend on data availability; improvements in data gathering are recommended to allow for effective assessments.
- *International guidelines for assessing systemic relevance, the form they might take, and their possible uses.* The objective is to establish a reasonable minimum framework that is sufficiently flexible to cater to a broad range of countries and circumstances, and that would reflect a set of good practices. Key elements would include the need to establish a framework for system-wide assessments, the use of appropriate information and methodologies, communication of assessment results depending on the purpose of the assessments, and cross-border cooperation in the assessments.

The guidelines would have a number of potential uses, including helping calibrate regulations to take account of systemic risks, to define the perimeter of regulation, and in the design of crisis management policies.

Note: The authors of this box are Barry Johnston and Li Lian Ong.

As illustrated in Márquez Diez-Canedo (2005), the use of credit VaR is helpful in determining an institution's regulatory capital requirements. The chapter further exploits this concept to estimate capital surcharges based on each institutions' marginal impact on the banking system's credit VaR. Besides its intuitive appeal, an additional advantage of this approach is that its

Chan-Lau (forthcoming), also proposes using an incremental VaR to calculate capital surcharges.

basic data requirements are similar to those under the Basel II internal-ratings-based approach. Furthermore, the modeling requirements are also based on standard techniques in the risk management literature.

For instance, to compute the system's VaR, the chapter relies on a simplified version of the CreditRisk+ model presented by Avesani and others (2006) that estimates the aggregate probability distribution of the system's losses based on individual banks' probabilities of default, assets, and losses-given-default (see Box 2.3 for details).[11] Since this chapter is interested in measuring each institution's *externalities*, the incremental VaR *excludes* the specific institution for which the capital surcharge is being computed. Note that, even though it is excluded, the hypothetical failure of a specific institution will affect the other institutions by increasing their direct losses from the defaulting institution and by increasing their probability of default. Both of these effects are captured by the incremental VaR computation.

Recognizing that each institution's systemic risk contribution would materialize only with some likelihood, proper design of capital surcharges would need to adjust each institution's contribution to systemic risk by its own probability of default. The chapter estimates this probability of default based on an adaptation of a distance-to-default model that builds on Merton (1974).

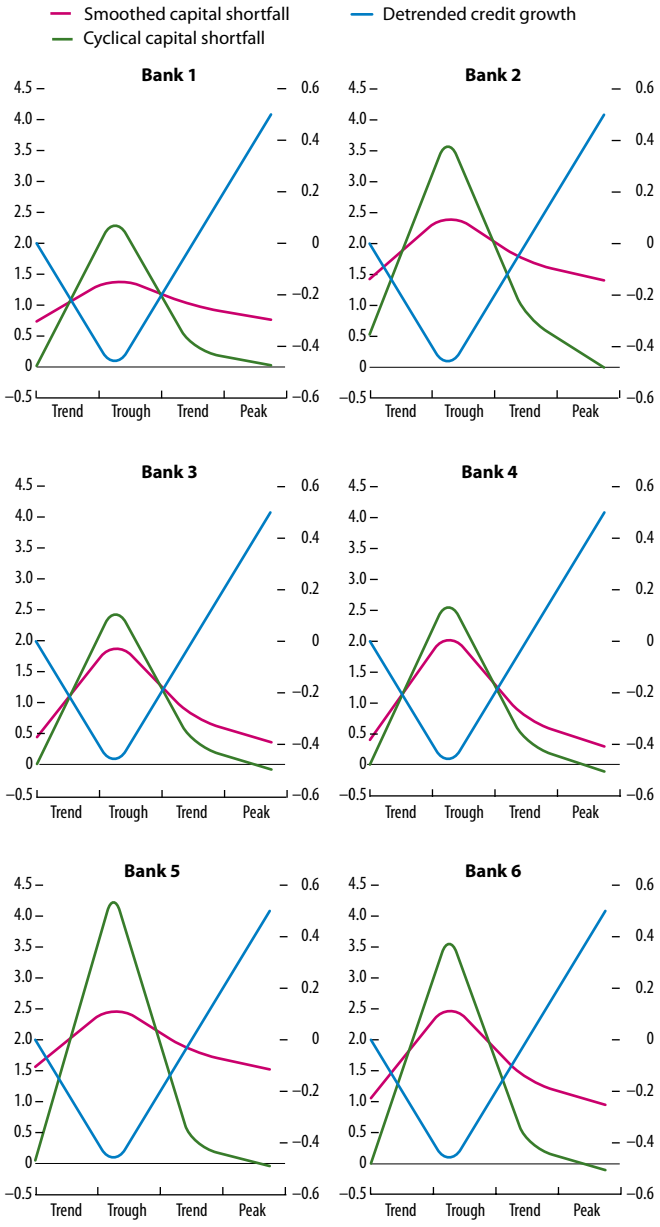
The capital surcharges obtained under the risk-budgeting approach for the data at hand are listed in Table 2.4. It is important to note that these surcharges would lessen the impact of systemic linkages by increasing banks' capital buffers by an average of 25 percent during economic downturns (see the bottom of the second column in Table 2.4).[12]

In general, however these surcharges would be procyclical: they would increase during economic downturns and decrease during expansions, as shown in Figure 2.5 where the blue line represents the credit

[11]CreditRisk+ is a methodology developed by Credit Suisse for calculating the distribution of possible credit losses from a portfolio (www.credit-suisse.com/investment_banking/research/en/credit_risk.jsp).

[12]While this increase appears significant, note that the Swiss authorities have increased the capital adequacy target ratio for UBS and Credit Suisse to be in a range between 50 and 100 percent above the minimum Basel II requirement, thus raising the total required capital to between 12 and 16 percent of risk-weighted assets by 2013.

Figure 2.5. Simulation of Systemic Risk Capital Surcharges
(Capital shortfall in percent of risk-weighted assets)



Source: IMF staff calculations.
Note: The capital shortfall is defined as the difference between the minimal Basel capital requirements *plus* the systemic-risk surcharge *minus* the actual total capital of each institution, in percent of risk-weighted assets.

Box 2.3. Computing an Aggregate Loss Distribution

The box illustrates the technicalities regarding how to compute the aggregate loss distribution and the value-at-risk for a portfolio of assets subject to credit risk, under specific default distribution assumptions for its individual components.

To illustrate the basic notions of how the credit risk of a portfolio of assets is evaluated, we start with a statistical distribution representing how frequently a loss of one asset might occur and how the assets in the portfolio affect losses associated with the portfolio as a whole. For instance, when individual defaults are subject to mutually independent Bernoulli distributions, a common representation of loss possibilities, the aggregate loss distribution can be computed by "convolution" (or combination) of the individual loss distributions. Consider a portfolio with two assets, each with a Bernoulli loss distribution: Asset 1 with default probability P1, and associated loss-given-default (LGD) L1; and Asset 2 with default probability P2 and LGD L2. Assume that L2 < L1. The table below shows that if the assets are independent:

Asset 1	Asset 2	Aggregate Loss	Probability
Default	Default	L1 + L2	P1 x P2
Default	No Default	L1	P1 x (1–P2)
No Default	Default	L2	(1–P1) x P2
No Default	No Default	0	(1–P1) x (1–P2) Total: 1

The last two columns of the table describe the aggregate loss distribution.

Note: The author of this box is Jean Salvati.

In this simple example with only two assets, the loss distribution is easily computed by enumerating all the possible combinations of individual losses. As the number of assets increases, this method becomes impractical. To see this, consider that the total number of combinations for 30 assets is over 1 billion. In order to handle larger portfolios, a more efficient algorithm is needed.

In mathematical terms, the vector [(1–P1) x (1–P2), (1–P1) x P2, P1 x (1–P2), P1 x P2] is the *convolution* of the vectors [(1–P1), P1] and [(1–P2), P2]. Based on the convolution theorem, the Fourier transform can be used to efficiently compute convolutions. Computing the aggregate loss distribution by convolution of the individual loss distributions is an efficient algorithm that can be applied to a large number of assets, thus its usefulness for the chapter (see Avesani and others, 2006, for details).

Once the loss distribution is known, various statistics and risk measures can be computed. One of the most important risk measures is the value-at-risk (VaR), which is the worst loss associated with a given confidence level over a target horizon. Let L represent the aggregate loss across the portfolio, and let $VaR(x)$ represent the VaR at the x-percentile level. The probability that the loss will not exceed $VaR(x)$ is:

$$P[L \leq VaR(x)] = x\%$$

The VaR can be computed in a simple way, by sorting the possible values for the aggregate loss, and by computing cumulative probabilities. In the example above, the probability that the loss will exceed L1 is P1 x P2. Therefore, L1 is the VaR at the (1–P1 x P2) level. When the VaR level is not equal to one of the cumula-

Table 2.4. Systemic-Risk-Based Capital Surcharges through the Cycle

(In percent of initial risk-weighted assets)

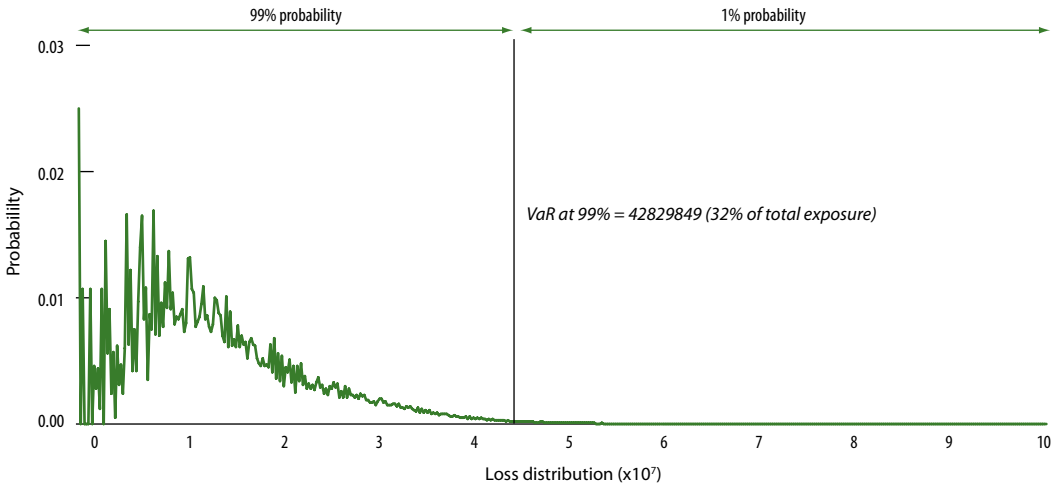
Institution	Credit Cycle Trough	Credit Cycle Trend	Credit Cycle Peak	Through-the-Cycle Smoothing
Bank 1	1.73	0.02	0.00	0.74
Bank 2	2.67	0.53	0.02	1.43
Bank 3	1.02	0.01	0.00	0.44
Bank 4	0.95	0.01	0.00	0.41
Bank 5	3.39	0.05	0.00	1.56
Bank 6	2.17	0.00	0.00	1.06
Average	1.99	0.10	0.00	0.94
Average/Initial capital	24.87	1.28	0.03	11.73

Source: IMF staff estimates.

cycle and the green line the amount of capital requirements coming from the model. For instance, the *average* systemic-risk surcharge *across* institutions fluctuates between zero and 2 percent of risk-weighted assets over the credit cycle (Table 2.4). Therefore, the chapter now explores an alternative smoothing technique consisting of averaging the methodology's inputs (i.e., probabilities of default and loss-given-default amounts) through the cycle, and then computing the capital surcharges.[13]

[13]Regarding ways to counteract the procyclical effects of risk-based capital charges, see also Gordy and Howells (2006) or

Loss Distribution and Value-at-Risk (VaR) for a Sample Portfolio of 25 Assets



Source: Avesani and others (2006)

tive probabilities, the VaR is computed by interpolating the loss distribution.

The figure displays the aggregate loss distribution and VaR for a sample portfolio of 25 assets. The x-axis represents all the possible values for the aggregate loss. The y-axis measures the associated probabilities. The VaR at the 99 percentile level is the 99th percentile of the loss distribution. It is expressed in absolute terms, and as a percentage of the aggregate exposure (the sum of losses given default for all 25 assets in the portfolio).

The model assumes that default probabilities are nonrandom. More sophisticated models recognize that default probabilities are not known with certainty, and treat them as random variables. This is the case, for example, of the CreditRisk+ model developed by Credit Suisse, a simplified version of which is used in this chapter to examine the defaults of the various portfolios of banks as in Figure 2.4. CreditRisk+ relies on very specific assumptions. In particular, it assumes that default probabilities are driven by Gamma-distributed random factors. It also uses the fact that, for small enough default probabilities, a Poisson distribution is a good approximation for a Bernoulli distribution. These assumptions make it possible to compute a fast and accurate analytical approximation for the loss distribution when default probabilities are random.

It is shown that after smoothing, systemic-risk capital surcharges would remain constant through the cycle; at about 1 percent of risk-weighted assets, on average (more exactly, the through-the-cycle average charge across all banks equals 0.94 percent in Table 2.4). The remaining procyclicality (as indicated by the magenta line) in Figure 2.5 mostly derives from the use of Basel II requirements, which continue to be procyclical.

Cross-Border Issues

As mentioned earlier, the universe of banks under consideration comprises two countries, and the simulations so far have assumed that (1) the capital surcharges are estimated across countries; (2) regulators have access to the relevant cross-border data; and (3) these surcharges can be enforced seamlessly across countries. However, in practice, it is likely that most national supervisors would regulate systemic risk exclusively within their own borders and based mostly on domestically available data.

Repullo, Saurina, and Trucharte (2009).

Table 2.5. Systemic-Risk-Based Cyclically Smoothed Capital Surcharges Across Countries
(In percent of initial risk-weighted assets)

Country	Institution	Global Charges	Country 1 Charges	Country 2 Charges
Country 1 Banks	Bank 1	0.74	0.97	n.a.
	Bank 2	1.43	1.11	n.a.
	Bank 3	0.44	0.54	n.a.
	Bank 4	0.41	0.50	n.a.
Country 2 Banks	Bank 5	1.56	n.a.	0.58
	Bank 6	1.06	n.a.	0.34

Source: IMF staff estimates.

Table 2.6. Sample Systemic Risk Report

Institution	Systemic Risk Rating[1]	Own Capital to System's Capital *(In percent)*[2]	Systemic Risk Capital Surcharge to Risk-Weighted Assets
Bank 1	NS	14.5	0.74
Bank 2	T1	16.9	1.43
Bank 3	NS	19.8	0.44
Bank 4	T2	20.4	0.41
Bank 5	T1	13.0	1.56
Bank 6	T1	15.4	1.06

Source: IMF staff estimates.
[1]T1 indicates institutions that are deemed to be highly systemic (Tier 1); T2 indicates institutions that are deemed to be relatively systemic (Tier 2); NS indicates institutions that are deemed nonsystemic.
[2]Denotes the capital of each bank as a percentage of the total capital of all banks in the network.

To illustrate the difference in calculating the surcharges from both global and country perspectives, the chapter computed systemic-risk-based capital surcharges for each of the two countries *in isolation*. That is, a new set of surcharges was computed under the risk-budgeting approach, assuming that each of the two local supervisors lacks information on financial linkages outside its borders. Under these circumstances, the capital charges differ from the ones obtained taking into account the full network of interbank linkages (Table 2.5). In particular, for banks in Country 2, the difference is almost 1 percent of institutions' risk-weighted assets (equivalent to 12 percent of institutions' total capital).[14] It is important to note that these results hinge on the specific assumption of the network structure. In this example, there are only two European banks, thus from a domestic perspective, their stylized spillovers and surcharges are smaller. However, from a global perspective, these European banks affect U.S. banks through Bank 2, thus compounding the spillover effects, hence leading to a higher surcharge, on average, for European banks. This fact illustrates the importance of cross-border, information-sharing agreements on financial linkages. Furthermore, it bears emphasizing that the estimated capital surcharges should not be misconstrued as specific recommendations on the optimal size of capital surcharges for U.S. or European banks.

In reality, since most large and complex financial institutions have a global presence, it is necessary to track potential cross-border domino effects in order to measure and regulate their contribution to systemic risk. In practice, this may be hard for local supervisors to do in isolation due to limitations imposed by the lack of effective data-sharing agreements, as well as cross-border confidentiality concerns across national supervisors.

Communication

To facilitate communication across financial stability regulators, the chapter proposes assembling confidential systemic risk reports on a regular basis. Such reports would be an effective and parsimonious way to track institutions deemed systemically important and their relative ranking (as proposed by Brunnermeier and others, 2009, among others). Table 2.6 presents a sample systemic risk report that gathers most of the key information produced by our methodology.

Reforming Financial Regulatory Architecture Taking into Account Systemic Connectedness

The previous section presented developmental approaches to operationalize cycle-neutral, systemic-risk-based capital charges. However, like any regulation, to be effective, it needs to be properly enforced and monitored by regulators. This is particularly important given that weak regulation has been identified as a key culprit in this financial crisis, which is why there have been a number of regulatory architecture reform proposals (Box 2.4).

[14]Incidentally, notice that the difference between the global and local charges is greater for banks in Country 2 than for banks in Country 1. This is because, in our example, when charges are computed based only on local interconnections, more information is lost in Country 2 than in Country 1 (see Figure 2.1).

Box 2.4. Regulatory Architecture Proposals

This box reviews key aspects of recent proposals to redesign the regulatory architecture to aid in the early detection of systemic risk.

Systemic Risk Regulators: Responsibilities and Powers

Most recent proposals would benefit from a better demarcation of powers and responsibilities across "macro and micro" regulators. Recent proposals by the U.S. House of Representatives, U.S. Senate, United Kingdom, and European Union call for the creation of respective councils, each comprising existing supervisory authorities and national central banks within their country (area).[1] These councils would be charged with monitoring the buildup of domestic financial systemic risk on a regular basis with no, or a small, permanent secretariat. Member agencies of the council, including central banks, are expected to provide analytical support. The councils would have the authority to demand, at any time, the information about any financial firm deemed necessary for the fulfillment of their mandate. The systemic risk regulators would also have the authority to make recommendations at the macroprudential level to relevant regulatory bodies. However, supervision of individual institutions is left with existing microprudential regulators.

Note: The author of this box is Kazuhiro Masaki.

[1]U.S. House of Representatives, *Wall Street Reform and Consumer Protection Act of 2009* (H.R.4173); *Restoring American Financial Stability Act of 2010* (U.S. Senate Committee on Banking, Housing, and Urban Affairs; see chairman's marked text, March 2010); U.K., *Financial Services Bill* (introduced in the House of Commons, November 19, 2009); European Union, proposals for regulation of the European Parliament and of the Council on Community macroprudential oversight of the financial system and establishing a European Systemic Risk Board, Commission of the European Communities, September 23, 2009.

Systemic Risk Regulatory Proposals

	United States			
	House of Representatives	Senate	United Kingdom	European Union
Systemic risk regulator	Financial Services Oversight Council (FSOC)	Financial Stability Oversight Council	Council for Financial Stability	European Systemic Risk Board (ESRB)
Institutional arrangements	A council of Treasury secretary (chair) and heads of federal regulators; resources provided mainly by Treasury	A council of Treasury Secretary (chair) and heads of federal regulators and an independent member	A council of heads of Treasury (chair), Financial Services Authority, and Bank of England	A council of central banks and regulators; secretariat provided by European Central Bank
Powers				
Assessment of systemic risk	Yes	Yes	Yes	Yes
Making recommendations	Yes	Yes	n.a.	Yes
Identification of systemic firms	Yes	Yes	n.a.	n.a.
Rule making	No	No	No	No
Central bank in microprudence	Fed supervises all systemic firms regardless of their legal structure	Fed supervisory authority narrowed	No change	No change
Restrictions to lender of last resort	Determination by FSOC and consent by Treasury secretary required for section 13 (3)	Liquidity assistance under section 13 (3) limited to market-wide systems or utilities	No	No
Enhanced resolution mechanism	Systemic Dissolution Fund is to be established for systemic firms	Orderly Resolution Fund is to be established for systemic firms	Special Resolution Regime for major banks has been established	No

Sources: U.S. House of Representatives, *Wall Street Reform and Consumer Protection Act of 2009* (H.R.4173); U.S. Senate Committee on Banking, Housing, and Urban Affairs, Restoring American Financial Stability Act of 2010 (see chairman's marked text, March 2010); U.K., *Banking Act of 2009*, *Financial Services Bill* (introduced in the House of Commons on November 19, 2009); and European Union, proposals for regulation of the European Parliament and of the Council on Community macroprudential oversight of the financial system and establishing a European Systemic Risk Board.

Box 2.4 *(concluded)*

Involvement of Central Banks in Microprudential Supervision

Because microprudential supervision would remain largely intact under most proposals going forward, it is unlikely that there will be major changes in the supervision of individual institutions by central banks (although the current level of involvement of central banks varies significantly across the jurisdiction). The only exception would be the U.S. Senate proposal under which the Federal Reserve's supervisory authority would be narrowed to bank holding companies with assets of over $50 billion.

Restrictions on Lender-of-Last-Resort Authority of Central Banks

Under the U.S. proposals, there would be some restrictions on the Federal Reserve's authority to extend emergency lending to nondeposit-taking institutions (revisions to section 13(3) of the Federal Reserve Act), in an attempt to limit the Fed's lender-of-last-resort authority, and thereby lessening its ability to lend to institutions that may already be insolvent. Under the House of Representatives' bill, the Fed would need the approval of the systemic risk regulator (Financial Stability Oversight Council) and the treasury secretary (after certification by the president) to act as a lender of last resort. In addition, the loans would be scrutinized by both houses of Congress after they were extended and could be "disapproved" by a joint resolution.

Enhanced Resolution Framework

Although a positive first step, recent proposals to overhaul the resolution framework of systemically important institutions remain vague. U.S. proposals call for strengthening resolution mechanisms for systemically important institutions, including by identifying them (although no concrete proposal has been advanced) and creating a dedicated fund to be financed by those institutions, with the financing provided in direct relation to their contribution toward systemic risks. In the United Kingdom, a permanent resolution framework for banks (Special Resolution Regime) has been introduced by the Banking Act of 2009, granting the authorities the necessary "flexibility" to deal with any financial institution in distress.

One of the most prominent proposals at the financial regulatory architecture level is the creation of systemic risk regulators to monitor the financial system as a whole. This responsibility could be carried out either by new or existing regulators with a new focus. For instance, the U.S. Senate has put forward a proposal for the creation of an independent and separately staffed agency to regulate systemic risk (the Agency for Financial Stability) and the consolidation of existing microprudential regulators under a single agency (the Financial Institutions Regulatory Administration). Pan-European initiatives are also advancing. The European Systemic Risk Board is expected to be launched soon. At the same time, the European Central Bank is expected to retain its cross-border financial stability watch mandate for euro area countries. Similarly, in the United Kingdom, a white paper calls for the granting of legal powers to the Financial Services Authority to pursue financial stability objectives—also a Bank of England mandate.

While the focus on systemic-risk oversight is a welcome development, there are significant uncertainties about the specific implementation and boundaries of responsibilities across new and existing supervisory bodies. These uncertainties, which are likely to create difficulties in coordinating financial regulatory functions across systemic and nonsystemic regulators, give rise to a number of questions requiring careful consideration. For example:

- Would regulation of systemically important institutions improve if, in addition to their current responsibilities, each of the existing regulators were charged with "monitoring" the buildup of potential

systemic linkages, while distinguishing between systemic and nonsystemic institutions?
- Would regulation of systemically important institutions improve if, as some recent proposals call for, financial regulatory functions were consolidated?
- Is there a need for more direct preemptive actions to prevent institutions from becoming systemic in the first place?

Because it is unfeasible to analyze every proposed distribution of regulatory functions stemming from an added systemic oversight mandate, this chapter focuses on the following plausible interpretations of alternative reform proposals (see Box 2.4):[15]

- An agency providing a lender-of-last-resort facility and also charged with systemic risk monitoring (a plausible interpretation of U.K. and U.S. proposals);
- An agency with early intervention powers (e.g., prompt corrective actions or structured early intervention and resolution), and also charged with deposit insurance and systemic risk monitoring (a plausible interpretation of a U.S. Senate proposal); and
- A "unified" arrangement, consisting of a single regulator, charged with the provision of lender-of-last-resort and early intervention powers for both systemic and nonsystemic institutions (a plausible interpretation of a U.S. Senate proposal).

Framework for Analyzing Financial Regulation Reform Proposals

This chapter suggests the need for a framework that (1) explicitly considers alternative allocations of regulatory functions; (2) takes into account regulators' incentives to accomplish their mandates (including forbearance); and (3) explicitly considers key sources of financial intermediaries' distress, while accounting for systemic linkages. The significance of this admittedly stylized framework is not that it provides a complete representation of the complex decision-making process of regulators and their interactions, but that it imposes discipline and transparency on the analysis of key drivers behind these decisions and interactions.

Regulatory Forbearance Incentives

Regulators and policymakers often encounter this dilemma: under what conditions would it make sense to show forbearance? That is, when would it be appropriate for a regulatory agency to overlook the need to enforce supervisory actions, such as the enforcement of prompt corrective actions or other early intervention actions, or withhold liquidity support when the expected value of a financial institution is below that of liquidation?

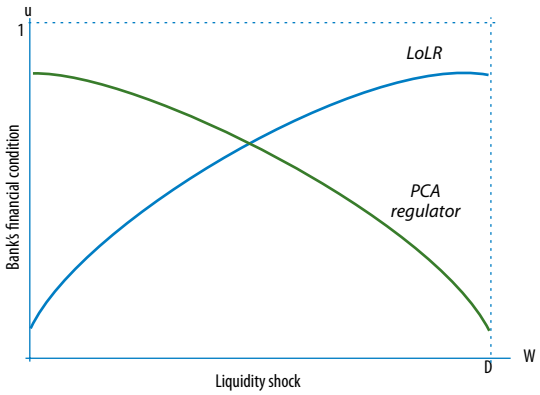
Recent research suggests that regulatory forbearance may be socially desirable when the economy experiences "aggregate" shocks (Kocherlakota and Shim, 2007). Because of the government's taxing powers and deep pockets, it can serve as an economy-wide insurer against shocks that no private insurance arrangement could credibly cover. Given the cost of economy-wide disruptions, it can make sense for a regulator to step in and rescue a troubled financial system as a whole. Nonetheless, this research suggests that in the absence of aggregate shocks, forbearance would be socially inefficient or "excessive."[16]

Forbearance by regulators also needs to be considered from a political-economy perspective. Regulators, like other economic agents, have objectives, which are not always aligned with economic efficiency goals. They may have a bias toward excessive forbearance because a bank failure is politically expensive. That is, they see the closing of an institution as negatively affecting their reputation: the higher the financial loss associated with a failure, the higher the reputational cost. The tendency to forbear is offset by other costs to the regulator, particularly if the regulator is assigned responsibility for the solvency of the public deposit insurance

[15]For a comprehensive taxonomy on current financial regulatory arrangements and issues, see also Nier (2009).

[16]Empirical evidence reveals that regulators worldwide are often too lenient, granting wiggle room to financial institutions to continue operating, hoping they will get back on their feet, even when their liquidation value is higher than the expected value of allowing the institution to continue to operate. Indeed, several analysts (e.g., Acharya, Richardson, and Roubini, 2009) have argued that, leading up to and during the current crisis, some of the largest global financial institutions benefited from regulatory forbearance.

Figure 2.6. Regulatory Forbearance under a Multiple Regulator Configuration



Source: Espinosa-Vega and others (forthcoming).

Note: Horizontal axis depicts unanticipated liquidity shocks to a representative financial institution. Vertical axis represents a financial institution's financial condition denoted by *u*. The higher the *u*, the higher "the bar" imposed by a regulator to support an institution (the lower the degree of excessive forbearance). LoLR = lender of last resort; PCA = prompt corrective actions.

fund or for the losses borne as a result of unpaid debts to a lender of last resort.

Distress and Systemic Linkages of Financial Intermediaries

In the framework underlying the analysis in this section, financial institutions hold illiquid assets funded by (implicitly or explicitly) insured short-term funding such as deposits (for more details see Annex 2.1 and Espinosa-Vega and others, forthcoming). Financial institutions face two potential types of shocks: liquidity shocks (represented by unexpected withdrawals by depositors) and solvency shocks (represented by a decrease in the value of their assets).

The framework features a tension encountered in practice: because of the protection provided by limited liability and insured deposits, the bank management does not have an incentive to close down voluntarily even when the institution is insolvent. This is what economists refer to as an *economically inefficient* outcome. To lessen this problem, an insolvent institution can be liquidated directly by a regulator with early intervention powers (prompt corrective actions). Alternatively, a bank can be forced to close by the refusal of a lender of last resort to supply the liquidity needed in the face of a liquidity shock. Finally, the framework explicitly incorporates the possibility of some institutions' chances of survival being negatively affected by the failure of other important players.

The above discussion has provided the basis for outlining answers to the three questions posed at the beginning of this section. As a way of preview, the analysis formalized two notions:

- First, even under an expanded mandate to explicitly oversee systemic interconnectedness, both the unified and single regulators would be more lenient with systemically important institutions than non-systemically important ones.
- Second, at least for "moderate" liquidity events, a unified regulator could lessen excessive forbearance relative to a multiregulator setting, because a unified configuration would allow the conflicting incentives faced by the regulator to be internalized by one regulator. However, consolidation of standard regulatory functions alone will not lessen systemic risk.

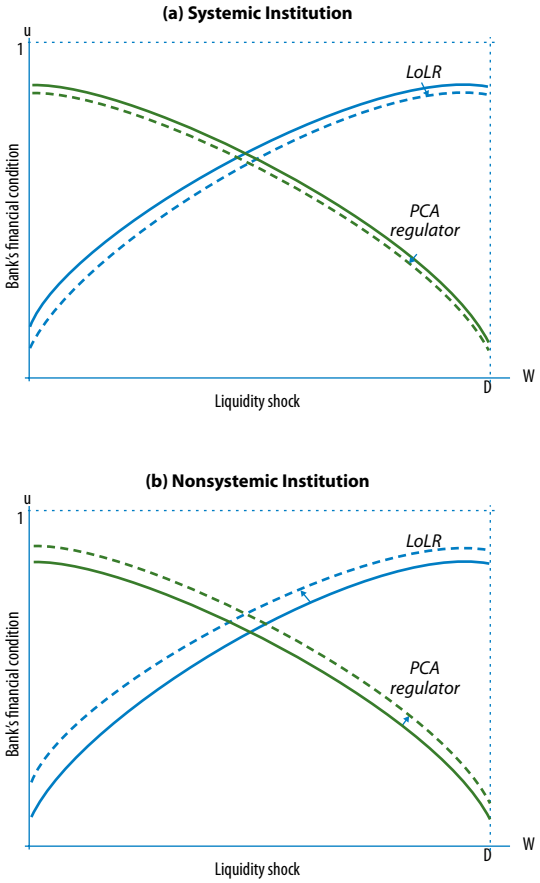
Why a Mandate to Monitor Systemic Linkages May Not Be Enough

Espinosa-Vega and others (forthcoming) show that for a lender of last resort, the size of the loan necessary to support a cash-strapped bank will determine the degree of forbearance: large infusions of liquidity will require concomitantly greater likelihood of success and therefore the lender of last resort will be less forbearing the larger the required liquidity infusion. This insight is illustrated in Figure 2.6. The horizontal axis depicts unanticipated liquidity shocks to a representative financial institution. The vertical axis represents a financial institution's financial condition, which can be summarized by the institution's expected solvency (denoted by u). The higher the u, the higher the bar imposed by a regulator to support an institution. The fact that the higher the required lender of last resort's liquidity injection, the less forbearing the lender of last resort is explains why the lender of last resort line in Figure 2.6 is upward sloping.

Consider now a separate regulator responsible for prompt corrective actions that also take into account the political costs of losses by the deposit insurance system. This regulator is more likely to engage in forbearance the greater the liquidity assistance supplied by the lender of last resort. This is because lender-of-last-resort liquidity support is outside the responsibility of the prompt corrective actions regulator. The higher the liquidity assistance, the lower the potential need for deposit insurance outlays, thus the lower the prompt corrective actions regulators' potential costs. This increases the temptation for an independent agency in charge of prompt corrective actions and deposit insurance administration to engage in forbearance as liquidity shortfalls increase—which explains why the prompt corrective actions line in Figure 2.6 is downward sloping.

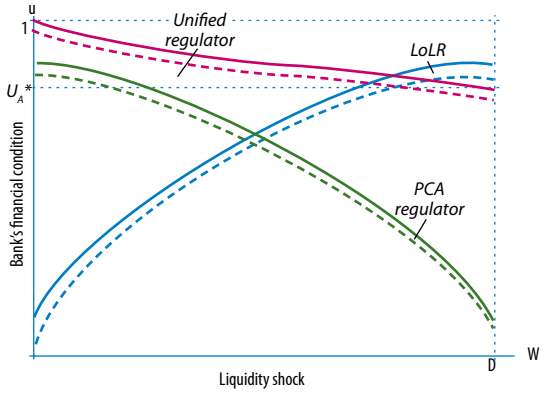
The failure of a systemically important institution increases the likelihood of failures among nonsystemic institutions. These increased costs mean that any regulator will be more lenient with a systemically important institution, as illustrated by the downward shift in lines in Figure 2.7a. On the other hand, since distress in the systemic institution negatively affects the chances of survival of the nonsystemic institution, in order to be rescued, the regulator will have to be convinced that the overall chances of survival of the

Figure 2.7. Regulatory Forbearance under a Multiple Regulator Configuration with Systemic Oversight Mandate



Note: Horizontal axis depicts unanticipated liquidity shocks to a representative financial institution. Vertical axis represents a financial institution's financial condition denoted by u. The higher the u, the higher "the bar" imposed by a regulator to support an institution (the lower the degree of excessive forbearance). The figure illustrates a higher degree of forbearance for systemically important institutions (panel a) compared to nonsystemic institutions (panel b). Solid lines denote regulators that do not distinguish institutions according to their degree of systemic risk and the dotted lines denote responses when systemic institutions are considered. LoLR = lender of last resort; PCA = prompt corrective actions.

Figure 2.8. Regulatory Forbearance under Multiple and Unified Regulator Configurations with Oversight Mandate over Systemic Institutions



Note: Horizontal axis depicts unanticipated liquidity shocks to a representative financial institution. Vertical axis represents a financial institution's financial condition denoted by *u*. The higher the *u*, the higher "the bar" imposed by a regulator to support an institution (the lower the degree of excessive forbearance). The figure illustrates a higher degree of forbearance for systemically important institutions. Solid lines denote regulators that do not distinguish institutions according to their degree of systemic risk and the dotted lines denote responses when systemic institutions are considered. LoLR = lender of last resort; PCA = prompt corrective actions.

nonsystemic institution are actually higher than would be the case if the systemic institution had not run into trouble. In other words, the regulator will become stricter with nonsystemic institutions, as illustrated by the upward shift in lines in Figure 2.7b.

Is Unified Regulation, by Itself, the Answer?

The analysis by Espinosa-Vega and others (forthcoming) also shows that a unified regulator exhibits a lower degree of excessive forbearance than a multiple regulator setting, at least for "moderate" liquidity shocks. To understand the logic, note that a unified regulator would solve the problem of a lender of last resort and a prompt corrective action regulator simultaneously and therefore would internalize the excessive forbearance incentives faced by multiple regulators, thus leading to the lowest degree of excessive forbearance. This is illustrated in Figure 2.8 by the magenta line with the highest bar imposed by the unified regulator. Note, however, that even under unified regulation, the regulator will be softer on potentially systemic institutions, as illustrated by the magenta dotted line. Consolidating standard regulatory functions without additional tools to preclude institutions from posing systemic risk will not eliminate regulators' incentives to be lenient with systemically important institutions.

It is also important to note that this analysis is silent about where to locate the unified regulator. Some proposals call for consolidating systemic regulation under the central bank. However, Espinosa-Vega and others (forthcoming) abstract from examining the interaction of monetary policy and these regulatory functions. The incentives of a central bank to forbear (perhaps by keeping interest rates lower than a purely inflation or growth objective would imply) are not treated in the model. Hence, they refrain from assessing the merits of this proposal.

Preventing Institutions from Posing Systemic Risk

As has been discussed, an expanded mandate to explicitly oversee systemic risk will not necessarily, by itself, lessen this risk. Therefore, it may be necessary to consider other, more direct preemptive measures. These measures could include (1) putting caps on leverage; (2) lessening potentially systemic linkages through, for example, systemic-based capital surcharges (as suggested in some reform proposals) or by assessing

Box 2.5. Contingent Capital—Part of the Solution to Systemic Risk?

This box reviews the concept of contingent capital as part of current regulatory efforts aimed at lowering systemic risk in the financial sector.[1] *In general, contingent capital represents a countercyclical measure that allows issuers to secure additional capital from investors when a certain predetermined stress situation arises.*

Current proposals focus on *convertible hybrid securities*[2] consisting of long-dated subordinated debt instruments that win their badge as contingent capital by automatically converting into equity when certain predefined trigger conditions are met, such as bank-specific threats, systemic risk, or both (see table). Such mandatory conversion represents a new and possible more robust form of hybrid securities, which were commonplace before their issuance stalled in 2007 when investors started questioning their ability to offset writedowns.

By issuing mandatory convertibles, banks hedge themselves against the possibility of capital shortfall and avoid costly funding in times of stress. These securities carry an obligation to pay interest and resemble debt in normal times until trigger conditions force conversion into common stock to augment their capital buffer. Besides increasing the issuer's resilience to distress, mandatory convertibles should help curb excessive risk-taking by managers to the extent that equity would be diluted upon conversion. On November 20, 2009, the U.K. bank Lloyds TSB premiered the concept of contingent capital by exchanging contingent convertible securities for existing impaired bonds in an operation worth £7.5 billion.

Note: The authors of this box are Wouter Elsenburg and Andy Jobst.

[1]For instance, both the U.S. House of Representatives' *Financial Stability Improvement Act of 2009* and the U.S. Senate's *Restoring American Financial Stability Act of 2009* make specific reference to the possibility of contingent capital. Moreover, the recent consultation paper on bank capital released by the Basel Committee on Banking Supervision (2010) highlights the role of convertible hybrid securities in the buildup of "countercyclical capital buffers."

[2]In general, the term "hybrid securities" does not only refer to cumulative or noncumulative, long-dated subordinated debt with an interest deferral mechanism, but also includes some conventional funding instruments with the capacity to absorb losses, such as preferred equity.

The effectiveness of contingent capital depends critically on the determination of both the trigger condition(s) and the conversion rate from debt to equity. The table provides some of the possibilities.

The advantage of a bank-specific conversion trigger is that a bank's capital position will be improved precisely when a bank needs it. Some, however, argue for triggers based on systemic risk in order to reign in more risk-taking by shareholders if conversion implies some debt forgiveness ex ante (Squam Lake Working Group on Financial Regulation, 2009). Another issue is whether triggers should be based on market conditions, which are more forward-looking than financial soundness indicators, which are based on a bank's balance sheet, in their ability to flag financial distress. Markets, however, can be distorted and might be subject to price manipulation (e.g., via short-selling) that could induce confidence-induced downward spirals, requiring a premature trigger to conversion. To mitigate this concern, market indicators could be combined with supervisory stress tests.

Similarly, setting the right rate of conversion requires an assessment of how potential dilution affects the burden-sharing between shareholders and bondholders. Setting the conversion rate so that debt securities convert into equity below the par value of the debt lowers the possibility of a speculative attack, since holders of contingent capital would benefit less from a negative shock triggering conversion into new equity in exchange for par value. However, smaller dilution risk could fail to deter ex ante risk-taking by existing shareholders. Conversion in terms of a number of shares prevents these unwanted effects by better aligning incentives of both parties (Flannery, 1994, 2002). Shareholders would be able to anticipate their potential dilution, and holders of convertibles are unlikely to profit from conversion.

Contingent capital could foster a self-correcting market mechanism aimed at restoring bank balance sheets before financial stresses become systemic. By requiring banks to issue a certain amount of contingent capital (relative to their size), regulators ensure that individual distress and/or adverse market conditions result in automatic recapitalization, which helps limit the public cost of leveraged financial intermediation. There are, however, some open issues that require further study, such as the implications

Box 2.5 *(concluded)*

of different conversion rates for issuer incentives and the possible contagion risk to other institutions that may result when one institution is forced to convert. Moreover, some practical concerns about pricing and creating sufficient investor demand might impede the marketability of contingent capital, especially if regulations require its issuance. Hence, although helpful as an additional buffer, it remains to be seen whether regulatory contingent capital can be designed to appreciably curb excessive risk-taking in order to mitigate systemic risk while preventing unintended market reactions. However, in conjunction with other tools to mitigate systemic risk it has the advantage of providing appropriate incentives.

Classification of Categorization of Trigger Conditions and Conversion Rates of Contingent Capital

Trigger	Bank-specific	Financial soundness indicator(s) Supervisory stress test Market indicator for the bank's credit risk
	Systemic	Broad market factors Credit loss trigger Declaration of a "systemic event"
	Combined	Combination of bank-specific and systemic triggers
Conversion rate	Relative to holds of contingent capital	At par value Below par value At/below/above trading price of contingent capital at time of conversion
	Relative to shareholders	Fixed dilution Relative dilution
	Relative to capital need	Book value multiple Risk-weighted-assets multiple

charges based on measures of the systemic component of over-the-counter derivatives' counterparty credit risk (as argued in Chapter 3 of this report); (3) a broader adoption of contingent capital initiatives (Box 2.5); (4) limiting the size and business activities of financial institutions; or (5) designing "living wills" and strengthening resolution processes.

Finally, because the analysis contains numerous simplifying assumptions, the reader may wonder about the robustness of the main findings in this section. For example, the chapter assumed that there is a stable trade-off between a regulator's desire to avoid bank failures and to maintain the agency's financial position. Also, by structuring the analysis as if regulators and banks interact only once, the analysis becomes tractable, but ignores some potentially important dynamic interactions. Nevertheless, as discussed in Espinosa-Vega and others (forthcoming), the main findings in this section are robust to the relaxation of these types of assumptions.[17]

Policy Reflections

The recent financial crisis has triggered a rethinking of the supervision and regulation of systemic con-

[17]Repeated interactions between banks and regulators will, over time, cause adjustments both in the riskiness of the investments chosen and in the size of the capital and liquidity buffers adopted by the banks; for the purposes of this exposition all of these are held constant, although they can be incorporated into the analysis. Repeated interactions between depositors and banks and regulators will endogenize liquidity demand, that is, that a fear of a closure or failure will trigger increased depositors' withdrawals. However, it is worth noting that, although repeated interactions among independent regulatory authorities could lessen the problems of the externalities they impose on one another, they would not eliminate them.

nectedness. As this chapter reports, there has been a flood of proposals covering the regulation of financial institutions and the regulatory architecture to better deal with systemic risks. Unfortunately, most of the proposals are still in the formative stages, limiting a critical evaluation of their merits.[18]

This chapter has aimed to contribute to this debate on two fronts: first, by presenting a methodology for computing systemic-risk-based surcharges that are also cycle-neutral; and second, by reviewing the regulatory architecture.

Systemic-Risk-Based Surcharges

By illustrating how to make systemic-risk-based capital surcharges operational while also removing their inherent cyclicality, this chapter contributes to a critical review of, among other things, the merits of this and alternative methodologies; the likely data requirements; the potential procyclical effects of systemic-risk surcharges; the need to evaluate alternative available methodologies; the means by which effective communication among supervisors can be enhanced; and cross-border regulatory issues that need to be confronted.

- *Data requirements.* The first step in rendering systemic-risk-based charges operational is the measurement of potentially systemic (direct and indirect) financial linkages. This requires more detailed, regular cross-market and cross-border exposures data for individual institutions that could be reported to relevant data repositories, possibly the Bank for International Settlements. When necessary to address confidentiality concerns, national laws should be modified to allow supervisors to fulfill this commitment. At a minimum, national supervisors could rely on international arrangements—such as the Financial Stability Board—to share confidential information at restricted forums with the appropriate safeguards.
- *Procyclicality of systemic-risk-based capital surcharges.* It is important that newly designed systemic-risk-based surcharges do not have procyclicality features. The surcharge designed in this chapter shows how this can be done.
- *Evaluation of alternative methodologies.* In order to advance the debate on how, and whether, to impose systemic-risk-based capital charges, it is important to draft concrete, practical proposals that can be reviewed and evaluated.
- *Cross-border issues.* Were capital surcharges to be introduced, they would need to be designed and implemented from a global perspective in order to be effective. The chapter illustrated some potential problems in designing surcharges for globally active institutions from a local perspective. The lesson is very relevant for those who oversee globally active large and complex financial institutions.
- *Communication*. To facilitate communication among regulators—within and across countries—confidential systemic risk reports could be prepared on a regular basis. Such reports would be an effective and parsimonious way to track institutions deemed systemically important and their relative ranking.

Most proposals for capital charges will likely accomplish the goal of raising capital buffers in line with the systemic importance of an institution—an important objective, but one that does not explicitly show institutions how they can adjust their behavior so as to be less systemically important. However, more analysis is required to design capital surcharges in a way that would induce institutions to take into account their spillovers to the rest of the global financial system. The task is difficult because, among other things, measures of systemic risk should consider second- and third-round effects following a distress event, and these effects are often beyond the direct control of the institution. Market-based measures do not allow institutions to trace back their individual effect on systemic risks either.

Furthermore, financial institutions may respond to the introduction of these surcharges by attempting to reverse the effects of the regulation (as institutions have attempted to do through, say, off-balance-sheet transactions) or by attempting to exit the perimeter of systemic risk oversight altogether. Therefore, it is important to consider the implementation of capital surcharges in conjunction with other proposals aimed at lessening systemic linkages (e.g., limiting business activities and channeling derivative transactions through central counterparties). This is another reason why there is a need to assess multipronged approaches to mitigate systemic risk. Moreover, all these possible

[18]To date, Bank of England (2009) is a notable exception, offering a discussion of operational issues.

approaches will require further examination through quantitative impact studies.

Regulatory Architecture

This chapter argues that an important missing ingredient from most architecture reform proposals is the analysis of regulators' incentives—including regulatory forbearance incentives—that vary under the alternative regulatory configurations under consideration. The analysis provided in the chapter suggests that:

- Under an expanded mandate to explicitly oversee systemic risks, both the unified regulators and multiregulators would be more lenient with systemically important institutions facing difficulties and tougher with nonsystemic institutions facing difficulties.
- This last insight—the fact that, even under a specific mandate to oversee systemic institutions and without regulatory retooling, regulators may continue to be more forbearing with systemic institutions facing difficulties—suggests the need to consider more direct methods to address systemic risks. It is not enough to mandate that regulators "monitor" systemic connections closely or that they treat systemic and nonsystemic institutions differently. It may be necessary for regulators to design regulation so as to prevent institutions from posing systemic risk.
- Thus, there is a need to carefully evaluate proposals such as instituting systemic-risk-based capital surcharges, directly limiting the size of certain business activities that financial intermediaries engage in, or establishing central counterparty clearing systems before deciding which of them would be best to adopt.

Annex 2.1. Highlights of Model Specification

This annex describes some of the key features of the model (Espinosa-Vega and others, forthcoming) underlying the analysis presented in the section in this chapter entitled "Reforming Financial Regulatory Architecture Taking into Account Systemic Connectedness." In particular, the model under consideration is an extension of Repullo (2000) and Kahn and Santos (2005), who study the political economy of banking regulation. Espinosa-Vega and others extend this analysis to examine the optimal institutional allocation of bank regulation when regulatory agencies are explicitly mandated to oversee financial institutions according to their degree of systemic importance.

Espinosa-Vega and others consider a three-period model in which there are two banks (one of them systemic—Bank *A*—and one that is not systemic—Bank *B*). Both banks hold illiquid assets funded by (implicitly or explicitly) insured short-term funding such as deposits. In addition, they face two types of potential shocks: liquidity shocks (represented by unexpected withdrawals by depositors) and solvency shocks (represented by a decrease in the expected value of their assets). Bank profits are random variables with the following distribution functions:

Assumption 1. If Bank *A* invests Y_A in loans at period 0 it will receive $Y_A\tilde{R}$ in period 2, where

$$\tilde{R}=\begin{cases} R \text{ with probability } u_A \\ 0 \text{ with probability } 1-u_A \end{cases}$$

Assumption 2. The expected return from lending (net of second period bankruptcy costs) for Bank *A* exceeds the zero return from holding liquid assets, that is,

$$E(U_A)[R + c] > 1 + c.$$

Assumption 3. Systemic interconnections are modeled as follows: the bankruptcy of Bank *A* negatively affects Bank *B*'s payoffs by lowering its probability of obtaining a high payoff (see assumption 4 below). It is also assumed that the default of Bank *B* has no effect on Bank *A*—in other words, Bank *B* is not systemic.

Assumption 4. If Bank *B* invests *YB* in loans in period 0 then, provided that Bank *A* does not fail, Bank *B* will receive $Y_B\tilde{R}$ in period 2, where

$$\tilde{R}=\begin{cases} R \text{ with probability } u_B \\ 0 \text{ with probability } 1-u_B \end{cases}$$

The expected return from lending (net of second period bankruptcy costs) for Bank *B* exceeds the zero return from holding liquid assets, that is,

$$E(U_B)[R + c] > 1 + c.$$

If Bank *A* fails, then the distribution for $Y_A\tilde{R}$ in period 2 is

$$\tilde{R}=\begin{cases}R \text{ with probability } u_B-\gamma \\ 0 \text{ with probability } 1-u_B+\gamma\end{cases}$$

where $0 < u_B < \gamma$.

At $t = 0$, banks decide on the structure of their balance sheet. Investment in assets Y_i is financed by deposits D_i and capital K_i, $i \in \{A,B\}$. Given a minimum regulatory capital requirement, banks are subject to funding risk. In particular, if the new level of deposits D_i at $t = 1$ is such that $D_i < \tilde{D}_i$, banks are forced to seek emergency liquidity from a lender of last resort. In turn, if banks fail to secure enough funding, they are liquidated at period 1. Banks can also be liquidated if there are insufficient funds at period 2 to meet remaining obligations.

The liquidation of banks entails societal costs c, which is meant to capture the administrative costs and other negative externalities associated with bank failures. Banks' loan portfolios can be liquidated in period 1 to yield a "fire sale" value L, with $0 < L < 1$. The liquid asset yields the market interest rate (which is normalized to zero).

Timing of the model. In period 0, both Banks A and B raise funds, D_i, simultaneously. In period 1, the probability of success for Bank A, u_A , is observed by the regulator, and if necessary, a regulatory liquidation decision is made for this bank. Regulators know that the fortunes of Bank B are linked to those of Bank A. Once the fate of Bank A is decided, the probability of success for Bank B, u_B , is observed and, if necessary, a regulatory liquidation decision is made for Bank B.

The next set of assumptions characterizes the risks faced by the banks.

Assumption 5. For each bank, the amount of deposits not withdrawn at $t = 1, \tilde{D}_i$, is an independent random variable with distribution function $G(D)$, where $G'(0) > 0$. The amount of deposits is publicly observable at date $t = 1$.

Assumption 6. The probability of success of bank i, u_i, is an independent random variable with distribution function $F(u)$. This variable, u_i, is publicly observable at date 1, but it is not verifiable.

Illustration: The Problem of a Unified Regulator

To illustrate how Espinosa-Vega and others (forthcoming) study excessive forbearance incentives under alternative regulatory structures, consider the problem faced by a unified regulator charged with liquidity provision and administration of the deposit insurance for both systemic and nonsystemically important institutions. For a liquidation value of L, a lender of last resort will lend to Bank B at a rate of P, when Bank A has been liquidated, if Bank B's continuation prospects (the left-hand side of the inequality) exceed the regulator's net political benefit of closing bank B (the right-hand side of the inequality) in equation (1).

$$\begin{aligned}&(u_B-\gamma)\mathrm{P}(D_B-\tilde{D}_B)+(1-u_B+\gamma)(-\alpha c_B-D_B) \\ &>LY_B-D_B-\alpha c_B\end{aligned} \qquad (1)$$

Similarly, as shown in Espinosa-Vega and others (forthcoming), the lender of last resort will weigh a more complex trade-off when Bank A is in need of a liquidity injection.

It is important to mention that these are only a few of the trade-offs analyzed in Espinosa-Vega and others. These trade-offs underlie the graphical representation in Figures 2.6–2.8.

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CHAPTER 3

MAKING OVER-THE-COUNTER DERIVATIVES SAFER: THE ROLE OF CENTRAL COUNTERPARTIES

Summary

In an effort to improve market infrastructure following the crisis, central counterparties (CCPs) are being put forth as the way to make over-the-counter (OTC) derivatives markets safer and sounder, and to help mitigate systemic risk. This chapter provides a primer on this topic and discusses key policy issues. It shows that soundly run and properly regulated CCPs reduce counterparty risk—the risk in a bilateral transaction that one party defaults on its obligations to the other—among OTC derivatives market participants. Importantly, systemic risk—the risk of knock-on failures from one counterparty to another—is also reduced due in part to the ability to net transactions across multiple counterparties. CCPs also have other risk-mitigating features that ensure that payments to others occur when a counterparty defaults. Nevertheless, movement of contracts to a CCP is not a panacea, since it also concentrates the counterparty and operational risk associated with the CCP itself.

The chapter makes recommendations for best-practice risk management and sound regulation and oversight to ensure that CCPs will indeed reduce risk. This may mean that existing CCPs will need to upgrade their risk management practices and that regulations will need to be strengthened. A big part of this is making sure that there is coordination among regulators and other overseers on a global basis to ensure that the playing field is level and that it discourages regulatory arbitrage. Contingency plans and appropriate powers should also be globally coordinated to ensure that the financial failure of a CCP does not lead to systemic disruptions in associated markets.

To achieve the multilateral netting benefits of a CCP, a critical mass of OTC derivatives needs to move there. However, this will be costly for some active derivative dealers. CCPs require that collateral (called initial margin) be posted for every contract cleared through them, whereas in the OTC context dealers and some other types of participants tend not to currently adhere to this practice. As a result, active OTC derivative dealers, those likely to be members of CCPs, will incur costs in the form of the increase in posted collateral and, if enacted, potentially higher regulatory capital charges against remaining derivatives contracts on their books. Hence, without an explicit mandate to do so there is some uncertainty as to whether dealers will voluntarily move their contracts and whether enough multilateral netting can be achieved. An approach that uses incentives based on capital charges or a levy tied to dealers' contribution to systemic risk could be used to encourage the transition.

The analysis in this chapter shows that CCPs can reduce systemic risks related to counterparty risks that are present in the bilaterally cleared OTC contracts, but that the short-run costs of moving contracts to CCPs are indeed far from trivial. Hence, because the relevant institutions are already challenged to raise funds and capital in the post-crisis period, a gradual phase-in period is warranted.

Over-the-counter (OTC) derivatives markets have grown considerably in recent years, with total notional outstanding amounts exceeding $600 trillion at the end of June 2009 (Figure 3.1). During the financial crisis, the credit default swap (CDS) market, a part of the OTC derivatives market, took center stage as difficulties in financial markets began to intensify and the counterparty risk involved in a largely bilaterally cleared market became apparent. Authorities had to make expensive decisions regarding Lehman Brothers and AIG based on only partially informed views of potential knock-on effects of the firms' failures.

Since the crisis has subsided, a series of initiatives have been entertained to better contain and mitigate systemic risks. These are generally in three areas: (1) preventive measures using, primarily, higher liquidity and capital buffers making an institution less likely to fail due to a shock; (2) containment measures such as better resolution frameworks, alongside the formulation of a "living will" allowing a firm to prepare for its own unwinding; and (3) improvements to financial infrastructure that provide firewalls to help prevent the knock-on effects of an institution's failure and allow shocks to be absorbed more easily. The improved infrastructure should be able to withstand various types of shocks as the next crisis may not be like the last. Chapter 2 discussed a potential systemic-based capital charge, while this chapter examines how infrastructure improvements through the use of central counterparties (CCPs) in OTC derivatives markets can help.

Since OTC derivative markets started up in the early 1980s, transaction clearing and settlement has been mostly bilateral (i.e., between two counterparties). "Clearing and settlement" refers to the various operations that take place after the trade, including matching and confirming details, and transferring funds or ownership of instruments as per the terms and conditions of the trade. At year-end 2009, although about 45 percent of OTC interest rate derivatives were centrally cleared by U.K.-based LCH.Clearnet, almost all other OTC derivatives were bilaterally cleared. Prior to the crisis, OTC markets had proven to be fairly robust despite rapid growth of trading activity. This is due in large part to the efforts of market participants, pushed by the New York Federal Reserve and other regulators and led by the International Swaps and Derivatives Association (ISDA), to continually improve the legal and operational infrastructure. However, the crisis exposed weaknesses. While CCPs worldwide functioned relatively well, where such CCPs were not involved, there were difficulties in unwinding derivatives contracts.

A major problem with bilateral clearing is that it has resulted in a proliferation of redundant overlapping contracts, exacerbating counterparty risk and adding to the complexity and opacity of the interconnections in the financial system. Redundant contracts proliferate because counterparties usually write another offsetting contract, rather than closing them out. All of this has left regulators and other relevant authorities largely in the dark about potential knock-on effects of a major counterparty failure.

This chapter focuses on the potential solution receiving the most attention—namely the movement of OTC derivatives to existing and new CCPs.[1] The primary advantage of a CCP is its ability to reduce systemic risk through multilateral netting of exposures, the enforcement of robust risk management standards, and mutualization of losses resulting from clearing member failures. At the same time, it is important to recognize that CCPs concentrate counterparty and operational risks, and thus magnify the systemic risk related to their own failure. Hence, a CCP needs to withstand such outcomes by having sound risk management and strong financial resources. Furthermore, moving OTC derivatives to a CCP is not without interim costs, which may particularly discourage the dealer community from moving its trades to a CCP. The chapter provides some rough estimates of the associated costs.

The chapter examines the regulation, supervision, and oversight of CCPs and suggests that these functions should be recognized as complementary

Note: This chapter was written by a team led by John Kiff and comprised of Randall Dodd, Alessandro Gullo, Elias Kazarian, Isaac Lustgarten, Christine Sampic, and Manmohan Singh. Yoon Sook Kim provided research support.

[1]This chapter does not extensively discuss proposals to force OTC derivatives trading onto organized exchanges, although such a move would have obvious price transparency benefits to the users of these contracts.

but with distinct focuses. Given the global nature of the OTC derivatives market, it also emphasizes the need for close cross-border coordination to establish international minimum risk management standards to avoid regulatory arbitrage. The joint initiative by the Committee on Payments and Settlement Systems (CPSS) and the International Organization of Securities Commissions (IOSCO) in revising international standards should be encouraged in this regard. The chapter finally discusses the current environment in which, due to various business, political, and regulatory obstacles to establishing a single CCP, multiple CCPs clearing the same type of derivative instrument are sprouting everywhere (Table 3.1). A single global CCP for OTC derivatives would provide maximum economies of scale and systemic counterparty risk reduction, but similar efficiencies can be achieved by linking multiple CCPs, the obstacles to which are not insurmountable, as shown by the success of the CLS Bank in settling cross-border foreign exchange transactions. However, currently, links are difficult to achieve and the business case is unclear.[2]

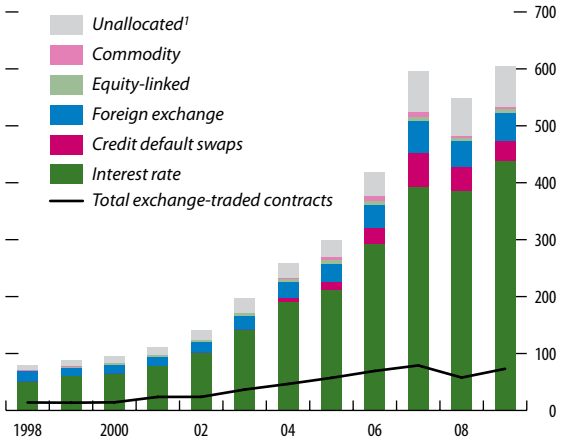
The Basics of Counterparty Risk and Central Counterparties

Counterparty risk is the risk that one of the contract counterparties fails to meet its payment obligations. Existing counterparty risk mitigation practices have generally been effective, though the Lehman Brothers bankruptcy and the near failure of AIG have led market participants and regulators to seek improvements. Typical mitigation practices include (1) netting of bilateral positions; (2) collateralization of residual net exposures; and (3) compression and tear-up operations that eliminate redundant contracts.

In very broad terms, a CCP can reduce systemic risk by interposing itself as a counterparty to every trade, performing multilateral netting, and providing various safeguards and risk management practices to ensure that the failure of a clearing member to the CCP does not affect other members (Box 3.1 describes

[2]Although CLS Bank is not a central counterparty in that it is not responsible for the risk that a counterparty fails to deliver foreign currency on time, its success shows that the cross-border complications that confront OTC derivative CCPs may not be insurmountable.

Figure 3.1. Global Over-the-Counter Derivatives Markets
(In trillions of U.S. dollars; notional amounts of contracts outstanding)



Source: Bank for International Settlements.
Note: Over-the-counter data through June 2009; exchange-traded data through December 2009.
[1]Includes foreign exchange, interest rate, equity, commodity, and credit derivatives of nonreporting institutions.

Table 3.1. Currently Operational Over-the-Counter Derivative Central Counterparties

	Contract Type				
Platform (Domicile)	Interest rate swap	Credit default swap	Foreign exchange	Equities	Other[1]
CME Clearing (U.S.)		✓			✓
BM&FBovespa (Brazil)	✓		✓	✓	✓
Eurex Clearing AG (Germany)	✓	✓		✓	✓
Euronext/LIFFE BClear (U.K.)				✓	✓
ICE Clear Canada (Canada)					✓
ICE Clear Europe (U.K.)		✓			✓
ICE Trust (U.S.)		✓			
LCH.Clearnet (U.K.)	✓				✓
LCH.Clearnet.SA (France)		✓			
IDCG International Derivatives Clearinghouse (U.S.)	✓				
NASDAQ OMX Stockholm AB (Sweden)					✓
NOS Clearing (Norway)					✓
SGX AsiaClear (Singapore)					✓

Source: IMF staff.
[1]Other includes commodities, energy, freight, and macroeconomic (e.g., inflation) indicators.

in more detail some of the mechanics of OTC derivatives clearing).[3]

Netting of Bilateral Positions and "Close-Out Netting"

OTC derivative contracts expose counterparties to the default risk of others while those contracts have positive replacement values—that is, the value or payment the nondefaulting party would receive if the contract were to be terminated today. In the absence of close-out netting, the maximum loss incurred by one counterparty to a defaulting counterparty is equal to the sum of the positive replacement values (i.e., "derivative receivables").[4] However, most OTC derivative contracts are covered by bilateral master agreements that aggregate all exposures between two counterparties. These bilateral master agreements allow for close-out netting when one of the counterparties defaults, which permits the "derivative payables" (the sum of the replacement values of the contracts with negative values, i.e., those that the nondefaulting counterparty owes the defaulting party) to be used to offset the derivative receivables.

Collateralization of Residual Net Exposures

The exposure of counterparties to each other can be further reduced by requiring the counterparties to post collateral (typically cash and highly-rated liquid securities) against outstanding exposures.[5] In order to cover potential future exposure and residual risks, there is often an "independent amount" deposited at the initiation of a contract.[6] Independent amounts

[3]Derivative clearing facilities need special risk management systems because these contracts have long lifespans as compared with cash and securities.

[4]Payment netting occurs throughout the life of a transaction as all payment obligations in a single currency between the counterparties are replaced with a single net amount on each relevant payment date. However, close-out netting occurs at the end of a transaction essentially when one party has defaulted. When default occurs, termination of the contract is typically triggered by the nondefaulting party, a single net amount due between the parties becomes payable, and the nondefaulting party is given access to its collateral if the defaulting party owes anything to the nondefaulting party.

[5]"Haircuts" are often applied so that the required amount of collateral reflects the potential for its value to decline between the time when the counterparty defaults and the time when the collateral is liquidated. A "haircut" is a discount applied to the posted collateral's current market value to reflect its credit, liquidity, and market risk. The Basel II haircuts on securities rated AA- or better range from 0.5 percent for sovereigns maturing within one year to 8 percent on corporates and public sector entities. Haircuts are also used to factor in foreign exchange risk if foreign currency assets are accepted as collateral. As with the underlying exposures, collateral is usually revalued on a daily basis.

[6]Residual risks include delays between when the new collateral requirements are calculated, called, and settled, the impact of

Box 3.1. The Mechanics of Over-the-Counter Derivative Clearing

Clearing is what takes place between the execution of a trade (when two counterparties agree to fulfill specific obligations over the life of the contract) and settlement (when all of the contract's legal obligations have been fulfilled). This box uses a hypothetical swap transaction to run through the key clearing functions using an interest rate swap as an example.[1] These clearing functions are relevant to both bilateral and centrally cleared trades.

The key clearing functions are illustrated with a hypothetical $100 million, 10-year interest rate swap that pays a fixed 5 percent rate against receiving floating-rate payments based on the one-year London Interbank Offer Rate (LIBOR). Both payments are made annually "in arrears," which means that the payment calculations are made at the beginning of each annual payment period, but payments are not made until one year later.

The first step in the clearing process is to confirm the terms of the swap contract with both counterparties. This is followed by various transaction and risk management functions throughout the contract's (10-year) life, unless it is terminated early (see Bliss and Steigerwald, 2006; and Hasenpusch, 2009). These functions include:

- Determining payment amounts at the start of each (one-year) interest period, notifying the counterparties and settling the payments at the end of the period. In the example, if LIBOR is less than 5 percent (e.g., 4 percent), the "fixed payer" makes a payment (and the "variable payer" receives an amount) equal to the difference between the two calculated payments ($1 million = $100 million times 1 percent).
- Daily valuations of all derivative contracts under the specific master agreement (in the case of a bilateral trade) or with the counterparty (in the case of centrally cleared trades) for collateral requirement purposes. Similarly, all posted collateral must be monitored and revalued daily, and "haircuts" determined and applied.
- Monitoring counterparty creditworthiness and compliance with all the terms of the contracts. This includes determining whether to exercise settlement rights if an event of default or termination occurs, and recovering or making net final payments.
- Keeping relevant records and producing various reports.

There are a number of commercial vendors that provide all or part of these services. These include ICE Trust's ICE Link, the Depository Trust & Clearing Corporation and Markit's MarkitSERV trade matching and confirmation services, Euroclear's DerivManager, and TriOptima's triResolve daily position and collateral reconciliation services. Also, TriOptima's triReduce and the Creditex tear-up and compression services eliminate redundant contracts. While these services provide the nuts and bolts of the process, they do not take on the credit risks associated with a failure of a counterparty. Hence the function of a central counterparty.

Note: This box was prepared by John Kiff.

[1]See Hasenpusch (2009) for a much more detailed explanation of the nuts and bolts of clearing.

are usually posted by end-users to dealers. End-users include investment funds, hedge funds, and other nondealers.

Market practice is that dealers do not typically post independent amounts to each other. Dealers also do not typically ask for collateral from some types of customers, namely sovereign and quasi-sovereign entities and some corporate clients.[7] Given these practices, exactly how much collateral is currently posted against OTC derivative positions is not known with certainty. According to a recent global survey by ISDA, 22 percent of OTC derivative transactions are uncollateral-

minimum transfer amounts, and the potential for replacement value fluctuations from the point when a counterparty defaults and the contracts are closed out. In futures markets, the upfront amount is called "initial margin" and is viewed as a performance bond or guarantee that a counterparty will honor its contractual agreements.

[7]Most dealers post collateral to each other against day-to-day changes in replacement costs (i.e., positive market value less negative market value)—that is, variation margin on mark-to-market valuations.

ized, which is a high proportion of uncovered risk (ISDA, 2010).[8] Also, of the 78 percent of transactions (by notional amount) that are collateralized, 16 percent are unilateral, where only one side of the transaction is obliged to post collateral. In addition, where there is an agreement for bilateral collateral posting, such posting can be hindered by disputes between parties about the valuation of the underlying positions and collateral that result from diverse risk management systems and valuation models. Central clearing substantially reduces this problem, as it standardizes valuation models and data sources.

Multilateral Compression and Tear-Ups

Multilateral compression and tear-up operations eliminate redundant contracts and reduce counterparty risk, and shorten and simplify systemic interconnections. The redundant contracts result from multiple bilateral transactions. For example, if party A owes party B a sum, say $10, and party B owes party C the same sum, say $10, then party B can be eliminated and party A will owe party C the $10. Since the Lehman bankruptcy, these multilateral contract termination operations have been pursued avidly. In 2008 and 2009, TriOptima's triReduce tear-up service eliminated about $45 trillion notional of CDS contracts and $39 trillion of interest rate swap contracts.[9] Over the same period, the compression service run jointly by Creditex and Markit eliminated about $6 trillion notional of CDS contracts. (To put these volumes in perspective, from end-2007 to end-June 2009, the Bank for International Settlements reported that outstanding CDSs dropped from $58 trillion to $36 trillion and interest rate swaps rose from $310 trillion to $342 trillion). The impact of these operations is visible in the shrinking amount of gross outstanding CDS contracts, with the reduction concentrated in index contracts, whose high degree of fungibility and standardization makes them easier to match off and tear up (Figure 3.2).[10]

ISDA has made important progress in standardizing single-name CDS contracts (those associated with a single entity), which should facilitate compression and tear-up operations for those contracts. Despite this progress, many OTC derivative contracts (e.g., bespoke contracts) are not eligible for such operations because they do not fit the standard product templates.

The Case for Over-the-Counter Derivative Central Clearing

OTC derivative bilateral clearing has some key weaknesses even after the application of best-practice risk management techniques. It is helpful that market participants continue to work toward convergence of best practice, but much remains to be done. The failure of dealers to follow best counterparty risk management practice such as requiring the posting of upfront collateral on all contracts, and to agree explicitly on valuation and data sources, is likely to arise more in a bilateral context than a CCP context because the latter requires more conformity.

Novation of Bilateral Contracts to Central Counterparties

By interposing itself between the two clearing members (CMs) to a bilateral transaction, a CCP assumes all the contractual rights and responsibilities. In particular, the two CMs legally assign their trades to the CCP (usually through "novation"), so that the CCP becomes the counterparty to each CM (Box 3.2). In order to clear trades and perform multilateral netting, the CCP requires contracts to be standardized. Nonstandard contracts cannot be netted, since each one's cash flow characteristics are different, though such contracts could be placed in trade repositories and hence information about them transmitted to

[8]According to the ISDA survey, collateralization coverage is quite diverse, ranging from 97 percent of credit derivatives to 84 percent on other fixed-income derivatives and 62 to 68 percent on all others (ISDA, 2010). However, another study by the Banking Supervision Committee of the European System of Central Banks found that over half of OTC derivative transactions were totally uncollateralized (ECB, 2009), although this report surveyed only European Union banks, including many smaller institutions.

[9]A contract's notional value is the nominal or face value used to calculate payments, and/or the quantity of the underlying reference instrument.

[10]CDS index contracts are based on standardized indices based on baskets of liquid single-name CDS contracts, those associated with a credit event of a single entity.

authorities (see below). Hence standardization, in turn, encourages further standardization and a convergence of risk management and valuation models.

Central Counterparties Reduce Counterparty Risk

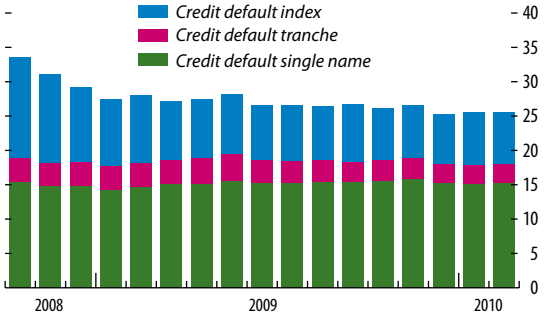
CCPs also reduce the potential knock-on effects of the failure of a major counterparty because the impact is mitigated and absorbed by the CCP's default protections, including the potential mutualization among its CMs who must share in any losses should the margin posted by the defaulting member be insufficient. In addition to lowering exposures through multilateral netting, CCPs require initial margin to be held against any losses of the defaulting CM. In the case of default, if initial margin funds are exhausted, then the defaulting CM's contribution to the CCP's guarantee fund made up of all the CMs' contributions is used. If this is also insufficient, then funds from the entire guarantee fund (now including other CMs' contributions) are used. Other backstops may also be in place to assure all other counterparties continue to be paid, thus halting the default of other counterparties (see below). The usefulness of a well-designed CCP became evident in the September 2008 Lehman Brothers failure and the near-failure of AIG (Box 3.3).

Central Counterparties Increase Market Transparency

CCPs can increase market transparency, as they maintain transaction records, including notional amounts and counterparty identities, although it is not the only route. The U.S.-based Depository Trust & Clearing Corporation (DTCC) shares CDS transaction information from its trade information warehouse with authorities.[11] However, it does not report on customized contracts, which by some estimates may comprise up to 15 percent of CDS and most equity derivative notional amounts outstanding. Sweden-based TriOptima is also collecting interest rate swap transaction data and sharing it with various countries' authorities. Also, MarkitSERV, jointly owned by

[11]DTCC has been publishing detailed information on notional amounts outstanding by product type, reference entity, and other characteristics on a weekly basis since November 2008 (Figure 3.2).

Figure 3.2. Outstanding Credit Default Swaps in the Depository Trust & Clearing Corporation Data Warehouse
(Gross notional amounts, in trillions of U.S. dollars)



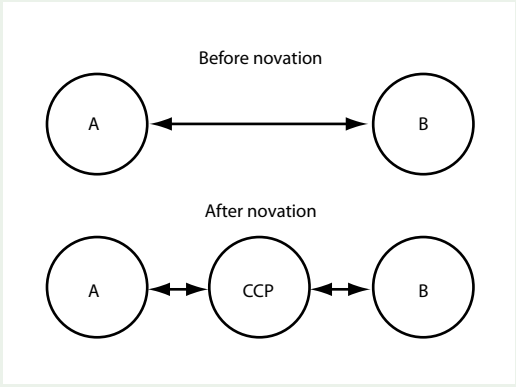
Source: Depository Trust & Clearing Corporation.
Note: Credit default swap (CDS) tranches are based on CDS index contracts, which are based on standardized indices of liquid single-name CDS contracts, those associated with a credit event of a single entity. Monthly data from November 2008 to February 2010.

Box 3.2. The Basics of Novation and Multilateral Netting

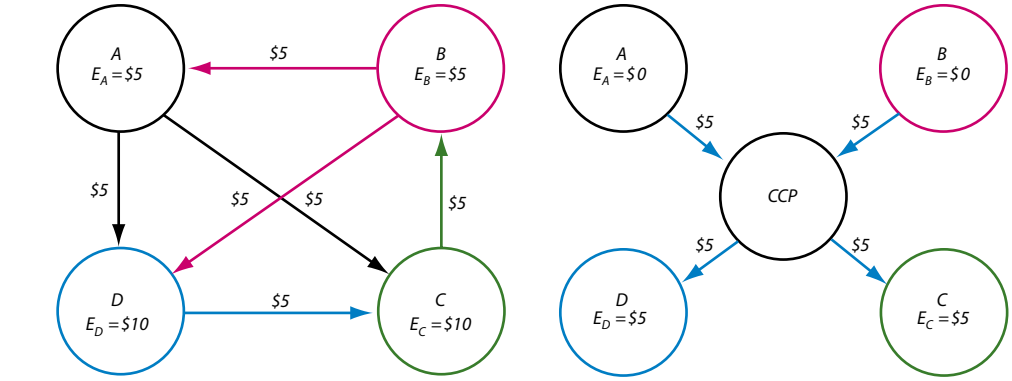
This box provides a brief primer on the mechanics and counterparty risk reduction benefits of transferring bilateral derivative contracts to central counterparties.

"Novation" discharges the original rights and obligations of the buyer and the seller and replaces their contracts with two new contracts with the central counterparty (see first set of figures). The assumption of counterparty risk can also be effected by an "open offer," in which the central counterparty interposes itself at the time of the trade.

The second set of figures show how multilateral netting reduces the amount of counterparty risk in the system. The first figure of this second set shows contracts across four counterparties in a bilateral world (A, B, C, and D, clockwise from the top left corner). The numbers on the arrows indicate the net current replacement costs, so that, for example, if the contract between A and B were closed out immediately, B would owe A $5. The E below those letters indicates the maximum counterparty exposure for the counterparty. Thus, for example, E_C = $10 because it will cost C $10 to replace the contracts with A and D if they both fail, etc. If all of these contracts are novated to a central counterparty, all of A's and B's counterparty risk exposure is eliminated, leaving C and D each with $5 of exposure to the central counterparty.



Note: This box was prepared by John Kiff.



DTCC and U.S.-based Markit, will also be performing similar functions for equity derivatives.

Ideally, there should be a single trade repository for each product type that collects and shares information in ways that are useful to the relevant authorities. Although different users will want information in different ways or for different purposes and at different times, they should agree to a standard framework.

Detailed individual counterparty transaction data should be available to all relevant regulators and supervisors of affected jurisdictions for use in monitoring individual and systemic risks. Indeed, relevant regulators are working on such templates and information sharing protocols in the OTC Derivatives Regulators Forum, which was formed in September 2009. Given the confidential nature of such data, the public should

Box 3.3. The Failure of Lehman Brothers and the Near-Failure of AIG

This box shows how central clearing might have reduced the systemic fallout from the Lehman Brothers' failure and AIG near-failure.

The logistical part of closing out Lehman Brothers' redundant credit default swap trades went quite smoothly, in large part due to an emergency round of compressions. However, the mass reestablishment of positions in already-stressed over-the-counter credit default swap markets was more difficult (Moody's, 2008). If all or most of Lehman's credit default swap trades had been novated to one or more central counterparties, the last-minute compressions and position reestablishments to other dealers would not have been necessary. In fact, all of Lehman's interest rate swap positions that had been cleared through LCH.Clearnet settled without difficulty in a few days following the bankruptcy, given the rules in place at the central counterparty. In fact, all other counterparties were paid what they were owed without using up all of Lehman's initial margin and without tapping the guarantee fund.

In the AIG case, systemically important banks had bought and relied on massive amounts of mortgage-backed security default protection in the form of credit default swaps on subprime mortgages written by the insurer's financial products subsidiary (AIG-FP) and guaranteed by AIG.[1] As the crisis unfolded, the value of the protection soared, and following the ratings downgrade of parent company AIG, AIG-FP was obliged to post huge amounts of collateral that it did not have. Because of the potentially disastrous systemic knock-on effects of a failure to post, U.S. authorities decided to supply AIG with liquidity assistance that, at one point, exceeded $100 billion. If these contracts had been novated to central counterparties, the collateral calls still would have been problematic for AIG, but they would have come sooner and more frequently. Hence, uncollateralized exposures would not have been given the chance to build to levels that became systemically critical.

Note: This box was prepared by John Kiff.

[1]AIG was able to amass such large positions because prior to March 2005 those positions were rated AAA and AIG was not required to post collateral. After the first downgrade (to AA+ in March 2005) AIG had to start posting. As the crisis unfolded, AIG's mounting collateral posting requirements, coupled with liquidity strains from its securities lending unit, became unsustainable in September 2008. See ISDA (2009) for more detail on the AIG situation.

not be provided with this level of detail, but receive information that is aggregated.

Mandating exchange trading for all standardized derivatives as outlined in the September 25, 2009 G-20 Communiqué has also been suggested as a way to improve price transparency and market liquidity. However, to begin trading on an exchange the prospect of enough liquidity to maintain an active trading environment is needed. Standardization alone may not be enough to guarantee widespread interest in active trading. However, standardization is a necessary condition to achieving the counterparty risk reduction benefits of central clearing. Hence, the legislative and regulatory focus should be first on centralized clearing, and let standardization provide the natural incentives for exchange trading. Moreover, for any particular type of contract, the potential benefits of exchange trading should be weighed against the infrastructure costs and benefits of continued customization typical in the OTC market.[12] Indeed, most of today's exchange-traded derivatives began as relatively customized bilateral transactions. An example of such evolutionary development is the "probability of default" (POD) credit derivative contract that is being developed for exchange trading. It is structured to resemble a eurodollar futures contract, which is among the most active exchange-traded derivative contracts.[13]

[12]Squam Lake Working Group on Financial Regulation (2009, p. 5).

[13]For example, the POD contract will be available on the same quarterly maturity cycle as used for eurodollar contracts, and at maturity, single-name contracts will settle at a price of

Incentivizing Central Counterparty Participation and the Role of End-Users

While central clearing offers numerous counterparty risk mitigation benefits at the individual counterparty and systemic level, the benefits are only realized if a critical mass of contracts is moved to CCPs. In that regard, there remain some potential challenges to facilitate novation to CCPs, including enhancing the degree of product standardization and liquidity, potentially large up-front capital and margin requirements, and more clarity on how customer collateral would be treated in the event of the default of the CMs through which they establish CCP positions.

Product Standardization and Liquidity

Central clearing generally requires the use of "mass production" processes that work best with standardized and fungible products, whereas customized contracts require specialized pricing and risk models and one-off infrastructure solutions. This problem is most acute in the CDS market, where contracts have historically been nonfungible along business, legal, and operational dimensions. However, almost all interest rate swaps and index-based CDSs have long been sufficiently standardized for CCP eligibility, as are almost all single-name CDS contracts transacted since early 2009.[14] That said, standardization is a necessary but not sufficient condition for CCP eligibility.

Another important condition for central clearing is the regular availability of prices and enough market liquidity to assure that such prices are representative, plus the ability of the CCP to manage the relevant risks (FSA/HM Treasury, 2009). All said, many end-users continue to prefer OTC bilateral arrangements in order to meet their specific hedging requirements and hence have a desire for customized contracts. Accounting for these factors, according to dealer and IMF staff estimates, the movement of OTC derivative contracts to CCPs will vary by type of product. For example, the vast majority of bilateral interest rate swap and index-based CDS contracts are expected to move to CCPs, as are most single-name CDS contracts. However, commodity-based, equity-based, and foreign-exchange-based derivatives will be harder to move (see Table 3.2 for some estimates).

Getting Dealers to Move[15]

In order to get a critical mass of bilateral OTC derivatives to move over to CCPs, the major derivatives dealers will require some incentives to alter their current collateralization practices. The multilateral netting within the CCP should reduce counterparty risk and thus also the initial margin requirements for the individual participants in the CCP. However, because these overall benefits may be outweighed by various individual costs and hence may discourage dealers to move, it may be necessary to consider a charge against their remaining bilateral positions.

One implicit cost for some market participants is the loss of the netting benefits they already obtain on their bilateral contracts within their own derivatives books. For example, a dealer may be getting substantial netting benefits from standardized contracts that are CCP-eligible and nonstandard contracts that cannot be centrally cleared, but that are all transacted under the same master agreement.[16] Collateral posting requirements associated with some market participants'

100 if the reference entity has not defaulted, or zero if it has defaulted. (The settlement price for index-based contracts will be equal to the sum of the referenced single-name probability of default contracts, divided by the number of entities.) Also, the contract is a pure play on default events, rather than on default events and recovery rates, as is the case with conventional CDS, in order to simplify settlement. Although this may limit the contract's usefulness to some hedgers, planned as well are POD recovery futures that, for single-name contracts, settle at a price of 100 times the proportional recovery rate (the proportion of par value ultimately paid to the holder of the defaulted obligation).

[14]See Kiff and others (2009) for more on ISDA's single-name CDS standardization protocols.

[15]See Singh (2010) for a more comprehensive discussion of the material in this section.

[16]For example, with a particular counterparty under the same master agreement, a dealer may have an in-the-money position (i.e., with a positive replacement value) via a nonstandard derivative contract and an out-of-the-money position via a standard derivative. These two positions can offset each other on the dealer's books, resulting in a small net exposure on which capital requirements are based. If the out-of-the-money standard derivative position were to be transferred to a CCP, the net exposure would increase to the replacement value of the nonstandard derivative position, and capital requirements would increase accordingly.

Table 3.2. Incremental Initial Margin and Guarantee Fund Contributions Associated with Moving Bilateral Over-the-Counter Derivative Contracts to Central Counterparties (CCPs)

	Total Outstanding *(Trillions of U.S. dollars of notional amounts)*	Increment Moved to CCPs[1] *(Trillions of U.S. dollars of notional amounts)*	Initial Margin and Guarantee Fund[2] *(As a fraction of offloaded notional amounts)*	Incremental Initial Margin and Guarantee Fund *(Billions of U.S. dollars)*
Credit default swaps	36	24	1/600 to 1/300	40–80
Interest rate derivatives	437[3]	100[3]	1/5,000 to 1/3,300	20–30
Other derivatives[4]	132	44	1/1,000	44
Total	605	168		104–154

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

[1]Two-thirds of all eligible credit default swaps and one-third of foreign exchange, equity, commodity, and "unallocated" derivatives are assumed to be moved to CCPs. See footnote 3 for the assumptions applied to interest rate derivatives.

[2]The ratios of initial margin and guarantee fund to notional cleared used to estimate costs to establish well-capitalized CCPs are drawn from recent CCP clearing activity. The ratios account for the impact of both multilateral compression and the margin rates on the resulting compressed notional amounts. For example, the 1/600 applied to credit default swaps could be consistent with a 1:10 compression ratio and a 1/60 margin rate.

[3]$200 trillion of interest rate swaps are already on CCPs against which about $20 billion of initial margin and guarantee fund contributions have been posted. $100 trillion of the remaining $237 trillion of interest rate derivatives is assumed to be moved to CCPs.

[4]Other derivatives include contracts linked to foreign exchange ($49 trillion), equities ($7 trillion), commodities ($4 trillion), and an "unallocated" amount ($72 trillion).

OTC derivative trading books may increase if only some of the contracts can be moved to CCPs, because some of the netting benefits under existing bilateral contracts could be lost.[17] Some dealers argue that the multilateral netting benefits within the CCPs will not be large enough to offset these potential increased collateral needs. However, most view that this is a transitional issue that will be lessened as more derivatives become CCP eligible.

Another possibly sizable incremental cost of moving contracts to CCPs relates to the upfront initial margin that is not typically posted on bilateral inter-dealer trades, plus guarantee fund contributions where they are dependent on the amount of contracts cleared.[18] The direct incremental initial margin and guarantee fund contributions are expected to be large—up to about $150 billion according to the analysis summarized in Table 3.2.[19] To put this in perspective, a recent JP Morgan report estimated that the total capital cost of all the recently introduced regulatory measures across 16 global banks would amount to about $221 billion (JP Morgan, 2010).

A somewhat smaller cost stems from the inability to relend or otherwise use the collateral that dealers do collect from some of their end-users. This collateral is typically re-used—for example, lent out again through rehypothecation (Singh and Aitken, 2009a). Such collateral that would then be posted at the CCP would be unavailable to the dealers for re-use. For example, at end-December 2009, posted collateral amounts ranged from $15 billion to $63 billion among the five U.S. banks most active in OTC derivative markets (Figure 3.3). In the current low interest rate environment, this lost revenue may

[17]If initial margin is not posted on contracts that are not centrally cleared, the loss of netting benefits becomes an increase in counterparty risk exposure. The assumption that it will be posted is based on the idea that the authorities will either mandate or incentivize (e.g., via higher capital charges) initial margin posting.

[18]The analysis here considers only bank-dealer initial margin requirements. Most nondealer financial firms (e.g., hedge funds) post both initial and variation margin to their dealer (and prime broker) counterparties. Other end-users, such as investment-grade corporates, sovereigns, and central banks, often do not post collateral.

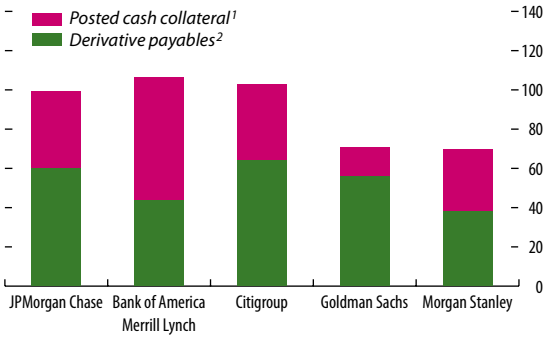
[19]Variation margin is not expected to change, since the calculation methodologies are expected to remain functionally identical to those currently used for bilateral contracts. The estimates of the incremental amounts associated with the guarantee fund and initial margin posting are based on a framework detailed in Singh (2010) and on information gathered from a number of CCPs and derivatives dealers. This information includes, by product class, an estimate of the proportion of total outstanding notional amounts that are likely to be transferred to CCPs, and an estimate of the range of initial margin posting requirements currently used at CCPs as a proportion of notional amounts. These estimates would change if the amounts transferred to CCPs are different and as the risk of the underlying the product class changes.

not be much greater than that which they would receive on the initial margin held at CCPs, since CCPs generally pass on whatever the posted collateral earns to their CMs. That said, as interest rates rise, the opportunity cost to the lost interest income may become greater and the reluctance to keep initial margin at the clearing house will rise.

Hence, all of these costs, which may be substantial for some dealers, could reduce or even eliminate any incentives to move contracts to CCPs. Given the higher costs for some dealers and their possible reluctance to clear OTC derivatives through CCPs, European and U.S. authorities are proposing legislation that will incentivize, if not mandate, clearing "eligible" OTC derivatives through CCPs. Eligibility standards for clearable contracts focus on contract standardization and market liquidity, and so far, are determined by the CCPs. In some cases the push will come from higher counterparty capital charges imposed on banks and dealers on bilaterally cleared transactions, and the pull from near-zero capital charges imposed on CMs on centrally cleared transactions.[20] There is a recognition that not all transactions will be eligible, but the proposals still intend to make noncleared transactions more expensive, reflecting their higher counterparty risks. Given the high upfront costs and a compelling case for some contracts to remain customized for end-users, some favor mandating a wholesale move of OTC derivatives to CCPs. This may help solve the dilemma that, without it, dealers may be reluctant to be first movers if they fear that not enough other dealers will move contracts to CCPs to achieve the multilateral netting benefits. On the other hand, because it would require dealers to post potentially large amounts of collateral at once, this may be disruptive.

The current method of assigning capital charges to derivative positions is based on net derivative exposures (i.e., derivative receivables minus derivative payables, net of collateral posted on receivables). This method is based on the traditional notion that the counterparty risk associated with an open derivatives position is borne by the dealer that holds the

Figure 3.3. Derivative Payables plus Posted Cash Collateral
(In billions of U.S. dollars as of December 31, 2009)



Source: Bank/dealer 10Q reports.
[1]Posted cash collateral is collateral posted against specific over-the-counter derivative contracts that may be reused (rehypothecated) for other purposes by the institution to which it is posted.
[2]Derivative payables are the sum of the negative replacement values of an institution's outstanding contracts.

[20]Regulatory counterparty risk capital requirements on centrally cleared transactions are currently zero, but the Basel Committee on Banking Supervision has proposed a nonzero regulatory capital charge on CM contributions to default or guarantee funds (BCBS, 2009).

open position (i.e., if its counterparty reneges on the contract the dealer will have an unsecured claim in its counterparty's insolvency proceeding for the net replacement cost of all the contracts under the master agreement). So far, the Basel Committee on Banking Supervision's latest proposals are aimed at strengthening counterparty risk capital requirements to take better account of this measure of counterparty risk (BCBS, 2009).

However, as a way of reflecting the risks that the large OTC derivative dealers' books pose to their counterparties and to the financial system as a whole, a direct charge or "tax" on derivative payables (the amounts owed to others) could be considered (Singh, 2010; Singh and Aitken, 2009b).[21] Figure 3.3 shows that the derivative payables of each of five large U.S. banks ranged from about $50 billion to $80 billion and totaled $337 billion at end-December 2009. The five European counterparts most active in OTC derivatives markets had similarly large payables at end-December 2009 (ranging from about $45 billion to $95 billion and totaling $370 billion). However, such amounts can vary. For instance, at end-December 2008, total derivative payables at these same 10 banks totaled over $1 trillion, due to the severely dislocated markets at the time. As an example of how such a charge could be constructed: assume an ad hoc "tax" of 20 percent is charged on the peak $1 trillion total derivative payables for these institutions and, say, on an assumed one-third of OTC derivative contracts that are not centrally cleared, then the total additional cost of such a surcharge will be about $70 billion (20 percent x 1/3 x $1 trillion).[22] The "tax rate" would need to be calibrated to provide enough incentive to move contracts to CCPs, but not so high as to overly burden dealers, as they attempt to deleverage and accommodate the more stringent regulations likely to be enacted. Also, timing of the introduction of such charges would need to be carefully considered.

This estimate should be considered very rough since the degree to which derivative payables may decrease when other Basel II capital charges are imposed or when more collateral is moved to CCPs is unknown. On the other hand, derivative payables may rise if bilateral netting is less effective given the movement of contracts to CCPs. However, in principle, a direct cost related to the systemic risk stemming from OTC derivatives that a large derivatives dealer poses to others would help induce them to lower their derivative payables in their OTC derivatives book—that is, their risk imposed on the rest of the system.

Getting End-Users to Move

One of the key challenges to moving OTC derivatives to CCPs is to get end-users to ask their CMs to move their positions. "End-users" in this case means investors, including hedge funds and insurance companies, and nonfinancial corporates, sovereigns, and quasi-sovereigns that are using derivatives to hedge balance sheet risks. While moving positions to CCPs reduces their counterparty risk, such end-users also want to be assured that their CCP positions will be seamlessly ported to another CM in the event of the default of the CM through which they have established their positions. Many large customers also want to be assured that any collateral they post will be segregated from the collateral posted by their CM, and ideally segregated from the collateral posted by the CM's (and CCP's) other customers. Some CCPs are providing customer clearing services offering different levels of position portability and collateral segregation, but this area remains a work in progress (Box 3.4).

Getting CCP buy-in from some end-users might be difficult, because many do not currently post any collateral or margin. In some cases, they pledge other assets in lieu of cash and high-quality securities, and in other cases they only have to post collateral if certain credit-quality triggers (e.g., credit-rating downgrades) are tripped. Reasons for noncollateralization include transaction volumes that are not high enough to justify the operational costs of collateralization, and insufficient liquidity to manage daily collateralization adjustments. Liquidity is a particular concern

[21]There are other amounts that a derivatives dealer bank would owe its counterparties besides those attributable to derivatives trades as such banks have many relationships with other counterparties. So a capital charge on derivatives payable would only cover systemic derivatives-based risks.

[22]The total amount of capital raised during the crisis, excluding government capital repaid, for banks in the United States, euro area, United Kingdom and other mature European countries to date is about $860 billion.

Box 3.4. Central Counterparty Customer Position Portability and Collateral Segregation

The segregation of customers' collateral and the portability of positions are viewed as key mechanisms to facilitate customer access to clearing, especially since direct access for most customers to a central counterparty (CCP) is not feasible or convenient. This box provides an overview of the legal foundations required to ensure that segregation and portability are effective. It also shows that when customer collateral is commingled in so-called omnibus or "consolidated" accounts, which is the case for most CCPs, some of that collateral is potentially at risk in the event of their clearing member's default.

Segregation occurs when a clearing member (CM) is holding two or more separate collateral portfolios: one for itself and one for its customers. While it may be technically possible, and in some jurisdictions feasible, to apply segregation techniques on cash, in other jurisdictions this will be legally difficult if not impossible.[1] Segregation is generally achieved by the CM lodging all customer collateral in a customer *omnibus* or consolidated account. In addition, a market practice is increasingly being considered under which the CM holds with the CCP the collateral of its customers in individualized or "designated" accounts (i.e., in the name of each customer). In some jurisdictions, and depending on the type of collateral (e.g., cash or securities) and agreements between stakeholders (CMs, CCPs, and customers), the collateral may be held at the CM, CCP, or a custodian.

The main purpose of segregation is to protect customers against the risk that, in the event of the insolvency of their CM, the insolvency receiver of the failed CM keeps the customer's collateral to satisfy the obligations of the failed CM generally, instead of its obligations to the customer. This is typically achieved through specific provisions in so-called securities holding laws, through which customers depositing securities collateral with a CM acquire individual or collective property law rights in collateral pools held by that CM on behalf of its customers with custodians such as CCPs. By providing such protection, segregation enables a CCP (or the regulator) to transfer both the defaulting CM's customers' exposures and their related collateral to another CM in an unhindered manner, which allows the customers to meet their settlement obligations and hedge their exposures as needed. However, even in cases of segregation, the practice of reuse may subject collateral to additional risk. To enhance protection to a customer of its collateral, collateral should be used only subject to the customer's specific authorization.

However, even though well-designed omnibus and individualized accounts both protect customers against the insolvency of a CM, these two techniques have different legal consequences. In most systems using customer omnibus accounts, when both a CM and customer become insolvent, the CCP first applies the insolvent customer's collateral to satisfy the obligations of the failed CM. Then all collateral lodged into the omnibus account (including the collateral originally provided by nondefaulting customers) is used to satisfy any remaining obligations of the defaulting customer. (If a customer, but not the CM, fails, the CM will remain responsible to the CCP for the margin obligations of all its customers.) In contrast, if customers' *individualized* accounts are held and recognized at the CCP level, only the collateral lodged in the individual account of a customer can be used to cover losses related to the default of that customer.

To the extent that omnibus accounts are less costly than individual accounts to maintain, customers face a trade-off between the safety inherent in the enhanced individualized segregation of their collateral and the costs associated with such additional protection.

Portability is the legal mechanism allowing, in case of default or insolvency of a CM, for the transfer by the CCP (or the regulator) of the CM's customers' cleared positions and collateral to another solvent CM. By enhancing portability, legal frameworks can help to mitigate systemic risks arising from disruptions to the financial system in case of insolvency of a CM.

Movement by CCPs of contracts and related collateral from a defaulting CM to a nondefaulting CM takes place through new contractual arrangements,

Note: This box was prepared by Alessandro Gullo and Isaac Lustgarten.

[1]See the "Report to the Supervisors of the Major OTC Derivatives Dealers on Proposals of Centralized CDS Clearing Solutions for the Segregation and Portability of Customer CDS Positions and Related Margin," letter delivered to the New York Federal Reserve on June 30, 2009 by an ad hoc group of market participants (www.managedfunds.org/members/downloads/Full%20Report.pdf).

sometimes supported by statutory provisions. Under such arrangements, the nondefaulting CM agrees to accept the defaulting CM's customer positions and collateral and the customers agree to accept the nondefaulting CM as a counterparty, commonly, without additional consent of the defaulting CM whose contract with the customer has been terminated as a result of its default. Positions and margins may be transferred as a unit or on a piecemeal basis.

The effectiveness of such a portability regime requires strong legal underpinnings. In particular:

- The laws applying to derivatives or to insolvent CMs should not limit the ability of customers to close out their position vis-à-vis the CM;
- The proceedings of the CCP should be carved out from general insolvency proceedings of insolvent CMs;
- Statutory provisions might be required to render portability enforceable even upon the commencement of an insolvency proceeding against the failed CM;
- Transfers organized by the CCP might need coordination with the supervisors in case the latter's approval is needed; and
- In some cases, private international law applicable to the transfer of contracts and related collateral should be harmonized.[2]

[2]The movement of positions and collateral made through the CCP, while being fully enforceable in the CCP's home jurisdiction, might not be recognized by other jurisdictions (e.g., where the CM is in insolvency proceedings) whose laws may provide for different treatment on issues such as the exercise of close-out netting rights.

for hedging transactions where the underlying cash flows being hedged occur years or even decades in the future. In this regard, the European Association of Corporate Treasurers has expressed concerns that if such transactions are not "carved out" of requirements to be fully collateralized, some corporations will find it too expensive to hedge genuine commercial risks (ACT, 2009).

Hence, there does seem to be a good case to "carve out" some "real" hedging transactions by end-users from requirements to move their contracts to CCPs. The legislation that was passed by the U.S. House of Representatives and similar legislation being considered by the U.S. Senate provides for exemptions for some hedgers who are not dealers or "major swap market participants." Furthermore, the House bill carves out transactions in which one of the counterparties is hedging commercial risk, including operating or balance-sheet risk, whereas the Senate bill carve-out applies only to derivatives that are "effective hedges" under generally accepted accounting principles. However, assuming end-users receive such relief, the dealers servicing these real hedgers should be expected to ensure that such hedges are truly effective, beyond the legislative definitions. European policymakers are also deciding on which approach to take and are considering whether it is appropriate to carve out nonfinancial corporate end-users. However, rules that exempt "real" hedging transactions will be difficult to enforce and would require dealers to be highly knowledgeable about the activities of their customers.

Criteria for Structuring and Regulating a Sound Central Counterparty

While CCPs have advantages in terms of efficiency, potential transparency, standardization, convergence of risk management and valuation techniques, and counterparty risk reduction, they also concentrate credit and operational risk associated with their own failure. The collapse of a CCP can have systemic consequences on the financial system, although such failures have been rare. This underscores the importance of making sure that CCPs are subject to effective regulation and supervision, have strong risk management procedures in place, and are financially sound. To this end, CCPs should have appropriate risk modeling capabilities, be built on solid multilayered financial resources that are

reinforced by financially strong CMs, have clear and legally enforceable layers of protection or financial support for covering losses given a CM default, and have developed contingency and crisis management plans, including for emergency liquidity support.

Moreover, given that CCPs are active internationally, given the global nature of the OTC derivatives market, this requires close cross-border coordination of regulatory and supervisory frameworks. This would help avoid regulatory arbitrage and mitigate systemic risk and adverse spillover across countries. The legal and regulatory treatment of CCPs should be clarified on issues such as their legal forms and charters, supervisory regime, risk management framework, insolvency regime, and emergency resolution process.

A report with recommendations for central counterparties, jointly produced by the CPSS and IOSCO, represents the current worldwide standards for CCP risk management (CPSS/IOSCO, 2004). However, the report does not address the specific risks associated with OTC derivatives, an omission that is being rectified by a joint CPSS and IOSCO working group established in 2009. Moreover, the European System of Central Banks (ESCB) and the Committee of European Securities Regulators (CESR) have jointly published recommendations for CCPs that already reflect OTC derivatives clearing (ESCB/CESR, 2009). Also, the establishment of the OTC Derivatives Regulators' Forum by several financial regulators in September 2009 represents an important first step to promote consistent application of public policy and oversight approaches and to coordinate the sharing of information. This section will discuss some of the key best practices that should be embedded in such frameworks.

Membership and Governance

Best practice CCP risk management starts with stringent requirements to become a CM in terms of sufficient financial resources, robust operational capacity, and business expertise. These requirements should be clear, publicly disclosed, objectively determined, and commensurate with risks inherent in the cleared products and the obligations of CMs to the CCP. Also, CCP governance arrangements should protect against compromising risk management and controls. The current CCP governance structures differ—some CCPs are for-profit entities with dispersed ownership, while others are effectively user-owned utilities. Although each type of governance structure has its strengths and weaknesses, the basic tenet to increase volume of business suggests that both models could lead to a loosening of risk management standards in order to either reduce the cost on the existing users or to attract new users. However, this tendency will be counteracted provided that users, who bear the risk of each other's default, have a sufficient voice in governance and particularly if the CCP is user-owned.

In most countries CCPs are set up as separate legal entities, although in some countries the CCPs are part of trading platforms or settlement systems. When CCPs are part of such larger groups there is a potential to create conflicts of interest and expose the CCPs to risks unrelated to their clearing operations. One way to mitigate these conflicts and protect CCPs from contagion risk is to legally ring-fence the CCP operations from the other activities and to have governance structures incorporating independent directors. When designing the governance structure, CCP risk management functions should report directly to the top organizational level (e.g., Board of Directors) and be separated from the management of financial resources. The interests of the CM's customers—such as through an advisory role in the corporate structure or as independent directors—should also be taken into account.[23]

Financial Resources

One of the key lessons learned from recent CCP failures and near failures is the importance of having transparent, ex ante resolution arrangements on how to close out positions (Box. 3.5). These arrangements include the auctioning of proprietary positions, the transfer of customer positions to the surviving CMs, and allocating the losses to the surviving CMs in a timely manner. The arrangements also include methods for determining the size and

[23]For example, the U.S. House of Representatives bill restricts dealers and other major swap market participants from collectively owning more than 20 percent of a derivatives clearing house.

nature of position allocations, as well as measures to handle confidentiality and conflict of interest between the CCP and the CMs.

Figure 3.4 illustrates the typical layers of protection that a CCP accesses to satisfy the obligations of a defaulting CM. Following the frequent payment of variation margin, initial margin collected from CMs against their specific positions forms the first buffer of protection against potential losses. Initial margin serves to protect the CCP against contract nonperformance—that is, a CM default. It should be determined by the specific features of the contracts and current market conditions, risk-based, reviewed and adjusted frequently, and stress-tested regularly, even daily for highly volatile contracts.[24] Initial margin should be in the form of cash, government securities, and possibly other high-quality liquid securities.[25] By contrast, variation margin, which passes daily losses or gains from losers to gainers to ensure that market risk exposures are covered, should be in the form of cash and collected automatically on a daily basis (or intraday in some cases).

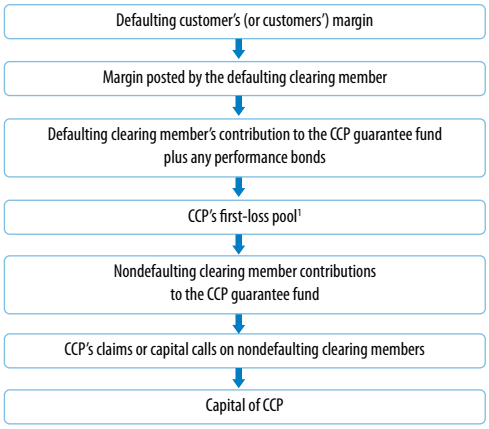
The next buffer of CCP protection comes from the defaulting CM's contributions to a guarantee fund (also known as a default fund or clearing fund). This is used, when a defaulting CM's margin is insufficient to fulfill its payment obligations, to temporarily cover the CM's losses while its other assets are being liquidated, and to permanently cover losses if the CM is insolvent. Guarantee fund contributions should be related to the CM's market position and the nature of its exposures, and be reevaluated regularly. Best practice for assigning this value is based on a combination of value-at-risk techniques and stress tests.[26] It is crucial that a CCP

[24]More specifically, initial margin should be sufficient to cover potential losses during the time it takes to liquidate positions in the event of a CM default. For example ESCB/CESR (2009, p. 16) recommends that there be sufficient margin "to cover losses that result from at least 99 percent of price movements over an appropriate time horizon."

[25]Some CCPs allow designated hedgers to use letters of credit from highly rated banks to be used as collateral. (This allows nonfinancial firms to use their unencumbered physical assets to secure their hedging activities.)

[26]Stress tests take into account extreme but plausible market conditions, and are typically framed in terms of the number of CM defaults a CCP can withstand. For example, ICE Trust's guarantee fund is sized to withstand the default of its two largest CMs.

Figure 3.4. Typical Central Counterparty (CCP) Lines of Defense against Clearing Member Default



Source: IMF staff.

Note: This is an illustrative example of lines of defense of a CCP. It should be noted that these structures, orders, and nomenclature vary in each CCP and there is not a legally mandated one (although their differences clearly have significant financial and operational implications). This figure assumes that a clearing member defaults because a customer fails to meet its obligations and its collateral is insufficient. Clearing member defaults may be triggered for other reasons, even ones unrelated to the derivative product involved in the transaction.

[1]The first-loss pool is an initial level of funds contributed by the CCP, which even if absorbed would still allow the CCP to continue to function.

Box 3.5. History of Central Counterparty Failures and Near-Failures

Central counterparty (CCP) failures have been extremely rare—there have been only three going back to 1974. There are additional instances of close calls or near-failures. This box reviews the circumstances behind the three failures as well as two near misses, and then draws some key lessons from these episodes.

The French Caisse de Liquidation clearing house was closed down in 1974 as a result of unmet margin calls by one large trading firm after a sharp drop in sugar prices on the futures exchange. As described by Hills and others (1999), one of the primary causes of the failure was that the clearing house did not increase margin requirements in response to greater market volatility. Also, although it lacked the authority to order exposure reductions, the clearing house should have informed the exchange (which had the authority) of the large size of the exposure of Nataf Trading House. The problem was further aggravated when the clearing used questionable prices and nontransparent methods to allocated losses among CMs. The Malaysian Kuala Lumpur Commodity Clearing House was closed down in 1983 as a result of unmet margin calls after a crash in palm oil futures prices on the Kuala Lumpur Commodity Exchange. Six large brokers that had accumulated huge positions defaulted as a result of the large losses that were generated by the price collapse. Again, the clearing house did not increase margin requirements in response to greater market volatility. Furthermore, there was a coordination breakdown between the clearing house and the exchange, which did not exercise its emergency powers to suspend trading. Also, sloppy trade confirmation and registration resulted in long delays in ascertaining who owed what to whom.

The Hong Kong Futures Exchange had to close for four days, and be bailed out by the government in 1987, as a result of fears of unmet margin calls on purchased equity futures positions following the October stock market crash (Cornford, 1995; Hay Davison, 1988). Adding to the situation was that many of the sold equity futures positions were being used to hedge purchases of stocks, so that a failure on the futures contract would likely require additional selling pressure by those holding the stocks themselves. Yet again, margin was not raised in amounts commensurate with rising volatility, plus many brokers were not diligently collecting margin from their customers. Also, there was a lack of coordination between those monitoring the market and those providing the guarantees due to the separation of ownership of the exchange, the clearing house, and the contract guarantee fund. In addition, there were no position limits and market risk became concentrated in a few brokers and customers (five of 102 brokers accounted for 80 percent of open sold contracts).

Near Failures

Also in the wake of the October 1987 crash, both the Chicago Mercantile Exchange (CME) and the Options Clearing Corporation (OCC) encountered severe difficulties in receiving margin. In the case of the

Note: This box was prepared by Randall Dodd.

balance the relationship between initial margining and a guarantee fund. For instance, a CCP that relies on a lower margining and a higher guarantee fund may contribute to moral hazard by encouraging some CMs to take higher risks, since their losses are mutualized among all CMs. On the other hand, higher margining and a lower guarantee fund reduces CMs' potential exposures to other CMs and may dilute their interest in ensuring that the CCP manages its risks robustly. Ultimately, the CCP should be managed so that it can survive an extreme but plausible stress event, such as simultaneous defaults of several large CMs.

If the defaulting CM's margin and guarantee fund contributions are insufficient, there are several additional layers of protection. These include a CCP-funded first-loss pool, the remaining guarantee fund contributions, and capital calls on nondefaulting CMs (which are typically capped). The capital of the CCP is the last layer of protection after the capital calls. Protections for various types of liquid-

CME, failure was averted when its bank, Continental Illinois, advanced the clearing house $400 million just minutes prior to the opening bell in order to complete all the $2.5 billion in necessary variation margin payments. These included a $1 billion payment from a major broker-dealer that had remained outstanding despite assurances from its executive management of its ultimate arrival (MacKenzie and Millo, 2001); Brady Commission, 1988). Although the crisis was averted, the CME realized that CMs retained too much discretion over the timely payment of margin and thus adopted a policy of automated payments from CMs.

At the same time, similar problems occurred in clearing equity options trades on the Chicago Board Options Exchange. A large CM at the OCC had difficulties meeting its margin calls and required an emergency loan from its bank in order to avoid non-compliance. The OCC was also plagued by some operational problems, including the lack of an automatic payment system, and the OCC was late in making payments to its CMs (Cornford, 1995; GAO, 1990). Also, the OCC and CME did not have joint or linked clearing arrangements, so traders who hedged options with futures on the CME experienced delays in transferring gains realized at one clearing house to cover losses at another.[1]

[1]In addition, a major broker's automated order submission systems did not accommodate options prices above $99.99, and so account payment instructions were sometimes understated (e.g., a price of $106 appeared as $6). Plus, in hindsight, there was a risk management failure in that it appears that too many market makers were selling insufficiently hedged puts with too little margin.

Lessons

There are several overall lessons to be gleaned from these derivative CCP failures and near-failures.

First, margin requirements should be adjusted frequently and collected promptly in order to secure contract performance. Automated payments systems can help avoid liquidity shortfalls at CMs and the clearing house. Joint clearing or direct payment arrangements between clearing houses can relieve some problems with payment shortfalls.

Second, clearing and market oversight functions within a clearing house/exchange context should be well coordinated, so that position exposures can be monitored and appropriate steps quickly taken.

Third, market surveillance and the authority to manage potentially destabilizing exposures are critical. CCPs need to monitor positions, potentially impose limits on positions and daily price changes, and enforce exposure reductions if necessary. Even intraday exposures can pose problems, so capital or margin requirements based on volatility may be needed.

Operational risks can lead to failure during times of stress. Trades need to be confirmed and cleared promptly so as to minimize uncertainty as to exposures. Trade reporting is needed for proper market surveillance.

ity problems can also be provided by emergency lines of credit and access to central bank liquidity facilities.

More broadly, the structure of these protective layers can play an important governance role in assuring effective financial management of CCPs. For example, while CCP-funded first-loss pools incentivize diligent risk management by the owners, the guarantee fund and capital calls incentivize CMs to be particularly interested in membership criteria.

Access to Central Bank Liquidity

At a minimum, CCPs should have access to liquidity backup commitments from banks and other financial institutions that are preferably not CMs, in order to cover temporary shortfalls in payments from otherwise solvent CMs, and as an additional source of support to fulfill contract performance. Such liquidity lines should be denominated in the same currency as the contracts cleared. However, OTC derivative CCPs settling their cash obligations, including CM margins,

through commercial banks, could lead to potential risk concentrations to a few settlement banks. For example, the bank might default and the CCPs and its CMs may lose their money, or the bank might not be able to provide the liquidity when it is needed by the CCP. Hence, those deemed to be systemically important should have access to emergency central bank liquidity. However, any such emergency lending should be collateralized by the same high-quality liquid securities as those typically posted against monetary policy operations. Also, it should not be done in any way that might compromise the central bank's monetary policy or foreign exchange policy operations.

In order to reduce settlement risk, some European CCPs (e.g., German-based Eurex Clearing AG and France-based LCH.Clearnet SA) are licensed as banks, and have access to their central bank accounts, including access to intraday liquidity. Also, some European central banks (for example, the Sveriges Riksbank and the Swiss National Bank) offer intraday liquidity to regulated nonbank financial institutions, including investment firms, clearing houses, and insurance companies. Although automated payments systems can help avoid liquidity shortfalls at CMs, CCPs should be able to settle their transactions using the central bank so that there is no uncertainty about the finality of payment. Furthermore, CCPs should be able to deposit cash collateral with their central bank.

Operational Risk Mitigation

In order to reduce intraday risks, CCPs should ideally capture trades and assume the related counterparty risk at the time of execution.[27] This immediately reduces counterparty risk to the CMs because trades are immediately novated to and cleared by the CCP. However, some OTC derivative CCPs catch transactions at the time of trade execution, and of those that do, the counterparty risk is not assumed until the end of the trade date.[28] In such cases, CMs remain exposed to the risk that their counterparties default.

CCPs should also identify and manage operational risks arising from operations outsourced to third parties or from interlinkages with other infrastructures. Finally, to ensure business continuity, CCPs should also implement robust infrastructures and sound internal controls and procedures so that operational failures are handled quickly, including offsite backup infrastructure and networks. CCP key system components also need to be scalable in order to handle increased volume under stress conditions.

Cross-Border Dimension of Central Counterparties and Regulatory Coordination

The failure of a major CCP will not only affect the functioning of the domestic financial market, but it will also have a cross-border dimension due to the global nature of OTC derivatives markets. Thus, authorities have an important role to play in ensuring that a CCP has adequate risk mitigation and management procedures and tools to protect the integrity of the markets more generally. There is also a need for authorities to have contingency plans and appropriate powers to ensure that the financial failure of a CCP does not lead to systemic disruptions in all related markets. Certain jurisdictions also empower supervisors to trigger early intervention tools to take control of a troubled CCP.

Potential complications are introduced if CCPs clear transactions originated outside the local market, involve counterparties from different jurisdictions, or deal with collateral located or issued in different countries or denominated in different currencies. Such internationally active CCPs require greater regulatory coordination than purely domestic ones.

These frameworks need to ensure that sound and efficient CCP linkages and clearing mechanisms are established across jurisdictions, without unduly constraining multiple-currency or cross-border transactions. Furthermore, cross-border cooperation among regulators should hinder any CCP "racing to the bottom," such as by loosening risk management standards

[27]This is in fact the case for exchange-traded derivatives—the CCP catches the trade information automatically in real time from the trading platform, and typically becomes the direct counterparty after trade execution.

[28]Some CCPs will only accept transactions after checking on available (and/or calling for additional) collateral.

in pursuit of market-share gains. Such coordination should also aim to ensure that regulatory arbitrage opportunities are minimized.

How Should Central Counterparties Be Regulated and Overseen?[29]

Regulation, prudential supervision, and oversight of CCPs are essential to ensure that risks are adequately managed, and that any adverse impact on the rest of the financial sector is limited. In the OTC derivatives market, securities regulators are generally responsible for transparency, protection of investors, and proper conduct. Central banks are typically responsible for the containment of systemic risk and the soundness of the systems. Sometimes enforcement of prudential rules (i.e., rules aimed at ensuring prudent management of risks by the CCP) is part of the securities regulator's remit, and sometimes it is the role of a separate prudential supervisor that may or may not be the central bank. Nevertheless, central banks responsible for financial stability have a keen interest in ensuring that the design and operation of the infrastructure does not have any adverse impact on financial market stability. Regulators, prudential supervisors, and central banks should cooperate to create an effective regulatory and oversight regime for CCPs avoiding overlaps or loopholes.[30] Various jurisdictions approach this issue differently (Box 3.6).

In order to ensure effective CCP regulation, prudential supervision and oversight, there should be a clear legal basis that assigns explicitly the role of the regulator, prudential supervisor, and systemic risk overseer, with appropriate coordination and division of labor in light of their competences. Memoranda of Understanding are insufficient in the absence of legally comprehensive and enforceable rules (Box 3.6). In addition, due to its systemic importance, a CCP should be subject to the oversight of a systemic risk overseer that has the authority to allow access to emergency liquidity, which in most countries is the central bank. Moreover, an international regulatory coordination framework should be in place for the regulation, prudential supervision, and oversight of internationally active CCPs that clear substantial trades executed in the relevant authorities' local jurisdictions.[31]

One versus Multiple Central Counterparties?

The CCP industry typically exhibits network externalities, in that the value of the services offered depends on the number of participants and contracts cleared. In other words, an increase in the number of CMs will have benefits that accrue to existing CMs, as they will be able to clear with more counterparties. In addition, the CCP industry exhibits important economies of scale, which means that the average cost per transaction declines with an increase in the number of transactions. Staffing, premises, and information technology infrastructure, such as a database engine, the clearing platform, networks, and interfaces have high fixed costs. Also, CCP multilateral netting efficiencies diminish as the number of CCPs clearing the same product type increases.[32] In sum, a single CCP has potentially the lowest costs.

On the other hand, a single CCP would lead to the concentration of default and settlement risks in a single entity. If a single CCP fails due to inadequate risk management measures, there would be a tremendous impact on the market for the cleared product and potentially other linked markets simultaneously. Indeed, the OTC derivative market is global and the failure of a major CM would likely have a similarly material impact on more than one CCP, although the provision of emergency liquidity

[29]The term "regulation" as used here encompasses both the issuance of rules and guidance by market regulators as well as enforcement, while the term "oversight" refers to the specific responsibilities and tools central banks have with regard to the safety and efficiency of payment and post-market infrastructures.

[30]Noting that the credit derivative market was a focal point during the crisis, the G-20 Summit in London in April 2009 committed to promote the standardization and resilience of credit derivatives markets, in particular through the establishment of CCPs subject to effective regulation and supervision.

[31]The CLS Bank that settles foreign exchange transactions has such an oversight structure with the Federal Reserve Board in the lead role. Other central banks provide the Federal Reserve Board with any issues to raise with the CLS Bank about their domestic currencies.

[32]Duffie and Zhu (2009) show that in plausible scenarios, the fewer the number of CCPs and the greater their scope, in terms of product types, the more efficient is the use of collateral and capital.

Box 3.6. The European and U.S. Regulatory Landscapes

This box outlines the respective regulatory landscapes in Europe and the United States and takes note that central counterparties providing similar services and products are subject to different regulatory regimes, creating potential regulatory arbitrage.

Currently in Europe, central counterparties (CCPs) provide services on a global basis but remain regulated at the national level. They are either part of the exchanges, settlement systems, or independent entities. In the latter case, they are mostly chartered as banks and, consequently, subject to the banking supervisory authorities. Furthermore, due to their impact on the orderly function of the securities market, CCPs are also regulated by securities regulators. Most are also subject to central bank oversight due to their systemic importance. The recommendations for CCPs by the European System of Central Banks and the Committee of European Securities Regulators (ESCB/CESR)—which are based on the Committee on Payments and Settlement Systems and International Organization of Securities Commissions recommendations—have started a process of converging national approaches, but they are not legally binding (ESCB/CESR, 2009). Recently, the European Commission, taking into account the ESCB/CESR recommendations, initiated work to produce European legislation that will govern the activities of CCPs, linkages between CCPs, and the features of instruments to be cleared. This work aims to allow cross-border provision of CCP services once it has been authorized by one member state's authorities.

In the United States, a CCP can also be established as a bank or as part of a settlement system or an exchange. Depending on its legal status, a CCP could be regulated by the Federal Reserve System, Securities and Exchange Commission (SEC), or Commodity Futures Trading Commission (CFTC). Typically one of these bodies would be the main regulatory body. For example, ICE Trust is subject to the banking supervision of the Federal Reserve Bank of New York because it is a chartered limited purpose liability trust company in New York state. The two CCPs of the Depository Trust & Clearing Corporation group, Fixed Income Clearing Corporation, and National Securities Clearing Corporation are regulated by the SEC. The CFTC has jurisdiction over the Chicago Mercantile Exchange Clearing House and both the SEC and the CFTC regulate the Options Clearing Corporation.

This implies that different U.S. CCPs, providing similar services and products, may be subject to different rules and regulations depending on which regulatory authority granted their license. Though there have been no failures to date, this may lead to competitive distortions and potentially higher systemic risk, as CCPs may have an incentive to relax their risk management standards in order to gain market share. To address this, a memorandum of understanding on oversight of credit default swap CCPs signed among the relevant authorities established a framework for consultation and information-sharing. However, this memorandum of understanding is not legally binding and does not establish a harmonized regulatory regime for entities providing similar products and services. Ideally, the Federal Reserve or some other authority responsible for systemic risk should be given the oversight responsibility as a complementary function to prudential regulation and supervision.

Note: This box was prepared by Elias Kazarian.

or other financial support to a distressed CCP may be easier to disperse in a multi-CCP world in which each CCP has its own liquidity and other financial support providers.

Furthermore, some central banks such as the Eurosystem/European Central Bank (ECB) have publicly stated that they do not favor a CCP for OTC derivatives traded in Europe that is located outside its jurisdiction. Such a statement is motivated, in part, by the consideration that the failure of a CCP that clears OTC derivatives denominated in euros may have an impact on the ECB's mandate to implement monetary policy and maintain financial stability in the euro zone. A single CCP would also raise significant challenges in terms of cross-jurisdictional coordination in regulation and oversight, particularly during periods of financial stress. However, as

international regulatory cooperation in the supervision of the CLS Bank, DTCC, and LCH.Clearnet demonstrates, cross-border coordination is possible.

Interlinking: The Final Frontier?

Currently, several CCPs are already clearing OTC derivatives and new ones are preparing to commence their operations shortly (Table 3.1). Some of the benefits of a single CCP can be achieved by connecting several CCPs through links (where CCPs cooperate with each other) and cross-margining (where a CM uses its positions at both CCPs to lower collateral requirements overall). There are several ways to accomplish this, with different implications for risk management and costs, provided that the respective legal, technical, and risk management obstacles can be addressed. In principle, participants in a cross-margining system can benefit by netting their positions across different CCPs, minimizing collateral and liquidity needs. Under linked arrangements, a CM of a CCP will be able to trade in another market and clear its trades through its existing arrangements with the home CCP.

One arrangement that could be considered for OTC derivatives is a link arrangement. The CM will continue to have a relationship with its "home" CCP, and the home CCP will assume its member obligations toward another CCP by, for instance, posting margin just like any other CM of the other CCP. Such arrangements typically do not require the CM to have any relationship with the remote CCP, although early versions of such links required CMs to transfer their positions executed in foreign markets to their home CCPs. When these positions were transferred, the home CCP replaced the other CCP, and assumed the counterparty risk of its CM. Another type of link is the creation of a joint (virtual) platform that allows CMs to manage all of their transactions in one place, independently of the market in which they were executed. Although a CM will continue its relationship with the home CCP, risk management procedures such as margin requirements, default procedures, and operational features will be compatible for both CCPs.[33] However, such an arrangement could be subject to complications, as described below.

Given the global nature of the OTC derivative markets, it would be beneficial if more CCPs had the operational capacity to clear trades from multiple venues, and to allow CMs to benefit from cross-margining. However, establishing efficient linkages between CCPs across different jurisdictions and regulatory regimes has so far proven to be very complex, and may lead to risks to other CCPs from the CCP with the lowest risk management standards. Also, interlinking will expose CCPs to new or elevated levels of risks, including operational, legal, and counterparty risks. For these reasons, authorities should encourage the creation of links only if there is certainty as to the CCP's legal framework (including its insolvency regime) and close regulatory coordination between relevant authorities and a common, robust risk management methodology (Box 3.7).

Conclusions and Policy Recommendations

Soundly run and properly regulated OTC derivative CCPs reduce counterparty risk among dealers and minimize the systemic risk associated with cascading counterparty failures. CCPs also provide the opportunity to improve transparency because of their collection of information on all contracts cleared. However, since CCPs concentrate credit and operational risk related to their own failure, a potential CCP failure could have systemic risk implications. Thus, CCPs should be subject to prudent risk management procedures and be effectively regulated and supervised.

Moving a critical mass of OTC derivatives to CCPs in order to realize the benefits associated with systemic risk reduction will be costly. Based on estimates of the degree of undercollateralization in OTC markets, dealers will be required to post substantially more collateral at CCPs than they currently do in the OTC context. Because of this and other associated costs,

[33]At present, some CCPs have opted to use a simple link model that lacks the possibility of cross-margining or the application of compatible and mutually acceptable risk management procedures. These linked CCPs calculate a CM's exposures separately, communicate to each other the outcome, and then try to offset the exposures and thereby reduce the total amount of collateral required. This has a limited benefit compared to a joint platform that would allow their CMs to enjoy similar multilateral netting efficiencies to what they would have in one CCP.

Box 3.7. Legal Aspects of Central Counterparty Interlinking and Cross-Margining

Interlinking and cross-margining arrangements have been proposed to support the efficient use of capital in over-the-counter (OTC) derivatives clearing. However, this box shows that there are a number of legal hurdles that need to be overcome to make such arrangements legally sound.

Typically, interlinking arrangements take two basic forms. Actual arrangements may share elements of each form:

In the "member link" model (sometimes called the "simple model"), a central counterparty (CCP1) is a clearing member (CM) of another CCP2, with the same legal obligations and rights as any other CM ("access"). This requires the member-CCP1, but not its CMs, to adhere to the contractual framework ("Rule Book") of the other CCP2. Most importantly, the CCP2 evaluates the creditworthiness and risk management systems of CCP1 as a member and requires CCP1 to post collateral and contribute to the financial resources of CCP2. Thus, CCP1 is exposed to the risk of CCP2 default.

In the "interoperating" model, two or more CCPs enter into a comprehensive, integrated contractual arrangement to clear contracts on a mutual basis, without requiring their respective CMs to become members of the other CCPs. The most typical example of interlinkage is when two CMs that are counterparties in a trade each have a different clearing arrangement with two different CCPs. CM3 opens a position in CCP4 and CM4 opens a corresponding/equivalent position that is mirrored for CCP3 at CCP4, without requiring the CM3 or CCP3 to become a member of CCP4, and thus allowing one CCP to offer its CMs the benefits of other CCPs' services. The two CCPs then clear the trade. The arrangement is referred to as interoperability because the two CCPs cooperate and share information about each other's positions and risk management (including the demands for collateral posted by the CMs) and may exchange collateral to cover the exposure of one CCP to the other.

Cross-margining allows a CM to use the margin it posts at a CCP as margin at another CCP in order to reduce the amount of collateral for its various transactions. Cross-margining could take the form of "one-pot" or "two-pot" margin arrangements. For example, in a one-pot arrangement, the margin is calculated based on the CM's total exposure across both CCPs and held in a single account at a CCP or at a custodian. If a CM defaults on its obligations to either CCP, the CM's collateral would be liquidated and shared as agreed between the two CCPs. In a two-pot arrangement, the margin requirement for the CM, calculated based on the exposure to each CCP, is held separately in each CCP in different accounts. If the CM were to default, each CCP would satisfy the CM's obligations based on what is in the respective CCP account subject to some loss-sharing arrangement between the two CCPs. Furthermore, in a two-pot approach, asset classes could be differentiated in the two accounts. Compared with the two-pot arrangement, the one-pot arrangement could be more effective for the CM in achieving an optimal offset of positions, thus reducing the CM's total margin. However, it requires an alignment of bankruptcy, customer protection, and regulatory regimes. In contrast to the bilateral nature of interlinking arrangements, the contractual relationships in cross-margining involve a triparty arrangement: a CM agrees with two CCPs to use its collateral or positions at one CCP as collateral or positions at the other CCP.

Interlinking and cross-margining can be used to pursue different objectives. Traditionally, in securities clearing, interlinking has been viewed as a tool to promote competition among marketplaces. In particular, it is believed that competition is increased by enabling CMs to use their CCP's services without requiring them to adapt to (and bearing the costs of) each CCP. In contrast, with OTC derivatives clearing, the primary objective of interlinking and cross-margining arrangements would be to reduce counterparty risk through multilateral netting, and to enhance the efficient use of collateral and capital.

Contractual and Legal Underpinnings

To effectively achieve those objectives, interlinking and cross-margining arrangements have to be supported by robust legal underpinnings, from both a contractual and a statutory perspective.

Note: This box was prepared by Alessandro Gullo and Isaac Lustgarten.

Contractual frameworks should clearly establish the rights and obligations of all parties involved, in particular CCPs and CMs. It is especially important to understand whether, and which, interested parties are exposed to losses in the event of a failure of a CM or a linked CCP. Other issues that can be solved through contract arrangements include dealing with (1) differing risk management practices and loss mutualization arrangements of CCPs; (2) differing mechanisms to assume counterparty risks; (3) the information needs of CCPs and CMs depending on whether they have established member link arrangements, interoperable arrangements, or cross-margining arrangements; and (4) the fungibility of cleared contracts for the CCPs. The laws governing the operation of CCP interlinking and cross-margining also need to provide robust statutory support. It is particularly relevant to establish clear and adequate rules on the insolvency and resolution of the CCPs involved, as well as on the treatment of the provision and segregation of collateral. These rules should specifically alleviate concerns that could arise from the treatment of inter-CCP margin requirements, which are applied by CCPs to cover counterparty risk to each other. For example, such concern could arise as to whether inter-CCP collateral would be subject to "claw-back rules," whereby the defaulting CCP can claw back collateral from the nondefaulting one, and thus may not be enforceable by the nondefaulting CCP.

Regulation and Oversight

The specific features of interlinking and cross-margining arrangements justify a specific regulatory and oversight regime:

At a domestic level, the overseers of CCPs need to pay close attention to the impact of interlinking and cross-margining on the overall risk profile of the CCPs involved, and ensure that these risks are adequately mitigated. Eventually, the overseers should be able to impose regulatory standards regarding interlinking and cross-margining arrangements to enhance the predictable functioning of such arrangements, as well as to mitigate the potential systemic risks arising from the impact that a failure of one CCP can have on other CCPs.

To avoid cross-border regulatory arbitrage, it would be appropriate to establish common standards for interlinking and cross-margining in international fora such as the International Organization of Securities Commissions and Committee on Payments and Settlement Systems. For instance, to avoid weaknesses in inter-CCP arrangements, a globally consistent approach could avoid the risks created by weak collateral standards, while recognizing the different risk management practices adopted by CCPs. It could also seek to support legal certainty as to fundamental rules governing linked CCPs and all interested parties.

For interlinking and cross-margining with cross-border features (e.g., between CCPs established in different jurisdictions), the overseers and supervisors of all involved CCPs should enter into comprehensive cooperative arrangements to coordinate their oversight over the inter-CCP arrangements. Such coordination could entail (1) information-sharing; (2) early warning mechanisms; (3) coordination of regulatory oversight actions for issues of common interest aimed at avoiding regulatory gaps or conflicting regulation; and (4) coordination of crisis management plans for intervention either in particular institutions or affected markets.

there is some uncertainty as to whether a critical mass of contracts will move without an incentive to do so. One approach that uses risk-based incentives could be based on capital charges or other "tax-like" features. This would be preferred over one that explicitly mandates that OTC derivatives must move to CCPs. That being said, mandating may be necessary to overcome some market participants' fears of being first movers. In any case, if authorities decide to mandate that OTC contracts move to CCPs, given the high upfront costs, it should be phased in gradually.

There are several key elements of best-practice risk management and sound regulation governing CCPs that increase the likelihood that counterparty and systemic risk will indeed be reduced in the OTC derivatives market. In terms of risk management these include:

- CCPs should be established with independent decision-making bodies that are designed to mini-

mize potential conflicts of interest and maintain a high level of risk management.

- CCP membership should be objective and subject to stringent financial resource and operational capacity requirements to ensure that the CMs can meet their obligations to the CCP. These obligations include appropriate contributions to the CCP's guarantee fund and the callable capital that can be tapped if the guarantee fund is exhausted.
- CCPs should arrange for emergency lines of credit from other financial institutions that are not CMs and, if systemically important, from the central bank.
- In the event of a CM default, CCPs should have in place ex ante crisis management arrangements including mechanisms to close out or transfer positions to the nondefaulting CMs in a timely manner.
- CMs should be required to post high-quality collateral (e.g., cash and government securities) as margin against their positions. Margin adjustments should be made daily and even intra-day during periods of market stress. Initial margin amounts should be risk-based and reviewed and, if necessary, changed regularly.

As regards the regulatory environment, the ongoing efforts of the joint CPSS/IOSCO working group to revise existing international standards are critical to address some of the shortcomings revealed during the financial crisis. The coordinated regulatory effort will also help enhance the soundness and safety of the global OTC clearing and settlement arrangements. Recommendations include the following:

- Central banks should provide CCPs access to their payment infrastructure, and put in place emergency liquidity backstops with the CCPs, given that in a systemic event other institutions are unlikely to be able to fulfill this role.
- Furthermore, CCPs should be able to deposit cash collateral with their local central banks to facilitate easy access in times of need.
- When a CCP is not present to assume counterparty risk, market participants should be mandated to record and store all transactions in regulated and supervised central trade repositories. Detailed, accurate, and timely individual counterparty transaction data should be available to all relevant regulators and supervisors of affected jurisdictions for use in monitoring individual and systemic risks.
- Regulatory authorities should ensure that a CCP has adequate risk mitigation and management procedures and tools to protect the integrity of all related markets and the interests of its participants. There is also a need for authorities to have contingency plans and appropriate powers to ensure that the financial failure of a CCP does not lead to systemic disruptions in markets, including plans for emergency liquidity provision and orderly resolution.

A global framework for CCP risk management and other mitigating measures to stem systemic risks should be instituted to level the playing field and to discourage regulatory arbitrage. Otherwise there is the possibility that CCPs could compete with each other by lowering collateral thresholds and clearing fees and adjusting the layers of protection in ways that expose CMs and their customers to greater risks. Alongside a global framework for CCPs there would need to be coordinated response of the official sector to a failure of a CCP in any jurisdiction, including emergency liquidity provision and resolution.

Many of the benefits associated with CCPs are inversely related to the number of CCPs over which positions are spread. Although fewer CCPs leads to more concentrated credit and operational risks, some of the benefits of a single CCP can be achieved by interlinking several CCPs. This process, however, can only take place once sound CCPs are in place, and the CCPs agree on common risk management models, which will be difficult to achieve.

In sum, though ultimately the benefits of systemic risk reduction from moving OTC derivatives to a CCP very likely outweigh the costs in the longer run, there are transition costs that suggest a gradual phase-in period is warranted.

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CHAPTER 4

GLOBAL LIQUIDITY EXPANSION: EFFECTS ON "RECEIVING" ECONOMIES AND POLICY RESPONSE OPTIONS

Summary

The transmission of abundant global liquidity and the accompanying surge in capital flows to economies with comparatively higher interest rates and a stronger growth outlook pose policy challenges as appreciation pressures and rising asset valuations return. In addition to the influence of domestic growth prospects and liquidity conditions, this chapter finds strong links between global liquidity expansion and asset prices, such as equity returns, in the "liquidity-receiving" economies, as well as official reserve accumulation and portfolio inflows.

There are a number of policy options available to policymakers of liquidity-receiving economies in response to surges in global liquidity and capital inflows. The menu of policy responses for mitigating risks related to capital inflow surges includes the following:

- A more flexible exchange rate policy, in particular when the exchange rate is undervalued. The analysis shows that a floating exchange rate provides a natural buffer against surges in global liquidity and ensuing valuation pressures on domestic assets.
- Reserve accumulation (using sterilized or unsterilized intervention as appropriate).
- Reducing interest rates if the inflation outlook permits.
- Tightening fiscal policy when the overall macroeconomic policy stance is too loose.
- Reinforcing prudential regulation.

If conditions allow, liberalization of outflow controls can also prove useful. The appropriate policy mix will depend on country-specific conditions.

When these policy measures are not sufficient and capital inflow surges are likely to be temporary, capital controls may have a role in complementing the policy toolkit. However, more permanent increases in inflows tend to stem from more fundamental factors, and will require more fundamental economic adjustment. Of course, well-formulated macroeconomic policies throughout the economic cycle can help to avoid a surge or abrupt reversal of capital inflows.

The evidence on the effectiveness of capital controls is mixed. There is some indication that controls can lengthen the maturity of inflows—although they do not reduce the volume of inflows—and create greater room for monetary independence. The chapter outlines some case studies to highlight those that have and have not been successful in the past.

Even if capital controls prove useful for individual countries in dealing with capital inflow surges, they may lead to adverse multilateral effects. The adoption of inflow controls in one country, if effective, can divert capital flows to its peers, prompting the introduction of capital controls in those countries as well. A widespread reliance on capital controls may delay necessary macroeconomic adjustments in individual countries and, in the current environment, prevent the global rebalancing of demand and thus hinder the recovery of global growth.

The global liquidity cycle started in 2003 and accelerated from the second half of 2007 when country authorities began to undertake unprecedented liquidity-easing measures to mitigate the effects of the crisis (Figure 4.1). While helping stabilize the financial system and support the return to growth, current easy global liquidity conditions and the accompanying surge in capital flows pose policy challenges to a number of countries where the crisis did not originate, with the primary challenge being an upside risk of inflation expectations in goods and asset markets. Such "liquidity-receiving" countries have had to ease domestic monetary conditions in response to both the slowdown in global demand and the acceleration in global liquidity, adding further pressure to asset prices.

The policy challenge posed by easy monetary conditions is greater in economies—primarily emerging markets—that, in addition to strong growth prospects, have fixed or managed exchange rate regimes.[1] The associated surges in capital inflows also raise early concerns about vulnerabilities to sudden stops once the global liquidity is unwound, with implications for financial stability.

This chapter primarily covers the acceleration of the global liquidity cycle from the outset of the crisis in mid-2007 until end-2009, and addresses the following questions: (1) How do we recognize the liquidity transmitted from the "source" to "receiving" economies and what are the liquidity transmission channels? (2) What policy challenges do receiving economies face in absorbing global liquidity? and (3) To what degree are policy tools effective in managing a surge in capital flows as well as their potential sudden stop?

The next section notes that in the context of abundant global liquidity at the tail end of the crisis, the resumption of capital flows to countries with a strong growth outlook or appreciation expectations brought back appreciation pressures and rising asset valuations. The chapter then analyzes and finds strong links between global liquidity expansion and asset prices such as equity returns in the receiving economies, as well as official reserve accumulation and equity portfolio inflows. The discussion then turns to the policy response options that countries have at their disposal, in the absence of monetary policy tightening in the countries where the liquidity expansion originated. It focuses in particular on policies that aim to affect the capital account, concluding that, when these policy measures are not sufficient and capital inflow surges are likely to be temporary, easing controls on capital outflows or introducing capital controls may usefully complement the policy toolkit.

The chapter then analyzes the effectiveness of tightening capital controls on inflows and of liberalizing outflows using evidence from earlier studies, selected country experience, an event study, and a short presentation of private sector views. It finds that the evidence on the effectiveness of capital controls is mixed, but there is some indication that controls can lengthen the maturity of inflows and create some room for monetary independence. The conclusion of the chapter notes that, although effective under certain circumstances, capital controls may have adverse multilateral consequences by delaying necessary macroeconomic adjustments in individual countries and, in the current circumstances, hinder global recovery and growth by preventing the global rebalancing of demand.

Overview of the 2007–09 Global Liquidity Expansion

In response to the financial crisis that started in the summer of 2007, the United States began to aggressively reduce its policy interest rate in September 2007, followed by the United Kingdom in December.[2] Emerging markets and advanced economies with little or no exposure to the first phase of the financial crisis did not reduce rates for some time, and actually raised them on average in response to rapidly rising commodity prices. It was not until late 2008 that these countries began to ease monetary conditions in response to declining global

Note: The authors of this chapter are Annamaria Kokenyne, Sylwia Nowak, Effie Psalida (team leader), and Tao Sun. Oksana Khadarina provided research support.

[1]See Chapter 1 for an assessment of emerging market inflows and their drivers, including whether asset prices have become stretched and conditions are ripe for the formation of asset price bubbles. The assessment concludes that concerns about capital inflows leading to inflation pressure or asset price overvaluation in emerging markets have risen.

[2]The European Central Bank (ECB) and the Bank of Japan did not begin to reduce their policy rates until about a year later in October 2008, with the ECB raising its rate in the interim to prevent inflation expectations from rising in view of high commodity prices.

demand in the second phase of the crisis, reducing their rates by more than the G-4 on average (Figure 4.2).[3]

In 2008, global capital inflows retreated to 16 percent of their 2007 volume.[4] However, in the second and third quarters of 2009 capital flows resumed to many emerging markets, which is to be welcomed. The flows consisted primarily of portfolio equity and fixed-income investment, with net cross-border bank flows remaining negative. (Figure 4.3 shows capital inflows for 37 liquidity-receiving economies; see Annex 4.1 for a complete list.) Foreign direct investment (FDI) diminished, but was more stable than other types of flows over the crisis period.

In the context of abundant global liquidity, the resumption of capital flows to countries with a strong growth outlook or appreciation expectations brought back pressures on the exchange rate and rising asset valuations, including equities (Figure 4.4).

Effects of the Global Liquidity Expansion on the Liquidity-Receiving Economies

Although, as a rule, asset valuations in the receiving countries are not yet at precrisis levels, observers are asking whether asset prices may be rising too fast. Are capital flows into receiving economies primarily driven by the countries' strong economic fundamentals and, therefore, likely to remain stable over the medium to long term, or are they primarily driven by the abundant global liquidity?

We find that for the period starting in 2003, when the global liquidity cycle began, to 2009, domestic liquidity (M2 or reserve money) is positively associated with equity returns and negatively with real interest rates for all the 41 countries in our sample—both the G-4 and the receiving economies. (See Box 4.1 and Annex 4.1 for more details on the econometric results and methodology.) Specifically, rising global liquidity—defined as G-4 M2, reserve money, or excess liquidity growth[5]—is associated with rising equity returns and declining real interest rates in the 34 receiving econo-

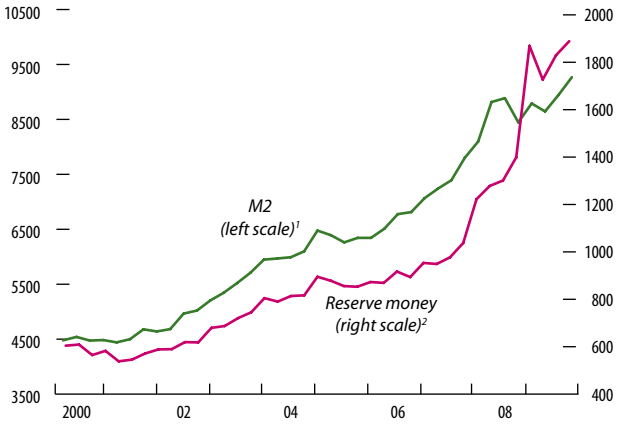
[3]For the purposes of this chapter, the euro area, Japan, the United Kingdom, and the United States constitute the G-4.

[4]Capital inflows refer to changes (increases/decreases) in the liabilities of countries' financial account.

[5]Excess liquidity is the difference between broad money growth and estimates for money demand in the G-4.

Figure 4.1. Global Liquidity

(In billions of U.S. dollars; GDP-weighted; quarterly data)



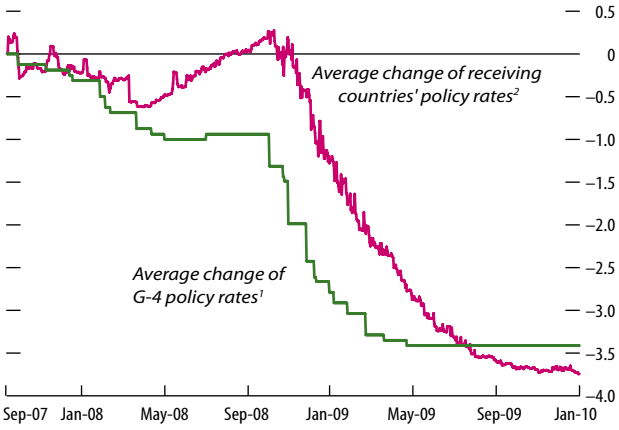
Sources: Datastream; IMF, International Financial Statistics database; and IMF staff estimates.

[1]Sum of GDP-weighted M2 for the euro area, Japan, the United Kingdom, and the United States.

[2]Sum of GDP-weighted reserve money for the euro area, Japan, the United Kingdom, and the United States.

Figure 4.2. Change of Central Bank Policy Rates

(In percentage points; September 1, 2007 = 0)



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

[1]G-4 includes the euro area, Japan, the United Kingdom, and the United States.

[2]Receiving countries are Argentina, Australia, Brazil, Canada, China, India, Indonesia, Korea, Mexico, Norway, Russia, Saudi Arabia, South Africa, Sweden, Switzerland, and Turkey.

Box 4.1. Global Liquidity Expansion and Liquidity Transmission

This box discusses global liquidity expansion and liquidity transmission during 2003–09 from the G-4 sources of "global" liquidity, defined here as the euro area, Japan, the United Kingdom, and the United States, to those economies in our sample that were at the receiving end of global liquidity, namely 32 emerging market economies, Australia, Canada, Iceland, New Zealand, and Norway.[1]

Global liquidity expansion is measured by the growth of excess liquidity and G-4 monetary aggregates—broad money and reserve money, where the latter is used to exclude the impact of the volatile money multiplier. The effect of the G-4 monetary aggregate growth on the "receiving" countries is measured by its link to "receiving" economies' asset valuations, real interest rate, and credit.

Three types of econometric tests are performed:

Panel specifications are used to test the effects of G-4 broad money growth (or reserve money growth and excess liquidity growth) on "receiving" economy asset returns (equity valuations and overvaluation, real interest rates, and—on a limited data sample—housing data), and excessive credit growth.

Utilizing an EGARCH model, which is designed to model asymmetric variance effects, we test whether volatility in the G-4 money growth spills over into volatility in the "receiving" economies.

Panel specifications are used to examine the transmission channel of global liquidity to receiving economies by examining their official reserve accumulation. In addition, Granger causality tests—using both growth rates and long-term level variables—examine whether G-4 broad money (or reserve money) explains future values of receiving countries' broad money (alternatively reserve money, or central bank net foreign assets), and vice versa.

To capture the links between global liquidity and capital flows to the "receiving" countries, capital inflows (by component) were regressed on global liquidity, while controlling for domestic and other global factors. The regression results show that global liquidity is positively associated with equity investment between 2003 and 2009, but has no statistically significant link with foreign direct investment and portfolio bond flows.[2]

Note: This box was prepared by Tao Sun.

[1]For a complete list of the countries in the sample and a description of the econometric methodology see Annex 4.1.

[2]These results are consistent with the panel estimation results in IMF (2007, Chapter 3).

mies, even after controlling for domestic (receiving-economy) liquidity.[6] This relationship supports the view that both global and domestic liquidity may have provided support to the rising asset prices during 2003–09.

A test with three distinct geographic groupings (Asia-Pacific, Europe-Middle East-Africa, and Western Hemisphere) shows that global liquidity is positively associated with equity returns in each of the three groups, while the 34 economies' domestic liquidity (M2) is now only statistically significant for Asia-Pacific equities.

In addition, the effect of global liquidity on equity returns is five times as large as that of domestic liquidity; case studies using Brazil, Chile, China, and Hong Kong SAR—in individual EGARCH specifications—also support the view that global liquidity is positively associated with equity returns in these countries.[7]

[6]Results using housing price data indicate no statistically significant link to global liquidity, although domestic liquidity is statistically significant with a positive sign. These results need to be interpreted with caution, however, given the limited housing data sample (Annex 4.1). A test using the change in the yield of domestic three-month government bills in receiving economies shows a statistically significant negative association to global liquidity.

[7]China and Hong Kong SAR are chosen for their rapid accumulation of official foreign reserves—taken as a transmission channel of global liquidity to domestic liquidity given their limited exchange rate flexibility. Brazil and Chile are chosen for their experience with volatile portfolio flows. EGARCH refers to an exponential generalized auto-regressive conditional heteroskedasticity model (Annex 4.1).

When receiving economies are separated into those with fixed exchange rate regimes and those with flexible exchange rate regimes, we find that, as exchange rate flexibility increases, the association of global liquidity with equity valuations declines, as indicated by the smaller positive coefficient for global liquidity starting from the left and moving to the right side of Table 4.1. Furthermore, the coefficient for domestic liquidity becomes statistically significant and negative in the group of independently floating regimes. These results further support the view that the higher the flexibility of the exchange rate, the lower the spillover of global liquidity and the more the cushioning impact of domestic liquidity on domestic asset returns.

The transmission of global liquidity to liquidity-receiving economies can be seen by examining the relationship between G-4 liquidity growth and official reserve accumulation in the receiving economies. As with the pattern exhibited with equity returns—discussed above—this transmission mechanism is stronger for economies with fixed exchange rates than for those with floating ones (Table 4.1).

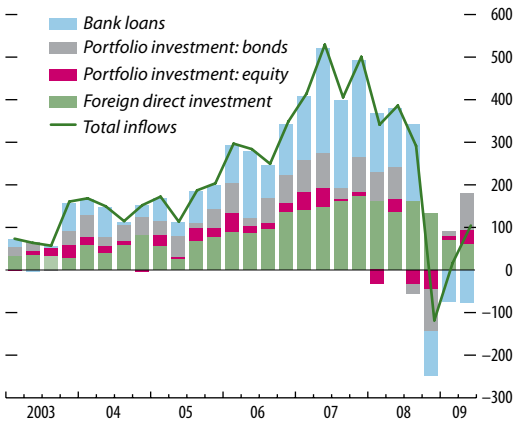
In addition, spillovers between global liquidity and receiving-economy liquidity (M2 and reserve money) are shown by the results of Granger causality tests, which indicate movements in both directions. Specifically, G-4 liquidity growth spills over into the other countries in our sample—economies where the crisis did not originate—but liquidity also spills over from these economies into the G-4, although the strength of the relationship is weaker.[8] Evidence of these relationships is further strengthened by the long-run Granger causality tests using nonstationary level data (Pedroni, 2007). These results indicate that both global and domestic liquidity are determinants of asset returns (see details in Table 4.6 in Annex 4.1).

Using the panel regression model, a "what if" scenario is carried out to check the effect of a liquidity "sudden stop" on equity returns. The results show that a 10 percent decline in global liquidity growth is associated with a 2 percent drop in liquidity-receiving economies' equity returns, based on data for October 2009 and holding all other variables constant.

[8]This is indicated by a smaller probability of rejecting the null hypothesis of no Granger causality.

Figure 4.3. Liquidity-Receiving Economies: Composition of Capital Inflows

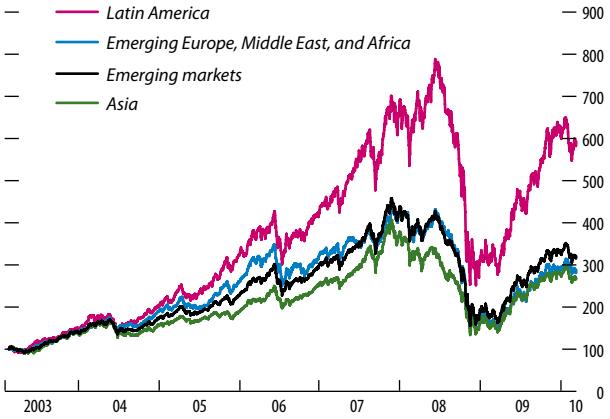
(In billions of U.S. dollars)



Source: IMF, International Financial Statistics database.
Note: See Annex 4.2 for a complete list of countries.

Figure 4.4. Emerging Markets Equity Indices

(January 1, 2003 = 100)



Source: Bloomberg L.P.

Table 4.1. Relation between Equity Returns, Official Foreign Exchange Reserve Accumulation, and Liquidity under Alternative Exchange Rate Regimes

	Full Sample (fixed and floating)	Fixed I (currency board; conventional peg; crawling peg)	Fixed II (currency board; conventional peg; crawling peg; managed float)	Floating I (independent float; managed float)	Floating II (independent float)
			Equity Returns		
	1.14	1.51	1.44	0.74	0.43
Global liquidity (G-4 M2)	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.03)**
Domestic liquidity (34	0.22	0.52	0.35	–0.18	–0.49
economies M2)	(0.00)***	(0.00)***	(0.00)***	(0.13)	(0.00)***
No. of observations	1,527	394	925	1,133	602
			Official Foreign Exchange Reserve Accumulation		
	0.86	0.76	0.94	0.79	0.32
Global liquidity (G-4 M2)	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.08)*
Domestic liquidity (34	0.41	0.35	0.46	0.26	–0.25
economies M2)	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.06)*
No. of observations	1,576	450	977	1,126	599

Sources: IMF, World Economic Outlook, Annual Report on Exchange Arrangements and Exchange Restrictions, and International Financial Statistics databases; World Bank, World Development Indicators database; Bloomberg L.P.; Consensus Forecasts; and Datastream.

Note: Probability values that the coefficient above is significantly different from zero are in parentheses (***significant at 1 percent level; **significant at 5 percent level; *significant at 10 percent level).

Policy Response Options for Liquidity-Receiving Economies[9]

What options are available to policymakers in response to a rapid global liquidity expansion and surges in capital inflows attracted by comparatively higher domestic interest rates and a stronger growth outlook? This section briefly discusses the various policy options before delving in more detail into the effectiveness of restricting or relaxing capital controls as a tool for stemming surges in capital flows and the risk of their sudden stop or reversal.[10]

Despite their beneficial effects, capital inflow surges can pose challenges to receiving economies. Specifically, their benefits include providing additional financing to countries with limited savings, allowing risk diversification, and contributing to the depth and development of financial markets.[11] However, surges of capital inflows can complicate macroeconomic management as the real economy may not be able to adapt to large swings in the exchange rate. They can fuel a boom in domestic demand leading to overheating and a combination of accelerating inflation and a widening current account deficit through the appreciation of the real exchange rate. They may also lead to asset price bubbles and increase systemic risk in the financial sector, even sometimes in the case of a generally effective prudential supervisory and regulatory system.

The menu of policy responses for mitigating risks related to capital inflow surges includes fiscal and monetary policies, exchange rate flexibility, reserve accumulation, prudential regulation, and, in some cases, liberalization of capital outflows or a restriction on capital inflows. The adequate response depends on the specific conditions in each country but the sequence of options outlined below could generally be considered.[12]

Exchange rate adjustment. Using the exchange rate as an automatic stabilizer may be the first policy option for countries with an undervalued exchange rate. Allowing the exchange rate to adjust toward its equilibrium level can mitigate the transmission of global liquidity and capital inflows attracted by appreciation expectations. Appreciation in countries where the exchange rate is not misaligned, however, may have significant repercussions on the economy.

[9]Although all the main policy response options are noted, the discussion focuses primarily on policies aimed at affecting the capital account.

[10]For a discussion on policy options see also Ostry and others (2010).

[11]For more on financial globalization see Dell'Ariccia and others (2008) and Kose and others (2009).

[12]See also Baqir and others (2010).

The tradables sector, which loses competitiveness when the exchange rate appreciates, may not be able to recuperate for a prolonged period even if the exchange rate returns to its previous level. In countries with a fixed exchange rate regime, the need to preserve the credibility of the peg may exclude the policy option of a temporary change in the exchange rate level.

Intervention. Economies may intervene to keep the exchange rate at the current level or to slow appreciation. Intervention may be useful in economies that need to increase their reserves. However, sterilization of the liquidity injected by interventions may be necessary to address inflation concerns, which can involve a significant cost. The difference between the interest paid by the central bank to commercial banks for draining liquidity and the interest received on official reserves will likely reduce central bank profitability, especially under the current high global liquidity conditions that keep interest rates in advanced economies low.[13] Potential associated risks could be concerns about central bank financial independence and possible fiscal costs. Moreover, sterilization may (1) elicit further inflows by maintaining the differential between domestic and international lending rates, in particular when market participants expect an eventual appreciation; (2) encourage domestic borrowers to switch to foreign currency liabilities, potentially raising financial stability concerns; and (3) be limited by the size of the country's financial market.

Monetary policy. Monetary easing can narrow the interest rate differential between foreign and domestic interest rates and, thereby, reduce the incentives for carry trade, in which investors borrow in low-yielding currencies and invest in high-yielding ones. Monetary easing, however, without the support of appropriate fiscal tightening, is not advisable in countries where inflation is a concern. Conversely, increasing interest rates to keep inflation in check can be counterproductive by attracting further capital inflows. Monetary tightening may occur through increasing reserve requirements (RR), which is mostly used for managing structural liquidity in emerging market economies. However, in many countries these are remunerated at, or close to, market interest rates. If the RR is high or not remunerated, it can increase the banks' deposit-to-lending margin, leading to disintermediation and higher direct external borrowing and lending by the nonbank private sector (see more below). Increasing the remuneration, on the other hand, would also increase the cost of sterilization, thereby limiting the central bank's ability to drain excess liquidity from the domestic market.

Fiscal policy. Fiscal tightening can support monetary policy by reducing the budget's financing needs and thus allowing for lower interest rates. Fiscal austerity could also mitigate asset bubbles directly by lowering aggregate demand growth and supporting a capital account adjustment, thereby cushioning the cost of a sudden reversal in inflows. For fixed exchange rate regimes, fiscal policy response is the main lever. However, material fiscal adjustment is not always feasible at the particular time when the adjustment should be made, and it may involve a lag.

Prudential regulation and supervision. Prudential ratios in the financial sector are used with both microprudential and macroprudential objectives. Either together with the conventional policy responses noted above or on their own, strengthened prudential measures such as liquidity ratios, which differentiate according to currencies, or reserve requirements that vary according to maturity, can provide a useful tool for dealing with capital inflow surges and their financial risks. A countercyclical use of prudential ratios or limits can help financial institutions withstand the effects of a liquidity or currency crisis.[14,15]

Adequate supervision of prudential regulations helps contain systemic risk in the financial sector. However, the ability of supervision to appropriately assess the risks faced by market participants and their risk management practices is often limited by capacity

[13]Interest rate differentials between some emerging markets and advanced economies reached 4 to 8 percent on an annualized basis on three-month local currency deposits in the second half of 2009, suggesting losses for emerging market central banks.

[14]Prudential ratios and limits are set by the financial sector regulator to ensure financial stability of financial institutions; they include inter alia capital adequacy and liquidity ratios, net open foreign exchange position limits, and limits on the concentration of risks, such as limits on credits to large borrowers.

[15]For example, tight prudential measures in Serbia, aimed at curbing excessive credit growth during the economic expansion, provided a buffer to the banking system from the initial financial crisis spillovers.

constraints. The effectiveness of prudential ratios can be limited by regulatory arbitrage when transactions subject to prudential ratios are moved to nonregulated entities or foreign-denominated assets are booked abroad on the parent bank's balance sheet. Prudential limits are also less effective in dealing with risks posed by capital inflows outside of the financial sector, such as direct external borrowing by the nonfinancial—corporate or household—sector, although such borrowing may increase the systemic risk in the financial sector indirectly.

Occasionally, in addition to conventional prudential ratios, other measures, which specifically target external borrowing by banks, have been used to reduce the risk of large capital inflows into the financial sector. These measures may be implemented for prudential reasons, such as to mitigate financial sector risks, and can be helpful in dealing with rapid credit growth or in preventing the dollarization of the banking sector's balance sheet and the buildup of asset price bubbles driven by capital inflows. However, they are likely to have an element of capital control. In such cases, their use should be subject to similar considerations as other types of capital controls (see Box 4.2 on the distinction between capital controls and prudential measures).

Liberalization of capital outflows. Countries may respond to a surge in capital inflows by liberalizing existing restrictions on capital outflows (see Box 4.3 on capital controls on outflows versus inflows). A relaxation of capital controls on residents' outward investment may help to alleviate exchange rate pressures from large capital inflows without adversely affecting the financial integration of the economy. Strong inflows can create a favorable backdrop for advancing the liberalization of outward capital transactions.[16] However, the relaxation of outflow controls depends critically on meeting the other preconditions of capital account liberalization and, therefore, may not be appropriate in all cases.[17] For example, although institutional investors' (insurance companies, pension funds) outward investment may represent a significant volume, such investment should generally be liberalized only if adequate prudential regulation and risk management are already in place. Furthermore, for credibility reasons the liberalization of outflows should be maintained even after the inflows ebb; therefore, a country's ability to maintain liberalized outflows should be assessed based on longer-term expected flows and not only on the basis of temporary surges in inflows.

Imposition of capital controls on inflows. When the available policy options and prudential measures do not appear to be sufficient or cannot provide a timely response to an abrupt or large increase in capital inflows, capital controls may be a useful element in the policy toolkit. However, if the inflows are not temporary, but are driven by more fundamental factors, policymakers should adjust their macroeconomic policies to address the root causes, instead of mitigating the effects of inflows or attempting to limit them through various measures.

Types of Capital Controls on Inflows

There are two main groups of capital controls: market-based and administrative. The choice generally depends on the aim of the controls (e.g., lengthen the maturity structure) and the type of the flows. It also depends on the authorities' experience with the specific type of controls, as countries typically prefer to use controls they have implemented in the past. The more familiar the authorities and the banking system are with the types of controls selected, the smoother the implementation can be.[18]

Price or market-based controls increase the cost of the targeted capital transaction. These controls are generally more transparent, since the additional cost involved can be calculated before the transaction takes place.

[16]In the precrisis period several countries did so. South Africa has been relaxing controls on residents' outward investments as a response to increased capital inflows over time, most recently in October 2009 when South African companies were allowed to open foreign bank accounts without prior approval, and the amount they can invest abroad without prior approval of the central bank has been increased tenfold while resident individuals' foreign capital allowance was doubled. Thailand has also permitted certain large Thai companies to invest in foreign securities directly, where previously such foreign investment had to be channeled through financial funds.

[17]For a sequencing of capital account liberalization see Ishii and others (2002).

[18]The banking system is typically required to assist in the administration of controls.

Box 4.2. Capital Controls versus Prudential Measures

Sometimes prudential measures implemented to help ensure financial stability contain an element of capital control and, conversely, certain capital controls have been described as serving a macroprudential function. The delineation of prudential measures and capital controls is often difficult, and the terms have often been used interchangeably and in partially inconsistent ways. This box provides the basic premises for the differentiation used in practice.

There is no unique generally accepted legal definition of capital controls. In the broadest sense they are measures that are meant to affect the cross-border movement of capital. In its *Code of Liberalization of Capital Movements*, the Organization for Economic Cooperation and Development (OECD, 2009) considers measures to be capital controls subject to liberalization obligations if they discriminate between residents and nonresidents. For example, if residents may buy domestic assets, such as securities, while nonresidents may not, the measure is considered a capital control. Capital controls can affect capital flows by imposing limitations on a type of capital account transaction or on a payment and transfer related to these transactions. Therefore, a prohibition of residents' purchase of foreign assets, and a prohibition of making a payment for the acquired asset are both capital controls.[1] Capital controls have often been used to achieve prudential goals in the absence of a developed regulatory framework or adequate risk management practices in the financial sector.

Prudential measures regulate risks taken by financial institutions, including risks related to cross-border financial transactions to ensure the soundness of the financial sector. They can focus on individual institutions or on the financial system as a whole and can take the form of quantitative and qualitative standards on capital adequacy, risk management, asset concentration, and liquidity, among others. In some cases, they discriminate between international and domestic capital transactions and, as such, may be economically equivalent to capital controls. For example, a higher reserve requirement on nonresident deposits than on resident deposits contains an element of capital control and needs to be considered as such. Measures that differentiate between the use of domestic currency and foreign exchange, such as limits on banks' net open foreign exchange position, are internationally accepted as prudential measures. However, asymmetric open position limits, which introduce different limits on short and long positions, can discourage the respective flows (for example, a lower short position can limit capital inflows).

Note: This box was prepared by Annamaria Kokenyne.

[1]IMF member countries have the right to regulate capital transactions according to Article VI, Section 3, of the IMF's Articles of Agreement. However, this right is limited by their obligations to ensure unrestricted payments and transfers for current international transactions and to collaborate with the IMF and other members to promote a stable system of exchange rates.

In addition, they do not prohibit transactions; only discourage them by increasing their cost. In the recent inflow episodes, two types of measures in this group were typically applied on capital inflows, albeit in a very small number of countries. As Annex 4.2a indicates, since 2003 only four countries introduced unremunerated reserve requirements (URRs) and one implemented taxes on capital inflows (Box 4.4 defines URRs).

Both taxes and URRs reduce the rate of return to investors on the targeted financial transactions and can be applied on cross-border transactions. The rate of the tax and the URR can be differentiated to discourage certain transaction types (portfolio versus FDI) or maturities (short versus long). Since they affect short-term flows more than longer-term flows, they are also used to lengthen the maturity of inflows.

The implementation of direct taxation on inflows can be less demanding than that of the URR, although the banking system, which generally needs to support the execution of both, can incur significant costs. The implementation of URR requires that the subjected transactions be properly recorded and the reserves permanently

Box 4.3 Capital Controls on Outflows versus Inflows

Controls on inflows and outflows are defined as controls affecting nonresidents' investment in the country and residents' investment abroad, respectively. This box examines the typical forms of these types of controls.

According to this definition, controls on outflows aim to affect residents' investment abroad by regulating the type or the volume of their investments. The controls often differentiate between the forms of investments, such as by allowing foreign direct investment while limiting lending to nonresidents. Occasionally different controls apply to individuals, public and private sector entities, and the financial sector. Controls on outward investment by the banking sector, mainly in the form of lending and deposits, are often liberalized earlier than controls on other residents' investments, to facilitate international trade operations. Controls can be both administrative, such as a ceiling on the foreign exchange residents can purchase in the domestic financial markets for outward investments, or market-based, such as an unremunerated reserve requirement.

Capital controls on inflows aim to affect capital inflows by reducing the volume or changing the composition of nonresident investment in the country. Inflow controls can be applied at both the entry and the exit points of a nonresident investment. At entry, they are applied on the acquisition of domestic assets by nonresident investors, such as on the purchases of securities or on lending to the domestic financial or nonfinancial sectors. At the exit, a similar effect can be achieved by implementing controls on the transfer of the proceeds from such investments, such as when, after liquidating an investment, nonresidents receive or remit the proceeds. Such controls can take the form of an administrative control, such as a minimum stay requirement, requiring that the funds stay in the country for a certain period, or as a ceiling on the amount that can be transferred in a certain period. They can also be market-based in the form of a tax on remittance of the proceeds abroad from an investment.

Note: This box was prepared by Annamaria Kokenyne.

monitored to ensure that they are returned to the investor when the withholding period expires. Because the tax and the URRs usually affect a wide range of capital account transactions, countries need to ensure that administering these controls does not delay unnecessarily the execution of capital transactions. Both controls can be circumvented if transactions are misreported as inflow types that are either not subject to controls or are subject to a lower tax or URR rate. The complexity of administering controls increases significantly with the number of rates, withholding periods, and exemptions. As with other controls, the coverage of the tax and URR may need frequent adjustment to prevent circumvention, which may further increase control costs.

Administrative controls can be less transparent than market-based controls. They restrict capital transactions and/or the associated payments and transfers of funds through outright prohibitions or explicit quantitative limits. They can involve the approval of the transaction by the authorities, often on a discretionary basis. While these controls allow for a relatively flexible application, the nontransparency of their application criteria renders them prone to arbitrary selection. They impose administrative obligations on the banking system and often involve significant documentation requirements. Enforcement of administrative controls also requires adequate administrative capacity in the foreign exchange authority (usually the central bank).

Effectiveness of Capital Controls

This section discusses the effectiveness of tightening capital controls on inflows and of liberalizing outflows based on earlier studies, selected country experience, an event study using the Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) database, and a short presentation of private sector views.[19]

[19]The AREAER database is maintained by the IMF and updated yearly based on information from country authorities. For the country case studies, information from the relevant IMF staff reports was also used.

Box 4.4. Reserve Requirements and Unremunerated Reserve Requirements

Reserve requirements (RRs) and unremunerated reserve requirements (URRs) are differentiated according to their distinct objectives: an RR may have a range of objectives (monetary policy, prudential or liquidity management–related), while a URR functions as a capital control. This box looks at the features of RRs and URRs.

RRs applied for monetary policy purposes aim to affect the spread between deposit and lending interest rates: higher RR will increase lending rates (discourage borrowing) and reduce deposit rates (discouraging deposits, and so reducing bank access to funding) (see table). If used for prudential reasons, they may be more akin to a liquidity ratio; this is rarely now the purpose of RRs. In many cases, RRs with averaging during the maintenance period are used to facilitate liquidity management and to reduce short-term rate volatility. Sometimes RR levels are different for local currency and foreign currency liabilities, reflecting the authorities' other objectives, such as the desire to attract or discourage foreign currency deposits. Different ratios can also be applied depending on the maturity of the liabilities. Reserve requirements may also contain an element of capital control; differentiated RRs on liabilities according to the residency of the depositor is considered a capital control because it discriminates between liabilities of residents and nonresidents and thus affects cross-border capital flows.

URRs can be imposed on both inflows and outflows in both the financial and nonfinancial sector and are not remunerated. They are often coupled with a minimum stay requirement during which capital may not be repatriated without an often-stiff penalty. Nonresidents or residents are required to deposit for a fixed period with the central bank an amount of domestic or foreign currency equivalent to a proportion of the inflows, at zero interest. URRs may function as a selective exchange tax that may be differentiated to discourage particular types of transactions. The effective rate of the tax depends on the period of time during which the funds stay in the country, as well as on the opportunity cost of these funds. URRs can also impose a burden on the central bank, which holds the deposits, and on the banking system, which has to implement the controls, especially if the corresponding administrative system is not already in place.

Note: This box was prepared by Annamaria Kokenyne.

Features of Unremunerated Reserve Requirements and Reserve Requirements

	URR	RR
Purpose	Limit certain types of capital flows.	Provide liquidity buffer, limit credit growth, facilitate liquidity management, sterilize excess liquidity.
Base	Applied on the amount of the inflow/outflow/exchange of foreign exchange to local currency. No averaging is allowed.	Applied on average daily balance of reservable liabilities; RR may be met by average reserve balance held at central bank over maintenance period.
Payment	Immediately (shortly) upon receipt.	Fixed date/period following the calculation period.
Maintenance period	Maintenance period longer than one month and does not depend on the maturity of the liability.	Maintenance period is not usually longer than one month, and may be as short as one week.
Remuneration	Never remunerated.	Often remunerated.
Transactions covered	Only on foreign exchange inflows/transactions.	Generally on both foreign exchange and domestic reservable liabilities.
Additional measures	Minimum stay requirement.	No additional measures.
Form of holding	Maintained on account with the central bank.	Reserve balances at the central bank.

Review of the Literature

The literature assesses the effectiveness of capital controls on inflows by their ability to (1) reduce their overall volume; (2) alter their composition; (3) alleviate appreciation pressure on the exchange rate; and (4) gain monetary policy independence (Magud and Reinhart, 2007). In practice, however, it is often difficult to delineate one objective from another.

Evidence in the literature regarding effectiveness is mixed. Ariyoshi and others (2000), who analyze effec-

tiveness of controls imposed in the 1990s, note that the main macroeconomic motivation for the controls is to maintain a suitable difference between domestic and foreign interest rates and to reduce pressures on the exchange rate.[20] The controls had short-term value; they were effective initially, but countries generally could not achieve both interest rate and exchange rate objectives. The controls lengthened the maturity of foreign exchange inflows but were less successful in reducing their overall volume.

In general, controls tend to lose effectiveness as market participants find ways to circumvent them. Circumvention occurs as long as the return on the controlled transaction exceeds the cost of circumvention. Because of the relatively lower possibility for circumvention, controls appear to be more effective in countries where they are extensive.

The conclusions of recent literature on the effectiveness of capital controls are broadly consistent with earlier mixed findings. Many studies find no effect of controls on the volume of inflows, although some recent cross-country analyses conclude that countries with capital controls experience smaller inflow surges.[21] Also, according to most studies, controls on inflows do not succeed in stemming exchange rate appreciation pressures, although there are some cases where they are successful.[22] Williamson (2000) argues that controls on inflows have a better chance of working because incentives to evade them are not as high-powered as the incentives to evade outflows. Regarding monetary policy autonomy, studies often find inflow controls effective in that they allow for larger differences between domestic and foreign policy rates.[23] In addition, an empirical study by Ostry and others (2010) based on 37 emerging market economies finds that in the recent crisis the output decline of the countries that had maintained capital controls in the run-up to the crisis was lower than in other countries without capital controls.[24]

While the evidence on the effectiveness of capital controls in the literature is far from conclusive, this is partially due to the complexity of measuring effectiveness. In addition to the difficulties in establishing an appropriate measure of the intensity of capital controls, there are issues of endogeneity—capital controls are usually not implemented in isolation but rather as a part of a policy package that includes macroeconomic and structural policies and other measures, which renders the disentangling of the effects of the capital controls difficult.

Selected Country Experiences

The results of the country case studies assessing effectiveness of capital controls appear to support previous studies' conclusions. For each of the following countries individually, we examined the effect of a specific inflow control tightening in Brazil (2008), Colombia (2007–08), Croatia (2006–07), and Thailand (2006–08) and outflow liberalization in Korea (2005–08) using a vector autoregression (VAR) framework.[25] The analysis suggests that while controls

[20]The study by Ariyoshi and others (2000) examined inflow surge episodes in Brazil (1993–97), Chile (1991–98), Colombia (1993–98), Malaysia (1994), and Thailand (1995–97).

[21]Magud and Reinhart (2007), who provide a comprehensive assessment of the capital controls literature up to 2006, conclude that capital controls on inflows are not effective in reducing the volume of net flows. For the most recent evidence, see Binici, Hutchison, and Schindler (2009) for a cross-country study; Balin (2008) for India; and Concha and Galindo (2009) and Clements and Kamil (2009) for Colombia. The two recent studies that report some effectiveness are Coelho and Gallagher (2010) and Jittrapanun and Prasartset (2009). In particular, Jittrapanun and Prasartset (2009) suggest that direct restrictions on portfolio inflows caused a short-term decline of portfolio inflows in Thailand. Similarly, Coelho and Gallagher (2010) find that the URRs introduced in Colombia and Thailand during 2007–08 were modestly successful in reducing overall volume of inflows, though at the cost of exchange rate volatility. Cardarelli, Elekdag, and Kose (2009) find that countries that had capital controls experienced lower capital inflows during episodes of inflow surges. Kim, Qureshi, and Zalduendo (2010), examining a panel of emerging market economies, similarly conclude that countries with capital controls experienced smaller inflow surges.

[22]Studies show URRs had no or small impact on the exchange rate (Gallego, Hernandez, and Schmidt-Hebbel, 2002, and De Gregorio, Edwards, and Valdes, 2000, for Chile; Clements and Kamil, 2009, for Colombia). The only exceptions are Edwards and Rigobon (2009) and Coelho and Gallagher (2010).

[23]In a vector autoregression framework, De Gregorio, Edwards, and Valdes (2000) find Chile's central bank was able to target a higher domestic interest rate for six to 12 months.

[24]For more references on the relevant literature see Ostry and others (2010).

[25]An impact of restrictions on capital transactions is assessed in a VAR framework, which treats capital control indices, interest

are generally associated with a decrease of inflows and a lengthening of maturities, these results are statistically significant in only a few cases. Controls are rarely successful in dampening exchange rate appreciation pressures. However, they are often able to provide room for some monetary independence for a limited time. (See Annex 4.3 for a detailed description of the five country case studies mentioned above and Annex 4.2b for a summary on effectiveness.)

Foreign Exchange Tax

Foreign exchange taxes appear to be mostly ineffective in reducing exchange rate pressures, but they can alter the composition of inflows toward longer-term maturities and reduce somewhat the volume of flows in the short run.[26] These taxes can be flexibly adjusted—in terms of both rate and coverage—in response to the challenges posed by capital flows, but can be circumvented over time by misreporting and misclassification. For example, Brazil adopted a tax on capital inflows—the "entrance tax"—on certain foreign exchange transactions and foreign loans during 1993–97, in combination with a number of administrative controls on certain types of inflows.[27] The regulations were adjusted at times of depreciation pressures on the exchange rate (during the Mexican and Asian crises), and the tax was reimposed later in 2008 (see Annex 4.3 for more details on Brazil) and in the fall of 2009 when the surge of capital inflows returned. The 2008 tax episode did not have a statistically significant effect on net inflows or on the maturity composition of inflows according to our VAR estimation.

Unremunerated Reserve Requirements

URRs—typically accompanied by other policies—have been effectively applied in reducing short-term inflows in overall inflows, but their effect diminishes over time. Chile (1991–98) and Colombia (1993–98) used URRs to limit short-term capital inflows with a view to maintaining a wedge between domestic and foreign interest rates while reducing pressures on the exchange rate. They were accompanied by a liberalization of outflow controls, an adjustment or progressive increase in the flexibility of the exchange rate, and a further strengthening of the prudential framework for the financial system.

The more recent imposition of URRs in Thailand (2006–08) and Colombia (2007–08) to stem capital inflows appears to have had some initial effect on the volume of net flows (see Annex 4.3).[28] However, this effect diminished over time. Controls on capital inflows also had a temporary maturity-lengthening effect in Colombia, but there is no evidence regarding the longer-term effectiveness of controls.

Prudential Measures as Capital Controls

There is some evidence that prudential-type capital controls can be effective in reducing capital inflows. For instance, the increased reserve requirements in Thailand (1995–97) accompanied by other prudential-type capital controls were effective in reducing net capital inflows. In Croatia, the marginal reserve requirement seems to have a statistically significant effect on reducing net inflows and slightly depreciating the exchange rate. However, its effect on decreasing bank flows is not significant (see Annex 4.3).

rate spreads, net capital flows, and real exchange rates as potential endogenous variables. Exogenous variables include domestic and foreign business cycles and investment risk indicators. The intensity of capital controls is captured by three indices—administrative inflow controls, administrative outflow controls, and price-based inflow controls—each tracking cumulative changes in regulations on capital transactions reported in the AREAER database. Variables are first differenced, if necessary, to ensure stationarity. We estimate the VAR system for each country with quarterly data for the period 2000:Q1 to 2008:Q2 with one lag and, if available, with monthly data for the period January 2000–August 2008. The capital flow data are from the IMF's Balance of Payments Statistics website and from central bank websites.

[26]Cardoso and Goldfajn (1998); Carvalho and Garcia (2008); and Reinhart and Smith (1998).

[27]A study on the controls in Brazil in the 1990s shows that taxes on certain short-term inflows resulted in a large increase of longer-term transactions such as FDI; however, this was only a result of disguising short-term flows as long-term ones. Therefore, the de facto maturity-lengthening effect was much less pronounced than evidenced by the reported numbers (Carvalho and Garcia, 2008).

[28]In Thailand, the increase in outflows resulted in a decrease of net flows, while in Colombia a VAR estimation covering the period ending two quarters after the introduction of the controls shows a statistically significant decrease in inflows for a short period and a lengthening of maturities.

Administrative Measures

The URRs are sometimes accompanied by administrative controls. For example, Chile combined the URR with administrative (minimum stay requirement for direct and portfolio investment) and other regulatory measures (minimum rating requirement for domestic corporations borrowing abroad and extensive reporting requirements on banks for all capital account transactions).[29]

The effectiveness of controls largely depends on the existence of other capital controls in the country. For example, our analysis shows that while the URR in Thailand in 2006–08 was not successful in reducing the volume of inflows, the other capital controls in effect could allow monetary independence for a short period. The administrative controls implemented in Malaysia in 1994 were found to be effective in reducing the volume of inflows and exchange rate pressures. Countries with extensive capital controls in place can generally implement capital controls more effectively, since they have significant administrative capacity for and experience in operating such systems (see Annex 4.3 for a discussion on China and India).

Liberalization of Capital Outflows

Responding to a surge in capital inflows by liberalizing outflows is likely to have a lagged effect, and thus may not be appropriate as an immediate response. The lag depends on pent-up demand for such investments and the extent of the country's integration in the global financial system (see Annex 4.3 for a discussion of the effectiveness of Korea's outflow liberalization). The more experienced a country's residents with investments abroad, the greater the number of channels that have been built up previously for the intermediation of such transactions, and hence the sooner the outflows pick up. Thus, capital outflow liberalization is likely to be more effective if it involves a significant liberalization of the controls and in countries with a largely liberalized capital account or where capital flows were free before the introduction of the controls.

[29]See Cardoso and Goldfajn (1998) for more details regarding Chile.

Analytical Assessment of Effectiveness: Results of an Event Study

The event study results indicate no clear effect of inflow-control tightening on the total volume of inflows. However, measures aimed at liberalizing outflows contributed to higher capital outflows, thereby reducing net flows and possible pressure on the exchange rate (see Box 4.5 for details).

Although the results do not point to a reduction in the volume of total capital inflows, they suggest that general prudential measures reduce portfolio inflows, whereas URRs and prudential measures that specifically target nonresidents reduce bank loans from abroad. There is also evidence that the application of URRs may contribute to lengthening the maturity of capital inflows, as they were associated with more reported FDI flows and less foreign bank borrowing. There was also some indication from the event study that countries that experienced a surge in capital inflows and imposed controls often observed smaller ensuing inflows than their counterparts, although this difference is not statistically significant.

Private Sector Views

Discussions with market participants revealed a uniform view that capital controls are ineffective in the long run, although views differed about effectiveness as an immediate response. Some noted that if the yield differentials are sufficiently high, investors will find a way to gain exposure to a country and, unless administrative restrictions are prohibitive, to circumvent capital controls (Box 4.6).

Conclusions

A number of policymakers worldwide are asking what would be effective policies in managing capital inflows and are considering the applicability and effectiveness of capital controls. The argument is that (1) recent capital movements have been partly generated by the low interest rate policy in the G-4 and abundant liquidity in the global financial system; and (2) capital inflows can come to a sudden stop once monetary policy in the G-4 is tightened. Not only is there uncertainty about the timing and speed

Box 4.5. Capital Account Measures—Event Study Results

This box examines the effectiveness of capital account measures introduced by the "liquidity-receiving" economies between 2003 and mid-2009. It finds that the implementation of controls generally does not stem total capital inflows, although, in some cases, it can lengthen their maturity. Measures aimed at liberalizing capital outflows yielded a significant growth of outflows, thereby effectively reducing net flows.

The effectiveness of capital controls is measured by their ability to stem surges in net capital flows. This box first examines the ability of controls on capital inflows to reduce the net volume of total capital inflows and each of the three main components of capital inflows, namely foreign direct investment (FDI), portfolio inflows, and bank loans (proxied by "Other Investment Liabilities" as defined in the IMF's *Balance of Payments Statistics Manual*). The box then analyzes the effectiveness of outflow liberalization strategies to increase the net volume of total capital outflows and each of the three main components of capital outflows, namely outward direct investment, portfolio outflows, and "Other Investment Assets." The analysis is conducted using quarterly capital flow data from 2003:Q1 to 2009:Q2, scaled by GDP, from the IMF's International Financial Statistics database.

Of the 211 capital-account-related measures introduced by the "liquidity-receiving" economies[1] during 2003–09, 52 percent aimed to ease capital outflows and 48 percent to tighten capital inflows. Among the tightening events, administrative measures are most popular (17 percent), followed by prudential measures that do not discriminate against nonresidents (14 percent), prudential measures that discriminate between residents and nonresidents (12 percent), and unremunerated reserve requirements (URRs) (5 percent).[2] The capital account data come from the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*.[3]

The impact of a control on inflows is expected to be felt—if at all—immediately after implementation of the measure. Therefore, the impact of each type of control is tested over the period between the introduction of the control and the end of the following calendar quarter,[4] controlling for preexisting capital inflow volumes during the quarter prior to the introduction of the control. The significance of the impact is measured here by averaging the differences between the post-control and prior-control inflows across country events over the sample period. The significance of the average impact on each inflow type (total capital inflows, FDI, portfolio investment, and bank loans) is then tested using a standard one-sided t-test.

In contrast, liberalizing outflows is likely to have a lagged effect. Therefore, we study the response to outflow-easing measures over a longer period of two years and control for the average preexisting capital outflow volumes over a period of four years prior to liberalization.[5] That is, for each capital outflow variable (total capital outflows, outward direct and portfolio investment, and outward loans) we assume that the expected outflows each quarter post-liberalization should be at least as big as the average quarterly outflows during the previous four years. The differences between the actual outflows over a period of two years post-liberalization

Note: This box was prepared by Sylwia Nowak.

[1]The "liquidity-receiving" economies are the emerging market economies, Australia, Canada, Iceland, New Zealand, and Norway. See Annex 4.1 for a complete list.

[2]Taxes on inflows are not tested due to a small sample size (there are only two Brazilian events in the first and second quarter of 2008; Brazil also reintroduced this type of measure in the fourth quarter of 2009, however, capital flow data are not yet available for this period).

[3]While the analysis is based on all capital-account-related measures introduced by the liquidity-receiving economies between 2003 and mid-2009, only a few countries tightened capital inflows considerably. Indeed, measures introduced by many countries were not so far-reaching as to expect a significant effect.

[4]Capital inflows during the quarter when the control was introduced are calculated as the proportion of days in the quarter that the measure was effective times the volume of this flow during this quarter.

[5]As a robustness check, we test the impact of both inflow control tightening and outflow liberalization measures on the inflows/outflows over periods of one quarter, one year, and two years. Within each post-event observation period, we examine average responses to controls while controlling for the preexisting capital inflow volumes during one quarter, one year, and four years prior to the control introduction. The results support our priors that the response to inflow-restricting controls—if any—is immediate, while the impact of outflow-easing measures is gradual and depends on the countries' outward investment environment.

Box 4.5 *(concluded)*

Average Impact of Capital Controls

(In percentage points of GDP and average effectiveness rate)

	Tightening Inflows				
Type of flows	Administrative	General prudential	Prudential aimed at foreign inflows	Unremunerated reserve requirements	Easing outflows
Total inflows/outflows			–3.0		13.7
			[56]		[84]
Foreign direct investment					4.2
					[76]
Portfolio investment		–1.6			2.2
		[62]			[57]
Bank loans/other investment			–2.0	–1.7	7.1
			[56]	[81]	[83]
Sample size	36	29	25	11	110

Sources: IMF, *Annual Report on Exchange Arrangements and Exchange Restrictions*; IMF, International Financial Statistics database; and IMF staff estimates.

Note: Only unique events, for which capital flows data are available, are considered in the analysis. The impact of each type of inflow control (and easing outflows) is tested over a period of one quarter (two years for easing outflows), controlling for preexisting capital flow volumes during one quarter (four years) prior to the introduction of the capital inflow control (outflow liberalization measure). For each capital flow variable, differences between the post-control and prior-control flows are averaged and tested for significance using a standard one-sided t-test. Only statistically significant results are reported. Average effectiveness rates, reported in square brackets, represent the percentage of all inflow-tightening (outflow easing) measures of a given type that resulted in a decline in the volume of net capital inflows (increase in the volume of net capital outflows) over the next quarter (the next two years).

and their expected values are summed up, averaged across all liberalization events, and tested for significance using a one-sided t-test.

On average, capital controls seem unable to stem the volume of total inflows in a statistically significant manner, even if the average response is often in the right direction. Specifically:

- Large variations in responses to implemented capital controls imply that controls are often as likely to decrease the net inflows as they are to increase them. However, the results suggest that prudential measures that specifically address nonresidents and URRs significantly reduce bank loans by 2 and 1.7 percentage points of GDP, respectively (see table). In addition, general prudential measures reduce portfolio inflows by 1.6 percentage points, perhaps as a result of a drop in the foreign funding of local banks in the form of debt securities issued by banks.
- On average, prudential-type capital controls aimed at foreign inflows are most likely to stem total inflows, with an average reduction of 3 percentage points.
- A counterfactual analysis performed on the sample indicates that, although countries that experienced a surge in capital inflows and imposed controls often observed smaller ensuing inflows than their counterparts with a similar surge that did not tighten controls, the difference is not statistically significant.
- If the observation window is lengthened to two years, and we control for average quarterly inflows over the previous four years, prudential measures significantly lower portfolio inflows by 2.9 percentage points of GDP, while no other measure is significant (not shown).
- URRs are statistically significant in lengthening the maturity of inflows. The application of URRs resulted in a significant increase in FDI of 4.5 percentage points of GDP over the first two years, as cross-border bank loans declined.

Outflow easing strategies yield a significant increase of outflows, with the ratio of total outflows to GDP increasing by 13.7 percentage points within the first two years. Outflow liberalization measures resulted in increases of total outflows 84 percent of the time, with outward loans being most responsive (an average increase of 7.1 percentage points occurred 83 percent of the time) followed by outward FDI (an average increase of 4.2 percentage points, 76 percent of times).

Box 4.6. Market Participant Views Regarding Effectiveness of Capital Controls

Market participants report that, in general, capital controls are of secondary importance when they make investment decisions regarding emerging markets.

In discussions with market participants, the generally shared view was that capital account restrictions are circumvented in the long run, although views varied as to their effectiveness as a first response.

Some participants were of the opinion that, for example, Brazil's tax imposition had only a marginal effect, if any, on investment decisions, and was not effective in preventing appreciation pressures. However, hard capital controls, such as unremunerated reserve requirements of nonresident deposits, could effectively keep investors out.

Other asset managers noted that when emerging market yields were high relative to other asset classes, capital controls did not have a large influence on investor decisions, posing only an administrative burden but not affecting the volume of flows. However, investor allocation decisions of active fixed-income portfolios may be affected, either marginally or even significantly if returns decline further, especially in terms of further spread compression relative to other asset classes.

Analysts noted, as a positive policy evolutionary development, that some emerging markets have used countercyclical measures, such as lowering interest rates, as a response to the surge in capital inflows.

The surge in capital inflows poses the additional challenge of a sudden stop or reversal of flows. Market participants questioned whether countries such as Brazil and Colombia can effectively address a sudden stop in capital inflows, although the larger the domestic investor base the better a country would be able to deal with such reversals, participants noted.

of future tightening—in itself a significant policy challenge in countries receiving inflows—but the inflows may in the meantime lead to exchange rate overshooting and risks to financial sector stability. Indeed, policymakers in the G-4 need to be cognizant of the potentially adverse effects of a prolonged accommodative monetary policy stance.

While domestic liquidity is also important, the analysis supports the argument that global (G-4) liquidity is indeed transmitted to liquidity-receiving economies as evidenced by

- higher portfolio equity inflows;
- official reserve accumulation; and
- changes in asset valuations, including rising equity returns and declining real interest rates.

On the other hand, in this study, global liquidity was not found to be positively correlated with FDI, portfolio bond investment, and cross-border bank lending.

For economies with a floating exchange rate regime, the statistical link between global liquidity and domestic asset valuations declines, and the correlation between domestic liquidity and asset valuations turns negative. This suggests that a flexible exchange rate could reduce the transmission of global liquidity to liquidity-receiving economies, including valuation pressures on domestic assets. Thus receiving economies may want to consider a more flexible exchange rate policy in the presence of large liquidity inflows from abroad.

There are a number of policy options available to policymakers in response to capital inflows. The menu of traditional policy responses for mitigating risks related to capital inflow surges includes a more flexible exchange rate policy, in particular when the exchange rate is undervalued, reserve accumulation (using sterilized or unsterilized intervention as appropriate), reducing interest rates if the inflation outlook permits, tightening fiscal policy when the overall macroeconomic policy stance is too loose, and reinforcing prudential regulation.[30] If conditions allow, liberalization of outflow controls can also prove useful. The appropriate policy mix will depend on country-specific conditions.

When these policy measures are not sufficient and capital inflow surges are likely to be temporary, capital controls may have a role in complementing the policy toolkit. However, more permanent increases in inflows

[30]Although a tightening of fiscal policy as a medium-term objective may signal a better policy environment and thereby attract inflows.

tend to stem from more fundamental factors, and will require more fundamental economic adjustment.

The conclusions of recent economic research, including our own analysis, on the effectiveness of capital controls are broadly consistent with earlier findings.

- Most studies find no effect of controls on the volume of total inflows, nor do they find that controls succeed in stemming exchange rate appreciation pressures, although some measures, such as URRs, may reduce valuation surges on some domestic assets, such as equities, by lengthening the maturity structure of inflows toward more stable flows.
- Tightening controls on capital inflows can lengthen the maturity of inflows toward potentially less-volatile components.
- Controls tend to lose effectiveness over time, as market participants find ways to circumvent them.
- There is no clear empirical evidence that market-based controls are more effective than administrative controls. However, they tend to be more transparent and predictable and less prone to governance issues than administrative controls.
- Our event study and VAR analysis results indicate no clear effect of capital control measures on the volume of inflows, although outflow liberalization appears to increase capital outflows, thereby reducing net flows.

Even though they may be useful under certain circumstances, capital controls have significant drawbacks. They distort the efficient allocation of resources and, even if introduced as a temporary measure, tend to remain a longstanding feature of the foreign exchange regulatory system. They are expensive for both the authorities, who administer the controls, and the banks, which usually assist the authorities in their implementation, in particular in those countries that have already liberalized their capital account and first would have to build up the necessary institutional framework. The private sector can also incur significant compliance costs. In some cases, the county's commitments under international agreements may prevent the introduction of controls or allow it only under specific conditions.

Even if capital controls prove useful in dealing with capital flows for individual countries, they may lead to adverse multilateral effects. The adoption of inflow controls in one country, if effective, can divert capital flows to its peers, prompting the introduction of capital controls in those countries as well. A widespread reliance on capital controls may delay necessary macroeconomic adjustments in individual countries and, in the current environment, prevent the global rebalancing of demand and thus hinder global recovery and growth.

Overall, the message is that one size does not fit all. There are a number of different types of controls that can be imposed with varying degrees of success under different country circumstances. Since the use of capital controls is advisable only to deal with temporary inflows, in particular those generated by external factors, they can be useful even if their effectiveness diminishes over time. However, the decision to implement capital controls should consider their distortionary effects not just on the individual country, but also on the global economy in the event their use were to become widespread.

The design of the appropriate capital controls is highly country-specific. While it is generally advisable to use market-based controls because they are more transparent, the choice between administrative and market-based controls is also determined by the previous experience of the authorities with controls, the country's administrative capacity, and the extent to which the banking sector can be relied upon to implement the controls. Countries that have a relatively well-functioning set of administrative controls in place may find it more useful to introduce administrative measures.

The preferred control type also depends on the type of inflows the authorities intend to reduce and the macroeconomic objectives the controls aim to support. If, for instance, the main concern is financial sector stability, prudential-type capital controls may be appropriate, while if the concern is appreciation pressure and loss of external competitiveness, more broad-based control measures need to be introduced. It is also important to strike the right balance in the trade-off between comprehensiveness, which minimizes circumvention, and precision in targeting the specific type of inflows that are of concern.

Annex 4.1. Econometric Study on Liquidity Expansion: Data, Methodology, and Detailed Results[31]

Panel data specifications are employed to estimate the impact of global liquidity on asset returns for a monthly

[31]This annex was prepared by Tao Sun.

sample of 41 advanced and emerging market economies covering the period from January 2003 to December 2009.[32] The dependent variables tested in the estimations are asset returns in the receiving economies approximated by nominal equity returns (in U.S. dollars) and the real interest rate denoted as the difference between three-month interbank rate, London Interbank Offered Rate (LIBOR) or treasury rate, and inflation rate.

We use two groupings of explanatory variables in the panel specifications:

(1) Domestic or fundamental factors include economic growth, the forward exchange rate, the growth in money supply (M2) or reserve money, net foreign assets of the central bank, the three-month interbank rate, the LIBOR or treasury rate, and the inflation rate based on consumer prices.

(2) Global factors include proxies for (1) global liquidity defined as the growth rates of broad money, reserve money, and excess liquidity in the euro area, Japan, the United Kingdom, and the United States;[33] (2) credit risk premium defined as the level of the 10-year U.S. dollar swap spread, which is the difference between the 10-year U.S. dollar swap rate and the 10-year U.S. treasury bond, as a proxy for aggregate default risk; and (3) a market risk premium defined as the implied volatility of the at-the-money option on the S&P 500 index (VIX).[34]

The economies examined are:

- Asia-Pacific: Australia, China, Hong Kong SAR, India, Indonesia, Japan, Korea, Malaysia, New Zealand, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, and Vietnam.
- Europe, Middle East, and Africa: Bulgaria, Croatia, Czech Republic, Estonia, euro area, Hungary, Iceland, Latvia, Lithuania, Nigeria, Norway, Poland, Romania, Russia, Saudi Arabia, South Africa, Turkey, and the United Kingdom.
- Western Hemisphere: Argentina, Brazil, Canada, Chile, Colombia, Mexico, Peru, and the United States.

[32]This period is chosen because it can capture the rapid increase in global liquidity; GDP-weighted G-4 M2, for instance, have increased twofold during this period.

[33]Baks and Kramer (1999) use similar approaches to define global liquidity.

[34]See similar frameworks in (IMF, 2008a, 2008b) and Psalida and Sun (2009).

Table 4.2. Fixed-Effects Panel Least-Square Estimation of the Determinants of Asset Returns—41 Economies, January 2003–December 2009

	Equity Returns	Real Interest Rate
Constant	63.1	4.39
	(0.00)***	(0.00)***
	Global Market Conditions	
VIX	–1.57	0.010
	(0.00)***	(0.29)
Credit risk premium	–13.45	0.65
	(0.01)**	(0.45)
	Domestic Macroeconomic Factors	
M2 (1 lag)	0.18	–0.04
	(0.03)**	(0.00)***
Exchange rate (1 lag)	–1.05	–0.01
	(0.00)***	(0.54)
Change in GDP growth	7.85	–0.25
	(0.00)***	(0.09)*
Inflation (1 lag)	–1.77	
	(0.00)***	
Adjusted R^2	0.57	0.59
Monthly sample	1/03–12/09	1/03–11/09
No. of cross-sections	31	30
No. of observations	1,792	1,713

Sources: IMF, World Economic Outlook and International Financial Statistics databases; World Bank, World Development Indicators database; Bloomberg L.P. Consensus Forecasts; and Datastream.

Note: Probability values for a test that the coefficient is different from zero are in parentheses (***significant at 1 percent level; **significant at 5 percent level; *significant at 10 percent level).

Relationship between Domestic Liquidity and Asset Returns

We first examine the relationship between domestic liquidity (M2) growth and real asset returns using a panel data specification for a total of 41 economies, separated into the G-4 "liquidity-creating" economies and 37 "liquidity-receiving" economies. Specifically, we have two panel specifications, which have nominal equity returns and the real short-term interest rate as dependent variables, respectively. VIX, the credit risk premium, domestic money, the forward exchange rate, inflation, and change in GDP growth are taken as independent variables.

Table 4.2 shows that domestic liquidity is positively associated with equity returns. Inflation, credit risk, and VIX are negatively associated with equity returns. In addition, an expectation of exchange rate appreciation and a positive change in GDP growth contribute to rising equity returns. Also, domestic liquidity has a significant negative impact on the real interest rate.

Table 4.3. Fixed-Effects Panel Least-Square Estimation of the Determinants of Asset Returns, 34 Economies, January 2003–December 2009

	Equity Returns	Real Interest Rate
Constant	62.28	4.86
	(0.00)***	(0.00)***
	Global Market Conditions	
G-4 M2 (1 lag)	1.14	–0.09
	(0.00)***	(0.00)***
VIX	–1.64	–0.004
	(0.00)***	(0.80)
Credit risk premium	–41.84	–2.54
	(0.00)***	(0.03)**
	Domestic Macroeconomic Factors	
M2 (1 lag)	0.22	–0.021
	(0.00)***	(0.16)
Exchange rate (1 lag)	–0.89	–0.05
	(0.01)**	(0.02)**
Change in GDP growth	7.18	–0.4
	(0.00)***	(0.02)**
Inflation (1 lag)	–1.5	
	(0.00)***	
Adjusted R^2	0.62	0.54
Monthly sample	1/03–12/09	1/03–12/09
No. of cross-sections	27	26
No. of observations	1,527	1,450

Sources: IMF, World Economic Outlook and International Financial Statistics databases; World Bank, World Development Indicators database; Bloomberg L.P.; Consensus Forecasts; and Datastream.

Note: Probability values for a test that the coefficient is different from zero are in parentheses (***significant at 1 percent level; **significant at 5 percent level; *significant at 10 percent level).

Liquidity Spillovers from the G-4 to 34 Liquidity-Receiving Economies

We perform three types of tests to estimate cross-country liquidity spillovers: (1) a panel estimation of the effect of G-4 liquidity on the asset returns and excessive credit growth of receiving economies; (2) a panel estimation of the effect of G-4 liquidity on receiving economies' capital inflows; and (3) Granger causality tests relating G-4 and receiving economies' liquidity.

Effect of G-4 Liquidity on Receiving Economies' Asset Returns Using a Panel

We perform a panel estimation to gain a better understanding of the relation between asset returns in the 34 liquidity-receiving countries (excluding Pakistan, Sri Lanka, and Saudi Arabia) in our sample and G-4 (global) liquidity. Table 4.3 shows that, in the case of 34 economies, global liquidity is positively (negatively) associated with equity returns (the real interest rate). This relationship further supports the view that both global and domestic liquidity may have provided support to rising asset prices during 2003–09.[35] In addition, the effect of global liquidity is five times as large as that of domestic liquidity, and the expectation of exchange rate appreciation can also drive up equity prices. Moreover, global liquidity also drives down the real interest rate.

We separate the full sample into three geographic groupings to test the impact of global liquidity on equity returns by region: Asia-Pacific; Europe, Middle East and Africa; and the Western Hemisphere. The results show that global liquidity is positively associated with equity returns in each of the three groups, while the 34 economies' domestic liquidity (M2) is statistically significant only for Asia-Pacific equities, given this group's higher proportion of economies with fixed or managed exchange rates (Table 4.4). This is consistent with the results on fixed versus flexible-rate economies as shown in Table 4.1.

When we include contemporaneous capital control dummies in the panel regressions to test the impact of capital control measures on asset returns, we find no statistically significant impact, except for URRs (significant at the 10 percent confidence level).

We also check whether high global liquidity affects a measure of financial stability by replacing equity returns with equity overvaluation (defined as the deviation of equity returns from their one-year moving average) and excessive credit growth (defined as the deviation of private credit growth from its one-year moving average) as dependent variables. As expected, global liquidity is positively associated with equity overvaluation and excessive credit growth.

A further test was conducted to check whether a reverse association holds, that is, whether liquidity growth in the 34 economies is associated with positive asset returns in the G-4. We replaced the

[35]An alternative test that replaces G-4 M2 with G-4 overnight index swaps (OIS) as a proxy for global liquidity indicates similar results for the period January 2003–April 2008, that is, a negative association between the GDP-weighted G-4 OIS and equity returns. But this relationship breaks down when the global crisis period (May 2008 to December 2009) is included. This is not surprising given the lessened effectiveness of interest rates as a policy tool during the crisis.

Table 4.4. Fixed-Effects Panel Least-Square Estimation of the Determinants of Equity Returns—Regional Disaggregation, January 2003–December 2009

	Asia	Europe, Middle East, and Africa	Western Hemisphere
Constant	59.55	56.89	64.09
	(0.00)***	(0.00)***	(0.00)***
	Global Market Conditions		
G-4 M2 (1 lag)	1.59	1.15	0.68
	(0.00)***	(0.04)**	(0.00)***
VIX	–1.65	–1.93	–1.34
	(0.00)***	(0.00)***	(0.00)***
Credit risk premium	–61.12	–4.84	–48.12
	(0.00)***	(0.76)	(0.00)***
	Domestic Macroeconomic Factors		
M2 (1 lag)	0.68	0.12	0.14
	(0.00)***	(0.60)	(0.15)
Exchange rate (1 lag)	–0.92	–0.48	–1.3
	(0.00)***	(0.07)*	(0.00)***
Change in GDP growth	6.98	5.49	7.55
	(0.00)***	(0.01)**	(0.00)***
Inflation (1 lag)	–1.82	–3.24	–0.1
	(0.00)***	(0.00)***	(0.76)
Adjusted R^2	0.59	0.62	0.65
Monthly sample	1/03–12/09	1/03–12/09	1/03–12/09
No. of cross-sections	9	11	7
No. of observations	606	341	580

Sources: IMF, World Economic Outlook and International Financial Statistics databases; World Bank, World Development Indicators database; Bloomberg L.P.; Consensus Forecasts; and Datastream.

Note: Probability values for a test that the coefficient is different from zero are in parentheses (***significant at 1 percent level; **significant at 5 percent level; *significant at 10 percent level).

34 economies' equity returns with G-4 equity returns (for both individual countries and the average) as the dependent variable, while using the same explanatory variables as in Table 4.3. The results show no statistical significance, indicating that the 34 economies' liquidity growth is not associated with equity returns in the G-4.

Housing price data—where available—were also tested as an additional asset indicator of their association with the growth in global liquidity. Using quarterly house prices in 11 economies, we estimate the growth of nominal and real house prices using the same independent variables as in Table 4.4.[36] Global liquidity is statistically insignificant, while domestic liquidity is statistically significant with a positive sign. These results indicate that domestic liquidity plays a role in driving up housing prices, but point to no role for global liquidity. These results need to be interpreted with caution, however, given the limited housing data sample.

As a robustness test, we replaced G-4 M2 as a liquidity measure with G-4 reserve money and excess liquidity, respectively, and the 34 economies' M2 with their reserve money and net foreign assets of the monetary authorities separately as explanatory variables. These alternative variables for global and domestic liquidity are generally statistically significant with a positive coefficient. These results further support the notion that the contribution of global liquidity to the change in asset returns remains robust under alternative measures for global liquidity.

Relation between Global Liquidity and Capital Flows

We perform regressions using capital flows as dependent variables to capture the links between global liquidity and capital flows. In this test, we take global liquidity as an independent variable and control for domestic and other global factors. The results in Table 4.5 show that global liquidity has a significant impact on portfolio equity inflows.

Relation between G-4 Liquidity and 34 Receiving Economies' Liquidity Using Granger Causality Tests

We perform Granger causality tests to see whether global liquidity Granger-causes domestic liquidity, that is, the growth of monetary indicators in the 34 liquidity-receiving economies in our sample. We look specifically at broad money and reserve money growth in the G-4, as an approximation of global liquidity, and at domestic broad money and reserve money in the 34 liquidity-receiving economies. Table 4.6 indicates that both global and domestic liquidity Granger-cause each other. In addition, we can also see the long-run causality relations between global liquidity and domestic liquidity by using the level of the variables in the panel. The advantage of this approach is that we can use nonstationary data to capture the long-run causal relationships.

[36]The 11 economies are Australia, Canada, China, Iceland, Indonesia, Korea, Malaysia, New Zealand, Norway, South Africa, and Thailand.

Impact of Global Liquidity on Asset Returns: Case Study for Brazil, Chile, China, and Hong Kong SAR

We test the impact of global liquidity on asset returns in four economies over the period 2003–09. Specifically, we test the effect of G-4 liquidity growth on equity returns in Brazil, Chile, China, and Hong Kong SAR, while controlling other variables in an EGARCH (1,1) specification. The results in Table 4.7 show that global liquidity is positively associated with equity returns, and the signs of the coefficient of the EGARCH variable (β) are statistically significant, indicating that the volatility in global liquidity spills over into the volatility of all liquidity-receiving economies.

Table 4.5. Fixed-Effects Panel Least-Square Estimation of the Determinants of Capital Flows, 34 Economies, January 2003–December 2009

	Foreign Direct Investment	Equity Securities	Debt Securities	Other Investments
Constant	–11.6	–23.05	26.7	19.08
	(0.02)**	(0.17)	(0.14)	(0.07)*
		Global Market Conditions		
G-4 M2 (1 lag)[1]	–0.38	1.62	0.7	–0.61
	(0.07)*	(0.02)**	(0.36)	(0.18)
VIX	–0.34	–0.86	–0.2	–0.54
	(0.00)***	(0.02)**	(0.61)	(0.02)**
Credit risk premium	53.42	9.64	–102.27	–13.19
	(0.00)***	(0.76)	(0.00)***	(0.51)
		Domestic Macroeconomic Factors		
Exchange rate (1 lag)	0.08	0.65	–0.73	–0.60
	(0.46)	(0.06)*	(0.04)**	(0.01)**
Change in GDP growth	0.16	5.69	–3.6	–0.14
	(0.90)	(0.19)	(0.43)	(0.96)
Real interest rate (1 lag)	0.21	–1.06	–4.57	–0.92
	(0.28)	(0.09)*	(0.00)***	(0.03)**
Adjusted R^2	0.09	0.04	0.15	0.04
Monthly sample	1/03–12/09	1/03–12/09	1/03–12/09	1/03–12/09
No. of cross-sections	25	24	23	25
No. of observations	1,283	1,210	1,132	1,283

Sources: IMF, World Economic Outlook and International Financial Statistics databases; World Bank, World Development Indicators database; Bloomberg L.P.; Consensus Forecasts; and Datastream.

Note: Probability values for a test that the coefficient is different from zero are in parentheses (***significant at 1 percent level; **significant at 5 percent level; *significant at 10 percent level).

[1]The decline in foreign direct investment during the global financial crisis likely contributes to the coefficient of G-4 M2 being negative; it is positive but insignificant during the subperiod January 2003–September 2007.

Table 4.6. Granger Causality Relations between Global and Domestic Liquidity

	Probabilities[1]			
Data	M2 in 34 economies does not Granger-cause G-4 M2	G-4 M2 does not Granger-cause M2 in 34 economies	Reserve money in 34 economies does not Granger-cause G-4 reserve money	G-4 reserve money does not Granger-cause reserve money in 34 economies
Growth rate	$7.8*10^{-14}$	$18.2*10^{-38}$	$3.2*10^{-4}$	$4.5*10^{-7}$
Level	0	0	0.05	0

Sources: IMF, World Economic Outlook and International Financial Statistics databases; World Bank, World Development Indicators database; Bloomberg L.P.; Consensus Forecasts; and Datastream.

Note: The null hypothesis is that there is no Granger causality between the respective pairs of variables.

[1]Probability of rejecting the null hypothesis.

Table 4.7. Determinants of Equity Returns, EGARCH (1,1) Specifications, January 2003–November 2009

	Brazil	Chile	China	Hong Kong SAR
		Mean Equation		
Constant	229.24	−1.05	−78.51	−19.85
	(0.00) ***	(0.92)	(0.00)***	(0.00)***
		Global Market Conditions		
G-4 M2 (1 lag)	3.03	1.45	2.20	0.87
	(0.00)***	(0.00)***	(0.00)***	(0.00)***
VIX	−1.44	−1.16	−1.38	−1.21
	(0.01)**	(0.00)***	(0.00)***	(0.00)***
Credit risk premium	−20.77	11.58	48.18	19.11
	(0.45)	(0.53)	(0.00)***	(0.01)**
		Domestic Macroeconomic Factors		
M2 (1 lag)	−1.65	0.38	2.88	1.33
	(0.00)***	(0.04)**	(0.00)***	(0.00)***
Exchange rate (1 lag)	−2.04	0.62	4.36	0.94
	(0.00)***	(0.04)**	(0.00)***	(0.76)
Change in GDP growth	1.43	−3.87	−5.75	0.29
	0.71	(0.13)	(0.08)*	(0.62)
Inflation (1 lag)	−2.63	−6.09	−4.46	−2.71
	(0.09)*	(0.00)***	(0.02)**	(0.00)***
		Variance Equation		
ω	1.92	1.68	2.73	1.67
	(0.02)**	(0.00)***	(0.00)***	(0.00)***
α	0.08	−0.52	−0.63	−0.13
	(0.21)	(0.00)***	(0.00)***	(0.21)
β	0.65	0.67	0.54	0.60
	(0.00)***	(0.00)***	(0.00)***	(0.00)***
γ	−0.21	0.77	1.00	0.80
	(0.05)*	(0.00)***	(0.00)***	(0.00)***
Adjusted R^2	0.85	0.75	0.75	0.89
Monthly sample	1/03–11/09	1/03–11/09	1/03–09/09	1/03–11/09
No. of observations	83	83	81	83

Sources: IMF, World Economic Outlook and International Financial Statistics databases; World Bank, World Development Indicators database; Bloomberg L.P.; Consensus Forecasts; and Datastream.

Note: The specification for the mean equation is: equity returns$_t$ = constant + θ_1G4 M2$_{t-1}$ + θ_2VIX$_t$ + θ_3Credit risk$_t$ + θ_4M2 $_{t-1}$+ θ_5Exchange rate$_{t-1}$ + θ_6GDP$_t$ + θ_7Inflation $_{t-1}$ + ε_t , where the conditional variance of ε_t is denoted:

$$\log(\sigma_t^2) = \omega + \sum_{j=1}^{q} \beta_j \log(\sigma_{t-j}^2) + \sum_{i=1}^{p} \alpha_j \left| \frac{\varepsilon_{t-i}}{\sigma_{t-i}} \right| + \sum_{k=1}^{r} \gamma_\kappa \frac{\varepsilon_{t-k}}{\sigma_{t-k}}$$

Annex 4.2a. Global Liquidity Expansion—Capital-Account-Related Measures Applied in Selected Liquidity-Receiving Economies

Type of Measure	Country
Tax	Brazil (2008), (2009)[1]
Unremunerated reserve requirements	Argentina (2005–) Colombia (2007–08) Russia (2004–06) Thailand (2006–08)
Prudential-type capital controls: marginal reserve requirements on external borrowing; high reserve requirements on foreign exchange liabilities; limited foreign exchange lending to residents; other.	Colombia (2004–05, 2007) Croatia (2003, 2004–08) India (2006–07) Indonesia (2005) Korea (2004, 2006, 2008) Peru (2008) Romania (2005–06) Russia (2004) Turkey (2008)
Administrative measures: Include ceilings and maturity requirement for external borrowing, limits on the amounts nonresidents can repatriate from their investments, authorization requirement for nonresidents investments.	Argentina (2005–08) China (2007) Colombia (2004) India (2003, 2006–07) Indonesia (2005) Mexico (2006) Philippines (2007) Russia (2004) Slovenia (2007) Taiwan Province of China (2009)[1] Thailand (2003, 2006, 2008) Vietnam (2007)
Liberalization of outflows[2]	Argentina (2003–04, 2008) Brazil (2005–06) Bulgaria (2003, 2007) Canada (2005) Chile (2003, 2005,2008) China (2006–07) Colombia (2003, 2005, 2008) Croatia (2003, 2006–07) Hungary (2007–2008) India (2003–04, 2006–07) Indonesia (2007) Korea (2005–08) Latvia (2003) Lithuania (2004) Malaysia (2003–08) Mexico (2007–08) Moldova (2009) Nigeria (2008) Pakistan (2003, 2005) Peru (2004, 2007–08) Philippines (2004–05, 2007–08) Poland (2007) Romania (2003, 2007) Russia (2004, 2006–07) Singapore (2004) Slovak Republic (2003–04) Slovenia (2003–04) South Africa (2003–08) Sri Lanka (2003, 2006–08) Thailand (2003, 2007–08) Turkey (2006, 2008) Vietnam (2006–07)

Source: IMF, *Annual Report on Exchange Arrangements and Exchange Restrictions*, 2003–08.

Note: This annex was prepared by Annamaria Kokenyne. The annex does not include capital controls that were introduced before, and remained in effect during, the period in the selected liquidity-receiving economies or other countries, and therefore cannot be considered indicative of the restrictiveness of the capital control regime in these countries. Also, the measures are not equally significant; some of them have only a minor potential effect.

[1]Based on press articles.

[2]The measures include the easing or lifting of controls on one or more type of capital account transaction of residents abroad.

Annex 4.2b. Global Liquidity Expansion—Policy Responses Affecting the Capital Account in Selected Liquidity-Receiving Economies

			Effectiveness/Limitations			
Type of Measure	Type of Capital Flow	Aim of Measure	Reduced net inflows	Lengthened the maturity structure	Stemmed appreciation pressure	Countries
Tax	Short-term capital inflows, loans and fixed-income securities	Ensure monetary independence, ease exchange rate appreciation pressures	Yes (temporarily)	Yes, but large-scale circumvention due to sophisticated financial markets	No	Brazil (1993–97) Complemented by various administrative measures
	Loans and fixed income securities	Ease appreciation pressures	No	No	No	Brazil (March–October 2008)
Unremunerated reserve requirements	Banks' external borrowing, later extended to nondebt flows	Ensure monetary policy independence, preserve export competitiveness	No	Yes	No	Chile (1991–98) Complemented by various administrative measures
	Banks' short-term external borrowing	Preserve competitiveness	No	Yes	No	Colombia (1993–98)
	External borrowing and fixed-income portfolio flows	Preserve competitiveness	Yes[1] (temporarily)	No	No	Thailand (2006–08)
	Banks' external borrowing, portfolio inflows	Preserve competitiveness	No Yes[2] (temporarily)	No Yes[2] (temporarily)	No No	Colombia (2007–08)
Administrative measures	Short-term debt inflows	Ensure monetary policy independence, reduce financial sector external debt	Yes	Yes	Yes	Malaysia (1994)
Prudential measures with an element of capital control	Short-term external borrowing and lending in local currency	Maintain fixed exchange rate and tight monetary policy	Yes	Yes	Yes	Thailand (1995–97)
	Banks' external borrowing	Reduce rapid credit expansion, ensure financial sector stability	Yes	n.a.	Yes	Croatia (2004–06) Complemented by strengthened macroprudential measures
Capital outflow liberalization	Short-term external borrowing	Stem appreciation pressures and preserve financial sector stability	No	n.a.	No	Korea (2005–08)

Note: This annex was prepared by Annamaria Kokenyne. Assessments are based on previous studies as summarized in Ostry and others (2010) and IMF staff calculations.
[1]Unremunerated reserve requirement decreased the net flows (inflows minus outflows) by increasing outflows.
[2]The period covered by the vector autoregression estimation ends one year after the introduction of controls.

Annex 4.3. Country Case Studies[36]

Foreign Exchange Tax—Brazil

Brazil has attracted increasing foreign exchange inflows since the early 2000s, with the 2008–09 financial crisis prompting a sharp but temporary interruption. During this decade, the exchange system has been liberalized significantly, reaching almost full liberalization by 2006. Against the backdrop of strong economic growth, FDI has been the largest single source of inflows, but portfolio inflows, to both bond and equity markets, have been growing. These have been attracted by high relative interest rates, a stable macroeconomic environment, and appreciation expectations in the context of a liquid and diversified domestic capital market (Figure 4.5).

Following a series of foreign exchange interventions, concerns about the potential effects of further hot money inflows on external competitiveness led to the introduction of capital controls in the form of taxes in 2008.[37] Taxes on capital account transactions were reintroduced in March 2008 at the rate of 1.5 percent. Exemptions were applied to funds related to equities, equities derivatives, initial public offerings, and subscription of shares. In May, the tax was extended to cover "simultaneous operations" that intend to circumvent the inflow tax. The tax was lifted in October 2008 at the peak of the global financial crisis, when the exchange rate came under depreciation pressures.

Facing a surge in portfolio flows, a 2 percent tax on fixed-income and equity inflows was reintroduced in October 2009. To limit circumvention, the authorities implemented a 1.5 percent tax on certain trades involving American Depositary Receipts (ADR) issued by Brazilian companies in November.

Our VAR estimates indicate that the taxes introduced in 2008 did not have a significant effect on the overall volume and maturity structure of capital inflows or the real exchange rate. This may be explained partially by the ability of some market participants to circumvent the controls. However, it seems that the tax has provided for greater monetary independence, as it contributed to maintaining an increasing interest rate spread for two quarters.

Unremunerated Reserve Requirements—Colombia

In 2007, the Colombian authorities responded to surges in capital inflows with a combination of policies. Early that year, Colombia had experienced a significant appreciation of the peso due to increased capital inflows, mainly in the form of FDI, whose surge was partially driven by higher-than-average growth in the region and high interest rates (Figure 4.6). The authorities initially responded with sterilized foreign exchange interventions followed by tightening capital controls and prudential measures.

Capital controls on foreign borrowing, which were soon extended to portfolio inflows, took the form of a 40 percent URR to be held with the central bank. The measure was complemented by a ceiling on banks' gross derivative positions—not allowed to exceed 500 percent of capital—to prevent the circumvention of controls and reduce the amount of position-taking against the peso. Withdrawals of funds before the six-month period were subject to penalties of 1.6 to 9.4 percent of the reserve, depending on the length of time they were held. Colombian institutional investors, which were major participants in both the domestic and the offshore capital markets, were exempt from the URR.

The controls, which also aimed at macroprudential concerns, were adjusted several times before they were eliminated. In June 2007, equities issued abroad were exempted, which allowed ADR trading without a URR. In December, the URR on initial public offerings was eliminated and early-withdrawal penalties were reduced. Although foreign borrowing declined, appreciation pressures persisted and, as a result, the URR was increased to 50 percent in May 2008. To prevent the circumvention of controls, a two-year minimum-stay requirement was implemented on

[36]This annex was prepared by Annamaria Kokenyne and Chikako Baba.

[37]Taxes on foreign exchange transactions are not a new feature in the Brazilian foreign exchange system, as they had been implemented in the second half of the 1990s when large, mainly portfolio inflows, had put pressure on the exchange rate. A tax with rates of up to 7 percent was applied to fixed-income funds, interbank exchange operations, and short-term asset holdings by nonresidents. In 1999, a 5 percent tax was imposed on foreign borrowing with maturities shorter than 90 days.

inward FDI. The limit on banks' derivative positions was raised slightly but the penalty for the early withdrawal of funds was increased in June 2008. In the second half of 2008, controls were backed up by renewed sterilized interventions to fend off an appreciation and higher reserve requirements to support sterilization of large foreign exchange purchases. The onset of the global crisis set the stage for lifting capital controls in October 2008. The minimum stay requirement was eliminated and equities were exempt from the URR in September 2008. Ultimately, the controls (except for the ceiling on the gross derivative position of banks) were lifted in October 2008.

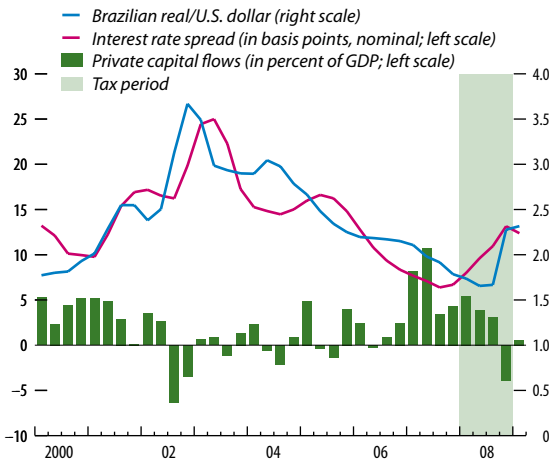
Short-term loans decreased substantially following the introduction of controls; however, our VAR estimations show no statistically significant effect on short-term flows or total net inflows.[38] A VAR estimation covering the period ending two quarters after the introduction of the controls, however, finds that controls reduced short-term inflows and the overall volume of inflows for about four months. The large and stable volume of FDI inflows throughout the period and the gradual increase of portfolio and short-term debt inflows, despite the later tightening of controls, may have contributed to this result. Since the overwhelming majority of inflows consisted of FDI, which was not affected by the controls, exchange rate appreciation pressures could not be reduced effectively. The controls may have temporarily allowed for increased monetary independence, estimated to have lasted less than six months.

Unremunerated Reserve Requirements—Thailand

Large capital inflows led to a significant appreciation of the Thai baht in 2006 and ultimately prompted the introduction of capital controls (Figure 4.7). In the authorities' view, appreciation was not in line with fundamentals and would have adversely affected competitiveness. Following extensive foreign exchange interventions, and unsuccessful attempts to curb inflows through tightened capital controls since

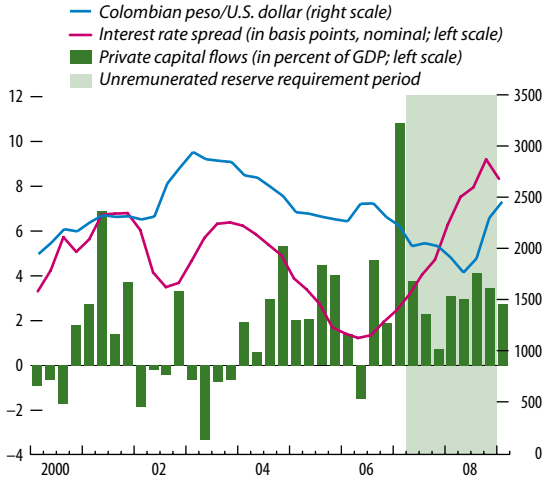
[38]This result holds for both quarterly and monthly data (due to data limitations, the monthly data analysis begins in January 2004).

Figure 4.5. Brazil



Sources: IMF, International Financial Statistics, Balance of Payments Statistics, and Annual Report on Exchange Arrangements and Exchange Restrictions databases.
Note: The spread is between the domestic and the U.S. money market rate.

Figure 4.6. Colombia



Sources: IMF, International Financial Statistics, Balance of Payments Statistics, and Annual Report on Exchange Arrangements and Exchange Restrictions databases.
Note: The spread is between the domestic and the U.S. money market rate.

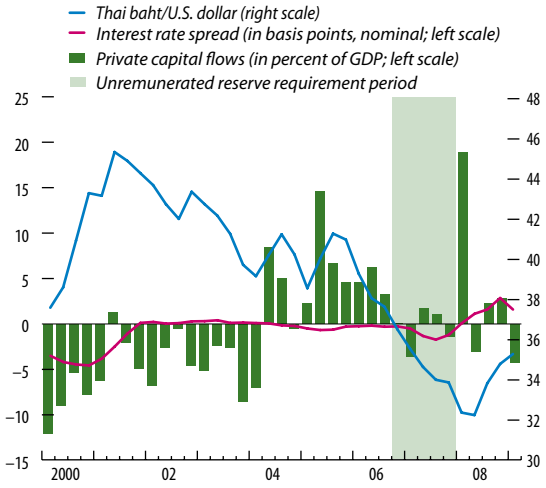
November 2006, the authorities introduced new capital controls on all capital inflows in December 2006.

The main element of the capital controls was a 30 percent URR. Financial institutions were required to withhold 30 percent of the foreign currency purchased or exchanged against the baht exceeding $20,000. The amount withheld was refunded after one year upon proof that the funds had been kept in Thailand for at least one year. If the funds were transferred abroad within one year, only two-thirds of the amount withheld could be refunded. The measure was meant to discourage short-term capital investments by imposing a 10 percent tax on withdrawals within one year.

The URR was adjusted several times until it was finally eliminated in early 2008 and was complemented by other measures, including the easing of controls on capital outflows. Stock market equity inflows were exempt after one day as the introduction of the URR resulted in a sharp decline of 15 percent in equity prices. Further adjustments took place, including a change in focus from controlling inflows to easing controls on outflows by increasing or eliminating the limits on the amount Thai firms and individuals were permitted to invest and transfer abroad. The controls were ultimately lifted in March 2008.

The URR was successful in reducing net capital flows (inflows-outflows) by increasing outflows; however, it did not have a statistically significant effect on the volume and composition of inflows, according to our VAR estimates. The URR was associated with a decrease in short-term inflows, but this effect dissipated in two to three quarters. The higher outflows may have been the result of a loss of residents' confidence in domestic policies due to the introduction of the controls. Although the URR could not stem the appreciation of the real exchange rate or increase the independence of the monetary policy, the other inflow controls implemented in the same period seem to have contributed to increasing monetary independence for two quarters. Capital outflows reversed toward the end of the URR regime, and surged as soon as the controls were eliminated.

Figure 4.7. Thailand



Sources: IMF, International Financial Statistics, Balance of Payments Statistics, and Annual Report on Exchange Arrangements and Exchange Restrictions databases.

Note: The spread is between the domestic and the U.S. money market rate.

Prudential Measures as Capital Controls—Croatia

Sustained economic growth and prospects of accession to the European Union have attracted

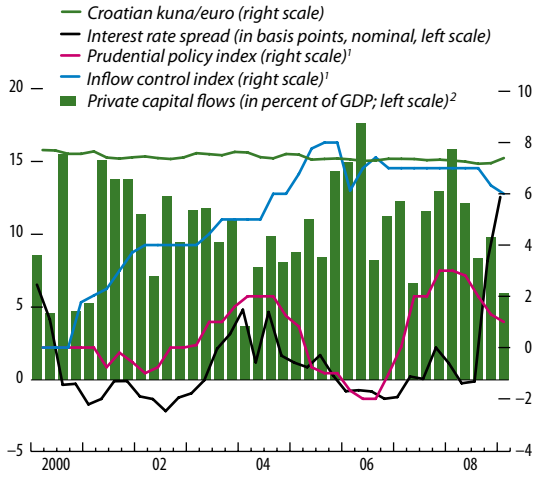
large capital inflows to Croatia since the early 2000s (Figure 4.8). While FDI represented a substantial part of inflows, foreign borrowing in the context of a stable exchange rate increased banks' dependence on external financing and fueled unhedged credit expansion in foreign currency.

The authorities relied on a combination of prudential (including macroprudential) measures and capital controls to reduce financial sector vulnerabilities. The measures implemented from 2004 onward were aimed at reducing credit expansion and the related foreign borrowing. They remained in effect until late 2008, when local banks' foreign funding dried up due to the crisis. The authorities also strengthened supervision of the banking sector and implemented measures to prevent regulatory arbitrage through leasing companies.

Both the controls and the prudential measures increased the cost of foreign borrowing and domestic lending. A marginal reserve requirement (MRR) was introduced and gradually increased on banks' new foreign borrowing. To close a loophole, a special reserve requirement (SRR) was introduced at the rate of 55 percent on increases in banks' liabilities arising from issued debt securities in 2006. Credit controls, previously used in 2003, were reintroduced in 2007, requiring that banks purchase low-yield central bank bills for 50 percent of the increase in their credit growth exceeding the allowed limit, which was increased to 75 percent in 2008. In addition, banks were required to comply with a monthly 1 percent sublimit on credit growth. The liquidity ratio of 32 percent for assets maturing in three months was extended to foreign-exchange-indexed instruments, while the general RR was reduced in several steps but remained relatively high at 17 percent until December 2008. The MRR and the SRR were ultimately eliminated in October 2008.

Banks' external borrowing started to decline in 2006, credit growth decelerated, and the share of foreign exchange loans declined. Following the introduction of the MRR, loans and advances owed by Croatian banks to nonresident banks declined by 10 percent. The implementation of the SRR was followed by a close to 20 percent drop in inflows. The measures also led to some disintermediation. To avoid the reserve requirements, the corporate sector increased its direct cross-border borrowing from abroad. The

Figure 4.8. Croatia



Sources: IMF, International Financial Statistics, Balance of Payments Statistics, and Annual Report on Exchange Arrangements and Exchange Restrictions databases; and IMF staff estimates.

Note: The spread is between the domestic and the euro area money market rate.

[1]Higher values indicate more restrictive policy.

[2]The series is seasonally adjusted.

high MRR also encouraged parent banks to fund Croatian subsidiaries by beefing up their equity (FDI inflows) rather than by debt financing. This raised banking system capital buffers (which paid off during the crisis), but also enabled banks to extend more credit to the private sector.

The capital controls and the prudential measures have achieved some success. The impulse responses based on our VAR estimates show that the MRR and the SRR reduced the overall volume of inflows and contributed to the depreciation of the exchange rate for about two quarters. In addition, the prudential (including macroprudential) measures reduced capital inflows for one quarter and led to a short-lived minor depreciation. The prudential measures also increased monetary independence marginally for about a year.

Administrative Measures—China and India

Despite progress in liberalization over the past six years, China and India retain extensive administrative controls on the capital account. Both countries have taken a gradual and cautious approach to liberalizing the capital account supported by a vast foreign exchange administrative system and strong enforcement capacity.

China maintains control on most capital transactions. Inward FDI is relatively free, but portfolio equity and fixed-income investments are allowed only to qualified foreign institutional investors and are subject to yearly quotas, individual investment limits, and a minimum stay requirement.

India also maintains controls on the majority of capital account transactions. Although there is no overall ceiling portfolio, equity investments by foreign institutional investors are subject to individual limits as a proportion of the issued share capital of the Indian company. A yearly ceiling applies on investment in fixed-income securities. Inward FDI is free in many sectors; however, in some sectors foreign ownership is limited or prohibited. Cross-border lending and borrowing are controlled.

Recent strong inflows led to tightening inflow controls and a limited liberalization of outflows. While the global crisis resulted in significant outflows in both countries, the relatively closed foreign exchange control regime may have contributed to limiting swings in the capital account. Furthermore, the persistent difference between the onshore and offshore renminbi yields may suggest that Chinese controls continue to bind (Ma and McCauley, 2007).

Liberalization of Capital Outflows—Korea

Korea has experienced significant net capital inflows since the early 2000s. Foreign investors, encouraged by stable fundamentals, the gradual foreign exchange liberalization, and the generally well-developed and open financial markets, increased their investment, which led to an exchange rate appreciation. A significant share of short-term inflows was channeled through foreign banks' branches in Korea as part of hedging operations and investments in the sovereign bond market in anticipation of further appreciation of the won (Figure 4.9).

Policy responses to stem appreciation pressures and preserve financial sector stability included monetary and financial regulatory measures. Raising interest rates from the fourth quarter of 2005 was aimed at reining in inflation and cooling speculative pressures in the property market. In addition to implementing strict liquidity ratios in the banking sector, the authorities restricted foreign currency lending to residents to specific transactions in August 2007 and extended the thin capitalization rules on foreign bank branches in Korea.[39] To allow greater flexibility in managing foreign exchange transactions, banks' open foreign exchange position was increased in two steps to 50 percent from 20 percent in 2006 while banks' long nondeliverable forward position was limited to 110 percent of their long nondeliverable forward positions on January 14, 2004.[40]

To stem appreciation pressures, the authorities also actively liberalized capital outflows, eliminating most

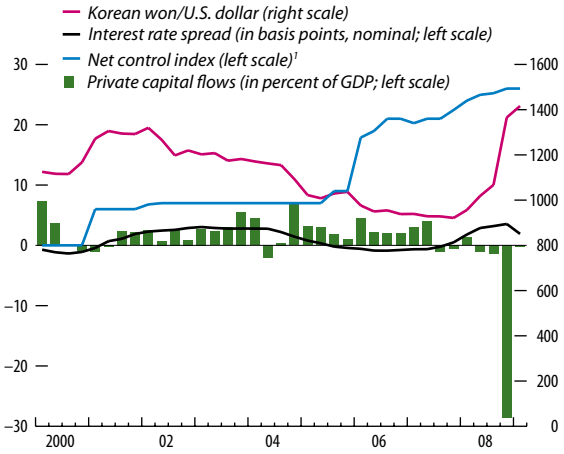
[39]The rule, which is a common element of many tax systems, limits the tax deductibility of interest paid on loans exceeding three times the capital of foreign bank branches in Korea.

[40]The regulation on long nondeliverable forward positions ended in September 2008. Further strengthening of prudential regulation in the banking sector has been announced by the authorities, including limits on the hedging of export proceeds to 125 percent of exports and a tighter liquidity ratio on long-term funding, a minimum safe-asset requirement on foreign assets, and stricter liquid asset classification requirements. The measures will take effect step by step from the beginning of 2010 to July 1, 2010.

of the controls by 2007. While Korea had a capital account liberalization plan, the relaxation of the controls on some of the measures has been accelerated against the backdrop of strong capital inflows. The upper limit on Korean insurance companies' assets in foreign currency was increased to 30 percent in March 2005 and repatriation requirements on proceeds from resident capital transactions abroad were relaxed in 2006. Limits were gradually increased on resident investments abroad and finally eliminated by lifting the ceilings on individuals' FDI and real estate purchases abroad in March 2006 and May 2008, respectively. In the same year, the previous approval requirement on certain capital transactions was changed to a notification requirement, reducing the administrative burden on market participants. In 2007, reporting requirements related to capital transactions were further relaxed, allowing more freedom in extending won loans to nonresidents.

The capital account liberalization measures implemented may have helped in mitigating the effects of capital inflows. The VAR analysis shows a response of net flows in line with the prediction, although the impact is not significant in a statistical sense. The liberalization of outflows was carried out simultaneously with some inflow liberalization, and the resulting inflows decreased somewhat the effect of the increase in outflows. The combined effect of inflow and outflow liberalization is associated with a slight increase in outflows, possibly alleviating some of the appreciation pressures on the exchange rate in 2006–07. A potential explanation of the weak response is that the liberalization measures affected relatively minor elements of the control system and less-significant capital transactions that do not affect outflows significantly.

Figure 4.9. Korea



Sources: IMF, International Financial Statistics, Balance of Payments Statistics, and Annual Report on Exchange Arrangements and Exchange Restrictions databases; and IMF staff estimates.

Note: The spread is between the domestic and the U.S. money market rate.

[1]Difference between the inflow control index and outflow control index. Higher values indicate more liberalized outflow or more restricted inflow controls.

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