CHAPTER 2

Adapting Micro Prudential Regulation for Emerging Markets

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Introduction

Current financial regulations and bank supervision are essentially *micro prudential* in nature, in that they seek to limit each institution's risk. Many rationales exist for focusing on institution-level risk in this way. First, traditional banking is funded by dispersed creditors who are more likely to respond to warning signals about bank health via disruptive "runs" (demand of immediacy) rather than ensure ex ante that banks remain healthy. Regulators can represent depositors and get around their collective action problem in monitoring and supervising banks by placing some constraints on risk taking. Second, because the government insures deposits up to a threshold amount to reduce the incidence of disruptive runs, it becomes the effective creditor of financial firms and thus has an interest in minimizing its downside risk from bank failures. Third, in many countries—especially in emerging markets—banks are state owned, making the government a direct stakeholder in the financial sector. Government-sponsored enterprises (such as Fannie Mae and Freddie Mac in the United States, or the *Landesbanken* in Germany) and state-owned banks (which play an important role in the banking sector of many Asian countries, including India and China) are primary examples.[1] In such cases, micro prudential regulation is a part of the overall governance structure of individual financial firms.

Yet, increasingly the concern for economies is not the failure of an individual financial firm but a systemwide collapse that threatens to result in loss of intermediation and impairment of growth. Such "systemic risk" can result in the failure of a significant part of the financial sector, leading to a reduction in credit

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availability that has the potential to adversely affect the real economy. Given the interconnectedness of various financial elements, the contemporary market-based financial sector should be thought of as not just the deposit-taking, loan-making activities of commercial banks, but also as, including investment banks, money-market funds, insurance firms, and potentially even hedge funds and private equity funds.[2] Even though the financial sectors of emerging economies primarily consist of traditional commercial banks, recent evidence from China and India shows that when commercial banks are restricted in risk-taking and leverage, emerging economies tend to have an outgrowth of "shadow banking," that is, nonbank financial intermediaries (money market funds and nonbank finance corporations) that often remain outside of regulatory scope.

Several types of systemic risks can be generated from the failure of financial institutions, including counterparty risk, especially in interbank markets; spillover risk due to forced asset sales in asset- or market-based economies; the risk of "runs" on the shadow-banking system; or simply the inability to resolve failed banks by selling them to other better-capitalized firms (given their dearth in a systemic crisis) leading to a credit crunch or regulatory forbearance and creation of "zombie" institutions that do not allocate resources effectively in the economy given their debt overhang problems.[3] A financial crisis only serves to exacerbate these risks.

Unless the external costs of such systemic risks imposed on the rest of the financial sector, as well as on the rest of the economy, are internalized by each financial institution, an incentive to take risks that are borne by others will remain. A financial institution's risk is a negative externality on the system.[4] Thus, *financial regulation should be not only micro prudential but also macro prudential in nature*, focused on limiting systemic risk. Absent such macro prudential regulation, economies run the risk of excessively large amplifiers over and above normal cyclical macroeconomic fluctuation. This risk occurs because moral hazard due to regulatory forbearance during systemic crises is particularly severe;[5] even if the regulator would like to commit ex ante to not bail out failed institutions, it is not credible ex post.

The costs of such bailouts tend to be significant, often a nontrivial fraction of the gross domestic product (GDP) of the economies involved. Caprio and Klingebiel (1996) argue that the bailout of the thrift industry cost 3.2 percent of GDP in the United States in the late 1980s. They document that the estimated cost of bailouts were 16.8 percent for Spain, 6.4 percent for Sweden, and 8 percent for Finland. Honohan and Klingebiel (2000) find that countries spent 12.8 percent of their GDP to clean up their banking systems, whereas Claessens, Djankov, and Klingebiel (1999) set the cost at 15–50 percent of GDP. Using longer time-series data, Laeven and Valencia (2008, 2010) and Reinhart and Rogoff (2009a, 2009b) also document that the costs of these crises—assessed over decades and centuries, respectively—appear to be substantial, often amounting to more than 50 percent of GDP, wiping out several years of growth and resulting in "lost decades."

The large potential cost to the economy warrants macro prudential regulation focused on systemic risk, rather than micro prudential regulation focused on an

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individual institution's risk of failure. Importantly, micro prudential regulation can be readily adapted to incorporate macro prudential concerns.

The next section (Regulatory Distortions and Systemic Risk in Emerging Markets) lays out why systemic risk concerns are as important, if not more important, in emerging markets as in advanced economies. That section also considers, most notably, the pervasive and distortive role played by government guarantees in these countries and the need to charge upfront for the systemic risk of financial firms, which is presently largely government guaranteed. As the role of emerging markets in the global economy rises, the importance of risk spillovers across these markets has grown. Thus, it is important to look for emerging pockets of macro prudential risk, not just inside economies but also outside. Finally, the section discusses in greater detail the possible spillovers and global linkages, and provides a potential blueprint for achieving better international coordination of macro prudential regulation.

The third section (Basel Capital Requirements) takes the Basel capital requirements (Basel III in particular) as a case in which micro prudential regulation largely ignores macro prudential concerns, and in many cases, aggravates macro prudential outcomes. How should micro prudential regulation be adapted to incorporate macro prudential concerns? In the same way that firms are often regulated to limit their pollution or are taxed based on the externalities they cause, macro prudential regulation should consider a "tax" on firms' contribution to systemic risk. To the extent market-based signals are available to assess the risk of institutions and the correlation of this risk with aggregate risks of the economy, systemic risk contributions of financial firms can be measured, as outlined in the next section.

The fourth section (Measuring Systemic Risk) also entertains the possibility that regulators can generate their own valuable information to supplement or substitute for market data, where it is either unavailable or unreliable, as in some emerging markets. In particular, "stress tests" that subject financial firms to a common set of aggregate shocks can assess whether the firms would be adequately capitalized in such scenarios. Thus, rather than limiting the stress scenarios to effects on individual firms, micro prudential stress tests can be given an important macro prudential dimension. Capital shortfalls of firms in such stress tests could be an alternative measure of their systemic risk.

Depending on the availability of market data to assess and measure systemic risk, the fifth section (Regulating systemic risks) proposes regulation of systemic risk. There are three alternatives: capital requirements based on systemic risk contributions; tax or premiums along the lines of deposit insurance premiums; and leverage restrictions as well as adjustments of sector risk weights in (Basel-style) capital calculations, based on outcomes of stress tests.

Whereas all these alternatives may be implementable in an emerging market context, they may serve different purposes in practice. Capital requirements, for instance, may be more easily gamed than premiums (which require upfront cash payments) but also provide a buffer against future losses. Importantly, in many emerging markets and for nonpublicly traded financial firms, market availability of

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data and risk indicators is a challenge (even though financial firms are increasingly being publicly traded in emerging markets, given the size and growth of capital markets).[6] To the extent systemic risk contributions are not perfectly assessable, direct leverage restrictions (for example, no loan-to-value ratios that exceed 80 percent, or no leverage for financial firms based on overall assets that exceed 15:1) can lend macro prudential regulation a certain amount of robustness to regulators' own "model risk" in assessing systemic risk. Finally, sector risk-weight adjustments (for example, increased risk-weight of mortgages if the entire financial sector is found in a stress test to be increasing exposure to them) recognize that regulation can get outdated and the financial sector can "cherry pick" the cheapest risk-weight classes, once again lending robustness to macro prudential regulation.

The fifth section on regulating risk also touches briefly on issues related to "shadow banking," namely, the propensity of the financial sector to exit the regulatory perimeter and operate in a manner that enables certain concentrations of leverage and aggregate risks to develop risking the macro prudential health of economies. Some measures to integrate the regulation of shadow-banking institutions with traditional banking and financial sectors are discussed. Although this issue may not be paramount for emerging markets at present, it is bound to grow in importance as the financial sector grows and regulations are strengthened. The section closes with a focus on the emerging market context of a proposed policy toolkit.

Regulatory Distortions and Systemic Risk in Emerging Markets

In this section, we discuss market and regulatory failures that lead to financial instability in emerging markets, focusing on three issues: (1) government guarantees, mostly in the form of deposit insurance, (2) the implications of these guarantees in the current crisis, and (3) the transmission of systemic risk. [7]

Government Guarantees

Government guarantees, such as deposit insurance and too-big-to-fail designations, can generate significant moral hazard in the form of risk-taking incentives. Even absent other market failures, this moral hazard can lead to excessive systemic risk and financial fragility. Consider our analysis of the lessons learned from the current crisis in the United States. Deposit insurance enacted in the 1930s in the wake of the Great Depression had long-term success only because significant protections were put in place in terms of insurance charges, regulation (mostly in the form of capital requirements and wind-down provisions), and restrictions on bank activity. As these protections began to erode, the moral hazard problem resurfaced.

To some degree, researchers already knew this. Demirguc-Kunt and Kane (2002), for instance, noted that the number of countries offering explicit deposit insurance increased multifold from 12 to 71 in the 30-year period starting in the 1970s. They argue that the key feature of a successful deposit insurance scheme is the financial and regulatory environment in which it functions, including coverage limits of deposit insurance, the degree to which depositors take coinsurance of

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their balances, restrictions on certain deposit accounts, and whether the program is funded publicly or privately.

Demirguc-Kunt and Detragiache (2002) look at a large cross-section of countries in the post-1980 period and conclude that deposit insurance increases the likelihood of a banking crisis.[8] Moreover, the likelihood and severity of the crisis are greater for countries that have weaker institutional and regulatory environments and that offer greater coverage to depositors. The authors conclude that the incentive problems associated with the moral hazard from deposit insurance can be partially offset by effective prudential regulation and loss-control features of deposit insurance.

Laeven (2002) finds that in many countries deposit insurance is sharply underpriced, contributing to both the likelihood of a financial crisis and the cost of one if it occurs. Of course, deposit insurance premiums were not collected for most banks in the United States from 1996 to 2005 because the fund was well capitalized.

Government Guarantees and Emerging Markets

It is common practice to provide government guarantees during a crisis. Demirguc-Kunt and Kane (2002) cite the examples of Sweden (1992), Japan (1996), Thailand (1997), the Republic of Korea (1997), Malaysia (1998), and Indonesia (1998). In the current crisis, the United States guaranteed money-market funds after the fall of Lehman Brothers, and made explicit the previous implicit guarantees of the government-sponsored enterprises (GSEs) and the too-big-to-fail institutions.

What is the impact of such guarantees? Honohan and Klingebiel (2003) find that unlimited depositor guarantees and regulatory forbearance increase the fiscal costs of financial crises.[9] Moreover, these actions increase the expectation that the government will use the same solution for future crises, thus killing market discipline and increasing the chances of risk shifting among financial institutions. The lesson is that the problems that plagued the United States are similar to those that have afflicted emerging markets.

Of course, many analysts might point to the apparent "success" of the guarantees employed in the United States in the recent financial crisis and, even more so, to the banks in India and China and the government backing they received. Let us analyze these cases as examples in emerging markets.

Consider India. A significant part of the Indian banking system is still state-owned. Although they are generally considered less efficient and sophisticated than private-sector banks, public-sector banks in India grew in importance during the financial crisis starting in 2008. The reason for their growth is somewhat perverse: there was a "flight to safety" away from private-sector banks, which have limited deposit insurance, to public-sector banks, which are fully guaranteed by the government as outlined in India's Bank Nationalization Act.

Thus, as the financial crisis unfolded in India (particularly in the fall of 2008, by which time the Indian stock market had lost more than half its value and corporate withdrawals from money market funds threatened a chain of liquidations

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from the financial sector), there was a flight of deposits to state-owned banks.[10] Between January 2008 and February 2009, public-sector banks' market capitalization fell by 20 percent less than that of private-sector banks. This decline was despite the fact that public-sector banks were substantially more likely to lose market capitalization during a marketwide downturn than private-sector banks on the basis of the "marginal expected shortfall" measure, a precrisis measure of systemic risk developed in detail in the final section of this chapter. In addition, private-sector banks with higher systemic risk suffered more during the economy-wide crisis of 2008 (as the systemic risk measure would predict), whereas public-sector banks with higher systemic risk, in fact, performed better! This divergence in behavior of public- and private-sector banks is telling and strongly suggests a role of government guarantees in boosting weak public-sector banks at the expense of similar-risk private-sector banks.

Such support to state-owned enterprises continues. Loan growth at public-sector banks, for instance, was as much as 10 percent, compared with dismally low levels for private-sector banks in 2009. Government guarantees have distorted the level playing field, which is destabilizing for two reasons. First, it has weakened institutions that are, in fact, subject to market discipline. Second, it has raised prospects that "handicapped" private-sector banks may have to lend—or take on other risks—more aggressively to maintain market share and generate comparable returns to shareholders. Bank regulation in India tends to be on the conservative side, often reining in risk-taking with overly stringent restrictions. However, the debilitating effects of government guarantees can travel quickly to the corporate sector and other financial firms reliant on banks, which are not directly under bank regulators' scrutiny or legal mandate.

Let us turn to China. As part of its fiscal stimulus, the Chinese government employed its almost entirely state-owned banking sector to lend at large to the economy. Between July 2008 and July 2009, lending by the Chinese banking sector grew by 34 percent. Although this increase in lending has clearly helped the Chinese economy recover quickly from the effect of the financial crisis in the United States—and its consequent effects on global trade—much of the growth in banking-sector loans mirrors the growth in corporate deposits, that is, loans are often sitting idle on corporate balance sheets, a phenomenon generally associated with severe agency problems in the form of excessive investments.

Although some of the "excess" may be desirable as part of the stimulus, especially if it is in public goods such as infrastructure projects, estimates suggest that excess liquidity is also finding its way into stock market and real estate speculation. It is not inconceivable that such lending through state-owned banks would be reckless and sow the seeds of asset-pricing booms and, perhaps, the next financial crisis. The moral hazard is clear: China has bailed out its entire banking system more than once, and in far greater magnitudes than the United States has in this crisis.

The examples of India and China highlight the classic risks that arise from government guarantees. First, government guarantees create an uneven playing field in banking sectors where some banks enjoy greater subsidies than others. This

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unevenness invariably leads to excessive leverage and risks by less-subsidized players to compensate for a weak subsidy, and worse lending decisions by more-subsidized players, given the guarantees. Second, government-guaranteed institutions are often employed to disburse credit at large to the economy, but this situation ends up creating distortions because the costs of the guarantees are rarely commensurate with the risks taken. The situation in India partly mirrors that in the United States, where commercial banks enjoyed greater deposit insurance than investment banks; over time, investment banks expanded their leverage significantly, leading to greater systemic risks. The situation in China is comparable to the massive credit expansion and risky betting that occurred on the balance sheets of GSEs like Fannie Mae and Freddie Mac in the United States.

Both of these problems festered because of government guarantees and contributed to the financial crisis of 2007–09. Government guarantees do not just weaken the banks that are guaranteed, but they also create systemic risk by weakening competing banks, subsidizing corporations, and fueling excessive asset speculation.

Systemic Risk and Emerging Markets

As discussed earlier, when it fails, a financial institution can produce systemic risk in several ways: counterparty risk, fire sales, and "runs." One of the principal conclusions from the earlier analysis was that systemic risk is a negative externality on the system and, therefore, cannot be corrected through market forces. In other words, there is a role for regulation to force the financial institution to internalize the external costs of systemic risk. This conclusion applies to financial institutions operating within a domestic market as well as in international markets, and is especially critical for emerging markets.

Even if a domestic regulator penalized a multinational financial firm for producing systemic risk locally, the impact of this penalty may not carry through to all the international markets in which the firm operates. Thus, one can make a case for more severe penalties for firms whose actions can lead to systemic consequences elsewhere. The issue is further complicated by financial institutions' propensity to conduct regulatory arbitrage across national jurisdictions, that is, if institutions are more strictly regulated in one jurisdiction, they may move their base for financial intermediation services to jurisdictions that are more lightly regulated. However, given their interconnected nature, such institutions nevertheless expose all jurisdictions to their risk-taking. Individually, jurisdictions may prefer to be regulation "lite" to attract more institutions and, thereby, jobs.

This crisis' poster child for being internationally interconnected is Iceland.[11] Iceland allowed its banking sector to grow almost tenfold in terms of foreign assets compared with its GDP. Its huge leverage aside, its survival was completely dependent on conditions abroad; the systemic risk of the three largest Icelandic banks (Kaupthing, Landsbanki, and Glitnir) went beyond its own borders. Because these banks had fully exploited internal expansion within Iceland, they opened branches abroad (in particular, in the United Kingdom and the Netherlands) by offering higher interest rates than comparable local banks. When

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Icelandic banks began to run aground and faced massive liquidity problems, in a now somewhat infamous event, U.K. authorities invoked an antiterrorism act to freeze their assets. The Icelandic economy essentially shut down.

Although it is generally accepted that capital inflows are critical for emerging markets, there are numerous examples of capital flowing into new, emerging markets only to have the flow reverse when a crisis occurs. These "runs" can seriously harm the corporate and banking sector of developing economies, especially if there are currency, liquidity, or maturity mismatches between assets and foreign liabilities. For example, net private capital flows to emerging Europe fell from approximately US$250 billion in 2008 to US$30 billion in 2009. Unsurprisingly, emerging Europe has been one of the hardest hit in terms of the impact of the crisis on GDP and internal institutions.

The current crisis was severe both for its financial effects (for example, spikes in risk aversion of investors) and for its economic impacts (for example, the largest drop in global trade since World War II).[12] It is, thus, remarkable that emerging markets weathered this financial storm relatively well compared with past experiences. This resilience can be partly attributed to better internal planning (a substantial stock of international reserves) and partly to the availability of liquidity funding from international organizations, such as the International Monetary Fund (IMF) and World Bank. Both elements suggest an approach to international coordination that mirrors how one might regulate systemic risk domestically.

We now turn to a critical assessment of Basel capital requirements: why they need to be fundamentally rethought, in what ways they may be modified, and which of these are particularly suitable in an emerging market context.

Basel Capital Requirements: When Micro Prudential Puts Macro Prudential at Risk

In response to the systemic impact of the failure of the relatively small German bank Herstatt in 1974, the central bank governors of the G-10 established the Basel Committee on Banking Supervision (BCBS). Although it had no statutory authority, the Basel Committee has emerged over the past 40 years as the go-to group to formulate international standards for banking supervision, and especially capital adequacy requirements. The Basel process started with the 1988 Basel Accord (Basel I), which imposed the now infamous minimum ratio of capital-to-risk-weighted-assets of 8 percent. The committee produced a revised framework in June 1999, which culminated in the implementation of a new capital adequacy framework in June 2004 (Basel II). Basel II expanded Basel I's capital requirement rules and introduced internal risk assessment processes. As a result of the financial crisis, the Basel Committee is once again developing and refining proposals for capital adequacy and liquidity requirements, denoted Basel III.

Before outlining the broad strokes of the Basel III agreement, it is helpful to briefly review the earlier Accords because Basel III works iteratively off them.

The purpose of the Basel Accords is to provide a common risk-based assessment of bank assets and required capital levels. Basel I separated assets into

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categories and gave risk-weights ranging from 0 to 100 percent to each category. Risk-weighted assets are calculated by multiplying the sum of the assets in each category by these risk-weights. Banks then should hold a minimum ratio of 8 percent of capital-to-risk-weighted-assets.

Basel II refined the relatively crude analysis of Basel I by (1) adding further gradation of risk categories; (2) allowing for internal, and more sophisticated, risk models; and (3) incorporating value-at-risk-based capital charges for trading books. Even with the apparent improvements of Basel II, large complex financial institutions (LCFIs), armed with their too-big-to-fail funding advantage, easily exploited the conflict of interests of rating agencies and played off external versus internal risk models, while minimizing value-at-risk, though not systemic risk. Because the Basel II approach measured individual bank risk but ignored systemic risk (the primary rationale for bank regulation) and did not address the fragility that was developing on the bank liability side in the form of uninsured wholesale deposit funding, the financial sector had a race to the bottom in risk-taking and economic leverage and ended up in the poor shape it was in during the crisis.

Basel III recognizes that there are two types of risks that can cause a financial firm to fail:

- *Solvency* or *capital risk*, that is, the market value of the firm's assets falls below its obligations; and
- *Liquidity risk*, that is, the firm cannot convert assets into cash to pay off its obligations because asset markets have become illiquid; or its close cousin, *funding liquidity risk*, that is, the firm is unable to roll over its maturing debt obligations with immediacy at some point in the future.

These risks can spread quickly through fire sales, defaults, and contagious runs, and systemic risk can engulf the financial sector in no time. To the extent that Basel I and II focused almost exclusively on solvency risk, Basel III constitutes an improvement. However, the absence in Basel III of any effort to identify when an institution's solvency or liquidity risk can lead to systemic risk is disappointing. By not differentiating these risks, it directly subsidizes those solvency and liquidity risks that contribute to systemwide instability.

Although Basel III tries to correct some of these areas, its basic approach to regulation is essentially a follow-up to Basel II. Specifically, Basel III is stricter on what constitutes capital; introduces a minimum leverage ratio and, to be determined, higher capital requirements (possibly countercyclical in nature); and creates liquidity ratios that banks will eventually have to abide by. But with respect to systemic risk—the real issue at hand—the July 2010 Basel Committee report states that the committee will "undertake further development of the 'guided discretion' approach as one possible mechanism for integrating the capital surcharge into the Financial Stability Board's initiative for addressing systematically important financial institutions." This statement is somewhat surprising because one would think systemic risk *should* have been the primary focus of the regulatory guidelines.

Dealing with the Challenges of Macro Financial Linkages in Emerging Markets
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Capital Requirements

The Basel III rules, as far as capital holdings of banks are concerned, endorsed by the G-20 can be summarized as shown in table 2.1.

In particular, several hybrid instruments are being eliminated as eligible forms of capital, and Tier 3 capital[13] is eliminated altogether, inducing a significant shift in bank liability structure away from hybrid capital, whose growth (especially in Europe) had been substantial pre-2007.

The rules, in response to the severe criticism received by the risk-weighted approach, put a floor under the buildup of leverage in the banking sector by requiring that the ratio of capital to (unweighted) assets be at least 3 percent. In addition, the plan is to introduce additional safeguards against model risk and measurement error by supplementing the risk-weighted assets approach with a simpler measure based on gross exposures.

Other more specific but not yet fully spelled-out changes focus on strengthening the risk coverage of the capital framework by requiring that the reforms:

- Strengthen the capital requirements for counterparty credit exposures arising from banks' derivatives, repo, and securities financing transactions; raise the capital buffers backing these exposures; provide additional incentives to move over-the-counter (OTC) derivative contracts to central counterparties (probably clearinghouses); and, provide incentives to strengthen the risk management of counterparty credit exposures.
- Introduce a series of measures to promote the buildup of capital buffers in good times that can be drawn on in periods of stress by addressing procyclicality; achieve the broader macro prudential goal of protecting the banking sector from periods of excess credit growth; and promote stronger provisioning practices (forward-looking provisioning) and advocate a change in the accounting standards toward an expected loss (EL) approach.

Liquidity Requirements

As discussed earlier, financial distress arises not just from capital risk but also from liquidity risk, and the recent financial crisis shows that liquidity risk deserves

Table 2.1 Capital Adequacy Standards, Basel III

	Year to abide by rule	
Capital type	*2013*	*2019*
Minimum equity capital ratio (pure stock)	3.5 percent of risk-weighted assets (RWA)	4.5 percent of RWA
Minimum Tier 1 capital (equity and other instruments, including hybrid bonds)	4.5 percent of RWA	6 percent of RWA
Minimum total capital plus new "capital conservation buffer"	8 percent of RWA	10.5 percent of RWA

Source: Basel Committee on Banking Supervision 2010. Annex 4.

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equal footing. The problem arises because regulated institutions, as well as their unregulated siblings, have fragile capital structures in that they hold long-term assets with aggregate risk and low liquidity, but face highly short-term liabilities.

One solution to address this mismatch is to impose liquidity requirements on financial institutions (similar in spirit to imposed capital requirements) with the intention of reducing runs. These would require that a proportion of the short-term funding must be in liquid assets, that is, assets that can be sold immediately in quantity at current prices. This requirement might be sufficient to prevent runs, as it will, in effect, increase the cost of financial institutions taking on carry trades and holding long-term asset-backed securities.

The original December 2009 proposal in Basel III outlined two new ratios that financial institutions would be subject to the following:

- A *liquidity coverage ratio (LCR)*: the ratio of a bank's high-quality liquid assets (for example, cash, government securities) to its net cash outflows over a 30-day period (for example, outflows in retail deposits or wholesale funding) during a severe systemwide shock. This ratio should exceed 100 percent.
- A *net stable funding ratio (NSFR)*: the ratio of the bank's available amount of stable funding (that is, its capital, longer-term liabilities and stable short-term deposits) over its required amount of stable funding (that is, value of assets held multiplied by a factor representing the asset's liquidity). This ratio should also exceed 100 percent.

The introduction of LCR and NSFR as prudential standards has merit. Consider the example of the super senior AAA-rated tranches of collateralized debt obligations (CDOs) relative to a more standard AAA-rated marketable security (say, a corporate bond). Specifically, assume that the probability and magnitude of losses (that is, the expected mean and variance) associated with default are similar between the two classes of securities. What are the implications of LCR and NSFR on these holdings?

"Liquidity risk" refers to the ability of the holder to convert the security or asset into cash. Even before the crisis started, the super senior tranches were considered to be less liquid than standard marketable securities. The fact that these securities offered a spread should not be surprising, given that there are numerous documentations of a price to illiquidity. The LCR would most likely count the AAA-rated CDO less favorably in terms of satisfying liquidity risk.

"Funding risk" refers to the mismatch in the maturity of the assets and liabilities. Financial institutions tend to hold long-term assets using cheap, short-term funding—a type of "carry trade." But this practice exposes the institution to greater risk of a run if short-term funding evaporates during a crisis. These two points suggest that it would be useful to know the "liquid" assets the financial institution holds against its short-term funding. The higher the ratio, the less an institution is subject to a liquidity shock, and, therefore, the less risky it is. The NSFR would help answer this question.

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Basel Capital Requirements: An Assessment

From a conceptual standpoint, the Basel capital requirements are a flawed tool for overall financial stability as they are *not* macro prudential in nature. First and foremost, a macro prudential tool should be concerned with—and attempt to address—systemic risk contributions of financial firms. Basel requirements, for the most part, are focused instead *only* on the micro prudential risks of financial firms.

Second, the very act of reducing individual financial firms' risk can, in principle, aggravate systemic risk. For instance, if institutions cannot diversify perfectly but are encouraged to do so at all costs, they can all be left holding the same aggregate risk as they diversify away all idiosyncratic risk. If the costs to bank failures are nonlinearly increasing in number of failures, such diversification could, in fact, be welfare reducing. A good analogy is banks holding AAA-rated tranches to ensure a diversified bet on the housing market. Such a diversified bet was rewarded by Basel requirements in terms of capital regulations relative to holding the underlying mortgages on banking books.

Third, even if one ignores the possibility of individual financial firms becoming more correlated as they reduce their own risks, Basel requirements ignore the *endogenous* or *dynamic* evolution of risks of the underlying assets. Consider again the case of AAA-backed residential mortgage-backed securities (MBS). By providing a relative advantage to this asset class, the Basel requirements explicitly encourage greater lending to residential mortgages. As banks lent down the quality curve, they made worse mortgages (that is, in terms of loan-to-value ratios). Even though residential mortgages as an asset class had historically been stable, a static risk-weight that favored this asset class made it endogenously riskier.

Finally, just as Basel requirements ignore that they increase correlated investments and endogenously produce deteriorating asset quality on a risk-favored asset class, they also ignore that when the risk of this asset class does materialize, financial firms face an endogenous liquidity risk since they are overleveraged in a correlated manner on this asset class. For instance, as each financial firm attempts to deleverage by selling its AAA-backed MBS, so does every other financial firm. Because there is not enough capital in the system to deal with the deleveraging, systemic risk is created, not only ex ante but also ex post. Basel requirements, thus, induce procyclicality over and above the fact that risks are inherently procyclical.

In economic parlance, the Basel risk-weights approach is an attempt to target relative prices for lending and investments by banks, rather than restrict quantities or asset risks directly. In the absence of the price discovery provided by markets, regulators have little hope of achieving relative price efficiency that is sufficiently dynamic and reflective not only of underlying risks but also of the fact that that these risks will evolve. In contrast, concentration limits on asset class exposure for the economy as a whole, or simple leverage restrictions (assets-to-equity ratio not greater than 15:1 for each firm, for instance), or an asset-risk restriction (loan-to-value of mortgages not to exceed 80 percent, for instance) are more likely to be robust and countercyclical macro prudential tools. These tools

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do not directly address systemic risk but at least offer hope of limiting the risks of individual financial firms and asset classes.

To understand the grave limitations of the current Basel approach to capital requirements, consider the following analysis of financial firms and their risk-taking in the context of the crisis of 2007–09.

Table 2.2 shows the 12 largest write-downs (and credit losses) of U.S. financial institutions from June 2007 (the beginning of the crisis) until March 2010. The top six firms combined saw a total of US$696 billion in losses. Five of these six firms received the largest bailouts (Wachovia was acquired by Wells Fargo). Although prior to their failure, most of these financial institutions were still considered "well capitalized" by regulatory agencies, the market clearly thought differently. The middle column in table 2.2 shows that between June 2007 and December 2008 the market values of the six firms (the first six firms listed in the table) dropped by an average of 88.71 percent, a precipitous decline. Moreover, during this period, any part of the financial sector in which major institutions fell short of capital—special purpose vehicles, such as conduits and structured investment vehicles (in August 2007), independent broker-dealers (in March and September of 2008), money market funds (in September 2008), and hedge funds—faced massive runs on their short-term liabilities. By the fall of 2008 and the winter of 2009, systemic risk had fully emerged and the real economy was suffering the consequences.

This finding begs the obvious question, and one with which regulators must grapple: Why, under the Basel core capital requirement of capital-to-risk-weighted-assets ratio of 8 percent, did the top 20 U.S. banks look "safe" averaging a ratio of 11.7 percent? And perhaps more striking, why did the five largest LCFIs that were subject to Basel rules and effectively failed during the crisis (Bear Stearns, Washington Mutual, Lehman Brothers, Wachovia, and Merrill Lynch) all have

Table 2.2 Largest Write-Downs for U.S. Financial Firms, 2007–10

Firm	*Write-downs and credit losses, June 2007–March 2010 (US$ billions)*	*Equity return, June 2007–December 2008 (percent)*	*Equity return, June 2007–September 2008 (percent)*
Fannie Mae	151.4	−98.14	−99.23
Citigroup	130.4	−82.46	−67.20
Freddie Mac	118.1	−97.98	−99.56
Wachovia	101.9	−88.34	−73.18
Bank of America	97.6	−67.79	−34.35
A.I.G.	97.0	−97.57	−94.50
JP Morgan	69.0	−31.51	−12.13
Merrill Lynch	55.9	−85.16	−72.45
Wells Fargo	47.4	−10.77	4.47
Washington Mutual	45.3	−99.95	−90.07
National City	25.2	−94.29	−86.61
Morgan Stanley	23.4	−75.99	−57.65

Source: Bloomberg.

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capital ratios between 12.3 and 16.1 percent, based on their last quarterly disclosure documents? Something was clearly amiss.

To understand what went wrong from a *regulatory* point of view, note that the LCFIs took their leveraged bet as a regulatory arbitrage response to Basel I and II. First, they funded portfolios of risky loans via off-balance-sheet vehicles (conduits and structured investment vehicles [SIVs]). These loans, however, were guaranteed by sponsoring LCFIs through liquidity enhancements that had lower capital requirements under Basel. Thus, the loans were effectively recourse but had a lower capital charge, even though the credit risk never left the sponsoring LCFIs. Second, they made outright purchases of AAA-rated tranches of nonprime securities, which were treated as having low credit risk and zero liquidity and funding risks. Third, they enjoyed full capital relief on AAA-rated tranches if they bought "underpriced" protection on securitized products from monoline insurers (which insure only one type of bond) and A.I.G., both of which were not subject to similar prudential standards. Fourth, in August 2004, investment banks successfully lobbied the Securities and Exchange Commission (SEC) to amend the net capital rule of the Securities Exchange Act of 1934, which effectively allowed for leverage to increase in return for greater supervision. This lobbying was in direct response to the internal risk management rules of Basel II.

Let us consider a few of these observations in greater detail. One of the two principal means for "regulatory arbitrage" under the Basel Accords was the creation of off-balance-sheet vehicles, which held onto many of the asset-backed securities they helped issue in the market. With securitized loans placed in these vehicles rather than on a bank's balance sheet, the bank did not need to maintain any significant capital against them. However, the conduits funded the asset-backed securities with asset-backed commercial paper (ABCP)—short-term, typically less than one-week maturity, debt instruments sold in the financial markets, notably to investors in money market instruments. To be able to sell ABCP, a bank would have to provide the buyers, that is, the banks' "counterparties," with *guarantees* on the underlying credit—essentially bringing the risk back to the banks themselves, even though that risk was not shown on their balance sheets.[14]

These guarantees had two important effects. First, guaranteeing the risk to banks' counterparties was essential in moving these assets off the banks' balance sheets. Designing the guarantees as "liquidity enhancements" with maturities of less than one year (to be rolled over each year) allowed the banks to exploit a loophole in Basel capital requirements. In fact, almost all of these loans had 364-day maturities. The design effectively eliminated the "capital charge" from retaining the risk of these loans, so that banks achieved a tenfold increase in leverage for a given pool of loans. Second, the guarantees ensured the highest ratings for the off-balance-sheet vehicles from the rating agencies. Indeed, the AAA ratings made it possible for banks to sell ABCP to money market funds, which are required by law to invest mainly in short-term, highest-rated paper. This allowed banks to fund the ABCP at low interest rates, similar to that paid on deposit accounts.

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Acharya, Schnabl, and Suarez (2009) document an increase in the ABCP market from US$600 billion in 2004 to US$1.2 trillion in the second quarter of 2007. When the collapse occurred in the next quarter, the cost of issuing ABCP rose from just 15 basis points over the federal funds rate to over 100 basis points (peaking at close to 150 basis points). Consequently, the ABCP could no longer be rolled over, and banks had to return the loans to their balance sheets. Acharya, Schnabl, and Suarez (2009) show that when the crisis hit, of the US$1.25 trillion in asset-backed securitized vehicles, only 4.3 percent of the loss was structured to remain with investors. The remaining loss wiped out significant portions of bank capital and threatened banks' solvency.

Off-balance-sheet financing was not the only way banks performed "regulatory arbitrage" against the Basel rules. In the second approach, a bank would still make loans and move them from its balance sheet by securitizing them. The bank then turned around and reinvested in AAA-rated tranches of the same securitized products they (or other banks) had created. Because of their AAA ratings, these securities had a significantly lower capital requirement under the Basel II arrangement. For commercial banks, the Basel Accord weighted the risk of AAA-rated securities at less than half of the risk of ordinary commercial or mortgage loans, and thus required an even lower capital reserve for them (a 20 percent risk-weight, compared with 50 percent for mortgages and 100 percent for corporate bonds). In 2004, the SEC granted stand-alone investment banks the ability to employ internal models to assess credit risk and the corresponding capital charge. This rule change allowed the investment banks to take on even higher leverage than commercial banks, with leverage duly skyrocketing from a 22:1 debt-to-equity ratio to 33:1 within just three years.

In fact, as a Lehman Brothers' report from April 2008 shows (see table 2.3), banks and thrifts, GSEs, and broker-dealers held US$789 billion of the AAA-rated CDO tranches that were backed by nonprime loans in 2007, or approximately

Table 2.3 Distribution of the U.S. Real Estate Exposures
US$, billions

	Loans	*HELOC*	*Agency MBS*	*Nonagency AAA*	*CDO subord*	*Non-CDO subord*	*Total*	
Banks & thrifts	2,020	869	852	383	90		4,212	39%
GSEs & FHLB	444		741	308			1,493	14%
Brokers/dealers			49	100	130	24	303	3%
Financial guarantors		62			100		162	2%
Insurance companies			856	125	65	24	1,070	10%
Overseas			689	413	45	24	1,172	11%
Other	461	185	1,175	307	46	49	2,268	21%
Total	2,925	1,116	4,362	1,636	476	121	10,680	
	27%	10%	41%	15%	4%	1%		

Source: Mago, Sabarwal, and Iyer 2008.
Note: HELOC = home equity line of credit; MBS = mortgage-backed security; AAA = prime bond credit rating; CDO = collateralized debt obligation.

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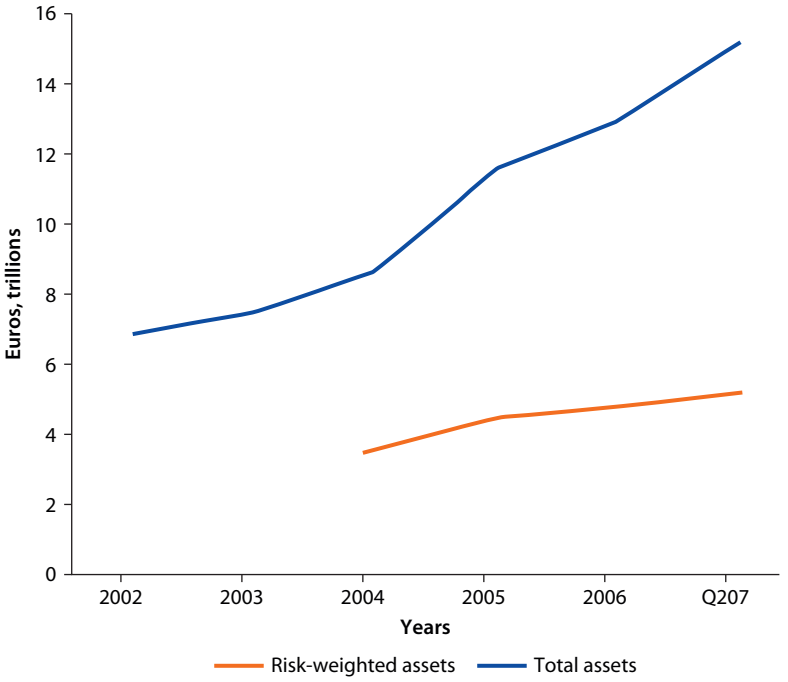
Figure 2.1 Growth in Total Assets and Risk-Weighted Assets
trillions of euros



Source: IMF 2008, based on balance sheets of 10 largest global financial institutions.

50 percent of the volume outstanding at the time. Moreover, banks, broker/dealers, and monoline insurers also held the majority of the subordinated tranches of the CDOs. They collectively held US$320 billion of the US$476 billion total outstanding.

Arbitraging Basel's capital requirements resulted in a doubling of global banking balance sheets between 2004 and 2007 with only a minor increase in Basel-implied risk (figure 2.1). This fact alone should have been a red flag to regulators, but combined with the growth in short-term shadow-banking liabilities from US$10 trillion to US$20 trillion between 2000 and 2007 (compared with US$5.5 trillion to US$11 trillion in traditional bank liabilities), it is clear in hindsight that the focus of Basel capital requirements over the prior 30 years has been misplaced.

In fact, as illustrated in table 2.2 and figure 2.2, financial firms with the best regulatory capital ratios (effectively, caused by substantial regulatory arbitrage) fared the worst in terms of market capitalization declines during the crisis. In other words, their high regulatory capital ratios, that is, low unweighted-assets-to-risk-weighted-assets ratio in figure 2.2, were not a sign of their financial stability, but ironically a sign of their propensity to hold onto systemically risky assets with maximum economic leverage.

It is thus somewhat surprising that Basel III, in many ways, mirrored the Basel Committee's previous two attempts. While the Basel III process focuses on using

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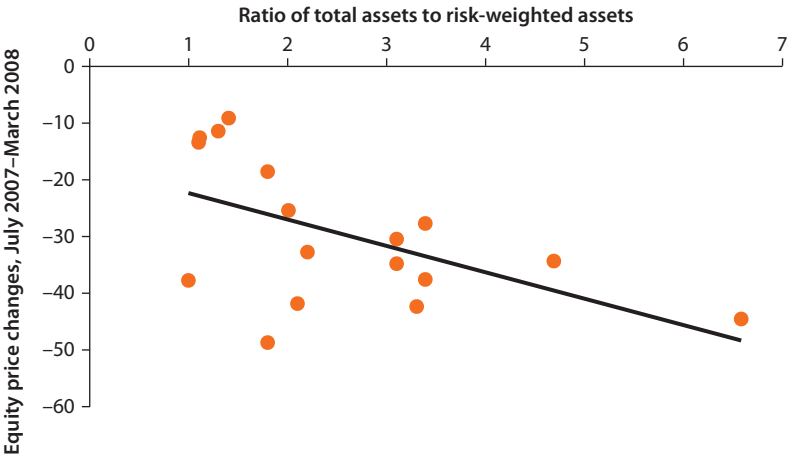
Figure 2.2 Bank Equity Price Changes and Balance Sheet Leverage
percent



Source: IMF 2008.

more stringent capital requirements to get around some of these issues, it ignores the crucial market and regulatory failures of the financial system:

- Although recognizing the systemic risk of financial firms, the Basel approach remains focused on the risk of the individual institution and not the system as a whole. In other words, the level of a firm's capital requirements in Basel I, II, or III does not depend on its interaction with other financial firms.
- Whatever capital or liquidity requirements are placed on one set of financial institutions, it is highly likely that the financial activities affected by these requirements will simply move elsewhere in the shadow-banking system. Without an understanding that the entire financial system must be looked at and treated in unison, Basel III will run into the same shadow-banking issues that arose with Basel I and II.
- There seems to be no recognition of the role government guarantees play in the allocation of capital. *Ceteris paribus*, the more guarantees a firm receives, the lower its costs of debt funding. This artificially increases the relative cost of nonguaranteed funding like equity, preferred stock, and possibly subordinated debt (under a credible resolution authority).

Also problematic is that the Basel process retains old definitions of capital and leverage not entirely suitable for reducing excessive systemic risk brought on by modern financial firms. It is certainly true that Basel III has tightened the treatment of off-balance-sheet financing. Moreover, the fact that liquidity risk is now at the forefront of Basel III, and presumably future financial regulation in the United States as a result of the Dodd-Frank Act, is clearly a step forward. The LCR and NSFR liquidity adequacy standards are reasonable approaches toward the regulation of liquidity risk. But their focus is still not on measures that actually reflect broad systemic risk, and the approach is eerily similar to that of Basel I and II for

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setting capital requirements. All the adjustment factors and weights used in calculating the LCR and NSFR have their counterparts in the risk-weights of capital ratios. It is very likely that implementation of the liquidity ratios will push banks toward regulatory arbitrage of the liquidity weights, in particular, to the *best-treated* illiquid securities and systemically risky funding. Of course, the unintended consequence will be a concentration into these activities. Regulators should be acutely aware of this problem and be prepared ex ante to adapt in an expedited way.

The other problem is that the liquidity rules do not seem to take into account the impact a liquidity crisis at one bank has on the financial sector as a whole, especially in a crisis. In other words, banks that contribute more to systemwide liquidity events (in a crisis) should be charged for this negative externality.

Finally, a significantly problematic issue with Basel III's specific implementation of liquidity risk management is whether the risk-weights on government bonds are suitably calibrated for the emerging sovereign credit risk in European zone countries, which implies that many securities that would traditionally have been both liquid and safe, are now liquid (because of central bank collateral qualification) but significantly credit risky.

In summary, although Basel III does make indirect attempts to address systemic risk by considering a capital surcharge for global systemically important financial institutions (G-SIFIs) and requiring countercyclical capital surcharges, it is useful to ask: How should micro prudential regulation be adapted to incorporate macro prudential concerns? In the same way that firms are often regulated to limit their pollution or are taxed based on the externality they cause, macro prudential regulation should consider a "tax" on firms' contribution to systemic risk. To the extent market-based signals are available to assess the risk of institutions and the correlation of this risk with aggregate risks of the economy, systemic risk contributions of financial firms can be measured. We discuss this measurement issue in the next section and then present some specific forms that regulation incorporating systemic risk could take in the final section of the chapter where we entertain the possibility that in some emerging markets, market-based assessments may as of now be infeasible, though with the growing size and nature of capital markets in these countries, they may become more feasible in the future.

Measuring Systemic Risk

Macro prudential regulation needs to ascertain which institutions are, in fact, systemically important. Indeed, the systemic risk of an individual institution has not yet been measured or quantified by regulators in an organized manner, even though systemic risk has always been one of the main justifications for our regulatory apparatus.[15]

Institutions that follow highly procyclical activities are heavily correlated with aggregate economic conditions. If these institutions are also highly levered, especially with short-term debt, they face "runs" in the event of sufficiently adverse news about their condition making them more prone to failure and liquidation. If their failure were unrelated to aggregate conditions, their liquidation would be

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straightforward; healthy players in the financial sector would acquire their assets. However, when institutions' asset risk is correlated with that of the economy, they are likely to fail when the rest of the financial sector is also under stress, and their liquidation is difficult and potentially destabilizing for other players if fire-sale asset prices lead to externalities. In this case, systemic risk propagates through firm failures on asset prices. The markdowns in prices of illiquid "toxic" assets during the crisis of 2007–09 may be attributed (at least partly) to several, highly levered financial firms having taken a one-way bet on the housing price in the economy—a bet that went bad and produced difficult funding conditions for less levered financial institutions that were holding similar assets.

Interconnection among financial firms can also lead to systemic risk under crisis conditions. Financial institutions are interconnected in a variety of networks in bilateral and multilateral relations and contracts, as well as through markets. Under normal conditions, these interconnections are highly beneficial to the financial system and its constituents. For example, they can be used by financial institutions to diversify risk as well as to accumulate capital for specific functions. Under crisis conditions, this is not the case: first, these interconnections (including markets) may fail to function in the normal way, resulting in particular institutions facing excessive and unexpected risks. Second, many interconnections and commitments cannot be altered quickly and, therefore, may transfer risk and losses across financial firms in a crisis, resulting in cascading failures.

Third, certain institutions are central to key financial networks, and their failure can result in widespread failures. These institutions may either be "too large" (to fail) or may be highly interconnected, or both. The failures of Bear Stearns, Lehman Brothers, and A.I.G. all contributed to systemic risk in the form of uncertainty about which interconnections would transmit default risk. In the case of Bear Stearns, the risk was stemmed through government support. But in the case of Lehman Brothers, the risk spread as losses on Lehman bonds caused the Reserve Primary Fund, a money market fund, to "break the buck,"[16] causing a run on it and several other money market funds. In the case of A.I.G., its counterparty position was so large (in terms of exposures of other potentially systemic institutions and municipalities in the United States as well as in Europe) that it could not be allowed to fail.

Finally, although size by itself need not lead to systemic effects of failures, it may do so if large-scale liquidations are feared and lead to markets disruptions, interconnections, and the loss of intermediation functions. The failure of Continental Illinois Bank in 1984, the near collapse of Long-Term Capital Management in 1998, and that of Citigroup in the autumn of 2008 are appropriate examples. Of course, these examples bring with them the curse of "too-big-to-fail" expectations and the attendant moral hazard problems.

The discussion to follow is centered on the following themes: (1) the criteria for determining systemic institutions can be supplemented with market-based continuous measures of systemic risk; (2) the need to assess systemic risk is linked to the interconnectedness of institutions and the role centralized data repositories could play in such assessment; (3) employing stress tests and

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aggregated risk exposure reports to assess the risk of the system as a whole (not just during crises but on a regular basis); and (4) whether the list of systemic institutions should be made public.

Market-Based Measures of Systemic Risk

By way of example, the U.S. Dodd-Frank Act of 2010 proposes that systemically important financial institutions (SIFIs) be identified. In partial departure from the Act, we do not recommend a pure reliance on classification-based criteria with specific thresholds. Suppose for example that banks are divided into systemic risk categories by size and that resolution plans applied only to the largest size category. Clearly, there would be tremendous advantage for banks that are near the lower threshold of the largest size category to remain just below that level. Indeed, larger banks may simply break themselves up but still be exposed to a common aggregate risky asset (the housing market, for instance). In this case, the true systemic risk may not be substantially reduced as the comovement in different parts of the financial sector remains, even though it is now contained in many more, smaller institutions. The same regulatory arbitrage rationale applies for a coarse categorization based on leverage. A corollary of this argument is that a group of institutions that are individually small but collectively exposed to the same risk—for example, money market funds—could all experience runs when there is an aggregate crisis. They should be considered as part of a potentially systemic risk pocket of the economy.

An alternative to coarse categorization of systemic risk is to employ market-based measures that are more continuously variable.[17] One possibility is to use market data to estimate which firms are most exposed—and, therefore, would contribute most to the losses incurred—during an economywide downturn. Such measures would be inexpensive and responsive to market conditions. They would also be natural complements to the more detailed investigations envisioned in the act.

These measures are generally based on stock market data because they are most regularly available and least affected by bailout expectations. For instance, the simple marginal expected shortfall (MES) measure estimates the loss that the equity of a given firm can expect if the broad market experiences a large fall. A firm with both a high MES and high leverage will find its capital most depleted in a financial crisis relative to required minimum solvency standards and, therefore, faces high risk of bankruptcy or regulatory intervention. It is such undercapitalization of financial firms that leads to systemic risk.[18]

Overall, the two approaches—relying on simple systemic risk criteria (such as size, leverage, and interconnectedness) and relying on market-based estimates of systemic risk—are complementary. The first is more transparent, likely to flag obvious candidates, and may be the only option available if a large part of the financial sector is not publicly traded or stock price data are unreliable; the second cross-checks whether some candidates have been missed altogether (or some obvious ones are less systemic than they seem) based on market perceptions. For instance, securities broker-dealers show up as being most systemic in every year

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since 1963, based on stock market data (the MES measure), even though they have remained essentially unregulated. By contrast, A.I.G. is a natural one-way insurance provider of large quantities that was not identified by stock market data as being significantly systemic until six months into the crisis. Whereas systemic risk categories can be "arbitraged" by market participants, market-based systemic risk measures are more difficult to evade until the firm's true systemic risk has diminished.

Interconnectedness

A key issue that arises in measuring systemic risk is that interconnections of financial institutions are somewhat opaque, and their precise nature may be different in a stressed scenario than under normal conditions. For instance, counterparty exposures can reverse signs when conditions change. There is no simple answer to these questions, but important steps can be taken.

To assess the interconnectedness of a financial institution, detailed information about exposures to other institutions through derivative contracts and interbank liabilities is essential. Obtaining this information requires legislation that compels reporting, such that all connections are registered in a repository immediately after they are formed or when they are extinguished, along with information on the extent and form of the collateralization as well as the risk of collateral calls when credit quality deteriorates. These reports could be aggregated by risk and maturity types to obtain an overall map of network connections. What is important from the standpoint of systemic risk assessment is that such reports, and the underlying data, be rich enough to help estimate *potential exposures* to counterparties under infrequent but socially costly marketwide or economywide stress scenarios. For each systematically important institution, for instance, knowing the following is relevant: (1) what are the most dominant risk factors in terms of losses and liquidity risk (for example, collateral calls) likely to be realized in stress scenarios; and, (2) what are its most important counterparties in terms of potential exposures in stress scenarios. A transparency standard that encompasses such requirements is needed with ready access to information for purposes of macro prudential regulation.

The often international nature of such networks further complicates the picture. Because many counterparties may be foreign entities, the data to follow the stress event may not be available. As subsidiaries of the firm under examination may be registered internationally, the flow of funds may also be exceedingly difficult to follow. The Lehman bankruptcy illustrates many of these issues.

On the bright side, however, many clearing and settlement businesses are already international, providing information to the public and confidential data to regulators. Such global organizations will be natural components of the regulatory environment and their contributions should be warmly welcomed. One recommendation for improving the functioning of the over-the-counter (OTC) derivatives market is to move the public utility function out of private financial firms (for example, clearinghouses) wherever possible and to subject the public utility to sufficiently high capital standards, so as to eliminate most of the

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systemic risk associated with the performance of this function. Going forward, as many OTC derivatives start being centrally cleared, clearinghouses would be important "utilities" that should be included in the set of systemically important institutions and, thus, be subject to prudential risk standards.

Stress Tests

To understand the behavior of financial institutions and project their likely behavior into infrequent future scenarios, one needs to be able to model such scenarios in the first place. An attractive way of dealing with such projection is to conduct "stress tests" along the lines of the Supervisory Capital Assessment Program (SCAP) exercise conducted by the Federal Reserve and other regulators in the United States in 2009. SCAP reported:[19]

> From the macro prudential perspective, the SCAP was a top-down analysis of the largest bank holding companies (BHCs), representing a majority of the U.S. banking system, with an explicit goal to facilitate aggregate lending. The SCAP applied a common, probabilistic scenario analysis for all participating BHCs and looked beyond the traditional accounting-based measures to determine the needed capital buffer. The macro prudential goal was to credibly reduce the probability of the tail outcome, but the analysis began at the micro prudential level with detailed and idiosyncratic data on the risks and exposures of each participating BHC. This firm-specific, granular data allowed tailored analysis that led to differentiation and BHC-specific policy actions, for example, a positive identified SCAP buffer for ten BHCs and no need for a buffer for the remaining nine.

We believe stress tests should be a regular part of the macro prudential toolkit to determine the risk of institutions in stressed systemic scenarios, as well as to assess the overall systemic risk of the financial sector in such scenarios. Valuable knowledge and experience was developed in the 2009 SCAP exercise that could be built upon by regulators all over the world.[20]

Acharya and others (2010a) have found that market-based measures of systemic risk (such as MES and leverage) help shed more light on the outcomes of the SCAP exercise. Thus, the historical data-based systemic risk measures and the projected systemic risk measures through stress tests are complementary. Regulators should embrace both as useful cross checks and independent pieces of valuable intelligence for assessment of systemic risk of financial firms.

Transparency

We recommend a fully transparent approach to systemic risk measurement and categorization. A key benefit of transparency is that releasing valuable capitalization and counterparty exposure information can allow market participants to price risk in contracts with each other more accurately, and to employ suitable risk controls. The primary objection to the public disclosure of systemically important institutions is that it implicitly confers too-big-to-fail or too-interconnected-to-fail guarantees on such institutions. The problem of implicit guarantees, however, is best resolved by the creation of a resolution authority and a process

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that limits the fallout from failure. Unfortunately, forces against transparency gather momentum when a credit resolution mechanism or recapitalization plan is not in place. To wit, absent the ability to deal with potentially insolvent firms once they have been detected, regulators would shy away from releasing this information and instead let such institutions fester and potentially risk the rest of the financial sector. However, the evidence presented so far suggests that the information released by the SCAP exercise of 2009 on relative strengths and weaknesses of banks in the United States was perceived as welcome news in the marketplace, since it was followed by a credible plan to get them to recapitalize.

Another key benefit of requiring regulators to produce transparent systemic risk reports that are based on information aggregated across institutions and markets is that they help address another risk *within* an institution—the so-called operational risk—which can also lead to systemic risk concerns if it brings down a sufficiently large and systemically important firm. Operational risk is typically attributed to deficiencies in corporate processes (a firm's risk management systems), in its people (caused by incompetence, fraud or unauthorized behavior), and in its technology (its information systems, quality of its data, its mathematical modeling). Risk management systems benefit considerably from information transparency (intrafirm as well as interfirm), while satisfying all corporate, regulatory, and privacy constraints. Within a company, there have to be rules for daily aggregation of positions that are reported to senior management, ideally in conjunction with matching aggregate information received from important counterparties to reduce probabilities of errors and fraud. At the corporate level, the net positions of the separate divisions of the company have to be compiled and analyzed (including dependencies and risk correlation analyses). Thus, it is beneficial if a top-down structure for risk reports required by the systemic risk regulator is in place, whereby minimum standards are imposed on individual firms to gather and aggregate such information on their own exposures. At regular intervals, the aggregate information would be shared with the regulator and other counterparties.

To facilitate such transparency, high-quality data must be collected from the financial sector, in a timely manner, and be subject to both data integrity standards and analysis for purposes of building and disseminating adequate systemic risk measures and reports. A model is the newly proposed Office of Financial Research (OFR) in the United States, which could over time provide "financial stability reports" of the type produced by central banks in a number of economies.[21]

Regulating Systemic Risk: Adapting the Micro Prudential for the Macro Prudential

Two challenges exist in the regulation of systemic risk. First, systemic risk must be measured as we have discussed so far. Second, economic theory suggests that the tightness of regulation should be based on the extent to which a given firm is likely to contribute to a general crisis, so that the correct price can be charged to each firm for its contributions to systemic risk. We propose a framework to

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achieve this goal that is advantageous for a number of reasons: it forces regulators and financial firms to deal explicitly with systemic risk; it reduces moral hazard, in that it provides incentives for regulated firms not to take on excessive systemic risk; it reduces the procyclicality of risk taking; and it is based on tools tested and well understood by the private sector.

Three regulations based on this overall approach are presented. [22]

Capital Requirements: An Alternative to Basel III

Under this scheme, a systemic risk regulator would first measure each firm's systemic risk contribution, as discussed earlier. Then, the regulator would impose requirements or costs depending on each firm's contribution. One natural way to do this consistent with current regulation is to impose capital requirements, that is, the regulator would impose a capital requirement that depends explicitly on systemic risk contributions. This method adjusts the incentives of firms to limit their contributions to aggregate risk since keeping capital reserves is costly and, additionally, it gives the firm an appropriate safety buffer in systemic crises.[23]

For instance, the "systemic capital charge" would be

$$SCC = s \cdot MES\% \cdot A$$

where s is the systemic factor chosen by the regulator to achieve a given degree of aggregate safety and soundness; $MES\%$, the marginal expected shortfall expressed in percent of assets, would measure the aggregate tail risk on the firm; and A would be the assets of the firm.

This equation is, in effect, Basel II with systemic risk. The focus on systemic risk would be a clear improvement over existing regulations, but it must be enforced efficiently. Two key points must be insisted upon. First, there must be a limit on the ability to decrease apparent leverage by moving assets off the balance sheet.[24] Second, the measurement of systemic risk must be either acyclical (or even countercyclical) to avoid fire sales induced by violations during crises. In particular, the MES measure could, in principle, be replaced by the capital shortfall estimated for a financial firm in a stress test conducted by the regulators under some extreme aggregate outcomes.[25]

"Taxing" the Externality: A FDIC-Style Premium

A second possibility is to "tax" the activity that imposes a negative externality on the system, that is, to tax activity leading to systemic risk. The tax has two benefits. First, it discourages behavior that leads to systemic risk, and, second, the generated levies could potentially go toward a general "systemic crisis fund," to be used in the future by the regulators to inject capital into the system at their discretion. Of course, in equilibrium, some institutions will still find it optimal to engage in risky behavior and, therefore, pay the higher taxes, while others will reduce their risky behavior.

Financial institutions that pose systemic threats have three characteristics: excessive leverage, highly illiquid securities, and concentration of aggregate risk. Given these characteristics, the tax can take various forms.

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One possibility is to approach this issue the same way that deposit insurance is implemented. Institutions that take deposits are governed by sequential servicing rules in terms of deposit withdrawals, that is, first come, first served. This method increases the probability of a run on the financial institution's assets. The probability of a run imposes discipline on the financial institution but, in a world of balance-sheet opacity, runs on poorly performing institutions can also lead to runs on disciplined institutions and, thus, to systemic risk. As a result, the government offers guarantee programs by insuring the deposits of participating institutions up to a certain amount.

For instance, in recognition of the fact that insurance is not free, the U.S. Federal Deposit Insurance Corporation (FDIC) imposes a fee on financial institutions. Until 1993, this fee was based only on the size of the institution's deposits and not on its risk. This method of assessing the fee created a severe moral hazard problem because these institutions could borrow at artificially low rates and undertake risky investments. As FDIC losses rose during the 1980s, FDIC contracts were redesigned.[26] That being said, while the new contracts do lead to premiums increasing in the risk characteristics of financial institutions, no systemic measure is incorporated into the assessment rate formula.[27]

We propose to charge an additional *systemic risk fee* to each financial institution based not only on the amount of assets it holds, but also on its contribution to systemic risk (based on its MES, as described earlier); its individual risk characteristics, including the ones under current FDIC rules; and on measures of complexity and interconnectedness. The majority of financial firms contribute only marginally to systemic risk, so presumably their fee would be close to zero.

Leverage Restrictions and Sectoral Risk-Weight Adjustments

One concern often raised with market measures is that they may not be readily available in emerging markets, at least not with high reliability or frequency. Another concern is that regulators might lack sophistication or expertise to price deposit insurance premiums in a way that would sufficiently counteract incentives to build up systemic risk in good times. Ongoing research shows that the former is not necessarily the case, and utilizing somewhat simpler but coarser approaches can be a way around the latter.

The most popular of these simpler approaches is a direct leverage restriction, a variant of which can be imposed at the level of each institution. No risk-weights are attached so that (perhaps with the exception of the highest-rated government debt) all assets are treated equally in terms of their potential risks. The leverage restriction, then, is simply that the institution's unweighted assets not exceed its equity value by more than a set threshold, say 15:1. Alternately, leverage restrictions can be imposed at the level of each asset class (limiting mortgages to loan-to-value ratios less than 80 percent, for instance).

Although apparently simple, these restrictions, in fact, require a fair bit of regulatory oversight and sophistication. If enforcement is weak, the financial sector can evolve a "shadow- banking" system, as was the primary problem in the United States in the buildup to the financial crisis. The regulation must now

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ensure that all assets—on and off the balance sheet—are suitably accounted for in leverage calculations. Similarly, if regulators have to use coarse leverage measurements on complicated securities and derivatives, regulatory arbitrage would push the financial sector toward innovation of such products. Again, this would call for sufficiently broad-scoped asset-level leverage requirements. Although it is conceivable that it would be useful to "ban" outright certain derivatives and innovation, there is no evidence that this approach has worked. Regulators are often playing catch-up to the financial sector. Hence, more prudent enforcement would ensure that the regulatory perimeter is irrefutably enforced, so that *all* risks of the financial sector are dealt with adequately while limiting system leverage.

Another macro prudential tool that is less market dependent—and one that is employed by some emerging markets, such as India—is the sector-weight adjustment approach. This approach requires horizontal aggregation of financial institutions' balance sheets and risk exposures to identify over time, say, annually, which asset classes are being "crowded in" as far as systemic risk concentrations are concerned. For instance, if mortgages or mortgage-backed securities are increasingly picking up the lion's share of all risks on bank balance sheets, then regulators could proactively react by limiting any further buildup. This limit could be achieved by increasing the risk-weights on future exposures to this asset class. In principle, stress tests could also be employed to glean such information about emerging pockets of risk concentrations.

One advantage of the dynamic sector risk-weight adjustment approach is that if it is consistently implemented by regulators and anticipated by the financial sector, then it can act as a valuable countercyclical incentive. Financial firms, anticipating the future risk in risk-weights, may stop adding exposure to an asset class once it is sufficiently crowded in. One disadvantage is that it may create a race to "get in first." The approach relies heavily on regulatory discretion being prescient in identifying risk pockets and on regulators having sufficient will in good times to lean against the wind of fast-growing asset classes.

Of course, there is no reason why these approaches could not be used in conjunction. Good regulation should look for robustness or resilience, both to its own potential errors as well as to the arbitrage of regulation by the financial sector. Rule-based approaches, such as in the capital requirements or in tax and premium schemes described earlier exonerate the regulators from relying too much on discretion and, therefore, from the lobbying influence of the industry; whereas discretionary-based approaches counterbalance the rule-based approach by creating sufficient dynamic and constructive ambiguity in the minds of the industry about increasing correlated risks and leverage. Our recommendation, however, is that discretionary approaches such as sector-based risk adjustments should also be sufficiently rule-based, to the extent possible, in terms of the framework guiding the adjustments.

Dealing with Shadow Banking

Shadow banking refers to a system of financial institutions that mostly look like banks. These financial institutions borrow short-term funds in rollover debt markets, leverage significantly, and lend and invest in longer-term and illiquid assets.

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This part of the financial system includes asset-backed commercial paper (ABCP), money market funds, securities lending and collateralized repos (at broker-dealers).[28] Although shadow banks may not be paramount for emerging markets at present, the issue could grow in importance as financial sectors expand and regulators strengthen regulation. Indeed, nonbank finance corporations and money-market-fund-style activities are already on the rise in fast-growing economies such as China and India even as regulators employ deposit rate ceilings and interest rate rises to contain commercial-bank loan growth. Lessons from the impact of the recent crisis on how to regulate shadow banking are, therefore, important for emerging markets so that shadow-banking risks can be contained proactively rather than postcrisis.

Important differences exist the in current regulatory treatment of the shadow-banking and banking sectors. The shadow-banking system is, for the most part, unregulated. It is also unprotected from banklike runs (that is, there are no explicit guarantees provided by the government). The financial crisis of 2007–09 showed that much of the shadow-banking system (investment banks and money market funds, in particular) ended up being bailed out. This part of the financial system, considered in whole, was too big to fail.

As the housing market deteriorated in 2007 and prices fell in the credit market, the value of assets held by shadow banks fell significantly and put into question their solvency. Given the opaque nature of these institutions, uncertainty about which institutions were solvent led to a run on the sector. For instance, when Lehman Brothers failed in September 2008, the Prime Reserve Fund, a large money market fund, was exposed to its short-term debt. The losses on Lehman caused the fund to "break the buck." Not knowing what other non-Treasury money market funds were holding, investors immediately pulled their funding from these funds, causing a run on the money market sector and, thereby, the collapse of the commercial paper market for financial institutions. To restore confidence, the government had to guarantee the money market sector. There are numerous other such examples from the recent crisis, and their systemic impacts cannot be understated.

Uncertainty and lack of information in the financial sector are not novel concepts. The Panic of 1907 and the various banking crises during 1930–32, in the wake of the Great Depression, are just some examples of how uncertainty about the solvency of financial institutions can lead to systemwide bank runs. The Federal Reserve (as a lender of last resort), the FDIC, and deposit insurance were created in response to these systemic runs. Arguably, the most important aspect of this system is that depositors no longer had to run on the bank because the government now guaranteed their funds. To counteract the moral hazard such safety nets invariable induced, policy makers set up a system of countervailing barriers: (1) banks would have to pay to be a part of the deposit insurance system, so, at least, on an ex ante basis, regulators took into account the cost of the insurance; (2) the risk-taking activities of banks were ring fenced to the extent that there was a separation between commercial and more risky investment banking activities; and (3) enhanced supervision and winding-down provisions of

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individual banks in the form of capital requirements and prompt corrective action were established.

The initial success of these Depression-era measures in stabilizing the financial sector (until shadow banking eventually outgrew them) offers two lessons to reduce the buildup of systemic risk in the shadow-banking system today.

The first lesson is to explicitly guarantee the short-term liabilities of the shadow-banking sector in a systemic crisis. In return, institutions like broker-dealers, ABCP conduits and money market funds would (1) be charged a fee akin to the FDIC premium; (2) have their risk-taking activities restricted; (3) be forced to hold a capital buffer; and (4) be subject to wind-down provisions to avoid excessive risk shifting in distress.

The second is to leave the shadow-banking institutions unprotected, but set up an airtight mechanism for dealing with these firms in a systemic crisis. Specifically, if there is a run on an institution's liabilities, then, with the approval of a systemic risk regulator (or the central bank), the institution may suspend redemptions. This action would not in itself either initiate bankruptcy proceedings or force the firm into receivership. The collateral underlying these liabilities would be sold off in a slow orderly fashion (or, alternatively, pledged back to the lenders). But since most of the lenders in the shadow-banking system participate in this sector to access liquidity, the government would, at a significant haircut and for a fee, lend against the collateral. This way the lenders would have access to some funds during a systemic crisis, thus allaying any fears that all their funds would be frozen for a prolonged period. Most importantly, however, any losses in the collateral would eventually be borne by these creditors and not by taxpayers.[29]

The Emerging Market Context

Although the three approaches proposed earlier for marrying micro prudential and macro prudential objectives may be potentially implementable in an emerging markets context, they may serve different purposes in practice.

First, capital requirements, for instance, may be more easily gamed than premiums (which require upfront cash payments) but also provide a buffer against future losses. Tax premiums, conversely, deplete such a buffer. When financial firms are not publicly traded, their ability to tap into market equity capital may be limited and a push for tax premiums can cause a severe reduction in asset growth, that is, an induced credit crunch.

Second, in many emerging markets and for nonpublicly traded financial firms, market availability of data and risk indicators is a challenge (even though financial firms are increasingly being publicly traded in emerging markets, given their size and growth of capital markets). Some of the data limitations are as follows: rating agencies are generally less available and thus ratings less used for loan classifications; data series are shorter so that through-the-business-cycles classification of loans to assess their risks gets harder; and, until recently, emerging markets have been far more volatile in growth and risk terms than the developed markets of the West.

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Taking account of these limitations, micro prudential regulation of financial sectors in emerging markets could provide the required macro prudential slant by adopting a number of tools. Direct leverage restrictions (for example, no loan-to-value ratios that exceed 80 percent, or no leverage for financial firms based on overall assets that exceeds 15:1) can lend micro prudential regulation a certain amount of robustness in additional to regulators' own "model risk" in assessing risks. Sector risk-weight adjustments (for example, increased risk-weight of mortgages if the entire financial sector is found to be increasing exposure to mortgages in a stress test) recognize that regulation can get outdated and the financial sector can "cherry pick" the cheapest risk-weight classes, once again lending robustness to macro prudential regulation. Lastly, transparency and disclosure for financial firm assets and liabilities could be improved to build longer datasets over time and, thus, better through-the-cycle assessments of risks. Many emerging markets already have credit bureaus and more research could be conducted using them to assess the key historical macro- and micro-drivers of credit crunches.

Notes

1. Acharya and others (2011) paint a compelling picture that Fannie Mae and Freddie Mac, the government-sponsored enterprises in the United States to securitize mortgages, effectively participated in a substantial race to the bottom in risk-taking with private-sector financial institutions, in which both their government mandates for lending for affordable housing and their poor regulatory capital requirements (given their deteriorating portfolios since 1991) played a crucial role.
2. The scope of macro prudential regulation is the financial industry, rather than any cyclical sector in the economy, because of the financial industry's intermediation role. Financial institutions are a unique part of the economy in that they act as intermediaries between parties that need to borrow and parties willing to lend. Indeed, poor performance of the financial industry will impose additional losses to the rest of the economy, from entrepreneurs to retirees.
3. Goodhart (2010) also considers asymmetric information, which can be a significant contributor to markets freezing up, as are issues concerning the governance structure of banks that, because of shareholders versus creditor/taxpayer conflicts, can lead to socially inefficient outcomes.
4. An analogy can be made to an industrial company that produces emissions that lower its own costs but pollute the environment.
5. See Acharya (2001) and Acharya and Yorulmazer (2007) for a discussion
6. Some of the data limitations are: rating agencies are generally less available and thus ratings less used for loan classifications; data series are shorter so that through-the-business-cycles classification of loans to assess their risks gets harder; and, until recently, emerging markets have been far more volatile in growth and risk terms than developed markets of the West.
7. The discussion of this section is partly based on Acharya, Cooley, Richardson, and Walter (2010).
8. See also Hovakimian, Kane, and Laeven (2003).

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9. See also Claessens, Klingebiel, and Leaven (2004) and Kane and Klingebiel (2004) for further analysis and discussion of the costs of providing guarantees during a banking crisis.
10. In a notable incident, Infosys, the bellwether of Indian technology and a NASDAQ-listed company, moves its cash in hand from ICICI Bank, one of the largest private-sector banks, to State Bank of India, the largest public-sector bank.
11. See Buiter and Sibert (2008).
12. http://www.wto.org/english/news_e/pres10_e/pr598_e.htm.
13. Tier 1 capital—also called "core capital" or "basic equity"—includes equity capital and disclosed reserves. Tier 2 capital—also called "supplementary capital"—includes undisclosed reserves; revaluation reserves; general provisions or general loan-loss reserves; hybrid debt capital instruments; and subordinated term debt. Tier 2 capital cannot exceed Tier 1 capital, which means that effectively at least half of a bank's capital base should consist of Tier 1 capital. Tier 1 capital is the most stable and reliable source of funding for a bank's operations. Tier 3 capital to cover market risks may be used only at the discretion of the national authorities, and includes only short-term subordinated debt that satisfies certain conditions. Tier 3 capital is limited to 250 percent of a bank's Tier 1 capital that is required to support market risks. See http://www.bis.org/publ/bcbs128.pdf - p14.
14. See Acharya, Schnabl, and Suarez (2009).
15. The discussion of financial architecture in this section draws in part from Acharya and others (2010).
16. "Breaking the buck" occurs when a money market mutual fund's net asset value (NAV) drops below US$1 per share. Money market funds are not federally insured like bank deposits; therefore, fund assets have an implied promise to preserve capital at all costs and preserve the US$1 floor on share prices.
17. The use of market-based measures has recently been studied by Acharya and others (2010a) and (2010b), Adrian and Brunnermeier (2009); Brownlees and Engle (2010); De Jonghe (2010); Gray and Jobst (2009); Huang, Zhou, and Zhu (2009), and Lehar (2005), among others.
18. An implementation of this idea is now available at the New York University Stern School of Business volatility laboratory (Vlab). Rankings are updated regularly and posted on Vlab at: http://vlab.stern.nyu.edu/. Over time, these rankings will be extended to European and Australasian financial firms.
19. See the Federal Reserve Bank of New York report on the SCAP exercise (Hirtle, Schuermann, and Stiroh 2009)
20. The Dodd-Frank Act of 2010 in the United States calls for systemic institutions to be subject to periodic stress tests: "The Board of Governors, in coordination with the appropriate primary financial regulatory agencies and the Federal Insurance Office, shall conduct annual analyses in which nonbank financial companies supervised by the Board of Governors and bank holding companies described in subsection (a) are subject to evaluation of whether such companies have the capital, on a total consolidated basis, necessary to absorb losses as a result of adverse economic conditions." Moreover, systemically important financial institutions are required to perform semi-annual tests. Such assessments may be done more frequently in a crisis and may complement the firm's own test.
21. Christensson, Spong, and Wilkinson (2010) document, for instance, how financial stability reports in five countries (United Kingdom, Sweden, the Netherlands, Spain,

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and Norway) describe identification of risks to the system (low interest rates, rising asset prices, increasing debt levels and trade imbalances, risks from the United States) and exploit market-price data and balance sheet data as well as regulatory intelligence (supervision and stress-test data).

22. This discussion is based on Acharya and others (2009).
23. Purely idiosyncratic risk would require less capital and firms might occasionally fail if they took significant risk, but an isolated failure can generally be resolved by the private sector and would not cause externalities (deposit insurance creates the need for additional regulations, but this is not our focus here).
24. The recent crisis has shown that firms such as Bear Stearns and Citigroup looked extremely well-capitalized even at points when it became clear that because of erosion of their equity's market values, they had limited funding capacity (if any) to perform day-to-day operations and manage their liquidity in an orderly fashion.
25. Greenlaw and others (2011) argue that the amount of capital required of a financial firm should depend on a stress test not just on the firm's own direct losses, but also on indirect loss contributions if these losses lead to deadweight losses through fire sales and contagion risks. Elliott (2011) provides a discussion of how bank capital requirements could be designed in a countercyclical manner to contain the boom and bust cycle of credit.
26. The Federal Deposit Insurance Corporation (FDIC) was created in the wake of the Great Depression to address the massive number of bank runs that took place from 1930 to 1933. The contracts went through several iterations ending with the Federal Deposit Reform Act of 2005 which instituted a pricing scheme for deposit premiums that attempted to capture risk by combining examination ratings, financial ratios, and, for large banks, long-term debt issuer ratings. Institutions are divided into four risk categories: I through IV. The lowest risk category contains institutions considered healthy by the examiners that are well capitalized, with total-risk-based ratios of 10 percent, tier 1 risk-based ratio of 6 percent, and tier 1 leverage ratio of 5 percent. Within risk category I, a premium between 5 and 7 cents per US$100 of deposits would be assessed, depending on formula, which takes into account tier 1 leverage ratios, loans past due 30–89 days/gross assets, nonperforming assets/gross assets, net loan charge-offs/gross assets, and net income before taxes/risk-weighted assets. As health and capitalization weakens for the firm, the risk category increases, eventually leading to premiums as high as 43 cents per US$100 of deposits.
27. The historical mandate that the FDIC must return premiums to the sector if losses are low is a very poor idea. It is paramount to returning fire insurance if there has been no fire yet.
28. The size of this market is roughly US$8 trillion in the Unites States (and even larger by some estimates) and matches the size of deposits, both insured and uninsured, held at depository institutions. The growth of shadow banking over the last 25 years has been extraordinary relative to the growth in deposits.
29. Finally, at least a part of the shadow-banking system such as money market funds and ABCP vehicles appear to have evolved largely as an end run around regulations on commercial banks. The loopholes involving different accounting and regulatory capital treatments of on- and off-balance sheet assets should be removed because they facilitate leverage buildup in the shadow-banking world in opaque forms. Money market funds are also generally an end run around taxes or restrictions on banks to offer high interest rates on deposits or any interest rates on corporate deposits. Such distortions could also be eliminated.

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