

*Viral V. Acharya, Thomas Cooley, Matthew Richardson and Ingo Walter*¹

MARKET FAILURES AND REGULATORY FAILURES: LESSONS FROM PAST AND PRESENT FINANCIAL CRISES

FIRST DRAFT: 5 DECEMBER 2009

ABSTRACT

We analyze the financial crisis of 2007-2009 through the lens of market failures and regulatory failures. We present a case that there were four primary failures contributing to the crisis: excessive risk-taking in the financial sector due to mispriced government guarantees; regulatory focus on individual institution risk rather than systemic risk; opacity of positions in financial derivatives that produced externalities from individual firm failures; and runs on the unregulated banking sector that eventually threatened to bring down the entire financial sector. In emphasizing the role of regulatory failures, we provide a description of regulatory evolution in response to the panic of 1907 and the Great Depression, why the regulation put in place then was successful in addressing market failures, but how, over time, especially around the resolutions of Continental Illinois, Savings and Loans crisis and the Long-Term Capital Management, expectations of too-big-to-fail status got anchored. We propose specific reforms to address the four market and regulatory failures we identify, and we conclude with some lessons for emerging markets.

¹ Viral V. Acharya is Professor of Finance at the New York University Stern School of Business and a Research Affiliate of the Center for Economic Policy Research (CEPR), European Corporate Governance Institute (ECGI) and National Bureau of Economic Research (NBER). Thomas Cooley is Richard R. West Dean and the Paganelli-Bull Professor of Economics at the New York University Stern School of Business. Matthew Richardson is Charles Simon Professor of Applied Financial Economics at the New York University Stern School of Business and Sidney Homer Director of the Salomon Center for Research in Financial Institutions and Markets, and a Research Associate of the NBER. Ingo Walter is Vice Dean of Faculty and Seymour Milstein Professor of Finance, Corporate Governance and Ethics at the New York University Stern School of Business. Some of the material in this article is based on the book *Restoring Financial Stability: How to Repair a Failed System* (ed. Acharya and Richardson, 2009a). The authors would like to thank the discussant, Marcus Miller, and are grateful to their colleagues at NYU-Stern who contributed to the book and to the thinking that has influenced this essay greatly.

I. Introduction

The severity of the financial crisis of 2007-2009 has forced academics, regulators and policymakers to rethink contours of the current financial system. Calls for the greatest regulatory overhaul since the Great Depression have become common. Indeed, many observers, including ourselves, view the crisis first and foremost as a regulatory failure and are convinced that the current regulatory architecture -- the product of many ad-hoc responses to prior crises and antiquated in the face of the evolving structure and role of financial institutions -- is in need of repair. But regulation is a tricky business -- the law of unintended consequences always applies. The wrong decisions may well make future crises more likely and more severe, while regulation that is too heavy-handed could stifle future financial efficiency and innovation.

While the current crisis has exposed multiple cracks in the financial system, the instinctive reaction of some is to call for a paradigm shift -- even blaming the nature of capitalism itself. In reality, the problem is far less dramatic. A good rule of thumb for designing effective regulation is to focus almost exclusively on the specific source of the market failures and evaluate robust ways of addressing these failures through regulatory interventions.

History can be a good guide here. Somewhat paradoxically, even though financial crises are rare, they are recurring phenomena, just like the business cycle. Thus, it is possible to think about crises -- and how to respond to them -- in a systematic manner. What are the common causes of crises across their recurrences? Are there lessons to be learned from the crises of the past that can be helpful in the future? What responses to crises have been most successful? And based on these, what do we do next to try to improve stability without unduly undermining efficiency and innovation?

One view of the financial crisis of 2007-2009 has been that it illustrates the failure of the market-driven view of economic activity. In this view, the past decades of liberalizing markets, removing regulatory restrictions, and trusting markets to discipline themselves have had the unintended consequence of destabilizing the financial system.

A companion view is that we can best understand behavior in markets as behavioral phenomena – like herd behavior – where market participants all move in the same direction in waves of pessimism and optimism. And indeed, if one had to describe market behavior in terms of bubbles and collapses, this turns out to be a very useful description. But there is an important distinction to be made between description and explanation. The notion of herd behavior or “animal spirits” carries with it little, if any, positive prescription for policy.

A contrasting view is an analytical market-driven view that asks what the specific market failures were that led to the crisis, and paves the way for thinking about regulatory solutions that can address these failures. We argue in this essay that such an analytical view also provides a better positive explanation of the financial crisis.

The set of institutions that today provide the architecture for our financial system in the United States – the Federal Reserve System (Fed), the Securities Exchange Commission (SEC), the Federal Deposit Insurance Corporation (FDIC) and the Commodity Futures Trading Commission (CFTC) – all emerged over time in response to events, most often to past crises. Regulatory institutions that survive today exist because they turned out to be useful. They are seen to have contributed to the stability and growth of the U.S. financial markets for many decades. There were many other institutions that did not meet this test, either because they were ill-conceived from the beginning or because financial innovation rendered them obsolete.

Today, there is a strong desire to reform the surviving institutions, and there is some urgency to do so because of the enormous costs to society associated with their manifest failure in the current financial crisis. In this paper, we document the market failures that characterized the recent financial crisis and then develop a sensible set of policy responses to reform the regulatory landscape.

Section II reviews some of the historical precedents, panics and banking crises that got us to the environment we have today and that shaped the current regulatory system.

Section III describes the recent financial crisis in terms of specific market failures as they relate to the following:

- (i) the excessive risk-taking incentives of financial institutions when government guarantees are not priced or are mispriced;
- (ii) the regulatory focus on individual, rather than the systemic, risk of financial firms;
- (iii) opacity of financial firms and markets that created externalities from failures of individual firms; and
- (iv) the likelihood of “runs” in the shadow banking system that relies heavily on uninsured short-term funding.

In Section IV, we lay out some principles of regulation that address these failures. Specifically, we propose the following regulation to address these issues:

- The government guarantees in the system (e.g., deposit insurance, too-big-to-fail, and implicit subsidies to hybrid financial intermediaries, such as the GSEs) need to be priced to align the risk-taking incentives of financial firms.
- The systemic risk associated with actions of individual financial institutions needs to be priced; that is, firms need to be forced to internalize the costs of the negative externalities imposed by their actions on the system as a whole.
- Arguably, the leading candidate for the bottleneck that emerged in the financial system was the over-the-counter (OTC) market for derivatives; we argue for much greater transparency in this market.
- A key aspect of the crisis centered on runs in the wholesale funding markets (asset-backed commercial paper, repurchase agreements, unsecured commercial paper, and unsecured inter-bank lending). We argue for liquidity requirements for financial institutions that are similar in spirit to the way capital requirements are imposed.

Section V illustrates, through a series of examples, that these principles are as relevant for emerging markets as they are to the global wholesale markets.

II. Lessons from Past Crises

Focusing for the moment on the United States during the 20th century, it may be surprising to find that it has suffered a number of significant financial crises. Among them were the Panic of 1907, a severe contraction in 1921, the banking panic of the 1930s

and the Great Depression, the failure of the Continental Illinois Bank and Trust Company in 1984, the Savings and Loan crisis of the 1980s, and the Long-Term Capital Management crisis in 1998. We discuss several of these, in turn, to illustrate the relationship between market failure and financial regulation.

Table 1 provides a summary of our discussion. In brief, we argue that the financial regulation of the 1930s was successful to the extent that it addressed the main sources of market failure at the time, namely uncertainty about which institutions were insolvent. Financial crises began to recur in the 1980s. In contrast to the 1930s, however, the problems that arose in the more recent period – runs in the wholesale funding market, excessive risk-shifting and legal barriers to winding down institutions – were not repaired by regulatory responses. In hindsight, some of these regulatory failures sowed the seeds for the crisis of today, just as poor regulatory responses today could likely sow the seeds of crises tomorrow.

Table 1: Description of Five Financial Crises in the United States During the 20th Century

Crisis	Event	Market Failure	Solution	Success?
Panic of 1907	Losses due to speculation; bank run due to links across players	Uncertainty about bank insolvency and lack of liquidity	Creation of Federal Reserve and lender of last resort	Did not deal with uncertainty issue and thus bank runs
Great Depression	Huge macroeconomic shock, caused large losses at banks nationwide	Uncertainty about bank firm insolvency led to massive runs	Creation of FDIC and deposit insurance coupled with bank regulation	Served well for 50 or so years before becoming antiquated
Continental Illinois (1984)	Losses due to concentrated exposure, lost access to funding	Relied on wholesale, as opposed to retail, funding	Bailout and creation of too-big-to-fail (TBTF) designation	Gave TBTF special status without any cost. Ignored wholesale funding.
S&L Crisis	Losses throughout system due to risk-shifting on the part of banks	Mispriced government guarantee created misaligned incentives	Bailout and the creation in 1991 of risk-based deposit insurance	From 1996-2006, premiums no longer collected due to fund being well-capitalized
LTCM	Large hedge fund ran aground	Too-interconnected-to-fail	Negotiated unwind	Ignored LCFI mantra

A. Lesson #1 – The panic of 1907²

The panic of 1907 was triggered in the “curbside” stock market that was organized outside of the formal confines of the New York Stock Exchange. Investors tried to corner the market in United Copper Company by executing a short squeeze. Their scheme failed, and the price of United Copper plummeted. The same investors were also heavily involved with a number of banks and brokerages. When the United Copper play collapsed, it raised concerns about the safety of the banks that had lent to back their scheme. The panic spread and led to pressure on other banks, forcing a number of banks to close their doors and suspend operations.

The problem that faced the banks and financial markets more broadly was the inherent contradiction of fractional reserve banking. All of the institutions involved in the panic were engaged in intermediation of one form or another, with less than 100% reserves. When depositors became concerned and demanded their money back, even solvent financial institutions found their cash and gold reserves insufficient to meet demand. Drained of cash, they were forced to shut their doors. The institutions that had evolved endogenously (see Gorton 1985) to address the problems of temporary liquidity shortages were bank clearing house associations that pooled resources to provide liquidity in times of stress and performed many of the functions of a central bank. However, two problems emerged in the Panic of 1907. The first was that private clearing house associations also faced the risk of default. The second was that some companies, notably the Trust Companies in New York, were not allowed to be members of the Clearing House Association due to the internecine rivalry between commercial banks and trust companies.

There were many important lessons to be derived from the Panic of 1907. First, fractional reserve banking is inherently precarious. Second, information on solvency (or lack thereof) of financial institutions is incredibly valuable but extremely difficult to gather, and at the time, no institution existed to provide it. Finally, a lender of last resort (LOLR) for solvent but illiquid institutions is needed for financial stability, but the private provision of that liquidity through the Clearing House Associations was ineffective when it was most needed.

² The best recent account of this episode is Bruner and Carr (2007).

In May 1908, Congress passed the Aldrich Vreeland Act that created something called the National Monetary Commission, Chaired by Senator Nelson Aldrich, whose mission was to study the underlying causes of the panic of 1907 and develop proposals to make such events less likely in the future. The final report of the National Monetary Commission was published on January 11, 1911. For nearly two years, legislators debated the proposal and it was not until December 22, 1913, that Congress passed the Federal Reserve Act. The bill was signed by President Woodrow Wilson on December 22, 1913, creating the Federal Reserve System.

The Federal Reserve has evolved over time and periodically has been severely challenged, notably in the 1930s and in the crisis of 2007-2009. But it has quite successfully served one of the critical purposes for which it was created, that is, the need for a credible lender of last resort facility. This was only a partial solution, however, since it failed to resolve the information problem of consumers who had to decide whether or not to join a run on a bank in the first place. It took the banking panics of the 1930s to focus additional attention on sources of instability other than illiquidity.

B. Lesson #2 -- The Banking Panic of the 1930s

There were three separate waves of banking panics during the 1930s – in 1930, 1931 and early 1933. The economic forces at work in creating and perpetuating the Great Depression have been much discussed and debated. We will not repeat those issues here except to note that there is a general consensus that the contractionary monetary policies that the Federal Reserve Board pursued at the time were a contributing factor to the banking crisis of the early 1930s.³

The prices of goods and services in the U.S. fell by approximately 25% between 1929 and 1933. This led to debt deflation, a phenomenon by which the collateral underlying loans shrinks in value, causing the real burden of debt to rise and leading the economy to spiral further downward. In a parallel with the recent financial crisis, the collapse of the real estate bubble in the second half of the 1920s was arguably a contributing factor to the 1929 stock market crash and added materially to the solvency stresses imposed on the banks. The debt deflation of 1929-1933 and the contemporaneous soaring of unemployment rates made it extremely difficult for

³ See Friedman and Schwartz (1971) and Meltzer (2003, 2004).

homeowners to repay their debts. As borrowers were increasingly unable to make their payments, the underlying value of banks' assets fell, many banks were unable to meet the needs of their depositors, listed bank stocks plummeted, and a lack of confidence in the remaining banks led to a general state of panic (Bernanke (2000)).

By March 1933, as Franklin D. Roosevelt took office, there was a full-fledged banking panic and cries for reform of the banking system. The response to those pressures could have been many – for example, nationalizing the banks, a relaxation of restrictions on bank mergers or interstate banking, leading to a highly concentrated banking system – all of them solutions that had been adopted elsewhere and all actively debated at the time.

The immediate response to the panic was to declare a “bank holiday” in order to determine, as had been the case in 1907, whether individual banks were solvent, illiquid, or liquid enough to re-open. This helped to calm the system but only restored the status quo of the post-1907 world. The fundamental market failure still existed. Banks made money by engaging in risky intermediation. Consumers had no easy way of assessing that risk, leaving intact the possibility of panics and bank runs.

The policy innovation that addressed this problem was the Banking Act of 1933, which created the Federal Deposit Insurance Corporation to provide credible government insurance for individual bank deposits and which effectively dealt with the problem of retail bank runs. The Glass-Steagall provisions of the Act separated investment banks from commercial banks, in an effort to insulate depositor's savings from being used to finance high-risk investments in the financial markets. Firms that already engaged in both commercial and investment banking activities, such as the J.P. Morgan Bank, were forced to break up into commercial banks (in this case that later became the Morgan Guaranty Trust Company of New York) and investment banks (in this case Morgan Stanley & Company). The Act further stipulated that interest not be paid on demand deposits in commercial banks – those seeking returns would have to use less liquid savings deposits or securities.

The creation of the FDIC was arguably the most successful policy response to the banking crisis of the 1930s. In fact, the FDIC resulted from an amendment to the Banking Act of 1933, and had been opposed by President Franklin Roosevelt and many

leading bankers in the big U.S. money centers. Nevertheless, this one institutional innovation was responsible for calming the fears of depositors and ending retail bank runs. Its creation was followed by many decades of relative stability in the financial system.

The Banking Act of 1933 required that all banks that were members of the Federal Reserve System have their deposits insured, up to a monetary limit, by the FDIC. Nonmember banks could also be covered, subject to approval by the insurer. Insured banks were required to pay premiums covering their insurance, based on their deposit size. Within six months of the creation of the FDIC, 97% of all commercial bank deposits were covered by insurance.

The FDIC has been a highly successful institution because it solved a well-defined problem – uncertainty about the solvency of the banks among retail depositors. More importantly, it did so in a way that acknowledged the contradictions and risks inherent in fractional reserve banking by making those responsible for managing the risks – the banks themselves -- pay for insuring against them. These costs were passed through to bank borrowers, time-depositors and investors. Judged by the results, this was a remarkably successful piece of regulation. It stabilized the industry. Bank runs disappeared, and the number of banks failures dropped to an extremely low level compared with prior decades.

The other important regulatory innovation of the 1930s comprised the Securities Act of 1933 and the Securities Exchange Act of 1934. The main intention of this legislation was to ensure that investors receive significant (or “material”) information concerning securities being offered for public sale and to redress market misbehavior. The objective was to “shine a bright light” on financial information, so that investors could make informed decisions. To underscore the need for reliable information, the 1933 and 1934 Acts required that public financial information be verified by independent auditors using standardized accounting rules. These rules gave a major boost to the efficiency and transparency of financial markets, and deserve much credit for stimulating the flow of capital in the U.S. economy.

The important thing to note about both of these seminal regulatory innovations is that they were not attacks on the free market or on capitalism – something that could not be taken for granted, since at the time the spread of socialism and communism was

gaining momentum, and other options might well have seemed appealing. What these reforms recognized was the need for information and confidence to make the markets function better. These were attributes only public policy could provide. They also constituted a bet on the decision-making of the individual investor. Given enough transparency, investors were believed capable of making smart and profitable long-term decisions. These were intelligent, effective pro-market regulations that worked well for many decades.

C. Lesson #3 -- Continental Illinois and Too-Big-To-Fail⁴

From the 1930s until the 1980s, the banking system in the U.S. functioned fairly smoothly. The lessons learned in the early part of the 20th century and the institutions created to deal with the fundamental market failures and information frictions -- the Fed, the FDIC, and the SEC (bolstered by the Investment Company Act of 1940) -- led to a long period of relative tranquility in banking and financial markets. Bank failures slowed to a trickle, as bank regulation focused on maintaining adequate capital and controlling risk.

There were bank failures to be sure, but the FDIC had a well-tested approach to the problem. When failure was unavoidable, the regulatory machinery worked as designed: Either the regulators sold the bank successfully ("purchase and assumption") or they liquidated the institution, made good on deposit insurance promises, and wiped out the uninsured depositors and other creditors. This set of procedures imposed a discipline the banking system that seemed to work very well.

In 1982, however, federal regulators decided to close the Oklahoma-based Penn Square Bank, a \$436-million institution that specialized in oil and gas sector loans. Penn Square originated large volumes of loans to the historically risky exploration sector of the U.S. energy industry, which began to suffer as energy prices fell in the recession of the early 1980s. The seventh-largest bank in the United States, Continental Illinois Bank and Trust Company, had invested aggressively alongside or through Penn Square and booked a large volume of Penn Square-originated loans. Continental Illinois had made many other loans to the energy sector and, at the same time, had expanded its lending to developing countries to help them finance debts incurred in the energy crises of the

⁴ This account relies heavily on FDIC (1997).

1970s. In 1982, Mexico was forced to renegotiate its debt, triggering the less-developed country (LDC) debt crisis involving hundreds of bank loan syndications.

While many other U.S. commercial banks followed the same lending strategy in the late 1970s, Continental Illinois's credit exposures were compounded by a funding strategy that was unusual at the time. Traditionally, banks funded growth in their lending activities by attracting larger volumes of savings from retail depositors. Continental Illinois, however, had a limited retail presence, due in part to federal and local banking regulations that limited the number of banking outlets it was permitted to have. Consequently, Continental Illinois depended heavily on funding itself in the wholesale money markets. Indeed, by 1981, it was sourcing most of its funding through federal funds and by selling short-term certificates of deposit on the wholesale money markets. Only 20% of Continental Illinois's funding came from traditional retail deposits in Chicago.

Continental Illinois had pursued an aggressive growth strategy and had assumed a great deal of concentrated risk. When the energy sector turned sour and the LDCs rescheduled, Continental Illinois was unusually vulnerable to the views of the wholesale funding markets. In 1984, investors and creditors lost confidence in the bank, and in a precursor to the crisis of 2007-2008, Continental Illinois was quickly shut out of its usual sources of funding in the domestic and Eurodollar markets.

In May 1984, Continental Illinois experienced what the FDIC described as a high-speed electronic bank run. To stem the panic, regulatory agencies and the banking industry arranged billions of dollars in emergency funding for the bank. The fear was that a failure of Continental Illinois would undermine the entire banking system. More than 2,300 banks had correspondent accounts with Continental Illinois. Unlike the uninsured retail depositor runs of the 1930s, this time it was an uninsured wholesale depositor run. In an extremely controversial decision, the FDIC tried to stop the run by extending its guarantee beyond its retail deposit limits to cover uninsured depositors and creditors, as well. This was the beginning of the notion that some banks should be considered too big (or too interconnected) to fail.

The FDIC's emergency help was followed by a package of permanent measures, making Continental Illinois the largest bank in U.S. banking history to be rescued by government agencies. Unable to find a takeover partner, the FDIC ended up owning more than 80% of the bank. The Continental Illinois board was replaced, senior management was fired, the bank was restructured and later floated in a public offering, and subsequently was acquired by Bank of America. The FDIC's share of the bill to rescue Continental Illinois was later calculated to be \$1.1 billion.

The Continental Illinois story provided a classic example of how a sharp drop in confidence can lead counterparties in the wholesale markets suddenly to withdraw funding from a wounded bank, spinning the institution into a liquidity crisis as potentially fatal as any 19th century run on a bank by retail depositors – in this case, a liquidity crisis triggered by a suspected insolvency problem that turned out to be true.

It should have been a warning call that systemic risk can build up quickly in a credit expansion cycle and needs to be appropriately priced and regulated. But that was not to be. Continental Illinois should have been the canary in the coal mine. It demonstrated that the regulatory system crafted in the 1930s needed updating to account for the development of massive wholesale banking markets. Instead, and despite many warning voices, the problem was ignored.

D. Lesson #4 -- The Savings and Loan Crisis

The most serious postwar crisis in the U.S. banking sector was the savings and loan (S&L) crisis of the late 1980s. It is often blamed (with at least some justification) on the more lax regulatory environment that evolved during the Reagan Administration (White 1991). That is not the entire story, however, and the S&L crisis remains an episode that contains valuable lessons for the crisis of 2007-2009.

Savings and loan institutions, as distinct from commercial banks, were another product of the Great Depression. They were created to serve the public policy goal of encouraging home ownership. The Federal Home Loan Bank Act of 1932 created the Federal Home Loan Bank System to provide liquidity and low-cost financing for S&Ls. There were 12 regional Home Loan Banks; these were owned by their members and

were under the supervision of the Federal Home Loan Bank Board (FHLBB). The National Housing Act of 1934 created the Federal Savings and Loan Insurance Corporation (FSLIC) to provide federal deposit insurance for S&Ls, similar to what the FDIC provided for commercial banks. In contrast to the FDIC, which was established as an independent agency, the FSLIC was placed under the authority of the FHLBB. In retrospect, the FHLBB carried far heavier political baggage than did the FDIC.

For decades, the FHLBB's examination, supervision and regulatory capabilities were relatively poorly developed, in part because S&Ls had a narrowly defined financial intermediation role and not much scope for expanding it. S&Ls took in savings on which they paid low interest rates and lent the money at marginally higher interest rates on 30-year fixed-rate mortgages. This model all began to change with the accelerating inflation of the 1970s when interest rates soared. S&L deposits began to flee in pursuit of higher returns and, even when Congress lifted caps on deposit rates, the S&Ls were still being squeezed on the other end by their legacy portfolios of 30-year fixed-rate mortgages. It was a classic maturity mismatch. They needed to find other sources of income.

In response, the FHLBB began loosening its regulations. It allowed the thrifts to begin issuing adjustable-rate mortgages. Congress also encouraged diversification and explicitly authorized the thrifts to engage in consumer lending and investments in commercial real estate. Accordingly, both federal and state thrift regulators began relaxing restrictions on their asset allocation options, easing safety and soundness regulation, lowering capital requirements, and changing accounting rules to make it easier for S&Ls to meet their net worth requirements. All of these changes helped the thrift industry to grow dramatically. Between 1980 and 1986, 492 new thrifts were chartered in the United States. Taken together, it was a recipe for disaster.

Things began to change when inflation was brought under control early in the Reagan Administration, and a major recession took hold. Oil prices fell to levels that made many earlier investments unprofitable. An array of tax benefits for real estate investments was eliminated, and that made many earlier projects unprofitable. Much of the banking growth between 1983 and 1985 had been in commercial real estate lending.

By 1985, it had become clear that the thrift industry faced serious trouble. Enough

S&Ls had folded or were in danger of folding that the FSLIC was insolvent. Efforts to recapitalize the FSLIC in 1986 and 1987 were bitterly opposed by the industry, which lobbied aggressively with members of Congress. Thrift failures increased during 1987 and into 1988, but the insolvency of the FSLIC meant that rescuing troubled thrifts would cost more than the FSLIC had available in its insurance fund. As a result, the regulators could not intervene in S&Ls that had more in liabilities than assets. This left many insolvent thrifts still in business. These “zombie” banks had incentives to take even greater risks in the hope that they could improve their outcomes, and many did so using an early version of brokered deposits by returns-chasing clients who hoped to be bailed out if things went wrong.

The crisis in the S&L industry was finally acknowledged and resolved after the inauguration of George H.W. Bush in 1989. Congress passed the Financial Institutions Reform Recovery and Enforcement Act (FIRREA), which abolished the FHLBB and shifted regulation of S&Ls to the Office of Thrift Supervision (OTS), transferred the thrifts’ deposit insurance function from the FSLIC to the FDIC, and reinstituted many of the regulatory provisions that had been weakened during the previous decade. In turn, FIRREA created the Resolution Trust Corporation (RTC) to liquidate or restructure the insolvent S&Ls.

There are several lessons to be learned from the S&L mess. The first is that when regulatory institutions have outlived their usefulness or have been rendered obsolete by market developments, it is not enough just to eliminate the boundaries without consideration of the risks that are being created. This was the case with the thrift industry, which had been created and developed with specific goals in mind.

Another lesson is that regulators can easily be captured by the industry they regulate. This was clearly the case with FHLBB. The S&L crisis reinforces the point that moral hazard is an important and ever-present issue. It is critical to close insolvent, insured financial institutions promptly in order to minimize potential losses to the deposit insurance fund (or the taxpayer, in general) and to ensure a more efficient financial marketplace – zombie financial intermediaries extract a heavy price on financial market efficiency. Finally, resolution of failing financial institutions requires that the deposit insurance fund be strongly capitalized with reserves based on real risk assessments.

E. Lesson #5 – Long-Term Capital Management

An episode that deserves mention in any litany of financial crises is the collapse of Long-Term Capital Management, the storied hedge fund that had grown so quickly between 1994 and 1998, and was so interconnected, that it was thought to be a systemically risky institution.

In 1998, LTCM collapsed in a “liquidity event.” A sudden disappearance of liquidity from credit markets -- associated with a Russian default on external debt on August 15, 1998 -- triggered a global “flight to quality.” It is interesting to ponder why this enormous liquidity event did not lead to a global financial meltdown.

As it became clear that the magnitude of LTCM’s liquidity problem was enormous and that unwinding its positions could put severe strains on financial markets, the President of the Federal Reserve Bank of New York, with Allan Greenspan’s blessing, called a meeting of all of LTCM’s major banks and prime brokers to get them to work on a cooperative solution to the problem. Reluctant banks were forcibly dragged into the workout. That is the formula that the Fed and Treasury were trying to reprise on the fateful weekend in October 2008 when they met to discuss the fate of Lehman Brothers. What they did worked in 1998. There was an orderly insolvency and dissolution of LTCM without undue harm to the markets or the banks most directly involved.

The resolution of LTCM and the unwinding of its complicated positions were orderly because they were carried out by LTCM itself with the support of the other major financial firms and the New York Fed. The lessons of the LTCM collapse were clearly articulated in a 1999 report entitled “Hedge Funds, Leverage and the Lessons of Long-Term Capital Management” written by The President’s Working Group on Financial Markets⁵. It was signed by Robert Rubin, Alan Greenspan, Arthur Levitt, and Brooksley Born.

One lesson the report clearly delivers is that procedures for unwinding complicated systemic firms needed urgent attention. The report devotes an entire Appendix to a discussion of the inconsistencies in the U.S. Bankruptcy Code that interfered with a private market resolution of LTCM’s debt problems and derivatives

⁵ See www.ustreas.gov/press/releases/reports/hedgfund.pdf.

contracts. It describes the extent to which existing bankruptcy procedures are not, in fact, conducive to private market solutions in complex situations involving both standard loan contracts and derivatives contracts. These were clearly failings that needed to be fixed.

The key LTCM lesson was that we needed better mechanisms for the resolution of large, systemic firms. Absent that, and absent methods for penalizing institutions for accumulating systemic risk, we would be stuck with firms that are both too big and too interconnected to fail and to resolve at acceptable cost to the public. Unfortunately, regulators believed that hedge funds might be the type of firm to get into trouble in a financial crisis; but in the crisis of 2007-2009, it turned out to be investment banks and universal banks themselves, many of which were in fact running “in-house” hedge funds.

III. Market Failures of the Financial Crisis of 2007-2009

Financial crises have many common features. In the background real economy, there is usually the presence of an asset price “bubble” (or asset price inflation, for purists), a corresponding credit boom, and large capital inflows into that economy (see, for example, Reinhart and Rogoff, 2008). However, these characteristics are necessary, but not sufficient, for a financial crisis to develop. The severity of the crisis depends crucially on the underlying financial sector’s exposure to these conditions and, in fact, the overall market’s uncertainty about the financial sector’s exposure to them. A key role of financial regulation is to put limits on financial institutions, so as to limit this exposure. While there are many reasons for the relative calm of the U.S. financial system during the 50 years after the Great Depression, many analysts continue to give credit to the financial regulation that was enacted at that time.

As described in Section II, the banking acts of the 1930s solved the uncertainty problem that led to bank runs by providing deposit insurance through the creation of the FDIC. Depositors no longer had to run on insured banks because the government guaranteed deposits up to certain maximums. Of course, it was well understood that deposit insurance creates moral hazard -- that is, an incentive for banks to undertake greater risk than they would otherwise without the insurance. Regulators and

policymakers understood that deposit insurance could lead to excessive risk taking, so they set up a number of counteracting barriers:

- Banks would have to pay to be part of the deposit insurance system. So, at least, on an ex ante basis, regulators took into account the cost of the insurance. Deposit insurance was limited in magnitude per account, thus restricting the size of the banks.
- The risk-taking activities of banks were ring-fenced to the extent there was a separation of the commercial and, presumably more risky, investment banking activities.
- Enhanced supervision and winding-down provisions for individual banks, generally centered around required minimum capital requirements, which served as a buffer against the risk-shifting incentive arising from deposit insurance.

So what happened in the 1980s that kept deposit insurance but took away these protections?

There is considerable debate about this issue, but the general consensus is that technology changed the nature of banking -- and therefore competition -- in the financial sector (Kroszner, 2000, and Kroszner & Strahan, 2007). Some of these technological changes include the following: (i) the development of the automated teller machine (ATM) that reduced geographical ties between banks and depositors; (ii) the proliferation of money market funds and cash management accounts by broker-dealers and asset managers outside the banking system; and (iii) an increase in the types of communication channels, further reducing the ties between local bankers and depositors. In other words, the traditional lines of business of banks no longer enjoyed their previously protected status.

Keeley (1990) uses the increase in bank competition as an explanation for the S&L crisis described earlier. Prior to these technological changes, banks and thrifts enjoyed monopolistic advantages so that their bank charters had "franchise value." But once this disappeared, the value to risk-shifting and exploiting the guarantees of deposit insurance increased. In general, there is ample evidence of risk-shifting related to deregulation, stepped-up banking competition and the S&L crisis. (See, for example,

Saunders, Strock and Travlos, 1990, Cordell, MacDonald and Wohar, 1993, Kroszner and Strahan, 1996, and Hovakimian and Kane, 2000.)

Around the same time, the institutional side of banking also changed dramatically. There was tremendous growth in the so-called “shadow” banking system -- i.e., financial institutions outside the traditional banking system that provide very similar services (Gorton, 2009). The shadow banking system includes derivatives – futures, options, swaps, repurchase agreements, and money market funds, securitization of loans in the mortgage, corporate, and household sectors, and an increasing importance of public equity and bond markets. As an illustration, the amount of assets of the financial sector held by depository institutions dropped from 60% in 1950 to less than 30% in 2006 (Kroszner and Melick, 2009).

Kroszner and Melick (2009) provide a description of two financial systems, one being the traditional model of banking, the other a modern version of banking (see also Acharya, Schnabl and Suarez, 2009, and Gorton 2009). In the old model, an individual deposits funds in a bank. The bank then uses these funds to lend to corporations or individuals. The bank pays interest on the short-term deposits using interest earned on the loans. Concern over the funding mismatch and potential solvency issues of the bank are addressed through the bank’s asset/liability management process and the individual’s deposits being insured. This insurance, however, comes at a cost, both in terms of premiums paid, restrictions on the bank’s actions and the requirement that a fraction of the funds be held as capital.

In the new model, the same individual now provides funds to a money market fund. This fund buys commercial paper issued by a special purpose vehicle (SPV) of the bank backed by asset-backed securities. These asset-backed securities (ABS) are made up of the same loans described above in the old model of banking. The money market fund rolls over the commercial paper periodically as it becomes due. In the overwhelming majority of the cases, the credit risk of the loans underlying the ABS had embedded recourse back to the banks (effectively what Acharya, Schnabl and Suarez 2009 call “securitization without risk transfer”). On the surface, this means that the economics underlying these two banking models are almost identical.

Yet the risk-sharing mechanics and pricing are quite different. The rate offered by money market funds is invariably higher than that for equally liquid funds at checking

and savings accounts of banks. Are these higher rates due to greater efficiency? Or are the rate differentials due to credit risk and the lack of “deposit-like” insurance? Or are the rates due to implicit government guarantees in a framework in which these guarantees are not priced, bank actions are much less restricted, and at most, only one-tenth the capital is required for off-balance sheet financing via the SPVs? One set of arguments focuses on efficiency (welfare gains), and the other set of arguments focuses on risk-shifting (inefficient wealth transfers).

Taking this background into account, we now describe the four market failures that we believe triggered and amplified the financial crisis of 2007-2009.

A. Risk-Taking Incentives of Financial Institutions

Given their inherently high leverage and the ease with which the risk-profile of financial assets can be altered, banks and financial institutions have incentives to take on excessive risks. Ordinarily, market mechanisms would be expected to price risks correctly and thereby ensure that risk-taking in the economy is at efficient levels. However, there are two factors that have impeded such efficient outcomes.

First, with the repeal of most protections from the Banking Act of the 1933, the only remaining protection against risk-shifting is capital requirements. If the guarantees are mispriced, financial firms have an incentive to skirt capital requirements and take excessive risk. One way of telling the story of the 2007-2009 crisis is that financial institutions managed to exploit loopholes in the regulatory system and built up large amounts of tail risk on the economy, particularly tied to residential real estate, with little or no underlying capital.

The second mechanism that induces excessive risk-taking is a failure of corporate governance involving shareholders and employees. The fact that financial institutions have become large and increasingly complex and opaque in their activities has weakened external governance that operates through capital markets (accurate prices), market for corporate control (takeovers) and boards. Coincident with this, and to some extent a corollary to it, has been the fact that financial risks at these institutions are now increasingly concentrated in the hands of a few “high performance” profit/risk centers, which have an incentive to produce short-run imaginary profits at the expense of long-term risks (i.e., “fake-alpha”).

We now concentrate on what we consider to be the primary factor associated with the financial crisis, namely the accordance of the numerous government guarantees in the system -- most notably (i) deposit insurance, (ii) the implicit guarantee of too-big-to-fail, and (iii) the “subsidies” provided to government-sponsored enterprises like Fannie Mae and Freddie Mac. Together, these imply that the vast majority of liabilities in the U.S. financial system were subject to some form of safety net with profound implications for efficiency in capital allocation, incentives and the structure of financial intermediation.

At the same time, it is important to note that the fact that banks received “free” or underpriced government insurance does not necessarily imply excess risk-taking on their part. If the franchise value of their enterprise exceeds the benefits to risk-shifting, then there might be very little effect associated with moral hazard from the insurance. The possibility of material shareholder losses, and the limits imposed on banks via Glass-Steagall, did contribute to relative calm for 50 or so years after the 1930s. However, once the Glass-Steagall separation between commercial and investment banking was lifted (steadily since 1970s), and competition dramatically increased (within and across states in the U.S. as well as globally), the only real protection for the financial system came from adequate capital requirements.

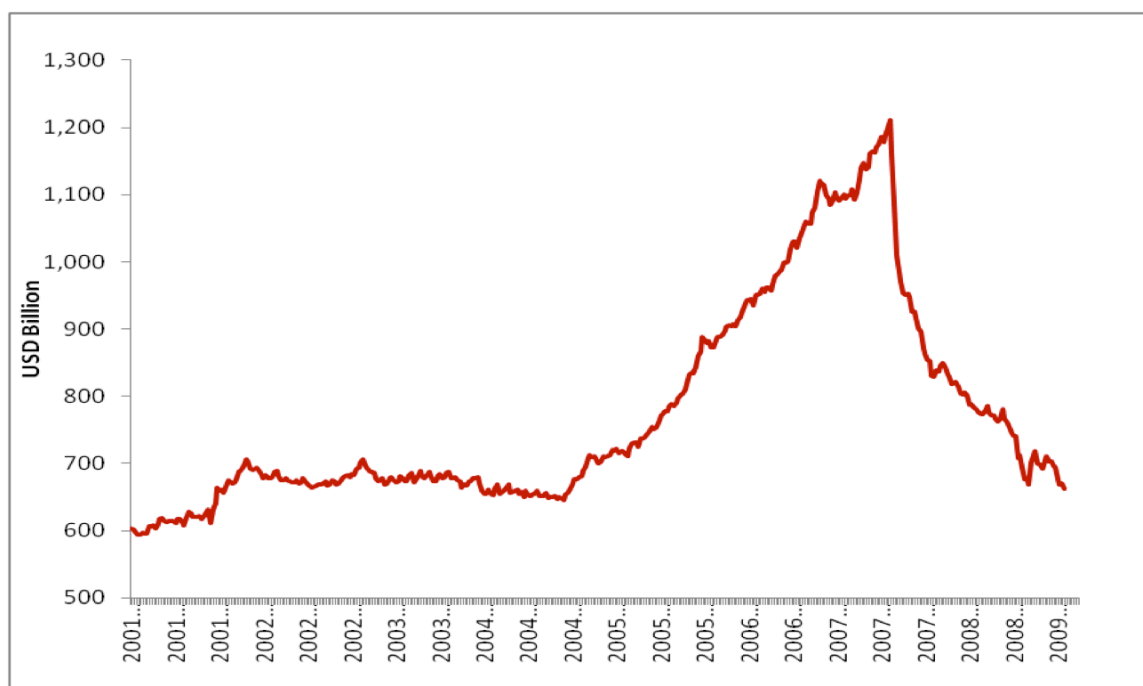
There were two consequences resulting from increased competition and the erosion of profits underlying the traditional lines of business of banks. First, it meant banks moved more and more into businesses highlighting noninterest income such as trading and fees. Second, and more important, it increased the relative value of risk-shifting, since bank charter values had been eroded by deregulation. Because mispriced guarantees had effectively removed the market discipline component of governance normally reserved for creditors, risk-shifting was particularly easy to do.

In the crisis of 2007-2009, financial firms managed to risk-shift by exploiting loopholes in regulatory capital requirements to take an under-capitalized \$2- to 3-trillion highly leveraged, one-way asymmetric bet on the economy, particularly tied to residential real estate, but also commercial real estate and other consumer credit exposures. This bet was taken in four distinct ways:

- First, the banks funded their portfolios of risky loans via off-balance sheet vehicles (SIVs and conduits). These vehicles required about one-tenth the

amount of capital of the same exposures held on the balance sheet, yet in 95% of the cases, the credit risk effectively had full recourse back to the sponsoring institutions.⁶ Figure 1 provides evidence of the remarkable growth in asset-backed commercial paper in the pre-crisis period.

Figure 1: Asset-Backed Commercial Paper Around the Financial Crisis of 2007-2009 (Billions of Dollars)



Source: Federal Reserve Board. Data do not include European ABCP.

- Second, financial institutions bought “underpriced” protection from monoline insurers and AIG in the sense that banks were able to pocket the difference between the spread on the AAA-tranches of the securitization instruments and the monolines’ premiums. Because neither AIG nor the monolines had much capital backing this insurance, and certainly not enough in a systemic crisis, the risk again was effectively recourse back to the financial institutions through the counterparty risk of the insurers.

⁶ See Acharya, Schnabl and Suarez (2009) for an anatomy of asset-backed commercial paper conduits.

- Third, financial institutions made outright purchases of AAA-tranches of non-prime securities, which were treated as having low credit risk and zero liquidity and funding risk. Together, the broker-dealers, the government-sponsored enterprises and the banks held more than one-half of the \$1.6 trillion of these securities outstanding.⁷ Table 2 highlights in bold these holdings in 2007 for financial institutions. This is the exact opposite of the key objective of securitization, in which the safest parts of credit risk are meant to be transferred from the financial sector to institutional investors and the capital markets at large.

Table 2: Holdings of Mortgage-Related Debt by Financial Institutions (2007)
(Billions of Dollars)

	Loans	HELOC (Home Equity Lines)	Agency MBS	Non- Agency AAA	CDO Subord.	Non- CDO Subord.	Total	
Banks & Thrifts	\$2,020	\$869	\$852	\$383	\$90		\$4,212	39%
GSEs & FHLB	444		741	308			1,493	14%
Broker/Dealers			49	100	130	\$24	303	3%
Financial Guarantors		62			100		162	2%
Insurance Companies			856	125	65	24	1,070	10%
Overseas			689	413	45	24	1,172	11%
Other	461	185	1,175	307	46	49	2,268	21%
Total	\$2,925	\$1,116	\$4,362	\$1,636	\$476	\$121	\$10,680	
	27%	10%	41%	15%	4%	1%		

Source: Krishnamurthy (2008).

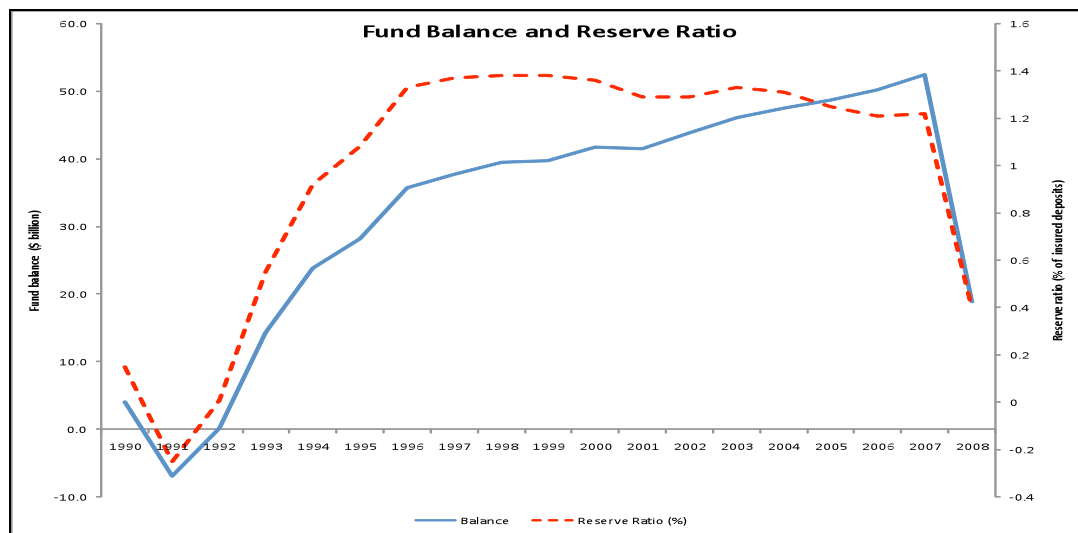
- Fourth, in August 2004, investment banks successfully lobbied the SEC to amend the net capitalization rule of the Securities Exchange Act of 1934. This amendment allowed a voluntary method of computing deductions to net capital for large broker-dealers – it permitted the investment banks to use internal models to calculate net capital requirements to market risk and derivative-related credit risk, placing them on an equal competitive footing with universal banks of Europe operating under Basel II. The net impact was essentially to double the leverage applied by investment banks.

⁷ See Acharya and Richardson (2009b).

There is strong evidence in the literature for the existence of mispriced government guarantees, and the consequences arising from these guarantees. In terms of the financial crisis of 2007-2009, how did these guarantees contribute to market failures?

With respect to deposit insurance, as described earlier, there is some consensus that moral hazard played an important role in both initiating and prolonging the S&L crisis. As a logical consequence, substantial reforms were enacted to address this issue, notably the Federal Deposit Insurance Corporation Improvement Act (FDICIA) of 1991. One of the major changes in setting FDIC premiums was to make them more risk-based. In theory, the FDIC assesses higher rates on those institutions that pose greater risks to the insurance fund. In practice, however, if the deposit insurance fund is well-capitalized (i.e., 1.25% of reserves to total insured deposits), no premiums are assessed to those banks considered to be of the lowest-risk category. In fact, from 1996 to 2006, more than 90% of all banks paid very little in deposit insurance premiums.⁸ Figure 2 illustrates this point by showing a reserve ratio close to 1.25% for this period and a small increase in fund balances.

Figure 2: Balances of Deposit Insurance Fund and the Reserve Ratio



Source: Federal Deposit Insurance Corporation.

⁸ This issue was only partially addressed by the Federal Deposit Insurance Reform Act of 2005 to the extent the ratio of reserves to total deposits covered a wider range for which premiums would be collected.

The S&L crisis implied the need for risk-based insurance premiums to be charged to banks. In what constitutes a significant regulatory failure, the risk-based method was not applied to the extent that 90% of the banks fell in a single risk bucket, and indeed no insurance premiums at all were charged to the majority of U.S. banks. This effectively meant that the U.S. was running a free deposit insurance system with little or no protection at all at the time Glass-Steagall was repealed and commercial banks were free to engage in all forms of investment banking and trading.

At first glance, the moral hazard inherent in depository institutions was limited in scope, since deposits were only a limited fraction of the assets (and liabilities) of the U.S. financial system. However, since the majority of assets of the financial sector were held by a small number of large complex financial institutions (LCFIs), the market discipline provided by liability holders can be considered notionally similar to that provided by depositors given the presumptive too-big-to-fail (TBTF) guarantee. Since the 1984 bailout of Continental Illinois (described in Section II), the TBTF issue had been much discussed in regulatory and academic circles (see, for example, Stern and Feldman, 2004, and Ennis and Malek, 2005). Even before the financial crisis of 2007-2009 made the TBTF guarantee explicit, there was ample evidence that TBTF was effectively in force and that it distorted market pricing for more than two decades before the onset of the crisis itself (see, for example, the empirical evidence in O'Hara and Shaw, 1990, Penas and Unal, 2004, and Morgan and Stiroh, 2005).

The case of the government-sponsored enterprises (GSEs) -- Fannie Mae and Freddie Mac -- illustrate the key importance of moral hazard and government guarantees. Fannie Mae was founded in 1938 in the wake of the Depression to provide liquidity and aid to the mortgage market. It became a government-sponsored enterprise in 1968, and shortly after, Freddie Mac was formed to compete with Fannie Mae to create a more efficient secondary market for mortgages. Both were listed companies, with shares actively traded in the market. While not explicit and often denied, there was the presumption that both the guarantor function and debt of the GSEs had full backing of the U.S. Government. Fannie and Freddie shareholders could be wiped out under adverse circumstances, but their debt-holders fully expected to be rescued at face value by the GSE relationship with the U.S. Treasury. Indeed, GSE debt generally was priced marginally above the prevailing treasury rate. U.S. institutional investors (like pension funds) and foreign investors (like China's central bank) were big players, chasing a few

basis points of “free lunch” and fully expecting the implied Treasury backstop to kick in if times got tough. An excellent bet, as it turned out.

Consider the investment function of the GSEs. For every \$1 of mortgage-backed securities (MBS) purchased with equity, there was a large amount of debt issued to purchase additional mortgage-backed securities. Figure 3 provides the book and market leverage ratios of the GSEs over the period 1993 to 2007. The extraordinary point is the GSEs’ access to very high leverage, given that they were investing in risky mortgage securities with questionable liquidity. This provides an idea of the size of the implicit government guarantee. In fact, the empirical literature has quantified the transfer from the taxpayer to the GSEs’ bondholders and stockholders to be in many billions even before the crisis ignited (see, for example, Passmore, 2005 and Lucas and McDonald, 2006).

Furthermore, it has been well-documented that the investment portfolio of the GSEs also became riskier through time, as both Fannie Mae and Freddie Mac began to load up on non-prime mortgages – under intense pressure from both the Clinton Administration (through the Department of Housing and Urban Development under Secretaries Henry Cisneros and Andrew Cuomo) and by Congress, to better serve the political end of housing affordability for lower-income Americans. Though the available data are sparse and somewhat controversial -- with some analysts arguing the non-prime bets were much larger (Pinto, 2008) -- it is clear that by the mid 2000s at least 15% of GSE funds were invested in subprime mortgages. In contrast to prime mortgages, however, they were not hedged using corresponding interest rate swaps, making them highly vulnerable.

Figure 4 provides the size of the GSE mortgage portfolios, noting the subprime holdings in the years immediately before the crisis. With the lack of market discipline from debt-holders due to the government’s guarantee, one would expect that the GSEs would invest in riskier assets to the extent possible. It is therefore not surprising that, as non-prime mortgages took off, the GSEs risk-shifted toward these assets. As creditors did not price the risk exposures of GSEs given the implicit guarantee, and as equity holders allowed the risky bets to maximize their option value on the guarantee, the interests of effective claimants of GSEs – the taxpayers – were marginalized in the

highly politicized corporate control environment of these public-private hybrid financial institutions.

Figure 3: The Leverage Ratio of the GSEs (1993-2007)

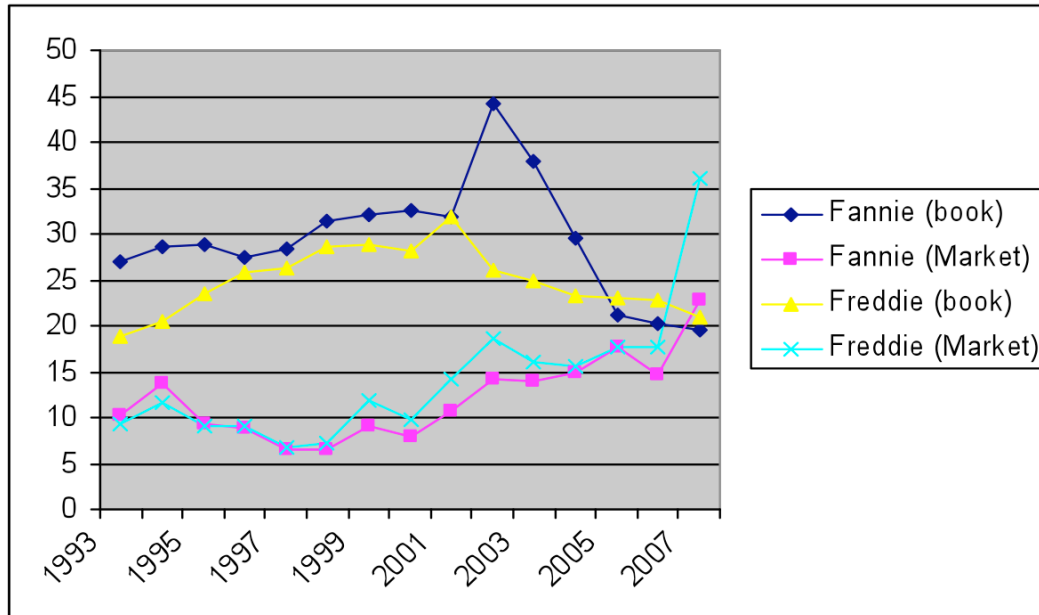
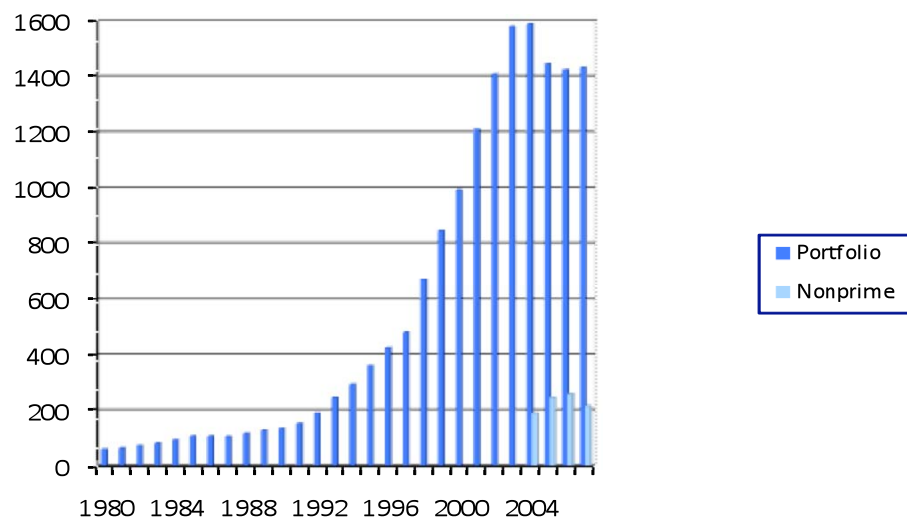


Figure 4: The Size of the GSE Retained Mortgage Portfolio (Billions of Dollars)



B. Systemic Risk of Financial Institutions

Over the past two decades, there had been tremendous, sometimes unrecognized, growth in the systemic risk arising from failures of financial institutions (LTCM case, described in Section II, being the prime example). There is in essence a negative externality on the system, because the systemic cost of a financial institution's collapse – which can lead to failures of others and/or the freezing of capital markets – is not fully internalized by that institution.

With mispriced guarantees and the repeal of Glass-Steagall, the only protection the financial system had from excessive risk-taking was prudential bank regulation, primarily through capital requirements, aimed at constraining financial leverage and risk. The market failure here was that regulation should have been focused on such externalities so as to curb the risks to the financial sector and the economy at large. However, prudential regulation of the financial sector has focused not on systemic risk but rather on the individual institution's risk profile. This design is seriously flawed. Regulation that ignores externalities encourages financial institutions to pass their risks in an unfettered manner throughout the system and on to unregulated entities.

For instance, as they reduce their individual risks, financial institutions are rewarded with a lower capital requirement that gives them the license to originate more risk, possibly aggregate in nature. This new risk gets passed around in the system and creates a financial sector in which any individual institution's risk of failure appears low to the regulator, but it is either hidden in the unregulated sector or has combined to form an aggregate concern – in either case, it is systemic in nature. Instead of penalizing behavior that leads to excessive systemic risk, current financial regulation appears to be rewarding it.

As we have emphasized, in this crisis, financial firms loaded up on assets with low volatility and high systemic risk (and therefore high expected returns). At the cost of reiterating, the best example was many of the large financial intermediaries that ignored their own securitization business models by holding onto the non-diversifiable credit risk associated with the AAA-tranches of securitized loan portfolios. Because little capital (typically 10%-20% of nominal credit exposure) was attached to these bets -- i.e., the transactions were highly leveraged -- it can be shown that their economic properties

were those of writing an extreme out-of-the-money put option on the aggregate market (see, for example, Coval, Jurek and Stafford, 2008).

It is well-known that writing out-of-the-money put options produces large expected returns – this is why financial institutions engaged in the trade. Large expected returns, however, go hand-in-hand with large aggregate risk. There is no free lunch. This is why financial institutions got into so much trouble when the negative aggregate shock to the real estate market occurred starting in 2007. Consequently, the financial sector's capital buffer to protect underperforming loans in times of recession eroded almost instantaneously, leaving the sector with no capital protection for very weak portfolios.

The failure to focus on systemic risk, as opposed to individual institution risk, extends beyond prudential bank regulation. Specifically, there are several types of systemic risk that can be generated from the failure of a financial institution, especially during a financial crisis. Past crises also provide a guide here.

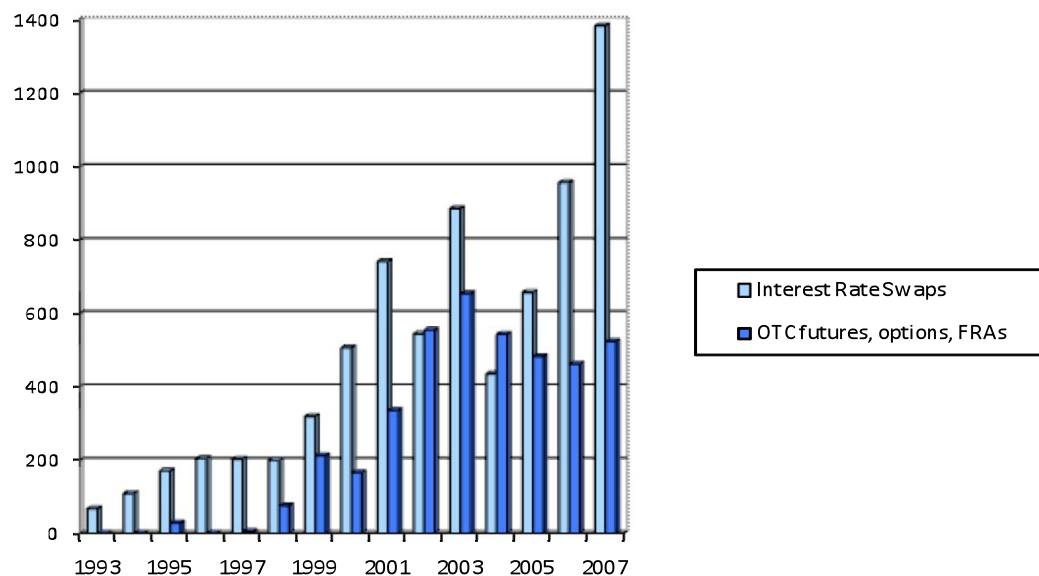
The first is counterparty risk. If a financial institution is highly interconnected to many other financial institutions, then its failure can have a ripple effect throughout the system. Consider the OTC derivatives market. The main reason for systemic risk in OTC markets is that bilaterally-set collateral and margin requirements in OTC trading do not take account of the “counterparty risk externality” that each trade imposes on the rest of the system, thus allowing systemically important exposures to be built up without sufficient capital to mitigate associated risks (see Acharya and Bisin, 2009, who formalize the notion of counterparty risk externality). The prime example in the current crisis is AIG, which built up \$450 billion of one-sided credit default swap exposure on the so-called AAA-tranches of securitized products. These positions were created with little or no capital support. Because all the trades were in the same direction, once the trades lost value, it meant that AIG's failure would inevitably propagate and amplify throughout the financial system.

Another example was the rating downgrade of monoline insurers that took place in the first six months of 2008. As the major rating agencies began to downgrade the monoline insurers during 2008, their guarantees lost their AAA-backing, and thousands of municipal bonds and structured products were downgraded as a consequence. The downgrades, in turn, caused financial institutions to increase capital requirements as the losses on the insured securities were forced back onto their balance sheets.

Furthermore, institutions had to rebalance portfolios now that some of their underlying bonds were no longer AAA-rated, putting additional downward pressure on bond pricing.

And, consider again the GSEs. As one of the largest investors in capital markets, the GSEs presented considerable counterparty risk to the system, similar in spirit to LTCM in the summer of 1998, as well as to the investment banks and some insurance companies during this current crisis. While often criticized for not adequately hedging the interest rate exposure of their portfolio, the GSEs were nevertheless major participants in the interest rate swaps market. As was characteristic of other LCFIs, Figure 5 shows the growth of their swaps and derivatives positions through the years – by 2007, the total notional amount of swaps and OTC derivatives was \$1.38 trillion and \$523 billion, respectively. Failure of GSEs would have led to a winding down of large quantities of swaps with the usual systemic consequences.

Figure 5: the GSEs' Holdings of Financial Derivatives (Notional Amount in Billions of Dollars)



The list could go on. But whether it was a few punters speculating in the curbside market outside the New York Stock Exchange in October 1907 who happened also to be exposed to many banks; or the 1984 collapse of Continental Illinois with exposure to over 2,000 other banks; or a failing LTCM in August 1998 with more than \$1.25 trillion in

notional swap positions, making it the seventh-largest institution in notional derivatives, the warning signs should have been clear. The system cannot withstand the failure of a highly interconnected institution. In the oft-cited words of Mark Twain, “History doesn’t repeat itself, but it does rhyme.”

The foregoing discussion also points to the second way systemic risk can enter the market, namely spillover risk that arises as one institution’s trouble triggers liquidity spirals, leading to depressed asset prices and a hostile funding environment, pulling others down and thus leading to further price drops and funding illiquidity (Brunnermeier and Pedersen, 2008). In a distressed market, you sell what you can sell, as long as liquidity remains, regardless of the underlying asset quality. Going back to the example of the GSEs, by owning such a large (and leveraged) portfolio 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, which was holding similar assets. To the extent that the MBS market is one of the world’s largest debt markets, the fire sale could have brought other financial institutions down, similar to what actually happened with the subprime collateralized debt obligations (CDOs).

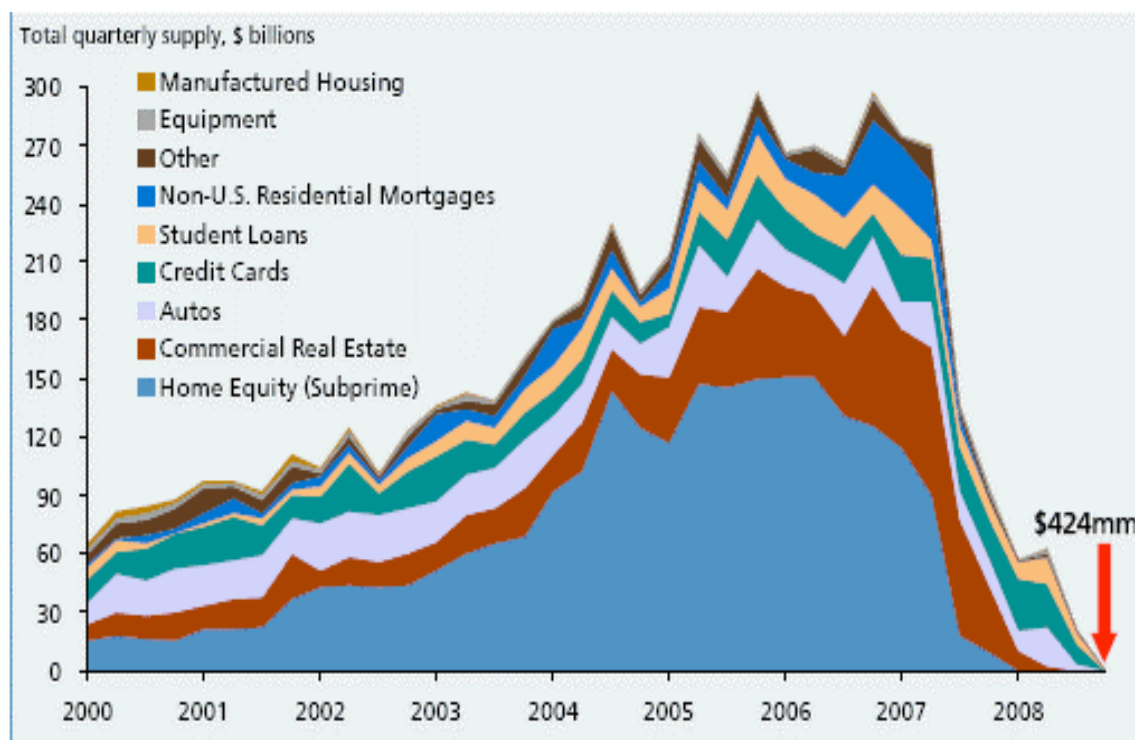
The third type of systemic risk is that financial institutions operating in the shadow banking system are subject to bank-like runs. The “new model” of banking relied heavily on the short-term wholesale funding market. For example, the volume of repo transactions soared from \$2 trillion daily in 1997 to \$6 trillion a decade later in 2007, and money market funds accumulated over \$4 trillion in assets, compared with the \$8 trillion of deposits in the banking sector. Since these funds were rolled over on a short-term basis, sudden fund withdrawals that occur because of uncertainty about a financial institution’s health can ironically cause the institution to fail. Short-term liabilities were funding longer-term, less liquid assets that the institutions could not unload in an orderly way. These are the same issues that exist in “old fashioned” banking and are handled inside the bank using conventional asset and liability management, except here, the problem exists across institutional boundaries and there is no asset-liability management process that transcends them.

When a particular institution that is engaged in maturity mismatch fails in this manner, uncertainty about the health of similar institutions can lead to an indiscriminate run, and otherwise well-capitalized firms can face withdrawals of their short-term

liabilities, in turn causing a systemic crisis. While many observers point to the fall of Lehman Brothers, the forced sale of Merrill Lynch, and near-failure of Morgan Stanley and, possibly Goldman Sachs, as the most-telling illustration of runs in this crisis, there are others. Most notably, the collapse of Lehman Brothers and the value of its short-term debt caused the largest money market fund, the Prime Reserve Fund, to “break the buck,” leading to a run on the entire system. Only the government’s 100% backstop of money market funds reversed the slide.

More generally, consider the fact that securitization had become a primary tool to issue credit to individuals and corporations. Figure 6 shows the massive growth in this market from 2001 to 2007. Of course, if the securities underlying the pool of loans via securitization were held in the capital market at large, then there would not be a systemic issue. But as we know from this crisis, many of these securities were in fact held in vehicles that had recourse back to the sponsoring financial sector firms, funded using short-term, highly mobile, asset-backed commercial paper. This funding exposed the financial institutions to runs reminiscent of those seen during the Great Depression.

Figure 6: Asset-Backed Security Issuance (2000-2008) (Billions of Dollars)



Source: J.P. Morgan Securities Inc. Data as of 10/31/2008.

Two of the most recent crises discussed earlier – the failure of Continental Illinois and LTCM – should have alerted the system and its regulators to the dangers of a new type of “bank run” (via the wholesale funding markets) and to the systemic nature of counterparty risk. These two types of failures were at the center of the current crisis.

C. Opacity of Financial Institutions and Markets

One can reasonably debate about the advantages and disadvantages of a more transparent financial system. On the one hand, transparency reduces the benefit of private information, which, in turn, reduces the collection of such information. On the other hand, the past crises – especially the panic of 1907, the Great Depression and the LTCM crisis – illustrate how information asymmetry can potentially lead to runs on the entire system, even if many of its institutions are healthy.

There are four types of institutions with different regulation and guarantee levels - commercial banks, broker/dealers (investment banks), asset management firms, and insurance companies – and mispriced guarantees and excessive risk-taking for any one type can wreak havoc on the whole financial sector. This is because of the *counterparty risk externality* that has largely been unregulated. There are several aspects that have contributed to this externality.

First, the incentive to get too-big-to-fail pushes institutions towards the LCFI model, the regulatory structure for which has yet to be fully articulated. The coarseness and lack of regulatory granularity of these institutions has allowed the unregulated sectors – primarily, the so-called “shadow” banking sector and hedge funds – to thrive. Financial institutions have innovated ways to take unregulated risk exposure (for example, through prime brokerage activity) and to park their assets off-balance sheet temporarily (for example, in the form of asset-backed conduits and SIVs), so as to get regulatory capital relief and subsequently take on additional risks. The sheer magnitude of this activity — especially in the shadow banking sector — and its recourse to the financial sector have meant that systemically important pockets can easily develop in the financial system that have little or no regulatory oversight or scrutiny.

With the repeal of Glass-Steagall and the lack of market discipline due to government guarantees, the financial system’s only protection was through the regulators (that is, regulatory capital requirements). However, there was no one single regulatory body responsible for LCFIs. This allowed for substantial regulatory arbitrage

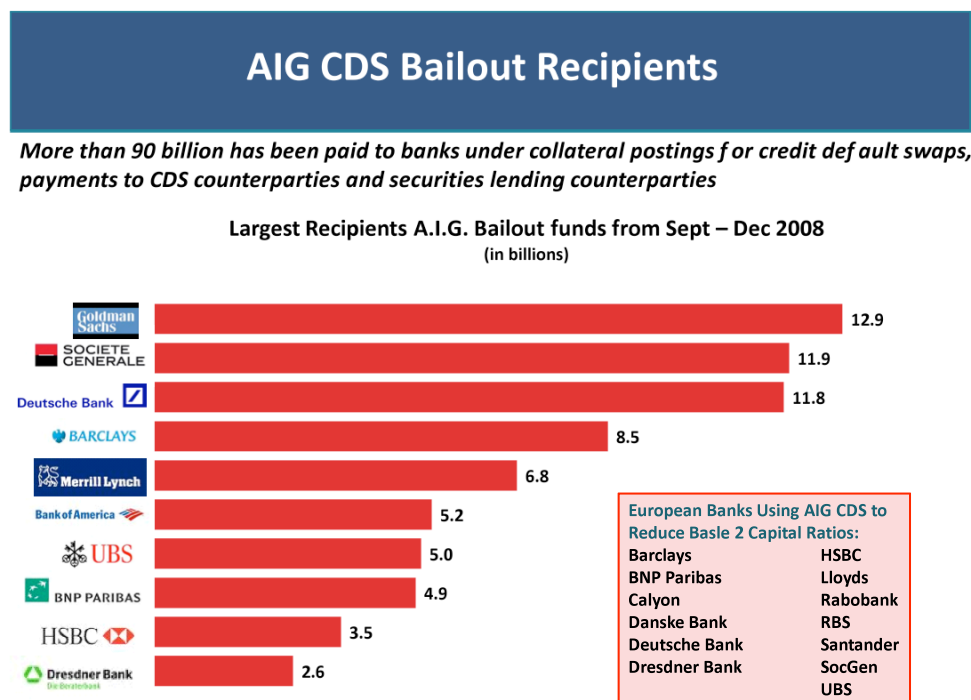
across regulators. The most telling example was that AIG was able to choose its regulatory body for its holding company as the Office of Thrift Supervision (OTS) because it had bought a small savings and loan. OTS clearly did not have the expertise to supervise the insurer's parent company. Indeed, it can be argued that lapses in LCFI corporate governance, laid-bare during the crisis, suggest that such institutions may be too big and complex to manage and control, not to mention too big and complex for just about any external regulator to do its job effectively.

Second, innovations for sharing risk such as credit default swaps (CDS) and collateralized debt and loan obligations (CDOs and CLOs), which have the potential to serve a fundamental risk-sharing and information role in the economy, were designed to trade in opaque, OTC markets. While such a trading infrastructure is generally beneficial to large players and has some benefits in terms of matching trading counterparties, its opacity — especially in terms of counterparty exposures — is a serious shortcoming from the standpoint of financial stability during a systemic crisis. If financial institutions take on large exposures in such markets (for example, commercial banks with access to mispriced deposit insurance encouraging the growth of a large insurer providing credit protection), then the failure of a single large institution can raise concerns about the solvency of *all* others, given the opacity of institutional linkages.

The main problem associated with the trading of OTC derivatives (CDSs, foreign exchange derivatives, and interest rate swaps, among others) is that the contracts are bilateral, typically with collateral depending on the type of contracts and the rating of the counterparty. The advantage of OTC contracts is that they are tailor-made, which is important to entities that want to be perfectly hedged. On the other hand, they are more subject to liquidity shocks and counterparty risk. Moreover, an issue that transcends these two problems is the lack of transparency within the system. Unlike in the case of a central clearing house or an exchange, no one knows precisely what the total exposure is, where it is concentrated, what the value of such contracts is, etc. These issues always exist, but they rarely surface when positions are small. But when the sizes become large, and combined commitments are many times larger than the underlying contracts, the lack of transparency makes the system prone to information problems, converting a small shock into a systemic failure.

In the current crisis, counterparty risk concerns arose around the failures of Bear Stearns (which was a large CDS clearer), Lehman Brothers (on which CDS was traded in significant quantity) and AIG (which had written \$450 billion worth of CDSs on AAA-rated CDO tranches of mortgages, loans and bonds). Figure 7 and Table 3 illustrate the magnitude of the OTC derivatives problem in this crisis relating to AIG, showing the ten largest payments (via government aid) to its various counterparties in the autumn of 2008. The payments are broken down as follows: (i) collateral postings under credit default swap contracts; (ii) the outright purchase and closing of contracts tied to credit default swaps on non-prime mortgage-backed securities via Maiden Lane III; and (iii) guaranteed investment agreements held by municipalities. The table shows that almost \$60 billion of losses would have been borne by counterparties, causing possible failures elsewhere in the system, leading to a potential meltdown.

Figure 7: Overall Distribution of AIG Bailout Funds Among its CDS Counterparties (Billions of Dollars)



An equally important issue is that there was essentially no regulatory oversight/jurisdiction. Currently, the CFTC, SEC and the Fed regulate exchange-traded

derivatives in a fragmented manner, resulting in inefficiencies and arguably a waste of valuable resources. In contrast, OTC derivatives are mostly unregulated, creating a clear incentive to engage in regulatory arbitrage. This lack of regulation of OTC derivatives received a seal of approval by the passage of the Commodity Futures Modernization Act of 2000 (CFMA), under heavy lobbying pressure from the financial industry. In fact, a number of policymakers have argued that CFMA led to serious deficiencies in the system, including Enron taking advantage of this legislation in some of its fraudulent accounting practices, and perhaps more important, the unchecked growth of the CDS market.

Table 3: AIG Financial Products Counterparty Payments (9/16/08-12/31/08) (Billions of Dollars)

Collateral Postings under AIGFP CDS	Maiden Lane III Payments to AIGFP CDS Counterparties	Payments under Guaranteed Investment Agreements
Societe Generale \$4.1	Societe Generale \$6.9	California \$1.02
Deutsche Bank \$2.6	Goldman Sachs \$5.6	Virginia \$1.01
Goldman Sachs \$2.5	Merrill Lynch \$3.1	Hawaii \$0.77
Merrill Lynch \$1.8	Deutsche Bank \$2.8	Ohio \$0.49
Calyon \$1.1	UBS \$2.5	Georgia \$0.41
Barclays \$0.9	Calyon \$1.2	Colorado \$0.36
UBS \$0.8	Deutsche Zentral-Genossenschaftsbank \$1.0	Illinois \$0.35
DZ Bank \$0.7	Bank of Montreal \$0.9	Massachusetts \$0.34
Wachovia \$0.7	Wachovia \$0.8	Kentucky \$0.29
Rabobank \$0.5	Barclays \$0.6	Oregon \$0.27
Top 20 \$18.3		Top 20 \$7.00
Total \$22.4	Total \$27.1	Total \$12.10

Source: AIG.

In short, growth in the size of financial institutions, their linkages and their fragility, have raised the prospect of extreme counterparty risk concerns. When these concerns have materialized, financial institutions have themselves been unable to fathom how losses resulting from a large institution's failure would travel along the complex chains connecting them. The consequence has been complete illiquidity of securities held primarily by these institutions (such as credit derivatives) and a paralysis of interbank markets, which, in turn, has paralyzed credit intermediation in the whole economy. It is important to realize that what superficially may appear to be a problem of illiquidity of a class of assets and markets may well be a symptom of the deeper issues of excessive leverage, risk-taking, and the resulting insolvency of financial institutions fuelled at least partly by mispriced guarantees.

Financial institutions, left to private incentives, do not and will not internalize this potentially severe *counterparty risk externality*.

D. "Runs" on the System

As discussed in the systemic risk section of this paper (Section III.B), regulated financial institutions, as well as their unregulated siblings, have fragile capital structures in that they hold assets with long duration or low liquidity, but their liabilities are mainly short term in nature. While commercial banks are not subject to large-scale runs because of deposit insurance and central bank lender of last resort support, the other institutions are, and indeed many of them -- most notably Bear Stearns and Lehman Brothers, as well as a number of managed funds in the money market and hedge fund arena -- did experience "wholesale" runs during the crisis. And, importantly, commercial banks, too, are subject to localized runs in the wholesale funding and interbank markets if they themselves are perceived to have exposure to institutions experiencing large-scale runs.

Of course, not all runs are problems that need a regulatory fix. In the crisis of 2007-2009, it is not clear that the run on subprime lenders in the first half of 2007, the run on asset-backed commercial paper (ABCP) conduits in the second half of 2007, and the run on hedge funds post-Lehman were market failures. Take the asset-backed commercial paper market as an example. There is much discussion in academic and policy circles for the sudden inability of ABCP conduits to roll over their commercial paper. Some view this as a run on the system that needs to be fixed -- a "buyer's strike."

But this was not because of information asymmetry about the quality of the underlying asset-backed securities. There was a sudden awareness that (i) the risk of *all* the AA- and AAA-rated tranches of the underlying asset-backed securities was systematic in nature, and (ii) the likelihood of this risk had increased sufficiently so that they were no longer safe securities for investment portfolios. In other words, this was not a question of insolvency. If insolvency is defined as trading below par, then all these conduits were insolvent, given the fact that they lacked any meaningful capital support.

Thus, the real concern is when runs are *not* affiliated with failure or insolvency. For example, during the early 1930s, the banking crisis led to runs on many solvent institutions, and during the week of Lehman's failure, the crisis led to runs on money market funds that had not "broken the buck." To the extent that such runs represent an information contagion from runs on other, less deserving institutions, they carry a systemic externality. In other words, addressing the likelihood of runs on the shadow banking sector – the uninsured parts of the intermediation sector – may be a critical ingredient to stabilizing the system as a whole.

IV. Principles of Financial Regulation

What implication does the financial crisis -- and our assessment of market failures that led to it -- have for financial regulation going forward?

The previous section outlined four market failures that are inter-linked and need to be addressed collectively: (i) mispriced government guarantees; (ii) focus on individual versus systemic risk of firms; (iii) lack of transparency in the financial system; and (iv) runs on the financial system. We now consider appropriate regulation to deal with these failures.

A. Risk-Taking Incentives and Systemic Risk of Financial Institutions

With respect to the risk-taking incentives of financial firms, much of the focus by policymakers in the U.S. and elsewhere has been both on the type and level of compensation contracts within financial firms. It has been argued that, in the period leading up to the crisis, bankers were increasingly paid through short-term cash bonuses based on volume and current marked-to-market profits, rather than on the long-term profitability contribution of their bets. Coupled with the fact that shareholders of the failed (or near failed) institutions lost most of their investments, policymakers see this as prima

facie evidence of massive failure of corporate governance at the equity level (i.e., between shareholders and boards, and between boards and managers). That Citigroup's board fired its CEO in 2008 without a succession plan would be astounding in any listed company whose shareholders are about to be devastated, much less a systemically critical financial conglomerate. While clearly this view cannot be completely discounted, we believe that, in the end, it is not the issue of greatest urgency or an issue where it is clear what advantage regulators have in resolving it. As outlined in III.A above, the costliest market failure of corporate governance – which regulators can do something about with reasonable precision and success – was at the debt and regulatory level.

To understand this, we need to examine how the claim structure of the LCFIs is different from that of a regular nonfinancial firm. On the liability side, LCFIs are highly levered entities. At least 90% of the claim holders of an LCFI are debt holders (including depositors). Another claimant is the government as guarantor. Given this structure of claims, corporate governance mechanisms that align the manager with equity holders may deviate significantly from those that maximize firm value. Put differently, corporate governance mechanisms in LCFIs have to be designed so as to align the manager with the interests of the debt holders and the government guarantor and not just those of the shareholders.

In order to assess the role of regulation in this context, it is useful to think through the optimal governance system that the LCFI should have. Take the example of FDIC insurance (the same reasoning holds for other types of insurance provided by the government - for instance, implicit insurance provided to too-big-to-fail' institutions.) If the FDIC insurance is properly priced, the with-guarantee value of the LCFI would be equal to the without-guarantee value of the LCFI. On the other hand, if the FDIC insurance is not properly priced, then the appropriate objective in structuring corporate governance and managerial incentives would be to maximize the without-guarantee value of the LCFI. Otherwise, the LCFI management might make value-destroying choices to take advantage of the discrepancy in the pricing of the FDIC insurance.

If one were to specify a model of a banking system with limited liability in which each bank maximizes shareholder value under conditions in which the regulator provides a safety net (i.e., guarantees for creditors such as deposit insurance or implicit

TBTF support) and also faces systemic risk (i.e., systemwide costs in a crisis), the optimal plan would be for the regulator to “tax” (i.e., charge an insurance premium) each individual bank an amount equal to the sum of two components⁹:

- *Its expected losses upon default:*

That is, the government guarantees in the system need to be priced. Financial firms must pay for the guarantees they receive. Because the price of these guarantees will vary across firms in light of their different risk profiles, each firm will choose some optimal level of risk-taking activities consistent with the cost of the guarantees, almost surely at a more prudent level than in the absence of appropriately priced insurance. Ostensibly, the FDIC chooses the level of FDIC premiums on a risk basis, although in reality, premiums are only charged when the fund is poorly capitalized. Consequently, the policy will not achieve the optimal policy of valuing the firm’s assets, and the result will be excessive risk-shifting. Hence, insurance premiums need to be charged to banks on a risk-sensitive basis, and crucially, at all parts of the cycle. Premiums should not be rebated to banks in good times, as this destroys the incentive role played by premiums.

- *Its contribution to a systemic crisis, that is, its marginal expected losses in the crisis, or in other words, the contribution of each firm to aggregate losses above a certain threshold of aggregate losses:*

In addition to expected losses, the systemic risk contribution also needs to be priced. This way, the financial institutions can be made to internalize the costs of the negative externality imposed on the system by their losses and failures. Arguably, the principal failure that contributed to the 2007-2009 crisis was that financial sector regulations sought to limit each institution’s risk in isolation, and were not sufficiently focused on systemic risk. As a result, while individual firms’ risks might have been properly dealt with in normal times, the system itself remained, or was induced to be, fragile and vulnerable to large macroeconomic shocks. Consistent with economic intuition, these systemic

⁹ See Acharya, Pedersen, Philippon and Richardson (2009) and Acharya and Yorulmazer (2009) for a formal treatment of such a “tax.”

losses increased with lower initial capital, riskier asset holdings that contributed to the tail-interdependence between the institution and the system, institutional and aggregate volatility, and the severity of the externality.

Charging a premium for systemic risk will cause financial institutions on the margin to hold more initial capital up front (i.e., be less leveraged) and to take less risky positions. That is, by incorporating the “tax” in exposure decisions, the financial institution will organically choose to become less systemic. Putting aside the political economy of the viability of expanding FDIC-like premiums, the biggest hurdle to successful implementation is measuring systemic risk contributions and setting the proper price for the insurance. There are two main obstacles:

First, the regulator may not have the expertise to set the appropriate price. This is especially true with LCFIs, since their risk profile can change rapidly as they enter and exit markets or change the weight of various kinds of exposures. There are a number of empirical studies that use publicly available data and standard statistical techniques to evaluate whether the more systemic firms do in fact perform worse in crisis conditions, and the findings seem quite encouraging that systemic risk is generally measurable. (See, for example, Acharya, Pedersen, Philippon and Richardson 2009).

An alternative solution to this first problem would be to partially privatize the systemic guarantees through private reinsurance or a public-private reinsurance scheme.¹⁰ The idea is that private insurers would help price the insurance, while the government would provide most of the underlying capital in return for a proportionate share of the premium income. While some reinsurance schemes have been considered by the FDIC, most recently in 1993, with the conclusion that the market did not seem viable, there is reason to be more optimistic today. Financial markets in general have become much more sophisticated in how they develop niche products. An example of innovative co-insurance, motivated by the events of September 11, 2001, is the Terrorism Risk Insurance Act (TRIA), enacted in November 2002, and providing federal reinsurance for qualifying losses from a terrorist attack. TRIA incorporates both industry loss triggers and government excess loss coverage, which helps to minimize the

¹⁰ See Chapter 13 “Regulating Systemic Risk” of Acharya and Richardson (2009b).

insurance industry's losses, yet provides them with an incentive to price, monitor and reduce risks. Something similar might work here.

The second problem in charging for systemic risk contributions is perhaps more serious. The issue with moral hazard is that ex ante contracting does not lead to first-best actions (e.g., John, John and Senbet, 1991 and Prescott, 2002). Because the actions of banks are not fully observable after the premiums for the guarantees and systemic risk are set, the banks can subsequently change their behavior. While a private market such as that just described may be better able to monitor bank actions, the optimal contract in such a setting usually calls for some type of state-contingent mechanism. It often imposes a severe penalty function in bad states to get the agent (i.e., the bank) to avoid excessive risk-taking activities. It involves the same underlying economics as do most insurance contracts to the extent those contracts often have large deductibles. Here, the “punishment” can take several forms, all with the intention of aligning incentives and thus bringing back market discipline:

- The creation of an insolvency regime for complex financial institutions that would allow the orderly failure or restructuring of insolvent firms. Under current discussion are plans to force firms to develop an ex ante way for them to unwind if they fail -- a “living will”. Putting aside whether this is feasible for global institutions, this type of punishment would pass the moral hazard test.
- Alternatively, one could require financial institutions to hold in their capital structure a new kind of “hybrid” claim that has a *forced* debt-for-equity conversion whenever a pre-specified threshold of distress (individual and/or systemic) is breached. (See, for example, Doherty and Harrington, 1997, Flannery, 2002, Squam Lake Working Group, 2009, and Hancock and Passmore, 2009.) While this has the benefit of recapitalizing financial firms in a crisis, it most importantly brings back market discipline via creditor losses.
- A less discussed option is to institute so-called “double liability” for stockholders of financial institutions (e.g., Kane and Wilson, 1997). Under double liability, shareholders of the bank lose not only the value of the stock but are also charged an additional penalty, possibly up to the par value of their holdings.

While double liability may be impractical and raises many conceptual and legal issues, it was in fact standard practice from 1863 to 1933.

Arguably less efficient, but easier to implement, would be a state-contingent plan for deposit insurance premiums that are higher in good states and thus reduce the net payoff in these states. Reducing these payoffs provides less reward to excess risk-taking activities as well. These would effectively take the form of windfall profit taxes. (See Prescott, 2002 for examples of payoff structures in a stylized model of deposit insurance.) A related idea from John, John and Senbet (1991) is to require that firms have a certain amount of convertible debt that dilutes shareholders' during good economic times, reducing the return to undertaking risky gambles.

The success of the Banking Acts of 1933 had two sides to it. On the one hand, it effectively put an end to runs on bank deposits. On the other hand, it managed the moral hazard problem through a combination of insurance premiums, capital requirements and separation of investment and commercial banking. While there is a general view that insurance premiums are lowered by banks through lobbying in good times, higher capital requirements are quite costly – not just privately for bankers but also for society. and that separation of bank activities by scope is no longer feasible, we believe the concerns are either surmountable or overstated.

Consider, for instance, the case of higher capital requirements. Define capital as core equity. The most basic theorem in finance (Modigliani and Miller, 1958) shows that the value of the firm's assets will be the same regardless of how those assets are financed when there is no distortion induced by the form of financing on the nature of asset investments. In other words, choosing investments should be based solely on whether the return on the project's assets exceeds its cost of capital for those assets. Increasing the return on equity via leverage is just a wash and contributes nothing to efficiency in capital allocation. Given that the systemic costs to leverage are so high, this suggests that higher capital requirements will not necessarily be socially costly at all. While M&M is not reality, it is a useful starting point.

Putting aside the tax benefits of debt, the issue of how costly it is to raise equity depends on whether one believes the agency problems of LCFIs are due primarily to conflicts between shareholders and managers, or to conflicts between shareholders and creditors/regulators. If it is the latter, as we have argued, then the relatively higher cost

of equity financing versus debt financing is being driven by the mispriced guarantees that benefit the creditors. Fixing this problem -- i.e., charging for the guarantees and systemic risk -- is tantamount to charging for higher leverage, which will, in turn, put the cost of capital for debt and equity on equal footing. While it is true that banks can alter their risks in fairly swift and opaque fashions and this necessitates a certain amount of demandable debt for discipline, this argument has yet to be tested for complete empirical merit when favorable tax treatment of debt and mispricing of debt due to government guarantees have been properly accounted for.

Thus, higher capital requirements for riskier – and systemically riskier – activities are certainly an option. However, as we have learned from the 2007-2009 financial crisis, capital requirements can be gamed. So to some extent the financial system must rely on the power and supervisory expertise of the regulator. Furthermore, significant improvements are possible by closing major capital loopholes and relying less heavily on the rating agencies. With respect to the loopholes, a good rule of thumb is that if off-balance sheet financing in reality involves recourse back to the banks, then the capital at risk should be treated as though activity were on-balance sheet. Moreover, counterparty credit risk exposures to financial firms, including OTC derivatives and securities financing transactions, should also be taken into account.

While the Basel II Accord did expand the notion of risk for financial institutions, in hindsight it chose simplicity over accuracy in the determination of how capital should be treated. It seems reasonable to consider not only the credit risk of defaultable assets, but also liquidity, funding, market and specification (or valuation model) risks. In retrospect, Basle II was necessary but not sufficient in preventing institutional and systemic failure. It focuses narrowly on the individual risk of institutions, but ignores altogether the systemic risk. Indeed, by encouraging the use of CDSs to reduce banks' regulatory capital, it arguably encouraged the concentration of risk elsewhere (in monoline insurers and AIG, which turned out to be highly vulnerable) and propagated systemic risk.

Example: AAA-rated tranches of CDOs. We can illustrate some of these ideas using the super senior AAA-tranche of collateralized debt obligations relative to a more standard AAA-rated asset, say a AAA corporate bond. Specifically, assume that the probability and magnitude of losses (i.e., the expected mean and variance) associated with default are similar between the two classes of securities. What are the differences?

- Liquidity risk refers to the ability of the holder to convert the security or asset into cash. Even before the crisis started, the super senior tranches were considered to be highly illiquid and more of a hold-to-maturity type of security. The fact that these securities offered a spread should not be surprising, given that there are numerous documentations of a price to illiquidity. For instance, consider the well-documented spread between the off-the-run and on-the-run Treasuries (Krishnamurthy, 2002).
- Funding risk refers to the mismatch in the maturity of the assets and liabilities. There is a tendency for financial institutions to hold long-term assets using cheap short-term funding, a kind of a “carry trade.” But this exposes the institution to greater risk of a run if short-term funding evaporates during a crisis. Indeed, some researchers have argued for capital requirements to take into account this particular funding risk (see Geneva Report, 2009). These two points suggest that it would be useful to know the “liquid” assets the financial institution holds against short-term funding. One could imagine that the higher the ratio, the less an institution is subject to a liquidity shock, and therefore the less risky it is.
- The systematic risk of the AAA-tranche is much higher than that of the more standard AAA-rated asset. The AAA-tranche has no idiosyncratic risk, so all of its volatility surrounding the probability and losses associated with default occurs only when the market does poorly and households’ or corporations’ underlying assets in the CDOs default in a correlated fashion. In other words, the losses occur when the system can least afford them. This is particularly acute in systemic crises, because these are most likely to occur during extreme market downturns.
- The final risk, rarely discussed, is that associated with specification error or model risk. It is important to realize that the measurement error of risk varies across assets -- e.g., consider the difference between measuring the interest rate risk of Treasury securities versus aggregate market risk of stocks. The AAA-tranches, especially those involving more structured products like CDO²s, are mathematically equivalent to a compound option (see Coval, Jurek and Stafford, 2008). It is well-known that compound options are very sensitive to the risk (volatility) -- and the risk that risk will change (volatility of volatility) -- of the underlying asset. For AAA-tranche CDOs, the initial parameters chosen are the correlation and volatility of the loans in the portfolio. Given the fact that these

parameters are mostly unknown and likely to evolve over time in any case, it suggests caution in estimating the risks and treating them as known in banks' or regulators' internal risk models.

Capital requirements should be a function of the risk of the underlying assets and these risks should be related to the above issues. To the extent that financial institutions spend considerable time and effort circumventing capital rules by searching for higher spreads and consequently engaging higher risks, appropriate accounting for these risks would help alleviate the excessive risk-taking.

As a final comment on capital requirements, there is much discussion in policy circles about whether narrower banking, along the lines of the Glass-Steagall provisions of the 1933 Banking Act, would help alleviate systemic risk. Narrow banking would generally restrict the types of exposures that could be built up by institutions subject to deposit insurance and other forms of government support, such as proprietary and directional trading, equity investments using the firm's capital and implicitly through asset management activities like mutual funds and hedge funds, and structured asset-backed securities intended to be passed onto the capital market at large ("pipeline or warehouse exposure"). There is some validity to this view, although it is often described as impractical in a world of global banking. Of course, if substantial capital requirements were tied to the riskier exposures, then LCFIs should, on their own, decide to engage in less of these risky activities, and functional separation of activity generating systemic risk could be achieved in an organic fashion rather than by fiat.

B. Transparency

All financial crises have the common feature that opacity greatly amplifies the financial shock, leading to bank-like runs and the freezing of markets. It is not clear how one could regulate LCFIs to become more transparent. Any "systemic risk" regulator that is established will undoubtedly try, most likely by requiring the LCFI to release financial information that takes into account off-balance sheet financing, maturity mismatch, liquid asset holdings versus short-term funding, and so on. The hope is that regulation based on correctly pricing government guarantees, a systemic risk assessment, and mandatory convertible debt would organically lead to greater transparency. The LCFIs would have incentives to let the market know it is much less complex and risky than meets the eye.

In 2007-2009 crisis, the leading candidate for the bottleneck in the financial system was the OTC market for derivatives. Its mere size and unregulated nature meant that there literally was no information about counterparty exposures, either at the regulatory or market level. Fixing this key problem, perhaps after the LTCM debacle, would have gone a long way to making the most recent crisis less severe.

Regulators should separate the economic role played by derivatives and financial transactions from shortcomings in their trading infrastructure. There is little merit in shutting down these markets (for example, prohibiting short-selling), even during crises. However, the concerns arising in the case of counterparty risk due to the opaque nature of OTC derivatives need to be addressed:

- i. Standardized markets such as credit default swaps and related indices should be traded on centralized counterparty-cum-clearinghouses or exchanges;
- ii. Smaller, less standardized markets, such as in collateralized debt and loan obligations, which also pose significant counterparty risk issues, should have at the least a centralized clearing mechanism so that a clearing registry is available to regulators to assess contagion effects of a large institution's failure;
- iii. OTC markets can continue to remain the platform through which financial products are innovated; but, to give these markets an incentive to move to a centralized registry and eventually to a clearinghouse, there should be an explicit regulator in charge of enforcing higher transparency in OTC markets – possibly in the form of bilateral information on net exposures with some time delay -- and providing infrastructure for enforcement relating to insider trading and market manipulation practices;
- iv. In order to implement these changes, the regulator may simply have to play the coordinating role — possibly requiring some firmness with large players — to move trading on to centralized trading platforms. Also, the global nature of these markets will require a certain degree of international coordination between regulators, especially when timely counterparty information is required.

Table 4 summarizes some of the market mechanisms and characteristics associated with possible trading of OTC derivatives.

Table 4: Summary of Different OTC Market Organizations

Market Characteristic	Market Organization			
	OTC	Registry (Solution I)	Clearing House (Solution II)	Exchange (Solution III)
trading style	bilateral negotiation	bilateral negotiation	bilateral negotiation	continuous auction
market participants	large well-capitalized firms	large well-capitalized firms	well-capitalized counterparties only	retail trade possible; largest trades in upstairs market
flexibility/standardization of contracts	maximum flexibility	maximum flexibility	flexible terms; standardized credit enhancement	largely standardized contracts
counterparty credit risk	substantial	substantial	little to none	little to none
collateral/margin requirements	bilateral negotiation and management	consistent mark-to-market valuation of positions and collateral; required amounts set bilaterally by counterparties	consistent mark-to-market valuation of positions and collateral; required amounts standardized and set by Clearing House	consistent mark-to-market valuation of positions and collateral; required amounts standardized and set by Clearing House
currently enforced (“current”) levels of price information	largely opaque; daily quotes available	currently largely opaque; daily quotes available;	more transparent; daily settlement prices publicly available	transparent to all
current levels of volume and open interest information	opaque	largely opaque	more transparent	transparent to all
current level of information on large trader positions	opaque	available only to regulators	available only to regulators	available only to regulators
netting of cash flows	bilateral only	yes	yes	yes
netting of offsetting positions	bilateral only	bilateral only	yes	yes
secondary market	only by mutual agreement between counterparties	only by mutual agreement between counterparties	yes	yes

Source: Chapter 11 “Centralized Clearing of Credit Derivatives” (Acharya and Richardson 2009b).

C. Bank Runs in the Shadow Banking System

The Panic of 1907 and the Banking Crises of 1930, 1931 and 1932, all had in common massive systemwide runs on banks. Arguably, the most recent crisis also went pandemic when there was a run on the investment banks and money market funds after Lehman Brothers failed. But the earlier Bear Stearns episode also had the features of a run, even though the firm was neither particularly large nor particularly complex. Like past runs, the runs on investment banks and money market funds occurred because there was uncertainty and lack of information about the health of these institutions, and their funding sources were short-term and highly mobile (repo and securities lending transactions for investment banks and short-term fund flows for money market funds).

As mentioned repeatedly in this paper, the solution in the 1930s was to create deposit insurance and a number of protections to counter risk-taking activities. In the most recent crisis, the government temporarily guaranteed money market funds, and some would argue, the creditors of investment banks when it offered support to Goldman Sachs and Morgan Stanley after experiencing the systemic impact of Lehman's failure in the fall of 2008. The ongoing question is: What should financial regulation to contain the risk of contagious runs in the shadow banking world look like? There seem to be two ways to go:

- A surefire approach to prevent runs would be to guarantee the liabilities. But these guarantees would need to be priced, and surely the activities of these firms would need to be restrained in a Glass-Steagall manner. This regulatory approach advocated above – insurance plus scope restrictions – also calls for pricing the guarantees and systemic risk. Existing research, both ours and others, suggests that systemic risk (estimated from market data) is higher for firms that have a mismatch between their assets and liabilities. Thus, a systemic premium for a guarantee would be one way to proceed. Financial institutions would have an incentive to lower the assessment through reducing the mismatch in funding. This reduction in funding would naturally lower the probability of a systemwide run.
- A more structured approach would be to impose liquidity requirements on financial institutions that are similar in spirit to the way capital requirements are imposed. The basic idea would be to mandate that a proportion of the short-term funding must be in liquid assets -- ones that can be sold immediately and in

quantity at current prices. This requirement might also be sufficient to prevent runs. It will, in effect, increase the cost to financial institutions of taking on carry trades and holding long-term asset-backed securities. For example, in the context of the securitization market, the business model was developed under the premise of “originate to distribute.” But, in this crisis, financial firms did not follow this model. Instead, firms held onto these securities and funded these purchases short term, creating a significant mismatch and making them susceptible to runs. By imposing liquidity requirements, these trading activities would naturally migrate to the capital market at large (e.g., pension funds, mutual funds, hedge funds, and trading accounts of wealthy individuals) where they arguably belong.

Highly regulated entities such as money market funds would be treated similarly, albeit with less reliance on the credit rating agencies. Similar to our earlier arguments, regulators need to consider not only the credit risk of defaultable assets, but also their liquidity, market and specification or model risks.

The implementation of liquidity requirements to stem runs is complicated by the fact that some institutions benefit from a government guarantee of their short-term funding (e.g., deposit insurance) while other firms do not. The purpose of the guarantee (at least in the case of deposit insurance) is that banks can provide loans to the real sector of the economy without the threat of a run, not so that they could load up on illiquid, long-term securities. Of course, if the guarantees are mispriced, then banks with insured deposits will have an incentive to enter the market of managed funds and money market funds, and this regulatory arbitrage might distort prices and risks.

V. Lessons for Emerging Markets

We conclude by discussing the implications of the financial crisis -- and our assessment of 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 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.¹¹ 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. This result is completely consistent with the analysis provided in Sections II and III of this paper for the U.S.

¹¹ See also Hovakimiam, Kane and Laeven (2003).

In addition, the analysis in Section II and III argued that 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.¹²

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, 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.¹³ 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, as described in Section III.A, deposit insurance 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

¹² This too is the conclusion of Demirguc-Kunt and Kane (2002).

¹³ 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.

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 financial sector -- there was a flight of deposits to state-owned banks.¹⁴ 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 measure¹⁵ -- 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.

¹⁴ 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.

¹⁵ 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 sensex 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.

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 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

The analysis in Section III.B described 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.¹⁶ 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 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

¹⁶ See Buiter and Sibert (2008).

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.

References

Acharya, Viral V., Philipp Schnabl and Gustavo Suarez, 2009. "Securitization Without Risk Transfer," Working Paper, New York University Stern School of Business.

Acharya, Viral V. and Bisin, Alberto, 2009, "Centralized versus Over-the-counter Markets," Working Paper, NYU Stern School of Business.

Acharya, Viral V., Lasse Pedersen, Thomas Philippon and Matthew Richardson, 2009, "Measuring Systemic Risk," Working paper, NYU Stern School of Business.

Acharya, Viral V. and Matthew Richardson (editors), 2009a. *Restoring Financial Stability: How to Repair a Failed System*, New York University Stern School of Business, John Wiley & Sons.

Acharya, Viral V. and Matthew Richardson, 2009b. "Causes of the Financial Crisis," *Critical Review*, 21(2–3): 195–210.

Acharya, Viral V. and Tanju Yorulmazer, 2009, "Systemic Risk and Deposit Insurance Premiums," *forthcoming, Economic Policy Review*, Federal Reserve Bank of New York.

Bernanke, Ben S., 2000. "Essays on the Great Depression," Princeton University Press.

Bruner, Robert and Sean D. Carr, 2007. "The Panic of 1907: Lessons Learned from the Market's Perfect Storm," New York: John Wiley & Sons.

Brunnermeier, Markus K. and Lasse Heje Pedersen, 2008, "Market Liquidity and Funding Liquidity," *forthcoming, Review of Financial Studies*.

Buiter, William and Anne Sibert, 2008, "The Collapse of Iceland's Banks: the Predictable End of a Non-Viable Business Model," *The First Global Financial Crisis of the 21st Century Part II*, ed. Andrew Felton and Carmen Reinhart, voxeu.

Claessens, Stijn, Daniela Klingebiel and Luc Leaven, 2004, "Resolving Systemic Financial Crises: Policies and Institutions," World Bank Policy Research Paper no. 337, World Bank.

Cordell, Lawrence, Gregor MacDonald and Mark Wohar, 1993, "Corporate Ownership and the Thrift Crisis," 36 *Journal of Law and Economics*, vol XXXVI, pp.719.

Coval, Jurek and Erik Stafford, 2008, "Economic Catastrophe Bonds," *forthcoming, American Economic Review*.

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

Demirgüç-Kunt, Asli and Edward J. Kane, 2002, "Deposit Insurance Around the Globe: Where Does It Work?," *Perspectives*, Volume 16, no.2, Spring,, Pages 175-195.

Doherty, Neil A. and Scott Harrington, 1997, "Managing Corporate Risk with Reverse Convertible Debt," Working Paper, Wharton School, University of Pennsylvania.

Ennis, Huberto and H. S. Malek, 2005, "Bank Risk of Failure and the Too-Big-to-Fail Policy," *Federal Reserve Bank of Richmond Economic Quarterly*, Vol. 91, pp. 21-44.

Federal Deposit Insurance Corporation, 1997, *History of the Eighties – Lessons for the Future: Volume I: An Examination of the Banking Crises of the 1980s and Early 1990s* (online at www.fdic.gov/bank/historical/history/vol1.html)

Flannery, Mark (2002) "No Pain, No Gain? Effecting Market Discipline via Reverse Convertible Debentures," Working Paper, University of Florida.

Friedman, Milton and Anna Jacobsen Schwartz, 1971, *A Monetary History of The United States 1867-1960*, Princeton University Press.

Geneva Report (2009). "The Fundamental Principles of Financial Regulation," a VoxEU.org Publication, by Brunnermeier, Markus, Andrew Crocket, Charles Goodhart, Avinash Persaud, and Hyun Shin.

Gorton, Gary, 2009, "Slapped in the Face by the Invisible Hand: Banking and the Panic of 2007," Working Paper, Yale University.

Gorton, Gary, 1985, "Clearing Houses and the Origin of Central Banking in the United States," *Journal of Economic History*, Vol. XLV, No. 2. 277-283.

Hancock, Diana and Wayne Passmore, 2009, "Three Initiatives Enhancing the Mortgage Market and Promoting Financial Stability," *The B.E. Journal of Economic Analysis & Policy*, vol. 9(3), (Symposium), Article 16.

Honohan, Patrick and Daniela Klingebiel, 2003, "The Fiscal Cost Implications of an Accommodating Approach to Banking Crises," *Journal of Banking and Finance*, vol. 27 (8), pp. 1539-1560.

Hovakimian, Armen and Edward J. Kane, 2000, "Effectiveness of Capital Regulation at U.S. Commercial Banks, 1985 to 1994," *Journal of Finance*, vol. 55(1), pp. 451-468.

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.

John, Kose, Teresa A. John and Lemma W. Senbet, 1991, "Risk-Shifting Incentives of Depository Institutions: A New Perspective on Federal Deposit Insurance Reform," *Journal of Banking and Finance*, vol. 15(4-5), pp. 895-915.

Kane, Edward J. and Berry K. Wilson, 1997, "A Contracting-Theory Interpretation of the Origins of Federal Deposit Insurance," *Journal of Money, Credit & Banking*, Vol. 30.

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

Kaufmann, Daniel and Gil Mehrez, 2000, "Transparency, Liberalization and Banking Crisis," Policy Research Working Paper no. 2286, World bank.

Keeley, Michael C., 1990, "Deposit Insurance, Risk, and Market Power in Banking," *the American Economic Review*, vol. 80(5), pp. 1183-1200.

Kehoe, Timothy J. and Edward C. Prescott, 2007, *Great Depressions of the Twentieth Century*, Federal Reserve Bank of Minneapolis.

Krishnamurthy, Arvind, 2002, "The Bond/Old-Bond Spread," *Journal of Financial Economics*, vol. 66(2-3), pp. 463-506.

Krishnamurthy, Arvind, 2008, "The Financial Meltdown: Data and Diagnoses," Working Paper Northwestern University.

Kroszner, Randall, 2000, "Lessons from Financial Crises: The Role of Clearinghouses," *Journal of Financial Services Research*, Springer, vol. 18(2), pages 157-171.

Kroszner, Randall and William Melick, 2009, "The Response of the Federal Reserve to the Banking and Financial Crisis of 2007/2008," Working Paper.

Kroszner, Randall S., and Philip E. Strahan, 1996, "Regulatory Incentives and the Thrift Crisis: Dividends, Mutual-To-Stock Conversions, and Financial Distress," *the Journal of Finance*, vol. 51(4), pp. 1285-1319.

Kroszner, Randall S., and Philip E. Strahan, 2007, "Regulation and Deregulation of the U.S. Banking Industry: Causes, Consequences and Implications for the Future," in "Economic Regulation and its Reform: What Have we Learned?" edited by Nancy Rose, University of Chicago Press.

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

Lucas, Deborah and Robert, L. McDonald, 2006, "An Options-Based Approach to Evaluating the Risk of Fannie Mae and Freddie Mac," *Journal of Monetary Economics*, vol. 53(1) 1, pp. 155-176.

Meltzer, Allan, 2003. *A History of the Federal Reserve, Volume 1 1913-1951*, University of Chicago Press.

Meltzer, Allan, 2004, "Monetarism Revisited," *World Economics Journal*, vol. 5 (2), pp. 161-164.

Modigliani, Franco and Merton H. Miller, 1958, "The Cost of Capital, Corporation Finance and the Theory of Investment," *The American Economic Review*, Vol. 48, No. 3, pp. 261-297.

Morgan, Donald P. and Kevin J. Stiroh, 2005. "Too Big to Fail After all These Years," *Staff Reports 220*, Federal Reserve Bank of New York.

O'Hara, Maureen and Wayne Shaw, 1990, "Deposit Insurance and Wealth Effects: The Value of being Too Big To Fail," *Journal of Finance*, Vol. 45, pp. 1587-601.

Passmore, Wayne, 2005, "The GSE Implicit Subsidy and the Value of Government Ambiguity," *Real Estate Economics*, vol. 33(3), pp. 465-486.

Penas, Maria and Haluk Unal, 2004, "Gains in Bank Mergers: Evidence from the Bond Markets," *Journal of Financial Economics*, Vol. 74, pp. 149-179.

Pinto, Edward, 2008, "Statement before the Committee on Oversight and Government Reform," U.S. House of Representatives, December 9.

Prescott, Edward C., 2002, "Prosperity and Depression," *American Economic Review*, vol. 92(2), pp. 1-15.

Reinhart, Carmen M. and Kenneth S. Rogoff, 2008. "The Aftermath of Financial Crises," *American Economic Review*, vol. 99(2), pp. 466-472.

Stern, Gary and Ron Feldman, 2004, "Too Big to Fail: The Hazards of Bank Bailouts," *Brookings Institution Press*, Washington D.C.

Saunders, Anthony, Elizabeth Strock and Nickolaos G. Travlos, 1990, "Ownership Structure, Deregulation, and Bank Risk Taking," *the Journal of Finance*, vol. 45(2), pp. 643-654.

Squam Lake Working Group Financial Regulation, 2009, "An Expedited Resolution Mechanism for Distressed Financial Firms: Regulatory Hybrid Securities," Working Paper, Council on Foreign Relations, Center for Geoeconomic Studies, (online at www.cfr.org/content/publications/attachments/Squam_Lake_Working_Paper3.pdf).

White, Lawrence J. 1991, *The S&L Debacle: Public Policy Lessons for Bank and Thrift Regulation*, Oxford University Press.