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Five Years Later: Lessons from the Financial Crisis

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Five Years Later:

Lessons from the Financial Crisis

By:

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Executive Summary

The collapse of subprime mortgages that began in the U.S. in mid-2007 developed into the biggest financial crisis in more than 75 years and made 2009 the first year since World War II in which global economic activity declined. The effects of the boom and bust in U.S. housing were multiplied by the implosion of a fragile financial system, resulting in a calamity much greater than losses in the subprime market could possibly account for.

The buildup to the crisis took place amid easy monetary conditions and a rising external imbalance in the U.S. economy, which drained the supply of safe financial assets and pushed economic activity into sectors that did not compete with foreign production, such as housing. Complacency infected the markets and regulators, allowing growing risks to be overlooked. A number of factors in the mortgage market contributed to excesses:

- Long-standing policy support for housing got new impetus from the Clinton and Bush Administrations, both of which sought to extend homeownership to those who would not have qualified for mortgages earlier.
- Looser credit standards extended to the mainstream mortgage market.
- Structured retail mortgage-backed securities (RMBS) grew explosively in response to the shortage of safe assets.
- Packaging and distribution of RMBS was often accompanied by credit ratings, many of which, in retrospect, appear to have been based on assumptions that failed to capture what eventually happened. The role of ratings was exaggerated by their use in setting bank capital requirements.
- Fannie Mae and Freddie Mac responded aggressively to the loss of market share, using their implied U.S. government guarantee and 'AAA' ratings to push into alt-A and subprime mortgages.
- Standards of documentation of mortgages collapsed, masking a collapse of underwriting standards by originators.

The housing boom was followed by a bust, but as it became evident, private-sector and Fed economists and the U.S. Treasury expected only moderate fallout. Four trends in the financial markets, which had gone almost unrecognized, created fragility that amplified the housing and mortgage market adjustment into a global systemic crisis:

1. Rising leverage, which left the system much more sensitive to changes in the value of outside assets, such as housing.
2. Increasing maturity transformation—the financing of long-term assets with short-term liabilities—in securities portfolios.

3. More opaque financial instruments and markets generated by financial innovation, which resulted in an increase in information asymmetries—one side of the market with knowledge that the other side lacks.
4. Increasing intensity of incentive-based compensation in financial institutions.

The first meant that when credit risk on mortgages increased, depositors and other creditors of the financial institutions and funds that held mortgages or mortgage-backed securities had a reduced equity buffer to protect their positions. They looked more quickly for an exit. The second meant that the exit could quickly become blocked as assets became unsellable except at fire-sale prices. The third allowed a buildup of risk that was not recognized and intensified the flight to quality once events increased the uncertainty about the value of many assets. The fourth contributed to neglect among traders in financial institutions of small probability risks of large losses. Risk management systems failed to control for this.

Signs of liquidity distress first appeared in early August 2007 when it became difficult to refinance asset-backed commercial paper and LIBOR, the interest rate at which banks lend to one another, jumped. Distress recurred with increasing intensity over the ensuing 13 months, with banks and affiliated conduit funds reporting large losses, the emergency takeover of Bear Sterns, and the loss of market access by Fannie and Freddie. The Federal Reserve took increasingly strong actions in an effort to preserve liquidity and ease monetary conditions as financial distress spilled over into the rest of the economy. But markets' focus on the vulnerability of investment banks intensified with Lehman Brothers next in the spotlight after Bear Sterns. Lehman's failure was followed by distress in Merrill Lynch, AIG, Morgan Stanley, Goldman Sachs, and money market mutual funds. Government support averted failures by these institutions. But depository institutions—Washington Mutual, Wachovia, Citigroup, and Bank of America—then came under severe pressure and received government support, and the first two disappeared. The extraordinary support needed to stabilize the U.S. financial system could not have been provided without the passage of the $700 billion Troubled Asset Relief Program (TARP). Total support to the financial system reached $2 trillion, but all of this has been or will be recovered for the taxpayers as liquidity has returned to markets. Even with these efforts, the fallout on the global economy was severe.

During the course of the crisis, institutions' vulnerability to loss of liquidity was at the core of the problems that arose. It was the intersection of exposure to the collapse of liquidity provided by markets and uncertainty about valuations and, hence, capital that put an institution at risk. And as institutions sought liquidity from the same markets, they destroyed value and exacerbated the systemic crisis. Institutions that were insulated from the liquidity collapse weathered the storm whether they had strong capital or not.

Reflections are given on 10 lessons learned from the crisis:

1. Financial markets are not inherently stable and not always efficient in making use of information.
2. Inflation targeting is not sufficient for a central bank to maintain an economy on a stable course.
3. A collapse of market liquidity is the greatest risk to which a modern financial system is exposed.
4. The Federal Reserve exercised its role as a lender of last resort courageously. Its powers to do so need to be protected, not curbed as Dodd-Frank seeks to do.
5. Moral hazard should be a policy concern, but it was not at the heart of what went wrong.
6. Regulatory capital is important, but it should be a buffer to be used in time of need, not a rigid requirement.
7. Problems build up where attention is not focused—shadow banking will always be a challenge.
8. Credit ratings played a role in the crisis, alongside the mistaken risk assessments of investors and regulators, but they cannot account for its scale. The ratings process needed to be reviewed and improved. Officials, the ratings agencies, and users of ratings have taken actions.
9. Consumers often do not make good decisions when subjected to sales people who have an incentive to use high pressure to close a deal. They need government protection when making what for them are huge decisions, such as buying and financing a home.
10. Post hoc (after this) does not necessarily mean propter hoc (because of this). It is far from clear that the repeal of the Glass-Steagall Act's separation of banking and investment banking in 1999 played a central role in the crisis.

A recurring theme is that a number of problems converged to create the conditions for it. The many contributors to the crisis were most often acting in good faith, guiltier of being caught up in a world that was blind to the systemic risks that were building up or of acting on distorted incentives than of consciously putting the markets and the global economy at risk.

Regulations cannot provide complete assurance that public money will never have to be called on again to support the financial system. Putting in place strong building codes does not make it possible to eliminate the fire department. We need both building codes and fire departments to keep people and property as safe as possible from fire. And we need both strong oversight and regulation, together with strict enforcement of it and a strong lender of last resort, to keep people and their wealth safe from financial calamity.

Introduction

The collapse of subprime mortgages that began in the U.S. in mid-2007 developed into the biggest financial crisis in more than 75 years and made 2009 the first year since World War II in which global economic activity declined. The recovery since then has been weak in the U.S., and Europe has slipped back into recession. Much has been written about what happened, but there is still a lack of clarity as to why. The documentation of events and of the roles that key actors have played has been intensive. Academic research on specific questions the events have raised has been deep and informative. This work, although valuable, has tended to lose sight of the forest for the trees. Some have sought to find individual villains, but what happened was far too large to be accounted for by a single failure. Princeton Professor Markus Brunnermeier (2009) has written a paper that takes a broader perspective than most and focuses on how the effects of the buildup and deflation of a housing bubble in the U.S. were multiplied because financial markets had become extremely fragile. Short term-funding of long-term assets exposed firms and funds to an evaporation of liquidity.

This paper follows the path to understanding what happened that was blazed by Brunnermeier, drawing on the recollections of the author, who led a team charged with assessing the economic and political forces shaping the global business environment from within a financial institution at the center of the crisis as it unfolded. The objective is to sort through the multiple forces and actors that played a role in the immense disruption that occurred with almost no warning to find a coherent explanation of how it could have happened.

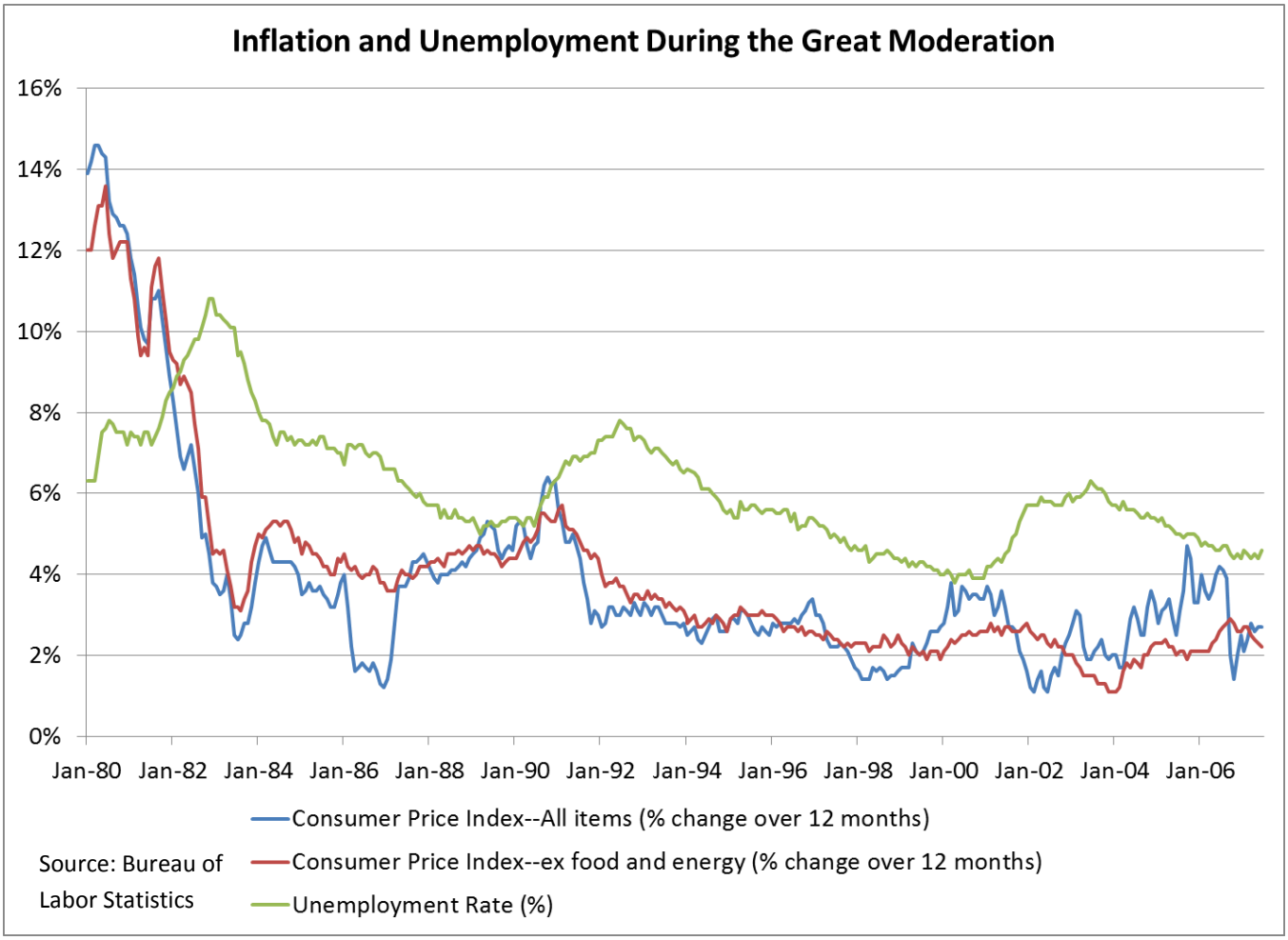
When looking for causes of a historical event like the 2007-2009 crisis, it is natural, even necessary, to look at what had changed in the run-up to that event. This approach can identify candidates as causal factors, but one must be careful not to fall into the post hoc ergo propter hoc (after this, therefore because of this) fallacy. Some sequences of events clearly reflect a causal relationship, but others do not. And causation must be looked at in two senses for an event like the crisis. There are factors that created a fragile environment that was vulnerable to collapse, and there was a trigger for the most acute phase of the crisis—the bankruptcy filing of Lehman Brothers—that brought about a collapse just as the rusting away of one too many bolts in a bridge will send the bridge into the water. But the last bolt is not important. It might have been the one before and, in the absence of this one, it would have been the next bolt or the one after that brought down the bridge. The increasingly unstable structure created by weakening at many points is the important thing.

The paper will come back to an assessment of the fundamental factors that created a precarious financial system after reviewing the major trends that led up to the collapse. Finally, it will present 10 reflections on the lessons learned from the experience for participants in the markets and the officials who oversee them. A brief review of the key events of the collapse is in the Appendix. (For a detailed record of what happened, see "The Financial Crisis Inquiry Report," 2011.) This paper focuses almost entirely on the U.S., although, from the beginning, foreign financial institutions were caught up in the crisis, and foreign markets, especially in Europe, were deeply distressed. The central events and the key participants in them, both in the private sector and in the official world, were American.

The Buildup

Monetary conditions were relatively easy

The conditions for the crisis built up as confidence grew over several decades that macroeconomic policy had been mastered and the stable financial conditions that it could provide. For 25 years following the painfully-won triumph over inflation by the Federal Reserve, led by Paul Volcker, in the early 1980s, the U.S. economy had enjoyed an unprecedented period of stability. Ben Bernanke, now Chairman of the Federal Reserve Board, called this period "the great moderation."[1] The rate of inflation measured by the annual rate of change of the core (excluding food and energy) personal consumption expenditure (PCE) deflator, favored as an indicator of inflation by the Federal Reserve, fell from more than 9% in 1980 to less than 2 ½% in 1993 and remained between 1 ½%-2 ½% thereafter. The "headline" (without exclusions) inflation rate was nearly as well behaved. The unemployment rate declined from more than 10% in 1982-1983 to less than 7% in 1993 and remained well below this level for 15 years until the crisis took it back to 10%.



The Federal Reserve became more activist following the mild inflation and deflation of the information technology (IT) equity bubble and the shock of Sept. 11, 2001, as it sought to sustain the Great Moderation. It directed policy to provide greater assurance of sustained growth amid concern about the risk of deflation, which had become entrenched in Japan. This became a theme in the public statements of Federal Open Market Committee (FOMC) members.[2] Policy from 2002 into 2006 lagged on the easy monetary policy side of the Taylor rule.[3] This rule stipulates the Federal funds interest rate that the Fed should set at each point in time in light of GDP and inflation to stay close to or return to an inflation target. Analysts widely use it as an indicator of the extent to which monetary policy is on the easy or tight side, but it does not account for factors that may justify a bias on one side or the other. The focus of policy was on sustaining growth. This became known in the markets as the "Greenspan put"—an implicit option contract with the market that removed the risk of a steep decline in the economy or the markets. The expansionary thrust of Fed policy was reinforced by large Federal budget deficits produced by tax cuts in 2001 and the cost of the second Gulf War from 2003 on.

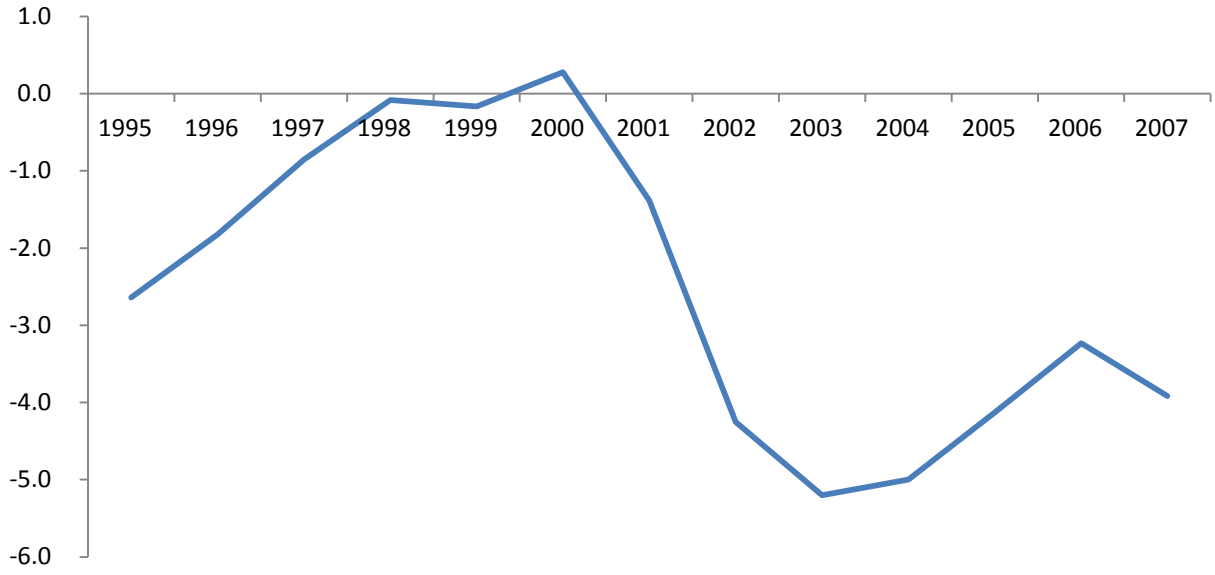
Taylor Rule Rate vs. Fed Funds Rate

Source: Board of Governors of the Federal Reserve System

U.S. Cyclically Adjusted Budget Balance

% of GDP

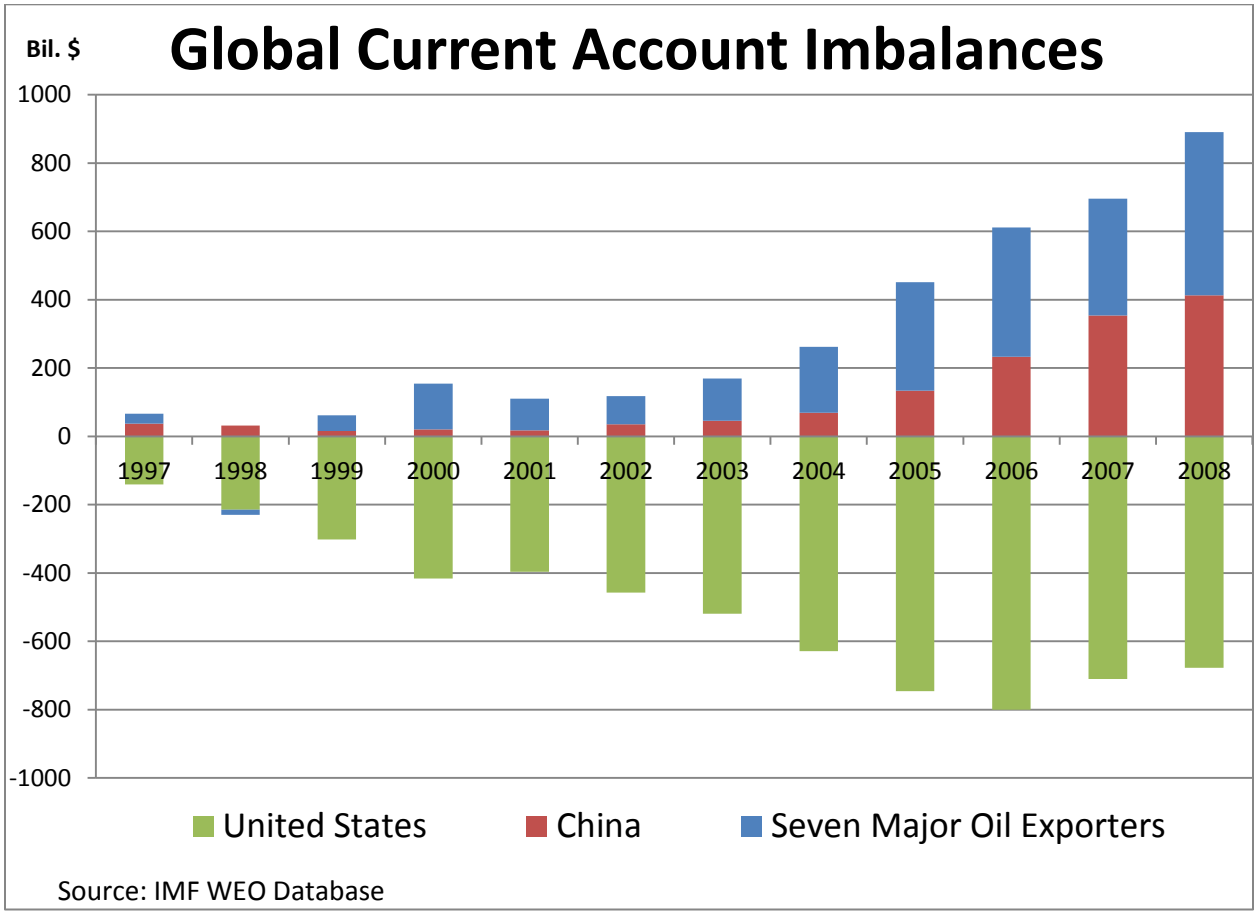
Federal, State and Local Governments

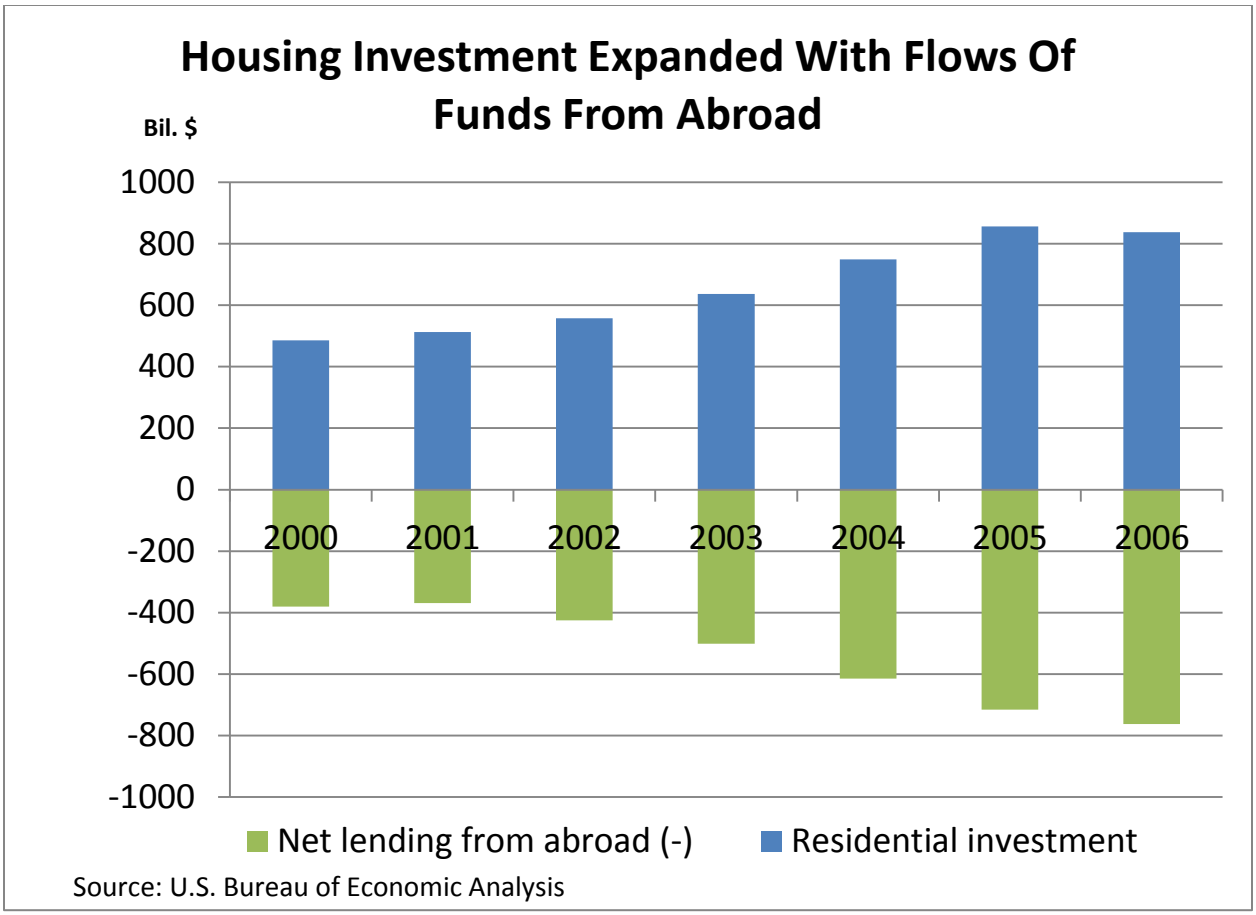


Source: OECD Economic Outlook. Volume 2012 Issues 2 No. 92. © OECD 2012

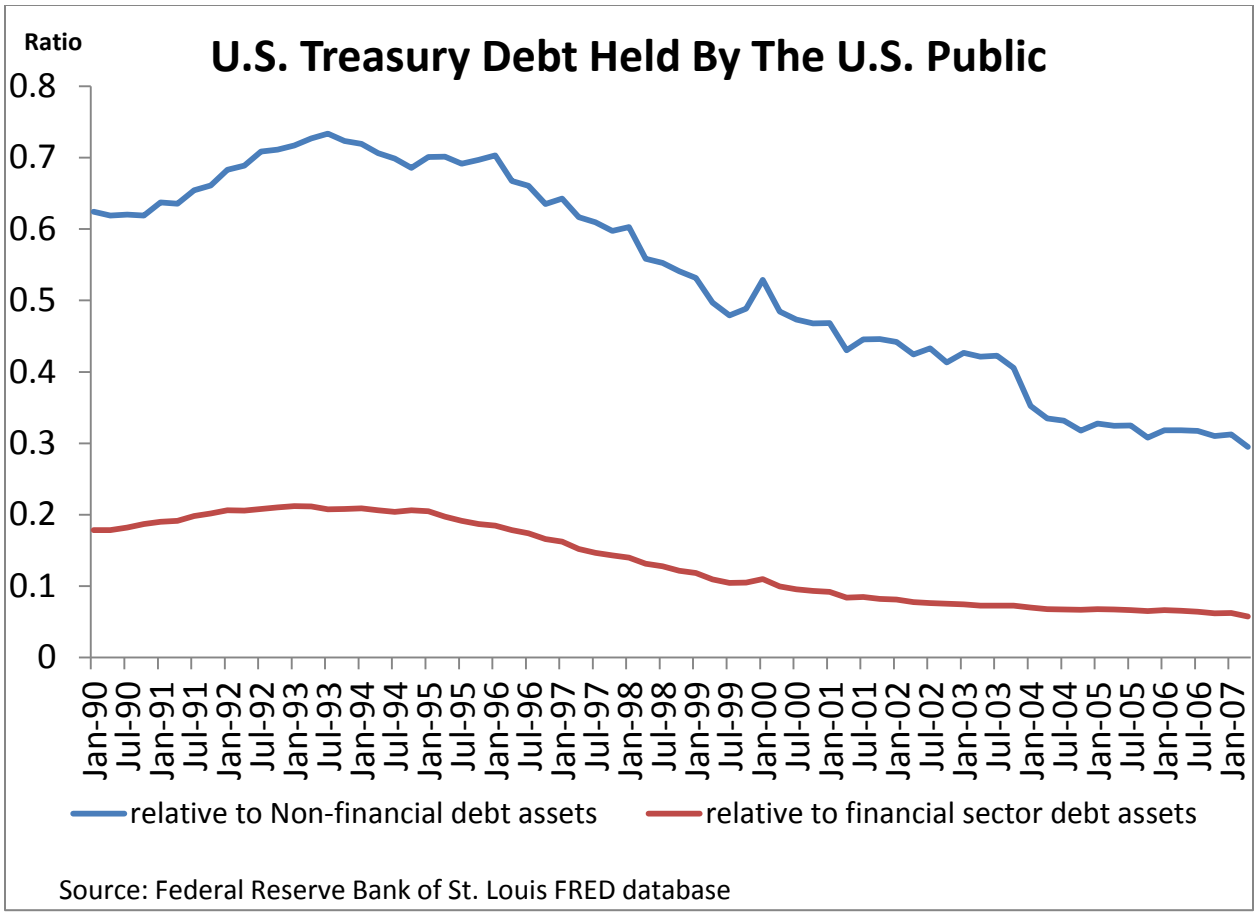
Global imbalances were part of a distorted pattern of economic activity

From the mid-1990s through 2006, the current account imbalance widened between the U.S. and the rest of the world, most significantly with China and oil-producing countries. The U.S. was buying a lot more than it was selling and was financing this by building up debt owed to foreigners. This led to calls for more rapid exchange rate adjustment by China and to Chinese criticism of U.S. budget deficits and low saving. But with steady growth in both countries, neither felt any urgency to address the imbalances. Such concern as there was focused on the sustainability of international capital flows and the demand for Treasury securities. The external imbalances did not point economists toward what would become the unsustainable piece of the global pattern: the financing of housing in the U.S. The connection was largely indirect. But foreign central banks directly supported the U.S. mortgage market by buying obligations of government-sponsored enterprises (Fannie Mae and Freddie Mac) that were major buyers and guarantors of home mortgages.

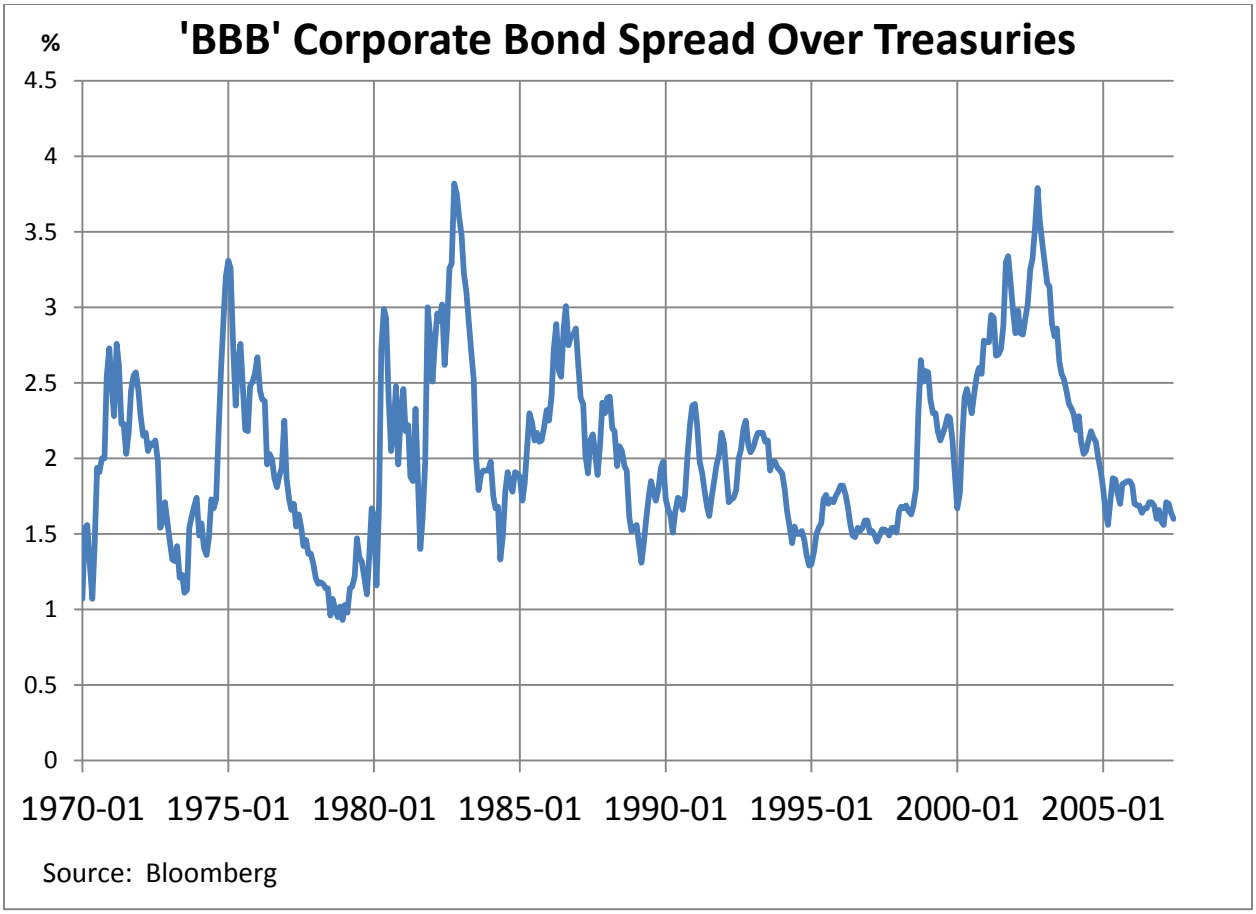




The global imbalance was seen to reflect a "global saving glut," another description that Bernanke provided (2005), as strong saving from China and other East Asian countries flowed into the U.S. The inflows were invested overwhelmingly in U.S. Treasury and other safe securities, creating a supply shortage of highly rated paper despite U.S. budget deficits boosted by tax cuts and wars. Treasury securities held by the U.S. public declined by 3/5 relative to debt assets held in the financial system and by ¾ relative to debt assets held by households and nonfinancial business between the spring of 1993 and the eve of the crisis. Clearly, there was demand for more safe assets than were available. Innovation in housing finance responded to this demand for safe assets. The rising imbalance between China and the U.S. also reflected a rising flow of low-priced imports to the U.S., which held inflation down while limiting growth in tradable goods. Consequently, the expansionary thrust of policy fell on sectors that did not compete with imports. Housing construction was a leading beneficiary.

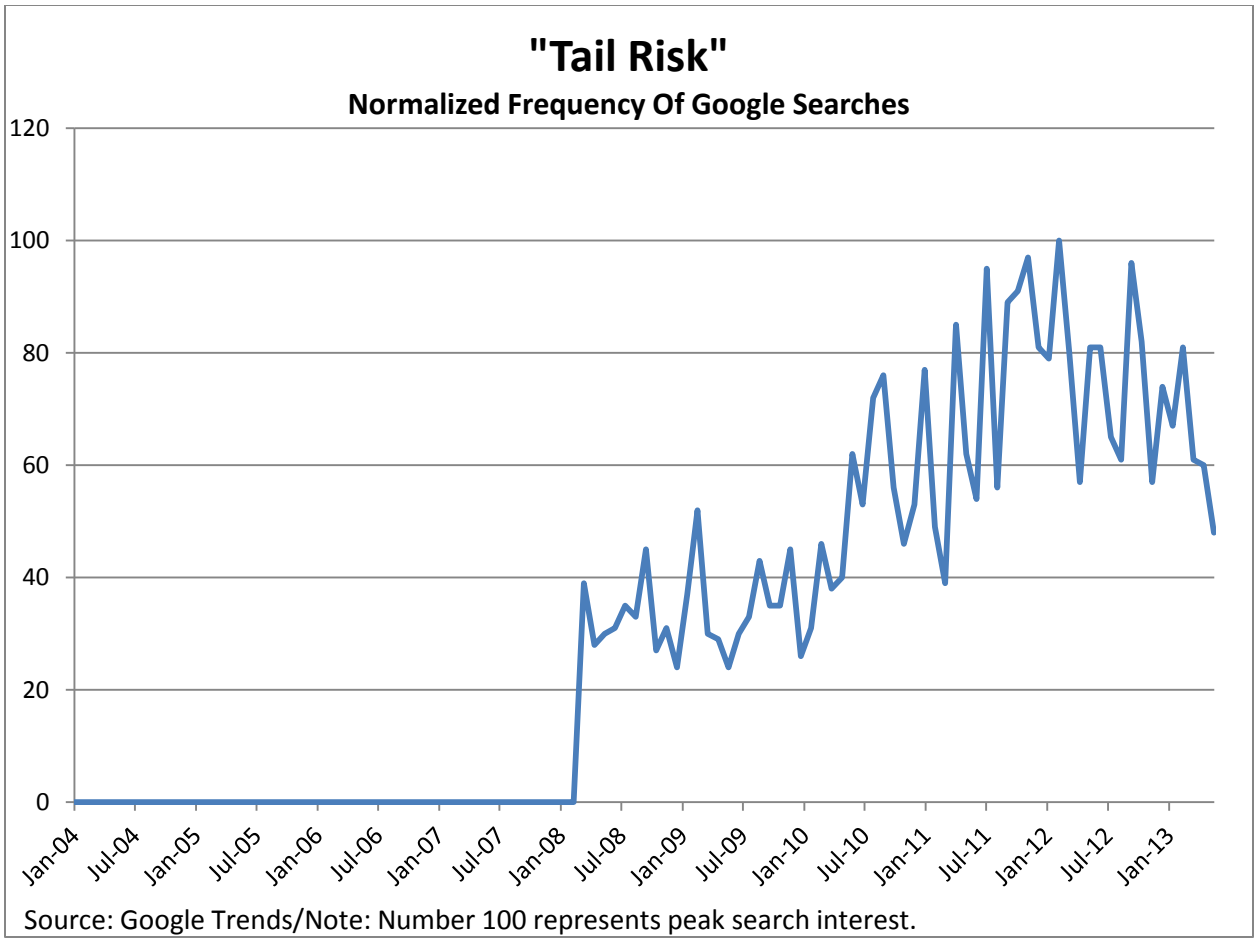


Contrary to some of what has been written, the appetite for risk in the market was not historically strong in the run-up to the crisis. Portfolios filled up with securitized mortgages thought to be safe. Interest rates on bonds with significant credit risk (rated 'BBB'—at the low end of investment-grade ratings) did not drop below past levels relative to U.S. Treasury bonds than had prevailed in reasonably good economic times. Spreads of risky bonds over Treasuries had narrowed substantially in the years immediately before the crisis, but this was a return to normal rather than an appetite for more risk than had been seen before. Spreads had been elevated earlier in the decade by high-profile bankruptcies such as Enron, WorldCom, 3Com, Global Crossing, and other telecom companies.



Complacency infected the markets and the regulators

Although the price of risk was not abnormally low in 2006 and early 2007, complacency among financial market participants was high. The potential for large adverse events was neglected. Talk about the "Greenspan put" was one indicator. Another indicator was the very low incidence of Google searches for the term "tail risk," a well-established concept in risk theory, in the years before the crisis. It was as though no one was thinking of it. Once the crisis began to unfold, "tail risk" became a term frequently used in Google searches.

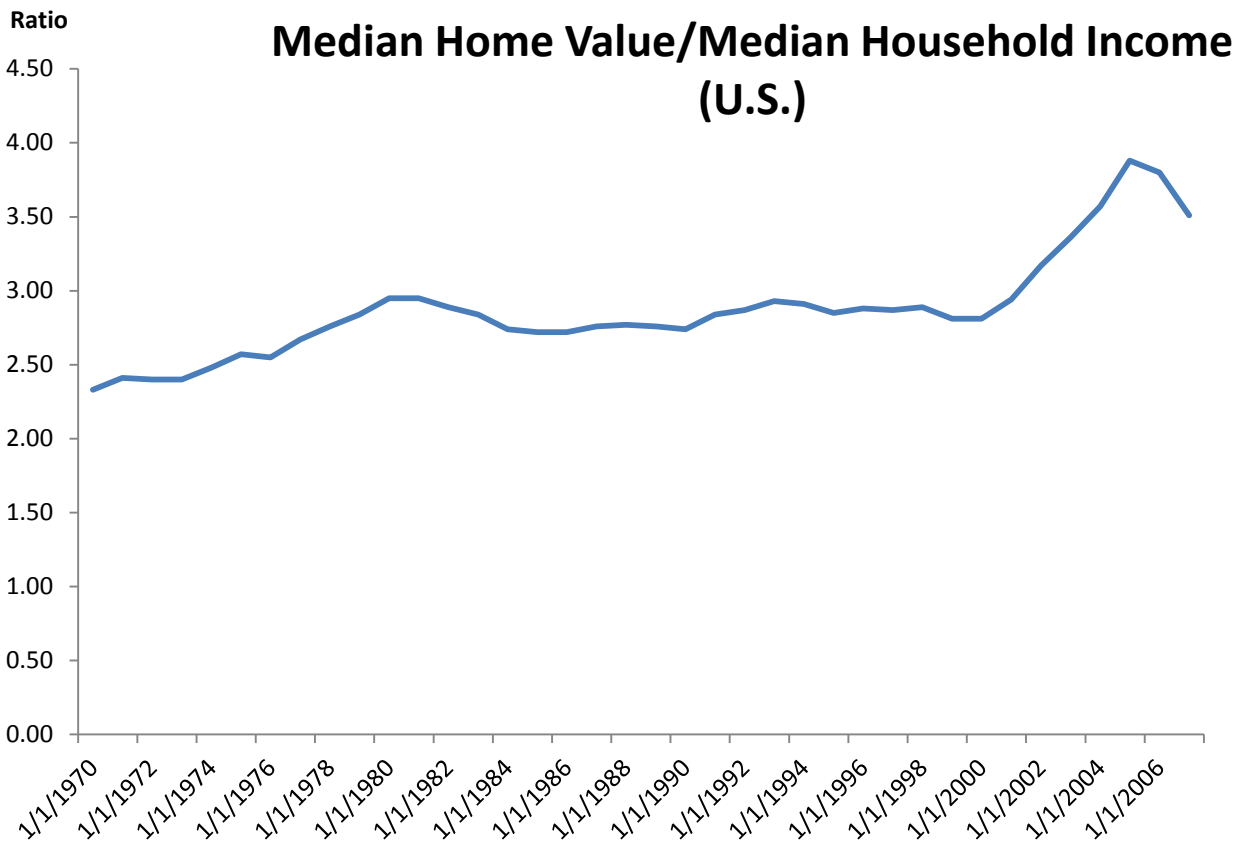


Source: Google Trends/Note: Number 100 represents peak search interest.

The Great Moderation fed a growing confidence that markets could be counted on to efficiently and rationally respond to information and adjust to changing conditions relatively smoothly. Regulation focused on correcting recognized market failures and creating a level playing field by, for example, ensuring full disclosure by issuers of securities, eliminating conflicts of interest, and prosecuting insider trading. But systemic stability was pretty much taken for granted, and the trend was to relax and rely more heavily on rating agencies' and banks' internal risk assessments in setting capital requirements as the international regulatory community moved from Basel I to Basel II.

A housing boom ensued

While no serious inflation threat emerged in response to the Fed's easy monetary policy, housing prices took off. The 12-month increase in the S&P/Case-Shiller 20 City Home Price Index rose at an average rate of nearly 16% in 2004 and 2005. The boom took the median price of a house in America, as measured by the National Association of Realtors, from 2.8x median household income at the beginning of the decade to 3.9x in 2005—an increase of more than one-third. In the previous three decades, the ratio had never risen as high as 3x.



Source: Bloomberg

One reason that stimulative monetary and fiscal policy conditions had a stronger impact on housing than on most other sectors is that intense competition from abroad curbed growth in America's tradable goods and services sectors despite strong consumer demand. Resources flowed into activities that did not face competition from abroad (but workers in housing and other nontradable sectors did face competition from a record inflow of immigrants).

Other forces also contributed to a housing boom:

- Long-standing government policy support for housing and homeownership got new impetus from both the Clinton Administration and the Bush Administration that followed. This especially favored expansion of homeownership to those who would not have qualified for mortgages under earlier credit standards. The private sector responded to the demands for greater homeownership by developing mortgage products for those who did not meet the credit criteria for conventional mortgages—subprime and alt-A mortgages. Subprime mortgages swelled from only 6% of mortgage originations at the start of the last decade to 25% by 2006.[4]

- Looser credit standards extended to the mainstream mortgage markets as down payments fell, refinancing to withdraw equity became common, and many homeowners drew on home equity lines of credit. Despite the increasing use of homes as piggy banks, homeowners' equity share in housing continued to increase as rising house prices outstripped rising mortgage debt.[5] This led to complacency about household financial strength among economic analysts.
- Exploitation of earlier innovations in the retail mortgage-backed securities (RMBS) market enabled mortgages to be packaged in ways that facilitated management of interest rate and repayment risk while providing the market with a spectrum of credit ratings. The development of the RMBS market had played a critical role in filling the housing finance hole that the collapse of the savings and loan industry at the end of the 1980s left, and these securities had come to play a central role in housing finance. The highest-rated tranches (French for slices) of these securities would typically only suffer losses after lower tranches had been wiped out. This credit structuring helped fill the demand for safe assets created by the shrinking supply of Treasury securities. RMBS issuance, which had totaled about $100 billion per year in the second half of the 1990s, surged to more than $700 billion in 2005 and was close to that level again in 2006.[6]
- The packaging and distribution of RMBS was often accompanied by ratings from the credit rating agencies, many of which, in retrospect, appear to have been based on assumptions that failed to capture what eventually happened. Those assumptions were little questioned at the time, and indeed many were shared by those in the market and in the regulatory agencies, given the widespread view that housing prices were unlikely to decline steeply nationally. In addition, buyers and the rating agencies saw the structure of the securities as providing ample protection for the highly rated tranches. Analysts in both the private and public sectors began paying increasing attention to the risk of a housing price decline as the peak was approached in 2006, but an analysis of the effects of relatively large housing price declines did not point to large defaults on highly rated tranches of RMBS. For example, Standard & Poor's published in September 2005[7] an analysis of the effects of a 20% national housing price decline with a 30% decline on the East and West coasts. This found no significant probability of downgrade, let alone loss, in the highly rated tranches of even subprime RMBS. The losses were expected to be absorbed by the speculative-grade tranches. An update in May 2006[8], just at the top of the housing market, simulated the effect of the same housing price decline along with a recession and continued high interest rates. The analysis came to essentially the same conclusion—that highly rated tranches would withstand such a

shock. Looking back at what happened, the risk models that rating agencies and others in the industry used for the complex structured products were deficient, but the extent of the misrepresentation of mortgages' characteristics on the part of borrowers and originators stands out. The defaults to date on the 'AAA' rated tranches of securities clearly labeled as subprime have been 5.4% of those outstanding on Jan. 1, 2007, while those categorized as having higher-quality mortgages suffered higher default rates since the senior tranches were given less protection. Their performance suggests that they were much lower quality than represented.[9]

- The attractiveness of the top-rated tranches of mortgage-backed securities as substitutes for Treasuries was enhanced by the use of credit ratings in setting capital requirements for banks. For example, the rules then in effect in the U.S. gave a 20% weight to mortgage-backed securities carrying a 'AAA' or 'AA' rating, a 50% risk weighting to those with a 'A' rating, and a 100% weight to those with a 'BB' rating. This meant that capital requirements rose in jumps as ratings fell.
- Fannie Mae and Freddie Mac, privately owned but government-sponsored enterprises (GSEs that the market treated as government guaranteed), responded aggressively to loss of market share to private mortgage securitizations and expanded into lower-quality alt-A and subprime mortgages by issuing securities perceived to be close substitutes for sought-after Treasuries. This was done both by issuing 'AAA' rated liabilities and investing the proceeds in mortgages and by guaranteeing mortgages bundled into asset-backed securities assembled by others, thereby giving them the GSEs' valued 'AAA' rating. The GSEs also became active purchasers of private subprime RMBS. Issuance of GSE debt, already a major source of top-rated bonds, more than doubled by 2003 from its highest level before 2001. The GSEs either held or guaranteed $5.3 trillion in mortgages when these institutions became distressed and were put into conservatorship with government backing in 2008.[10]
- As the housing boom gathered momentum and the demand for mortgages to put into securitized products swelled, underwriting standards deteriorated markedly. Mortgage originators—often newly hired and half-trained agents working in storefront offices and compensated on a commission basis—became casual about documentation, leading to “liar loans” and “NINJA” loans (no income, no job or assets). Questions about borrowers' debt-servicing capacity were swept aside by complacency that the value of the collateral (a house) would only go up. Originators also became increasingly aggressive in marketing products that were often not well suited to the borrower. The Federal Reserve Board, which had responsibility for consumer borrower protection, remained

passive in the face of reports of questionable practices. But not all borrowers were innocent victims; many took on debt to buy property to "flip" with the intention of walking away if markets turned down. The nonrecourse mortgage laws in many states, which allow a borrower to walk away from a mortgage by giving up the house and nothing else, encouraged this. Of the four states with the biggest housing booms and busts, two have nonrecourse laws (California and Arizona), and Florida has homestead exemptions from bankruptcy that limited the exposure of other assets in bankruptcy. Of the four, only in Nevada were the other assets of a defaulting borrower at significant risk.[11]

What happened in the housing boom followed the pattern of credit booms and busts of the past: the opportunity for providing financing through a new channel is recognized, growth breeds optimism and a buildup of capacity in which market knowledge becomes diluted, regulators lag behind, and the market becomes overextended.

The housing boom was followed by a bust

Booms have limits, and housing was no exception. The pool of potential first-time homebuyers shrank as home ownership reached an all-time high of 68.8%. High home prices brought forth additional supply as new home completions reached 1.65 million, up one-third from the beginning of the decade. The inventory of unsold new homes built up as supply outstripped demand.

Housing prices peaked in the summer of 2006. By the spring of 2007, one could reasonably expect, and many did, that a painful repricing of mortgages lay ahead, and perhaps a recession, as home construction declined and households adjusted their spending to declining home values. But looking at housing alone would not have led one to see the force of what would come. Indeed, in July 2007, on the eve of the first appearance of financial distress, the Wall Street Journal panel of forecasters had an average forecast for GDP growth of 2.2% in 2008.[12] GDP ended up shrinking by 0.3% for the year and by another 2.9% the following year.

In June 2007, The Green Book prepared by the staff for the Federal Reserve FOMC meeting said "Residential construction activity continues to decline as builders attempt to work off an elevated inventory of unsold new homes….Some, though not all, of this further weakening is likely related to the tightening of lending standards for nonprime borrowers that began in February." The Fed staff went on to say "The issuance of subprime RMBS has slowed somewhat, suggesting that subprime mortgage borrowing has declined from the frenzied pace of late 2005 and the first half of 2006 but remains at a solid level." The forecast in that

document was for GDP growth of 2.4% in 2008, slightly stronger than private-sector forecasts, with the subsequent outcome outside the 90% confidence interval. This outlook included a forecast that housing prices would remain flat. An alternative "greater housing correction" scenario showed growth averaging less than 0.5% below the baseline over the remainder of 2007 and 2008.[13]

At the Treasury, the fallout from the housing and mortgage market adjustment was not seen as posing serious problems. On Aug. 1, Hank Paulson said, "The market has focused on this [the subprime distress]. There's a wake-up call, and there's an adjustment to this repricing of risk, but I see the underlying economy as being very healthy."[14]

The financial and economic response to the end of the housing boom was amplified

Whatever the causes of the housing boom and its deflation, and however badly forecasters missed the housing price decline that was to come, the tremendous impact on the financial system and the U.S. and global economies cannot be ascribed to the scale of the loss of value in residential real estate and debt secured by it. The loss of value in American homes of $5.8 trillion was large. But it was only two-thirds the size of the stock market decline in the early part of the last decade when the IT bubble burst, and this was followed by 9/11. That led to a mild and brief recession, but no systemic financial distress. By contrast, the housing price adjustment triggered financial distress that spread across markets. Indeed, the eventual size of the U.S. stock market decline during the 2007-2009 crisis, at $12.9 trillion, was more than twice as large as the home value decline. [15] And a deep recession further magnified this decline. The result was the first global economic decline since World War II, from which we have not yet fully recovered.

The relatively easy monetary conditions and complacency engendered by the Great Moderation had some impact on the nonfinancial corporate sector, which increased its leverage during the years leading up to the crisis. But except for leveraged loans to finance buyouts by private equity firms, the financial strength of corporate America continued to be viewed as strong, as the resiliency of corporate credit through the deep recession that followed the crisis demonstrated. By contrast, the financial system was becoming more fragile, and this amplified the housing downturn into a financial and economic calamity.

A Fragile Financial System

Over the period of the Great Moderation, four trends in financial markets led to the creation of an extraordinarily fragile system:

1. Rising leverage, which left the system much more sensitive to changes in the value of outside assets, such as housing.
2. Increasing maturity transformation—the financing of long-term assets with short term liabilities—in securities portfolios.
3. More opaque financial instruments and markets generated by financial innovation, which resulted in an increase in information asymmetries—one side of the market with knowledge that the other side lacks.
4. Increasing intensity of incentive-based compensation in financial institutions.

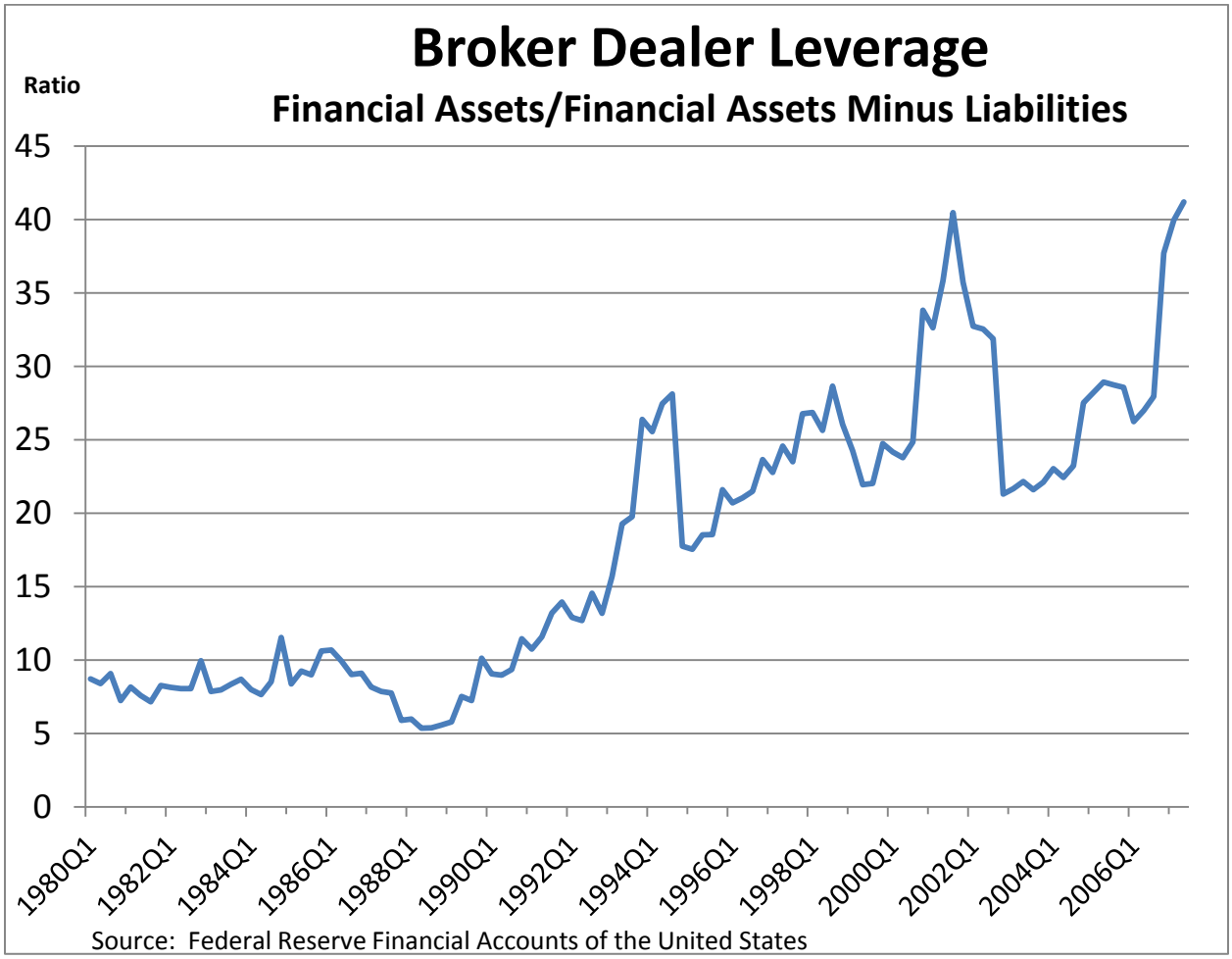
The first meant that when credit risk on mortgages increased, depositors and other creditors of the financial institutions and funds that held mortgages or mortgage-backed securities, including other financial institutions, had less of an equity buffer to protect their positions. They looked more quickly for an exit. The second meant that the exit could quickly become blocked as assets became unsellable except at fire-sale prices, leading to the inability of institutions or funds to meet their obligations. The third allowed a buildup of risk that was not recognized and intensified the flight to quality once events increased the uncertainty about the value of many assets. The fourth contributed to neglect among traders in financial institutions of small probability risks of large losses. Risk management systems failed to control for this.

Incomplete data and the use of off-balance-sheet transactions masked the full extent of the trends that created the fragility. Some saw pieces of the growing fragility, but few, if any, saw the extreme vulnerability that was building up and the intensity of the collapse that would follow when the system shattered. The result was a systemic liquidity crisis that the Federal Reserve System could not contain, despite a series of actions as lender of last resort, which were extraordinary in their scale and unprecedented in their design.

The buildup of leverage in the financial system

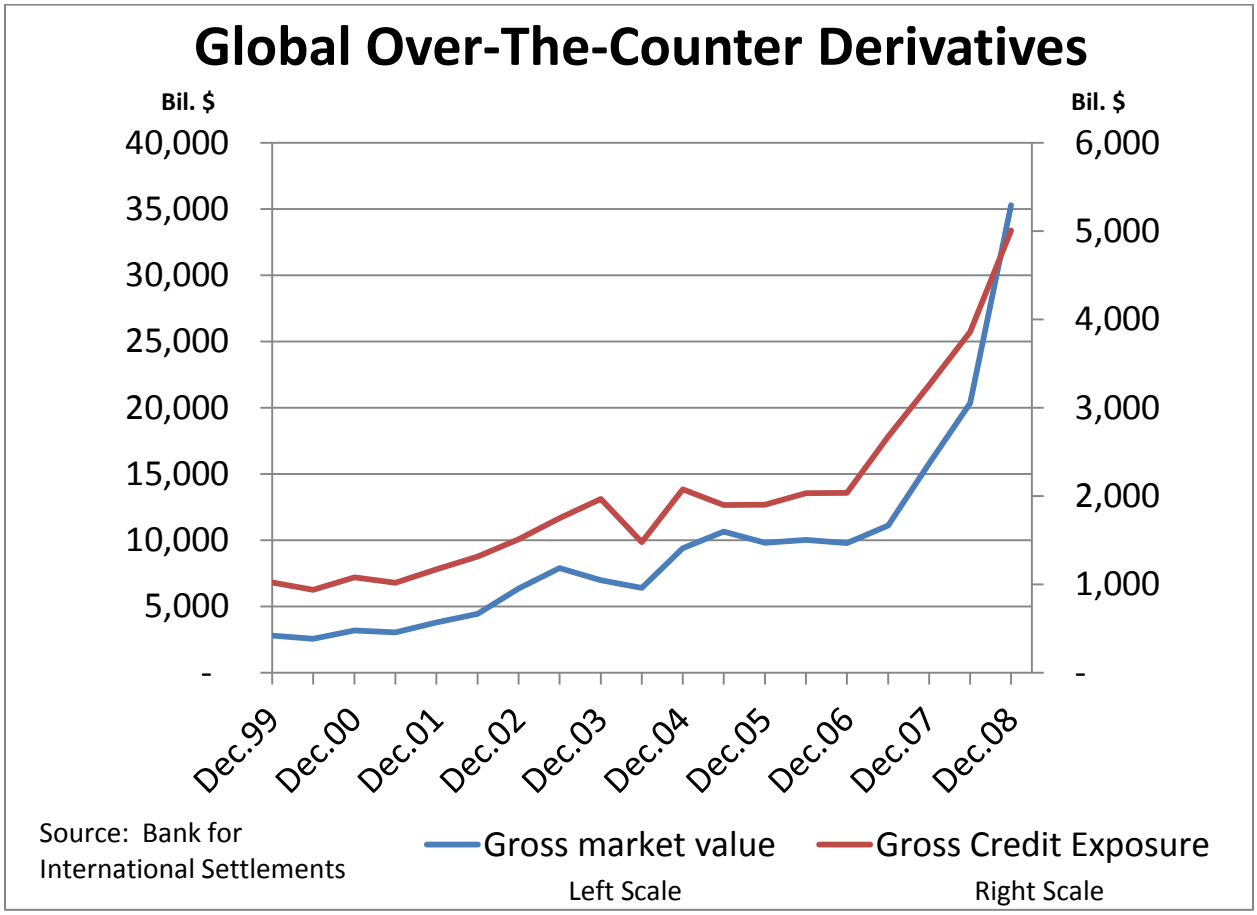
The rise in leverage ratios within the financial system was not universal. Large U.S. commercial banks, constrained by capital requirements internationally coordinated in the Basel Committee, actually reduced their leverage modestly in the 1990s and the first half of the 2000s. But broker-dealers (both the independent investment banks like Bear Stearns, Lehman Brothers, Merrill Lynch, Morgan Stanley, and Goldman Sachs and the investment banking subsidiaries of bank holding companies like Citigroup) boosted their leverage from an average of less than $10

of assets per dollar of capital in the 1980s to a ratio of 40 on the eve of the crisis.[16] The SEC, whose principal mandate was investor protection and not safety and soundness, gave much less emphasis to capital adequacy than the banking regulators. It has been criticized for having loosened its Uniform Net Capital Rule in 2004, but the increase in leverage, including all affiliates of the broker-dealer which were not covered by the rule, had been climbing for 15 years before this.



Leverage also increased in other ways that were hard to observe then and impossible to fully document now. One example that contributed to the distress that followed was the growth of off-balance-sheet structured investment vehicles (SIVs) and other conduits that banks were obliged to support when they lost funding. These were funds that had narrow equity cushions and were financed largely through issuance of short-term paper.

Another development brought state and local governments into the morass. Monoline insurers, which had long provided credit protection for municipal bonds, moved with thin capitalization into doing the same for RMBS. Still another leverage magnifier was the explosion of derivatives. These increased exposure to market fluctuations to an unmeasured, but clearly huge, extent since their valuation on balance sheets bore no relationship to the risk that they entailed. The global market value of over-the-counter derivatives (surveyed by the Bank for International Settlements) increased 5.6x from the end of 1999 to the end of 2007. It then doubled to $15.8 trillion as the crisis unfolded and prices moved by huge amounts in unexpected ways. The associated gross credit exposure from these positions grew even more explosively, reaching $3.9 trillion by the end of 2007, and rose further as prices in distressed markets became more and more distorted. The increasing exposure on derivatives was driving collateral calls, forcing asset sales when there were few, if any, buyers and pushing many institutions to the brink of failure, some over the brink.



The leverage of hedge funds had declined following the Long-Term Capital Management collapse in 1998 as both the lesson that bank counterparties learned and the pressure from the Federal Reserve led to more conservative financing of hedge fund positions. As a result, hedge funds, for the most part, stayed on the margins of the storm. At the other extreme was the Financial Products subsidiary of AIG, a holding company otherwise concentrated in insurance. AIG Financial Products was able to take on massive derivatives positions without posting collateral on the strength of its parent's 'AAA' rating. Keeping this operation afloat once AIG lost its very high rating, counterparties demanded collateral, and its funding was lost took Federal Reserve and U.S. government support that reached $182 billion.[17]

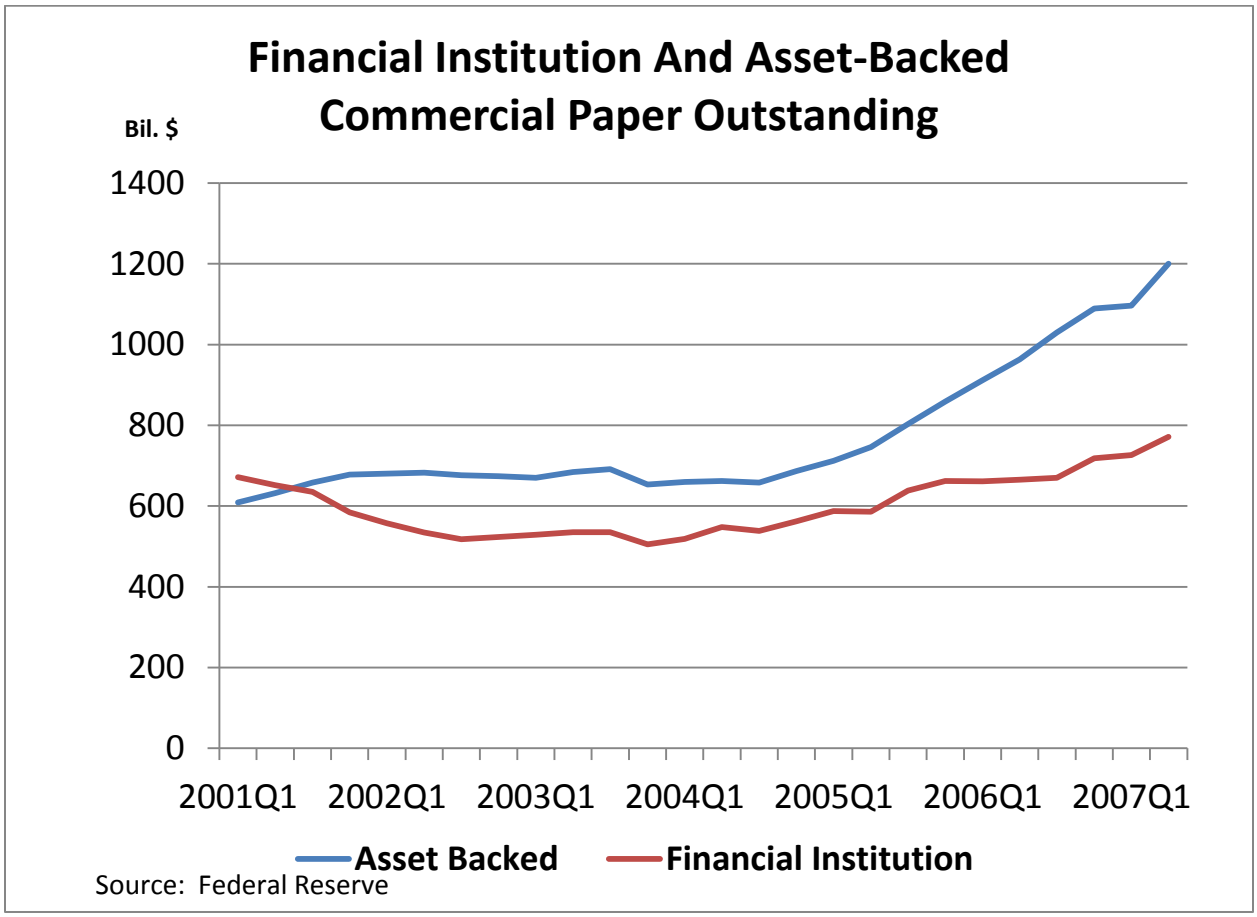
Increasing maturity transformation

For more than 150 years, conventional wisdom in the financial markets has been that institutions with long-term assets funded with short-term liabilities are vulnerable to runs. This maturity transformation created the risk that an institution, most often a bank with short-term deposits and longer-term loans, would lose funding and be unable to meet its obligations. Hence, maturity transformation entailed systemic risk. Most often this risk took the form of a flight into foreign assets or gold because confidence in the capacity of the government to stand behind its financial institutions was in doubt. But at times, when unexpected credit losses were followed by increased uncertainty about where there might be more losses and who might be exposed to them, institutions that would be considered sound in normal times could be subject to a run. When this happened, the losses could be many times the size of the initial shock.

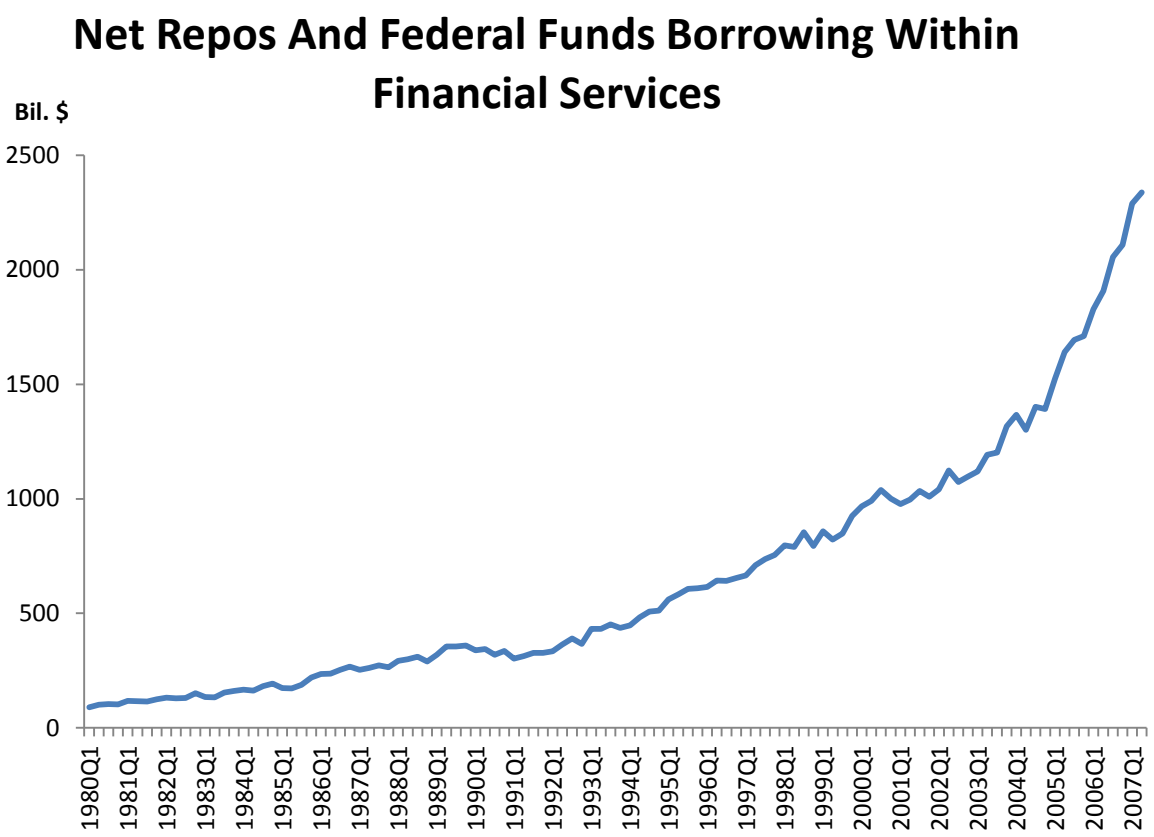
The financial crisis of 2007-2009 had some elements of previous liquidity crises, but its unimagined intensity was the result of the role that securities played on both sides of balance sheets—long term on the asset side and short term on the liabilities side. This led to a systemic liquidity crisis in a country with a very strong sovereign financial position, as evidenced by the flows into, not out of, dollars as the crisis escalated. The dollar appreciated and U.S. Treasury bond yields fell.

The financing of securities portfolios did not receive close attention in the years before the crisis. It was becoming increasingly short term. Two instruments that were widely used as short-term financing vehicles were commercial paper and repurchase agreements (repos—overnight or other very short-term borrowing effectively collateralized by securities). Neither was new, but the extent of their use was. Commercial paper is generally issued for maturities of one day to 90 days.

Paper that financial institutions issued directly grew only modestly from early 2001 (when the Federal Reserve data begin) to mid-2007, but asset-backed commercial paper (ABCP) issued by SIVs and other conduits more than doubled. Repos and Federal funds (usually overnight loans of funds on deposit with a Federal Reserve Bank by one commercial bank to another) exploded, increasing by more than 10x from 1980 to 2000 and rising another 140% from then to mid-2007. On the eve of the crisis, $4.3 trillion of these short-term instruments were funding the financial sector—much of this debt taken on by funds holding mortgage securitizations.



Source: Federal Reserve

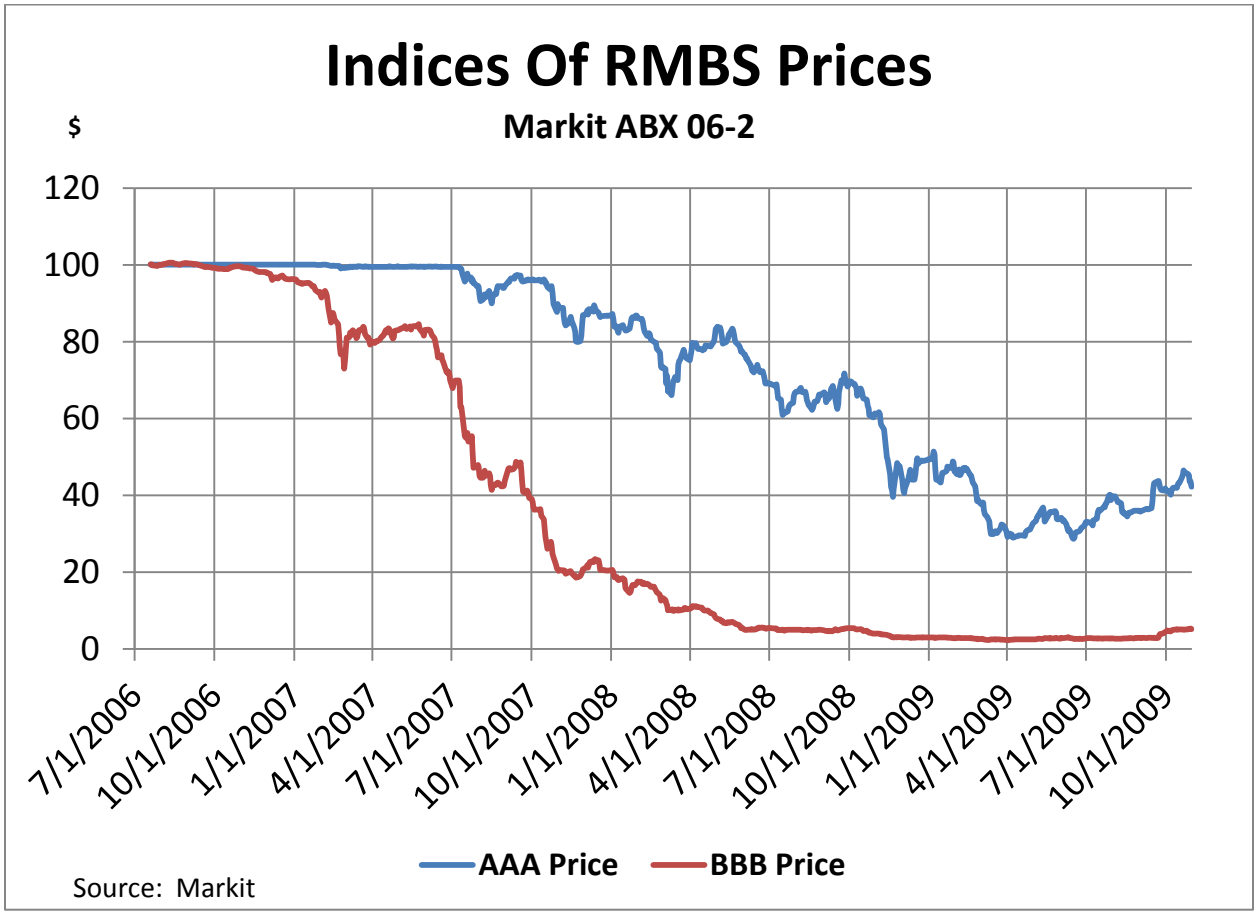


Source: Federal Reserve

Few observers saw this short-term funding as a problem, since the issuers held marketable assets that they could sell in case of need, unlike traditional banks that held loans that would be difficult to unload. But two developments proved this assumption wrong. One was that as uncertainty grew about underlying values, potential buyers asked for larger and larger discounts on the value of the securities. The second was that, as the short-term funding dried up, everyone using these markets faced the need to raise cash. The number of sellers increased and buyers disappeared. Even securities of unquestioned quality, except for U.S. Treasury obligations, could be sold only at a steep discount.

Repo funding and derivatives transactions proved particularly vulnerable. These transactions were generally collateralized. Reductions (called "haircuts") were applied to the value of the collateral, reflecting confidence in its value. So, for example, an RMBS might have been acceptable as collateral at 90% of its current market value before markets became unsettled. As the crisis deepened, the collateral lost value and uncertainty led lenders to increase haircuts. Gorton and Metrick reported that average haircuts on repo collateral rose from near zero to 45% as the crisis deepened.[18] The power to sell assets or to borrow against them collapsed. This reduced their market value to a much greater extent than any erosion of their fundamental

value owing to increased credit risk attached to the payment of interest or eventually of the principal. RMBS prices fell, and their value as collateral fell even more.



Increasing opacity of financial instruments and markets

Rapid financial innovation beginning roughly in the early 1980s stemmed largely from the development of powerful new tools for financial analysis and the emergence of IT as a means of obtaining and processing information. It was facilitated by regulations that reflected the positive view of innovation among policymakers. They avoided creating obstacles in the absence of clear policy concerns. (One area of concern that did receive close policy attention was the expanding capacity to launder money and move funds to support criminal and terrorist activities.)

Much of this innovation had a cumulative effect of reducing the transparency of markets, though the extent of this did not receive close attention until the crisis. Several forces were at work:

- More complex instruments were developed that may not have been fully understood by many who dealt with them, including those who designed them. Examples include exotic mortgages, structured RMBS, collateralized debt obligations (CDOs), and many derivatives. Buyers often lacked an understanding of what they were buying, and risk managers were poorly equipped to oversee activities within financial institutions in these instruments.
- Chains between ultimate obligor and ultimate risk bearer grew longer, resulting in a loss of information. For example, a mortgage banker in a storefront office would originate a mortgage. This would be passed to the firm's central office, where it would be sold to another institution. This institution would place the mortgage in a complex structured RMBS. This could then become a part of a CDO, which could then be sold to a SIV. The SIV could then issue ABCP, which a money market mutual fund would buy. The fund shares would be held by an individual half a dozen steps removed from the person with the mortgage. Market participants relied on statistical models to compensate for lack of information about the ultimate credits. But these proved to have been built on wrong assumptions (about how effectively risk was being diversified) and failed to take adequate account of how mortgage origination practice was changing (the increase in irregular practices such as "liar loans").
- New instruments and analytical techniques ended up having unanticipated consequences. This is an inescapable cost of innovation that is minimized by alertness and generally far outweighed by the benefits that innovation brings. Most often, an innovation does not reach a level where unanticipated consequences can be systemic before it is thoroughly tested by use. But the Great Moderation sustained conditions in which innovations in mortgage origination and distribution, risk management, and financial institution funding grew to have systemic consequences before they were well tested.

The increased opacity of financial instruments and markets had two adverse consequences. The first contributed to the inflation of the housing bubble, and the second helped multiply its collapse once the crisis began.

1. The loss of information in markets created an environment in which investment decisions had a weaker fundamental basis. Not only were poor decisions made, but the tendency to follow the herd also increased. Bad investment decisions cumulated and became systemic.

2. Once the correction process began, market participants lost confidence in what they thought they knew. They questioned fundamentally sound instruments, as well as those that were troubled. This contagion reinforced the implosion of liquidity and resulted in loss of value far beyond the underling losses that were unavoidable with a repricing of housing and consequent mortgage losses.

Increasing intensity of incentive-based compensation

Incentive-based compensation is as old as business—piecework payment to craftsmen and commission compensation for sales forces are the norms for these jobs. Extensive economic research shows that well-designed incentive-based compensation enhances productivity and efficiency. In recent decades, the breadth and intensity of incentive-based compensation has grown across the economy. In 1990, the equity-based share of senior executive compensation in U.S. corporations was 20%. By 2007, this form of incentive-based compensation had risen to 70%[19] And incentive-based compensation has moved into areas far from finance and culture—public school teachers, for example.

The key to effective incentive-based compensation is that the incentives be tightly linked to the desired behavior. Thus, when the objective is to sell as much of a product as possible, a commission provides an incentive that is aligned with the objective. But when the incentive is not closely aligned with the objective, behavior will be different from what was sought. If the incentive is very intense, the result can be costly. For example, academic research shows that teachers have a greater tendency to organize cheating on standardized tests when their positions or compensation are at stake.[20]

The shift toward incentive-based compensation was especially strong in finance where it had always played an important role. This was facilitated because the output of many finance professionals—sales people, traders, portfolio managers, loan officers, and investment bankers—can be measured in dollars. And rising competition for staff from alternative investment firms (private equity and hedge funds), which use very intense incentive compensation systems, pushed mainstream commercial and investment banks further in this direction. Concern about distorted incentives created by compensation systems in finance had been recognized: “The problem at Salomon Brothers has been a compensation plan that was irrational in certain crucial respects,” said Warren Buffett in 1991 about the investment bank in which he then owned a large stake.[21] In the wake of the crisis, several incentive compensation issues have come to the fore.

One seems overdone: that CEOs were given incentives to take on too much risk. Academic research suggests that CEOs' risk-taking behavior was, if anything, restrained relative to the

wishes of shareholders, although they may have underweighted the interests of debtholders and of the government as a backstop.[22] Moreover, it is difficult to believe that the CEOs of Bear Stearns, Lehman Brothers, Citigroup, and other damaged firms would not have followed very different strategies if they had any inkling in time to get off the track of the freight train that was headed straight at them. Their losses of jobs, prestige, and money were immense.

A systemic incentive distortion that may well have played more of a role in the crisis was the asymmetry of compensation structures within financial firms. Positive outcomes were rewarded in finance, and large positive outcomes were often rewarded very highly. But in the event of a loss, the worst one could experience is loss of a job and no compensation. The employee had a put option with the firm—the employee shared the gain and could put losses back to the firm. It could be no other way if rewards were going to be large. Few, if any, would have the financial capacity to sign up for a symmetrical compensation system that assessed employees for large losses as it gave high rewards. As a result, there was an incentive to take risk built into the compensation systems of financial institutions. Good luck as well as sound decision-making was rewarded. Bad luck carried a much smaller loss. Risk management functions in financial services firms were intended to play a compensating role, but they proved to be weak. The result was a buildup of risks, especially of tail risks of large losses that were expected to occur with small probability if they were recognized at all. Compensation structures have changed, but only on the margin, since the crisis.

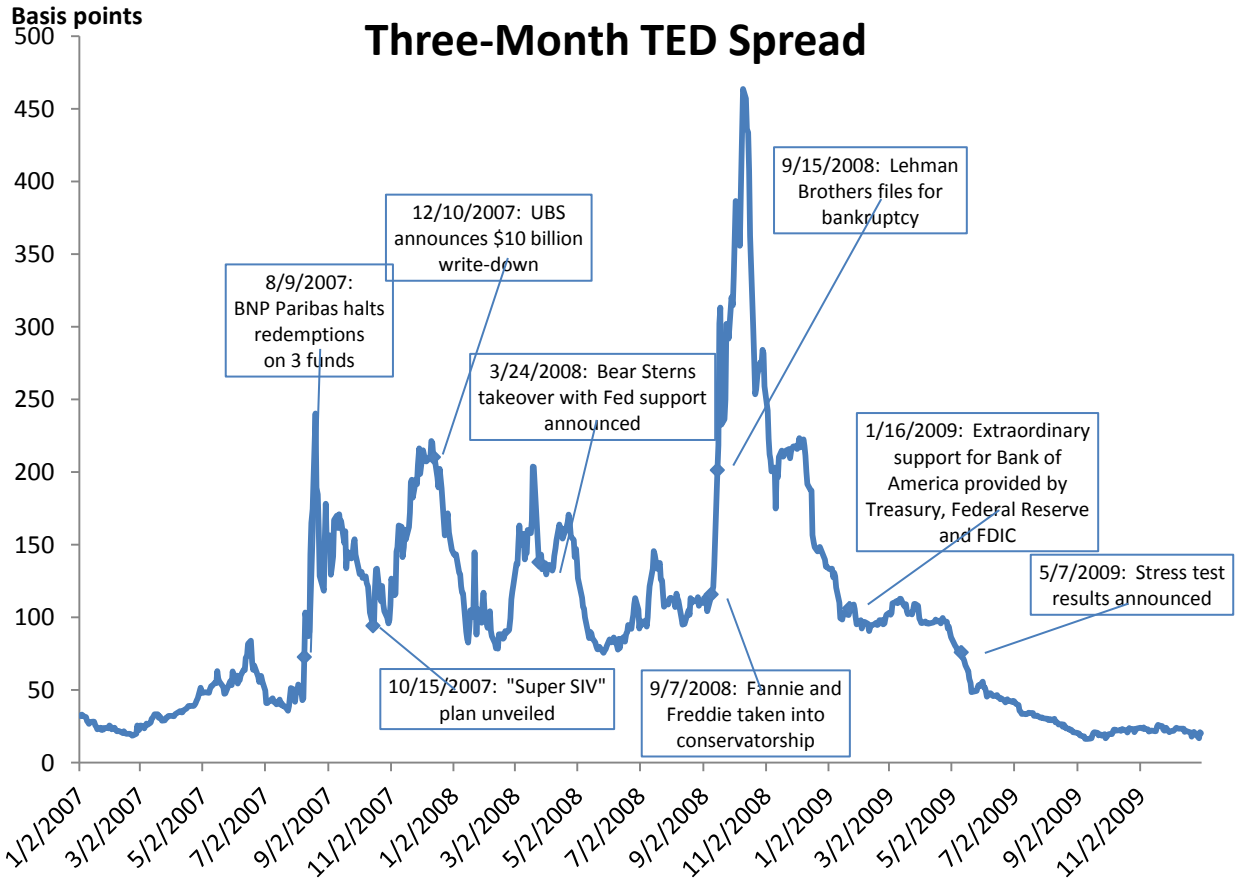
Acharya, Cooley *et al,* in a thoughtful early *post mortem* on the financial crisis, place the manufacture of tail risk at the center of the crisis and attribute this to an important extent to incentive distortions faced by those within the business. But they give more weight than I would to institutional incentives created by the regulatory environment adding to the buildup of tail risk. I am inclined to give this less importance than the opacity of the structure that had developed, which left both senior managements and equityholders oblivious to risks that were being created under their noses. There may be more to be faulted in the knowledge and skills of CEOs and equity investors, which are very heavily weighted toward institutions with professional portfolio management, than in their intentions.

The Collapse

The collapse of liquidity and consequent financial distress that followed the bankruptcy of Lehman was an intensification of what had been building for over a year. It was not something new.

The first tremors that indicated more than a repricing of subprime housing credit in the U.S. was underway came in early August 2007, when the halting of redemption on three funds that BNP Paribas managed led to acute distress in the interbank dollar funding market and a runoff of ABCP. An indicator of the first is the spread over the interest rate on three-month Treasury bills of the three-month London Interbank Offer Rate (LIBOR, originally the interest rate on Eurodollars, hence the TED acronym).[23] Normally, this spread is small, less than 50 basis points. It widened to 103 basis points the day after the BNP Paribas announcement and widened further to 240 basis points on Aug. 20. The spread reflected banks' unwillingness to lend to one another in the absence of a large premium, either because they attached greater credit risk to the counterparty or because they wanted to hold onto any funds they had in case of need.

The TED spread proved to be a good indicator of liquidity distress throughout the crisis and financial analysts closely followed it. Spikes occurred when banks reported large write-downs in late 2007, when Bear Sterns was approaching default in March 2008, and in the run-up to and after Lehman Brothers' bankruptcy. It reached a high of more than 450 basis points in mid-October 2008, just before the Treasury announced its plan to inject liquidity into U.S. banks using the authority recently granted by the Troubled Asset Relief Program (TARP) legislation.



Source: Federal Reserve Bank of St. Louis FRED database

A recounting of the main events in the dialectic of market development and policy response is provided in the Appendix. It is a story of the unraveling of a precarious financial structure as providers of short-term funding withdrew from the market, leaving funds and institutions that were dependent on these markets in acute distress. This was not a continuous process, but rather a series of crises. The Federal Reserve acted with increasing intensity to each as lender of last resort. It also progressively eased monetary conditions by lowering the Fed funds interest rate.

The commitment of public money that was required to contain the collapse of liquidity in the markets was immense. Exposure of the Federal Reserve, the FDIC, and the Treasury with the authorization of Congress was on the order of $2 trillion. A relatively small part of this commitment was in the form of capital. Although there was risk associated with much of the liquidity that was provided, in the end, the operations had a positive return for taxpayers. Liquidity was essential in a time of great uncertainty to stabilize the banks and broker-dealers in a system that had been built around short-term funding of financial institutions and portfolios.

The experiences of two other groups of institutions highlight the systemic vulnerability of the parts of the system that were at the core of the collapse. For one, the hedge funds were one dog that did not bark in the crisis. There were a few casualties among them. They suffered a 20% outflow of funds after the Lehman bankruptcy as investors fled to safety (FCIR, p. 361). But they were able to manage the loss of funding without great distress because their liquidity management had become a focus of attention following Long-Term Capital Management's collapse in 1998. Counterparty banks held more than enough collateral against their exposure to hedge funds, and the funds themselves were careful to maintain sufficient liquidity to meet even an extraordinary call on funds, such as the one that occurred. Investors may have experienced losses because of losing trades, but funds did not fail in large number or threaten the condition of their counterparties.

For another, life insurance companies suffered large losses on a mark-to-market basis during the crisis from the decline in equity prices, as well as falling prices of mortgage and other fixed-income securities that were being sold by others facing immediate cash needs. As a result, in early 2009, some had negative tangible equity value on a mark-to-market basis. This was reflected in the price of their shares, which, on average, dropped 75% over the course of the crises. A few applied for TARP assistance for additional capital. But they faced little or no financial distress because their liabilities, principally obligations to make payment on policies, were long term. They could and did wait for markets to return to more normal levels.

It was the intersection of exposure to the collapse of liquidity provided by markets together with uncertainty about valuations and, hence, capital that put an institution at risk. And as institutions sought liquidity from the same markets, they destroyed value and exacerbated the systemic crisis.

The most vulnerable proved to be:

- SIVs funded by commercial paper;
- Investment banks funded by repos—Bear Sterns and Lehman Brothers and Merrill Lynch, which were casualties, and Morgan Stanley and Goldman Sachs, which narrowly survived;
- AIG with its escalating collateral demands from counterparties;
- Fannie Mae and Freddie Mac, which lost the capacity to do repo financing using their own obligations;
- Commercial banks with large mortgage securitization operations dependent on market funding—Citigroup, Bank of America, Wachovia, and WAMU;
- Money market mutual funds with their dependence on short-term funding; and
- Monoline insurance companies that had built up large obligations in the event of defaults on mortgages without corresponding capital increases or assured funding to meet contingent claims.

Institutions that were insulated from the liquidity collapse weathered the storm whether they had strong capital or not. The liquidity implosion turned what would have been a very serious adjustment in housing markets into a financial and economic calamity, despite the largest financial rescues by the U.S. authorities that the world has ever seen.

The collapse of Lehman Brothers was the watershed event in the crisis. Much has been written about the efforts to find an alternative resolution, but in the end, Lehman Brothers filed for bankruptcy. Debate will continue as to whether there was a better avenue available to the officials in the Treasury, Federal Reserve, and the SEC. I can make two points with confidence, however:

1. No one in command of sufficient financial resources, public sector or private sector, was confident that Lehman Brothers had value as a going concern and would not prove costly to a rescuer, even if relieved of pressure to meet escalating collateral calls and to sell assets at fire-sale prices. This included the leadership of the Treasury and Federal Reserve; the U.K. Chancellor of the Exchequer, who did not take action to enable a bid by Barclays; the Korean authorities, who did not support an investment by Korea Development Bank; and others.

2. The orderly process that could be used to resolve a failing depository institution was not available, and the only established mechanism under U.S. law for allocating losses to stakeholders was bankruptcy, which typically operates slowly and with uncertainty and, in this case, triggered a global systemic collapse.

Given these points, it is far from clear that there was a better path. Extraordinary action by the Federal Reserve earlier in supporting the acquisition of Bear Stearns, and in the following days in approving Goldman Sachs' and Morgan Stanley's applications to become bank holding companies eligible for discount window borrowing, as well as providing financing assistance to AIG, have led many to believe that the Federal Reserve also could and should have done something to rescue Lehman. But in the end, the judgment of Federal Reserve officials that they were acting within their authority to provide liquidity support and not filling capital holes in these other cases has been borne out in all of the support programs that the Federal Reserve System undertook. It appears that they did not have this confidence in the case of Lehman, and they were not alone in this.

It is also far from clear that the financial authorities would have had the capacity to contain the implosion of liquidity and destruction of value that was underway even if support had been provided to Lehman Brothers or to a buyer of it. Despite the unprecedented assistance provided to other institutions, financial conditions continued to deteriorate. Massive infusions of capital into financial institutions were necessary to achieve a turnaround, and this was only possible with the $700 billion in budget authority granted to the Treasury by Congress under TARP. This legislation was unpopular and was only passed on a second vote in the House of Representatives after the full scale of the financial meltdown and its impact on the broader economy were evident. The Congressional resistance to TARP suggests that an improvised rescue of Lehman would have triggered a reaction on the Hill that would have called into question the ability to provide further support. The Lehman bankruptcy or another shock with as disastrous consequences may have been unavoidable before the political capacity could be created to deal with the conditions that had emerged.

The consequences of the failure of Lehman laid bare the vulnerability of the financial system because the authorities had no options other than providing support with taxpayer money or leaving its resolution to the bankruptcy process. Bankruptcy proved extremely disruptive, confirming the long-held view of the author and many others that the existing U.S. bankruptcy framework is not an appropriate way to resolve a complex financial institution. One of the most valuable reforms in Dodd-Frank is the requirement that all financial institutions have "living wills" that would provide for their orderly resolution in ways that will not come as a shock to markets.

Ten Reflections On Lessons Learned

The crisis provided many lessons for those in the financial markets. Investors, traders, and managers are taking many of these lessons to heart and implementing strategies that will change behavior for a long time. It also generated an active debate on how the financial sector ought to be structured and regulated. The result was the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010, which regulators are still implementing. Its most important provisions are:

- Established the Stability Oversight Council and Office of Financial Research to institutionalize systemic risk oversight for the first time.
- Provided for orderly liquidation of any troubled covered financial institution, thus providing an alternative to another Lehman Brothers bankruptcy other than providing government backing for all liabilities.
- Gave a legislative mandate for stronger risk-based capital requirements, leverage limits, and liquidity requirements for financial institutions.
- Established additional oversight and regulation of systemically important financial institutions (SIFIs).
- Strictly limited trading involving risk taking for profit (proprietary trading) of banks and bank holding companies—the Volcker Rule.
- Established closer regulation of credit rating agencies and required that credit ratings not be used in regulation.
- Curbed the powers of the Federal Reserve to extend credit in a crisis.
- Created a Consumer Financial Protection Bureau and established a legal framework to curb abusive mortgage practices.
- Established much closer regulation of derivatives with restrictions on over-the-counter transactions and transactions by banks.

Passage of Dodd-Frank did not end the debate on the relationship between government and financial institutions. Some strongly support further regulatory intervention, and others are strongly in favor of rolling back parts of the legislation.

Lessons continue to be learned as the events are studied more closely and the effects of changes that have been introduced are observed. Neither the management of a financial institution nor the oversight of the system can become static. Markets adapt to regulations, to demands of users of financial services, and to technological development. Although the last word on what we should conclude from the crisis cannot be given, some thoughts on the most

important issues raised by the events of 2007-2009 can be offered. Ten of the author's reflections follow.

1. ***Financial markets are not inherently stable and not always efficient in making use of information.***

An idealized model of financial markets as efficient processors of information and allocators of capital and risk had grown in acceptance for roughly 50 years since the first academic work in support of this view appeared. It shaped the views of market participants, the public, and regulators. Even many of those who rejected a pure efficient markets view, including the author, were of the view that markets worked well, if not perfectly, and that participants or their agents would not expose themselves to risks out of line with the potential rewards. But many did expose themselves to such risks in the run-up to the crisis, often without being fully aware of what they were doing. And many of the costs fell on those who were far removed from the decisions that created the conditions for the crisis.

It was recognized even by exponents of efficient markets that government intervention could distort outcomes and require a second government intervention to neutralize the effects of the first. For example, deposit insurance would enable bank owners to attract deposits even without capital and put the downside risk on the insurance fund unless regulators set minimum capital requirements. The need for policies regarding disclosure and trading on insider information was also recognized. This would maintain public confidence in the fairness of markets and, thereby, promote broad participation. But by the end of the last century, these were accepted limits, at least in the U.S., to the role of government in sophisticated financial markets that professionals dominated. Other market imperfections received the attention of academics—asymmetric information, herd behavior, and other human behavioral tendencies—but were not widely seen as having the potential to create systemic failure.

In the wake of the crisis, some continue to ascribe all market failure to misguided government intervention, notably in housing policy. Policy failures certainly occurred, most notably in allowing Fannie Mae and Freddie Mac to pursue aggressive growth with their implicit government backing. But no government policy forced institutions to abandon any reasonable credit standard in offering subprime mortgages or forced investors to buy exposure to them in RMBS, nor did policy drive the buildup of a fragile liquidity structure, although it may have enabled it. The systemic risks were the creation of people thought to be sophisticated responding to market incentives, and, thus, they must be ascribed to market failures.

The need for more attentive oversight of markets has become clear. Dodd-Frank has put much of this in motion. But getting the balance right and keeping it right as markets evolve will be an ongoing policy challenge.

2. *Inflation targeting is not sufficient for a central bank to maintain an economy on a stable course.*

Following the inflation problems of the 1970s, academic and practitioner thinking on monetary policy converged on inflation targeting as the primary, if not the only, objective of monetary policy. This had the virtues of providing clarity for markets and keeping the focus of policy on a critical policy objective that was generally accepted to be in the control of the monetary authority. As inflation targeting took hold, at first implicitly and then increasingly explicitly, it provided good outcomes, as reflected in the "great moderation." But in retrospect, it allowed imbalances to build up and create conditions for a crisis and painful adjustment. A warning of the potential problem was the Japanese bubble economy of the late 1980s. Consumer prices followed a moderate path, while asset prices, both equity and real estate, exploded. The Japanese case was generally seen as special. But the subsequent U.S. experience, first the IT bubble of the late 1990s and then the housing bubble, showed the costs of ignoring rapid credit growth and asset price inflation, as well as the increasing reliance on short-term financing in the financial sector. A second warning was the growing international imbalance, which, in retrospect, was a sign of an unsustainable financial path. The monetary policy debate of the early years of the last decade ignored it too.

This experience clearly showed that inflation targeting is insufficient to assure a reasonable, stable path for an economy. But it is not a simple matter to find an alternative. A fundamental proposition of economic policy is that one can achieve only one objective with one instrument, and traditional monetary policy has only one instrument—the policy interest rate. Right now, the search for more instruments, such as quantitative easing, is driven by the loss of power of the interest rate at a near-zero level to influence economic activity. But the question of whether other instruments can be developed to restrain credit growth and asset price inflation as the economic expansion continues and interest rates assume their historical role once again should remain at the center of monetary policy development. Better supervision will help but is unlikely to be sufficient. One postcrisis reform goes in this direction—provision for procyclical capital requirements in Basel III and U.S. bank regulation. But more tools are likely necessary to avoid badly unbalanced financial conditions once again threatening economic stability.

3. *A collapse of market liquidity is the greatest risk to which a modern financial system is exposed.*

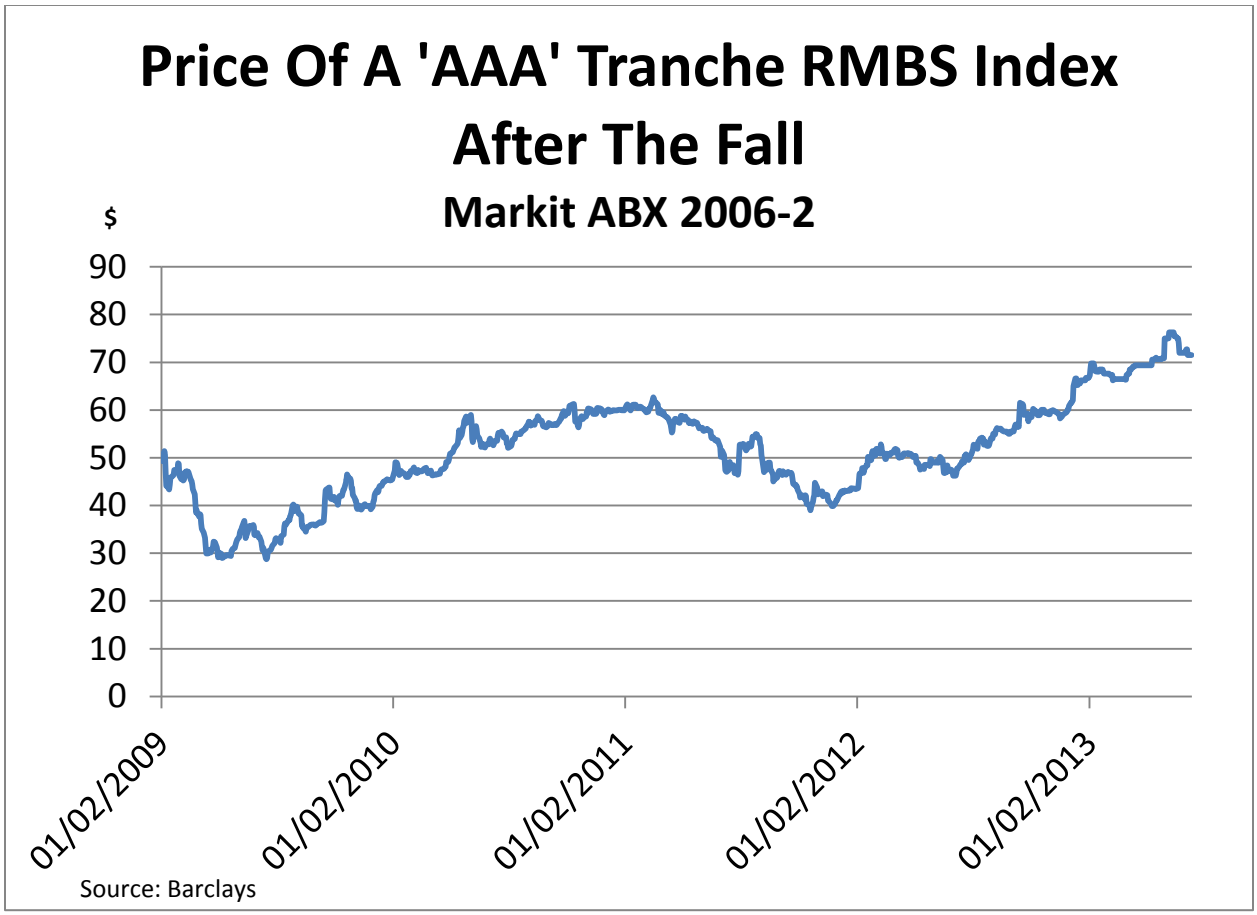
As noted earlier, liquidity crises have occurred since modern financial markets first emerged in the late 18th century. With the financial reforms of the 1930s, which brought confidence through deposit insurance and a stronger Federal Reserve, fears of liquidity crises faded in the U.S. A number of threats were kept from becoming systemic through effective action by banking authorities:

- A run on commercial paper following the bankruptcy of the Penn Central Railroad in 1970
- A Continental Illinois Bank run and the Latin American debt crisis in 1982
- A stock market crash in 1987
- The collapse of Long-Term Capital Management in 1998
- The IT bubble collapse in 2000
- The terrorist attacks of Sept. 11, 2001

Over time, complacency grew that the innate resiliency of a modern financial system with global linkages to diffuse shocks reduced the risk of a systemic liquidity crisis, and that the authorities had the capacity to manage any conceivable problems. This complacency fed the buildup of vulnerability through short-term financing of long-term positions and concentration of risks described earlier. This magnified the shock of a decline in the housing market. The result was a financial collapse with consequences that were deeper and broader than anyone imagined.

This crisis differed from those most often described in textbooks in that it centered on the securities markets: retail mortgage-backed securities, commercial paper, repos, and associated derivatives. A vicious cycle of collateral calls leading to efforts to sell securities at any price was at the heart of the meltdown. This had been seen before, notably in 1907 and 1929, but it was not at the heart of the systemic problems then, which were centered on commercial banks. Commercial banks were seriously affected in the recent crisis, but deposit runs were not a systemic threat. Their efforts to get out of the way of collapsing prices of assets were.

It is important to appreciate how much markets for mortgage-backed securities overshot the unavoidable repricing of the credit risk once the bubble in housing was recognized. More than half of the 71% drop in the price of 'AAA' tranches of late-2006 vintage subprime mortgages has been recovered. This overshooting spilled over into the markets for all but the assets considered the safest haven—U.S. Treasury obligations. Equities and highly rated corporate bonds plunged, as well as riskier credits. The overshooting froze transactions between banks, including the financing of world trade.



Two fundamental lessons should stay with us from this experience:

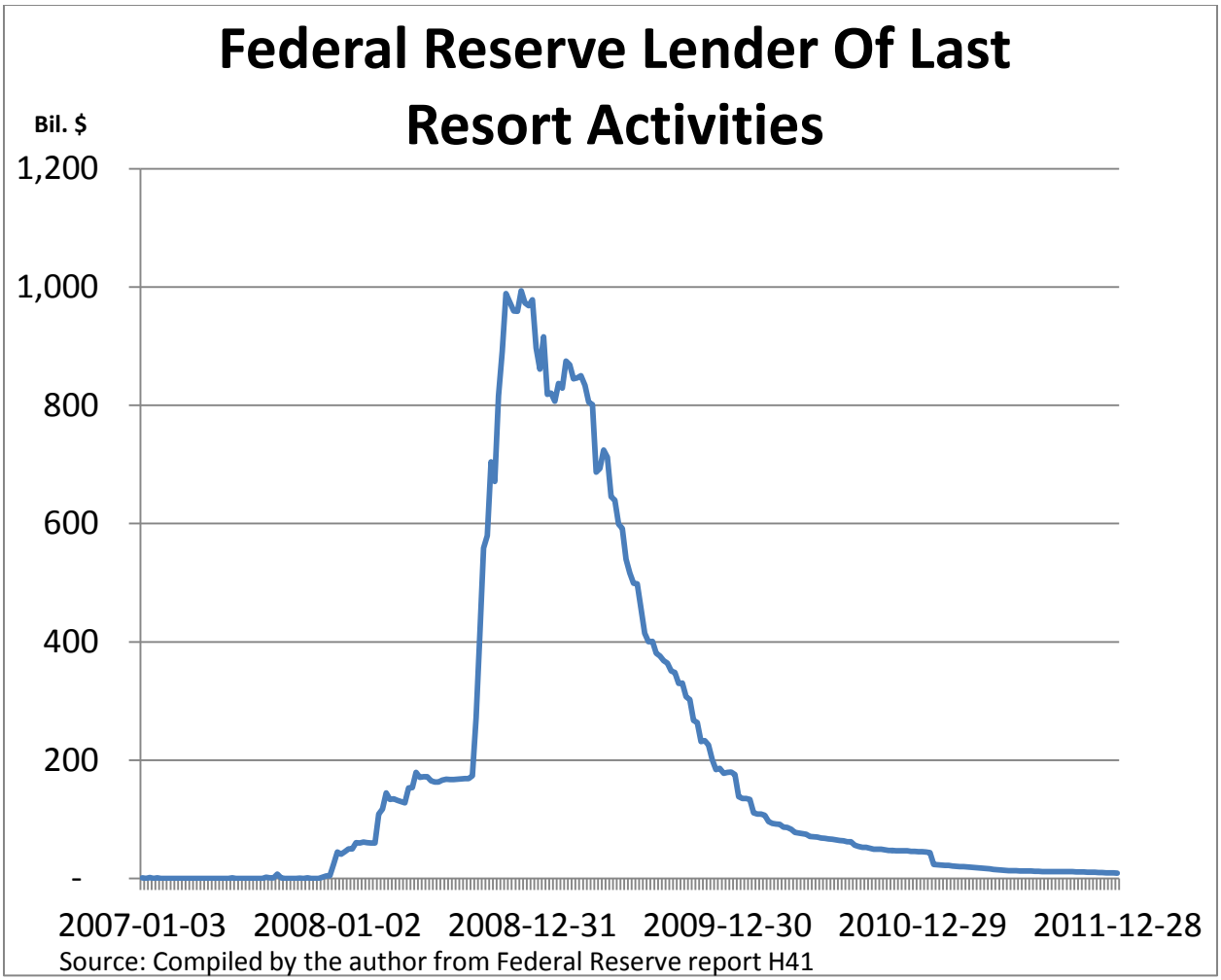
1. The investment in stronger oversight and regulation of markets to ensure liquidity conditions can remain reasonably stable is perhaps the highest return investment that a society can make. World economic output dropped roughly $4 trillion below trend in 2009, and recovery in the most developed countries has been slow. This was an enormous global disaster. The right kind of investment to avoid a recurrence would have a tremendous return, almost without regard to its cost. Liquidity ratios are one good response, and they are included in Dodd-Frank and in the new Basel capital standards internationally. These need to continue to be in the spotlight, to be tested, and to be refined in the light of experience.
2. A systemic liquidity collapse can happen again despite best efforts to head off problems, and it probably will. The same complacency that allowed the conditions for the recent crisis to build up will almost certainly arise again after a period of more stable markets. Even with the greater financial sophistication that will develop over coming years, vulnerability will increase. Indeed, a sense of sophistication may add to the risk, as it did in the last decade.

4. *The Federal Reserve exercised its role as a lender of last resort courageously, and its capacity to do this needs to be protected, not curbed.*

The Federal Reserve was cautious when the first signs of distress appeared against the background of a strong economy, with inflation a bit on the high side of the Fed's implicit target of 2%. But as the crisis deepened, the Fed repeatedly responded with actions that were inventive, massive, and carried both investment and political risks. Although the Fed failed to prevent a deep recession, the consequences would have been much worse if it had failed to act forcefully—worse in terms of wealth lost, financial wreckage, and lost jobs and economic output. The main programs that the Fed launched were:

- August 2007
  - Discount window actions
- December 2007
  - Term Auction Facility (TAF)
  - Central Bank Liquidity Swaps (expanded and broadened later)
- March 2008
  - Single Tranche Open Market Operations
  - Term Securities Lending Facility (TSLF)
  - Primary Dealer Credit Facility (PDCF)
  - Maiden Lane (Bear Stearns)
- September 2008
  - Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF)
  - AIG loans (expanded later)
- October 2008
  - Commercial Paper Funding Facility
  - Money Market Investor Funding Facility (MMIFF)
- November 2009
  - Term Asset-Backed Securities Lending Facility (TALF)
  - Sales of Treasury bonds matched by purchases of agency (Fannie Mae or Freddie Mac) guaranteed bonds
  - Citigroup backstop
- January 2009
  - Bank of America backstop

At its peak, The Fed was providing nearly $1 trillion in lender-of-last-resort support to the financial system.



The Fed's actions corresponded relatively closely to the doctrine of the lender of last resort as formulated by Walter Bagehot in 1873:[24]

1. Lend on good collateral to solvent institutions,
2. Lend at a penalty rate, and
3. Lend in unlimited large amounts.

As for the first, the Fed did accept a wider range of collateral as the crisis deepened, some of it much riskier than a central bank would have contemplated accepting in normal times, but it has recouped much of what it lent, and the rest looks acceptable on a mark-to-market basis today. The Fed will more than be made whole when the books are closed on this episode.

As for the second, the Fed declined to provide assistance to Lehman Brothers, which it could not satisfy itself was solvent. While interest rates did not always carry high penalties,

they were always at a premium over the Fed's cost of funds—the Fed funds rate or the interest rate that it paid on reserves. In some cases, notably AIG, the assistance came at a pretty high cost to the borrower.

And as for the third, the Fed lent on an unprecedented scale. When it engaged, amounts were not an issue.

Most analysts who embrace the Bagehot view of the responsibilities of a central bank give the Fed high marks. Alan Blinder[25] and Brian Madigan[26] are two of them. This author would join these ranks. Others who focus on the risk of creating moral hazard, for example William Poole[27], or who view the ad hoc responses as creating more uncertainty, for example John Taylor[28], are more critical.

5. ***Moral hazard should be a policy concern, but it was not at the heart of what went wrong.***

Moral hazard is an insurance industry term for the risk that an insured party will take less care to avoid a loss because he or she is insured and, therefore, will not bear the cost of a loss. In finance, the term is often applied to the possible increased risk taking because of explicit or implicit insurance provided by the government—deposit insurance, lending facilities of the sort the Fed provides, or capital infusions provided under TARP. Although distorted incentives, especially those that traders faced and risk managers did not check, very likely played a role in creating risk that was not well managed, it is not plausible that the expectation of government support by shareholders and management was at the heart of the buildup of fragility that preceded the crisis. There are several reasons for this:

1. Deposit insurance had been a part of the financial system for 75 years without a liquidity crisis on this scale.
2. Ground zero for this crisis was the investment banks that had not enjoyed government support in the past.
3. No one would have anticipated the extraordinary Fed response on the basis of the history of the institution or statements by its leadership.
4. The extraordinary assistance that was provided by the Treasury under TARP could also not have been anticipated and came at a very high cost to shareholders. While AIG, Citigroup, and others survived, managements were replaced and shareholders were diluted to a small fraction of their precrisis stakes.

This is not to say that government insurance has no effect on markets. Depositors and nonequity investors in insured institutions accept a lower interest rate, but capital requirements, as well as insurance fees, limit the funding advantage to banks. But equityholders are still in the first-loss position. Regulatory capital requirements are intended to make sure that capital providers stakeholders will incentivize risk management, even if creditors do not. Shareholder oversight may have been weak given the opacity of the financial institutions that had developed, and equityholders may have had a strong appetite for risk with a commensurate return, but it would not have been in their interest to encourage managements to take risks in anticipation of the losses that occurred, even given government support.

Looking ahead, however, all players in the market will adjust their behavior to what has happened. Some assistance provided may encourage more risk taking in the future. Failure to act in the case of Lehman may also encourage more risk taking by those who conclude that such a calamity would never be allowed to happen again. The regulatory structure does need to reflect the increased moral hazard that has been created in responding to the crisis. But this ought not to be overdone. The much stronger lesson market participants learned is that risks can be much greater than thought before. Regulators should be careful not to restrict risk taking to the point that economic growth is undermined, when investors have become more cautious on their own.

6. ***Regulatory capital is important, but it should be a buffer used in time of need, not a rigid requirement.***

Increasing regulatory capital requirements has been a major thrust of regulatory action since the crisis. Basel III sets much higher capital ratios and requires higher-quality capital. Dodd-Frank establishes parallel, but not completely compatible, standards for the U.S. The focus of regulators has been taken up in the market, so a bank is rewarded in its equity price for exceeding regulatory requirements, a change from before the crisis.

In retrospect, somewhat higher capital (reduced leverage) seems warranted for the securities and derivatives on financial institutions' balance sheets. Indeed, banks were turning loans into asset-backed securities held on their balance sheets and reducing capital requirements in this way. It is not clear, however, that the crisis demonstrated a need for greater capital against loans.

The crisis also exposed flaws in the Basel Committee’s approach to capital, which was tied to risk-weighted assets. Measures of risk, whether based on categories the committee established (which gave home mortgages favored treatment), on the banks' own risk measures, or on

ratings from the credit rating agencies, proved deficient. The result was distorted asset allocations with higher risk than the regulators intended. One response to this in the new Basel Committee approach (Basel III) and in Dodd-Frank is to establish unweighted leverage ratios. By itself, such a requirement would also distort banks' asset allocation, but combined with the risk-weighted approach, this provides a belt-and-suspenders approach to leverage that will almost certainly be an improvement.

One source of pressure to boost capital is the determination of much of the public and their elected representatives that large financial institutions never again require support from the Federal Reserve or the Treasury. This desire reflects a misunderstanding of the support that was provided. While some of it took the form of preferred stock, which counted as capital, the overwhelming need at the time was for liquidity support, and this is what the Fed provided in the amount of nearly $1 trillion. Public equityholders (and subordinated debtholders in the case of WAMU) did take all of the ultimate losses in major U.S. financial institutions after the dust settled, except for Lehman Brothers. The public has not been asked to make the distinction between liquidity support, which may be needed in extraordinary times of systemic breakdown and can be returned to the taxpayer once normal markets are restored, and covering losses from bad credit once capital is exhausted.

Pushing bank capital beyond the point of real need to cover credit losses and other normal risks will raise the cost of financial intermediation with two adverse consequences.

1. It will slow investment activity and economic growth.
2. It will create an incentive for the growth of new shadow banking outside the regulatory net and with less transparent risks.

Of perhaps greater importance for future financial stability than the amount of capital in financial institutions is that capital be a real buffer in a time of stress. Capital requirements regulators and the market set played a role in reinforcing the cycle, rather than damping it in the crisis. As capital shrank, often because of mark-to-market losses, pressure built to meet higher capital standards. Banks redoubled their efforts to sell assets into a market without buyers. And the vicious cycle continued. It would not build confidence if regulators were to replace mark-to-market accounting with something less transparent. But the standards need to be elastic so banks can operate with reduced capital in times of stress. Dodd-Frank seeks to provide for this by setting higher requirements in good times. It would be even better if the capital requirements also allowed capital to be a more usable buffer in bad times.

7. ***Problems build up where attention is not focused—shadow banking will always be a challenge.***

Institutions peripheral to the supervision and regulation system that focuses on safety and soundness were deeply involved in the crisis. SIVs, which could be described as banks without licenses, were prominent examples. So too was AIG Financial Products. And broker-dealers like Bear Sterns and Lehman Brothers were not subject to the close safety and soundness regulation of a bank, although they had grown to be larger than most banks. Risk tends to concentrate where it is not closely regulated, so this should not be a surprise. With the stronger regulation of risk in banks in the wake of the crisis, the incentives for risk taking elsewhere have intensified. The systemic risk surveillance and response capability must take this into account. Of paramount importance is that the authorities have a complete picture of where risk has been lodged in the financial system. Hence, the legislative support for information gathering in Dodd-Frank is important. This should be of great value to the Financial Stability Council and the Office of Financial Research, which supports the Council with analysis, to maintain a reasonably complete picture of systemic risk.

It is not necessary to remove all risk from the system, only that which is, or is on the way to becoming, systemic. And it would be nearly impossible to do so effectively. To some extent, systemic risk objectives can be achieved by regulating the dealings of directly regulated institutions with shadow banking institutions. The earlier campaign by the Federal Reserve to get banks to demand greater collateral from hedge funds is an example of this. But there will be times when direct regulation of activities that are now outside the net and are growing to a large scale will become necessary, whether they involve only a few institutions or many small players. The authority to take action needs to be established and maintained.

8. ***Credit ratings played a role in the crisis, alongside the mistaken risk assessments of investors and regulators, but they cannot account for its scale. The ratings process needed to be reviewed and improved. Government officials, the ratings agencies, and users of ratings have taken actions.***

Credit ratings have been fiercely attacked for the role that they have been seen to play in the crisis. Standard & Poor's and the other agencies have accepted that they failed to identify the systemic risks that led to much greater losses on 'AAA' and other highly rated U.S. RMBS and related securities than the ratings implied. Several points provide important context for this failure:

- Credit rating analysts were using the same assumptions that prevailed among investors and regulators, all of whom underestimated the likelihood of a significant national housing price decline that would negate the diversification of the risk of default provided by bundling mortgages into securitized bonds. Indeed, careful research shows that participants in the subprime RMBS market acted in their personal financial decisions in ways that were consistent with an optimistic outlook for housing.[29] Critics have asserted that the agencies were subjected to pressure from issuers and their underwriters to take a positive view, but there was not a more conservative view being expressed by many potential buyers of RMBS or by others.
- The use of credit ratings in setting regulatory risk-weighted capital requirements on financial institutions created a focus on credit ratings that went beyond their appropriate use as one of several tools in portfolio risk management. As a result, credit ratings may have taken on a weight in the market that they could not support given their inherent limitations.
- The losses recorded on RMBS in the midst of the crisis reflected the price collapse in the distressed liquidity conditions of the time. There was a fire sale. Credit ratings provide an indicator of default risk, not market price. Defaults did run well above expectations, but to nowhere near the extent that prices declined in the crisis. As noted earlier, prices have recovered substantially, and the ultimate losses on highly rated paper, although still high, will be much less than the impression one had as the financial collapse reached bottom in early 2009.
- The systemic liquidity collapse amplified the financial and economic distress. Whatever ultimately inaccurate assumptions raters and investors in RMBS made, these were only one of the problems that emerged and were far less important than those that arose from the liquidity management of financial firms.
- The performance of ratings on securities other than RMBS and related CDOs was in line with historical experience. Standard & Poor's has reviewed its ratings performance and found that default experience for corporate debt, sovereign debt, and even structured asset-backed securities other than mortgages was in line with historical experience for debt with a given rating.[30] Thus, the ratings industry structure as a whole, with competing firms paid by issuers, seems robust, notwithstanding that the modeling of some mortgage-backed securities failed to capture the risk in them.
- The loss of confidence in ratings as a result of the record of ratings on RMBS has been extremely costly to an industry in which reputation is the most important asset. This was a foreseeable consequence of failure, and, as a result, it is hard to believe that the agencies would have intentionally given stronger ratings than they believed were clearly warranted.

The rating agencies and authorities have made significant efforts to strengthen ratings and confidence in them since the crisis.

- Standard & Poor's has intensively reviewed and modified models for rating RMBS. While issuance of non-GSE supported RMBS has been relatively dormant since the crisis, these securities should play a role in mortgage financing going forward. The ratings infrastructure is ready to support this. Methodologies for establishing and implementing ratings criteria have been strengthened across all areas, not just RMBS, as has the training of analysts. And the insulation of ratings analysts from fee negotiations services has been strengthened.
- Regulation implementing the Dodd-Frank Act is removing ratings from use in the U.S. regulatory system, and the EU is moving in the same direction. This will remove the distorted value sometimes attached to ratings.
- Regulatory oversight of the ratings process has intensified in the U.S., Europe, and elsewhere without interfering in the ratings decisions.
- While the issuer pays model of the ratings industry has been maintained, ways to provide additional assurance of unbiased outcomes from this model continue to be explored for asset-backed securities where the experience with RMBS has given rise to understandable concerns. It will be important that any changes in this area preserve the universal access by investors to ratings, which the issuer pays model provides, and preserve the agencies' analytical independence.

As a result of intense efforts over the past five years since the ratings failures on RMBS became evident, the industry is much stronger and able to provide an important part of the financial market infrastructure.

9. Consumers need protection when making what for them are huge decisions, such as buying and financing a home.

The home purchase and associated mortgage decisions many families made in the housing boom before the crisis proved disastrous. Some analysts were concerned about this while it was going on. But the prevailing view among financial policymakers was that households could make sound decisions and their freedom to do so ought not to be curbed. They discounted the ways in which mortgage lenders could push people toward decisions that were not in their best interest, as well as having too much confidence in consumers' capacity to make complex decisions.

A notable exception was Federal Reserve Board Member Edward M. Gramlich. In a 2004 speech,[31] he expressed concern about fraud, abuse, and predatory lending problems in mortgage lending. As a Fed official, he was upbeat in public about the effectiveness of

regulatory tinkering that had taken pace, but he noted that "despite these actions by the Fed and other bank regulators, we still have no obvious way to monitor the lending behavior of independent mortgage companies." His reported quiet pressure for stronger action had no impact. Abuse in the mortgage origination market continued to grow until the end.

The Dodd-Frank Act has established a Consumer Financial Protection Bureau in response to evident failure of the market to protect consumer interests. Even before getting up to full speed, it has encountered backlash from the financial services industry and its supporters. Not every idea that comes from the bureau will be the best way to achieve both the objectives of consumer protection and having a strong, innovative industry that responds to their needs. The bureau must pursue its mission in dialog with both the industry and advocates for consumers. But its authority should remain strong. Otherwise, risks will build up again.

10. Post hoc (after this) does not necessarily mean propter hoc (because of this).

It has become common to ascribe a central role in the crisis to financial deregulation and, in particular, the passage of the Gramm Leach Bliley Act (GLB), which removed remaining barriers to the conduct of banking, securities business, and insurance in the same institution, in 1999. Regulatory failure certainly played an important role in allowing the conditions to develop that led to the crisis, but GLB was not at the heart of the failures.

One evident failure was the lack of oversight of mortgage origination, which allowed aggressive sales forces to market unsuitable mortgages to families who were not equipped to resist. America has recognized since the Securities Act of 1933 that marketers of securities have a responsibility to consider their suitability for the buyer. But no oversight was conducted on mortgage originators as they extended unsuitable mortgages to borrowers who were making their most important financial decisions.

Oversight of the safety and soundness of banks and broker-dealers fell short of the mark owing to a focus on individual institutions, failure to give close attention to risks in the shadow banking system, and neglect of systemic trends—the regulators were looking at many of the trees but not the forest. And regulation failed to keep up with the emergence of new products from CDOs to credit default swaps (CDS) to auction-rate securities to SIVs.

These were more failures to keep up with changing markets than the result of deregulation. What happened in the crisis does not suggest that GLB played a significant role. Most of the institutions at the heart of the crisis in the U.S.—Bear Stearns, Lehman Brothers, AIG, Merrill Lynch, WAMU, Wachovia, and Bank of America—were not changed significantly by GLB before the crisis hit.

The firm whose form was authorized by GLB, Citigroup, was also deeply stressed in the crisis, but this cannot be ascribed to GLB. The biggest change from GLB was to allow a bank and an insurance company to be in the same holding company. But Citigroup management concluded that this was not a good business combination and had spun off Travelers Insurance in 2002. Citigroup was hurt by holdings of mortgages that it had originated in the preexisting Citicorp banking structure. It was hurt by the need to give support to its SIVs, a structure that Citicorp had invented in 1988 to reduce capital requirements under Basel. And it was hurt by holdings of RMBS, which were specifically authorized for commercial banks under the Glass-Steagall Act of 1933 that separated commercial and investment banking.

A focus on U.S. deregulation overlooks the difficulties that emerged in institutions outside the U.S. Indeed, the first tremors of the crises involved European institutions. In July 2007, IKB Deutsche Industriebank in Germany announced that it had serious losses on U.S. subprime mortgages and was later rescued by German Government institutions. This was quickly followed in August 2007 by the announcement by BNP Paribas of France that it was closing two funds that were invested in mortgages. A month later, Northern Rock of the U.K. experienced a run unrelated to subprime mortgages in the U.S. and received emergency support from the Bank of England. Financial distress in Europe continued to build, forcing massive government interventions and huge taxpayer losses, in contrast to the positive return on support for private financial institutions in the U.S.

Some have focused on the size of the largest U.S. financial institutions as a source of fragility, but this too is hard to support. It is true that the largest U.S. banks have grown rapidly in recent decades as barriers to interstate branching have fallen. But some large banks weathered the storm well—JPMorgan Chase and Wells Fargo. Indeed, they have grown substantially larger as a result of acquisitions of distressed institutions during the crisis. And U.S. banks are not large relative to large banks abroad that fared well in the crisis, especially when scaled to the size of the home country. Canada and Australia stood out in the resiliency of their financial systems through the crisis. Both are dominated by a few very large banks.

Two concluding thoughts

1. A recurring theme in this review of what led to the crisis is that a number of problems converged to create the conditions for it.
    - If the problem had simply been abusive mortgage origination and investors had been more demanding of information and looked more closely at what they were buying, the problem would have been contained.
    - If investors had not outsourced their due diligence to rating agencies, the problem might similarly have been contained.

- If senior managements in financial firms had been more conscious of the liquidity risk that was building up on their balance sheets and controlled it, the implosion would have been much less strong.
- If the independent investment banks had been subject to closer capital adequacy scrutiny, the system would have been much more resilient.
- If the authorities had made a more intense effort to identify systemic risks, asking tough questions about how stress could play out, systemic fragility might not have been allowed to build up to nearly the extent that it did.
- And there are other "ifs" that might have changed the outcome.

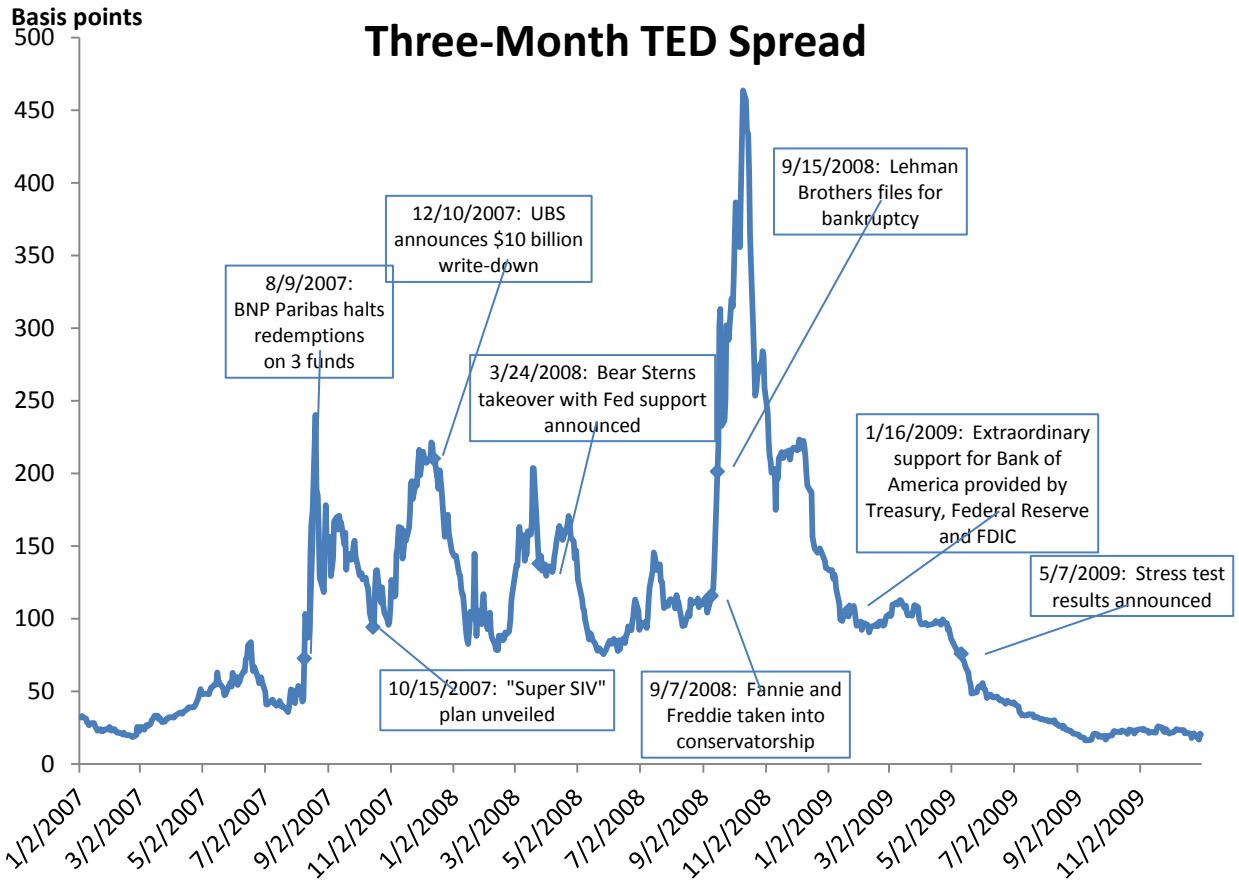
Looking for a single villain, or even a few, is a mistake. The many contributors to the crisis were most often acting in good faith, more guilty, along with the rest of the world, of being blind to the systemic risks that were building up or of acting on distorted incentives than of consciously putting the markets and the global economy at risk.

2. Much of the policy focus since the financial crisis has centered on the wish to put in place regulation so that public money never has to be called on again to support the financial system. Some have argued that the capacity of the authorities to respond to a crisis, should it occur, ought to be dismantled, and indeed Dodd-Frank somewhat curtailed the emergency lending authority of the Federal Reserve. This approach is like putting in place strong building codes and then eliminating the fire department. We need both building codes and fire departments to keep people and property as safe as possible from fire. And we need both strong oversight and regulation, and a strong lender of last resort, to keep people and their wealth safe from financial calamity.

Appendix: The Mileposts Of The Crisis

The story of what happened through the crisis of 2007-2009 has been told in great detail and with great drama. The most complete record of what happened in the U.S., which collects both facts and recollections of central actors, is found in The Financial Crisis Inquiry Report, 2011. Here we outline the main events as background for the discussion of the forces that drove the events, which were much bigger than the actors.

It will be useful to track the TED spread, introduced in the body of the paper, as we follow the chronology.



Source: Federal Reserve Bank of St. Louis FRED database

First tremors—August 2007

As noted earlier, housing prices had peaked in mid-2006. A number of developments in the first half of 2007 showed that the mortgage market was turning, including downgrades of subprime RMBS by Standard & Poor's and Moody's on June 1, as well as Standard & Poor's placement of

its ratings on a large block of subprime RMBS on CreditWatch on July 11.[32] But market liquidity was not visibly affected. On July 9, Chuck Prince, CEO of Citigroup, made his now famous statement, "When the music stops, in terms of liquidity, things will be complicated. But as long as the music is playing, you've got to get up and dance. We're still dancing."[33]

The questions surrounding subprime RMBS began to visibly affect broader market liquidity in the week of Aug. 6. The event that made news was the halting of redemptions on three investment funds by BNP Paribas. This was associated with a tightening of liquidity in wholesale markets. The TED spread spiked. So too did the interest rate on ABCP. A decline in the volume of issuance in the ABCP market began, which would continue and reduce the amount outstanding by more than a third by the end of the year. Repos and Fed funds purchases also shrank, by more than 10% in the second half of the year. Not in the headlines was a "quant meltdown" in the U.S. equity market triggered by deleveraging pressure.[34] This would have signaled changing market liquidity conditions reaching far beyond mortgages if it had been visible at the time. The Federal Reserve recognized the troubled liquidity conditions and announced on Aug. 10 its intention to "provide reserves as necessary…" and that the discount window was available. It reduced its discount rate a week later but only began to ease monetary policy by cutting the Federal funds rate in mid-September. The Federal Reserve would continue easing until the Federal funds rate was brought down to 0%-0.25% in December 2008.

Signs of strained liquidity continued as the TED spread remained high in the coming months. A run in mid-September on Northern Rock in the U.K., a bank that had become heavily reliant on market funding to build up its balance sheet far beyond its deposit base, was the most visible sign of strain. This was the first run on a bank in the U.K. in 150 years. It was halted only when the Bank of England intervened to provide liquidity support.

Bank losses and liquidity strains exposed—October 2007-February 2008

The drying up of the ABCP market increasingly strained SIVs. On Oct. 15, Citigroup, Bank of America, and JPMorgan Chase announced plans for a "Super SIV" to relieve pressure on the conduits that they sponsored. Despite endorsement by Treasury Secretary Paulson, the "Super SIV" foundered and was abandoned in December, leaving the institutions to absorb the costs of supporting their SIVs. This was a substantial additional call on capital. Meanwhile, Merrill Lynch and Morgan Stanley announced write-downs in early October. Citigroup revealed on Nov. 4 that its exposure to subprime RMBS was in the neighborhood of $55 billion, and UBS and Lehman Brothers followed with large write-downs in December when the TED spread reached a new high. That month, the Federal Reserve initiated the first of what would become a

continuing series of measures to counter the contraction of market liquidity and respond to distress of key institutions with the establishment of the Term Auction Facility. This initiative involved the Fed auctioning funds secured by a wide range of collateral. The Fed also provided support for the efforts of the European Central Bank and the Swiss National bank to provide dollar liquidity to their banks by putting in place reciprocal currency swap agreements with them.

In January 2008, the precarious position of the monoline insurance companies became a market concern. These institutions had historically provided insurance to enhance the credit of municipal bonds but had extended to insuring mortgage-backed securities during the housing boom. The downgrade of Ambac by Fitch on Jan. 19 was followed by sharp drops in equity markets around the world. The next business day, the Federal Reserve held an emergency meeting of the FOMC and cut the Federal funds rate by 75 basis points, three times its normal step. At the regularly scheduled meeting the next week, the FOMC cut its policy interest rate another 50 basis points, making this the sharpest drop since the days after Sept. 11, 2001. The Fed had become an activist in its use of monetary policy to respond to the deepening financial distress.

Write-down announcements continued with the fourth-quarter earnings releases by financial institutions in early 2008. Banks and investment banks did succeed in efforts to raise new capital to offset the write-downs. Although the TED spread and other indicators continued to show strains in the short-term funding markets, bank lending, except for mortgages, continued to hold up well. And corporate long-term bond issuance was sustained.

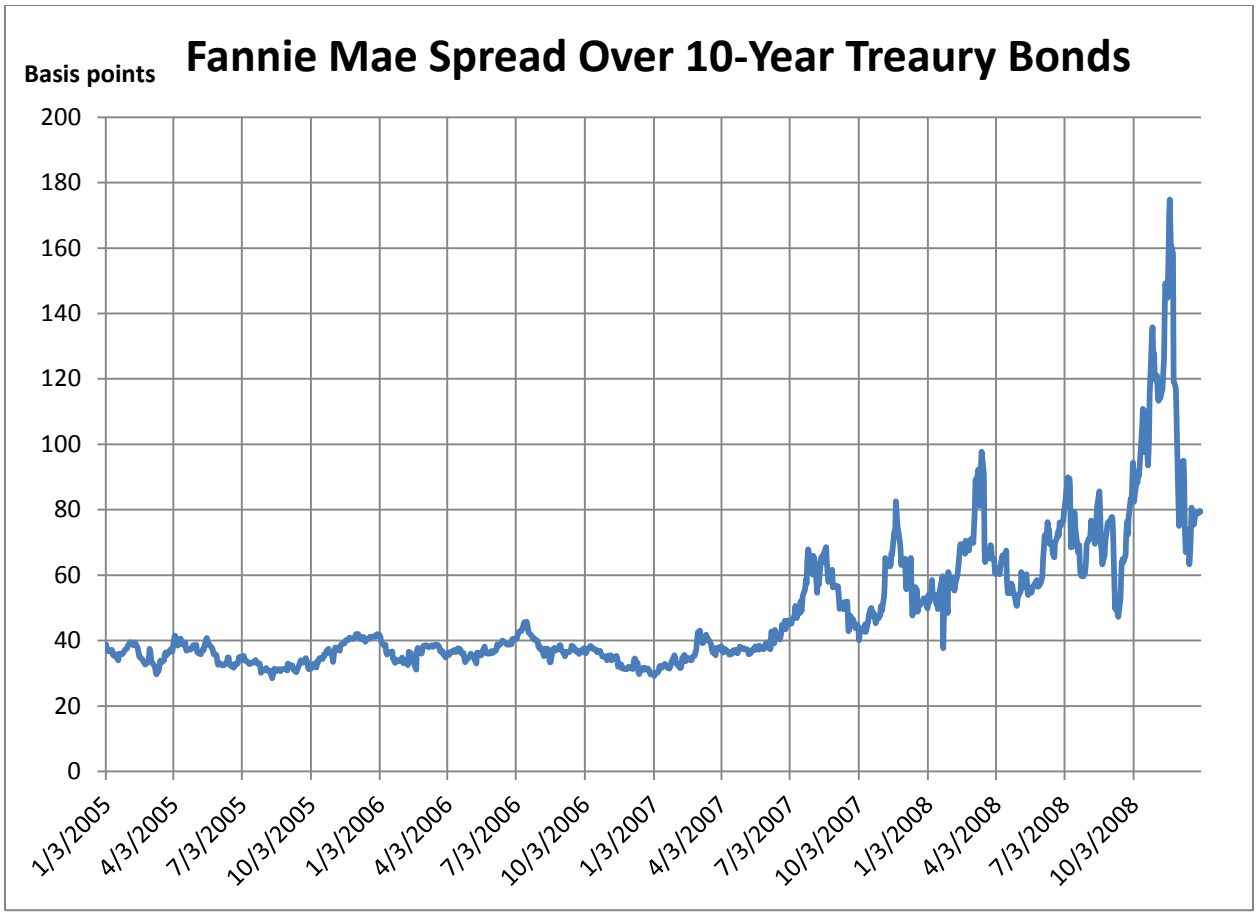
Bear Stearns rescued—March 24, 2008

In early March, markets focused on the distress of Bear Stearns, generally seen as the weakest of the five major independent investment banks. Concern that the problems of Bear could be wider sent the TED spread back to near its November high. Bear experienced an evaporation of liquidity as haircuts on repos and derivatives were raised by counterparties, clients moved business away to other houses, and the market for its assets became increasingly strained. Default appeared imminent. The Fed responded first with additional measures to supply liquidity to the market. Then, on March 24, the Federal Reserve Bank of New York announced the provision of $29 billion of financing to facilitate the takeover of Bear by JPMorgan Chase, which had been announced 10 days earlier. This calmed markets somewhat, and the TED spread eased back to the still-elevated levels of January and February. As time passed, some cautious optimism appeared that the continuing liquidity problems could be managed with the support that was seen from the Fed, and firms focused on dealing with their mortgage holdings.

The TED spread and corporate bond spreads receded. But the shrinkage of outstanding ABCP continued, and repos and Fed funds obligations of financial institutions, which had stabilized at the beginning of the year, began a runoff that would reduce their level by half over the ensuing 12 months. Investors shed mortgage-linked paper to regain liquidity and limit losses, and prices fell. The financial stress began to be felt beyond housing and the directly affected holders of mortgages as bank credit stopped growing.

Fannie Mae and Freddie Mac taken into government conservatorship—Sept. 7, 2008

Over the summer, the declining prices of houses and of mortgage-linked assets focused attention on the precarious financial condition of Fannie Mae and Freddie Mac. These GSEs had long operated with very thin capital. In June 2007, on the eve of the first shocks, they had a combined book capital ratio of 1.3% of assets, including off-balance-sheet guarantees.[35] Markets accepted this on the assumption, not backed by legislation or stated policy, that the U.S. government stood behind them. As their financial condition came more into doubt, creditors became nervous about the status of government support. The spread on Fannie Mae bonds, which had spiked during the first wave of systemic concern and then again when Bear Stearns was the center of attention, began rising even as corporate 'AAA' bond spreads tightened. The two institutions could no longer obtain adequate repo funding using their own paper. [36] On July 13, the Federal Reserve and Treasury announced support for the GSEs but stopped short of a guarantee. Investors remained skittish. At the end of that month, Congress passed legislation to expand the Administration's powers with respect to the agencies. But these actions provided only short-lived comfort to the markets. Second-quarter earnings statements released in early August showed both agencies had negative fair value under Generally Accepted Accounting Principles (GAAP).[37] Their spreads over Treasuries began widening again as the question of whether GSE creditors would be fully protected became the center of attention. There was no respite from the liquidity squeeze. By early September, the need was evident for stronger support to avert the failure of institutions with obligations of nearly $5 trillion held as safe assets in the most conservative portfolios, including as reserves of foreign central banks. On Sept. 7, Fannie and Freddie were placed in government conservatorship, and the Treasury announced that the authority granted in the July legislation would be used to ensure their positive net worth. But by now, the market's concerns about market liquidity had intensified, and they persisted following the support for the GSEs.



Source: Bloomberg

Lehman Brothers files for bankruptcy—Sept. 15, 2008

The focus of market pressure in a time of financial market distress tends to fall first on the apparently weakest institution. Once it is gone, the market focuses on the next weakest. So it was in the summer of 2008. JPMorgan Chase had absorbed Bear Stearns, with support from the Federal Reserve, so Lehman Brothers, the smallest of the remaining investment banks, which was known to be a big player in mortgage securitization, took the spotlight. A number of commercial banks were also in distress as a consequence of their mortgage business. The Office of Thrift Supervision had closed Indy Mac in July. National City Bank of Cleveland, one of the 10 largest banks in the country, announced it had entered into a memorandum of understanding with its regulators and was subsequently acquired with FDIC assistance by PNC in October. And Washington Mutual (WAMU) and Wachovia were in sufficient distress that they would be resolved through merger in the coming weeks. But these and other distressed depository institutions made few waves in the markets because they had access to the Federal Reserve discount window and deposits were insured by the FDIC. By contrast, as a broker-dealer,

Lehman operated without these official supports. And it was much more dependent on funding in the repo and commercial paper markets. This funding came under pressure as liquidity disappeared from these markets and concerns about Lehman's capacity to meet its obligations intensified. Counterparties who did not exit were demanding more and more collateral. Indeed, the same pressures fell increasingly on the other independent broker-dealers: Merrill Lynch, which was generally thought to be next in line, and even on Morgan Stanley and Goldman Sachs, which had been viewed until then as the paragons of the financial services industry.

Lehman management had succeeded in raising more than $15 billion in new capital and long-term debt in the spring that more than covered its reported $6 billion in losses for the December 2007 to February 2008 quarter. But this did little to restore market confidence. Potential sources of support in both the public and private sectors questioned the valuation of Lehman's real estate assets. Many of them were not actively traded, so value was not well determined. Under liquidity pressure to raise funds, assets would bring only fire-sale prices, leading many to consider Lehman insolvent, despite its own claims of adequate capital.

In light of market concerns, Lehman management again sought to raise additional equity capital, an exercise that the financial press followed closely. Hopes faded with the announcement on Tuesday, Sept. 9 that Korea Development Bank had declined to invest in Lehman Brothers. The impact of this announcement, which triggered a 55% decline in Lehman's stock price, reflected more than the size of the capital infusion that might have been expected. Failure to find investors signaled to others in the market that those who had had a closer look at Lehman's books could find no value there. Over the remainder of the week, the drain of liquidity out of Lehman became a rush. JPMorgan, Lehman's clearing bank, demanded $3.6 billion in additional collateral and then another $5 billion.[38] Other counterparties demanded more collateral. Commercial paper holders let their maturing holdings run off. And some investors increased short positions in Lehman stock and its CDS. Some liquidity was available for good collateral through the Federal Reserve Term Securities Lending Facility and Primary Dealer Credit Facility, which had been established to provide liquidity to nondepository institutions at the time of the Bear Stearns market turmoil in March. But it bought only a little time.

By the weekend, it was evident that Lehman Brothers would be unable to open for business on Monday without assistance. When efforts to put together an alternative resolution failed, Lehman Brothers filed for bankruptcy in the wee hours of Monday morning.

Rescues of other major financial institutions—Sept. 16-28, 2008

The Lehman Brothers bankruptcy triggered a further collapse of liquidity in global markets. The TED spread rose by one-third to more than 200 basis points over the weekend of the Lehman bankruptcy and continued rising, reaching 313 basis points on Thursday, Sept. 18. It would rise another 150 basis points over the ensuing month. The threat of further failures in the U.S. mounted:

- Merrill Lynch recognized that it would not be able to maintain funding and sold itself to Bank of America on the day that Lehman filed for bankruptcy with encouragement from Treasury Secretary Paulson but no official support.
- AIG, whose Financial Products subsidiary had become an outsized provider of credit protection, had been of growing concern. It faced large collateral calls when it lost its 'AAA' rating and funding dried up. It was clear that it would not be able to meet its obligations despite its large and stable insurance businesses. While these insurance businesses had substantial capital value, they were precluded by regulators from providing liquidity to other parts of the firm since this would put insurance policyholders at risk.
- Morgan Stanley found itself the next most exposed as counterparties moved funds to investment banks linked to commercial banks and collateral calls rose. In one week, it drew $67.8 billion from new Fed facilities but still saw its liquidity pool shrink by $75 billion to $55 billion. Clearly it had only days left.[39]
- Goldman Sachs also came under funding pressure but was not as stressed as Morgan Stanley.
- Money market mutual funds experienced a runoff, and one, the Reserve Primary Money Fund, “broke the buck” (that is, its shares were redeemable only at a price below $1.00) on Tuesday, reflecting losses on holdings of Lehman commercial paper. The runoff from most funds not invested solely in Treasury bills accelerated, and this resulted in a collapse of funding in the commercial paper market for manufacturing corporations that had not suffered any credit deterioration.

The liquidity pressures spread abroad, leaving banks around the world desperately seeking liquidity, especially in dollars, as interbank markets dried up.

The U.S. financial authorities responded once again in unprecedented ways.

- The Fed went far beyond any previous support to keep AIG from failing. A loan of $85 billion was authorized the day after the Lehman bankruptcy, but much more would be needed. Support for AIG from the Fed and Treasury would eventually reach $182 billion.

- The Treasury announced that it would use $50 billion from the Exchange Stabilization Fund, which the President controls, to guarantee investments in money market mutual funds.
- Over the following weekend, Morgan Stanley and Goldman Sachs applied for and received authorization to become bank holding companies with full access to the Federal Reserve Discount Window. This provided sufficient assurance of official support to bring in $9 billion in capital to Morgan Stanley from Mitsubishi UFJ and $5 billion to Goldman Sachs from Warren Buffett's Berkshire Hathaway.
- Existing swap lines between the Federal Reserve and foreign central banks expanded by $180 billion, and new ones were created to enable foreign central banks to provide dollar liquidity support to their banks. The swap lines further increased and broadened over the coming months.
- The Federal Reserve, as lender of last resort, increased its balance sheet by almost one-third in two weeks and more than doubled it in seven weeks, reflecting more than $1 trillion in liquidity support through a variety of facilities.

Although imminent failures were forestalled, the collapse of liquidity did not abate. The liquidity of depository institutions became a more acute problem.

- Regulators closed Washington Mutual, a large mortgage lender, and its banking operations were bought by JPMorgan Chase 10 days after the Lehman bankruptcy. Depositors were protected, but subordinated debtors incurred losses, which accelerated the runoff of subordinated debt issued by other impaired institutions.
- Wachovia, which had an especially weak mortgage portfolio given its acquisition of Golden West, was next in the line of fire. A rescue by Citigroup was arranged over the following weekend with FDIC assistance. This was later supplanted through an acquisition by Wells Fargo, which did not call for FDIC support.

TARP first rejected and then passed by Congress and signed by the President, but distress remains high—Sept. 29, 2008, to Jan. 16, 2009

Meanwhile, the Treasury had recognized the need for a program of financial support that went beyond what the increasingly stretched Federal Reserve could be expected to provide under its mandate. TARP was developed as a $700 billion dollar commitment of appropriated funds to take toxic mortgages off the books of financial institutions. The initial three-page bill was badly

received in Congress. The Senate passed a more detailed version, but the House voted it down on Monday, Sept. 29, two weeks after the Lehman bankruptcy. The S&P 500 dropped 8.79% that day, the largest one-day decline in 21 years, and continued to slide over the following days, taking the fall from a year earlier to over 40%. The House quickly reconsidered, and a revised TARP became law on Friday, Oct. 3.

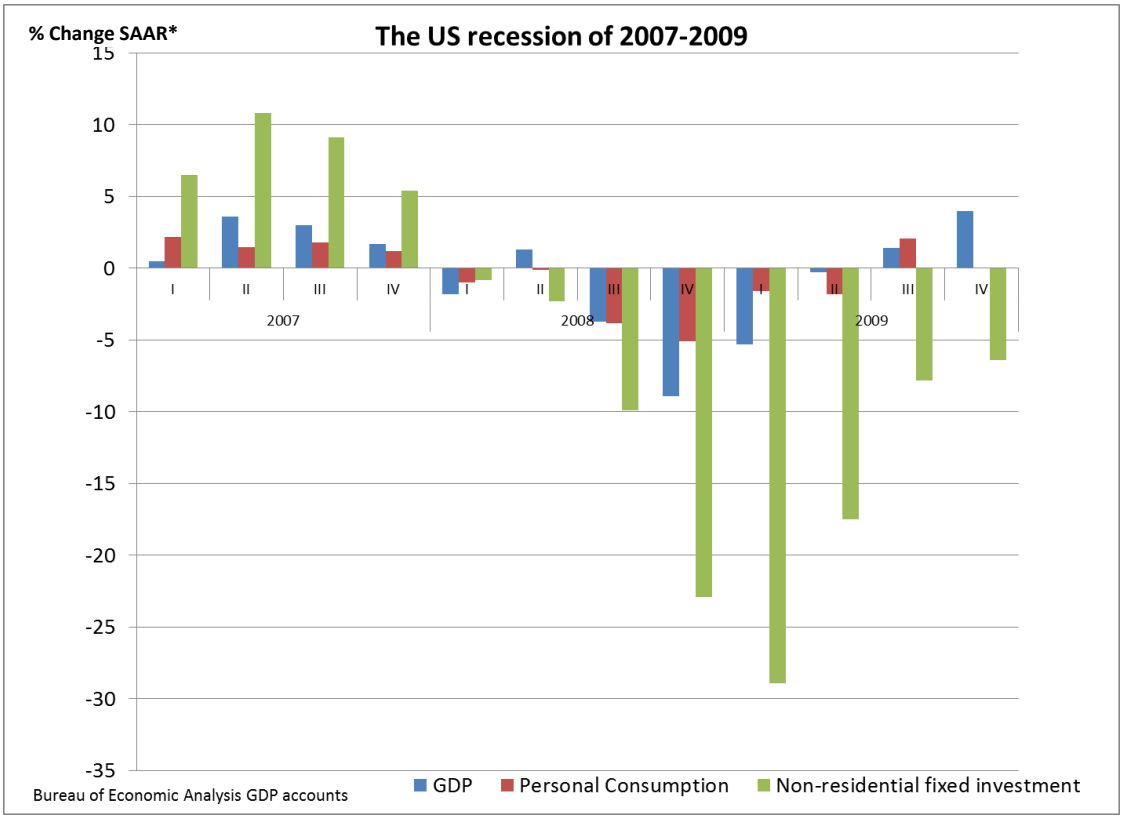
The original conception of TARP proved challenging to implement. The Treasury changed course and used the authority embedded in the legislation to directly recapitalize financial institutions instead of acquiring toxic assets. The CEOs of the nine largest financial institutions were called to Washington on Oct. 13. Secretary Paulson said that they were expected to accept capital infusions totaling $125 billion. This step, in retrospect, would begin to build a floor under the disintegrating financial system. The previous Friday, the TED spread reached its high point of 464 basis points. But calls for extraordinary emergency actions continued.

- The Fed would establish yet another program to relieve the loss of funding in the commercial paper market.
- The FDIC would provide guarantees for bonds issued by banks.
- A number of governments extended guarantees for some or all bank liabilities, including those of Australia, the U.K., Germany, Ireland, and South Korea, as well as the U.S.
- And the two largest U.S. financial institutions before the crisis required additional special support—Citigroup in November 2008 and Bank of America (which had amalgamated Countrywide and Merrill Lynch) in January 2009.

Bank of America proved to be the last rescue of a major financial institution, although the FDIC continued to work through a backlog of smaller underwater banks.

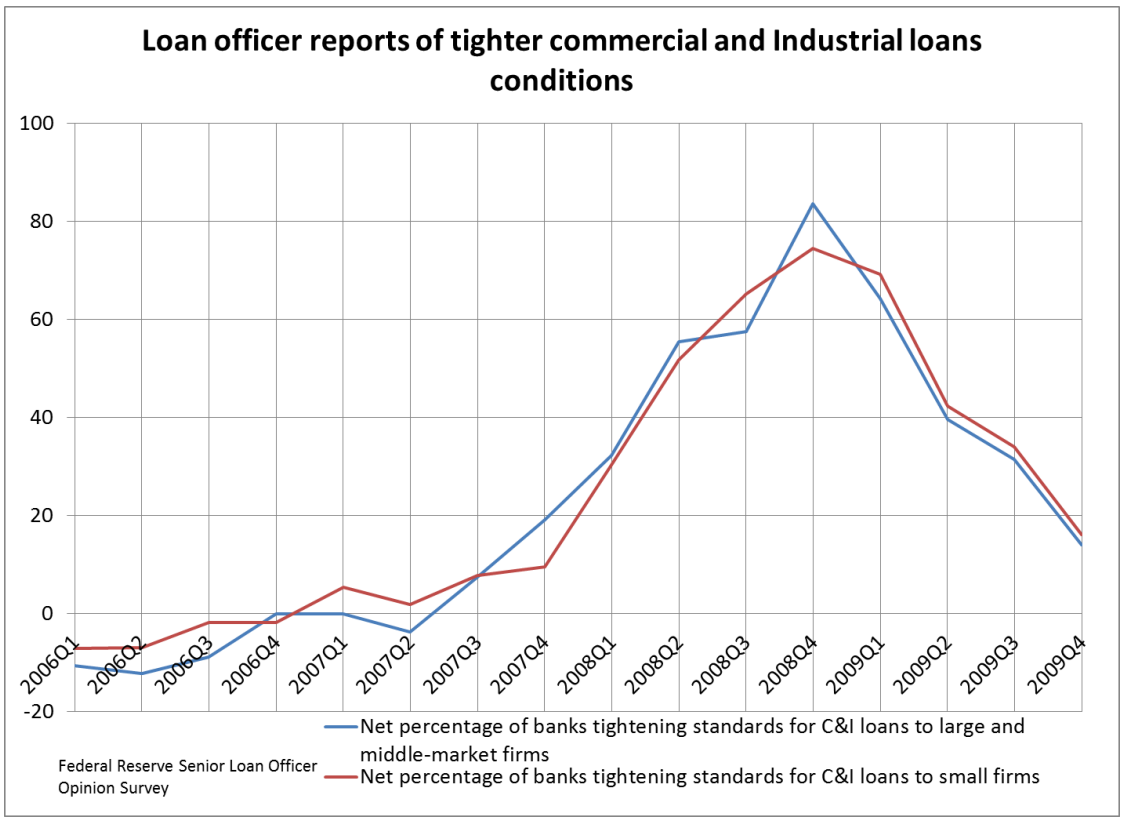
Recession gathers force in the U.S. and becomes global—September 2008 to June 2009

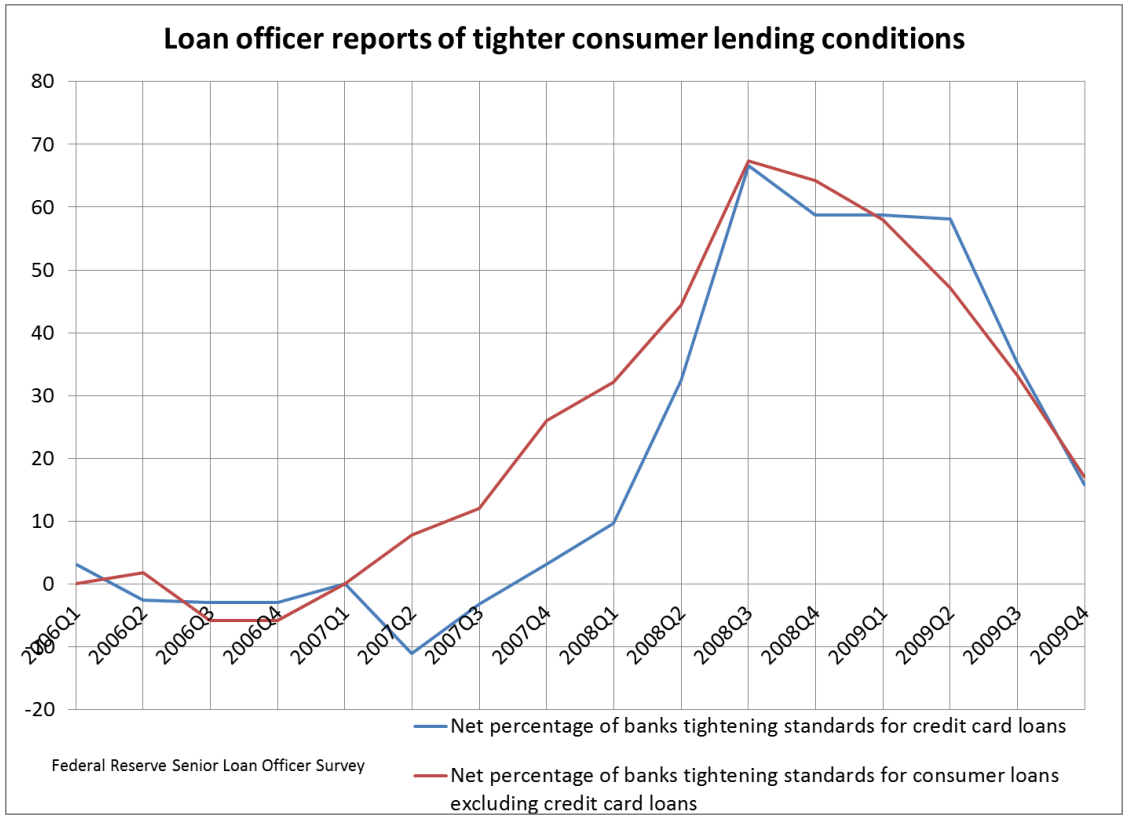
What in retrospect was a mild recession in the U.S. in the first half of 2008 became a steep decline as financial distress increased in the third quarter, even before the Lehman bankruptcy. Both household consumption and business fixed investment were declining going into the period of peak distress, and this accelerated in the fourth quarter.



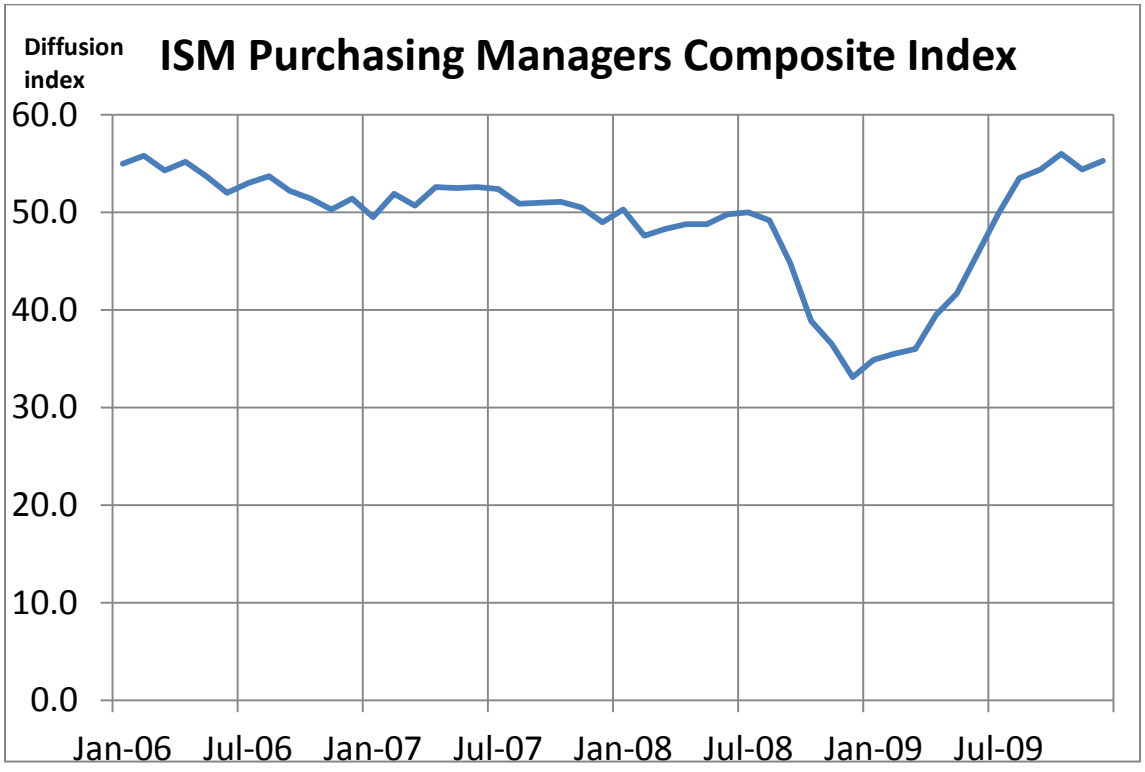
*** SAAR - Seasonally Adjusted Annual Rate**

Even before the Lehman shock, banks had begun sharply tightening their lending standards for both businesses and households, beyond mortgages.



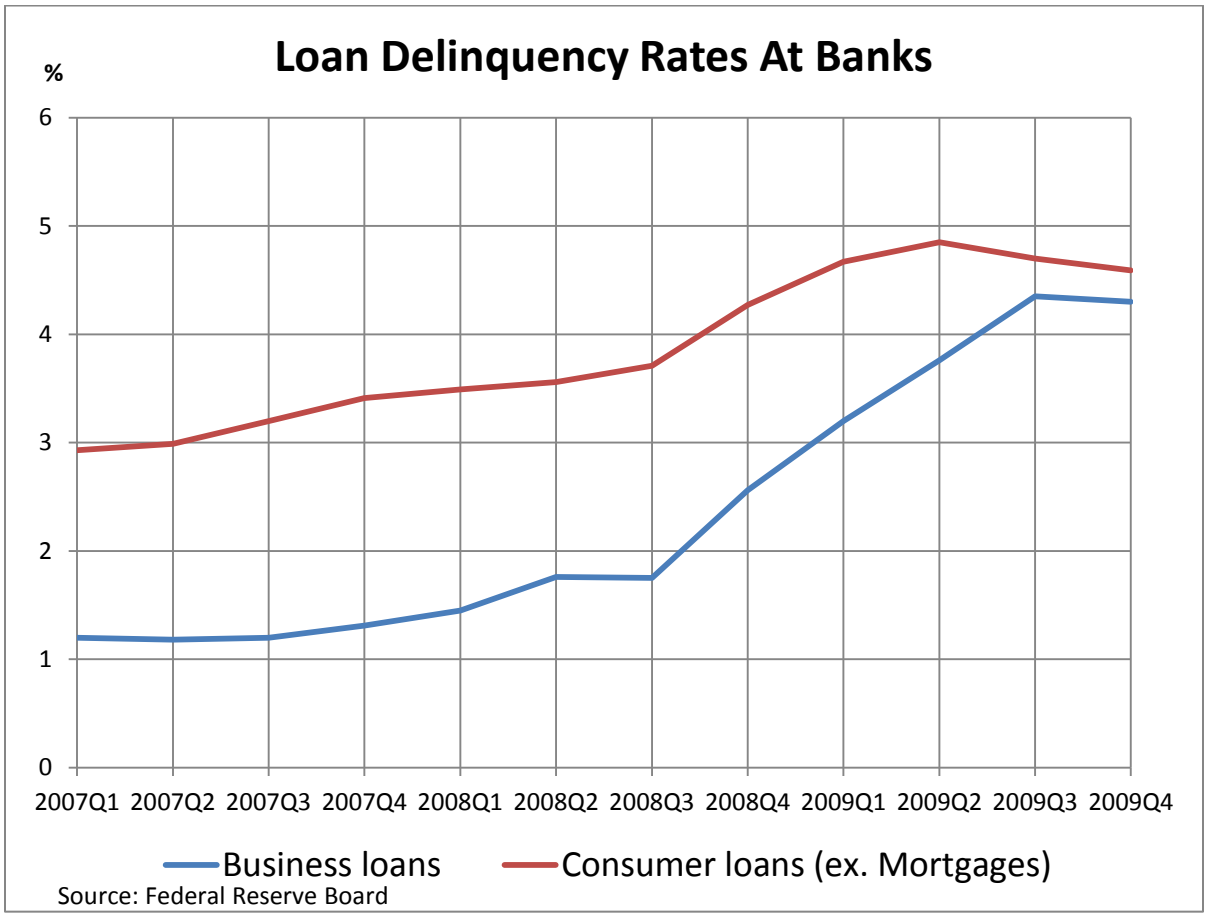


This added to the weight on consumers of falling housing prices and squeezed businesses, which had maintained a relatively positive outlook until September. The Purchasing Managers Index then showed a rapid deterioration of business expectations.



Source: Institute For Supply Management

As financial distress continued in the fourth quarter, the economic decline steepened, and it continued through the first half of 2009. The deep recession fed back into the financial sector. Lost family incomes compounded falling housing prices in creating mortgage arrears. Poor retail sales depressed commercial mortgage-backed securities, and delinquencies shot up on loans other than mortgages.



Source: Federal Reserve Board

The preoccupation with liquidity and safety among financial institutions spread to households and nonfinancial business. Wealth losses with stock markets dropping on top of home price declines continued to mount, encouraging deleveraging. Spending in the private sector declined. And access to credit contracted as banks stopped lending, although capital markets remained open for large investment-grade firms.

The active use of what was now a broad set of weapons by the authorities prevented further market-shaking events after November, even though revelations of weak capital positions continued to flow from the financial industry. By shortly after the start of 2009, the TED spread had receded to the low end of its range in the months before the Lehman bankruptcy.

Recovery and Reinvestment Act signed on Feb. 17, 2009, and stress tests of U.S. banks reported on May 7

Anxiety about both the financial system and the economy remained high, however, as President Obama took office in January 2009. Two policy actions set the stage for a turnaround:

1. The passage of the Recovery and Reinvestment Act, with its $787 billion of spending and tax cuts, put a floor under economic activity. The government became the spender of last resort as well as the lender of last resort. The recession reached its trough in June.
2. Continuing efforts to shore up the financial system were followed by what proved to be a decisive move toward reestablishing stability, with the Treasury ordering stress tests of the 19 largest banks, conducted by the Federal Reserve. The exercise was intended to assure the markets that the major U.S. banks were or would be soundly capitalized. It was successful in this. From the announcement of the results on May 7, the TED spread quickly returned to levels prevailing before the crisis.

The process of financial and economic reconstruction got underway in the second quarter of 2009. However, we have not yet reached the end of the long and hard path back to a robust economy, and the process of constructing a more stable financial system is still incomplete.

About the Author

Jeffrey Shafer is a consultant with a Ph.D. in economics from Yale who wrote this paper while engaged by Standard & Poor's Ratings Services. Early in his career, he served on the staff of the Board of Governors of the Federal Reserve System, the President's Council of Economic Advisers, the Federal Reserve Bank of New York, and the OECD. From 1993 to 1997, he was Assistant Secretary and, subsequently, Under Secretary of the U.S. Treasury for International Affairs. The author joined what would become Citigroup, and during the crisis period of 2007-2008, he led an analytical team in Citi Global Banking that sought to identify the economic and political forces shaping the business environment clients faced. Drawing on this experience and the literature on the crisis, he shaped the picture presented here while a Lecturer in the Woodrow Wilson School of Princeton University in the spring of 2013. He wishes to thank James Uko for his strong support in pulling together the data used in this paper. The views expressed are those of the author and do not necessarily reflect those of McGraw Hill Financial, Standard & Poor's Ratings Services, or the individuals who provided comments.

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[2] For example, Bernanke (2002).
[3] Taylor (2007),
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[18] Gorton and Metrick (2009)
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[20] Jacob (2002)
[21] Eichenwald (1991)
[22] See, for example, Fahlenbrach and Stulz (2009) and Cheng, Hong and Scheinkman (2013).
[23] Recent revelations have called into question the setting of LIBOR, but the distortions that may have been introduced would not have been large enough to greatly distort the picture that it provides of a global banking system in deep distress. If anything, the extremes of the spread may have been even larger than shown. Indeed, at the time, one heard that very few, if any, transactions were occurring at the high reported spreads.
[24] Bagehot (1873)
[25] Blinder (2013)
[26] Madigan (2009)
[27] Poole (2009)
[28] Taylor (2008)
[29] Cheng, Raina and Xiong (2013)
[30] **Analysis of Standard & Poor's database**
[31] Gramlich (2004)
[32] Federal Reserve Bank of St. Louis. (2013)
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[37] Fannie showed a very small fair value of $12.5 billion by including deferred tax assets as an asset which would have to have been written off under GAAP given the outlook.
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