

Systemic Risk and Macro-Prudential Regulation

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Introduction

Systemic risk can be broadly thought of as the failure of a significant part of the financial sector – one large institution or many smaller ones – leading to a reduction in credit availability that has the potential to adversely affect the real economy. Given the interconnectedness of the modern financial sector, and for the purposes of systemic regulation, one should think of a “financial firm” as not just the commercial bank taking deposits and making loans, but also include investment banks, money-market funds, insurance firms, and potentially even hedge funds and private equity funds.² There are several types of systemic risk that can be generated from the failure of a financial institution, and especially so during a financial crisis, such as counterparty risk, spillover risk due to forced

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² The scope of macro-prudential regulation is the financial industry, rather than any cyclical sector in the economy, because of the financial industry’s intermediation role. Financial institutions are a unique part of the economy in that they act as intermediaries between parties that need to borrow and parties willing to lend. Indeed, poor performance of the financial industry will impose additional losses to the rest of the economy, from entrepreneurs to retirees.

asset sales, increased cost of inter-bank borrowing, and the risk of “runs” on the shadow banking system.³

Current financial regulations such as the Basel capital requirements are *micro-prudential* in nature, in that they seek to limit each institution’s risk. However, unless the external costs of systemic risk are internalized by each financial institution, the institution will have the incentive to take risks that are borne by others in the economy. It is in this sense that the financial institution’s risk is a negative externality on the system.⁴ Thus, financial regulation should be *macro-prudential* in nature and focused on limiting systemic risk, that is, the risk of a crisis in the financial sector and its spillover to the economy at large. Absent such macro-prudential regulation, economies run the risk of excessively large amplifiers on top of the normal and cyclical macroeconomic fluctuations. In the limit, severe financial crises can cause prolonged loss of economic growth and welfare (e.g., “lost decade” in Japan following the crisis of late 1980’s and current uncertainty around economic growth of the United States).

Consider some examples from the global financial crisis of 2007-09 to illustrate these ideas. More details on these and other cases are in Appendix A.

On the weekend following Friday, March 14, 2008, the United States government helped engineer JP Morgan’s purchase of Bear Stearns by guaranteeing \$29 billion of subprime-backed securities. Without this involvement, it is highly likely Bear Stearns would have declared bankruptcy as there had been a classic run on their assets. Though Bear Stearns was the smallest of the major investment banks, it had a high degree of interconnectedness to other parts of the financial system. It was a major counterparty risk for three reasons: (i) it was an important player in the repo market, (ii) it was the leading prime broker to hedge funds, and (iii) it was a major counterparty in the credit default swap (CDS) market.

Over the weekend following Friday, September 12, 2008, the government attempted to engineer a purchase of Lehman Brothers by other financial institutions but attempts failed without any direct government support and Lehman went bankrupt. In hindsight, Lehman Brothers contained considerable systemic risk and led to the near collapse of the financial system (though that may have occurred regardless).

Why did the government let Lehman fail? Ex post, it is not clear whether (i) the government thought Lehman was no longer systemic because of the Fed’s opening of lending facilities to financial institutions, or (ii) as they now argue,

³ Goodhart (2010) also considers asymmetric information which can be a significant contributor to markets freezing up, as also issues concerning governance structure of banks which due to shareholders versus creditor/tax-payer conflicts can lead to socially inefficient outcomes.

⁴ An analogy can be made to an industrial company that produces emissions that lower its own costs but pollute the environment.

Lehman could not be rescued because Lehman did not have adequate collateral to post to access these facilities. In any event, like Bear Stearns, Lehman was a major player in various parts of the capital market. Its bankruptcy opened up the possibility that similar firms could also go bankrupt, causing a potential run on their assets. This led to Merrill Lynch selling itself to Bank of America. The other two investment banks, Morgan Stanley and Goldman Sachs, saw the cost of their five-year CDS protection rise from 250 basis points (bps) to 500 bps and 200 bps to 350 bps (respectively), and their stock prices fell by 13.54% and 12.13% (respectively) from Friday, September 12th, to Monday, September 15th. Both these investment banks adopted the status of bank holding companies.

The irony of the situation is that letting Lehman fail was supposed to draw a line in the sand and limit moral hazard, but it had precisely the opposite effect. Having been to the brink of collapse, it is now clearer than ever that the government will not let any other large complex financial institution fail (unless and until a credible resolution mechanism to deal with multiple, large financial firm failures is put in place).⁵ Moral hazard has therefore been strengthened, not weakened. These examples make it clear that there are two distinct reasons for regulating systemic risk: externalities and explicit or implicit government guarantees.⁶

1. Externalities

The first reason to regulate systemic risk is the presence of externalities between institutions. By its very nature, systemic risk is a negative externality imposed by each financial firm on the system. Each individual firm is clearly motivated to prevent its own collapse but not the system as a whole. So when a firm considers holding large amounts of illiquid securities, or concentrates its risk into particular ones (e.g., subprime-based assets), or puts high amounts of leverage on its books (as a way to drive up excess returns), its incentive is to manage its own risk/return tradeoff and not take into account the spillover risk it imposes on other financial institutions. An important externality comes from the resolution issue of failed institutions. When banks fail individually, other healthy banks can readily buy them, or otherwise take up most of their lending and

⁵ It has been stressed (see, for instance, Bank of England, 2009) – and rightly so – that subjecting financial firms purely to the corporate insolvency law may be insufficient if the failing firm has “systemically important liabilities”, namely creditors who can exert run-like behavior for wanting immediacy on repayments and asset liquidations.

⁶ We emphasize that systemic risk is not only driven by the size of the failed institutions. While it is possible that the failure of a large individual institution could cause inter-bank markets to dry up, such contagion risk becomes a systemic concern only when other institutions are not healthy to start with (e.g., the failure of Lehman Brothers in 2008 as compared to the failure of Barings in 1995).

related activities. Thus, real losses primarily arise when banks fail together and this collective failure cannot be readily resolved.⁷

Our suggestion in this monograph is to give financial institutions an incentive to internalize this negative externality. Doing so will give them an incentive to limit their contribution to systemic risk.

2. **Explicit or implicit government guarantees**

In addition to direct externalities, implicit government guarantees also create the need for regulating systemic risk. Implicit guarantees create moral hazard in several ways:

- Guarantees to state-owned enterprises such as government-sponsored enterprises (Fannie Mae and Freddie Mac in the United States, Landesbanken in Germany, etc.) and state-owned banks (such as in banking sector of many Asian countries such as India, China, among others), which allows them to grow and remain inefficient at the expense of private sector firms;⁸
- Deposit insurance for commercial or depository institutions that is not adequately priced based on systemic risk contributions of these institutions makes bank risk-taking subsidized and market discipline compromised;
- “Too-big-to-fail” creates a bias towards firms that are excessively large and levered;
- “Too-interconnected-to-fail” leads firms towards excessive counterparty risk;
- “Too-many-to-fail” leads firms to take on too much systemic risk.⁹

Moral hazard in all these cases is particularly severe. Even if the regulator would like to commit ex-ante to not bail out failed institutions, this is not credible ex post. The costs of such bailouts tend to be significant, often a non-trivial fraction of the GDP of economies

⁷ See Acharya (2001) for a discussion. Hoggarth, Reis and Saporta (2002) find that the cumulative output losses (“gap” compared to normal-time GDP) have amounted to a whopping 15-20% annual GDP in the banking crises of the past 25 years. Recent evidence from the current crisis suggests that there has been a freezing up of lending from banks to corporations, except for drawdowns on banks’ pre-committed lines of credit (Ivashina and Scharstein, 2008). Such freeze in lending could significantly affect growth in the real sector of the economy.

⁸ Acharya, van Nieuwerburgh, Richardson and White (2011) paint a compelling picture that Fannie Mae and Freddie Mac, the government-sponsored enterprises in the United States to securitize mortgages, effectively participated in a substantial race to the bottom in risk-taking with private-sector financial institutions, in which both their government mandates for lending to affordable housing and their poor regulatory capital requirements (given their deteriorating portfolios since 1991) played a crucial role.

⁹ See Acharya (2001) and Acharya and Yorulmazer (2007) for a discussion.

involved.¹⁰ All these reasons warrant macro-prudential regulation, that is, regulation of systemic risk, rather than micro-prudential regulation, that is, regulation of individual institution's risk of failure.

Firms are often regulated to limit their pollution or are taxed based on the externality they cause. Similarly, regulation should consider a "tax" on firms' contribution to systemic risk. In an ideal scenario, this requires measuring the extent of the externality. To the extent, market-based signals are available to assess the risk of institutions, and the correlation of this risk with aggregate risks of the economy, systemic risk contributions of financial firms can be measured (Section II).

Section II, however, also entertains the possibility that regulators can generate their own valuable information to supplement market data, or where market data are not available or not too reliable (as in some emerging markets). In particular, "stress tests" that subject financial firms to a common set of macro- or aggregate shocks can assess whether they would be adequately capitalized in such scenarios. Capital shortfalls of firms in such stress tests could be an alternative measure of their systemic risk.

Depending upon the availability of market data to assess systemic risk and/or stress-test based measures of systemic risk, section III proposes regulation of systemic risk. There are three alternatives: capital requirements based on systemic risk contributions, tax or premiums along the lines of deposit insurance premiums, and leverage restrictions as well as adjustments of sector risk-weights in (Basel-style) capital calculations based on outcomes of stress tests. While all of these may be potentially implementable in an emerging markets context, they may serve different purposes in practice. Capital requirements may be more easily gamed than premiums which require upfront cash payments. However, to the extent systemic risk contributions are not perfectly assessable, direct leverage restrictions (e.g., no loan-to-value ratios that exceed 80 percent or no leverage for financial firms based on overall assets that exceeds 15:1) lend macro-prudential regulation a certain amount of robustness to regulator's own "model risk" in assessing systemic risk. Finally, sector risk-weight adjustments (e.g., increase risk weight of mortgages if the entire financial sector is found in a stress test to be increasing exposure to it) recognize that regulation can get outdated and the financial

¹⁰ Caprio and Klingebiel (1996) argue that the bailout of the thrift industry cost \$180 billion (3.2% of GDP) in the US in the late 1980s. They also document that the estimated cost of bailouts were 16.8% for Spain, 6.4% for Sweden and 8% for Finland. Honohan and Klingebiel (2000) find that countries spent 12.8% of their GDP to clean up their banking systems whereas Claessens, Djankov and Klingebiel (1999) set the cost at 15-50% of GDP. The costs of the rescue package in the United States during the current crisis could easily mount to similar figures, if not more.

sector can “cherry pick” the cheapest risk-weight classes, once again lending robustness to macro-prudential regulation.

Section IV discusses the issue of who should regulate macro-prudential risk and overall leans on the side of central bank as being the most suitable institution.

Section V touches briefly upon issues related to “shadow banking”, namely, the propensity and ability of the financial sector to exit the regulatory perimeter and operate in a manner that enables certain concentrations of leverage and aggregate risks to develop risking the macro-prudential health of economies. Some measures to integrate the regulation of the shadow-banking institutions with the traditional banking and financial sectors are discussed. While this issue may not be paramount for emerging markets at present, it could as they strengthen regulation and their financial sectors grow further.

Section VI considers some specific lessons for the emerging markets, most notably the pervasive and distortive role played by government guarantees in these countries and the need to charge upfront for the systemic risk of financial firms which is largely government-guaranteed at the present.

As the role of emerging markets in the global economy rises, the importance of risk spillovers across these markets – and to and fro Western economies – has also grown. It is thus important to look for emerging pockets of macro-prudential risk, not just inside economies but also outside. Section VII discusses in greater detail such possible spillovers and global linkages, and a possible blueprint for achieving better international coordination of macro-prudential regulation.¹¹

I. Measuring Systemic Risk¹²

First and foremost, macro-prudential regulation needs to ascertain which institutions are, in fact, systemically important. Indeed, the systemic risk of an individual institution has not yet been measured or quantified by regulators in an

¹¹ Throughout, we provide measures adopted by the Dodd-Frank Act in the United States (enacted in July 2011 and currently being implemented) as a benchmark for corresponding reform, or lack thereof, in recent financial sector reforms.

¹² The discussion on financial architecture draws in part from Chapter 4, “Measuring Systemic Risk”, by Viral V Acharya, Christian Brownlees, Robert Engle, Farhang Farazmand and Matthew Richardson, in “Regulating Wall Street: The Dodd-Frank Act and the New Architecture of Global Finance”, edited by Viral V Acharya, Thomas Cooley, Matthew Richardson and Ingo Walter, John Wiley & Sons, October 2010.

organized manner, even though systemic risk has always been one of the justifications for our elaborate regulatory apparatus.

There are some institutions that follow highly cyclical activities and are thus heavily correlated with aggregate economic conditions. If these institutions are also highly levered, especially with short-term debt, then they face “runs” in the event of sufficiently adverse news about their condition. This makes them more prone to failure and liquidation. If their failure were unrelated to aggregate conditions, their liquidation would be straightforward, as there would be healthy players in the financial sector to acquire them or their assets. However, when institutions’ asset risk is correlated with that of the economy, they are likely to fail when the rest of the financial sector is under stress too, and their liquidation is difficult and potentially destabilizing for other players if fire-sale asset prices lead to externalities. In this case, systemic risk propagates through the effect of firm failures on asset prices. Many observers attribute the markdowns in prices of illiquid “toxic” assets during the crisis of 2007-2009 (at least partly) to several, highly levered financial firms having taken a one-way bet on the housing price in the economy – a bet that went bad and produced difficult funding conditions for much less levered financial institutions that were holding similar assets.

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

The failures of Bear Stearns, Lehman Brothers and A.I.G. all contributed to systemic risk in the form of uncertainty about which interconnections would transmit default risk. In the case of Bear Stearns, the risk was stemmed through government support. In the case of Lehman Brothers, the risk spread as losses on Lehman bonds caused the Reserve Primary Fund, a money market fund, to “break the buck,” causing a run on it and several other money market funds. And in the case of A.I.G., its counterparty position was so large in terms of exposures of other potentially systemic institutions and municipalities, in the United States as well as in Europe, that it could not be allowed to fail.

Finally, while size by itself need not lead to systemic effects of failures, it may do so if large-scale liquidations are feared and lead to disruption of markets, interconnections, and the loss of intermediation functions that they might take months, or years, to rebuild. Cases in point are the Continental Illinois Bank's failure in 1984, the near collapse of Long-Term Capital Management in 1998, and that of Citigroup in the autumn of 2008. Of course, this brings with it the curse of "too-big-to-fail" expectations and the attendant moral hazard problems.

The discussion to follow is centered around several themes: (i) the criteria for determining systemic institutions can be supplemented with market-based continuous measures of systemic risk; (ii) the need to assess systemic risk linked to the interconnectedness of institutions and what role the centralized data repositories could play in such assessment; (iii) employing stress tests and aggregated risk exposure reports to assess the risk of the system as a whole (not just during crisis but on a regular basis) and (iv) whether the list of systemic institutions should be made public.

Market-based Measures of Systemic Risk

By way of example, Box I shows how the Dodd-Frank Act passed in the United States in 2010 proposes that systemically important financial institutions (SIFI's) be identified. In partial departure from the Act, we do not recommend a pure reliance on classification-based criteria with specific thresholds. Suppose for example that banks are divided into systemic risk categories by size and that resolution plans applied only to the top size category. Clearly, there would be tremendous advantage for banks that are near the lower threshold of the top size category to remain just below that size. Indeed, larger banks may simply break themselves up yet retain pretty close in terms of their exposures to some common aggregate risky asset, for example, the housing market. In this case, the true systemic risk may not be substantially reduced as the co-movement in different parts of the financial sector remain, even though it is now contained in many more, smaller institutions. The same regulatory arbitrage rule applies for coarse categorization based on leverage. A corollary of this argument is that a group of institutions that are individually small but collectively exposed to the same risk -- for example, money market funds -- could all experience runs when there is an aggregate crisis and high-quality issuers of commercial paper also get close to default. These should be considered as part of a potentially systemic risk pocket of the economy.

Box I: Proposal for measurement of systemic risk under the Dodd-Frank Act in the United States of 2008

The Dodd-Frank Act signed in the United States in 2010 focuses on systemic risk. It establishes a **Financial Stability Oversight Council** which is chaired by the Secretary of the Treasury and consists of the top financial officers from various governmental and regulatory agencies (the Fed, the OCC, the Consumer Protection Bureau, the SEC, the FDIC, the CFTC, the FHFA, the NCUA and an independent member with insurance expertise). The role of this council is to “*identify risks to the financial stability of the United States that could arise from the material financial distress or failure, or ongoing activities, of large, interconnected bank holding companies or nonbank financial companies or that could arise outside the financial services marketplace.*” In addition, the council is to affirm the commitment of the government not to shield investors or counterparties from failures of such companies and to respond to any future emerging threat to the stability of the US financial system.

In addition to identifying systemically risky U.S. bank and non-bank financial institutions, the Council can insist that a foreign bank or non-bank financial institution be supervised by the Federal Reserve Board of Governors. In taking this step the Council must “*determine that material financial distress at the (...) financial company, or the nature, scope, size, scale, concentration, interconnectedness, or mix of the activities of the (...) financial company, could pose a threat to the financial stability of the United States.*” If a company is avoiding regulation by its organization or operations but would otherwise be considered systemically risky, the Council has the authority to insist that it be regulated by the Federal Reserve Board of Governors. The Council annually reviews the institutions it considers systemically risky and can terminate some oversight.

The chief role of the Council is to identify systemic risks wherever they arise and recommend policies to regulatory bodies. As a quick rule of thumb, financial institutions that have a huge concentration in volume of one or more product areas are likely candidates for systemically risky institutions. These entities are generally likely to be making markets in that product and are likely to be systemic in that their failures would impose significant counterparty risk and disruptions on other financial institutions. Hence, they should be deemed as systemic regardless of any other criteria.

As such, the Council is explicitly charged to “*identify systemically important financial market utilities and payment, clearing, and settlement activities.*” There may be addition to the systemic risk criteria of firms operating or significantly owning public utility functions which participate in the payments system and move reserves around in the economy -- such as clearing (for instance, Bear Stearns for credit derivatives until its failure in March 2008 and JPMorgan Chase and Bank of New York for repurchase agreements) and payment and settlement (several large commercial banks that provide banking services to households and corporations). The Dodd-Frank Act authorizes “*enhancements to*

the regulation and supervision of systemically important financial market utilities and the conduct of systemically important payment, clearing, and settlement activities by financial institutions,” including standards for risk and liquidity management.

As of yet, no specific list of systemic firms has yet been determined. Internationally, the Financial Stability Board, an international body of regulators and central bankers, based out of the Bank for International Settlements, has compiled a list of 30 global financial institutions; these firms are considered as “Systemic Risk Institutions” for cross-border supervision exercises, such as drawing up living wills or recovery and resolution plans. This list (see Appendix B) includes six insurance companies and 24 banks from the United Kingdom, Continental Europe, North America, and Japan, even though the exact criteria employed have not been revealed.

An alternative to coarse categorization of systemic risk is to employ market-based measures that are more continuously variable. One possibility is to use market data to estimate which firms are most exposed, and therefore contribute most to the losses incurred, during an economy-wide downturn such as the Great Depression or the Great Recession of 2007-09. Such measures would be inexpensive and responsive to market conditions. Such measures would be natural complements to the more detailed investigations envisioned in the Act. The use of market-based measures has recently been studied by Acharya, Pedersen, Philippon and Richardson (2010a)(2010b), Adrian and Brunnermeier (2009), Brownlees and Engle (2010), De Jonghe (2010), Gray and Jobst (2009), Huang, Zhou and Zhu (2009), and Lehar (2005), among others.

These measures are generally based on stock-market data because it is most commonly available at daily frequency and least affected by bailout expectations. For instance, a simple measure called *Marginal Expected Shortfall* (MES) estimates the loss that the equity of a given firm can expect if the broad market experiences a large fall. A firm with a high MES and also high leverage will find its capital most depleted in a financial crisis relative to required minimum solvency standards and therefore faces high risk of bankruptcy or regulatory intervention. It is such under-capitalization of financial firms that leads to systemic risk. An implementation of this idea is now available at the New York University Stern School of Business volatility laboratory (Vlab). These are updated regularly and are posted daily on Vlab. These rankings can be accessed at www.systemicriskranking.stern.nyu.edu. Over time, these rankings will be extended to European and Australasian financial firms also.

Overall, we see the two approaches – relying on simple systemic risk criteria such as size, leverage and interconnectedness and relying on market-based estimates of systemic risk – as complementary. The first is more transparent and

likely to flag obvious candidates and may be the only option when a large part of the financial sector is not publicly traded or stock price data are unreliable due to thin trading and reporting issues; the second is a reality check based on market perceptions as to whether some candidates have been missed altogether or some obvious ones are less systemic than they seem at first blush. For instance, securities dealers and brokers show up as being most systemic in every single year since 1963, based on stock market data (MES), even though they have remained essentially unregulated. By contrast, A.I.G. is a natural one-way insurance provider of large quantities that is not identified by stock market data as being significantly systemic until six months into the crisis. Also, while systemic risk categories can be “arbitraged” by market participants, market-based systemic risk measures are more difficult to evade until the firm’s true systemic risk has diminished.

Interconnectedness

A key issue that arises in measuring systemic risk is that interconnections of financial institutions are somewhat opaque, and their precise nature may be entirely different in a stressed scenario than under normal conditions. For instance, counterparty exposures can reverse signs when conditions change. And deep out-of-the-money options, such as those sold by A.I.G. to banks as synthetic insurance, can lead to defaults due to margin or collateral calls even before the events being insured against materialize. There is no simple answer to these questions, but important steps can be taken.

In order to have any hope of assessing interconnectedness of a financial institution and its pivotal role in a network, detailed exposures to other institutions through derivative contracts and interbank liabilities is a must. This requires legislation that compels reporting, such that all connections are registered in a repository immediately after they are formed or when they are extinguished, along with information on the extent and form of the collateralization and the risk of collateral calls when credit quality deteriorates. These reports could be aggregated by risk and maturity types to obtain an overall map of network connections. What is important from the standpoint of systemic risk assessment is that such reports, and the underlying data, be rich enough to help estimate *potential exposures* to counterparties under infrequent but socially costly market- or economy-wide stress scenarios. For instance, it seems relevant to know for each systemically important institution (i) what are the most dominant risk factors in terms of losses and liquidity risk (e.g., collateral calls) likely to realize in stress scenarios; and, (ii) what are its most important counterparties in terms of potential exposures in stress scenarios. A transparency standard that encompasses such requirements is needed with ready access to information for purposes of macro-prudential regulation.

A further complexity is the international nature of such networks. As many counterparties may be foreign entities, the data to follow the stress event may not be available. Further, as subsidiaries of the company under examination may be foreign registered institutions, the flow of funds may be exceedingly difficult to follow. The Lehman bankruptcy illustrates many of these issues. Many clearing and settlement businesses are already international. For example, the Depository and Clearing Corporation (DTCC) clears and warehouses the vast majority of swaps contracts in many segments of the financial space. They analyze positions and prices and provide information to the public and confidential data to regulators on these products. Such global organizations will be natural components of the regulatory environment and their contributions should be warmly welcomed.

One recommendation for improving the functioning of the OTC derivatives market is to move the public utility function out of private financial firms (for instance, as clearinghouses) wherever possible (for instance, for standardized products with sufficient daily volume of trading) and to subject the public utility to sufficiently high capital standards, so as to eliminate most of the systemic risk associated with performance of the function. Going forward, as many over-the-counter derivatives start being centrally cleared, clearinghouses would be important “utilities” that should be considered in the set of systemically important institutions and be subject to prudential risk standards.

A very important point is that as the legislation moves a wide range of OTC derivatives to centralized clearing and or exchange trading, the counterparty risk that is inherent in OTC derivatives simply becomes risk relative to the central counterparty. The central counterparty will automatically set margins so that risk positions will be nearly marked to market. This remaining central counterparty risk is potentially systemic and must be carefully monitored. However, it is a risk that can be easily regulated because clearinghouses are public utilities and are naturally supervised. Also, several over-the-counter derivatives will likely remain un-cleared and may collectively add up to a substantial part of derivatives markets. Regulators would have to be particularly watchful in ensuring critical entities in the un-cleared derivatives market are also brought under their radar.

Stress Tests

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 and other regulators in the United States during February to May 2009. To report its objectives and findings, we quote from the report (see the Federal Reserve Bank of New York report on the SCAP exercise ([Hirtle, Schuermann and Stiroh, 2009](#))):

“From the macroprudential perspective, the SCAP was a top-down analysis of the largest bank holding companies (BHCs), representing a majority of the U.S. banking system, with an explicit goal to facilitate aggregate lending. The SCAP applied a common, probabilistic scenario analysis for all participating BHCs and looked beyond the traditional accounting-based measures to determine the needed capital buffer. The macroprudential goal was to credibly reduce the probability of the tail outcome, but the analysis began at the microprudential 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.”

We believe stress tests should be a regular part of the macro-prudential toolkit to determine the risk of institutions in stressed systemic scenarios, as well as to assess the overall systemic risk of the financial sector in such scenarios. There has been valuable knowledge and experience developed in the exercise of SCAP 2009, and this could be built upon by regulators all over the world.¹³

We document below that academic research (Acharya, Pedersen, Philippon and Richardson (2010a)) has found that market-based measures of systemic risk such as Marginal Expected Shortfall and Leverage help explain the outcomes of the SCAP exercise conducted in 2009. Hence, we view the historical-based systemic risk measures and projected systemic risk measures through stress tests as complementary. Regulators should embrace both as useful cross-checks and independent pieces of valuable intelligence for assessment of systemic risk of financial firms.

¹³ The Dodd-Frank Act of 2010 in the United States calls for systemic institutions to be subject to periodic stress tests: *“The Board of Governors, in coordination with the appropriate primary financial regulatory agencies and the Federal Insurance Office, shall conduct annual analyses in which nonbank financial companies supervised by the Board of Governors and bank holding companies described in subsection (a) are subject to evaluation of whether such companies have the capital, on a total consolidated basis, necessary to absorb losses as a result of adverse economic conditions.”* Moreover, systemically important financial institutions are required to perform semi-annual tests. Such assessments may be done more frequently in a crisis and may complement the firm’s own test.

Supervisory Capital Assessment Program (SCAP)

The *Supervisory Capital Assessment Program* (SCAP) initiated in the United States in February 2009 and concluded in May 2009 was originated amidst the credit crisis which had cast into doubt the future solvency of many large and complex financial firms. A number of firms had already received financial aid through the Troubled Asset Relief program (TARP) but with the credit crisis deepening, a pressing issue that arose was whether the financial sector would be able to withstand a potential worsening of the crisis.

During such a severe time of distress and huge uncertainty about the future solvency of financial firms, the Federal Reserve found it necessary to conduct a stress test in order to assess the financial ability of the largest U.S. Bank Holding Companies (BHC) to withstand losses in an even more adverse economic environment. Such an exercise was intended to provide policy makers with information on the financial stability of the system and on the potential need for limiting a large scale financial meltdown with adverse effects on production and employment in the overall economy.

In the following paragraphs the companies that were the focus of the test, the stress tests and the main variable(s) used for measuring capital reserves will be briefly introduced.

The SCAP focused on the 19 largest financial companies which combined held 2/3 of assets and more than 1/2 of loans in the U.S. banking system, and whose failure was deemed to pose a systemic risk. The technical goal of the exercise was by means of “stress tests” to assess the ability of the firms to maintain on-going businesses in the case of a more severe negative shock.

Two scenarios were to be assessed. In the first *base* scenario the economy was assumed to follow the then-current consensus path with still negative expected outcomes. The second scenario was a more *adverse* path where a deeper downturn was assumed. Both scenarios were 2-year ahead what-if exercises and considered losses across a range of products and activities (such as loans, investments, mortgages, and credit card loans). Firms with trading assets in excess of \$100 billion were asked to estimate potential trading losses and counterparty credit losses.

For both the base and adverse case the Federal Reserve provided the companies with a common set of loss rate ranges across specific loan categories as guidelines for estimation purposes. For example, under the base scenario an indicative 2-year cumulative loss rate range of 1.5%-2.5% was provided for first lien mortgages in the prime category. The corresponding indicative loss rate range in the adverse scenario was set to 3 %-4%. As described in the May 7th 2009 report of the Federal Reserve containing the results of the SCAP stress tests, the

indicative loss rates were derived from methods of predicting losses, including historical loss experiences and quantitative models relating loan performances to macroeconomic variables.

However, firms were allowed to diverge from the indicative loss rates where they could provide evidence of the appropriateness of their estimates. More importantly, the supervisors recognizing the difference across firms asked the firms to provide data about particular characteristics of their portfolios in order to make more tailored quantitative assessments of losses.

The goal of the test was to measure the ability of a firm to absorb losses in terms of its Tier 1 capital with more emphasis on Tier 1 Common Capital “reflecting the fact that common equity is the first element of the capital structure to absorb losses”. Firms whose capital buffers were estimated small relative to estimated losses under the adverse scenario would be required to increase their capital ratios. The size of the SCAP buffer was determined in accordance with the estimated losses under the worst scenario and the ability of a firm to have a Tier 1 risk-based ratio in excess of 6% at year-end 2010 and its ability to have a Tier 1 Common capital risk-based ratio in excess of 4% at year-end 2010.

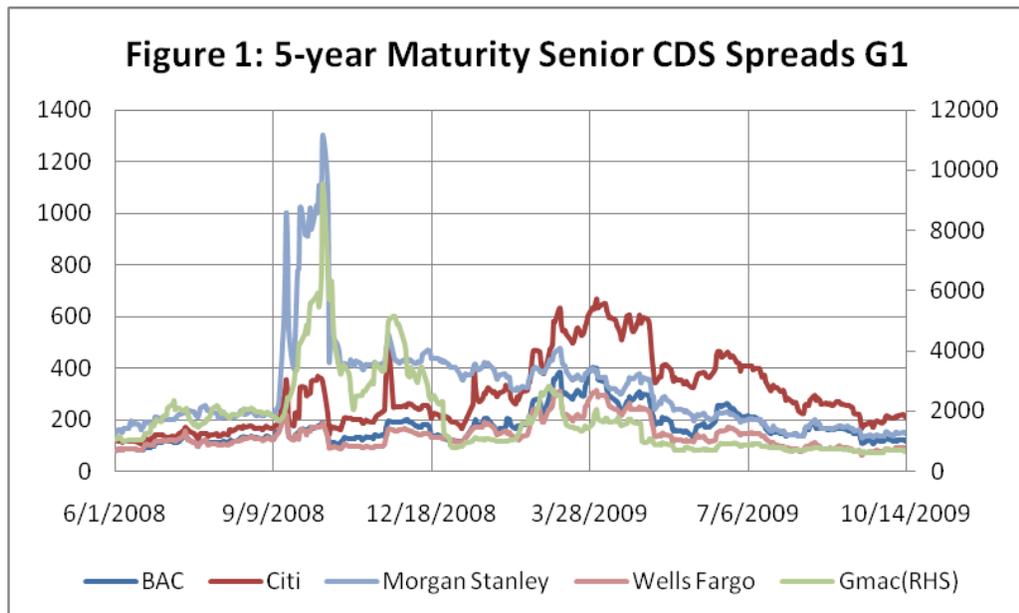
The main finding was that 10 of the 19 original banks needed to raise additional capital in order to comply with the capital requirements set forth in the SCAP. In all cases the additional buffer that had to be raised was due to inadequate Tier 1 Common Capital. In total around \$75billion had to be raised, though there were significant variations across the firms ranging from 0.6 to 33.9billion. The number is much smaller than the estimated two-year losses which were at \$600 billion or 9.1% on total loans. The total amount of reserves already in place was estimated to be able to absorb much of the estimated losses. Only using data up to end of 2008 the required additional buffer that had to be raised was estimated at \$185billion. However, together with the adjustments after the first quarter of 2009, the amount was reduced to \$75billion.

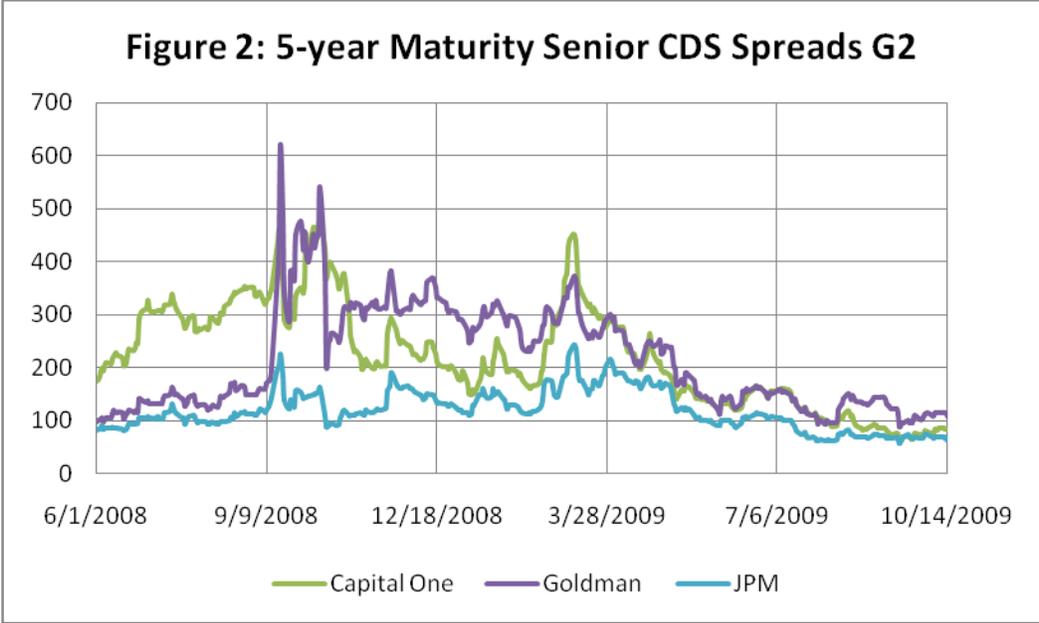
The stress test sought to determine the ability of a firm to withstand a large negative shock. To the extent that negative shocks increase the riskiness of a firm and their default risks, spreads on credit default swaps (CDS) would be indicative of the market’s reaction to SCAP and its findings. Figures 1 and 2 depict the times series plots of CDS spreads for a subset of the firms in the SCAP study. All data are from Datastream.

Figure 1 depicts the subset of firms who were later on required to raise their capital buffers. These are in the G1 group. Note that to accommodate the spreads for GMAC in the G1 group we have posted the spreads for GMAC in the right hand side scale. Figure 2 plots this for G2, the subset of firms that did not need additional buffers. These plots of CDS spreads show that subsequent to the

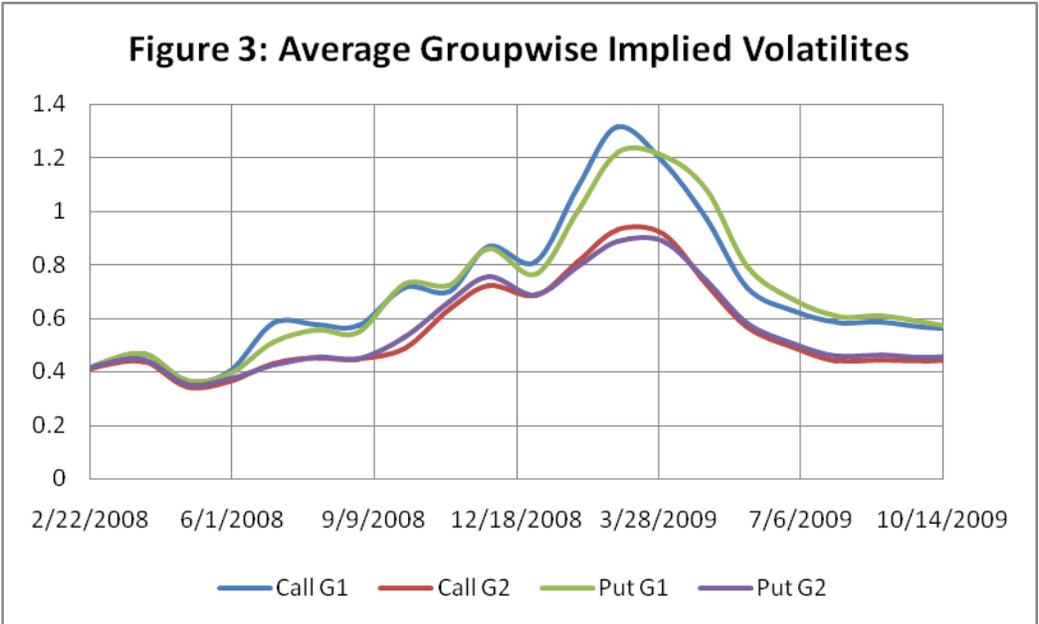
collapse of Lehman Brothers all spreads increased substantially, this is the large group of spike early in the sample. Interestingly there is also an increase in CDS spreads around the announcement of the stress test. There is though a difference amongst the two groups. With respect to the G1 group, the spreads continue to linger around a higher level after the initiation of the test whereas we observe a declining pattern for the G2 group subsequent to the announcement.

The pattern in the CDS spreads is suggestive of the fact that the transparency of the program may have aided the market participants to distinguish between the different groups. Market participants using the provided information may have been able to deduce the relative systemic riskiness of the firms well in advance of the Fed's announcement of the results. The drop in spreads for the firms in the G1 group subsequent to the announcement of the results could be indicative of better than anticipated results of the SCAP.





Another approach illustrated in Figure 3 is to observe the market’s reaction to the SCAP is to consider option implied volatilities. The implied volatilities are those of the 1-year ATM forward call and put options obtained from Option Metrics standardized files. The presented volatilities are cross-sectional averages with each group (G1 and G2) for both calls and puts. Although the implied volatilities exhibited an increasing pattern well before the initiation of the SCAP it is apparent that they peak around the time of the announcement and subsequently start on a declining pattern.



It is apparent that removing uncertainty about the near future prospects of the firms was the main purpose of the SCAP exercise. The exercise estimated the potential additional buffer that needed to be raised to cover a negative shock in the near future, and, by making the details and results of the test public, the FED resolved or helped reduce, in a timely and quick fashion, a lot of uncertainty in an already volatile market. A great advantage of the stress test was its focus on scenario testing and the ability of firms to operate in an economy with a larger than expected downturn. Although issues can be raised about the underlying assumptions in the scenarios and the shortage of adequate number of scenarios, the mere fact that large negative outcomes and the operational capabilities of firms were considered certainly seems to have provided much needed reassurance to the market participants.

Going forward, it is vital for financial system regulators worldwide to learn from the lessons of the stress test and implement on an on-going basis such scenario testing with the collaboration of firms and a supervisory entity. The purpose of such a regular supervisory system would be to monitor the health of firms and confirm the compliance of firms with the capital requirement regulations. Such a system can gauge the riskiness of the firms' portfolios and provide the guidelines for adequate capital buffers that need to be in place in order to weather through tough times. It can use both market and firm specific data in order to make assessments. Once again, transparency can be an important side benefit by providing relevant information on systemic risk not just to the regulators but also to the market participants to impose timely market discipline.

Marginal Expected Shortfall (MES) and Stress Test (SCAP)

SCAP, the stress test exercise undertaken by the Federal Reserve System in Spring 2009 and as described above, sought to determine the ability of a firm to withstand a large economic-wide negative shock. In order to do so it had to determine the loss to a firm in the event of such a shock.

Consider an estimate of *Marginal Expected Shortfall* (MES) of a firm, a market-based measure that, during a past period, on the worst days of the market, estimates the average percentage losses (negative stock return) of a firm. This is a simple non-parametric estimate of MES. MES is an attempt to answer the question of how much systemic risk a firm has by asking what would happen to the firm in an environment of a large negative shock to the economy or the financial sector.¹⁴

¹⁴ Systemic risk, however, requires estimation of the expected equity losses of a firm in a financial crisis. This differs from the MES in that the length of time and severity of the decline are both greater. In a financial crisis, the firms with more leverage will naturally have greater declines and firms in different financial sectors may have different impact. (See Acharya, Pedersen, Philippon and Richardson (2010a) for an

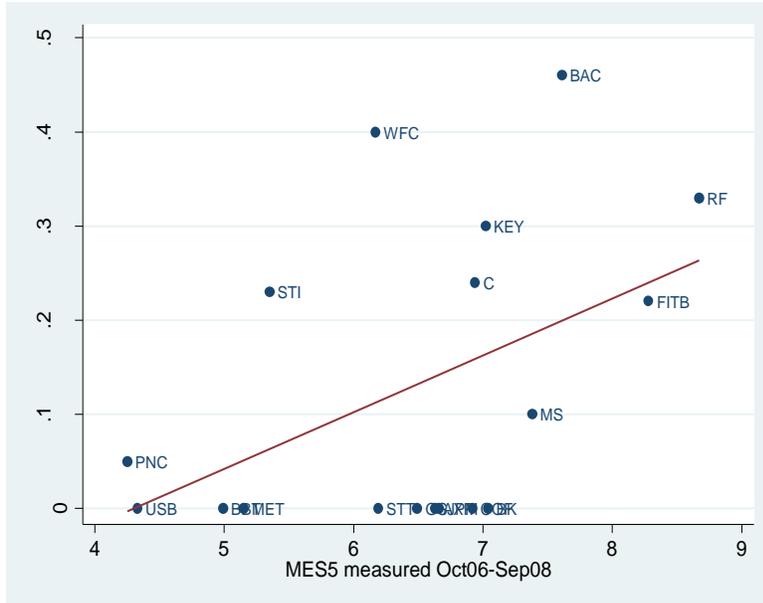
Thus, there is a distinct similarity between stress tests and MES albeit with some differences also. The stress tests are forward looking by nature. They test the what-if hypotheses of scenarios that may or may not unfold in the future. On the other hand, by focusing on past stock market data, the MES estimate described above, is constrained by projections based on history. If severely stressed outcomes are not present in the data, MES may paint an inaccurate picture of the firm's systemic risk compared to a stress test which focuses on scenarios specified by the supervisors. On the flip side, MES can serve to keep the supervisory discretion in check and ensure oversight of the systemic risk of some firms as well as provide a benchmark for comparative purposes. Hence, the results for the financial firms in the SCAP exercise of Spring 2009 can in fact be used to measure the usefulness of MES.

Table 2 contains results of the 19 banks that were part of the SCAP stress test and their capital buffers and additional requirements. The last but one row (SCAP Buffer) refers to the capital shortfall or additional Tier 1 Common Capital that the banks needed to raise. The first two rows (Tier 1 Capital and Tier 1 Common Capital, respectively) refer to the Tier 1 and Tier 1 Common capital that the banks already had in place. The last row of the table shows our calculation of MES for these firms computed during October 2007-September 2008. Note that MES is not reported for GMAC as it did not have publicly traded equity over this period.

Figure 4 shows the lineup of MES against the capital shortfall of the firms (SCAP Buffer) relative to their Tier 1 Common Capital. The presence of a strong positive relationship between MES and the finding of the SCAP stress tests emerges. In particular, there is a clear separation in level of MES between the firms that end up with a shortfall and those that do not. This provides an important testimony to the information content of market-based systemic risk measures. In particular, in the cross-section of financial firms, even the simplest non-parametric estimate of MES contained the ability to explain their systemic risk using historical data as was ascertained through more exhaustive and laborious regulatory stress tests of these firms.

Figure 4: MES Vs. SCAP/Tier1Comm. Scatterplot of the marginal expected shortfall measure, MES, against SCAP/Tier1comm. MES is the marginal expected shortfall of a stock given that the *market return* is below its 5th-percentile. The sample consists of 18 US financial firms included in the Federal Reserve's stress tests of Spring of 2009. SCAP is the announced capital shortfall of each firm and Tier1comm is its tangible common equity. MES5 was measured for each individual company stock using the period Oct07-Sep08.

economic analysis and then statistical description for how leverage enters the into the estimation of equity losses in a crisis beyond its effect already incorporated into MES.)



Transparency

We recommend a fully transparent approach to systemic risk measurement and categorization. A key benefit of transparency is that releasing valuable capitalization and counterparty exposure information can allow market participants to price more accurately risk in contracts with each other and to employ suitable risk controls. The primary objection to the public disclosure of systemically important institutions is that it implicitly confers too-big-to-fail or too-interconnected-to-fail guarantees on such institutions. However, the problem of implicit guarantees is best resolved by the creation of a resolution authority and a process that limits the fallout from failure. Unfortunately, however, forces against transparency gather momentum when a credit resolution mechanism or recapitalization plan is not in place. To wit, absent the ability to deal with potentially insolvent firms once they have been detected to be so, regulators would shy away from releasing this information and instead let such institutions fester and potentially risk rest of the financial system to their even greater problems down the road. However, all the evidence presented so far suggests that the information released by the SCAP exercise of 2009 on relative strengths and weaknesses of banks in the United States was perceived as welcome news in the marketplace, since it was followed by a credible plan to get them to recapitalize – privately or failing which through government capital injection, dilution of existing shareholders and firing of existing management. Furthermore, continuously varying market-based measures of systemic risk such as MES are easily computable by market participants, and they obviate for opacity.

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

To facilitate such transparency, first and foremost high-quality data must be collected from the financial sector, in a timely manner, and be subject to both data integrity and analysis for purposes of building and disseminating adequate systemic risk measures and reports. A model here could be the newly proposed – but yet to be set up – Office of Financial Research (OFR) in the United States (see Box II). Such an Office could over time provide “financial stability reports” of the type produced by the central banks in a number of economies but not currently in the United States.¹⁵

Box II: Proposal for setting up a centralized data repository for analysis of systemic risk – the Office of Financial Research - under the Dodd-Frank Act in the United States of 2008

In order to support the Systemic Risk Oversight Council with its task of generating and analyzing data and information relevant for systemic risk assessment, the Act establishes the Office of Financial Research (OFR).

¹⁵ Christensson, Spong and Wilkinson (2010) document, for instance, how financial stability reports in five countries (UK, Sweden, the Netherlands, Spain and Norway) describe identification of risks to the system (low interest rates, rising asset prices, increasing debt levels and trade imbalances, risks from the U.S., etc.) and exploit market price data, balance-sheet data as well as regulatory intelligence (supervision and stress-test data).

The purpose of the Office is to support the Council in fulfilling the purposes and duties of the Council ... by “(1) *collecting data on behalf of the Council, and providing such data to the Council and member agencies*; (2) *standardizing the types and formats of data reported and collected*; (3) *performing applied research and essential long-term research*; (4) *developing tools for risk measurement and monitoring*; (5) *performing other related services*; and (6) *making the results of the activities of the Office available to financial regulatory agencies*”.

The Director of the Office shall report on the assessment by the Office of significant financial market developments and potential emerging threats to the financial stability of the United States. As an organizational structure, there are two core parts:

(1) The Data Center - prepares and publishes, in a manner that is easily accessible to the public (i) a financial company reference database; (ii) a financial instrument reference database; and (iii) formats and standards for Office data, including standards for reporting financial transaction and position data to the Office.

(2) The Research and Analysis Center - on behalf of the Council, shall develop and maintain independent analytical capabilities and computing resources “(i) *to develop and maintain metrics and reporting systems for risks to the financial stability of the United States*; (ii) *to monitor, investigate, and report on changes in system-wide risk levels and patterns to the Council and Congress*; (iii) *to conduct, coordinate, and sponsor research to support and improve regulation of financial entities and markets*; (iv) *to evaluate and report on stress tests or other stability-related evaluations of financial entities overseen by the member agencies*; (v) *to maintain expertise in such areas as may be necessary to support specific requests for advice and assistance from financial regulators*; (vi) *to investigate disruptions and failures in the financial markets, report findings, and make recommendations to the Council based on those findings*; (vii) *to conduct studies and provide advice on the impact of policies related to systemic risk*; and (viii) *to promote best practices for financial risk management*.”

Since the OFR is funded by an assessment on systemically important financial firms, and the OFR is organized as an independent “think tank” within Treasury, we generally support the idea of its existence. The organizational structure and funding seem flexible enough to allow the OFR to collect data and produce research that other government agencies, e.g., the Federal Reserve, may not be able to produce.

The establishment of the OFR is an important step in obtaining and employing the necessary data. It provides a framework in which the data can be reported and analyzed and made available to regulatory bodies. The choice of data to be collected is not made explicit in the legislation but will be determined by the

staff at OFR. Thus the OFR can obtain both position data and collateral agreements so that contingent positions can be examined in stress scenarios. The analysis of network effects in a stress test is extremely complex even if all of the data on positions are available. The response by counterparties to a particular stress event may depend upon liquidity considerations, their own capital distress, netting conditions in stable and bankruptcy outcomes and many other factors. This calculation will only be feasible under simplifying assumptions that ongoing research must evaluate. Presumably much of this analysis will be carried out within the OFR and the academic community and is a high priority. (For some recent research related to the financial crisis, see Chan-Lau, Espinosa, Giesecke Sole (2009), Nier, Yang, Yorulmazer and Alentorn (2008), and Upper (2007).)

II. Regulating Systemic Risk¹⁶

There are two separate challenges in the regulation of systemic risk. First, systemic risk must be measured as we have discussed so far. Second, sound economic theory suggests that the tightness of regulation should be based on the extent to which a given firm is likely to contribute to a general crisis, so that the correct price can be charged to each firm for its contributions to systemic risk. We propose a framework to achieve this goal. The main advantages of our approach are that: It forces regulators and financial firms to deal explicitly with systemic risk; It reduces moral hazard in that it provides incentives for regulated firms not to take on excessive systemic risk; It reduces the pro-cyclicality of risk taking; It is based on tools tested and well understood by the private sector.

We present three regulations based on our overall approach.

Capital requirements: our suggested “Basel III”

Under this scheme, a systemic risk regulator would first measure each firm’s systemic risk contribution as discussed above. Then the regulator should impose requirements and/or costs depending on each firm’s contribution. One natural way to do this which is consistent with current regulation is to impose capital requirements. That is, the regulator should impose a capital requirement that depends explicitly on systemic risk contributions. This gives the right incentives to firms to limit their loading on aggregate risk since keeping capital

¹⁶ This discussion is based on Chapter 13 “Regulating Systemic Risk” by Viral V Acharya, Lasse Pedersen, Thomas Philippon, and Matthew Richardson, in *Restoring Financial Stability: How to Repair a Failed System*, eds. Viral V Acharya and Matthew Richardson, John Wiley & Sons, March 2009.

reserves is costly and, additionally, it gives the firm an appropriate safety buffer in systemic crises.¹⁷

For instance, the Systemic Capital Charge would be:

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

This is, in effect, Basel II with systemic risk. The focus on systemic risk would be a clear improvement over existing regulations, but it must be enforced efficiently. We would insist on two key points. First, there must be a limit on the ability to decrease apparent leverage by moving of assets to off-balance sheet but with recourse, or by relying too much on book values.¹⁸ Second, the measurement of systemic risk must be either a-cyclical, or even counter-cyclical, so as to avoid fire sales induced by violations during crises (see Section 3). In particular, the measure MES could in principle be replaced by the capital shortfall estimated for a financial firm in a stress test conducted by the regulators under some extreme aggregate outcomes.¹⁹

“Taxing” the externality – a FDIC-style methodology

A second possibility is to “tax” the activity that imposes a negative externality on the system, that is, to tax activity leading to systemic risk. The tax has two benefits: (i) it discourages behavior that leads to systemic risk, and (ii) the generated levies would go towards a general “systemic crisis fund” to be used in the future by the regulators to inject capital into the system (at their discretion). Of course, in equilibrium, some institutions will find it optimal to still engage in these behaviors and therefore pay the higher taxes, while others will lessen their use.

¹⁷ Purely idiosyncratic risk would require less capital and firms might occasionally fail if they took significant risk, but an isolated failure can generally be resolved by the private sector and would not cause externalities (deposit insurance creates the need for additional regulations, but this is not our focus here).

¹⁸ The recent crisis has shown that firms such as Bear Stearns and Citigroup looked extremely well-capitalized even at points when it became clear that due to erosion of their equity’s market values, they had limited funding capacity (if any) to perform day-to-day operations and manage their liquidity in an orderly fashion.

¹⁹ Greenlaw, Kashyap, Schoenholtz and Shin (2011) argue that the amount of capital required of a financial firm should depend in a stress test not just on its own direct losses, but also on indirect loss contributions if these losses lead to deadweight losses through fire sales and contagion risks. Elliott (2011) provides a discussion of how bank capital requirements could be designed in a counter-cyclical manner to contain the boom and bust cycle of credit.

Financial institutions that pose systemic threats have three characteristics: excessive leverage, highly illiquid securities and concentration of aggregate risk. Given these characteristics, what form should the tax take?

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

For instance, in recognition that insurance is not free, the Federal Deposit Insurance Corporation (FDIC) in the United States imposes a fee on financial institutions. Until 1993, this fee was based only on the size of the institution's deposits and not on its risk. This created a severe moral hazard problem because these institutions could borrow at artificially low rates and undertake risky investments. As FDIC losses mounted up during the 1980s, the government redesigned the FDIC contracts.²⁰ It is important to note, however, that while the new contracts do lead to premiums increasing in the risk characteristics of financial institutions, no systemic measure is incorporated into the assessment rate formula.²¹

We propose to charge an additional *systemic risk fee* to all financial institutions based not only on the amount of assets they hold, but also on their contribution to systemic risk (as described above based on its *Marginal Expected Shortfall*), on individual risk characteristics including the ones described above under current FDIC rules, and on measures of complexity and interconnectedness. The majority of financial firms contribute only marginally to systemic risk, so presumably their fee would be close to zero.

²⁰ The Federal Deposit Insurance Corporation (FDIC) was created in the wake of the Great Depression to address the massive number of bank runs that took place from 1930-1933. The contracts went through several iterations ending with the Federal Deposit Reform Act of 2005 which instituted a pricing scheme for deposit premiums that attempted to capture risk by combining examination ratings, financial ratios, and, for large banks, long-term debt issuer ratings. All institutions are broken into four risk categories, I through IV. The lowest risk category contains institutions considered healthy by the examiners that are well capitalized, with total-risk based ratios of 10%, Tier 1 risk-based ratio of 6%, and Tier 1 leverage ratio of 5%. Within risk category I, a premium between 5 and 7 cents per \$100 of deposits would be assessed, depending on formula which takes into account tier 1 leverage ratios, loans past due 30-89 days/gross assets, nonperforming assets/gross assets, net loan charge-offs/gross assets, and net income before taxes/risk-weighted assets. As health and capitalization weakens for the firm, the risk category increases, eventually leading to premiums as high as 43 cents per \$100 of deposits.

²¹ The historical mandate that the FDIC must return premiums to the sector if losses are low is a very poor idea. It is paramount to returning fire insurance if there has been no fire yet.

Leverage restrictions and sector risk-weight adjustments

One concern often raised with market measures is that they may not be readily available in emerging markets, at least not with high reliability or frequency. Ongoing research at NYU Stern shows that this is not necessarily the case. Another concern raised is that regulators might lack sophistication or expertise to price deposit insurance premiums in a way that would sufficiently counteract incentives to build up systemic risk in good times. A way around these issues of lack of market and regulatory sophistication is to rely on somewhat simpler but coarser 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 un-weighted assets of the institution 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, for instance, mortgages cannot have loan-to-value ratios that are greater than 80%.

While apparently simple, these restrictions in fact require fair bit of regulatory oversight and sophistication. If enforcement is weak, the financial sector can evolve a “shadow banking” system, as was the primary problem in the United States in build-up to the crisis (see Section V below). The regulation must now ensure that all assets – on- and off-balance-sheet – are suitably accounted for in leverage calculations. Similarly, if regulators have to use coarse leverage measurements on complicated securities and derivatives, regulatory arbitrage would push the financial sector 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 by and large this has worked. Regulators are often playing catch-up to the financial sector. Hence, more prudent enforcement would ensure that regulatory perimeter is irrefutably enforced, so that ALL assets/risks of the financial sector are dealt with adequately while limiting leverage of the system.

Another macro-prudential approach that is less market-dependent, and one that is employed by some central banks in emerging markets (such as in India), is the sector-weight adjustment approach. This approach requires horizontal aggregation of financial institutions’ balance-sheets and risk exposures to identify over time – say 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 lion share 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 dynamic sector risk-weight adjustment approach is that if it is consistently implemented by regulators and anticipated by the financial sector, then it can act as a valuable countercyclical incentive. Financial firms anticipating the future risk in risk weights may stop adding exposure to an asset class once it is sufficiently crowded in. One disadvantage is that it may create a race to “get in first” and also relies heavily on regulatory discretion turning out to be prescient in identifying risk pockets and having sufficient will in good times to lean against the wind of 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 financial sector. Rule-based approaches such as in the capital requirements or tax/premium schemes above exonerate the regulators from relying too much on discretion and therefore from influence activity by the industry; discretionary-based approaches counter-balance by creating sufficient dynamic and constructive ambiguity in minds of the industry about increasing correlated risks and leverage. Our recommendation, however, is that discretionary approaches such as sector-based risk adjustments also be sufficiently rule-based, to the extent possible, in terms of the framework guiding the adjustments.

Box III: Proposals to regulate systemic risk in the United States under the Dodd-Frank Act of 2010

The Dodd-Frank Act calls for stricter prudential standards for systemically important institutions. In particular,

“In order to prevent or mitigate risks to the financial stability of the United ongoing activities of large, interconnected financial institutions, the Council may make recommendations to the Board of States that could arise from the material financial distress, failure, or Governors concerning the establishment and refinement of prudential standards and reporting and disclosure requirements applicable to nonbank financial companies supervised by the Board of Governors and large, interconnected bank holding companies, that are more stringent than those applicable to other nonbank financial companies and bank holding companies that do not present similar risks to the financial stability of the United States”.

Moreover, these additional standards should be increasing in stringency based on

“ (A) the extent of the leverage of the company; (B) the extent and nature of the off-balance-sheet exposures of the company; (C) the extent and nature of the transactions and relationships of the company with other significant nonbank financial companies and significant bank holding companies; (D) the importance of the company as a source of credit for households, businesses, and State and local governments and as a source of liquidity for the United States financial system; (E) the importance of the company as a source of credit for low-income, minority, or underserved communities, and the impact that the failure of such company would have on the availability of credit in such communities; (F) the extent to which assets are managed rather than owned by the company, and the extent to which ownership of assets under management is diffuse; (G) the nature, scope, size, scale, concentration, interconnectedness, and mix of the activities of the company; (H) the degree to which the company is already regulated by 1 or more primary financial regulatory agencies; (I) the amount and nature of the financial assets of the company; (J) the amount and types of the liabilities of the company, including the degree of reliance on short-term funding; and (K) any other risk-related factors that the Council deems appropriate.”

While factors A-K above capture many important characteristics of risk, there is an obvious factor missing. At the core of a firm’s systemic risk is the co-movement of that firm’s assets with the aggregate financial sector in a crisis. Moreover, all but two factors – factor C and the mention of interconnectedness in factor G - are about dealing with the risk of banks from an individual bank by bank standpoint.

The policies to be followed in regulating financial companies that are deemed systemically risky are not specified in the bill. Instead a range of policies are laid out and will be proposed by the Council for implementation by the Board of Governors. These policies include

- *risk based capital requirements*
- *leverage limits*
- *liquidity requirements*
- *resolution plan and credit exposure report requirements*
- *concentration limits*
- *a contingent capital requirement*
- *enhanced public disclosures*
- *short term debt limits*
- *overall risk management requirements.*

Our interpretation of the Act is that its intention is to give the Board of Governors flexibility to reduce the risk of the systemically most important firms that are identified by the Council. One necessary feature is to provide the Council with the tools to be able make such identifications possible.

III. Who should be the Macro-Prudential Regulator?

It has been argued that much of build-up of systemic risk preceding the financial crisis of 2007-09 remained unchecked – and to an extent unknown – due to fragmented nature of regulation in the United States and other Western Economies. In the United States, for example, there were over ten agencies regulating the financial sector, and the Dodd-Frank Act has missed out a valuable opportunity to consolidate them (eliminating just one in the process). Since the basic purpose of macro-prudential regulation is to measure and regulate risks relating to the *entire* financial system, such fragmentation can pose significant operational risks besides the risk of regulatory or jurisdictional arbitrage by the financial sector. Even in Asian economies, it has been argued that requiring harmonization across different regulatory authorities (especially, the central bank and the supervisory authority, as they are often separate) is crucial. However, such harmonization is often marred by territorial responses of each regulator to any harmonization attempts.²² Assigning a specific regulator – by law – the task of macro-prudential regulation is desirable in order to put a limit on such fragmentation and “turf-war” risks. Our recommendation is that this task be assigned to the central bank of an economy.

Candidacy of the Central Banks²³

Since the late 17th century, the role of central banks has always been in flux. In their earliest years, the primary function of central banks was to act as fiscal agents for governments. Later, in the 19th century, Walter Bagehot articulated the importance of the lender of last resort function. The central bank’s policy role in economic stabilization – setting policy interest rates and managing money growth – did not emerge as a key function until the middle of the 20th century. Around the same time, central banks in many countries took on much of the responsibility for the supervision and regulation of banks. Most central banks also assumed responsibility for the integrity, efficiency, and accessibility of the payments and settlement systems.

Modern central bank functions fall into three areas: monetary policy, the supervision and regulation of individual financial institutions, and systemic

²² Park (2010) discusses such a challenge in the context of macro-prudential regulation in Korea.

²³ The discussion on central banks draws in part from Chapter 2, “The Power of Central Banks and the Future of the Federal Reserve System”, by Thomas F. Cooley, Kermit Schoenholtz, George David Smith, Richard Sylla and Paul Wachtel, in “Regulating Wall Street: The Dodd-Frank Act and the New Architecture of Global Finance”, edited by Viral V Acharya, Thomas Cooley, Matthew Richardson and Ingo Walter, John Wiley & Sons, October 2010.

regulation of the financial sector as a whole. This latter function includes both the traditional concern for the functioning of the payments system and a new set of concerns about system-wide risk arising from the increased complexity and interconnectedness of financial institutions and markets.

Monetary Policy

Very few argue with the idea that monetary policy aimed at economic stabilization should rest in the hands of an independent central bank. Economists and historians have amply documented that independent central banks achieve lower and less volatile inflation rates than those that are beholden to governments in power, and that they do so at no long-run cost to economic output. The central bank can use its tools to guide the economy toward goals set forth by the government. For example, in the United States, the Fed has a dual mandate to maintain stable prices and full employment. Many other central banks – the ECB is a notable example – have a single mandate to maintain price stability. A central bank influences interest rates and the growth of money and credit in order to attain its specified goals. An independent central bank can pursue these goals without concern for an election cycle that might tempt elected policymakers to pursue short-term goals, such as unsustainably high employment and real growth with little concern for longer-run inflationary implications.

Some argue that the function of a central bank should begin and end with monetary policy, and that any other obligation would distract the central bank from achieving its primary goal of economic stabilization. However, this ignores important links between monetary policymaking, financial regulation, and prudential supervision that favor a wider role for a modern central bank.

Supervision, Regulation and the Lender of Last Resort

In the 19th century, Bagehot introduced the idea that the central bank should serve broadly as a lender of last resort to the financial system. In fact, the modern notion of monetary policymaking evolved out of the central bank's lending activities. Traditionally, the central bank provided liquidity to the financial system. Its lending to the banking system influenced the aggregate economy even before the macroeconomic role of the central bank was acknowledged. When special liquidity problems threatened the operation of the banking system, the central bank also would act as the lender of last resort. It is only logical that such a lender should have sufficient information about borrowers to be able to make sound loans. Thus, it is no accident that bank regulatory and supervisory functions are often associated with the lender of last resort.

Some economists have claimed that the lender of last resort role for central banks is obsolete. They argue that in the presence of modern, well-developed

financial markets, there should be no such thing as an illiquid but solvent firm. Solvent firms should always be able to arrange financing on the interbank market, the repo market or in longer-term credit markets. In the aftermath of the 2007-2009 crisis, this view, which harkens back to the arrangements in place prior to the panic of 1907, seems to reflect an overly optimistic faith in the ability of financial markets to avoid collapses.

Conceivably, the supervision and regulation of individual banking institutions need not be a central bank function. In some countries, it is housed in other government agencies. And in some countries such as the United States, the Fed has always shared these functions with state and national agencies responsible for chartering banks, as well as with the deposit insurance agency.

However, as the lender of last resort, it is crucial that the central bank be able to obtain timely information about any potential borrower. This is a linchpin of the argument that the central bank should have a leading role in bank supervision and regulation. One might ask whether the real issue is effective communication between the central bank and any other agencies with supervisory authority. In practice, however, instances where the role of supervisor and lender of last resort have been separated have highlighted how difficult it is to communicate effectively in a crisis.²⁴

More importantly, the benefits of linking the lender of last resort and the role of supervision go beyond the advantages of rapid communication. The skills and expertise developed in the course of regulation and supervision may help the lender of last resort to innovate when necessary in a liquidity crisis. For example, the rapid, emergency introduction of several new Federal Reserve lending facilities in the United States during the crisis of 2007-2009 (e.g., the Treasury Auction Facility and the Primary Dealer Credit Facility) would have been difficult in the absence of extensive hands-on experience in the financial system on the part of Fed supervisors. Similarly, experience in regulation and supervision may be critical for the development and informed use of so-called macro-prudential powers, which aim to curb systemic financial threats.

Against this background, it is important to distinguish among the types of organizations to be supervised. The lender of last resort role probably is of greatest relevance in dealing with institutions whose instability would pose a direct threat to the financial system as a whole. It is possible for a wide array of small (non-“banking”) financial institutions to pose such a systemic threat if they face a common exposure that makes them collectively vulnerable. The experience of

²⁴ For instance, in the United Kingdom, where the Bank of England acts as lender of last resort and the Financial Supervisory Authority oversees the potential borrowers. As a result, U.K. Chancellor George Osborne recently announced plans to eliminate the Financial Supervisory Authority and return a leading role in bank supervision to the Bank of England.

money market mutual funds (MMMFs) in the recent crisis provides a case in point. Even the thrift crisis of the early 1980s was not truly systemic. Moreover, the experience of the recent crisis suggests that large, complex financial institutions (LCFIs) are more likely to be sources of systemic disruption. For this reason, there would appear to be a stronger case for linking the lender of last resort to the supervision of LCFIs than to the supervision of other financial institutions.

Systemic Risk Regulator

Although systemic risk is not a new idea, the notion of an explicit systemic risk regulatory function is new. Addressing systemic threats has been an implicit function of the central bank because its lender of last resort facility was the only tool available to respond to systemic risk problems. To be effective as a systemic risk regulator, the central bank or the equivalent regulatory authority has to have influence that stretches out in multiple directions.

First, the systemic regulator needs to augment the oversight and supervision of institutions that are so large and interconnected that any insolvency would create systemic problems.

Second, it must be able to address systemic problems that can arise from smaller institutions facing a common vulnerability.

Third, economic conditions can give rise to systemically risky activity. The extended period of low interest rates in the early 2000s created an environment that promoted rapid credit expansion and some of the excesses, particularly in the mortgage markets, that generated the crisis. Hence, new elements of monetary policy – so-called macro-prudential powers – such as loan-to-value restrictions, systemic risk taxes as we have proposed, countercyclical capital buffers and adjustments to risk weights of assets based on stress tests, etc., all constitute an important potential element of systemic risk management.

In summary, there is no escaping the fact that there are competing goals that make the role of the central bank difficult to determine. Although everyone agrees that monetary policy is a central bank concern and the *raison d'être* for central bank independence, there are wide differences of opinion regarding the extent to which the central bank should also have responsibility for the supervision and regulation of individual financial institutions and for systemic regulation of the financial sector as a whole. While a modicum of financial stability is necessary for economic stability, there are potential conflicts among the mandates of the central bank. Even the European Central Bank, which has the sole mandate of price stability, has been drawn into an expanded role by its decision (in the face of some fierce opposition) to hold the sovereign debt of member states that faced serious funding challenges, such as Greece, Spain and Portugal.

Overall, strong linkages among the three functions of a central bank are sufficiently compelling that, with proper oversight, the central bank should have broad authority in all three of them.

Box IV: Federal Reserve under the Dodd-Frank Act of 2010 in the United States

The Dodd-Frank Act passed in the United States this year reflects changing views of the role of a central bank in the post-crisis world by providing an explicit new goal for the Federal Reserve. In addition to its existing mandate to attain maximum employment and stable prices, the Act gives the Federal Reserve an explicit financial stability function: “The Board of Governors shall identify, measure, monitor, and mitigate risks to the financial stability of the United States.”

The Dodd-Frank bill in other ways strengthens the connection between the lender of last resort and regulatory and supervisory functions. It enables the Fed – subject to recommendation from the new Financial Stability Oversight Council (FSOC) – to supervise systemically important nonbanks.

The establishment of the FSOC as a systemic risk regulator is an important component of the Dodd-Frank bill. It is uncertain whether the Dodd-Frank FSOC will become the powerful systemic regulator that is needed. Rather than exercising direct authority, the FSOC will be able to authorize explicit Fed supervision of SIFIs. Such authority makes it possible in theory to rein in the systemically risky activities of any financial institutions – shadow banks, hedge funds, and insurance companies, for example – including ones that are not otherwise subject to regulatory oversight. If the behavior of any financial institution creates systemic threats, the regulator has reason to be concerned.

However, the Council is only a loose umbrella organization with the mission, among other things, “to identify risks to the financial stability of the United States that could arise from the material financial distress or failure, or ongoing activities, of large, interconnected bank holding companies or nonbank financial companies, or that could arise outside the financial services marketplace” and “make recommendations to primary financial regulatory agencies to apply new or heightened standards and safeguards for financial activities or practices that could create or increase risks of significant liquidity, credit, or other problems spreading among bank holding companies, nonbank financial companies, and United States financial markets.”

The Council will play a largely indirect role: instructing regulators to tighten oversight when it deems that systemic risks warrant action. Thus, the systemic regulator is removed from the direct issues of systemic concern – supervision of institutions that can create systemic risks and monetary policy. And, the Federal Reserve will be only one participant among several in the FSOC,

without a leading role. The argument for giving the Federal Reserve System a more central role in systemic regulation is that so many of the functions and concerns of a systemic regulator are closely related to essential Fed functions.⁹ The Fed monitors markets constantly and has to ensure the integrity and viability of the payments system. Business and financial cycles are closely linked: It is impossible to secure economic stability without a modicum of financial stability. Given its expertise and its degree of independence from the government, the Fed is a natural location for assessing the possible tradeoffs between these two policy goals. It already has key tools for managing systemic threats and is developing new ones.

The Federal Reserve had the authority to lend widely (that is, to nonbanks) in times of widespread financial exigency in order to manage a systemic threat. Until March 2008, however, these powers were hardly known and little understood because they had not been used after the 1930s, when they were created and employed. The evolution of discount lending authority in the 20th century gave the Fed a tool for responding to systemic risks. However, it did not make the Fed the actual systemic regulator with an obligation to monitor and prevent the rise of systemic risk. In fact, the recent crisis highlights what can happen when there is no one authority unambiguously responsible for responding to systemic risks. The Dodd-Frank bill ratifies the Fed's ability to provide nonbanks with emergency liquidity through facilities with broad access, but not with lending to individual nonbanks. A key issue in the future will be whether the new restrictions on emergency lending to individual nonbanks will inhibit a prompt and timely response to a crisis with potentially systemic implications.

Finally, the bill preserves the Fed's role as the principal regulator of the largest banks. And it permits the Council to grant the Fed supervisory authority over other SIFIs. If the Council acts effectively in this way, most key issues of systemic concern eventually will be brought under the wing of the central bank.

IV. How to Deal with Shadow Banking?

Shadow banking is a system of financial institutions that mostly look like banks. These financial institutions borrow short-term in rollover debt markets, leverage significantly, and lend and invest in longer-term and illiquid assets. This part of the financial system includes asset-backed commercial paper (ABCP), money market funds, securities lending and collateralized repos (at broker-dealers).²⁵

²⁵ The size of this market is roughly \$8 trillion in the United States (and even larger by some estimates) and matches the size of deposits, both insured and uninsured, held at depository institutions. The growth of shadow banking over the last 25 years has been extraordinary relative to the growth in deposits.

There are important differences in current regulatory treatment of shadow banking and banking sector. The shadow banking system is for the most part, unregulated. It is also unprotected from bank-like runs (i.e. there are no explicit guarantees provided by the government). Of course, the financial crisis of 2007-2009 showed that much of the shadow banking system – investment banks and money market funds in particular – ended up being bailed out. This part of the financial system, considered in whole, was too big to fail.

As the housing market deteriorated 2007 onwards, and more generally as prices fell in the credit market, the value of assets held by “shadow banks” fell significantly and put into question their solvency. Given the opaque nature of these institutions, uncertainty about which institutions were solvent led to a run on the sector.

- a. When non-prime mortgage prices collapsed in the early summer of 2007, highest-rated (AAA-equivalent) ABCP conduits that held non-prime mortgage-backed securities fell below par value (i.e. became insolvent) and lost their short-term funding. Because the holdings of other ABCP conduits were unknown, short-term funding got pulled from the \$1 trillion sector. As a result these mortgage-backed securities were forced back onto the balance sheets of large complex financial institutions because the conduits had either explicit or implicit recourse to their balance sheets.
 - b. When Lehman Brothers failed in September 2008, it shortly became known that a large money market fund, the Prime Reserve fund, was exposed to its short-term debt. The losses on Lehman caused the fund to “break the buck” (i.e. fall below par value). Again, not knowing what other non-Treasury money market funds were holding, investors immediately pulled their funding from these funds, causing a run on the money market sector and thereby the collapse of the commercial paper market for financial institutions. To restore confidence, the government had to guarantee the money market sector.
 - c. AIG’s securities lending business in its Life Insurance and Retirement Services segment invested two-thirds of its cash collateral in AAA-rated mortgage backed securities. When the value of the underlying mortgages fell, borrowers of AIG’s securities did not rollover the loans, causing massive fire sale losses on AIG’s AAA-rated mortgage backed securities. While it is well known AIG lost \$40.8 billion in its Financial Products Group, less known is the fact that its Life Insurance unit lost \$37.5 billion.
-

- d. Investment banks funded a considerable amount of assets, particularly longer-term less liquid asset-backed securities, using the short-term (typically overnight) repo market. Since repos were collateralized against these assets, as questions about the value of these assets arose, repo haircuts increased. This led to a funding liquidity problem for institutions with weaker assets, and in turn led to a systemic funding liquidity problem as they too withdrew liquidity from other firms, generating an *illiquidity* spiral. Bear Stearns, Lehman Brothers and Merrill Lynch all effectively failed and without government intervention, Morgan Stanley could possibly have failed as well.

In the earlier part of the century e.g. during the Panic of 1907 and the various banking panics between 1930-1932 in the wake of the Great Depression, uncertainty and lack of information about which financial institutions were insolvent led to system-wide bank runs. In response to these systemic runs, the government created the Federal Reserve with its lender of last resort facility, the FDIC and deposit insurance, along with a number of banking and investment acts. Arguably, the most important part of the legislation was that depositors no longer had to run on the bank because the government guaranteed the funds. Of course, it is well understood that this safety net creates a moral hazard, that is, an incentive for the bank to undertake greater risk than it would otherwise would without this insurance. Regulators and policymakers therefore set up a number of countervailing barriers: (i) banks would have to pay to be a part of the deposit insurance system, so, at least, on an *ex ante* basis, regulators took into account the cost of the insurance, (ii) the risk-taking activities of banks were ring-fenced to the extent that there was a separation of the commercial and the more risky, investment banking activities, and (iii) enhanced supervision, and winding-down provisions, of individual banks, generally in the form of capital requirements and prompt corrective action was established.

There seem to be two distinct possibilities to reduce the build-up of systemic risk in the shadow banking system:

- a. The first is to explicitly guarantee the short-term liabilities of the shadow banking sector in a systemic crisis. In return, institutions like broker-dealers, ABCP conduits and money market funds would (i) be charged a fee akin to the FDIC premium; (ii) have their risk-taking activities restricted, (iii) be forced to hold a capital buffer, and (iv) be subject to wind down provisions to avoid excessive risk shifting in distress.
- b. The second is to leave the shadow banking institutions unprotected, yet set up an airtight mechanism for dealing with these firms in a systemic crisis. Specifically, if there is a run on an institution's liabilities, then, with the approval of a systemic risk regulator (or the central bank), the institution can suspend redemptions. This action would not in itself either initiate

bankruptcy proceedings or force the firm into receivership. The collateral underlying these liabilities would be sold off in a slow orderly fashion (or alternatively pledged back to the lenders). But since most of the lenders in the shadow banking system participate in this sector to access liquidity, the government would, at a significant haircut and for a fee, lend against the collateral. This way the lenders would have access to some funds during a systemic crisis, thus allaying any fears that all their funds would be frozen for a prolonged period. Most importantly however, any losses in the collateral would eventually be borne by these creditors and not by taxpayers.

- c. Finally, at least a part of the shadow banking system, most notably ABCP conduits, appears to have evolved largely for commercial banks to make an end-run around Basel capital requirements. The loopholes involving different accounting and regulatory capital treatments of on- and off-balance sheet assets should be removed at the earliest as they facilitate leverage build-up in the shadow-banking world in opaque forms. Money market funds are also generally an end-run around taxes or restrictions on banks to offer high interest rates on deposits or any interest rates on corporate deposits. Such distortions could also be eliminated.

V. Lessons for Emerging Markets²⁶

Let us discuss the implications of the recent financial crisis -- and the market and regulatory failures that led to it -- on financial stability in emerging markets. We focus on three issues: (i) government guarantees, mostly in the form of deposit insurance, (ii) the implications of these guarantees in the current crisis, and (iii) the transmission of systemic risk.

A. Government Guarantees

We argued that 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 absent other market failures, this moral hazard can lead to excessive systemic risk and financial fragility. Consider our analysis of the lessons learned from the current crisis for the United States. Deposit insurance enacted in the 1930s in the wake of the Great Depression had long-term success only because

²⁶ The discussion of this section is partly based on Acharya, Cooley, Richardson and Walter (2010).

significant protections were put in place in terms of insurance charges, regulation (mostly in the form of capital requirements and wind down provisions), and restrictions on bank activity. As these protections began to erode in the recent period in the U.S., the moral hazard problem resurfaced.

To some degree, this lesson was already known to researchers studying the moral hazard of government guarantees in emerging markets. As pointed out by Demirguc-Kunt and Kane (2002), the number of countries offering explicit deposit insurance increased multifold from 12 to 71 in the 30-year period starting in the 1970s. They argue that the key feature of a successful deposit insurance scheme is the financial and regulatory environment in which it functions. The environmental conditions include coverage limits of deposit insurance, the degree to which depositors take coinsurance of their balances, restrictions on certain deposit accounts, and whether the program is funded publicly or privately, among other characteristics.

Demirguc-Kunt and Detragiache (2002) look at a large cross-section of countries in the post 1980 period and conclude that deposit insurance increases the likelihood of a banking crisis.²⁷ 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 authors conclude that the incentive problems associated with the moral hazard from deposit insurance can be partially offset by effective prudential regulation and loss-control features of deposit insurance.

In addition, opacity amplifies the financial crisis once it starts and suggests remedies for this problem. Consistent with this view, Mehrez and Kaufmann (2000) find that, for a large cross-section of countries, a lack of transparency worsens financial crises. The authors conclude that regulation should focus on increasing transparency of economic activity, government policy and the financial sector especially when the country is going through a period of financial liberalization.²⁸

B. Bailouts, the Current Crisis and Emerging Markets

As pointed out by Demirguc-Kunt and Kane (2002), it is quite common to provide government guarantees during a crisis, citing the examples of Sweden (1992), Japan (1996), Thailand (1997), Korea (1997), Malaysia (1998) and Indonesia (1998). In the current crisis, the U.S. guaranteed money market funds after the fall of Lehman Brothers,

²⁷ See also Hovakimiam, Kane and Laeven (2003).

²⁸ This too is the conclusion of Demirguc-Kunt and Kane (2002).

and made explicit the previous implicit guarantees of the GSEs and the too-big-to-fail institutions.

What is the impact of such guarantees?

Honohan and Klingebiel (2003) find that unlimited depositor guarantees and regulatory forbearance increase the fiscal costs of financial crises.²⁹ 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. Laeven (2002) also finds that in, many countries, deposit insurance is sharply underpriced, also contributing to both the likelihood of a financial crisis and the cost of one if it occurs. Of course, deposit insurance premium was not collected for most banks in the U.S., from 1996-2005 due to the fund being well-capitalized. As in Section V.A above, the lesson here is that the problems that plagued the U.S. are similar to those that have afflicted emerging markets.

Of course, many analysts might point to the apparent "success" of the guarantees employed in the U.S. in the current financial crisis, and even more so to the stellar success stories of India and China 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 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 the year 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 United States). This is because the relevant law ("Bank Nationalization Act") explicitly places 100% liability for public sector banks on the government.

Hence, when the financial crisis hit India -- especially in autumn of 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

²⁹ See also Claessens, Klingebiel and Laeven (2004) and Kane and Klingebiel (2004) for further analysis and discussion of the costs of providing guarantees during a banking crisis.

financial sector -- there was a flight of deposits to state-owned banks.³⁰ In the period January 1, 2008, through February 24, 2009, the public sector banks' market capitalization 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 measure³¹ -- 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 the state-owned banking sector at the expense of the private-owned banking sector continues. Recent reports suggest that loan growth of private sector banks in India has not been that high in 2009, whereas loans at public sector banks have grown in many segments, such as vehicle-backed finance, by as much as 10%. In essence, government guarantees have created a lack of level-playing field, which 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 – or take other risks -- more aggressively in order to maintain market share and generate comparable returns to shareholders. Bank regulation in India tends to be on the conservative side, often reining in risk-taking with overly stringent restrictions. However, the debilitating effects of government guarantees can travel quickly to the corporate sector and other financial firms reliant on banks, which are not directly under bank regulator's scrutiny or legal mandate.

In China's case, as a part of its fiscal stimulus, the Chinese Government 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 Chinese banking sector grew by 34%. While this has clearly helped the Chinese economy recover quickly from the effect

³⁰ In a notable incident, Infosys, the bellwether of Indian technology and a NASDAQ listed company, moves its cash in hand from ICICI Bank, one of the largest private-sector banks, to State Bank of India, the largest public-sector bank.

³¹ Acharya, Pedersen, Richardson and Philippon (2009). In particular, MES was calculated as follows. The worst 5% days for the S&P CNX nifty index (or Bombay Stock Exchange sensx index) were taken over the year 2007. On these days, the average return of a financial firm was measured. This average return is the MES for that financial. The results are available from authors upon request.

of the financial crisis in the United States – and its consequent effects on global trade -- much of the growth in banking sector loans mirrors the growth in corporate deposits. 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: China has bailed out its entire banking system more than once before, and in far greater magnitudes than the United States has in this crisis.

The examples of India and China highlight the classic risks that arise from government guarantees. First, that they create an uneven playing field in banking sectors where some banks enjoy greater subsidies than others. This invariably leads 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. The situation in India partly mirrors that in the United States, where commercial banks enjoyed greater deposit insurance but investment banks did not; over time, investment banks expanded their leverage significantly, leading to their demise. Commercial banks suffered, too, but fared somewhat better because of their insured deposits. The situation in China is comparable to the massive credit expansion and risky betting that occurred on the balance sheets of the Fannie Mae and Freddie Mac in the United States.

Both of these problems festered because of government guarantees and contributed to the financial crisis of 2007-2009. India and China should not rest on their laurels of rapid recovery from this global economic crisis. Instead, they need to safeguard their financial and economic stability by engaging in a rapid privatization of their banking sectors -- or at the least, stop inefficient subsidization of risk-taking through state-owned banks. Government guarantees do not just weaken the banks that are guaranteed, but they also create systemic risk by weakening competing banks, subsidizing corporations and fueling excessive asset speculation.

C. Systemic Risk of Emerging Markets

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 was that systemic risk is a negative externality on the system and therefore cannot be corrected through market forces. In other words, there is a role for regulation in order 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 inter-connected nature, such institutions nevertheless expose all jurisdictions to their risk-taking. Individually, jurisdictions may prefer to be regulation-“lite” in order to attract more institutions and thereby jobs.

The poster child in this crisis for being internationally interconnected is Iceland.³² 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 (Kaupthing, Landsbanki and Glitnir) also went beyond its own borders. Because the banks had fully exploited internal expansion within Iceland, they opened up branches abroad, in particular, the U.K. and Netherlands, by offering higher interest rates than comparable banks in the U.K. and Netherlands. When the Icelandic banks began to run aground and faced massive liquidity problems, in a now somewhat infamous event, the U.K. authorities invoked an anti-terrorism act to freeze the U.K. assets. Essentially, Iceland as a country went into shutdown.

Of course, the most common source of systemic risk is that of 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 withdrawn of all a sudden upon a crisis occurring. These “runs” can leave the corporate and banking

³² See Buiter and Sibert (2008).

sector of the developing country devastated, especially if there are currency, liquidity or maturity mismatches between the assets and foreign liabilities. An example from the recent crisis is that net private capital flows to emerging Europe fell from \$250 billion or so 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 for both its financial effect (e.g., spike in risk aversion of investors) and economic impact (e.g., large drop in global trade since World War II). Compared to past banking crises, therefore, it is quite surprising that by and all emerging markets got through unscathed. This can be partly attributed to better (or excess!) internal planning – a substantial stock of international reserves – and some to liquidity funding by international government organizations like 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 its larger brethren on prudent measures like leverage limits 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 shutdown 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 reduce regulatory arbitrage through jurisdictional choice substantially. The 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. We discuss these issues of global linkages and coordination in much greater detail next.

VI. Global Linkages and Coordination³³

The Case for International Coordination

Many of the policy recommendations we have put forward will prove to be ineffective - or at least their edge blunted - if there is a lack of international coordination among central banks and financial stability regulators in implementing them. This issue is important; although cross-border banking and financial flows are extensive, much of bank and financial supervision remains national. There is some consensus on prudential aspects of regulation such as capital requirements and their calculation, but there is hardly any consensus on how much forbearance regulators show towards their national banks and how they should share the burden of failures of global financial institutions.

Complications that could arise from lack of coordination between national regulators are many. These complications are largely due to 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 inter-connected nature, such institutions nevertheless expose all jurisdictions to their risk-taking.

Here are three examples, mainly based on policy recommendations in this book, which illustrate the negative externalities that can arise due to lack of international coordination:

1. The Pricing of Government Guarantees

The provision of implicit deposit insurance is now ubiquitous, and in most cases - up to some threshold level of deposit amount - explicit. Suppose, however, that deposit insurance guarantees are priced differently across countries. Say, for example, deposit insurance is priced fairly for banks in Country A but their commercial banking counterparts in Country B have to pay no premium whatsoever (as has been the practice so far, although it is now under consideration). Under such circumstances the country B banks, all else equal, would be able to offer higher deposit rates, attract a greater base of deposits, and more generally, face a lower effective cost of funding. This would affect the competitiveness of the country A banks – at least relative to those country B banks which are global players. If the disadvantage to the country A banks becomes sufficiently

³³ This discussion is based on Chapter 18 “International Alignment of Financial Sector Regulation” by Viral V Acharya, Paul Wachtel and Ingo Walter, in *Restoring Financial Stability: How to Repair a Failed System*, eds. Viral V Acharya and Matthew Richardson, John Wiley & Sons, March 2009.

large, they would soon attempt to induce their regulators to under-price deposit insurance as well. This will generate moral hazard at commercial banks all over the world. The excessive risk-taking by commercial banks, could in turn, be transmitted to unregulated parts of the financial sector as they deal with insurance companies, investment banks and hedge funds.

2. Lender-of-last-resort (LOLR) Policies

LOLR policy is one area where better coordination - at least among the largest central banks - could produce substantial improvements. Suppose the central bank of country A adds conditionality, explicitly or implicitly, to its terms for lender of last resort facilities, requiring that highly leveraged institutions raise capital in order to be eligible for borrowing against illiquid collateral. But suppose at the same time a central bank in another part of the world does not require such criteria. Then, a global player, based primarily in the country A, could simply access liquidity from these other central banks, rendering ineffective the purpose of conditionality in the country A central bank's LOLR policies, delaying its capital issuances, and imposing a cost on the entire financial sector.³⁴

3. Regulation of Systemic Risk due to Large, Complex Financial Institutions

Similarly, if large, complex financial institutions (LCFIs) are subject to a systemic risk charge then some jurisdictional coordination is necessary. How would a national regulator acquire the right to "tax" a financial entity that is not formally a part of its jurisdiction? The only reasonable outcome is that all significant national financial sectors have a LCFI regulator and they agree on the set of institutions that should be subject to the systemic risk tax. If each country implements some form of LCFI tax on its systemically large players, the outcome would lead to far fewer distortions in the form of gaming of regulatory guarantees through pursuit of the TBTF status.

³⁴ It appears that Lehman Brothers might have been an example of such a situation; Lehman borrowed heavily from the European Central Bank against illiquid collateral during the sub-prime crisis, substantially weakening the position of the Federal Reserve in persuading its top management to either find a suitor or issue more capital (which was costly for management due to dilution costs). Coordination among central banks in getting Lehman Brothers to reshape its balance-sheet before it could be deemed eligible for LOLR support might have altered history.

Addressing Regulatory Externality

All these examples suggest that a “beggar-thy-neighbor” competitive approach to regulation in different countries – or even the failure to coordinate without any explicit competitive incentives – will lead to a race to the bottom in regulatory standards. This will end up conferring substantial guarantees to the financial sector, giving rise to excessive leverage- and risk-taking incentives in spite of substantial regulation in each country. Such an outcome should be avoided at all costs. The problem is once again one of externalities, and the case for coordination is therefore a compelling one. It is imperative in our opinion for national leaders, preferably central bankers of countries with large financial markets (the G20, for example), to agree on a broad set of principles that all countries will adopt and implement.

National regulators do not like to give up their independence and discretion. Indeed, it may not be possible to agree on every detail of each issue pertaining to regulatory implementation. It appears to us, however, that the key is to agree on the “big” reforms. Overarching principles, such as (a) treatment of off-balance-sheet leverage in a fair and consistent manner by standardizing definitions, disclosure and accounting practices, (b) pricing guarantees and bailouts fairly; (b) requiring transparency in OTC derivatives that connect financial institutions; and (d) avoiding provision of liquidity to insolvent institutions, should be reasonably convincing to most regulators as desirable principles to follow. Once agreement on adopting such broad principles in their individual approach to regulation is reached, it is possible that different countries will proceed to implement slightly different variants of each principle. But, the constraints imposed by adopting sensible overall principles will minimize the arbitrage that financial institutions can engage in by shopping for the most favorable jurisdiction. This, in turn, will ensure that desired objectives of each individual country’s financial stability plans are not seriously compromised.

Will such coordination necessarily arise? And, if yes, what form will it take? It is useful to start with some history of efforts at such coordination.

History of International Coordination Efforts

As with the current crisis, global economic problems in the past have often called for global solutions with international policy coordination. However, nations do not have a very good track record at creating international policy institutions and rules with significant cross national powers. In finance, the history goes back to the Bretton Woods conference in 1944. With the end of the Second World War in sight, it was clear that the international financial structure should be reconfigured to avoid a return to “beggar-thy-

neighbor” policies of the pre-war period. Lord Keynes, the dominant intellectual figure at the conference, proposed that exchange rates be fixed to an international currency (the ‘bancor’) issued by an international central bank or global lender of last resort. Perhaps inevitably, the idea of a supra-national authority proved far too radical at the time, and the International Monetary Fund (IMF) system that emerged had limited lending authority. Nevertheless, Bretton Woods was a dramatic success because memories of the pre-war economic disaster lingered and the dawn of a new era provided an unprecedented opportunity to start afresh. So the shared determination to reform led to an important restructuring of international financial relationships that served the global economy well until the system broke down in the 1970s.

The original Bretton Woods agenda also called for the establishment of a trade organization to coordinate trade policies and reduce impediments to free trade based on two simple but compelling principles – reciprocity and most favored nation treatment (non-discrimination). However, global trade policy coordination from the establishment of GATT in 1947 and running to its successor, the World Trade Organization (WTO), has had important problems of compliance and enforcement. The WTO operates without any international enforcement powers and relies on consensus among all member nations to establish policies consistent with the agreed rules. Lack of enforcement often makes compliance problematic and agreements to reduce trade barriers can only be reached after endless rounds of negotiation such as the currently ongoing Doha round. Progress has been made but in the absence of any supra-national authority, it relies on very gradual consensus building.

In the aftermath of the 1997-98 Asian crisis, there were many proposals to strengthen the IMF by giving it the ability to discipline irresponsible countries or put them into a form of receivership. These proposals would have required countries to give up sovereign powers, and it was quickly clear that neither the US nor other governments would take external intervention on this scale seriously. Moreover, the conditionality imposed by the IMF on debtor countries led to substantial resentment of the institution in emerging markets. Partly as a result, the IMF has not played a significant coordinating role in the international response to the current crisis, although its sovereign lending facilities are once again being utilized. The IMF does, however, play an important role in collecting and disseminating information about national economies and their financial systems. Its Financial Sector Assessment Program (FSAP) does a thorough job of monitoring and evaluating national financial sector stability. However, FSAP reviews are only conducted with the permission of national authorities who have the final say on the

release of findings to the public. Importantly, the United States has never agreed to be the subject of an FSAP review.

Within the European Union, all barriers to trade in financial services and restrictions on cross border activities of banks were eliminated in 1992 when the Single European Act took effect and the creation of the Euro in 1999 reduced uncertainty due to exchange rate fluctuations among the participating countries. Nevertheless, the adoption of the Euro was controversial in many countries and rejected by several EU members, notably the UK, that wanted to retain sovereign control of monetary policy. The Euro area is now a well integrated financial sector – financial markets have caught up with product and services markets. Although the EU does a great deal of community-wide regulation in the real sector, financial sector regulation and supervision remains under the purview of national authorities. On occasion, the European community has been able to prevent some egregious bailouts from going through, even in the financial sector (for example, French recapitalization of Credit Lyonnais in the 90’s was subject to several EU-imposed constraints).³⁵ Even today there is some perception, that cooperation on financial sector regulation represents an undesirable surrender of national sovereignty of individual member countries.

There are some examples of international coordination of economic and financial policy but these are usually ad hoc responses to crisis without any mechanism for improving the overall picture. For example, the Plaza Agreement in 1986 among the world’s five largest economies led to a period of coordinated currency interventions and domestic policy alignment. Similarly, in the current crisis, there has been significant cooperation among central banks in creating almost unlimited currency swap arrangements. However, such instances of coordinated policy are not common and have become more difficult as the number of large economies has increased. In recent years, attempts to coordinate exchange rate policy with China, for example, have been notably unsuccessful, even though that remains the current focus of the G20 meetings.

Coordination is key, not centralization

While these examples do not inspire a great deal of confidence in the prospects for creating an international regulator - or even achieving significant international coordination after the current crisis, there is some silver lining. In mid-October 2008, the then British Prime Minister, Gordon Brown, made a dramatic call for a new Bretton Woods conference to establish a “global way of supervising our financial system.” He

³⁵ See Acharya (2003), especially Pages 2767-2770 for a discussion of attempts by participating countries in a cooperative arrangement such as the EU to be forbearing toward national banks.

called for turning the IMF into an international central bank and for placing financial supervision in the hands of an international body. His bold proposals were met with some half-hearted support, notably in Europe, and there has been no noticeable movement towards forming his suggested meeting of world leaders. Nevertheless, his exhortation appeared to contain an important initiative, in principle.

We concede that it is highly unlikely that an international financial sector regulator with power over markets and institutions will emerge in the foreseeable future; countries are simply not willing to surrender authority. It remains unrealistic to expect that an international central bank will be able to close down a large part of the financial sector of a country; or determine monetary or fiscal policy for a country; or that international civil servants will supervise or inspect national financial institutions.³⁶

Instead, improvements in the regulatory structure will have to come through increased coordination and an understanding that a more closely aligned and consistent approach is in each nation's best interest. Basle capital requirements provide an important precedent for this approach. The ostensible purpose of the Basle Accord of 1988 was to "level the playing field" by eliminating the funding cost advantage conferred to the Japanese banks by their regulators.³⁷ No matter what one thinks of the end-result of the Basle initiative, the process itself was important. The Basle Committee crafted an international consensus with a common set of rules for applying prudential capital requirements on all banks. Countries were then expected to adhere to these rules, although the decision to apply them or tweak them or use them at all remains country specific. The Committee has no way of imposing the agreement on countries or penalizing non-cooperation. It was participation in the negotiations that formed the consensus and created a commitment to the outcome.

The Bank for International Settlements (BIS) - which houses the Basle committee - has made several attempts to standardize rules and definitions in financial institutions. For instance, it has set standards for the collection and dissemination of financial sector information. There is also a new player on the scene. The Financial Stability Forum

³⁶ The limited capability of existing institutions is often recognized. Timothy Geithner noted in a speech in 2004, that the IMF developed a "financial mission that had some of the characteristics of a lender of last resort... but without mechanisms to constrain risk-taking behavior."

³⁷ Even then, unsurprisingly, Japanese regulators counteracted any harmful effect of the level-playing field created by the Basle Accord of 1988 on the Japanese banks by relaxing their non-Basel policies. Wagster (1996) and Scott and Iwahara (1994) provide supporting evidence for the implied difficulty in achieving a true level-playing field through adoption of Basle capital requirements.

(also housed at the BIS) was established in 1999 by the G7 countries. It has issued several reports detailing specific recommendations for strengthening and standardizing financial regulation. Specifically, its April 2008 report provided specific benchmarks for (a) strengthening prudential oversight, (b) enhancing transparency and valuation, (c) changes in the role and uses of credit ratings, and (d) strengthening the authorities' responsiveness to risks and providing robust arrangements for dealing with stress in the financial system. None of these suggestions have the force of law, nor can the BIS compel countries to act. However, the BIS looks like the most promising venue for an international consensus to develop, and the fact that the FSF is taken seriously (for now) means that meaningful cooperation and coordination might emerge.

Recommended Steps to Achieve International Coordination

What is in store for the future? Will a new Bretton Woods produce a new and powerful international regulator? We view this as unlikely and unrealistic, particularly in the midst of the current crisis. Instead, world leaders need to express a commitment to forge a regulatory consensus on a sensible blueprint for the overall global financial architecture. Our recommended steps to achieve such international coordination are thus as follows:

1. Central banks of the largest financial markets (say the G20 or a regional block of countries) should convene first, and agree on a broad set of principles for regulation of banks. As advocated in this book (and possibly elsewhere), these principles should cover the following themes:
 - a. Each central bank should carve out a dedicated role for a powerful LCFI regulator that is in charge of supervising and managing the systemic risk of large, complex financial institutions.
 - b. The supervisory and control apparatus of each LCFI regulator should feature:
 - i. Fair pricing of explicit government guarantees such as deposit insurance and, where implicit government guarantees are inevitable, limiting their scope by ring-fencing activities of guaranteed entities;
 - ii. Standards for transparency and accounting of off-balance-sheet activities and centralized clearing for large OTC derivative markets to reduce counterparty risk externality;
 - iii. Imposition of a systemic risk “tax” on LCFIs, that is based on aggregate risk contribution of institutions rather than their individual risk exposures;
 - iv. Agreement on overall objective and design of lender-of-last-resort facilities to deal in a robust manner with liquidity and solvency concerns; and,

- v. Agreeing on a set of procedures to stem systemic crises as and when they arise based on clear short-term policy measures (such as loan guarantees and recapitalizations that are fairly priced and impose low costs on taxpayers), and long-term policy measures (such as the shutting-down of insolvent institutions, providing fiscal stimulus, and addressing the root cause of financial crises – e.g., mortgages in this case).
2. Next, central banks should present their joint proposal with specific recommendations to their respective treasuries or national authorities, seek political consensus for an international forum such as the Financial Stability Forum or a committee of the BIS to coordinate discussion and implementation of these principles, and monitor their acceptance and application.

A commitment to such a process will generate a willingness to take the outcome seriously and hopefully pave the way for international coordination on well-rounded policies that balance growth with financial stability as efforts get under way to repair national financial architectures.

References

Acharya, Viral V. (2001). "A Theory of Systemic Risk and Design of Prudential Bank Regulation", Working Paper, New York University – Stern School of Business.

Acharya, Viral V. (2003). "Is the International Convergence of Capital Adequacy Regulation Desirable?", *Journal of Finance*, vol. 58(6), 2745-2781.

Acharya, Viral V., Christian Brownlees, Robert Engle, Farhang Farazmand and Matthew Richardson (2010). "Measuring Systemic Risk", in Acharya, Viral V., Thomas Cooley, and Matthew Richardson (Eds), *Regulating Wall Street: The Dodd-Frank Act and the New Architecture of Global Finance*, John Wiley & Sons.

Acharya, Viral V., Thomas Cooley, Matthew Richardson and Ingo Walter (2010). "Market Failures and Regulatory Failures: Lessons from Past and Present Crises", forthcoming in Masahiro Kawai and Eswar Prasad (Eds.), "Financial Sector Regulation and Reforms in Emerging Markets", Washington D.C: Brookings Institution Press.

Acharya, Viral V., Stijn van Nieuwerburgh, Matthew Richardson and Lawrence White (2011). *Guaranteed to Fail: Fannie Mae, Freddie Mac and the Debacle of Mortgage Finance*, Princeton University Press, March 2011.

Acharya, Viral V., Lasse Pedersen, Thomas Philippon, and Matthew Richardson (2010a). "Measuring Systemic Risk", Working Paper, NYU Stern.

Acharya, Viral V., Lasse Pedersen, Thomas Philippon, and Matthew Richardson (2010b). "A Tax on Systemic Risk", in Joseph Haubrich and Andrew Lo (Eds.), NBER publication on Quantifying Systemic Risk.

Acharya, Viral V., Paul Wachtel and Ingo Walter (2009). "International Alignment of Financial Sector Regulation", in Acharya, Viral V., and Matthew Richardson (Eds), *Restoring Financial Stability: How to Repair a Failed System*, John Wiley & Sons.

Acharya, Viral V., and Tanju Yorulmazer (2007). "Too Many to Fail - An Analysis of Time-inconsistency in Bank Closure Policies," *Journal of Financial Intermediation*, vol. 16(1), 1-31.

Park, Chang-Gyun (2010). "Political Economy of Macro-prudential Regulation in Korea", working paper, Chung-Ang University.

Adrian, T. and Markus Brunnermeier (2009), “CoVar”, Federal Reserve Bank of New York Staff Reports.

Bank of England (2009), “The UK Special Resolution Regime for Failing Banks in an International Context”, Financial Stability Paper No. 5, July 2009.

Brownlees, Christian T., and Robert Engle (2010). “Volatility, Correlation and Tails for Systemic Risk Measurement”, Technical report, Department of Finance, NYU.

Buiter, William and Anne Sibert (2008). “The Collapse of Iceland’s Banks: the Predictable End of a Non-Viable Business Model”, in Andrew Felton and Carmen Reinhart (Eds.), “The First Global Financial Crisis of the 21st Century Part II”, Voxeu.

Caprio, Gerard and Daniela Klingebiel (1996). “Bank Insolvencies: Cross Country Experience”, World Bank, Policy Research Working Paper No. 1620.

Chan-Lau, Jorge A., Marco Espinosa, Kay Giesecke, and Juan A . Sole (2009). “Assessing the Systemic Implications of Financial Linkages”, IMF Global Financial Stability Report, Vol. 2.

Christensson, Jon, Kenneth Spong and Jim Wilkinson (2010) “What Can Financial Stability Reports Tell Us About Macroprudential Supervision?”, Federal Reserve Bank of Kansas City (presentation at the Research Conference on “Government intervention and moral hazard in the financial sector”, Norges Bank, September 2, 2010).

Claessens, Stijn, Simeon Djankov and Daniela Klingebiel (1999). “Financial Restructuring in East Asia: Halfway There?”, World Bank, Financial Sector Discussion Paper No. 3.

Claessens, Stijn, Daniela Klingebiel and Luc Leaven (2004). “Resolving Systemic Financial Crises: Policies and Institutions,” World Bank Policy Research Paper no. 33, World Bank.

Cooley, Thomas, Kermit Schoenholtz, George David Smith, Richard Sylla and Paul Wachtel (2010). “The Power of Central Banks and the Future of the Federal Reserve System”, in Viral V Acharya, Thomas Cooley, Matthew Richardson and Ingo Walter (Eds.), *Regulating Wall Street: The Dodd-Frank Act and the New Architecture of Global Finance*, John Wiley & Sons.

De Jonghe, Olivier (2010). "Back to the Basics in Banking? A Micro-analysis of Banking System Stability," *Journal of Financial Intermediation*, Elsevier, vol. 19(3), 387-417.

Demirgüç-Kunt, Asli and Edward J. Kane (2002). "Deposit Insurance Around the Globe: Where Does It Work?," *Perpectives*, vol. 16 (2), 175-195.

Demirgüç-Kunt, Asli and Enrica Detragiache (2002). "Does Deposit Insurance Increase Banking System Stability? An Empirical Investigation," *Journal of Monetary Economics* vol. 49 (7), 1373-1406.

Elliott, Douglas (2011). "Exploring Counter-cyclical Bank Capital Requirements", Working paper, the Brookings Institution.

Goodhart, Charles (2010). "Financial Regulation", in *The Future of World Finance*, edited by Richard Layard and Paul Woolley, forthcoming.

Gray, Dale and Jobst, Andreas A. (2009), "Tail Dependence Measures of Systemic Risk Using Equity Options Data – Implications for Financial Stability," IMF Working Paper, Washington.

Greenlaw, David, Anil Kashyap, Kermit Schoenholtz and Hyun Song Shin (2011), "Stressed Out: Macroprudential Principles for Stress Testing", Prepared for the U.S. Monetary Policy Forum, February 2011.

Hirtle, Beverly J., Til Schuermann and Kevin J. Stiroh (2009). "Macroprudential Supervision of Financial Institutions: Lessons from the SCAP", Working paper, Federal Reserve Bank of New York.

Hoggarth, Glenn, Ricardo Reis, and Victoria Saporta (2002). "Costs of Banking System Instability: Some Empirical Evidence", *Journal of Banking and Finance*, vol. 26 (5), 825-855.

Honohan, Patrick and Daniela Klingebiel (2000). "Controlling Fiscal Costs of Bank Crises", World Bank, Working Paper #2441.

Hovakimian, Armen, Edward J. Kane and Luc Laeven (2003). "How Country and Safety-Net Characteristics Affect Bank Risk-Shifting," *Journal of Financial Services Research*, vol. 23(3), pp. 177-204.

Huang, Xin, Hao Zhou, and Haibin Zhu (2009). "A Framework for Assessing the Systemic Risk of Major Financial Institutions," *Journal of Banking & Finance*, Elsevier, vol. 33(11), 2036-2049.

Ivashina, Victoria and David Scharstein (2008). "Bank Lending During the Financial Crisis of 2008", Working Paper, Harvard Business School.

Kane, Edward J. and Daniela Klingebiel (2004). "Alternatives to Blanket Guarantees for Containing a Systemic Crisis," *Journal of Financial Stability*, vol. 1(1), 31-63.

Laeven, Luc (2002). "Pricing of Deposit Insurance," Policy Research Working Paper No. 2871, World Bank.

Lehar, Alfred (2005). "Measuring Systemic Risk: A Risk Management Approach," *Journal of Banking and Finance*, vol. 29, 2577–2603.

Mehrez, Gil, and Daniel Kaufmann (2000). "Transparency, Liberalization, and Banking Crisis," Policy Research Working Paper Series 2286, the World Bank.

Nier, Erlend, Jing Yang, Tanju Yorulmazer, and Amadeo Alentorn (2008). "Network Models and Financial Stability," Bank of England working papers 346, Bank of England.

Scott, Hal S., and Shinsaku Iwahara (1994). "In Search of a Level Playing Field: Implementation of Basel Capital Accord in Japan and U.S.," Group of Thirty, Occasional Paper No. 46, Washington, DC.

Upper, Christian (2007). "Using Counterfactual Simulations to Assess the Danger of Contagion in Interbank Markets", Working Paper of Bank for International Settlements (BIS) No 234.

Wagster, John D. (1996). "Impact of the 1988 Basel Accord on International Banks", *Journal of Finance*, vol. 51, 1321-1346.

Appendix A: Examples of systemic risk in the current crisis

Bear Stearns.

On the weekend following Friday, March 14, the government helped engineer JP Morgan's purchase of Bear Stearns by guaranteeing \$29 billion of subprime-backed securities. Without this involvement, it is highly likely Bear Stearns would have declared bankruptcy as there had been a classic run on their assets. Bear Stearns had substantive systemic risk. Though Bear Stearns was the smallest of the major investment banks, it had a high degree of interconnectedness to other parts of the financial system. In other words, it was a major counterparty risk. For example, as a major player in the \$2.5 trillion repo market (which is the primary source of short-term funding of security purchases), bankruptcy would have meant that the typical lenders in these markets – money-market mutual funds and municipalities – would have received collateral rather than cash on the following Monday. Since some of this collateral was illiquid, it is quite possible that these lenders would have had to pull their funds from other institutions, sparking a run on the financial system. In fact, in the week leading up to that Friday, Lehman Brothers' five-year CDS spread rose from 285 basis points (bps) to 450 bps in the anticipation of a run. Also, Bear Stearns was the leading prime broker on Wall Street to hedge funds. Failure of Bear Stearns would have put at risk any hedge fund securities hypothecated at the firm. Depending on the outcome of the failure, hedge funds might pull assets from other financial institutions that faced even slight bankruptcy risk, again leading to a run on the financial system and failures of other financial institutions. Further, Bear Stearns was a major participant in the credit default swap (CDS) market. Bankruptcy of Bear Stearns would have meant the closing out of all outstanding CDS contracts. Again, depending on how these contracts were netted out within the system, a number of these CDSs would have to be liquidated. Given the nature of the illiquidity of CDS contracts, the fire sales of these CDSs could have had a ripple effect across the financial system.

Lehman Brothers

Over the weekend following Friday, September 12th, the government failed in its attempt to engineer a purchase of Lehman Brothers by other financial institutions without any direct government support. In hindsight, Lehman Brothers contained considerable systemic risk and led to the near collapse of the financial system (though that may have occurred regardless). Ex post, it is not clear whether (i) the government thought Lehman was no longer systemic because of the Fed's opening of lending facilities to financial institutions, or (ii), as they now argue, Lehman could not be rescued because Lehman did not have adequate collateral to post to access these facilities. In any event, similar to Bear Stearns, Lehman was a major player in various parts of the capital market. Its bankruptcy opened up the possibility that similar firms could also go bankrupt, causing a potential

run on their assets. This led to Merrill Lynch selling itself to Bank of America. The other two institutions, Morgan Stanley and Goldman Sachs, saw the cost of their five-year CDS protection to rise from 250 basis points (bps) to 500 bps and 200 bps to 350 bps (respectively), and their stock prices fall by 13.54% and 12.13% (respectively) from Friday, September 12th, to Monday, September 15th. Both these institutions filed for bank holding company status soon after.

Fannie and Freddie

Under the Housing and Economic Recovery Act of 2008, the government placed Fannie Mae and Freddie Mac, the government sponsored enterprises (GSEs), into conservatorship on September 7, 2008, thus preventing their possible bankruptcy. At the time, it became clear to markets that the GSEs were quite likely insolvent due to their mortgage portfolio's investments in subprime and Alt-A loans and the firms' degree of leverage. The GSEs imposed large systemic risk. By owning over \$1.5 trillion of relatively illiquid MBSs, failure of the GSEs would have led to a fire sale of these assets that would infect the rest of the financial system, holding similar assets. To the extent that the MBS market is one of the largest debt markets, the fire sale could have caused other financial institutions to fail, similar to what actually happened with the subprime CDOs. Furthermore, as one of the largest investors in capital markets, the GSEs presented considerable counterparty risk to the system, holding, in 2007, \$1.38 trillion and \$523 billion total notional amount of swaps and OTC derivatives, respectively. Failure of GSEs would have led to winding down of large quantities of OTC derivatives with systemic consequences. Finally, the failure of the GSEs would have shutdown MBS issuance with guarantees. Since the GSEs represent 60%+ of the entire \$5.7 trillion securitization market, and with no substitute available (in the short-term), the result would likely have been a systemic failure of the US mortgage system with obvious dire consequences for the real economy.

Another source of the meltdown, however, had little to do with Lehman's interconnectedness, and more to do with the systemic risk of a large money market mutual fund. On September 16th, one of the larger money-market funds, the Reserve Primary Fund, suspended redemptions because of its unusually large exposure to short-term bonds of Lehman, causing its net asset value to fall below par, the dreaded "breaking the buck". This "failure" of the money-market fund to protect its investors against losses led to a freeze in money markets, causing the government to guarantee all money market fund losses. It would likely have been unthinkable prior to this crisis that a money market fund could induce systemic risk.

AIG

As yet another example of possible systemic risk, consider the government's injection of funds into AIG on September 15th. AIG received an \$85 billion loan secured against all its assets, including its insurance subsidiaries, as a way to meet the collateral obligations

of its \$400 billion portfolio of CDSs against a variety of higher tranches of CDOs and CLOs of mortgages, bonds and loans. AIG posed two forms of systemic risk. The first was that their exposure to CDSs was all on one side – they were receiving small premiums to insure against large, yet highly unlikely, losses. Of course, the unlikely event that these losses would occur would be systemic in nature, causing the CDSs to be highly correlated in these states. AIG would then have to fork over large amounts of capital it would not have access to at the parent level. As this systemic event became even slightly likely, AIG's counterparties demanded collateral to protect them against further declines, which caused AIG to be strapped for funds. As it became clear AIG could no longer post collateral, AIG's forced bankruptcy would mean that \$400 billion worth of securities on other financial institution's balance sheets would no longer be safely insured, leading to substantial write-offs which in turn would cause a fire sale of assets which could ripple across the financial system. At the very least, the insurance market for financial claims would freeze up.

Of course, as it turned out, with Morgan Stanley and Goldman Sachs on the brink of bankruptcy the week of September 15th, the government announced a possible market-wide bailout on September 19th. While the bailout changed forms a number of times over the next several weeks, the eventual plan resulted in, on an ex ante basis, a substantial transfer of wealth from taxpayers to financial institutions. The issue is whether a regulatory system could have been in place which would have made this, or some future unknown, crisis and resulting losses to taxpayers less likely.

Appendix B: List of 30 International Systemically Risky Institutions published by the Financial Stability Board (FSB)

North American banks:

Goldman Sachs (GS.N)
JP Morgan Chase (JPM.N)
Morgan Stanley (MS.N)
Bank of America-Merrill Lynch (BAC.N)
Royal Bank of Canada (RY.TO)

UK banks:

HSBC (HSBA.L)
Barclays (BARC.L)
Royal Bank of Scotland (RBS.L)
Standard Chartered (STAN.L)

European banks:

UBS (UBSN.VX)
Credit Suisse (CSGN.VX)
Societe General (SOGN.PA)
BNP Paribas (BNPP.PA)
Santander (SAN.MC)
BBVA (BBVA.MC)
Unicredit (CRDI.MI)
Banca Intesa, Deutsche Bank (DBKGn.DE)
ING (ING.AS)

Japanese banks:

Mizuho (8411.T)
Sumitomo Mitsui (8316.T)
Nomura (8604.T)
Mitsubishi UFJ (8306.T)

Insurers:

AXA (AXA.PA)
Aegon (AEGN.AS)
Allianz (ALVG.DE)
Aviva (AV.I)
Zurich (ZURN.VX)
Swiss Re (RUKN.VX)