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The Dodd-Frank Act and Basel III: Intentions, Unintended Consequences, and Lessons for Emerging Markets

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Abstract

This paper is an attempt to explain the changes to finance sector reforms under the Dodd-Frank Act in the United States and Basel III requirements globally; their unintended consequences; and lessons for currently fast-growing emerging markets concerning finance sector reforms, government involvement in the finance sector, possible macroprudential safeguards against spillover risks from the global economy, and, finally, management of government debt and fiscal conditions.

The paper starts with a summary of reforms under the Dodd-Frank Act and highlights four of its primary shortcomings. It then focuses on the new capital and liquidity requirements under Basel III reforms, arguing that, like its predecessors, Basel III is fundamentally flawed as a way of designing macroprudential regulation of the finance sector. In contrast, the Dodd-Frank Act has several redeeming features, including requirements of stress-test-based macroprudential regulation and explicit investigation of systemic risk in designating some financial firms as systemically important. It argues that India should resist the call for blind adherence to Basel III and persist with its (Reserve Bank of India) asset-level leverage restrictions and *dynamic* sector risk-weight adjustment approach. It concludes with some important lessons for regulation of the finance sector in emerging markets based on the global financial crisis and proposed reforms that have followed in the aftermath.

JEL Classification: G2, G21, G28

Contents

1. INTRODUCTION: THE DODD-FRANK ACT

The Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010, enacted by the Obama administration in the United States (US), is perhaps the most ambitious and far-reaching overhaul of financial regulation since the 1930s.[1]

The backdrop for the act is now well understood but is worth repeating. When a large part of the finance sector is funded with fragile short-term debt and is hit by a common shock to its long-term assets, there can be mass failures of financial firms and disruption of intermediation to households and corporations. Having witnessed such financial panics from the 1850s until the Great Depression, Senator Carter Glass and Congressman Henry Steagall pushed through the so-called Glass–Steagall provisions of the Banking Act of 1933. They put in place the Federal Deposit Insurance Corporation (FDIC) to prevent retail bank runs and to provide an orderly resolution of troubled depository institutions—"banks"—before they failed. To guard against the risk that banks might speculate at the expense of the FDIC, their permissible activities were limited to commercial lending and trading in government bonds and general-obligation municipals, requiring the riskier capital markets activity to be spun off into investment banks.

At the time it was legislated, and for several decades thereafter, the Banking Act of 1933 reflected in some measure a sound economic approach to regulation:

- *identify the market failure*, or in other words, why the collective outcome of individual economic agents and institutions does not lead to socially efficient outcomes, which in this case reflected the financial fragility induced by depositor runs;
- *address the market failure through a government intervention*, in this case by insuring retail depositors against losses; and
- *recognize and contain the direct costs of intervention, as well as the indirect costs due to moral hazard arising from the intervention*, by charging banks up-front premiums for deposit insurance, restricting them from riskier and more cyclical investment banking activities, and through subsequent enhancements, requiring that troubled banks face "prompt corrective action" that would bring about their orderly resolution at an early stage of their distress.

Over time, however, the banking industry nibbled at the perimeter of this regulatory design, the net effect of which was to keep the government guarantees in place but largely do away with any defenses the system had against banks exploiting the guarantees to undertake excessive risks. What was perhaps an even more ominous development was that the light-touch era of regulation of the finance sector starting in the 1970s allowed the evolution of a parallel ("shadow") banking system, consisting of money market funds, investment banks, derivatives and securitization markets, etc. The parallel banking sector that was both opaque and highly leveraged and, in many ways, reflected regulatory arbitrage, provided the opportunity for the finance sector to adopt organizational forms and financial innovations that would circumvent the regulatory apparatus designed to contain bank risk taking. Over time, the Banking Act began to be highly compromised.

Fast forward to 2004, which many argue was the year when a "perfect storm" began to develop that would eventually snare the global economy. Global banks were seeking out massive capital

[1] Dodd–Frank Wall Street Reform and Consumer Protection Act of 2010, Pub. L. 111–203, 124 Stat. 1376 (2010). http://www.gpo.gov/fdsys/pkg/PLAW-111publ203/content-detail.html

flows into the US and the United Kingdom (UK) by engaging in short-term borrowing, increasingly through uninsured deposits and interbank liabilities, financed at historically low interest rates. They began to manufacture huge quantities of "tail risk," i.e., a low likelihood but with catastrophic outcomes. A leading example was the so-called "safe assets" (such as the relatively senior [AAA-rated] tranches of subprime-backed mortgages) that would fail only if there was a secular collapse in the housing markets. As the large and complex financial institutions (LCFIs) were willing to pick up loans from originating mortgage lenders and pass them around or hold them on their own books after repackaging them, a credit boom was fueled in these economies. As Table 1 shows, more than 20% of US mortgage-backed exposure was guaranteed by "nonagencies", i.e., by the private sector (Table 1, columns 5–7), but unlike traditional securitization, in which the AAA-rated tranches would get placed with the pension fund of proverbial Norwegian village, these were to a significant extent (originated and) retained by banks and thrifts, and broker-dealers (column 5, Table 1).

The net result of all this was that the global banking balance sheet doubled from 2004 to 2007, but its risk appeared small. The LCFIs had, in effect, taken a highly undercapitalized one-way bet on the housing market, joined in equal measure by the US government's own shadow banks—Fannie-Mae and Freddie-Mac—and AIG, the world's largest insurer. While these institutions seemed individually safe, collectively they were vulnerable. And as the housing market crashed in 2007, the tail risk materialized, and the LCFIs crashed like a house of cards. The first big banks to fail were in the shadow banking world. They were put on oxygen in the form of Federal Reserve (Fed) assistance, but the strains in the interbank markets and the inherently poor quality of the underlying housing bets, even in commercial bank portfolios, meant that when the oxygen ran out in the autumn of 2008 some banks had to fail. A panic ensued internationally, making it clear that the entire global banking system was imperiled and needed—and markets expected them to be given—a taxpayer-funded lifeline.

Table 1: Distribution of United States Real-Estate Exposures

	Loans	HELOC	Agency MBS	Non-Agency 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%		

Notes: GSEs = Government Sponsored Enterprises, FHLB = Federal Home Loan Banks, HELOC = Home Equity Lines of Credit, MBS = Mortgage-Backed Securities, CDO = Collateralized Debt Obligations, and AAA = highest rating class attributable to fixed income securities.

Source: Lehman Brothers. 2008. Fixed Income Report. June.

In the aftermath of this disaster, governments and regulators began to cast about for ways to prevent—or render less likely—a recurrence. The crisis created focus and led first to a bill from the House of Representatives, then one from the Senate, that were combined and distilled into the Dodd-Frank Act. The critical task for the Dodd-Frank Act was to address the increasing propensity of the finance sector to put the entire system at risk and, eventually, to be bailed out at the taxpayer's expense.

The highlights of the Act are as follows:

- **Identifying and regulating systemic risk:** sets up a council that can deem nonbank financial firms systemically important, regulate them, and, as a last resort, break them up; also establishes an office under the Treasury to collect, analyze, and disseminate relevant information for anticipating future crises.
- **Proposing an end to too-big-to-fail:** requires "funeral plans" and orderly liquidation procedures for unwinding systemically important institutions, ruling out taxpayer funding of wind downs and instead requiring that management of failing institutions be dismissed, wind-down costs be borne by shareholders and creditors, and, if required, ex post levies be imposed on other (surviving) large financial firms.
- **Expanding the responsibility and authority of the Federal Reserve.** Grants the Fed authority over all systemic institutions and responsibility for preserving financial stability.
- **Restricting discretionary regulatory interventions:** Prevents or limits emergency federal assistance to individual nonbank institutions.
- **Reinstating a limited form of Glass–Steagall (the "Volcker rule"):** Limits bank holding companies to *de minimis* investments in proprietary trading activities such as hedge funds and private equity, and prohibits them from bailing out these investments.
- **Regulation and transparency of derivatives:** Provides for central clearing of standardized derivatives, regulation of complex derivatives that can remain over-the-counter (i.e., outside of central clearing platforms), transparency of all derivatives, and separation of "non-vanilla" positions into well-capitalized subsidiaries, all with exceptions for derivatives used for commercial hedging.

In addition, the Act introduces a range of reforms for mortgage lending practices, hedge fund disclosure, conflict resolution at rating agencies, origination and securitization, risk-taking by money market funds, and shareholder say on pay and governance. And perhaps its most popular reform, albeit tangential to the financial crisis, the Act creates a bureau of consumer financial protection that will write rules governing consumer financial services and products offered by banks and nonbanks.

1.1 The Dodd-Frank Act: An Overall Assessment

The first reaction to the Act is that it certainly has its heart in the right place. It is highly encouraging that the purpose of the new finance sector regulation is explicitly aimed at developing tools to deal with systemically important institutions. And it strives to give prudential regulators the authority and the tools to deal with this risk. The requirement of funeral plans to unwind LCFIs should help demystify their organizational structures, and the attendant resolution challenges when they experience distress or fail. If the requirement is enforced well, it could serve as a "tax" on complexity, which seems to be another market failure in that private gains from it far exceed the social ones.

In the same vein, even though the final language in the Act is a highly diluted version of the original proposal, the Volcker rule, limiting proprietary trading investments of LCFIs, provides a more direct restriction on complexity and should help simplify their resolution. The Volcker rule also addresses a moral hazard issue, which is that direct guarantees to commercial banks are largely designed to safeguard payment and settlement systems and to ensure robust lending to households and corporations. However, through the bank holding company structure, direct guarantees effectively lower the costs for more cyclical and riskier functions, such as making proprietary investments and running hedge funds or private equity funds, where there are thriving markets and a commercial banking presence is not critical.

Equally welcome is the highly comprehensive overhaul of derivatives markets aimed at removing the veil of opacity that has led markets to seize up when a large derivatives dealer experiences problems (e.g., Bear Stearns). The push for greater transparency of prices, volumes, and exposures—to regulators and in aggregated form to the public—should enable markets to deal better with counterparty risk in terms of pricing it into bilateral contracts as well as understanding its likely impact. The act also pushes for greater transparency by making systemic nonbank firms subject to tighter scrutiny by the Fed and the Securities and Exchange Commission (SEC).

However, the Act requires over 225 new financial rules across 11 federal agencies. The attempt at regulatory consolidation has been minimal. In the end, the finance sector will have to live with the great deal of uncertainty that is left unresolved until the various regulators (the Fed, the SEC, and the Commodities and Futures Trading Commission) spell out the details of implementation.

Perhaps more importantly, from the standpoint of providing an economically sound and robust regulatory structure, are the act's weaknesses on at least four important counts, as we explain below. The net effect of these four basic faults is as follows: (i) implicit government guarantees to the finance sector will persist in some pockets and escalate in others; and (ii) capital allocation may migrate in time to these pockets and newer ones that will develop in the future shadow banking world and, potentially, sow seeds of the next significant crisis. Implementation of the act and future regulation may guard against this danger, but that remains to be seen.

1.1.1 Government Guarantees Remain Mispriced, Leading to Moral Hazard

In 1999, economists John Walter and John Weinberg of the Federal Reserve Bank of Richmond performed a study of how large the financial safety net was for US financial institutions. Using fairly conservative criteria, they reported that 45% of all liabilities ($8.4 trillion) received some form of guarantee. A decade later, the study was updated by Nadezhda Malysheva and John Walter with staggering results—now 58% of all liabilities ($25 trillion) were under a safety net. Without appropriate pricing, government guarantees are highly distortionary: they lead to subsidized financing of financial firms, moral hazard, and the loss of market discipline, which, in turn, generate excessive risk taking. Examples include (i) FDIC insurance provided for depository institutions; (ii) implicit backing of the government-sponsored enterprises (GSEs), Fannie Mae and Freddie Mac (as described in detail in Acharya, Van Nieuwerburgh, Richardson, and White 2011); and (iii) the much-discussed too-big-to-fail mantra of LCFIs. The financial crisis of 2007–2009 exposed the depth of the problem with the failure of numerous banks and the need to replenish FDIC funds, the now-explicit guarantee of GSE debt, and the extensive bailouts of LCFIs.

The Dodd-Frank Act makes little headway on the issue of government guarantees. While admittedly such guarantees have been a problem for many years, the Act nonetheless makes little attempt to re-address the pricing of deposit insurance. And while the GSEs are the most

glaring examples of systemically important financial firms whose risk choices went awry given their access to guaranteed debt, the Act makes no attempt to reform them.[2] The distortion here is especially perverse, given the convenience of having them around to pursue political objectives of boosting subprime home ownership and using them as "bad" banks to avoid another titanic collapse of housing markets. Finally, there are several large insurance firms in the US that can—and did in the past—build leverage through minimum guarantees in standard insurance contracts. Were these to fail, there is little provision in the Act to deal adequately with their policyholders; there are currently only the tiny state guarantee funds, which would never suffice for resolving the large insurance firms. Under the Act, there would be no advance systemic risk charges on these firms, but it is highly unlikely that their policyholders will be wiped out or that the large banks will be made to pay for these policies (as the Act proposes)! Taxpayer bailout of these policies is the more likely outcome. These institutions remain too-big-to-fail and could be the centers of the next excess and crisis.

Of course, proponents of the Act would argue that at least the issue of too-big-to-fail has been dealt with once and for all through the creation of the Orderly Liquidation Authority (OLA). But when one peels back the layers of the OLA, it is much less clear. Choosing an FDIC-based receivership model to unwind such large and complex firms creates much greater uncertainty than would a restructured bankruptcy code for LCFIs, or the forced debt-to-equity conversions inherent in "living wills." Time will tell whether the OLA is considered credible enough to impose losses on creditors (FDIC-insured depositors aside), but market prices of LCFI debt will be able to provide an immediate answer through a comparison of yield spreads with firms that are not too-big-to-fail.

1.1.2 Individual Firms are not Sufficiently Discouraged from Putting the System at Risk

Since the failure of systemically important firms imposes costs beyond their own losses—to other financial firms, households, the real sector, and, potentially, other countries—it is not sufficient to simply wipe out their stakeholders—management, shareholders, and creditors. These firms must pay in advance for contributing to the risk of the system. Not only does the Act rule this out but it also makes the problem worse by requiring that other large financial firms pay for the costs, precisely at a time when they are likely to face the risk of contagion from failing firms. This is simply poor economic design for addressing the problem of externalities.

It is somewhat surprising that the Act has shied away from adopting an advance charge for systemic risk contributions of LCFIs. And, in fact, it has most likely compromised its ability to deal with their failures. It is highly incredible that, in the midst of a significant crisis, there will be the political will to levy a discretionary charge on the surviving financial firms to recoup losses inflicted by failed firms. It would, in fact, be better to reward the surviving firms from the standpoint of incentives in advance and relax their financing constraints later to boost the flagging economic output in that scenario. Under the proposed scheme, therefore, the likely outcomes are that the finance sector will most likely not pay for its systemic risk contributions—as happened in the aftermath of this crisis—and that to avoid any likelihood that they have to pay for others' mistakes and excesses, financial firms will herd by correlating their lending and investment choices. Both of these would increase, not decrease, systemic risk and financial fragility.

Equally problematic, the argument can be made that the Act has actually increased systemic risk in a financial crisis. While it is certainly true that the Financial Stability Oversight Council of regulators has more authority to address a systemic crisis as it emerges, there is the implicit

[2] For a detailed treatment of the role played by the GSEs in the housing boom and bust in the US, see Acharya, Van Nieuwerburgh, Richardson, and White (2011).

assumption that the council will have the wherewithal to proceed. Given the historical experience of regulatory failures, this seems like a tall order. In contrast, the Act reduces the ability of the Federal Reserve to provide liquidity to non-depository institutions, and, as mentioned above, provides no advance funding for solvent financial institutions hit by a significant event. The council will be so restricted that its only choice in a liquidity crisis may be to put systemically important firms through the OLA process, which, given the uncertainty about this process, could initiate a full-blown systemic crisis. Much greater clarity on exact procedures underlying the OLA would be necessary to avoid such an outcome.

1.1.3 The Dodd-Frank Act Falls into the Familiar Trap of Regulating by Form, not Function

The most salient example of this trap is the Act's overall focus on bank holding companies, after clarifying that nonbanks may also be classified as systemically important institutions and be regulated accordingly. As we just explained, the Act allows for provision of federal assistance to bank holding companies under certain conditions, but restricts such assistance to other systemically important firms, large swap dealers in particular. This will create a push for the acquisition of small depositories just as nonbanks anticipate trouble, undermining the intent of restriction. There are also important concentrations of systemic risk that will develop, e.g., as centralized clearing of derivatives starts being implemented. And when their systemic risk materializes, employing the Fed's lender-of-last-resort function may be necessary, even if temporarily so, to ensure orderly resolution.

Consider a central clearinghouse of swaps (likely to be credit default swaps to start with, but eventually several other swaps, including interest rate swaps). As Mark Twain would put it, it makes sense to "put all your eggs in one basket" and then "watch that basket." The Act allows for prudential standards to watch such a basket. But if the basket was on the verge of a precipitous fall, an emergency reaction would be needed to save the eggs—in this case, the counterparties of the clearinghouse. The restriction on emergency liquidity assistance from the Fed when a clearinghouse is in trouble will prove disastrous, as an orderly liquidation may take several weeks, if not months. The most natural response in such cases is to provide temporary federal assistance, eventual pass-through of the realized liquidation losses to participants in the clearinghouse, and its private recapitalization through capital contributions from participants. Why force intermediate liquidity assistance to go through a vote of the Financial Stability Oversight Council and have the markets deal with discretionary regulatory uncertainty?

1.1.4 Large Parts of the Shadow Banking Sector Remain in Current Form

The story of the financial crisis of 2007–2009 was that financial institutions exploited loopholes in capital requirements and regulatory oversight to undertake risky activities that were otherwise meant to be well capitalized and closely monitored. Examples are numerous: (i) financial firms choosing unqualified regulatory agencies to oversee them (e.g., American International Group's choice of the Office of Thrift Supervision for its financial products group); (ii) the loading up of so-called AAA-rated securities in a regulatory setting ripe for conflicts of interest between rating agencies, security issuers, and investors; and (iii) the development of a parallel banking sector that used wholesale funding and over-the-counter (OTC) derivatives to conduct identical banking activities, as commercial banks were not yet subject to the same rules and regulations.

To be fair, the Dodd-Frank Act does not ignore all of this in its financial reform. For example, it takes major steps to deal with the regulatory reliance and conflict of interest problems with rating agencies, OTC derivatives are brought back into the fold, and leverage-enhancing tricks such as off-balance-sheet financing are recognized as a major issue. But the basic principle that

similar financial activities, or, for that matter, economically equivalent securities, should be subject to the same regulatory rules is not core to the Act.

For example, several markets—such as the sale and repurchase agreements (repo)—that now constitute several trillion dollars of intermediation flows have been shown to be systemically important. In what sense do these markets perform different functions than demand deposits, and why aren't they regulated as such? Moreover, these markets can experience a freeze at large if a few financial firms are perceived to be risky but their exact identity is unknown. Orderly resolution of a freeze and prevention of fire-sale asset liquidations in these markets remains unplanned. The same applies for dealing with runs on money market funds whose redemption risk following the collapse of Lehman Brothers brought finance to a standstill. That a collection or herd of small contracts and markets can be systemically important is essentially lost in the Dodd-Frank Act, as its focus is almost exclusively on the too-big-to-fail financial institutions.

In conclusion, while the Dodd-Frank Act does represent the culmination of several months of sincere effort on the part of the legislators, their staffers, the prudential regulators, academics, policy think tanks, and, of course, the financial industry (and lobbyists!), it is important to recognize that the most ambitious overhaul of finance sector regulation in our times does not fully address private incentives of individual institutions to put the system at risk, leaves a great deal of uncertainty as to how we will resolve future crises, and is likely to be anachronistic, in parts, right from the day of its legislation.[3]

2. BASEL III REQUIREMENTS

In response to the systemic effect of the failure of the relatively small German bank Herstatt in 1974, the central bank governors of the G10 established the Basel Committee on Banking Supervision.[4] While having no statutory authority, the Basel Committee has emerged over the past 35 years as the lead group in formulating international standards for banking supervision, and especially capital adequacy requirements. This 35-year 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%. The committee produced a revised framework in June 1999, which culminated in the implementation of the New Capital 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 global financial crisis, the Basel Committee is at it again with proposals for new capital adequacy and liquidity requirements, denoted Basel III.

In terms of specifics, before outlining the broad strokes of the Basel III agreement, it is helpful to briefly review the earlier accords, as Basel III works iteratively off these.

The purpose of the Basel accords was to provide a common risk-based assessment of bank assets and required capital levels. Basel I separated assets into categories and gave risk weights ranging from 0% to 100% to each category. The 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% of capital to risk-weighted assets.

Because the risk analysis of Basel I was quite crude, Basel II refined this by (i) adding further gradations of risk categories; (ii) allowing for internal, and more sophisticated, risk models; and

[3] Not all is lost though, and these limitations can be fixed in due course. See a possible road map for addressing these limitations in Acharya, Cooley, Richardson, and Walter (2010).

[4] G10 refers to the group of countries that participated in the *General Agreements to Borrow* in 1968, and have continue to meet annually to review key international financial matters.

(iii) incorporating value-at-risk–based capital charges for trading books. Even with the apparent improvements of Basel II, LCFIs, armed with their too-big-to-fail funding advantage, easily exploited the conflicts of interest of rating agencies, played off external versus internal risk models, and minimized value-at-risk though not systemic risk. Arguably, 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 finance sector had a "race to the bottom" in risk taking and economic leverage and ended up in poor shape during the crisis.

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

- **solvency or capital risk**, where the market value of the firm's assets falls below its obligations; and/or
- **liquidity risk**, where 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**, where 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, counterparty risk, or contagious runs, and systemic risk can engulf the finance sector in no time. To the extent that Basel I and II focused almost exclusively on solvency risk and little on liquidity risk, Basel III constitutes an improvement. However, Basel III is disappointing in that it makes no effort to identify when an institution's solvency risk or liquidity risk is likely to lead to systemic risk. By not differentiating so, it directly subsidizes those solvency and liquidity risks that contribute to systemwide risks versus those that do not.

In particular, while Basel III tries to correct some of these areas, the basic approach to regulation is essentially a follow-up on Basel II. Specifically, Basel III (i) is stricter on what constitutes capital; (ii) introduces a minimum leverage ratio and, to be determined, higher capital requirements (possibly countercyclical in nature); and (iii) creates liquidity ratios that banks will eventually have to abide by.

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 systemically important financial institutions." One would think systemic risk *should* be the primary focus of the regulatory guidelines but, somewhat surprisingly, even after the recent crisis, it is not.

2.1 Capital Requirements

The Basel III rules endorsed by the Group of 20 (G20) leading economies can be summarized as shown in Table 2 as far as new rules on the capital banks hold are concerned (see Saunders 2011) for the full description of Basel III rules).

Table 2: Capital Adequacy Standards of Basel III

Capital type	Year to abide rule by	
	2013	2019
Minimum equity capital ratio (pure stock)	3.5% of risk-weighted assets (RWAs)	4.5% of RWAs
Minimum Tier 1 capital (equity + other instruments, including some hybrid bonds)	4.5% of RWAs	6.0% of RWAs
Minimum total capital plus new "capital conservation buffer"	8.0% of RWAs	10.5% of RWAs

Source: Bank for International Settlements. 2010(b). Group of Governors and Heads of Supervision announces higher global minimum capital standards, Annex 2 [press release]. Basel, Switzerland.

In particular, several hybrid instruments are being eliminated as eligible forms of capital, and Tier 3 capital is eliminated altogether, inducing a significant shift in bank liability structure away from hybrid capital, the growth of which (especially in Europe) was substantial prior to 2007.

In response to the severe criticism received by the risk-weighted approach, the rules put a floor under the build-up of leverage in the banking sector by requiring that capital to (unweighted) assets be at least 3%. In addition, the plan is to introduce additional safeguards against model risk[5] and measurement error by supplementing the risk-weighted assets measure with a simpler measure based on gross exposures.

In other more specific but not fully spelled-out changes, the risk coverage of the capital framework will be strengthened 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 OTC derivative contracts to central counterparties (probably clearing houses); and provide incentives to strengthen the risk management of counterparty credit exposures;
- introduce a series of measures to promote the build-up of capital buffers in good times that can be drawn upon in periods of stress:
    - introduce a series of measures to address procyclicality so as to dampen any excess cyclicality of minimum capital requirements; promote more forward-looking provisions; and conserve capital to build buffers at individual banks and the banking sector that can be used in stress;
    - achieve the broader macroprudential goal of protecting the banking sector from periods of excess credit growth; use long-term data horizons to estimate probabilities of default; downturn loss-given-default estimates, recommended in Basel II, to become mandatory; improved calibration of the risk functions, which convert loss estimates into regulatory capital requirements; and banks must conduct stress tests that include widening credit spreads in recessionary scenarios; and
    - promote stronger provisioning practices (forward-looking provisioning) and advocate a change in the accounting standards towards an expected loss approach.

[5] Model risk is the risk that ensues when using models to value financial securities.

2.2 Liquidity Requirements

As discussed before, financial distress arises not just from capital risk but also liquidity risk. The financial crisis of 2007–2009 shows that liquidity risk deserves equal footing. The problem arises because regulated institutions as well as their unregulated siblings have fragile capital structures in that they hold assets with aggregate risk and long-term duration or low liquidity, but their liabilities are highly short-term in nature. Arguably, the current crisis became a pandemic when there was a run on the investment banks and money market funds after Lehman Brothers failed.

One solution is to impose on financial institutions liquidity requirements that are similar in spirit to the way capital requirements are imposed, with the intention of reducing runs. The basic idea would be to require that a proportion of the short-term funding must be in liquid assets, i.e., 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:

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

The introduction of the LCR and NSFR as prudential standards has merit. Consider the example of the super senior AAA-rated tranches of collateralized debt obligations relative to a more standard AAA-rated marketable security (say, a corporate bond). Specifically, assume that the probability and magnitude of losses (i.e., the expected mean and variance) associated with default are similar between the two classes of securities. What are the implications of LCRs and NSFRs 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 and more of a hold-to-maturity type of security. The fact that these securities offered a spread should not be surprising, given that there are numerous examples of a price to illiquidity. For instance, consider the well-documented spread between the off-the-run and on-the-run Treasuries. The LCR would most likely count the AAA-rated collateralized debt obligation (CDO) less favorably in terms of satisfying liquidity risk.

Funding risk refers to the mismatch in the maturities of assets and liabilities. There is a tendency for financial institutions to hold long-term assets using cheap short-term funding, a kind of "carry trade." But this 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 short-term funding. One could imagine that 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, and again would be less favorable for the AAA-rated CDO versus the AAA-rated marketable security.

2.3 Basel Capital Requirements: An Assessment

From a conceptual standpoint, the Basel capital requirements are a flawed macroprudential tool. Here's why. First and foremost, a macroprudential tool should be concerned with—and attempt to address—systemic risk contributions of financial firms. Basel requirements are, for the most part, focused instead on individual risk of financial firms.

Second, the very act of reducing the individual risk of financial firms can in principle aggravate systemic risk. For instance, if institutions cannot diversify perfectly, but are encouraged to do so at all costs, then 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 the number of failures, then diversification could in fact be welfare-reducing in this form. A good analogy for this general point is banks holding AAA-rated tranches to hold a diversified bet on the housing market, since 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 ignored 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 encouraged greater lending in the aggregate to residential mortgages. As banks lent down the quality curve, they made worse mortgages (e.g., in terms of loan–value ratios). Hence, even though the residential mortgage as an asset class had historically been stable, a static risk weight that favored this asset class made it endogenously riskier.

Finally, just as the 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 materializes, because the financial firms are overleveraged in this asset class and in a correlated manner, they face endogenous liquidity risk. For instance, as each financial firm attempts to deleverage by selling its AAA MBS, so is every other financial firm, implying that there is not enough capital in the system to deal with the deleveraging, and systemic risk is created, not only ex ante, but also ex post. In this sense, Basel requirements 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 of banks, rather than restrict quantities or asset risks directly. Regulators—in the absence of price discovery provided by day-to-day markets—have little hope of achieving relative price efficiency that is sufficiently dynamic and reflective of underlying risks and the dangers that risks will change. In contrast, concentration limits on asset class exposure for the economy as a whole, or simple leverage restrictions (assets–equity of each financial firm not greater than 15:1, for instance), or an asset risk restriction (loan–value of mortgages not to exceed 80%, for instance), are more likely to be robust and countercyclical macroprudential tools. They do not directly address systemic risk but at least offer hope of limiting risks of individual financial firms and asset classes.

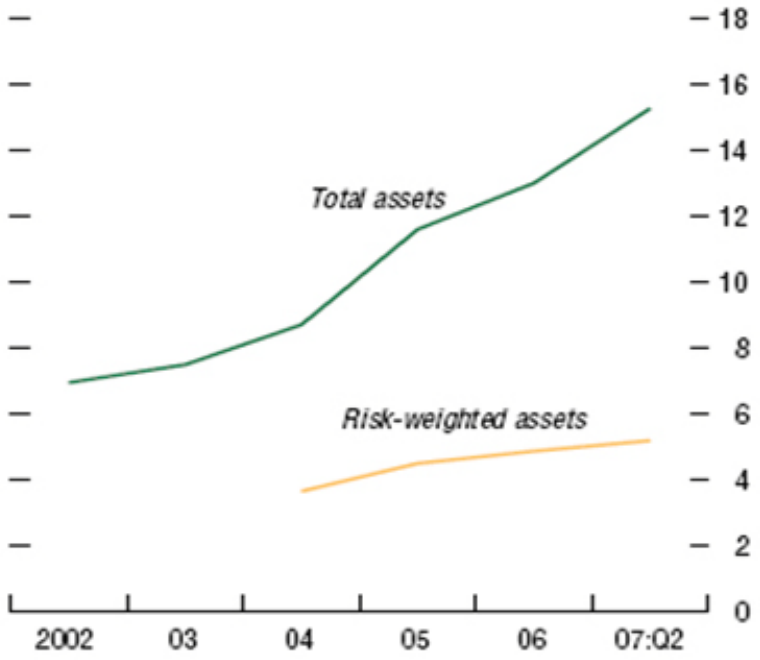
To understand what went wrong from a *regulatory* capital point of view before 2007, note that the LCFIs took their leveraged bets using regulatory arbitrage tricks as a direct result of Basel I and II (see the discussion in Acharya, Schnabl, and Suarez 2010): First, they funded portfolios of risky loans via off-balance-sheet vehicles (conduits and structured investment vehicles). These loans, however, were guaranteed by sponsoring LCFIs through liquidity enhancements that had lower capital requirement by Basel. So 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-tranches of nonprime securities, which were treated as having low credit risk and zero liquidity and funding risk. Third, they enjoyed full capital relief on AAA-tranches if they bought "underpriced" protection on securitized products from monolines and AIG (both of which were not subject to similar prudential standards). Fourth, in August 2004, investment banks successfully lobbied the 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.

The net effect of such arbitraging of Basel's capital requirements by financial firms was that global banking balance sheets doubled from 2004 to 2007 with only a minor increase in Basel-implied risk (Figure 1). This fact alone should have been a warning to regulators. When one combines this fact with the growth in short-term shadow banking liabilities from $10 trillion to $20 trillion between 2000 and 2007 (compared to $5.5 trillion to $11.0 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.

Figure 1: Growth in Total Assets and Risk-Weighted Assets Based on Balance Sheets of 10 Largest Global Financial Institutions

(€ trillion)

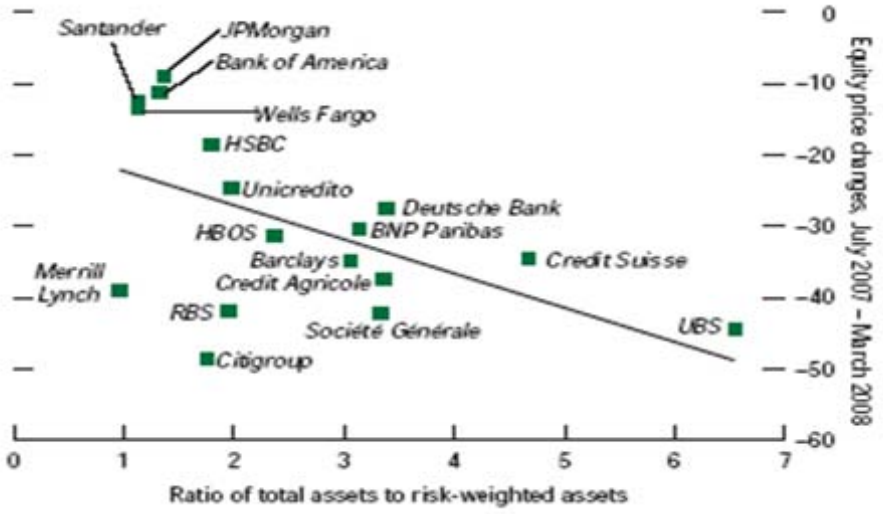


Source: International Monetary Fund (IMF). 2008. *Global Financial Stability Report.* {City} (April).

In fact, financial firms that had the best regulatory capital ratios (effectively, due to substantial regulatory arbitrage) fared the worst in terms of market capitalization declines during the crisis (Figure 2). In other words, their high regulatory capital ratios, e.g., low unweighted assets to risk-weighted assets ratios, 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 (such as by holding AAA-rated residential MBS that had little Basel capital charge).

Figure 2: Bank Equity Price Changes and Balance Sheet Leverage

(%)



Source: IMF. 2008. *Global Financial Stability Report.* (April).

Somewhat surprisingly, rather than the Basel committee providing a mea culpa, the committee offered a new set of rules and guidelines that, in many ways, mirror the previous two attempts. While the Basel III process focuses on using more stringent capital requirements to get around some of these issues, it ignores the crucial market and regulatory failures of the financial system:

- While recognizing the systemic risk of financial firms, the Basel approach very much 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 and/or liquidity requirements are placed on one set of financial institutions—say, banks and bank holding companies—it is highly likely that the financial activities affected by these requirements will just move elsewhere in the shadow banking system. That is, without the understanding that the whole 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. Other things being equal, the more guarantees a firm receives, the lower its costs of debt funding. This artificially increases the relative cost of nonguaranteed funding such as equity, preferred stock, and possibly subordinated debt (under a credible resolution authority).

It is also problematic that the Basel process sticks with tired old definitions of capital and leverage not entirely suited to modern financial firms and for reducing excessive systemic risk. At the time they were designed, the primary purpose of the Basel capital requirements was to guard the retail deposit base of commercial banks from unexpected losses on their loan

portfolios. While Basel II made improvements over Basel I by addressing OTC derivative positions, and Basel III has tightened the treatment of off-balance-sheet financing, the focus is still not on measuring quantities that actually reflect systemic risk, such as the change in value of a financial firm's assets given a macroeconomic shock and the impact such a shock has on its liability and funding structure.

That liquidity risk is now at the forefront of Basel III—and presumably future financial regulation in the US as a result of the Dodd-Frank Act—and is clearly a step forward. The LCR and NSFR liquidity adequacy standards are reasonable approaches towards the regulation of liquidity risk. For example, the focus of the LCR on a system-wide stress scenario is the appropriate way to think about the systemic consequences of holding less liquid assets and/or funding those assets with short-term liabilities.

That said, the approach is eerily similar to that of Basel I and II for setting capital requirements. All the adjustment factors and weights used in calculating the LCR and NSFR have their counterpart in the risk weights of capital ratios. Without a doubt, implementation of the liquidity ratios will push banks towards 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 in advance to adapt rapidly.

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 finance sector as a whole, especially in a broader crisis. In other words, banks that contribute more to system-wide liquidity events (in a crisis) should be charged for this negative externality.

Further, regulators need to be aware that, once the LCR and NSFR are imposed on a subset of financial institutions, these activities will migrate to a part of the finance sector not subject to these requirements. Regulators need to look at the financial system in the aggregate.

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 euro zone countries, which implies that many securities which would traditionally have been both liquid and safe, are now liquid (due to central bank collateral qualification) but significantly credit risky.

3. CONTRAST OF BASEL III WITH THE DODD-FRANK ACT

Consider the contrast of Basel III with the Dodd-Frank Act. As part of the broad mandate given to regulators, the Dodd-Frank Act calls for stricter prudential standards for systemically important institutions. Moreover, these standards should be increasing in stringency based on factors such as leverage, off-balance-sheet exposures, amount of short-term funding, interconnectedness, etc. These additional standards may include

> (A) risk-based capital requirements; (B) leverage limits; (C) liquidity requirements; (D) resolution plans and credit exposure report requirements; (E) concentration limits; (F) a contingent capital requirement; (G) enhanced public disclosures; (H) short-term debt limits; and (I) overall risk management requirements. (Footnote 1)

Of the nine recommendations for stricter regulation, note that five include additional capital, contingent capital,[6] or liquidity requirements. The basic idea is that, to the extent these stricter standards impose costs on financial firms, these firms will have an incentive to avoid them and therefore be less systemically risky. While the underlying premise is promising from purely a systemic risk viewpoint, our concern is that these standards may not be sufficient to get financial firms to internalize the costs of the systemic risk produced. *The glaring omission is any direct reference to the co-movement of an individual firm's assets with the aggregate finance sector in a crisis.*

Also, like Basel III, the Dodd-Frank Act provides for an explicit minimum leverage ratio (capital over total assets), along with minimum capital ratios (capital over risk-weighted assets). Specifically, the Dodd-Frank Act states that

> The appropriate Federal banking agencies shall establish minimum leverage (and risk-based) capital requirements on a consolidated basis for insured depository institutions, depository institution holding companies, and nonbank financial companies supervised by the Board of Governors. The minimum leverage (and risk-based) capital requirements established under this paragraph shall not be less than the generally applicable leverage (and risk-based) capital requirements, which shall serve as a floor for any capital requirements that the agency may require, nor quantitatively lower than the generally applicable leverage (and risk-based) capital requirements that were in effect for insured depository institutions as of the date of enactment of this Act. (Footnote 1)

In other words, the risk-based capital and leverage capital ratios applicable to FDIC-insured depository institutions will be applied to bank holding companies and systemically important institutions. Since these ratios represent a minimum standard, other regulatory guidelines, such as Basel III, could still be viable as long as their rules were stricter. Table 4 provides the current capital adequacy standards for depository institutions. It is of some note that these requirements are to be enacted within 18 months, though small institutions are generally exempt. Also important is the case in which, to the extent a financial institution is deemed systemically important, the Federal Reserve may exempt that institution if the capital and leverage requirements are not appropriate.

Table 4: Capital Adequacy Standards for Depository Institutions under the Dodd-Frank Act

(%)

Item	Well Capitalized	Adequately Capitalized
Tier 1 (risk-based capital ratio)	6	4
Total (risk-based capital ratio)	10	8
Leverage ratio	5	4

Source: Footnote 1

While the definitions of capital in the Dodd-Frank Act and Basel III do not perfectly coincide (so the comparison is not perfect), the proposed leverage ratio in Basel III is actually lower, i.e., 3%. The Dodd-Frank Act goes further still by requiring that bank holding companies with at least $50 billion in assets or systemically important institutions maintain a debt to equity ratio of no more

[6] See Chapter 6: Capital, Contingent Capital and Liquidity Requirements by V. Acharya, N. Kulkarni, and M. Richardson in Acharya, Cooley, Richardson, and Walter (2010).

than 15 to 1 (or a leverage ratio of at least 6.5%), upon a determination by the Council that such company poses a grave threat to the financial stability of the United States and that the imposition of such requirement is necessary to mitigate the risk that such company poses to the financial stability of the United States. (Footnote 1)

Along with the possible recommendation for more stringent capital requirements for systemically important financial institutions, the act explicitly calls for additional capital requirements for depository institutions, bank holding companies, and systemically important nonbank financial companies that address systemic risk arising from

> (i) significant volumes of activity in derivatives, securitized products purchased and sold, financial guarantees purchased and sold, securities borrowing and lending, and repurchase agreements and reverse repurchase agreements; (ii) concentrations in assets for which the values presented in financial reports are based on models rather than historical cost or prices deriving from deep and liquid two-way markets; and (iii) concentrations in market share for any activity that would substantially disrupt financial markets if the institution is forced to unexpectedly cease the activity. (Footnote 1)

Further, and much unlike Basel III, the Dodd-Frank Act recognizes that systemic risk of assets and balance sheets can vary over time, due to both change in underlying risk of assets and collective shifts in risk choices of financial firms. A possible approach to dynamically adjust to such variations is to periodically project losses of the finance sector into infrequent but plausible future scenarios, assess whether the finance sector has capital to be able to withstand these losses, and, in case of capital shortfalls, decide on an early recapitalization plan. In order to be able to project into infrequent future scenarios, such scenarios need to be modeled and considered 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 during February–May 2009 for bank recapitalization; in 2010–2011 for determining which banks could resume dividend payouts; and in 2012 (currently under way) for assessment of bank solvency to a significant shock to the US stock market, housing market, and unemployment rate.

To report the objectives and findings of the first of these stress tests, I quote from the SCAP report:

> From the macro-prudential perspective, the SCAP was a top-down analysis of the largest bank holding companies (BHCs), representing a majority of the US 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, e.g., a positive identified SCAP buffer for 10 BHCs and no need for a buffer for the remaining nine.[7]

The Dodd-Frank Act 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

[7] See the Federal Reserve Bank of New York report on the SCAP exercise (Hirtle, Schuermann, and Stiroh 2009).

> 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. (Footnote 1)

Moreover, systemically important financial institutions are required to perform semi-annual tests. Such assessments should be done more frequently in a crisis and may complement the firm's own test. Valuable knowledge and experience has been developed in the exercise of the SCAP 2009, and this could be built upon by regulators in the US. The recent decision to determine whether bank holding companies should resume dividend payouts—and by how much—was done based on a stress test (though transparency of this stress test in 2011 was lower than that of the SCAP in 2009). The Bank of America was one bank holding company that was not allowed to resume its dividends; most others were allowed to.

One specific, and generally sensible, rule that appears in both the Dodd-Frank Act and Basel III is

> in establishing capital regulations…, the Board shall seek to make such requirements countercyclical, so that the amount of capital required to be maintained by a company increases in times of economic expansion and decreases in times of economic contraction, consistent with the safety and soundness of the company. (Reference) (Footnote 1)

While Basel III is currently short on specifics, it is clear countercyclical capital adequacy standards will be a key component of both the Dodd-Frank Act and Basel III.

One way of implementing countercyclical regulation is to ensure financial firms are well-capitalized against their losses in stress tests, where stress scenario severity is not adjusted to be moderate even in good times or booms. Another way (and what is appearing to be the proposed Basel III approach) is to expand (shrink) the size of the capital conservation buffer in each economy if there is a positive (negative) deviation of the credit–gross domestic product (GDP) ratio with respect to certain pre-specified thresholds, such as its trend (other macroeconomic variables or groups of variables are also candidates for the assessment of excessive credit risk). While research is on its way to determine if these are sensible ideas, emerging evidence suggests that tying capital requirements to GDP growth rather than to credit–GDP deviations from trend produces more countercyclical capital buffers.

On liquidity requirements, while the Dodd-Frank Act explicitly calls for the regulator to take into account "the amount and types of the liabilities of the company, including the degree of reliance on short-term funding" in setting prudential standards for systemically important institutions, and for these standards to include, among others, "liquidity requirements" and "short-term debt limits," there are no other specifics. These are left to the Federal Reserve and other regulators. It is reasonable to infer, however, that the US regulators will look to the new liquidity requirements as part of Basel III.

Overall, the details of the Dodd-Frank Act implementation are, perhaps rightly, left to the regulators. While the Act's recommendations will be implemented later by the Federal Reserve, it is clear that bank holding companies with more than $50 billion in assets, or systemically important nonbank financial companies (as assigned by the Financial Stability Oversight Council), will be subject to these as-yet unknown additional capital and liquidity adequacy standards.

That said, it does seem to be the case that some significant improvements are possible by closing major capital loopholes and relying less on rating agencies. With respect to the loopholes, a good rule of thumb is that, if off-balance-sheet financing is effectively recourse to the banks, the capital at risk should be treated as such. Moreover, counterparty credit risk

exposures to financial firms, including OTC derivatives and securities financing transactions, should also be taken into account. While Basel II did expand the notion of risk for financial institutions, in hindsight the accord chose simplicity over accuracy in the determination of how capital should be treated. As for the reliance on ratings, it seems reasonable to consider not only the credit risk of "defaultable" assets (as defined by rating agencies) but also liquidity (funding and market) and specification risks.

The Dodd-Frank Act does make considerable progress on these fronts by

- addressing the conflict of interest inherent in the rating agency business model and the government's regulatory reliance on ratings;[8]
- including off-balance-sheet activities in computing capital requirements;[9] and
- with respect to derivatives, (i) requiring margin requirements that are centrally cleared or over-the-counter, (ii) reporting to data repositories and real-time price-volume transparency, and (iii) providing authority for prudential regulators to consider setting position limits and penalizing engagement in derivatives whose purpose is "evasive."[10]

On balance, the Dodd-Frank Act in the US leaves open greater possibilities for the regulators to address systemic risk through capital requirements, for instance by identifying a set of institutions as systemically important financial institutions (SIFIs), and undertaking periodic stress tests to ensure these institutions are well capitalized in aggregate stress scenarios.

On 4 November 2011, the Bank for International Settlements and the Financial Stability Board released a list of global SIFIs, which included 29 institutions:

- eight are headquartered in the US (Bank of America Corporation, Bank of New York Mellon Corporation, Citigroup, Goldman Sachs Group, JP Morgan Chase, Morgan Stanley, State Street, and Wells Fargo);
- four are headquartered in the United Kingdom (Barclays, HSBC Holdings, Lloyd's Banking Group, and Royal Bank of Scotland);
- four have headquarters in France (Banque Populaire, BNP Paribas, Crédit Agricole, and Société Générale);
- three have headquarters in Japan (Mitsubishi UFJ Financial Group, Mizuho Financial Group, and Sumitomo Mitsui Financial Group);
- two are headquartered in Germany (Deutsche Bank and Commerzbank) and two in Switzerland (UBS and Credit Suisse); and

[8] HR 4173, Title IX "Investor Protection and Improvements to the Regulation of Securities", Subtitle C "Improvements to the Regulation of Credit Rating Agencies.

[9] HR 4173, Title I, Subtitle C "Additional Board of Governors Authority for Certain Nonbank Financial Companies and Bank Holding Companies", Sec. 165 "Enhanced supervision and prudential standards for nonbank financial companies supervised by the Board of Governors and certain bank holding companies"

[10] Missing from the Dodd-Frank Act, however, is any recognition (except in the case of OTC derivatives) that, once these standards are imposed on one set of financial institutions, financial activity most likely will move elsewhere in the financial system to firms not subject to these standards. Of course, this reallocation would not be a problem if the systemic risk is reduced by separating it from core functions of financial intermediaries. The recent financial crisis, however, tells a different tale, as much of the systemic risk emerged from the shadow banking system, that is both less regulated and less subject to capital and liquidity requirements, albeit with weaker government guarantees.

- there is one each in Belgium (Dexia), the People's Republic of China (Bank of China), Italy (Unicredit Group), the Netherlands (ING Groep), Spain (Banco Santander), and Sweden (Nordea AB).

While the Basel Committee on Banking Supervision (BCBS) has designated a list of global SIFIs, the overall Basel III approach is to rely primarily on risk-weighted assets, with a capital conservation buffer. The BCBS does mention stress tests, but at bank level (rather than subjecting the banking sector as a whole to common stress as would be necessary for tying capital requirements to systemic risk, and the BCBS is still reviewing this, with no immediate clarity) and the need for additional capital, liquidity, or supervisory measures to reduce the externalities created by systemically important institutions (global SIFIs).

4. CURRENT IMPLEMENTATION STATUS OF DODD-FRANK ACT AND BASEL III REFORMS

The long-term implementation of these reforms started in the autumn of 2010. The Dodd-Frank Act sets a variety of deadlines for rule-making on the prudential regulators, mostly 1 year from when the Act was enacted (July 2010). For instance, initial proposals for designating financial institutions as systemically important ones, defining which derivatives will be cleared centrally and on what platforms, the FDIC's orderly liquidation authority for systemically important institutions, and separating proprietary trading from bank holding companies are all due some time in the second half of 2011. However, many of these rules will then be up against a public opinion and appeals period, and implementation will follow in the few years after the rules are finalized. In summary, considerable uncertainty still remains but much clarity should emerge by autumn 2011.[11]

The Basel III rules are largely laid out (e.g., see Saunders (2011), for further detail, with further clarity to be provided for a capital conservation buffer (especially its countercyclical implementation), as well as on whether contingent capital (a form of debt capital that converts to equity based on predesigned triggers) would be a part of Basel III requirement. Given the lengthy implementation phase (from now until 2013 for the first installment, and then until 2019), it is quite likely that rules may undergo at least some changes, even on the core capital and liquidity requirements.

While the Dodd-Frank Act, with all its limitations, represents a comprehensive overhaul of finance sector reforms in the US, such clarity is missing elsewhere in Western economies. The United Kingdom (UK) has set up the Independent Banking Commission, under the guidance of Sir John Vickers of Oxford University, to come up with proposals for reforming the finance sector in the UK. The UK is one country, where, given the support of Bank of England Governor Mervyn King, the idea of "structural reforms" along the lines of Glass–Steagall separation of trading activities from commercial banks, is still under debate. The UK is also among the few countries where the idea of relatively high bank capital ratios (in excess of 15% against unweighted assets) is still being debated. There is much less clarity on derivatives reforms in the UK, though before its inclusion into the Bank of England, the Financial Services Authority did present a view, somewhat surprisingly, of not pushing for centralized clearing and

[11] Some useful links to follow concerning ongoing implementation of the Dodd-Frank Act are (i) the Dodd-Frank section of the Securities Law Practice Center at http://seclawcenter.pli.edu/category/dodd-frank-act/, (ii) http://www.americansecuritization.com/uploadedFiles/ASFDodd-Frank_Rulemaking_Schedule.pdf, (iii) http://www.sec.gov/spotlight/dodd-frank/dfactivity-upcoming.shtml, and (iv) http://dodd-frank.com/sec-falls-short-on-rulemaking-agenda/

counterparties for derivatives markets. It is an open debate as to whether some of this reluctance is due to the international race for attracting greater order flow in markets such as credit derivatives where London thrived. Finally, the UK—even prior to the global financial crisis—had stricter liquidity requirements (holdings of pounds sterling at banks based on 1-week projected cash flow needs) than in other parts of the world. These have been strengthened but Basel III is likely to supersede these over time.

Finally, there is even less clarity as far as reforms in Europe are concerned. On one hand, Europe is likely to adhere to the Basel III reforms. On the other hand, there are a number of institutional changes taking place in the euro zone. For instance, the European Systemic Risk Board has been set up with an academic advisory council to guide the efforts on identifying systemically risky institutions and designing macroprudential regulation more broadly. Similarly, a college of supervisors has been put in place to provide a pan-euro-zone body that can share information about banks across regions and geographies. The current focus, however, is on resolving the sovereign credit risk issues in the euro zone, for which a pan-European stabilization fund has been set up. These sovereign risk issues in the euro zone are intertwined with bank solvency issues, and until they are resolved, reforms of the European finance sector are likely to be up in the air. After all, a significant crisis triggered by the restructuring debt of a euro zone country is not only possible, but highly probable at the moment.

5. CONCLUSION: LESSONS FOR EMERGING MARKETS FROM THE GLOBAL FINANCIAL CRISIS, THE DODD-FRANK ACT, AND BASEL III

5.1 Government Guarantees

Explicit and implicit government guarantees, such as deposit insurance and too-big-to-fail, can generate significant moral hazard in the form of risk-taking incentives. Even without 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 for the US. 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 recently erode in US, the moral hazard problem resurfaced.

To some degree, this lesson was already known in emerging markets. The number of countries offering explicit deposit insurance increased from 12 to 71 in the 30-year period starting in the 1970s. Research looking at a large cross-section of countries since 1980 has concluded that deposit insurance increases the likelihood of a banking crisis. Moreover, the likelihood and severity of the crisis are greater for countries with weaker institutional and regulatory environments and the greater the coverage offered depositors. 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. However, in many Asian economies, including India, the charging method for deposit insurance is poor.

In fact, to the extent that significant parts of finance sectors are state owned, the guarantees from the government exceed just deposit insurance. State ownership also brings with it the bailout “genie.” As has been demonstrated in Ireland during 2008–2011, unlimited depositor guarantees and regulatory forbearance increase the fiscal costs of financial crises. Moreover,

these actions increase the expectation that this will be the government's solution for future crises, thus killing market discipline and increasing the chances of risk-shifting amongst financial institutions.

Of course, many analysts might point to the apparent success of the guarantees employed in the US in the current financial crisis, and even more so to the stellar success stories of India and the People's Republic of China (PRC) and the government backing they received. Let us analyze these latter cases as examples in emerging markets.

Consider India first. A significant part of the Indian banking system is still state owned. While they are generally considered less efficient and less sophisticated than the private sector banks, public sector banks in India in fact grew in importance during the financial crisis (which for India could be considered as 2008). The reason is simple and somewhat perverse: there was a "flight to safety" away from private sector banks, which have limited deposit insurance, to public sector banks, which are 100% government guaranteed (effectively so, as with the GSEs in the US). This is because the relevant law (the Bank Nationalization Act) explicitly places 100% liability for public sector banks on the government.

Hence, when the financial crisis hit India—especially in autumn 2008, by which time the Indian stock market had plummeted by more than 50% and corporate withdrawals from money market funds threatened a chain of liquidations from the finance sector—there was a flight of deposits to state-owned banks.[12] In the period 1 January 2008 through 24 February 2009, the market capitalization of public sector banks fell by 20% less than that of the private sector banks. Interestingly, this occurred even though, based on a pre-crisis measure of systemic risk (the Marginal Expected Shortfall measure[13]), public sector banks were substantially more likely to lose market capitalization during a market-wide downturn than private sector banks. In addition, within the private sector banks, those with higher systemic risk suffered more during the economy-wide crisis of 2008 (as the systemic risk measure would predict), whereas within public sector banks those 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.

The trend of benefits to state-owned banks at the expense of privately owned banks continues. Recent reports suggest that loan growth of private sector banks in India has not been that high in 2009, whereas public sector bank loans have grown in many segments, such as vehicle-backed finance, by as much as 10%. In essence, government guarantees have created an uneven playing field, that is destabilizing for two reasons. First, it has weakened those institutions that are in fact subject to market discipline. Second, it has raised prospects that the "handicapped" private sector banks (due to lack of comparable government guarantees) may have to lend more aggressively—or take other risks—to maintain market share and generate comparable returns to shareholders. Bank regulation in India tends to be conservative, 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 regulator scrutiny or legal mandate.

[12] In a notable incident, Infosys, the bellwether of Indian technology and a NASDAQ-listed company, moved its cash-in-hand from the ICICI Bank, one of the largest private sector banks, to the State Bank of India, the largest public sector bank.

[13] Acharya, Pedersen, Richardson, and Philippon (2010) and Acharya and Kulkarni (2010). In particular, the Marginal Expected Shortfall was calculated as follows: the worst 5% days for the S&P CNX nifty index (or Bombay Stock Exchange sensex index) were taken for 2007. On these days, the average return of a financial firm was measured. This average return is the Marginal Expected Shortfall for that financial firm. (The results are available from the authors upon request.)

In the case of the PRC, as a part of its fiscal stimulus, the Government of the PRC essentially employed its almost entirely state-owned banking sector to lend at large to the economy. From July 2008 to July 2009, lending by the banking sector in the PRC grew by 34%. While this has clearly helped the PRC economy recover quickly from the effect of the financial crisis in the US—and its consequent effects on global trade—much of the growth in banking sector loans mirrors the growth in corporate deposits. In other words, loans are often sitting idle on corporate balance sheets, a phenomenon that is generally associated with severe agency problems in the form of excessive investments. While 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 the 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: the PRC has bailed out its entire banking system more than once before.

The examples of India and the PRC highlight the classic risks that arise from government guarantees. First, they create an uneven playing field in banking sectors where some banks enjoy greater subsidies than others. This invariably causes the less-subsidized players to take excessive leverage and risks to compensate for a weak subsidy, and the more-subsidized players to simply make worse lending decisions given the guarantees. Second, government-guaranteed institutions are often employed to disburse credit at large to the economy, but this invariably ends up creating distortions as the costs of the guarantees are rarely commensurate with risks taken.

Both of these problems festered because of government guarantees and contributed to the financial crisis of 2007–2009. India and the PRC should not rest on their laurels of rapid recovery from this global economic crisis. Instead, they need to safeguard financial and economic stability by engaging in rapid privatization of their banking sectors, or at least stop inefficient subsidization of risk taking through state-owned banks. The genie of government guarantees brought out to deal with the crisis of 2008 needs to now be put back into the bottle, as these guarantees not only weaken the banks that are guaranteed but they also create systemic risk by weakening competing banks, subsidizing corporations, and fueling excessive asset speculation. And this is all true even leaving aside the natural risks stemming from politically motivated priority lending targets subjected to state-owned banks, their inevitable underperformance, and eventual bailouts.

5.2 Systemic Risk of Emerging Markets and Coordinated Regulation

There are various ways a financial institution produces systemic risk when the institution fails: counterparty risk, fire sales, and “runs.” One of the principal conclusions from that analysis is 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. The exact same analogy for financial institutions within a domestic market can be made with respect to international markets, and especially so for emerging markets.

Even if a domestic regulator penalized a multinational financial firm for producing systemic risk locally, does this penalty carry through to all the international markets a firm operates in? In other words, should the penalty be more severe as failure can lead to systemic consequences elsewhere? The issue becomes even more complicated because financial institutions have an incentive to conduct regulatory arbitrage across national jurisdictions, i.e., 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. But given their interconnected nature,

such institutions nevertheless expose all jurisdictions to their risk taking. Individually, jurisdictions may prefer to be lightly regulated in order to attract more institutions and thereby jobs.

The "poster child" of the preceding crisis for being internationally interconnected is Iceland. Iceland, a tiny country with its own currency, allowed its banking sector to grow almost tenfold in terms of foreign assets compared to that of its own GDP. Its huge leverage aside, its survival was completely dependent on conditions abroad. The systemic risk of the three largest Icelandic banks (Glitnir, Landsbanki, and Kaupthing) also went beyond its own borders. Because the banks had fully exploited internal expansion within Iceland, they opened up branches abroad, in particular, the UK and the Netherlands, by offering higher interest rates than comparable banks in those countries. When the Icelandic banks began to run aground and faced massive liquidity problems, in a now somewhat infamous event, the UK authorities invoked an antiterrorism act to freeze the UK assets. Essentially, Iceland as a country went into shutdown.

For at least several centuries, the most common source of systemic risk has been the sudden flight of capital, known commonly as a “run”. It is well known that, for many emerging markets, capital inflows are their lifeblood. There are numerous examples of capital flowing into new emerging markets only to be suddenly withdrawn at the onset of a crisis. These runs can leave the corporate and banking sector of the developing country devastated, especially if there are currency, liquidity, or maturity mismatches between assets and foreign liabilities. An example from the recent crisis is that net private capital flows to emerging Europe fell from around $250 billion in 2008 to an estimated $30 billion in 2009. Not surprisingly, emerging Europe has been one of the hardest hit in terms of the impact of the crisis on its GDP and internal institutions.

The current crisis was severe in both its financial effect (e.g., spike in risk aversion of investors) and economic impact (e.g., largest drop in global trade since World War II). Compared to past banking crises, therefore, it is quite surprising that emerging markets got through by-and-large unscathed. This can be partly attributed to better (or excess!) internal planning (a substantial stock of international reserves) and partly to liquidity funding by international organizations such as the IMF and World Bank. Both of these elements suggest an approach to international coordination that mirrors how one might regulate systemic risk domestically.

Emerging markets need to coordinate with their larger brethren on prudent measures such as leverage limits (see section C below) and currency reserves. As a reward, these markets could access international lender-of-last-resort facilities during a liquidity event and, in a systemic crisis in which there is a run on all financial institutions, employ loan guarantees and recapitalizations that are fairly priced and impose low costs on taxpayers. Of course, it would be necessary to shut down and resolve insolvent institutions to maintain the right incentives in good times.

If national regulators can agree upon a core set of sensible regulatory principles, then the constraints imposed by such alignment would substantially reduce regulatory arbitrage through jurisdictional choice. Central banks could present their proposals with specific recommendations to their respective national authorities, and seek consensus internationally through the Financial Stability Board or committee of the Bank for International Settlements. The lessons learned from this crisis should be especially useful to aid in these discussions.

5.3 Macroprudential Regulation: Leverage Restrictions versus Sector Risk-Weight Adjustments

Given the various conceptual and implementation issues I have raised with the current Basel approach of charging capital requirements based on *static* risk weights of assets, it is worthwhile

considering the alternative macroprudential approaches. The most popular of these approaches is a direct leverage restriction. One variant of this takes the form where it is imposed and enforced at the level of each institution. No risk weights are attached so that (perhaps with the exception of highest-rated government debt) all other assets are treated equally in terms of their potential risks. Then, the leverage restriction is simply that the unweighted assets of the institution do not exceed its equity value by more than a threshold, say 12:1 or 15:1. Alternately, leverage restriction can be imposed at the level of each asset class, e.g., mortgages cannot have loan–value ratios that are greater than 80% (as recently employed by the Reserve Bank of India against low-income housing mortgages with loan–value ratios of more than 90%).

While apparently simple, these restrictions in fact require a fair level of regulatory oversight and sophistication. If enforcement is weak, a shadow banking system can evolve, as was the primary problem in the US in the build-up to the crisis. The regulation must now ensure that all assets—on and off balance sheet—are suitably accounted for in leverage calculations (e.g., by charging the recently founded council of regulators in India to take a macro view of various assets and markets and ensuring that commonly agreed leverage restrictions are met). Similarly, if regulators have to use coarse leverage measurements on complicated securities and derivatives, regulatory arbitrage would push the finance sector towards innovation of such products. Again, this would call for sufficiently broad-scoped asset-level leverage requirements. While it is conceivable that it would be useful to ban outright certain derivatives and innovation, there is no evidence that overall this has worked. Regulators are often playing catch-up to the finance sector. Hence, more prudent enforcement would ensure that the regulatory perimeter is irrefutably enforced, so that *all* assets and/or risks of the finance sector are dealt with adequately while limiting leverage of the system.

Another macroprudential approach that is employed by some central banks in emerging markets (such as employed by the Reserve Bank of India during 2006–2007 in dealing with the housing boom) is the sector risk-weight adjustment approach. This approach requires horizontal aggregation of financial institutions' balance sheets and risk exposures to identify over time—say, each year—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 majority of all risks on bank balance sheets, then the regulators could proactively react to limiting any further build-up. This could be achieved for instance 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 finance 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 and also relies heavily on regulatory discretion turning out to be prescient in identifying risk pockets and having sufficient will in good times to act against fast-growing asset classes.

Of course, there is no reason why the various approaches outlined above 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 finance sector. Rule-based approaches, such as in the Basel capital requirements above, exonerate the regulators from relying too much on discretion and therefore from influencing activity by the industry; discretionary-based approaches counterbalance by making regulation sufficiently dynamic and adaptive as well as by creating constructive ambiguity in minds of industry about increasing correlated risks and leverage. My recommendation, however, is that discretionary approaches such as sector risk-

weight adjustments are also sufficiently rule based, to the extent possible, in terms of the principles of the framework guiding the adjustments.

5.4 Government Fiscal Policy and Debt Management

As the euro zone sovereign crisis has shown (see, e.g., Acharya, Drechsler, and Schnabl 2010), when a fully-fledged financial crisis hits an economy the government balance sheet also gets embroiled, and the worse the starting condition of the government balance sheet (in terms of its debt–GDP ratio, for instance), the worse its ability to cope with the crisis. This effect on euro zone countries—and the somewhat muted but still significant effect on the US—suggests that governments should manage their fiscal policy and debt levels in a manner that is countercyclical to the rest of the economy. In the context of India, the increasing fiscal deficits suggest a potentially worrisome path where the high growth and boom phase of the economy is coincident with a somewhat profligate government. India's finance sector is not yet too deep, in that fixed-income markets are currently poorly developed, so that there is great reliance on the banking sector. While the Reserve Bank of India has historically done a prudent job of containing potential excesses of the banking sector, and the well-developed equity market counterbalances to some extent the lack of thriving fixed-income markets, it is clear nevertheless that there is a great deal of "fat" in the government's fiscal condition. There are excessive subsidies to farming and fuel, there are explicit and implicit government guarantees to state-owned banks, and a number of state-owned enterprises and sectors are poorly run and managed. A tidying up of the governments' balance sheet on most dimensions may be India's best preparation for any risks that it is exposed to, internally or externally.

REFERENCES

Acharya, V. V., T. Cooley, M. Richardson, and I. Walter. 2010. *Regulating Wall Street: The Dodd-Frank Act and the New Architecture of Global Finance*. Hoboken, NJ: John Wiley and Sons. http://www.wiley.com/buy/9780470768778

Acharya, V. V., T. Cooley, M. Richardson, and I. Walter. 2011. *Dodd-Frank: One Year On.* NYU-Stern School of Business and Center for Economic and Policy Research e-book. http://www.voxeu.org/index.php?q=node/6742

Acharya, V. V., I. Drechsler, and P. Schnabl. 2010. A Pyrrhic Victory?—Bank Bailouts and Sovereign Credit Risk. Working paper. New York, NY: NYU-Stern School of Business.

Acharya, V.V. and N. Kulkarni. 2010. State Ownership and Systemic Risk: Evidence from the Indian financial sector during 2007–09. Working paper. New York, NY: NYU-Stern School of Business.

Acharya, V. V., L. Pedersen, T. Philippon, and M. Richardson. 2010. Measuring Systemic Risk. Working paper. New York, NY: NYU-Stern School of Business.

Acharya, V.V., P. Schnabl, and G.Suarez. 2010. Securitization without risk transfer. Forthcoming*. Journal of Financial Economics.*

Acharya, V.V., S. van Nieuwerburgh, M. Richardson, and S. White. 2011. *Guaranteed to Fail: Fannie Mae, Freddie Mac and the Debacle of Mortgage Finance.* Princeton University Press. http://www.stern.nyu.edu/Newsroom/FacultyResearch/CON_024693)

Bank for International Settlements. 2010(a). *The Group of Governors and Heads of Supervision reach broad agreement on Basel Committee capital and liquidity reform package, Annex 1* [press release]. Basel, Switzerland. http://www.bis.org/press/p100726.htm

Bank for International Settlements. 2010(b). *Group of Governors and Heads of Supervision announces higher global minimum capital standards, Annex 2* [press release]. Basel, Switzerland. http://www.bis.org/press/p100912.htm

Hirtle, B. H., T. Schuermann, and K. Stiroh. 2009. *Macroprudential Supervision of Financial Institutions: Lessons from the SCAP*. Federal Reserve Bank of New York Staff Report No. 409. New York, NY.

IMF. 2008. *Global Financial Stability Report.* Washington, DC. (April).

Saunders, A. 2011. Basel III: The Reform Proposals Summary. New York: NYU-Stern School of Business. http://pages.stern.nyu.edu/~sternfin/vacharya/public_html/Dodd-Frank-Basel-and-India-by-Viral-Acharya-2.pdf