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The Financial Crisis of 2007-2009

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Abstract

This summary of the financial crisis of 2007-2009 was prepared for The Handbook of Major Events in Economic History (Routledge; forthcoming), edited by Randall Parker and Robert Whaples.

Introduction

The financial crisis of 2007-2009 was the event which was not supposed to happen, but it did. Few economists thought that the U.S. economy would ever experience a systemic financial crisis again. Or that it would turn into a global crisis. But, the crisis, which began in August of 2007, developed into the worst crisis in the U.S. since the Great Depression. It has been unprecedented in its depth and scope.

Though unobserved by those not on trading floors, the crisis was started by a bank panic, a run on short-term money market instruments, in particular sale and repurchase agreements and asset-backed commercial paper. These markets had become so large that the refusals of investors to renew the short-term debt meant that large financial firms had to try to raise the cash by selling assets. Asset prices plummeted. The entire U.S. financial system was in danger of meltdown. Federal Reserve Chairman Ben Bernanke reported that of the thirteen “most important financial institutions in the United States, 12 were at risk of failure within a period of a week or two.”¹ The resulting loss of confidence, concerns about liquidity and the solvency of counterparties, led to cash hoarding and cutbacks in bank lending. Credit markets froze, real investment sharply declined, and millions became unemployed.

The recession in the United States spread around the world. It appeared for a time that a new Great Depression was going to occur, but central banks engaged in extraordinary efforts to stabilize the economy. Events were momentous. And, as of this writing, recovery has been weak at best.

Table 1 shows the global nature of the recession.

Table 1: The 2007-2009 Recession in Perspective

	Output	Consumption	Investment	Employment	Hours
U.S., Postwar Recessions vs. 2007-2009 Recession (percentage change)					
Average Postwar Recessions	-4.4	-2.1	-17.8	-3.8	-3.2
2007-2009 Recession (2007 Q4-2009 Q3)	-7.2	-5.4	-33.5	-6.7	-8.7
2007-2009 Recession, U.S. vs. Other High Income Countries					
United States	-7.2	-5.4	-33.5	-6.7	-8.7
Canada	-8.6	-4.6	-14.1	-3.3	-
France	-6.6	-3.4	.12.6	-1.1	-
Germany	-7.2	-2.9	-10.2	0.1	-
Italy	-9.8	-6.6	-19.6	-3.0	-
Japan	-8.9	-3.6	-19.0	-1.6	-
United Kingdom	-9.8	-7.7	-22.9	-2.9	-
Average other high-income countries*	-8.5	-4.8	-16.4	-2.0	-

Source: Ohanian (2010). *Canada, France, Germany, Italy, Japan, and the United Kingdom.

The top panel shows that the 2007-2009 recession was much worse than the average post-World War II recession, not surprising since the other recessions did not have systemic financial crises. The bottom

¹ *Financial Crisis Inquiry Commission Report* (2011: 354).

panel compares the U.S. crisis-related declines to those of other countries. Notably, the U.S. suffered steeper declines in investment and employment.

For comparison purposes, in the United States during the worst years of the Great Depression between 1929 and 1933, employment fell about 25 percent and output fell about 30 percent. The 2007-2009 financial crisis recession ranks as one of the worst in recent U.S. history, but it was not as severe as the Great Depression and the recession of 1937-38. The crisis of 2007-2009 did not become as bad as the Great Depression likely due to extraordinary actions taken by the Federal Reserve. To stem the crisis, the Federal Reserve lent a total of \$1.1 trillion to various financial firms. Four banks—Bank of America, CitiGroup, Royal Bank of Scotland, and Barclays Group—borrowed \$233 billion. These Federal Reserve programs were in addition to the U.S. government's Troubled Asset Relief Program (TARP), which allowed the U.S. Treasury to insure or buy up to \$700 billion of troubled assets. Further, there was The American Recovery and Reinvestment Act of 2009 of about \$800 billion. (GAO 2011: 132). The Federal Reserve actions may well have prevented the crisis from equaling or exceeding the Great Depression.

The financial crisis of 2007-2009 is difficult to understand because the bank run was not visible publicly. And the markets and financial instruments involved were not widely understood. The run happened in over-the-counter markets when firms and institutional investors ran on some financial intermediaries. Academic economists had not studied the markets and institutions that were at the core of the crisis, and so they were uninformed. Bank regulators were unaware of the transformation of the banking system and so they too were caught unaware. Into the resulting vacuum came many popular narratives of what happened, some highlighting problems that, while not at the essence of the problem, are important. Other narratives emerged that reflect populist anger and little else. Understanding the crisis of 2007-2009 is imperative in order to keep such an event from happening again, at least for a significant period of time.

What Has to be Explained to Understand What Happened?

To understand what happened it is important to be clear about what has to be explained.

First, the subprime mortgage shock which triggered the crisis was not large. The crisis was connected to subprime mortgages, a relatively new kind of mortgage that was designed to make home ownership available to lower-income people, but which depended on house prices rising for its efficacy. (Gorton 2010). When house prices stopped rising, there were expected losses on these mortgages, many of which had been securitized.² But, subprime was not large enough to explain the crisis. At the time of the crisis there was about \$1.2 trillion of subprime mortgages outstanding, about 80 percent of which had been securitized. Even if every single one of those mortgages defaulted with no recovery at all, it would not explain the magnitude of the crisis. Furthermore, the losses on subprime mortgages have not, in fact, been large. Park (2011) examines trustee reports on February 2010 for 88.6 percent of the

² Securitization means the pools of the mortgages had been sold into the capital markets via bonds linked to the pools.

notional amount of subprime bonds issued between 2004 and 2007. She calculates the realized principal losses on the \$1.9 trillion of originally AAA/Aaa-rated subprime bonds issued between 2004 and 2007 to be 17 basis points as of February 2011. The same point is by the Financial Crisis Inquiry Commission (FCIC) Report (2011: 228-29) by looking at the ratings on subprime mortgages. The FCIC notes that: "Overall, for 2005 to 2007 vintage tranches of mortgage-backed securities originally rated triple-A, despite the mass downgrades, only about 10% of Alt-A and 4% of subprime securities had been 'materially impaired'-meaning that losses were imminent or had already been suffered-by the end of 2009." So, if the shock was not large, how did we get a crisis?

Second, at the onset of the crisis all bond prices fell (spreads rose), not just subprime-related bonds. In particular, the prices of all manner of asset-backed securities fell. Why did the prices of, say, AAA/Aaa credit card asset-backed securities nose-dive when this asset class has nothing to do with subprime mortgages, and did not experience losses? Moreover, the prices of other securities falling closely tracked measures of the deterioration of bank counterparty risk, rather than track prices of subprime mortgages. Financial institutions' counterparty risk is usually measured by looking at LIBOR (the London Interbank Offered Rate), the rate at which large financial institutions lend to each other, minus the rate on the overnight index swap (OIS), which is taken as the riskless rate. So, LIBOR minus OIS (LIB-OIS) measures the risk premium in the interbank market. Figure 1 shows this measure of counterparty risk (LIB-OIS) together with the spreads on three categories of AAA/Aaa asset-backed securities – student loans, credit card receivables, and auto loans. Spreads on subprime did not follow this pattern, but rose continuously from January 2007 (Gorton and Metrick 2012). The measure of interbank counterparty risk and the spreads on non-subprime bonds moved together, but they did not move with subprime spreads.

Finally, any explanation of the financial crisis confronts another issue, namely, the question of whether the crisis of 2007-2009 was special, an unlucky convergence of a number of unique factors. Or, was it at root fundamentally similar to all the financial crises that have repeatedly occurred throughout the history of market economies internationally? This question is especially important for policy considerations.

The evidence discussed here can be summarized as follows. The crisis of 2007-2009 was triggered by a bank run in the (unregulated) wholesale financial markets, where non-financial firms and institutional investors do their banking with financial intermediaries. There was a bank run by institutional investors and firms on investment banks, which had been providing a deposit-like bank product to institutional investors and non-financial firms, namely, sale and repurchase agreements. Also, asset-backed commercial paper was another bank instrument that suffered runs.³ These markets had become very large over the previous thirty years. In fact, they were so large, that in the face of the bank run, it was not possible for the financial system to honor the claims for cash. Too much cash was demanded. This is what Chairman Bernanke was noting when he said that 12 of the 13 largest financial firms were on the verge of insolvency.

³ Asset-backed commercial paper is shortterm debt with a maturity of between one and 180 days issued by a special purpose vehicle (a legal entity, a kind of robot bank) which uses the funds to buy asset-backed securities.

Like other bank runs in history, this one was not irrational. Bank runs are not irrational. The problem is that there, in fact, is reason to fear counterparties' defaults, even if in the end very few firms are in fact insolvent. There is a problem with the banks and so there is a run. It is not the other way around. Previous banking panics occurred when public information arrived that there was a coming recession, when a leading indicator of recessions was above a threshold. See Gorton (1988).

The wholesale banking system that had grown over the last thirty years provided a transaction product for institutions, very similar to demand deposits, namely sale and repurchase agreements (repo). Repo works as follows: An institutional investor, say a bond fund, deposits \$100 million with an investment bank overnight. The fund will earn interest overnight on the deposit. To ensure the safety of this deposit, the investment bank will provide \$100 million of bonds as collateral. So, the fund will earn, say, 3 percent per annum overnight, and the bond (which the fund has taken possession of) earns, say, 6 percent. But the 6 percent accrues to the bank. So, like traditional banking the bank is earning a spread, the difference between 6 and 3 percent. Note that to conduct this banking business the bank needs to hold bonds, which it can finance via repo.

Banks produce debt; that is, their output is debt. The debt is used for storing value over short intervals, and it can be used in transactions. In order for bank debt to be used in transactions, it must be unquestionably worth par. In other words, it needs to have the property that counterparties need not perform due diligence on the debt when it is offered in payment. Prior to deposit insurance hundreds of millions of dollars of checks were exchanged at par without questions being asked. In the repo market, every morning hundreds of billions of dollars of repo would be renewed without any depositor seriously looking at the collateral. Banks aim to produce this kind of transaction product.

But, repo, like demand deposits before deposit insurance, was vulnerable, in the sense that information about a coming recession can make depositors worry. Concerns such as this led to a demand for the comfort of cash. As Ben Bernanke (2010: 3) put it: "Should the safety of their investments come into question, it is easier and safer to withdraw funds—'run on the bank'—than to invest time and resources to evaluate in detail whether their investment is, in fact, safe".

The Build-Up to the Crisis

Sale and repurchase agreements (repo) have been in existence for many decades; repo is not a new product. What is new are the changes that have occurred in the financial sector of the economy which created a demand for repo and changes that resulted in the creation of or supply of private collateral for use in repo. These changes are at the root of the growth of this alternative wholesale banking system. First, the growth of institutional investors or institutional cash pools created a demand for a bank product to use as interest-earning money. And second, the decline of the traditional model of banking, led to securitization, the creation of asset-backed bonds.

In the last thirty years a number of forces caused asset markets to become dominated by very large institutional investors. Pozsar (2011) identifies three forces. The first is globalization. Large global corporations now manage corporate cash pools centrally. Second, asset management firms and pension funds have grown very large, and they have centralized the liquidity management of mutual funds,

hedge funds, and separate accounts into large pools. Finally, derivatives-based investment strategies involve overlaying synthetic investments, that is cash is held in near-riskless investments and risk is taken using derivatives, rather than buying risky cash bonds. These pools of cash are typically \$1 billion or more.

This growth of institutional cash pools resulted in a demand for liquidity; in particular, the investors have a demand for insured deposit alternatives. But, the demands of these funds for “safe” assets far exceeded the available safe assets, U.S. Treasuries. Pozsar (2011: 3) estimates “that between 2003 and 2008, institutional cash pools’ demand for insured deposit alternatives exceeded the outstanding amount of short-term government guaranteed instruments *not* held by foreign official investors by a cumulative of at least \$1.5 trillion; the ‘shadow’ banking system rose to fill this gap” (emphasis in the original).

The shortfall was filled largely by asset-backed securities. In the 1980s, the traditional banking model became less profitable in the face of competition from money market mutual funds and junk bonds. Securitization, the sale of loan pools to special purpose vehicles that finance the purchase of the loan pools via issuance of asset-backed securities in the capital markets, was an important response. The growth of securitization was explosive. The private-label securitization market grew from under \$500 billion in issuance in 1990 to over \$2 trillion in issuance in 2006, the year before the crisis.

The shadow or wholesale banking system was the coming together of the demands for insured deposit alternatives by the institutional cash pools and the creation of asset-backed securities via securitization. In order to supply repo, the investment banks (or dealer banks) had to hold securities that could be used as collateral for repo. These repo banks were broker-dealer banks, the old investment banks, and the largest of the commercial banks, as well as many foreign banks. Officially, these U.S. banks are broker-dealers, “dealer banks” for short, not regulated depository institutions.⁴ These are firms that were often in the press, Goldman Sachs, Lehman Brothers, Bear Stearns, Citibank, Morgan Stanley, and so on.

It is hard to say how large this shadow banking system had become prior to the crisis. There are no official data measuring the overall size of this market. Various estimates suggest that it was around \$10 trillion, the same size as total assets in the U.S. commercial banking sector (Hördahl and King 2008). The fact is, however, that we do not know for sure. The European repo market is viewed as being much smaller than the U.S. market. According to the International Capital Markets Association European Repo Market Survey, the European repo market was EUR 4.87 trillion (\$3.5 trillion) in June 2009, having peaked at EUR 6.78 trillion (\$5.1 trillion) in June 2007, a fall of 31 percent. Asset-backed commercial paper (ABCP) was also large, but nowhere near as large as repo. ABCP peaked at about \$1.2 trillion in July 2007.

One way to see the growth of the shadow banking system is to look at the growth of the total assets of the U.S. dealer banks, the “banks” which specialized in repo banking. Looking at U.S. Flow of Funds

⁴ A dealer bank or broker-dealer operates as a securities dealer by underwriting and trading publicly-registered securities. “Investment banks” are dealer banks that do not have any depository function.

data, the ratio of the total assets of the dealer banks to the total assets of the commercial banks grew from 6.3 percent to about 30 percent from 1990 until 2006, just before the crisis, an increase of 376 percent. And, the Security and Exchange Commission filings of Goldman Sachs, Merrill Lynch, Morgan Stanley, Lehman Brothers and Bears Stearns shows that these five former investment banks together had financial assets worth \$1.4 trillion of which 48 percent were pledged as collateral at the end 2006. In other words, there was a very large repo banking system that had developed over a fairly long period of time. The repo banks needed to hold assets to be able to supply collateral to repo depositors. Repo banking is a depository banking system.

The shadow banking system is genuine. It serves a real economic function. But it was vulnerable in the same way that uninsured depository banking systems were vulnerable. And the vulnerability of a banking system peaks following a credit boom. Credit booms often precede financial crises. In fact, the one variable that is most robust in predicting the likelihood of a systemic financial crisis is the growth in credit prior to the crisis. (Schularick and Taylor 2012). In the case of the U.S. in the recent crisis, the credit boom took the form of an increase in the issuance of asset-backed securities, particularly mortgage-backed securities. This is visible in Figure 2, which shows the increasing amounts of outstanding debt of various types in the U.S. economy prior to the crisis.

A credit boom means that firms and households are borrowing substantially more in the economy. What are they spending this money on? Many people were buying homes. In the U.S. housing prices were rising so fast that many thought home prices best described as a bubble. Reinhart and Rogoff (2008) show that house price increases are coincident with many credit booms which precede financial crises.

Thus, the stage was set. The changes in the economy over a decades' long period had resulted in a very large wholesale banking system based on short-term, uninsured, debt instruments that were vulnerable to being run. There was a coincident credit boom and house price increases, a build-up of fragility, a sensitivity to a shock. The shock did not need to be large.

The Panic

The bank run began in August 2007, after months of problems in the subprime mortgage market. During the first half of 2007 a number of subprime originators had failed and prices of subprime-related securities had been deteriorating.

The bank run first took the form of an increase in repo haircuts or of a refusal to renew the repo at all. A repo "haircut" corresponds to a demand by a depositor for over-collateralization. For example, suppose a bond that was completely financed by borrowing in the repo market is subsequently only 90 percent financed. In that case, there is said to be a 10 percent repo haircut. Concretely, this means that there is a withdrawal of 10 percent, the amount that the borrowing bank now has to fund in some other way.

Here's an example. Let's suppose that an institutional investor deposits \$100 million overnight in a repo and receives bonds with a market value of \$100 million as collateral. The bank pays a 3 percent repo rate and the bank receives 6 percent on the bond collateral, even though the institutional investor has

taken possession of the bonds. In this case, the repo deposit is financing 100 percent of the bond. The next day the nervous institutional investor only deposits \$90 million overnight (he takes \$10 million back), but asks for the full \$100 million collateral. Now the bank has to come up with \$10 million dollars from some other source in order to finance the bonds. In this case the institutional investor has withdrawn \$10 million from the bank. It is a 10 percent haircut.

If there is no new funding forthcoming, the borrowing bank must sell assets to meet the demands for cash. When many firms are forced to deleverage in this way—all selling assets at the same time—there are fire sale prices, prices below the value of the assets. This happens because there are not enough buyers to buy this volume of assets. This is what happened. By September 2009, repo transactions by the primary dealers (the banks that are eligible to trade with the Federal Reserve) had fallen by about 50 percent from the level of activity prior to Lehman's bankruptcy. The *Financial Times* reported that "Overall repo activity in the US during the first six months of this year has fallen to levels not seen since 2003."

Haircuts continued to rise during the crisis, with the largest increases following the bankruptcy of Lehman Brothers. This is shown in Figure 3, which plots the average haircut on nine asset classes, two categories of corporate bonds and seven categories of structured products (Gorton and Metrick 2012)). The figure is consistent with a spiral downwards of prices, causing haircuts to rise, more assets to be sold, a further decline in prices, and so on.

Since haircuts are withdrawals from the repo banking system, these firms were forced to sell assets (because no one would invest new money in these firms). And, they chose to sell the specific assets that would raise the most money. To raise the most money you would want to sell valuable assets, AAA/Aaa assets that were unrelated to subprime. But, all the dealer banks did the same thing, they sold the same assets. This explains Figure 1.

To get a sense of the scale involved, consider a back-of-the-envelope calculation. Suppose the repo market was \$10 trillion and haircuts rose from, say, zero to thirty percent. That would be a withdrawal of \$3 trillion from the shadow banking system.

Real Effects from the Crisis

The resulting loss of confidence in counterparties, concern over liquidity and solvency in the financial sector, particularly after Lehman Brothers failed, resulted in cash hoarding and a decline in the supply of credit. Of course, in a recession the demand for credit goes down, but the financial crisis exacerbates the recession by also reducing the supply of credit even further.

Ivashina and Scharfstein (2010) look at syndicated loans, a market which has evolved over the last thirty years much like the shadow banking system. The syndicated loan market has become the main portal for large corporations to get loans. Lending via this market was 47 percent lower in the fourth quarter of 2008 than in the prior quarter and 79 percent lower than at the peak of the credit boom, which was the second quarter of 2007. Syndicated lending fell, but commercial and industrial loans reported by the U.S. regulated banking sector rose by about \$100 billion from September to mid-October 2008. But,

Ivashina and Scharfstein show that this increase was not due to an increase in *new* loans. In fact, this was another run on the banks, as corporate borrowers drew down existing credit lines, that is, credit lines that had been negotiated prior to the crisis. Their main point, however, is that banks that were more vulnerable to a run, those that were to a greater extent financed by short-term debt other than insured deposits, cut their syndicated lending by more. So, the supply of credit was reduced by fragile banks.

The reduction in the supply of credit had real effects. Campello, Graham and Harvey (2009) surveyed 1,050 chief financial officers in 39 countries in North America, Europe and Asia in December 2008 asking whether they were financially constrained during the crisis. Among other questions, the survey asks whether a firm's operations are "not affected," "somewhat affected," or "very affected" by the turmoil in the credit markets. Firms that described themselves as "somewhat affected" or "very affected" were then further probed with questions concerning the nature of the effects, e.g., higher costs of external funds or limitations on credit. For U.S. firms, 244 indicated that they were unaffected by credit constraints, 210 indicated that they were somewhat affected, and 115 said they were very affected (In Europe, the numbers respectively were 92, 71, and 26; and in Asia, the numbers were 147, 112, and 24).

While all firms cut back on expenditure and dividend payments and saw their cash holdings and the number of employees decline, the constrained firms contracted these policies much more, in a very noticeable (and statistically significant) way. For example, unconstrained firms reduced the number of their employees by 2.7 percent on average, while constrained firms reduced the number of their employees by almost 11 percent. With respect to investment during the crisis, 86 percent of constrained U.S. firms reported that they bypassed attractive investments, compared to 44 percent of unconstrained firms.

What are the constraints that firms face? Eighty-one percent of the very affected firms reported that they experienced less access to credit; twenty percent cited problems with lines of credit. Thirteen percent of the constrained firms said that they drew down on their credit lines to have cash in the future. And 17 percent drew down their credit lines as a precaution, compared to six percent of the unconstrained firms. In other words, it seems that the reductions in credit that Ivashina and Scharfstein (2010) reported in their study of banks led directly to and resulted in the constraints studied by Campello, Graham and Harvey (2009).

The Policy Responses

The sudden and deep deterioration of the financial markets, and then the real economy, called forth some extraordinary policy responses, including monetary policy, central bank lending programs, bailouts, and fiscal stimulus programs. These are discussed by the Bank for International Settlements in Chapter VI of the *79th Annual Report*, International Monetary Fund in Chapter 3 of the *Global Stability Report*, GAO (2011), and Cecchetti (2009), among others.

Central banks created many new and innovative programs to address the immediate funding needs of financial intermediaries, particularly after Lehman Brothers' failure. Governments also took action to prevent the collapse of the financial sector. In the U.S, Congress passed the Emergency Economic

Stabilization Act of 2008 which authorized the creation of the Troubled Asset Relief Program (TARP) and allocated \$700 billion for that purpose. This came to be commonly viewed as a bailout of the financial system.

The Federal Reserve System adopted a number of lending facilities, each with a different purpose and aimed a different group of affected firms. In total the loans from the Federal Reserve System reached \$1.1 trillion (GAO 2011).

Finally, the U.S. Congress passed a stimulus bill, The American Recovery and Reinvestment Act of 2009, which included about \$800 billion.

It is too early for a full evaluation of these policies. This is a task that will occupy economists for some time. For some early evidence, we turn to IMF (2009), which classified 153 policy actions across 13 major economies into five groups: interest rate cuts, liquidity support, recapitalizations, asset purchases, and liability guarantees. The IMF then performed event studies on the announcement effects of these actions of various measures of economic and financial stress. Overall, they found a mixed record of short-term success for most types of policy actions. The best results were found for two types of actions: first, liquidity support actions – mostly looser lending terms by central banks – which were effective prior to the bankruptcy of Lehman; second, recapitalizations of financial institutions – either through equity or subordinated debt – which were effective following the bankruptcy of Lehman.

Conclusion

The Financial Crisis of 2007-2009 was a watershed event in modern economic history. As the largest financial crisis and global recession since the Great Depression, the effects of this event are still felt strongly as of this writing. In many ways, the crisis followed the script of previous crises: a large build up of leverage throughout the economy, a sharp increase in housing prices, and a run on short-term debt. The novelty of this crisis was that the run did not take place in the traditional banking sector, but rather in the newly evolving wholesale or “shadow” banking sector formed at the nexus of securitization, money market mutual funds, commercial paper, and repurchase agreements. With this crisis, we have learned that old maladies can be present with new kinds of carriers, a challenge for policymakers and economists that remains unmet.

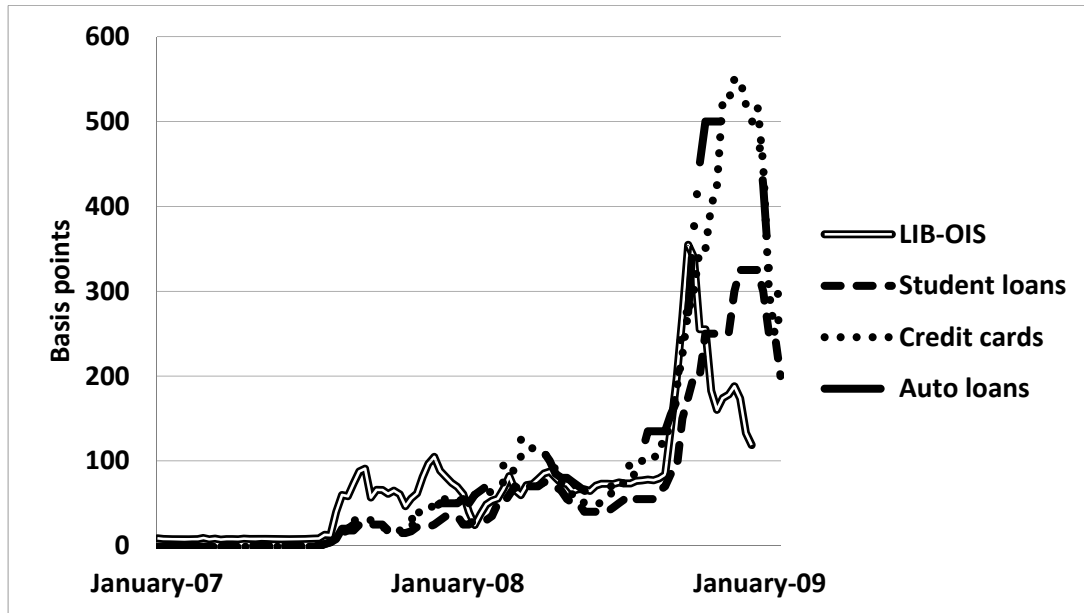
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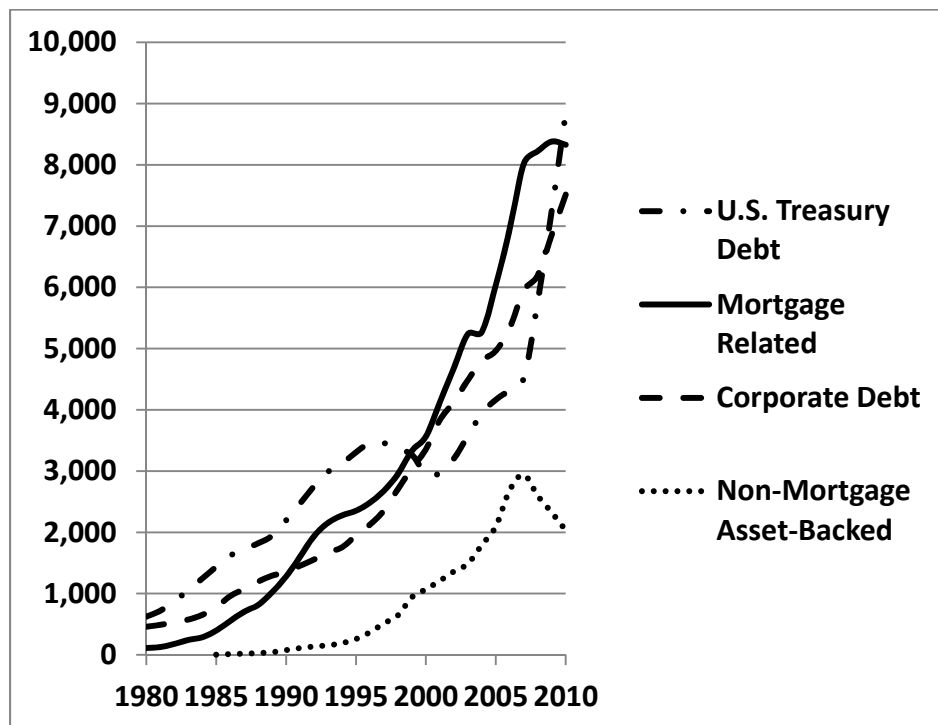
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Figure 1: Spreads on Non-Subprime-related AAA/Aaa Asset-Backed Securities and Counterparty Risk



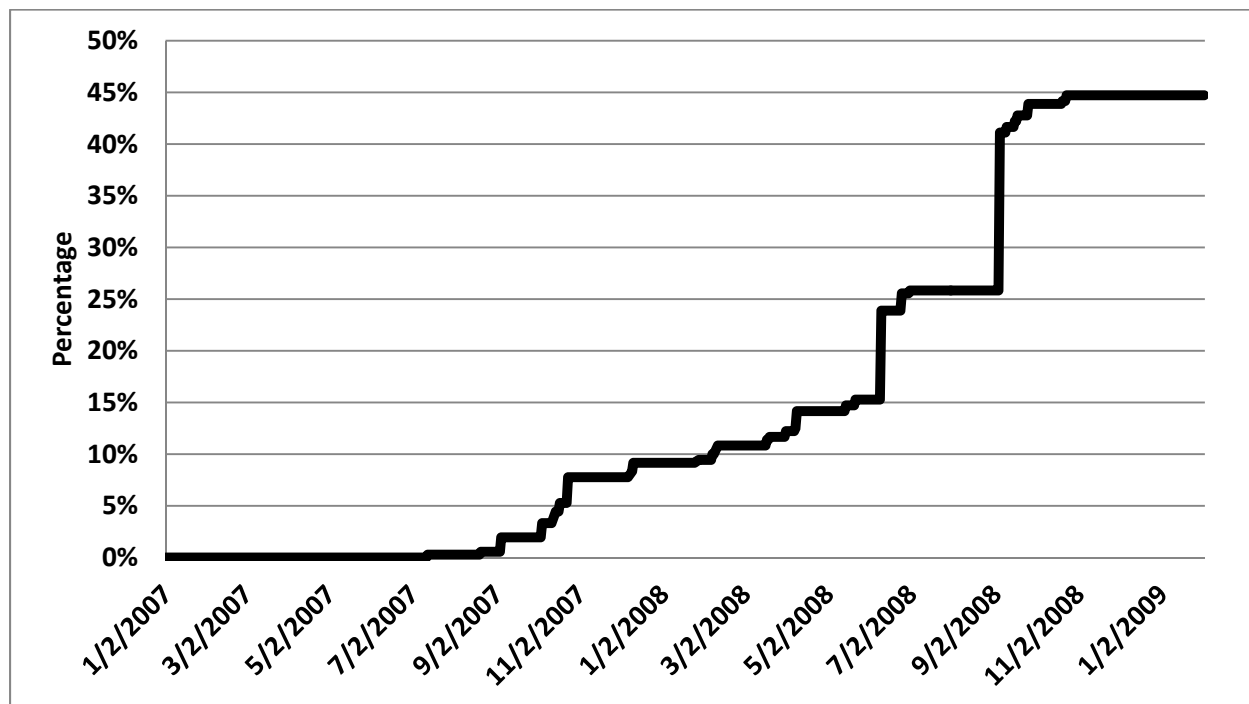
Source: Gorton and Metrick (2010).

Figure 2: Outstanding U.S. Bond Market Debt, \$ billions



Source: SIFMA, based on U.S. Treasury Department, Federal Reserve System, Federal agencies, Dealogic, Thomson Reuters, Bloomberg, and Loan Performance.

Figure 3: Average Haircuts (on nine asset classes)



Source: Gorton and Metrick (2011).

