The Efficacy of Monetary Policy

Following the 2008 Financial Crisis

by

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Introduction

In September 2007, the Federal Reserve made the first in a series of changes to the federal funds rate target that would bring it down to the zero bound within about 15 months. An unprecedented wave of liquidity programs and quantitative easing initiatives combined with the near-zero federal funds target to create one of the most significant and comprehensive monetary policy campaigns in the history of the Federal Reserve. Just as in the 1930s, the US's current economic malaise has been preceded by a serious banking crisis that has had widespread domestic and international effects.

Financial crises typically act to enhance and amplify contemporary recessions and create lasting effects that prevent a normal recovery in employment and GDP.[1] Despite being advanced in design and significant in magnitude, modern monetary policy has not been able to avoid the slow recovery that is typical of financial-crisis-related recessions. According to the Federal Reserve Bank of Minneapolis, seasonally adjusted nonfarm employment for the 2007 recession 50 months after the peak is still down 3.8%, compared to an average 5.8% increase for the other postwar recessions. Likewise, GDP is only 0.8% higher from the 2007 pre-recession peak 16 quarters later, compared to an average of 13.5% higher for all other postwar recessions.[2]

This paper will connect the transmission of recent monetary stimulus with the persistent effects of the banking crisis of 2008 in order to determine how these effects have contributed to U.S. monetary policy's inability to hasten the slow recovery that typically follows financial crises. The paper finds evidence that increased levels of counterparty, credit, and systemic risk

[1] Reinhart & Rogoff (2009); Hall (2010)
[2] Federal Reserve Bank of Minneapolis , "The Recession and Recovery in Perspective"

that surfaced during the crisis have contributed to lasting changes in the real economy and that these changes have hindered the transmission and intended goals of recent policy.

In order to analyze these connections, I first summarize a number of persistent effects of the recent banking crisis. This summary will bring together and cite a number of works that show the lasting effects of the banking crisis on debt markets, consumers, and institutions. The policy actions that I examine include the initial easing through the reduction of the federal funds rate to the zero bound, the initial round of quantitative easing that consisted primarily of purchases of agency mortgage-backed securities in 2009 and early 2010, and the second round of quantitative easing that was announced in November 2010 and completed in July 2011. Policy transmission mechanisms play an important role and are discussed with relevant banking crisis effects.

While it is generally understood that banking crises amplify recessions and have long-lasting effects well after the short crisis period ends and even once the relevant recession is over, there is little consensus as to why this is the case.[3] Unusual and little understood circumstances like this should lead to a reevaluation of the appropriate policy responses and potentially to the employment of rarer and more extreme actions. This proved true over the past few years as the severity of the crisis and the zero bound of the federal funds rate led to the adoption of large-scale asset purchases and long-term assurances of easy money. Although these are rarer policies, they are standard fare in a liquidity trap and are considered the basic central bank policy tools when at the zero bound for interest rates.[4] The occurrence of a banking crisis does not seem to matter to the reliance on these alternative policy tools despite the clear evidence that recessions linked to financial and banking crises are markedly different.

[3] Wynne (2011)
[4] Bernanke, Reinhart, & Sack (2004)

Monetary Policy in a Normal Economic Environment

In order to understand how monetary policy is affected by banking and financial crises, it is necessary to understand how it is expected to work in a normal environment. The Federal Reserve has several policy tools available that allow it to influence the money supply and interest rates: open market operations, changes in borrowed reserves, and changes in reserve requirements. Recently, the federal funds rate ("the interest rate on overnight loans of reserves from one bank to another") has become the primary focus of the Federal Open Market Committee (FOMC). At each meeting, the FOMC sets a target for the federal funds rate, and the tools listed above, such as open market operations, can be used to reach the target.[5]

The Federal Reserve's two mandates are to target price stability and high employment, both of which are closely tied to economic growth. Monetary policy transmits to the real economy through the effects that interest rates have on the economic decisions of individuals, firms, and other market participants. An easing of policy is achieved by lowering the policy rate. Lower interest rates reduce the cost of borrowing, leading to increased credit generation, and reduce the cost of capital, spurring investment spending, all of which is beneficial for economic growth. Raising the policy rate has the opposite effect and acts to curtail economic growth.

For the full process of monetary policy transmission to be realized, the real economy must act in accordance with the central bank's expectations. In a normal environment that is not dominated by extraordinary shocks or circumstances, lower interest rates will encourage borrowing, and higher rates will reduce borrowing, as intended by the policy makers. This is evident in the relative success of Federal Reserve policy in the decades prior to the 2008 crisis.

[5] Mishkin (2006), pp. 373

Systemic financial crises, however, provide the extraordinary shocks necessary to disrupt the credit cycle and interrupt the transmission of monetary policy to the real economy.

Banking and Financial Crises Effects

As Reinhart and Rogoff (2009) explain, banking crises are generally seen as amplifiers of recessions and not causal in their own right. But there are numerous characteristics of these crises that persist well after the economy has emerged from recession and continue to affect the way that markets function. The following attributes of banking crises pertain particularly to the recent crisis and recession of 2008, and thus the discussion draws primarily from relatively new literature that discusses this period. Some earlier work is considered as well, as most of these are characteristics of banking crises in general and appear in earlier episodes and research.

I classify the effects into three groups for ease of understanding: banking related, financial market related, and consumer related. While some effects fall into multiple categories or have spillover and secondary effects, they play different roles in each category and can be thought about as unique effects in each case. An example of this is the dearth of confidence, which manifested itself in important and different ways for institutions, financial markets, and consumers.

Banking Effects:

Confidence in individual banks and the banking and financial system as a whole has suffered significantly since 2008, and these changes comprise the most important effects in this category. The issue of trust and confidence for banks comes into play from multiple perspectives. Consumers' trust in banks has been eroded by Wall Street's central role in the crisis and by the

ensuing action and rhetoric that was related to the benefit of (bailouts) and against (new regulations, condemnations by policy makers) the industry. A 2010 Associated Press-GFK Poll found that 79 percent of people blame banks and lenders for the nation's economic problems, and an Ernst and Young report found that 44 percent of global bank customers lost confidence in the banking industry in 2010.[6]

Bank lending standards have increased dramatically during the crisis for commercial and consumer loans and for commercial and residential mortgages.[7] At the same time, however, excess reserves at depository institutions have exploded to almost incomprehensible levels, as seen in Figure 1. The long-run monthly average of excess reserves prior to September 2008 is below $1 billion.[8] Since September 2008, the monthly average has been over $1 trillion and peaked at over $1.6 trillion in July 2011. So, while credit standards have increased and lending has been curtailed, banks are sitting on record levels of reserves by many orders of magnitude, indicating that credit issues, as opposed to liquidity issues, are the most likely explanation for weak credit generation.

Although bailout costs are a unique feature of this recession when compared to previous recessions, Reinhart and Rogoff (2009) argue that estimates vary widely with methodology and time. The focus on these costs is inappropriate due to the lack of a widely-accepted method of calculation and incomplete because the effects of financial crises extend in many directions and are not remotely limited to the initial bailout costs.

New banking regulations in the U.S. are another example of significant change since the crisis. Also, uncertainty in expectations about future rules is currently apparent in the industry.

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[6] Associated Press, "Obama: Reform will hold Wall St. 'accountable;'" Ernst & Young, "Global Consumer Banking Survey 2011"

[7] See Figure 6

[8] Federal Reserve data; monthly average of excess reserves for January 1959 to August 2008 is $0.82 billion; monthly average of excess reserves for January 2000 to August 2008 is $1.8 billion

The ultimate effects of these factors are, however, still unclear and are outside the scope of this paper.

Financial Market Effects:

Financial markets froze in the fall of 2008 in many respects, and the ramifications of this episode are still apparent today. Krishnamurthy (2010) analyzes how debt markets malfunctioned during the crisis and outlines the key considerations that explain the seizure of markets and some lasting observable effects. While many of the other effects that are discussed in this section are difficult to quantify efficiently, there are several instances that pertain to financial markets where we can observe pronounced differences in interest rate levels and spreads pre and post crisis. These can indicate anything from new perceptions about counterparty and systemic risk, new limits on arbitrage ability, or less available capital.[9]

Krishnamurthy (2010) cites falling risk capital, rising repo haircuts, and increased counterparty risk as major characteristics of the crisis that have affected financial institution decisions, particularly by reducing liquidity. Tremendous losses to risk capital that were experienced by financial institutions during the crisis included real estate, consumer, and corporate debt. Looking at several estimates of capital across financial institutions, Krishnamurthy (2010) settles on an approximate $239 billion capital shortfall to the financial sector in 2009. A shortfall in risk capital reduces an institution's liquidity as well as increasing its risk aversion. As these losses were systemic and affected many institutions, they had subsequent effects on prices. Krishnamurthy (2010) indicates the feedback effect created here when falling asset prices create more losses for financial institutions, leading to reduced liquidity and higher risk aversion that again pushes prices down, and so on.

[9] Krishnamurthy (2010)

Repurchase agreement, or "repo," haircuts spiraled skyward for many of the more exotic, risky, and less liquid securitized products that were used as collateral. Krishnamurthy's (2010) explanation of the repo haircut describes the dual considerations of counterparty default and collateral recovery value. For many repo transactions, counterparty risks are limited due to the short-term nature of the contracts; but, with liquidity issues exacerbated during the crisis, the haircuts on less liquid collateral rose dramatically.

Krishnamurthy's (2010) data show repo haircuts on less liquid (relative to Treasuries) securities like Agency mortgage-backed securities, high-rated corporate bonds (A-/A3 and above), collateralized mortgage obligations (AAA), and other high rated asset-backed securities (AA/Aa2 and above) all growing to three to four times their spring 2007 levels by spring 2009. By comparison, repo haircuts for US Treasuries, which remained very liquid throughout the crisis, increased only about 1 percentage point for long maturities and did not change at all for short maturities during this same two-year period. This difference lets us isolate liquidity issues and concerns as the primary contributor to higher repo haircuts. While repo haircut data to 2012 would be useful to determine continued liquidity issues in these debt markets, Krishnamurthy's (2010) data seem to have come from a personal contact, and further data and sources are not readily available.

The last debt market malfunction that Krishnamurthy (2010) discusses is increased counterparty risk, primarily citing the Bear Stearns, Lehman Brothers, and AIG failures as key catalysts that affected perceived and actual risk and creditworthiness of institutions. The rapidity and magnitude of failures of high-quality credits like AIG and Lehman, in some sense, created counterparty risk where there had been none before. Fears of insolvency quickly spread to other major, high-rated financial institutions, which sent credit default swap rates soaring and froze

credit markets in the fall of 2008. Systemic risks of this scale were not on the horizon for many market players, policy makers, and academics, as Reinhart and Rogoff (2009) clearly show. The "this-time-is-different" syndrome convinced many active market participants and commenters that the US financial system was not in any serious danger and was well-equipped to handle any possible threat; unlike previous systems that once faced crises and failed, the current US system was believed to be resilient and developed enough to withstand and avoid shocks.[10] When this belief swiftly unraveled in the fall of 2008, markets reacted, and evidence of this experience remains today.

As measures of counterparty and systemic risk, we can look at the 30-year swap spread and the LIBOR-OIS spread throughout the crisis to 2012. The 30-year swap spread is the difference between 30-year US Treasury bond rates and the 30-year interest rate swap rate, which is the fixed rate one must pay in an interest rate swap to receive a floating (generally LIBOR) interest rate for 30 years. The spread between three-month LIBOR and the three-month Overnight Index Swap (OIS) rate is another signal of market stress, and its unusual movements during and after the crisis may have repercussions for policy effectiveness. The OIS is "a measure of what the markets expect the federal funds rate to be over the three-month period comparable to three month Libor. Subtracting OIS from Libor effectively controls for expectation effects, which are a factor in all term loans, including three-month Libor. The difference between Libor and OIS is thus due to things other than interest rate expectations, such as risk and liquidity effects."[11]

Because the 30-year interest rate swap generally represents an interest rate from a bank, and thus counterparty risk from a bank, the interest rate swap rate is expected to be and has

[10] Reinhart & Rogoff (2009)
[11] Taylor (2009), pp. 9

historically been above the respective Treasury rate for the same maturity. However, as seen in Figure 2, since November 2008 the 30-year swap spread has been negative, indicating that 30-year swap rates are below 30-year Treasury rates. Krishnamurthy (2010) emphasizes that this not only contradicts our intuitive expectation, but also creates a particular anomalous arbitrage opportunity: first, an arbitrageur can purchase a 30-year Treasury bond in the market and receive 3.15% as of March 1, 2012. To finance this transaction, the arbitrageur can use the Treasury bond as collateral to enter a repurchase agreement, rolling over the repurchase agreement every three months and paying the then prevailing repo rate. Then, the arbitrageur can enter a 30-year interest rate swap paying 2.85% fixed interest as of March 1, 2012 and receiving three-month LIBOR reset every three months.[12] Krishnamurthy (2010) summarizes the Treasury purchase and the swap trade as:

"*Treasury Purchase:*

Receive [3.15]% per annum for next 30 years

Pay 3-month repo rate, rolled every 3 months, to finance the purchase

And…

Swap Trade:

Pay [2.85]% per annum for next 30 years

Receive 3-month LIBOR rate, reset every 3 months, for next 30 years."[13]

Interest rate risk is eliminated if the repo and LIBOR rates move one-to-one. Additionally, LIBOR has historically averaged about 40 basis points higher than the Treasury repo rate, has never been below, and recently has been 100 to 300 basis points above the Treasury repo rate. Even if this spread closes, LIBOR should remain above the Treasury repo

[12] Bloomberg
[13] Krishnamurthy (2010), pp. 21-22

rate as LIBOR represents a bank's counterparty risk compared to repo lending against Treasury collateral.[14] On the fixed side, the trade also pays 2.85% for 30 years. Yet, more than three years after this opportunity appeared, the spread remains negative. Krishnamurthy (2010) attributes this to "limits of arbitrage" that were present in the market when the spread initially became negative, particularly a lack of available risk capital, a higher repo rate than usual, and even a need to provide collateral for the swap payments.[15]

The fact that this anomaly remains may signal higher perceived counterparty risk than existed before the crisis, particularly for such a long maturity because this anomaly is not present for shorter tenor swap spreads. Whereas major failures of institutions and markets were not on the minds of market participants before 2008, recent experience has taught them otherwise. Counterparty risk could also affect one's ability to enter even the Treasury repo market as a borrower. A Fitch Ratings report shows that the repo market is dominated by a small number of "large, systemically-significant financial institutions" and that this concentration became exaggerated during the fall of 2008 as "the 10 largest counterparties [accounted] for virtually all repo activity."[16] This concentration indicates that smaller counterparties were cut off from some repo funding even as haircuts on Treasuries were fairly steady throughout the crisis.[17]

Historically, the LIBOR-OIS spread has been around 10 basis points, but Figure 3 shows how it blew out, first, in 2007 and then again, to an even greater degree, in October 2008.[18] Taylor and Williams (2009) show how the unprecedented spread is primarily due to counterparty risk issues and not liquidity concerns by comparing it with the spreads between interest rates on secured and unsecured interbank loans of equal maturity. Taylor (2009) explains that a wider

[14] Ibid.
[15] Ibid.
[16] Fitch Ratings 2012, "Repo Markets, Shadow Banking Potential Liquidity Risks"
[17] Krishnamurthy, Nagel, & Orlov (2012)
[18] Taylor (2009)

spread due to increases in LIBOR can hamper the transmission of policy and have a negative economic effect "because trillions of dollars of loans and securities are indexed to Libor."[19] Interference with policy would likely have been the most severe in the 2007 to 2009 period when the spread was around 100 basis points or higher. The effects of this period of turmoil were not so short-lived, however, as the average spread for January 2010 through March 2012 was about 21 basis points, almost 90% greater than the average of 11 basis points for the December 2001 to December 2006 period.[20]

Consumer Effects:

Consumers played a significant role in the crisis through their primary roles in the housing and labor markets and the concurrent drop in consumer expenditures. Monetary policy initiatives were undertaken in an attempt to alleviate some of the pressure on these markets and to provide support to consumers. Fed Chairman Ben Bernanke's February 2009 testimony to Congress outlined plans to support consumer credit by lending against asset-backed securities that were backed by consumer loans (auto, student, credit card, etc.) and purchasing long-term securities that were backed by residential mortgages to assist the housing and mortgage markets. These two initiatives were intended to, respectively, "lead to lower borrowing rates and improved access in the markets for consumer and small business credit" and to "lower mortgage rates, thereby supporting housing activity and the broader economy."[21]

However, consumer behaviors with respect to spending and borrowing have changed since the crisis. The psychological effects of what amounts to personal austerity are not easily forgotten, and they are still leaving their mark on individuals' decisions. We can consider the

[19] Ibid. pp. 9
[20] Ibid.
[21] Bernanke before the Committee on Financial Services, U.S. House of Representatives (2009)

personal saving rate, seen in Figure 4, as a broad measure of consumer spending and saving decisions throughout and following the crisis period. When the rate increases, consumers are spending less of their disposable income (on average). One can see that the rate jumped sharply from 3.9% to 8.3% between April to May of 2008, only a few months after the recession officially began in December 2007 and as the Bear Stearns incident was playing out. Importantly, the rate has remained elevated since this initial spike, and the post-crisis average has been significantly higher than the average for the decade preceding the crisis. From January 2008 until the latest monthly data of February 2012, the personal savings rate has averaged 5.1%. By comparison, for the 10 years from January 1998 to December 2007 the rate averaged only 3.1%.

Another important point is that the highest rates of saving occurred while disposable income was declining during the second half of 2008 and the first half of 2009. So, consumers were spending a smaller share of a shrinking pool of income, instead of taking advantage of whatever buffer that the savings rate provides. Instead of reducing savings to maintain a certain level of spending as incomes fell or even saving the same share of income as before, consumers settled on saving a larger percentage of their shrinking income.

This pattern is particularly evident when we examine the initial spike in the savings rate. The jump to 8.3% in May 2008 from 3.9% in April 2008 can be largely attributed to the Economic Stimulus Act of 2008, which consisted primarily of tax rebates totaling about $100 billion to middle- and lower-income households. Taylor (2009) emphasizes that this was one of many policies that failed to target the underlying causes of the crisis. In Figure 5, the spike in disposable income during the middle months of 2008 is apparent. However, personal outlays are clearly not affected in any significant way. Additionally, Taylor's (2009) research points out that "formal statistical work shows that the rebates had no statistically significant increase in

consumption."[22] Consumer attitudes and decisions concerning saving and spending are markedly different pre and post crisis.

Consumer borrowing behavior and ability has also changed significantly through the crisis. Figure 6 shows total outstanding consumer credit going back to 1943, when the Federal Reserve data began. The dip in the late 2000s is clearly unprecedented across the entire time series. In each of the twelve months from March 2010 to March 2011, outstanding consumer credit was 5-7% less than its level two years prior. The only other period where outstanding credit was lower than it was two years earlier was in 1992, but even then credit never fell below 2% of the level two years before. Plus, the ten months from May 2011 until the latest data of February 2012 are the first in the entire data set when total outstanding credit is less than its level four years prior.[23] Credit understandably shrank during the recession, but consumers have clearly been more reluctant to begin borrowing anew in the post-crisis environment than in any previous episode since the 1940s.

Credit standards for consumer lending have changed as well. Data from the Federal Reserve's Senior Loan Officer Opinion Survey on Bank Lending Practices shows in Figure 7a that a net percentage of bank respondents were tightening standards for residential mortgage loans from Q4 2006 through Q2 2010. Since then, there has been a net percentage of respondents that loosened standards only in three individual quarters, and none of these net amounts exceeded 6%.

Similarly, credit standards were tightened significantly for other forms of consumer borrowing, such as credit cards and auto loans, during the crisis and recession, as seen in Figure 7b. Although the recovery in these areas has been much healthier than for residential mortgages,

[22] Ibid.
[23] Federal Reserve Economic Data

it still pales in comparison to the heavy tightening that took place. Consumer credit standards were drastically increased during the recession and throughout the crisis, but the same degree of loosening has not taken place in the recovery. This would indicate that lending standards are on average more stringent than they were preceding the crisis.

Finally, Figure 8 shows monthly asset-backed security issuance from 2004 to 2012. Asset-backed securities are often collateralized with credit card and auto loans. We can see issuance rising steadily through early 2007 and then falling sharply as the recession and crisis hit. Average monthly issuance from 2004 through June 2007 was about five times that of the period from July 2007 through March 2012. Such significant curtailment in ABS issuance could be due to a number of factors, including less underlying loan demand, less demand for the ABS, or reduced loan origination due to credit issues. In this case, all of these factors had an effect and continue to play a role in the changed face of the ABS market.

Policies:

Federal Funds Rate

Beginning in September 2007, the Federal Reserve began a series of moves to reduce the federal funds target rate. Over the following 15-month period, the fed funds rate was brought from 5.25% to its current level of 0.0-0.25%. The progression of the effective federal funds rate since 2000 can be seen in Figure 9. As the primary tool of monetary policy, the fed funds target was the first resort in responding to what was a growing crisis at the time. Lowering the rate, an easing of policy, is intended to strengthen the economy and spur economic activity. Likewise, raising the rate, a tightening of policy, is intended to curtail activity and slow the economy.

In order to analyze policy, we must understand the policy maker's intentions as well as the ways in which the policy is expected to work and have its effect, known as the transmission mechanism. As fed funds and discount rate modifications are the standard monetary policy tools, we can examine regular press releases that announce the changes for relevant discussion and intentions. The tone of the first few announcements, starting with September 18, 2007, indicates some possible concerns about the economic outlook: "the tightening of credit conditions has the potential to intensify the housing correction and to restrain economic growth more generally" and "the pace of economic expansion will likely slow in the near term, partly reflecting the intensification of the housing correction." These initial moves were intended to "forestall some of the adverse effects on the broader economy that might otherwise arise from the disruptions in financial markets and promote moderate growth over time."[24]

The theme of "disruptions in financial markets" is present throughout the remaining press releases and is one of the focuses of this paper. For example, the October 8, 2008, release, which announced a new target of 1-1/2 percent for the federal funds rate, emphasized that "the intensification of financial market turmoil is likely to exert additional restraint on spending, partly by further reducing the ability of households and businesses to obtain credit."[25] Market turmoil and disruptions play an important role in interfering with the transmission mechanism on top of their usual credit-disrupting effects. In clarifying that the concerns over "financial market turmoil" and "disruptions" are primarily due to restraining spending and credit generation, the Fed appears to be ignoring the potentiality for serious "turmoil" and "disruption" to affect the usual policy mechanisms.

[24] Federal Open Market Committee, Press Release 9/18/2007; Federal Open Market Committee, Press Release 10/31/2007
[25] Federal Open Market Committee, Press Release 10/8/2008

There are a few important transmission mechanisms for the standard tool of monetary policy: first among them is the effect that interest rates have on the cost of capital, which in turn affects investment decisions, as described by Boivin, Kiley, and Mishkin (2010). Expectations are a key part of this, as modifications to the short-term rate generally affect long-term rates because they are partially determined by expected future short-term rates. They also highlight consumption-based channels, which are understandably important due to consumption's significant contribution to GDP. By lowering interest rates and increasing the demand for capital assets like stocks and real estate prices, monetary policy contributes to a rise in household wealth. Prior theory cited by Boivin, Kiley, and Mishkin (2010), "indicate[s] that consumption spending is determined by lifetime resources of consumers, which includes wealth, whether from stock, real estate, or other assets."[26] So greater wealth leads to more spending, which boosts aggregate demand.

With respect to the investment channel, a decrease in the policy rate is expected to reduce the cost of capital and therefore spur investing activities and aggregate demand. However, the actual ability of firms and consumers to acquire the necessary capital seems to be either taken for granted or ignored altogether. Simply put, if lenders will not lend, then lower interest rates are not going to create much additional investment, even if firms and consumers want to borrow.

Lenders were reluctant to lend due to perceptions and market metrics of counterparty risk that increased dramatically at the height of the crisis and remain elevated into 2012. The behaviors of the 30-year swap spread and the LIBOR-OIS spread discussed above are perfect examples of the uniqueness of the recent crisis, and both demonstrate the elevated counterparty risk that has manifested itself in the past few years. The negative 30-year swap spread can be attributed to market participants' unwillingness or inability to arbitrage the trade because of new

[26] Boivin, Kiley, & Mishkin (2010), pp. 12

perceptions of counterparty risk. Some arbitrageurs may simply have been blocked out of the repo market due to who they were, even if they could provide the necessary collateral. Despite low rates and even good collateral, lending has been hampered due to changes to counterparty risk in the market, clearly interfering with the transmission of monetary policy.

The LIBOR-OIS spread also indicates serious shifts in counterparty risk. LIBOR has historically tracked the OIS rate very closely, but a widening spread due to a relative increase in LIBOR points to issues in the interbank market of counterparty or liquidity risk. As shown above, Taylor and Williams (2009) demonstrated that this widening is almost entirely due to counterparty risk. Plus, in the years following the crisis the average spread has been almost double that of the years preceding the crisis. The historical relationship has changed to a degree, and the policy rate is no longer as effective at reducing the important interbank rate.

These rate spreads also have secondary implications that can influence the transmission of the policy. Krishnamurthy (2010) defines a lack of available risk capital as a "limit of arbitrage," potentially explaining the anomaly of the 30-year swap spread. In the midst of the crisis, the risk capital to put on the arbitrage trade just did not exist. Banks likely were unable to lend in some cases because of a dearth of available risk capital even if rates and credit were satisfactory. The wider LIBOR-OIS spread implies a relatively higher LIBOR rate, which, as Taylor (2009) observes, increases the cost of trillions of dollars of borrowing, having a negative impact on credit and the economy.

Counterparty risk manifested itself for consumers as more stringent lending practices. The loan officer survey data discussed above clearly shows this, and the sharp dip and slow recovery of total consumer credit in Figure 6 can be partly attributed to tighter standards. Reluctance to borrow may also have contributed to the decline in consumer credit. Higher

personal savings rates during and after the crisis are a good indication of more austere consumer behavior that has reduced the attractiveness of borrowing despite low interest rates.

In addition to investment-based channels, wealth effects are meant to transmit policy through consumption-based channels. Figure 10 shows total owners' equity in household real estate as well as the share of total household net worth accounted for by real estate, going back to late 1998 from the Federal Reserve's Flow of Funds data.[27] The bursting of the housing bubble clearly took its toll and has left housing equity where it was in 1999. Historically low interest rates are surely bolstering home values, but the price declines from the peak, the large inventory of homes and pending foreclosures, and mortgage debt overhanging from the boom years are all weighing on household wealth.

Typical ways for households to take advantage of increased housing wealth include refinancing and taking out a home equity line of credit. However, counterparty concerns and stricter lending standards continue to hamper the ability of households to extract cash and equity. And, with about 12 million mortgages with negative equity as seen in Figure 11, many households are completely unable to extract any value from their homes.

Control over the short-term federal funds rate is the primary central bank tool, but there is clear evidence of changes and disruptions in the market that may affect the transmission mechanisms and possibly the efficacy of the policy. While quantifying these effects is beyond the scope of this paper, that exercise would likely be premature to an extent because much of the changes are still observable in the market today. When these market changes either revert to historical norms or become a new normal themselves, or when the policy rate is raised, would all be better markers for defining the end of the period to analyze.

[27] Federal Reserve Board's Flow of Funds

If these effects turn out to have significant consequences for policy rate transmission, how should monetary policy decisions incorporate this information? By nature, policy decisions are going to be made long before these kinds of effects can be fleshed out and fully analyzed. While they might have played a role in the most recent crisis, some of the more anomalous examples would indicate that this is not something that is always an issue and that in many cases transmission of monetary policy will operate as expected.

Also, there is little or no evidence of the policy being harmful at all on its own. Although transmission of the policy may be disrupted to a degree, it may still have provided a net benefit. Thus, it would be difficult and unlikely for a central bank to not ease if faced with possible transmission disruptions because even if they do occur the policy will be positive either way.

Further, there is the importance of market perceptions and expectations of the central bank in the face of a crisis. If the market perceived a serious threat and the central bank refused to act because of concerns about efficacy and transmission mechanisms, this could precipitate a Lehman-style event where the authority is not seen as playing its role as a backstop and market participants panic in response. In that case, of course, communicating the central bank's rationale would be necessary to moderate expectations. Instead of impacting initial policy decisions, understanding these effects could improve economic forecasting and help the central bank better control market expectations of monetary policy.

Quantitative Easing: MBS Purchase Program

In an effort to further support the economy and housing markets, the Federal Reserve purchased $1.25 trillion of agency MBS, "fixed-rate, mortgage-backed securities (MBS) guaranteed by Fannie Mae, Freddie Mac, and Ginnie Mae," between January 2009 and March

2010.[28] By focusing the policy on MBS purchases, the Fed hoped to "provide support to mortgage and housing markets" through "lower longer-term interest rates," as well as "foster improved conditions in financial markets more generally."[29] Support to the housing market would manifest itself through lower mortgage rates, which would fall as the yields on MBS come down as a result of the policy.

When the federal funds target was brought to its lower bound of zero, the Fed lost the ability to further ease monetary policy by directly reducing the short-term interest rate. In this situation, alternative policies need to be considered and implemented if there is a continued need for monetary stimulus. Bernanke and Reinhart (2004) discuss three types of policy actions that can have an effect on the economy when the policy rate is constant at or near zero: (a) affecting the market's expectations of future short-term interest rates via communication strategies; (b) adjusting the relative quantities of different types of securities that are owned by the central bank to change their supplies in the market; (c) and increasing the size of the central bank's balance sheet through asset purchases.[30]

The third alternative, increasing the size of the central bank's balance sheet, is referred to as "quantitative easing," and the Fed's MBS purchase program is of this type. Before 2008, the Fed's balance sheet holdings consisted almost wholly of Treasury securities. With the onset of the crisis, other asset classes began to make up a significant portion of the Fed's balance sheet, which grew from about $740 billion at the beginning of 2008 to over $2,600 billion in April 2012. As Figure 12 shows, balance sheet expansion began with liquidity facilities and support to specific institutions in 2008 (labeled "Other") and was maintained through the Fed's quantitative easing programs by purchasing Treasury, MBS, and agency debt securities.

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[28] Federal Reserve, "Agency Mortgage-Backed Securities (MBS) Purchase Program"
[29] Federal Reserve Bank of New York, "FAQs: MBS Purchase Program"
[30] Bernanke & Reinhart (2004)

Quantitative easing has a number of theoretical channels by which it can affect the economy. Bernanke and Reinhart (2004) suggest that "large increases in the money supply will lead investors to rebalance their portfolios, raising prices and reducing yields on alternative, non-money assets." In addition, large-scale asset purchases may be a more credible signal of the central bank's commitment to hold rates low than is a merely verbal communication of those intentions.[31] Credibility of the central bank is important, in part, because expectations of policy can have a meaningful impact on longer-term rates through expected future short-term rates.

Gagnon *et al.* (2010) echo these ideas but with an added focus on asset risk premiums. By reducing the relative supply to the public of longer duration assets with respect to assets compared with zero duration and convexity (in this case, supplies of long duration MBS were replaced by bank reserves with zero duration and convexity), large-scale asset purchases "reduce the risk premiums required to hold [riskier longer-term assets] and thus reduces their yield."[32] Another important point that they make about large-scale asset purchases related to debt market malfunctions is that "there may also be effects on the prices of longer-term assets if the presence of the Federal Reserve as a consistent and significant buyer in the market enhances market functioning and liquidity."[33]

Krishnamurthy and Vissing-Jorgensen (2011) also describe numerous channels by which quantitative easing programs affect interest rates. Through duration risk, liquidity, signaling, and several other channels, they show how each channel can have either positive or negative consequences for rates and how the type of asset being purchased has different consequences for different asset prices (i.e., purchasing MBS has a different effect on MBS prices than does purchasing Treasuries).

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[31] Ibid. 88
[32] Gagnon *et al.* (2010), pp. 2
[33] Ibid. pp. 5

Early research, including that of Gagnon *et al.* (2010) and Krishnamurthy and Vissing-Jorgensen (2011), estimates that QE1, which primarily consists of the MBS purchases, had a decidedly negative impact on rates. Chung *et al.* (2012) summarizes that this research estimates that the "first phase of the Federal Reserve's asset purchases reduced the general level of long-term interest rates by around 50 basis points, with estimates running as low as 30 basis points and as high as 100 basis points."[34]

However, transmission of the policy requires that it not only reduce rates, but also that those reduced rates stimulate the economy. So, those factors discussed above concerning transmission of the reduced federal funds target can also apply here.

We should also take a closer look at the housing and mortgage markets for consumers because the policy was primarily tasked with supporting those sectors of the economy. Observing only the decline in mortgage originations does not tell the full story. It is still fair to assume that by lowering rates, the policy has contributed to more originations than if the policy had not been undertaken.

Figure 13 shows the total value of single-family mortgages outstanding and the value of single-family mortgage originations each year from 1990-2011 (Q1 and Q2 2011 data are annualized quarterly amounts). Originations have collapsed, and the total outstanding value of mortgages has, at best, flatlined.

At the same time Fannie Mae, Freddie Mac, and the FHA have raised their standards for underwriting and insuring mortgages. Figures 14 and 15 depict the change in Fannie Mae and Freddie Mac's underwriting standards between 2006 and 2009 and a breakdown of the FHA's insured mortgages by credit scores from 2006 to 2009, respectively. Federal agencies have dramatically reduced the share of the mortgages that they guarantee or insure that go to high risk,

[34] Chung *et al.* (2012), pp. 68

low credit score borrowers. This has had serious consequences for these risky borrowers because, as Harvard University's 2009 "The State of the Nation's Housing" report explains,

> so complete was the shutdown of private mortgage lending that 73 percent of loans originated in 2008—and more than 85 percent of loans originated in just the second half of the year—were bought, insured, or guaranteed by a federal agency or by Fannie Mae and Freddie Mac.[35]

The government's involvement in the mortgage market has remained elevated since 2008, with federal ownership or guarantees for almost "90 percent of mortgage originations in 2010."[36]

With Federal government agencies and Fannie Mae and Freddie Mac dominating the mortgage market and imposing stricter lending standards, higher risk borrowers have been necessarily cut off. So, despite low rates and depressed home prices, many households are unable to borrow to the same extent as they were able to before the crisis. The policy has been unable to assist the full breadth of the market due to credit constraints arising out of the crisis period.

As mentioned above, as we continue to better understand the economy and the consequences of different kinds of shocks and scenarios, forecasting and policy should improve as a result. Chung *et al.* (2012) demonstrate how this is already the case for the recent crisis. Their work compares the predictions of several economic models made prior to the crisis with the predictions that those same models would have made about the crisis period utilizing additional data from 2007-2010.

> These simulations take account of the information learned over the past 3 years regarding both the structure of the economy, and most importantly, the incidence of large shocks

[35] Joint Center for Housing Studies of Harvard University, "The State of the Nation's Housing 2009," pp. 9
[36] Joint Center for Housing Studies of Harvard University, "The State of the Nation's Housing 2011," pp. 10

> during this period. Not surprisingly, the predicted probabilities of hitting the ZLB [zero lower bound] rise in most cases.[37]

Chung *et al.* (2012) focus on the predictability of hitting the zero lower bound on nominal interest rates. This is very relevant because "zero lower bound" events are primarily what force policy makers into alternative monetary policy strategies, such as increasing the size of the central bank's balance sheet. A better understanding of these events and their likelihood should aid policy makers in determining the size, scope, and necessity of alternative policy initiatives.

Quantitative Easing: Treasury Purchases

The Federal Reserve announced the planned purchase of $300 billion of Treasury securities in March 2009 as part of its initial balance sheet expansion, now referred to as QE1 (which also includes the purchase of $1.25 trillion agency MBS, discussed above, and $200 billion agency debt), to "help improve conditions in private credit markets."[38] Later, in November 2010, the Fed announced a new program to "purchase an additional $600 billion of longer-term Treasury securities," known as QE2, which would "promote a stronger pace of economic recovery and help ensure that inflation, over time, is at levels consistent with its mandate."[39]

In effect, many of the considerations discussed for both the federal funds rate and MBS purchases apply here too. Treasury purchases are intended to stimulate the economy in various ways (increased demand for borrowing, wealth effects, and portfolio balance effects) by reducing long-term interest rates. However, low interest rates might not be stimulating as much activity as

[37] Chung *et al.* (2012), pp. 59-60
[38] Federal Reserve Bank of New York, "Statement Regarding Purchases of Treasury Securities," March 18, 2009
[39] Federal Reserve Bank of New York, "Statement Regarding Purchases of Treasury Securities," November 3, 2010

would have been expected due to new considerations of counterparty and consumer credit risk and other changes in the functioning of financial markets.

Krishnamurthy and Vissing-Jorgensen (2011) conduct an event study on QE2 and its impact on interest rates. They determine that its primary effect is through a safety channel, by which the safest assets experience the greatest decline in yields (particularly, Treasury and agency debt yields fall relative to yields of agency MBS, which carry prepayment risk). Altogether, they estimate that QE2 reduced yields by about 20 basis points. However, the primacy of this safety channel with its effects on safe Treasury, agency, and highly-rated corporate debt "is a negative note for the policy as it indicates that nominal rates that are highly relevant for household[s] and many corporations—mortgage rates and [ratings] on lower-grade corporate bonds—were less affected by the policy."[40] The limited benefit to households and many corporations continues the theme of policy's ability to affect rates in general but not contribute entirely to credit growth and economic activity.

In July 2011, James Bullard, President of the Federal Reserve Bank of St. Louis, released a note expounding the significant benefits of QE2, which would be fully experienced within six to 18 months of the policy action. However, he points out that the financial market effects "occurred during the run-up to the November decision." Figure 16 depicts the 10-year Treasury rate and the level of the S&P 500 from 2010 through April 2012. When Ben Bernanke expressed a preference for further asset purchases at Jackson Hole on August 27, 2010, the S&P 500 began a rally that extended well into 2011. The financial market effects that Bullard notes during the run-up to November can be seen as the 10-year rate falls almost 150 basis points before and during the summer of 2010. While expectations of a significant policy action may have

[40] Krishnamurthy and Vissing-Jorgensen (2011), pp. 28

contributed to this Treasury rally, the European debt crisis was unfolding during this same period, and demand for safe assets such as Treasuries likely played a part. Once QE2 was officially announced in November, rates began to rise and remained elevated through July 2011, when the purchase program was completed. Shortly after completion, rates fell again to new lows.

So, while the event study and regression techniques of Krishnamurthy and Vissing-Jorgensen (2011) point to QE2's negative pressure on yields, it is interesting to see that rates during the policy's execution were significantly higher than immediately before and after this period. Of course, many factors contribute to the level of rates. Expectations of positive benefits to the economy due to QE2 may explain why rates and equities rose together. Plus, the currently low level of rates may be because of the effectiveness of QE2. However, the credit, counterparty, and systemic risk issues brought about by the banking crisis remain and continue to obstruct the creation of credit and stimulus of economic activity.

Conclusion

Monetary policy decisions require an understanding of how policy is going to be transmitted from initial announcement to the final effects on the real economy. The answers to these policy questions are going to change as our understanding of the economy improves, as well as when the economy itself changes. The recent crisis, recession, and recovery period is important by historical standards for monetary policy and for economics going forward.

The 2008 financial crisis amplified the concurrent recession, precipitated the U.S.'s slow recovery, and contributed to many of the lasting changes in the credit process, in counterparty and systemic risk considerations, and in the overall functioning of financial markets. These

changes have hindered the generation of new credit despite very easy monetary policy, both in terms of near-zero interest rates and unprecedented bank reserves. Many borrowers saw their eligibility for borrowing fall, if they didn't lose access to credit altogether due to insolvency or other issues. And, at the same time, banks and government agencies have prudently tightened their lending and underwriting standards.

This picture is eerily reminiscent of the 1930s image that was depicted by Bernanke (1983): "the growing level of bank liquidity created an illusion of 'easy money'; however, the combination of lender reluctance and continued debtor insolvency interfered with credit flows for several years."[41] Just as in the 1930's, flooding the financial system with cheap money in recent years has not lightened the persistent effects of the banking crisis that have led the economy into a protracted recovery.

While the exact size and scope of monetary policy to best counteract the combinatorial and latent effects of the banking crisis are unclear, it is imperative that further research continue to explore how these events affect the economy and what policies constitute the optimal response. As Reinhart and Rogoff (2009) have shown, even advanced economies have not been able to "graduate" away from banking crises historically. The latest crisis only solidifies the relevance of that point. With that in mind, it does not seem unlikely that similar events will appear on the horizon in the future. Policy makers would be wise to utilize every future opportunity to continue testing strategies and learning about how they can alleviate the severity of these crises.

[41] Bernanke (1983), pp. 272-273

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Figure 1. Excess Reserves of Depository Institutions

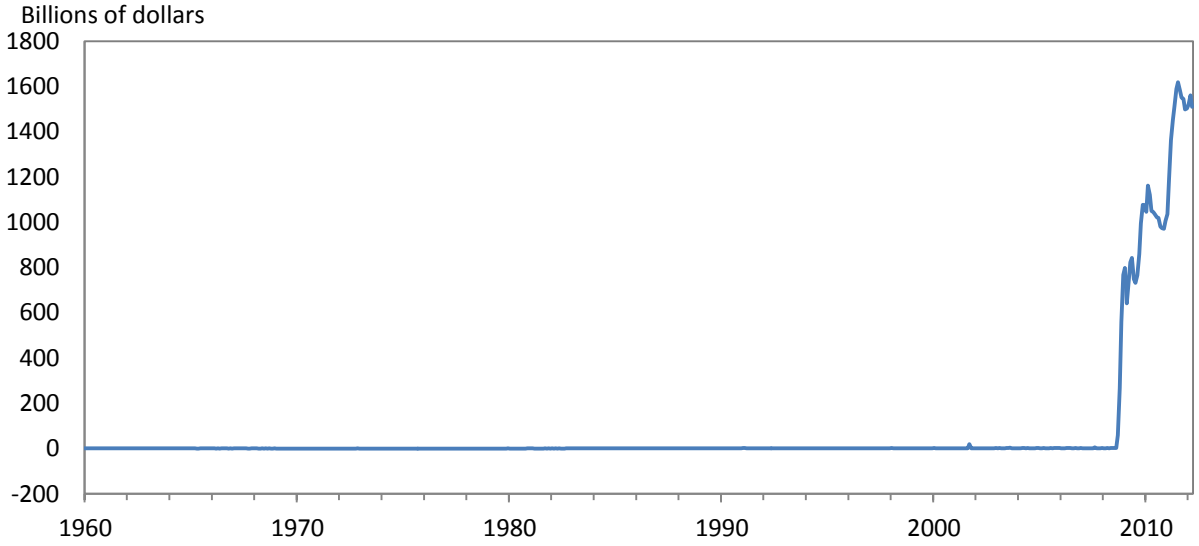
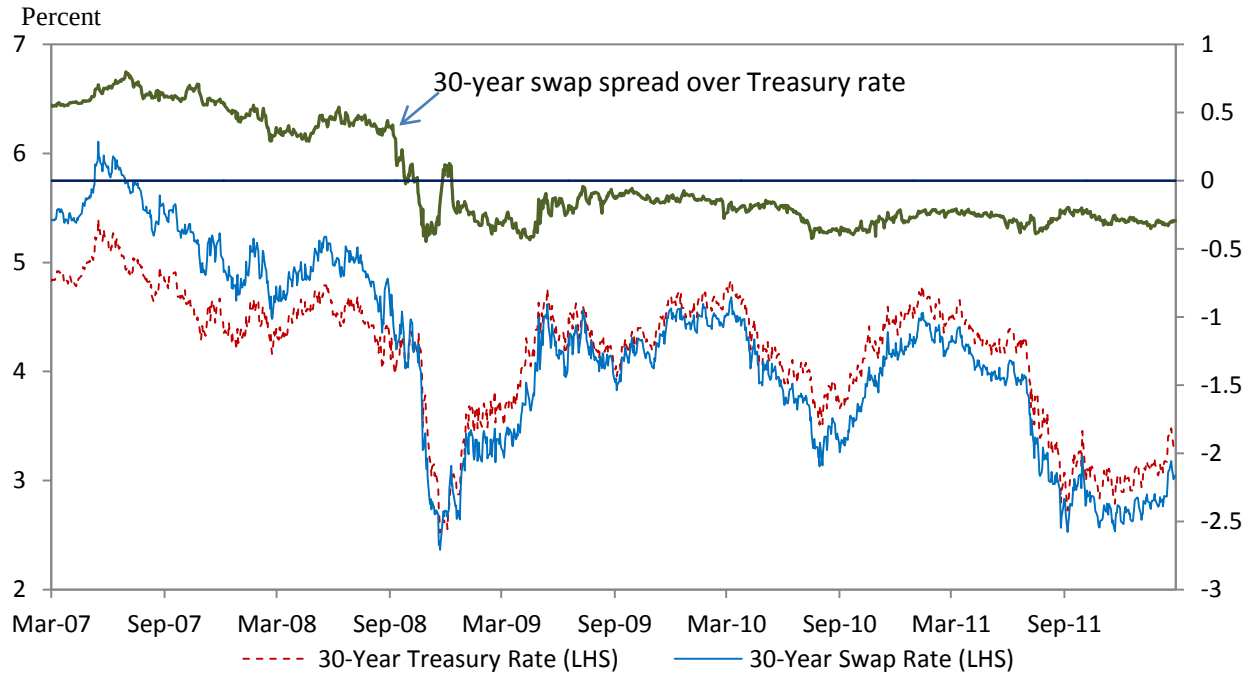
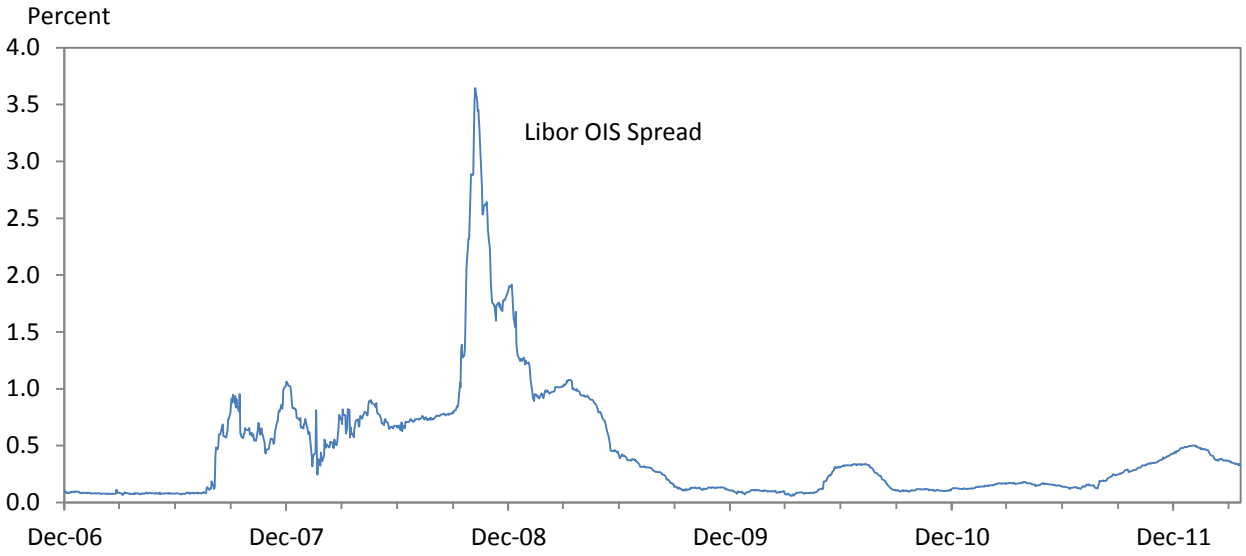


Figure 2. 30-Year Swap Spread



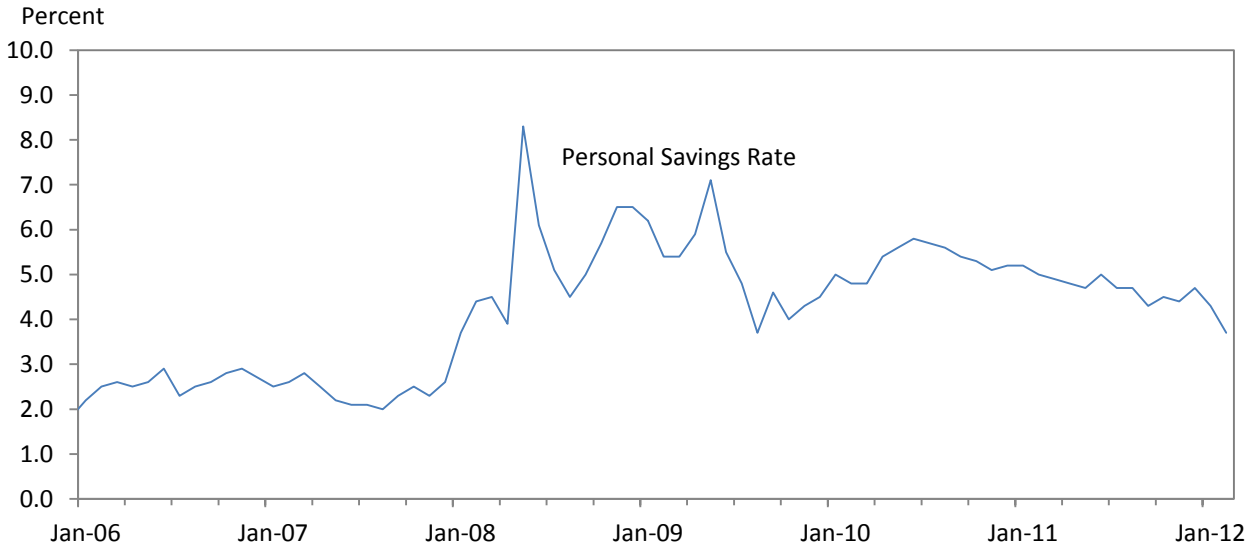
Source: Bloomberg

Figure 3. 3 Month Libor – 3 Month OIS Spread



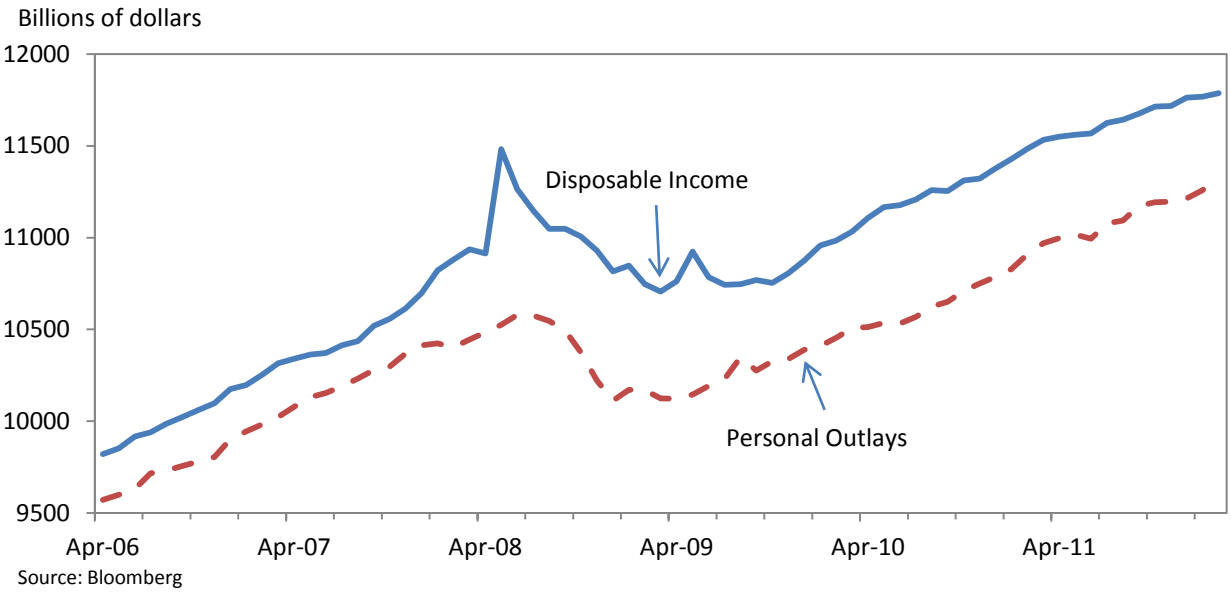
Source: Bloomberg

Figure 4. Personal Savings Rate



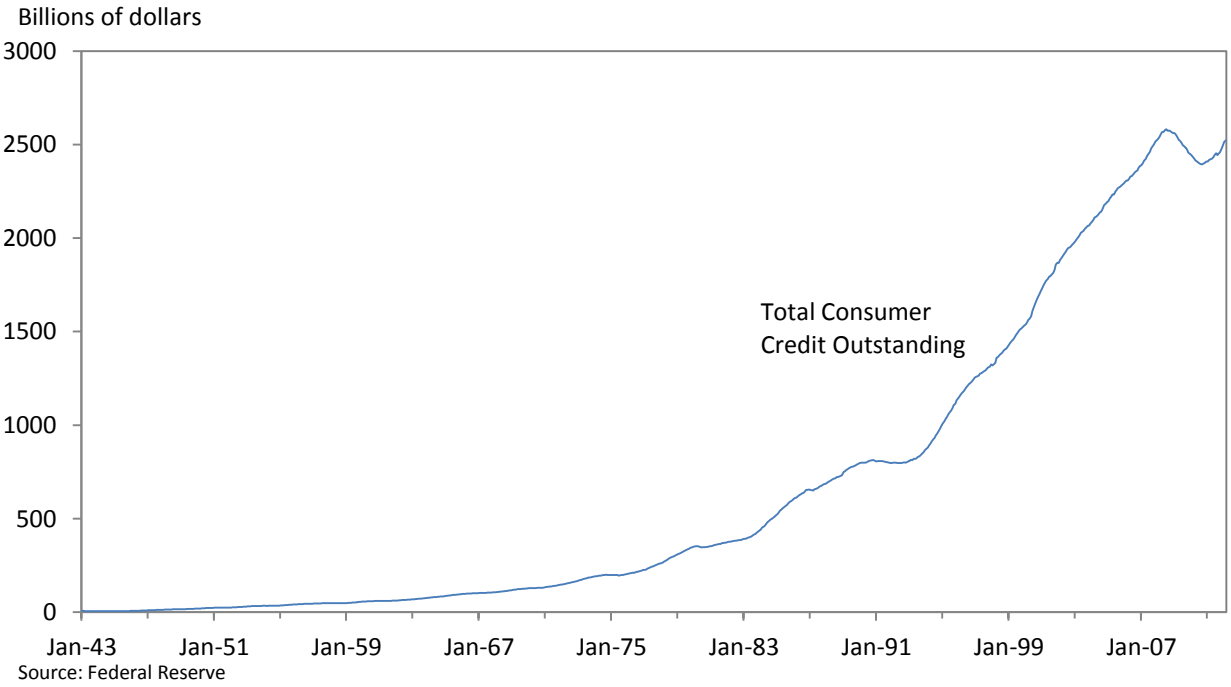
Source: Federal Reserve

Figure 5. Transitory Positive Income Surprise Has Negligible Effect on Consumption



Source: Bloomberg

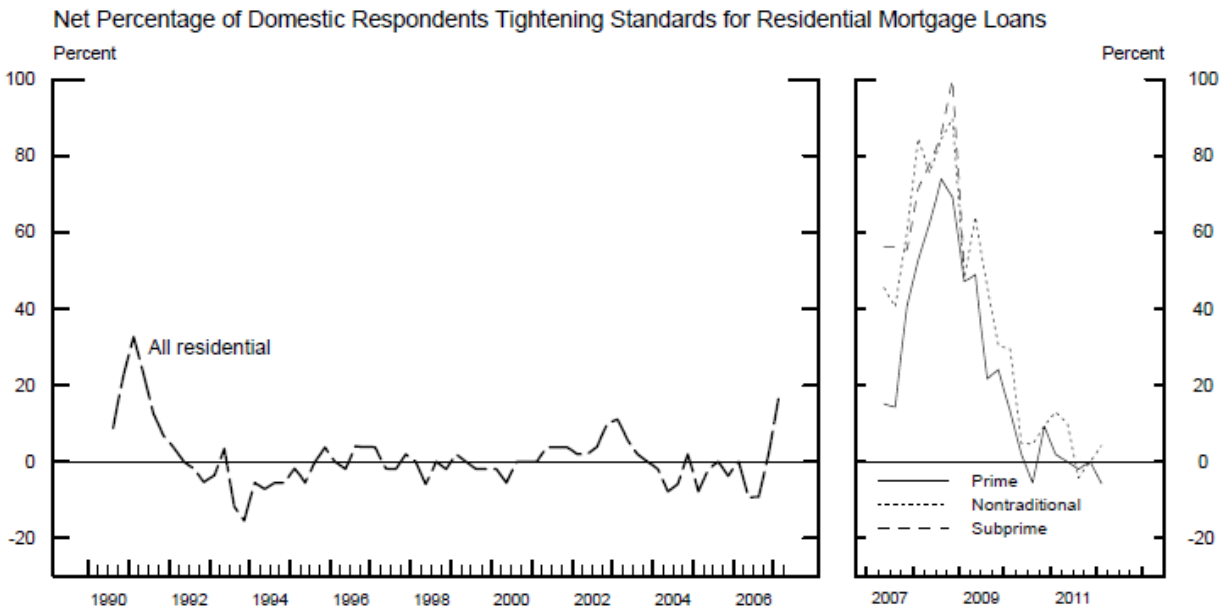
Figure 6. Total Consumer Credit Outstanding



Source: Federal Reserve

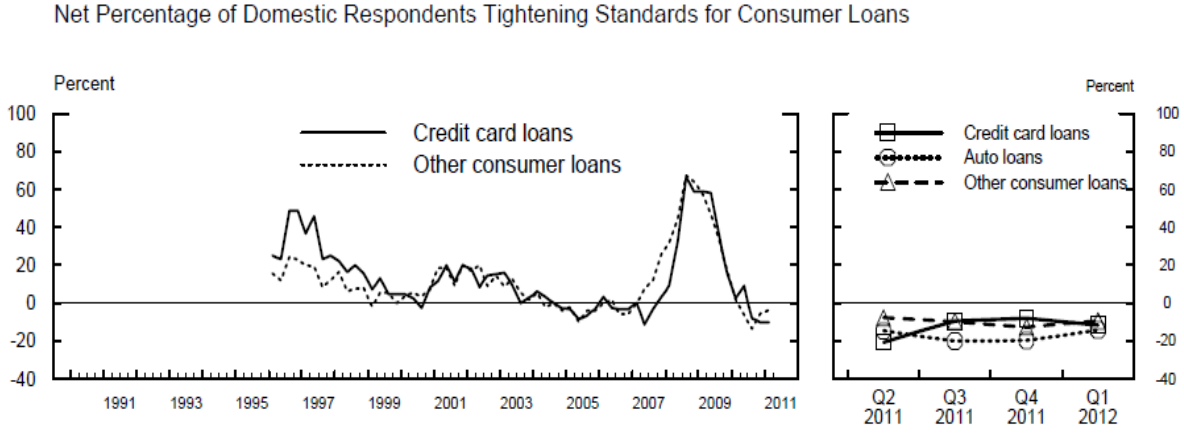
Figure 7. Lending Standards Tightened Significantly During the Crisis, Not Yet Loosened

a.



Note: For data starting in 2007:Q2, changes in standards for prime, nontraditional, and subprime mortgage loans are reported separately. Series are not reported when the number of respondents is three or fewer.

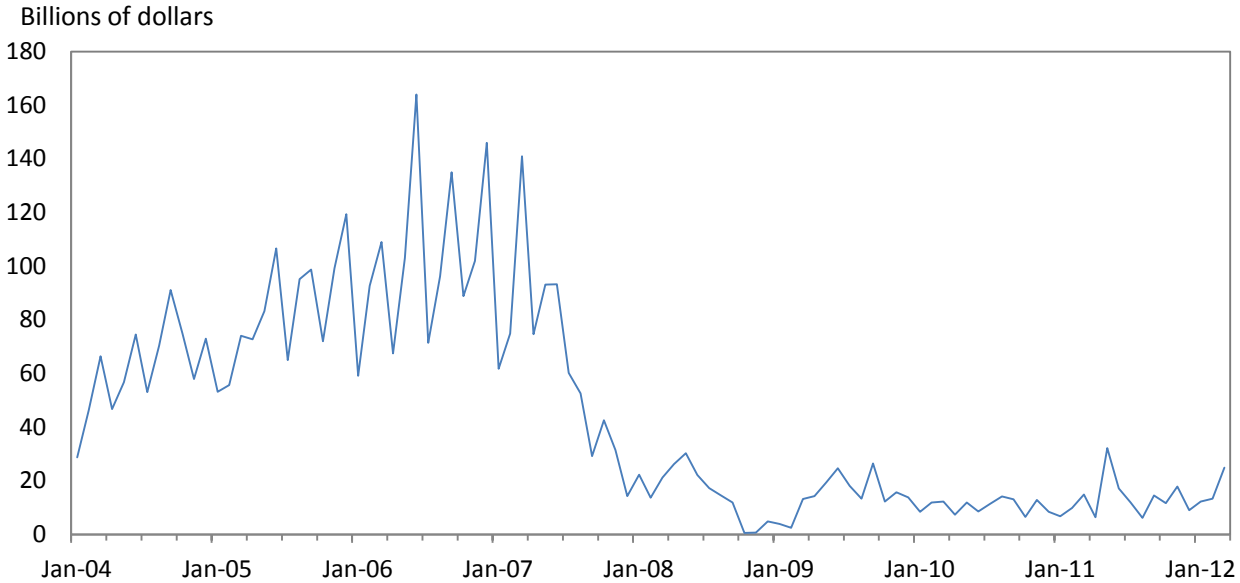
b.



Note: For data starting in 2011:Q2, changes in standards for auto loans and consumer loans excluding credit card and auto loans are reported separately. In 2011:Q2 only, new and used auto loans are reported separately and equally weighted to calculate the auto loans series.

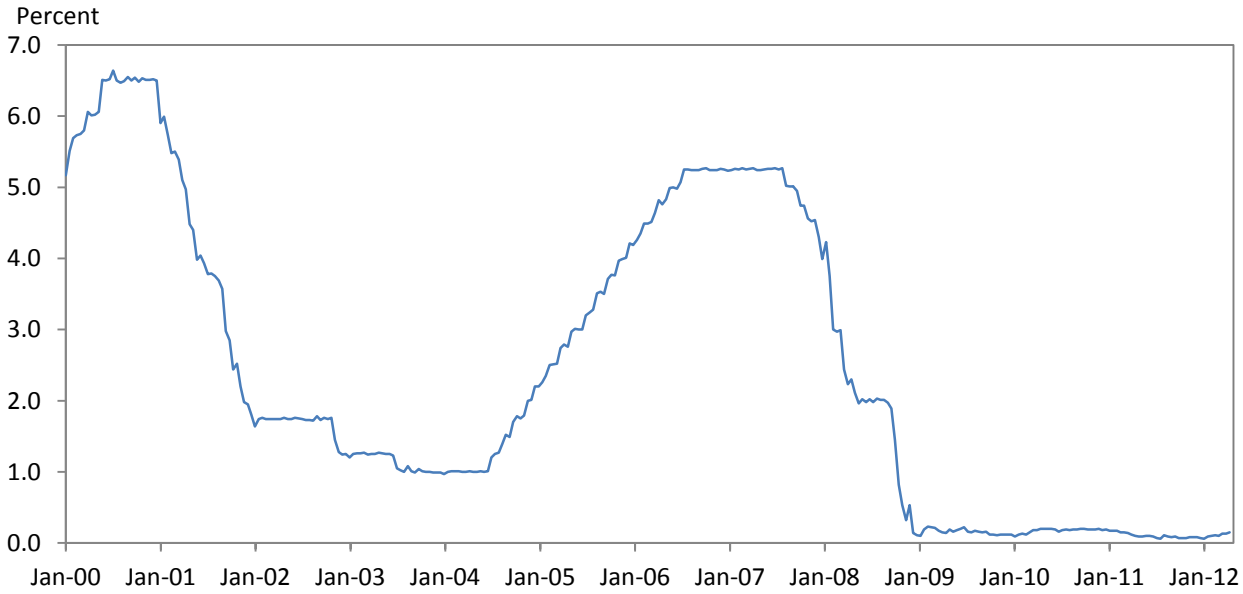
Source: Federal Reserve January 2012 Senior Loan Officer Opinion Survey on Bank Lending Practices

Figure 8. Monthly Asset-Backed Security Issuance



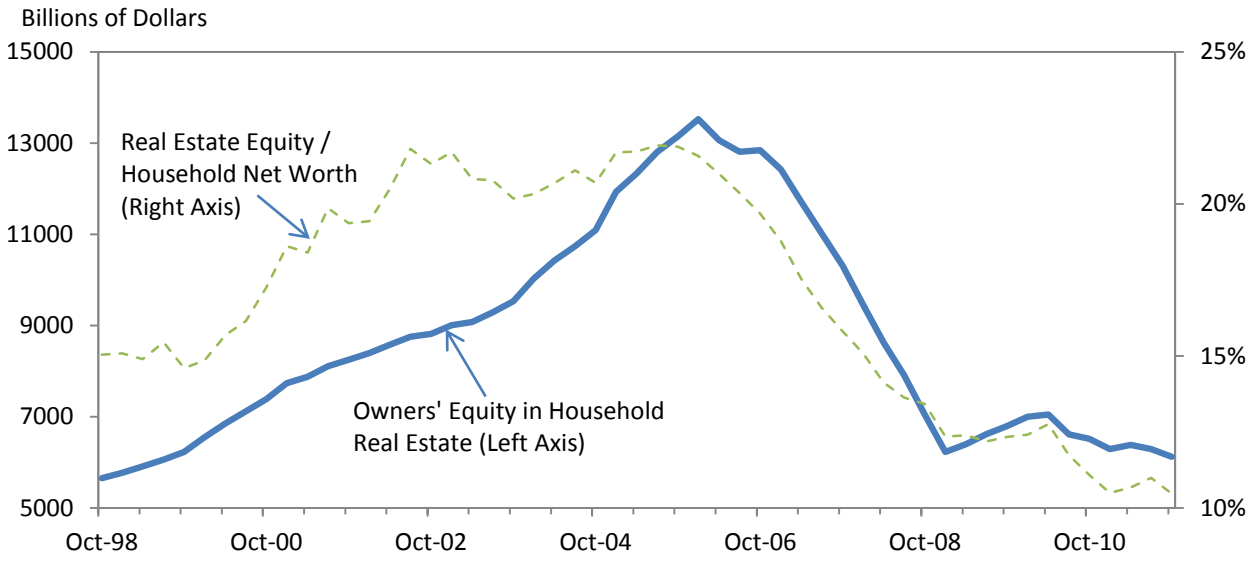
Source: Bloomberg

Figure 9. Effective Federal Funds Rate, 2000-2012



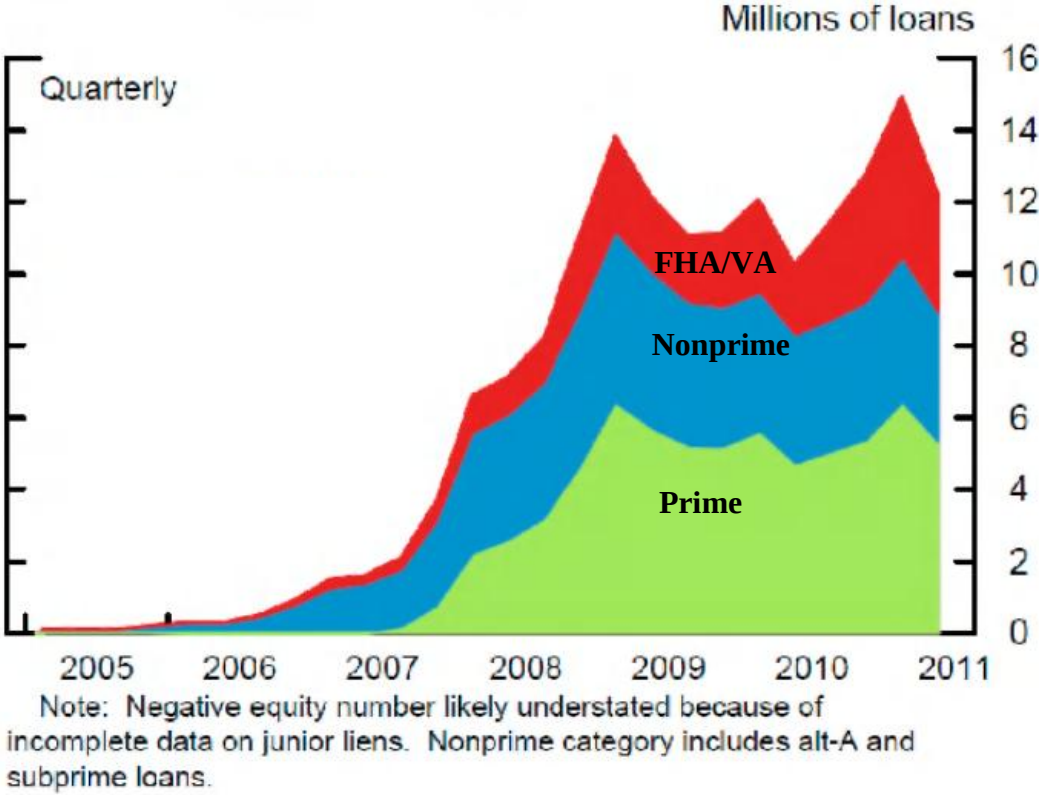
Source: Federal Reserve

Figure 10. Home Equity and Household Net Worth



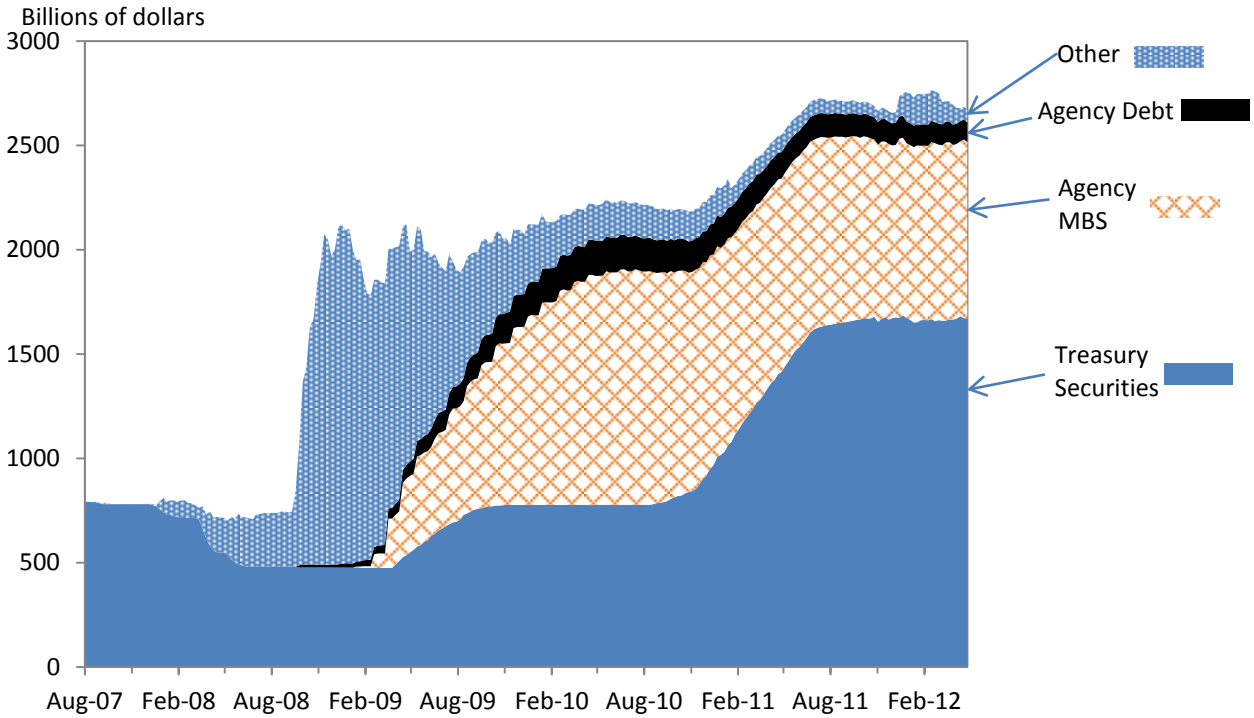
Source: Bloomberg

Figure 11. "Underwater" Mortgages: Loans with Negative Equity



Source: Federal Reserve, "The U.S. Housing Market: Current Conditions and Policy Considerations," *White paper*, January 2012

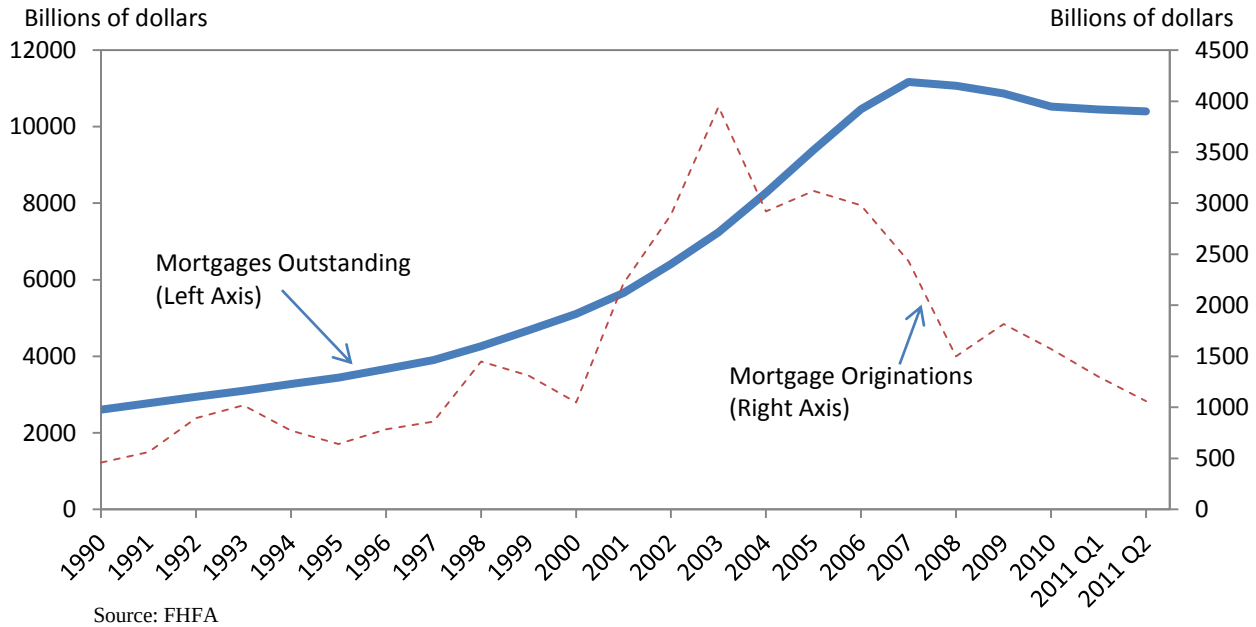
Figure 12. Federal Reserve Balance Sheet by Asset Type



Source: Federal Reserve

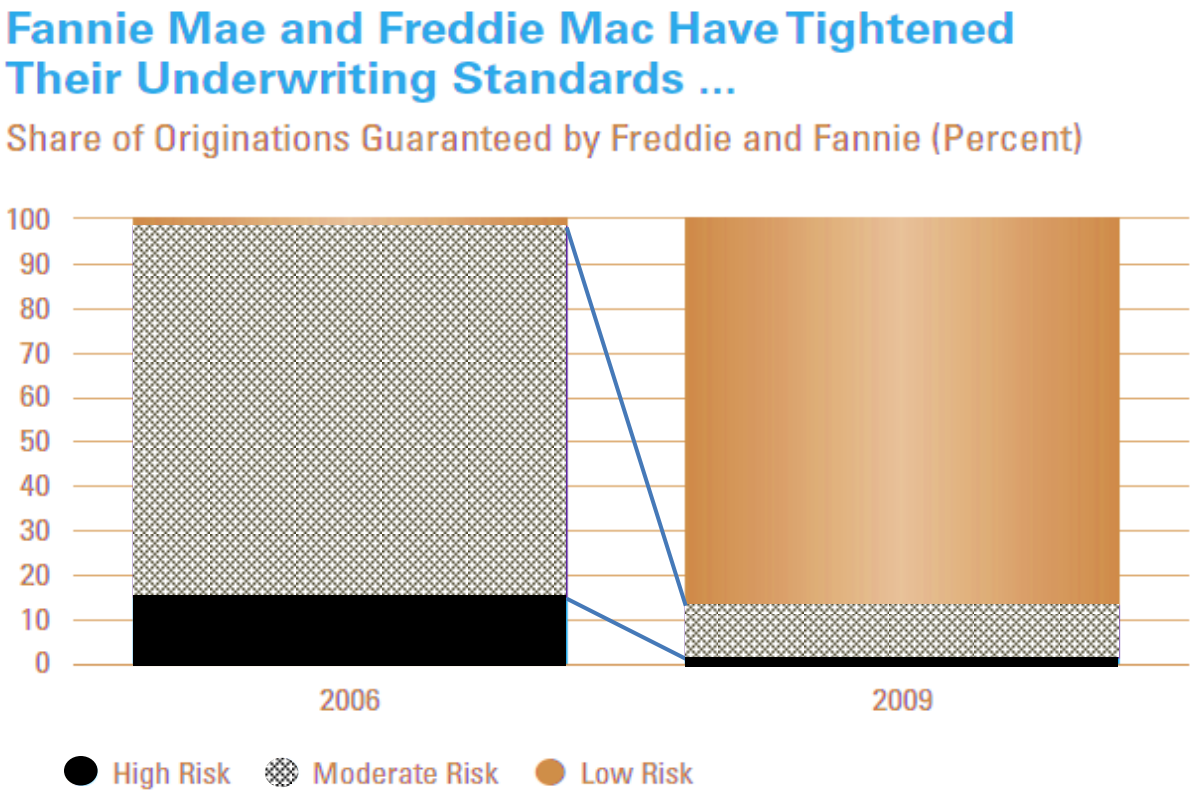
Note: **Other** includes all liquidity facilities (Term Auction credit; primary credit; secondary credit; seasonal credit; Primary Dealer Credit Facility; Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility; Term Asset-Backed Securities Loan Facility; Commercial Paper Funding Facility; and central bank liquidity swaps) and support for specific institutions (includes Maiden Lane LLC; Maiden Lane II LLC; Maiden Lane III LLC; and support to AIG)

Figure 13. Single-Family Mortgages Outstanding and Originated



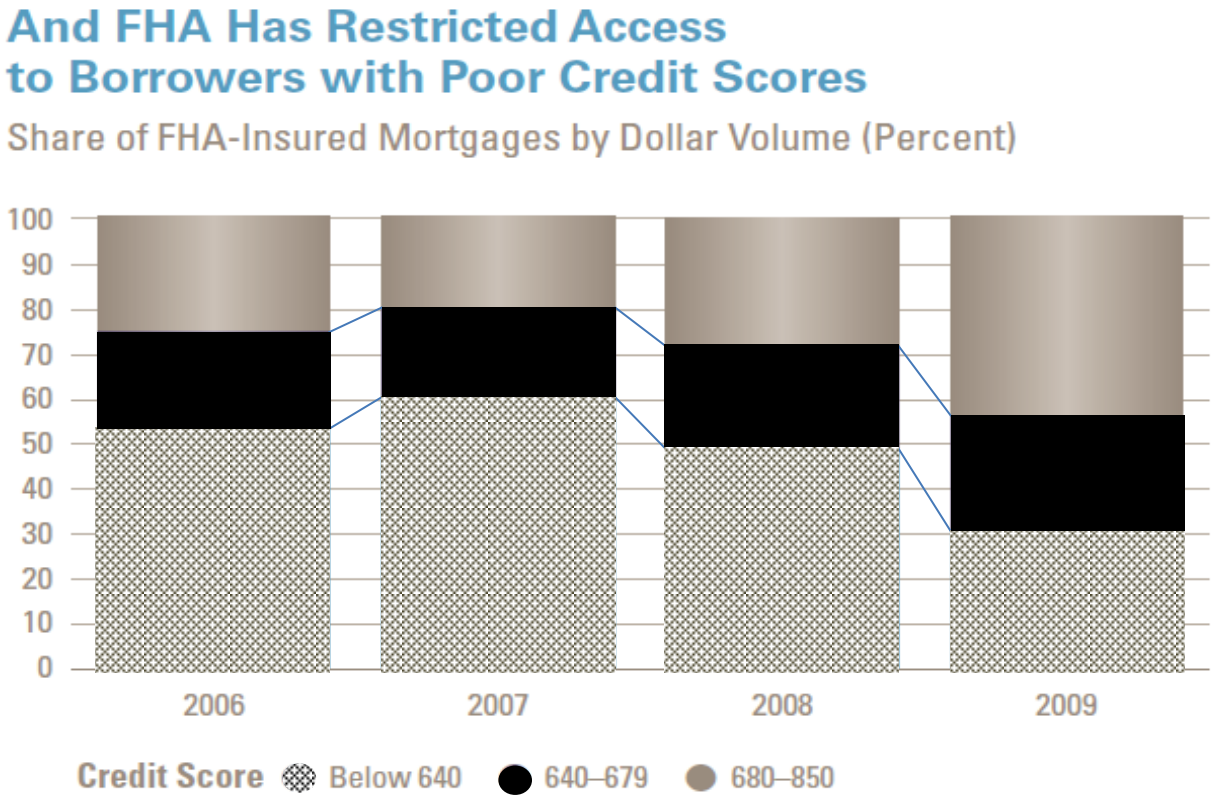
Source: FHFA
Note: 2011 Q1 and Q2 originations show annualized quarterly data

Figure 14. Dramatic Shift towards Low Risk Originations for Fannie and Freddie



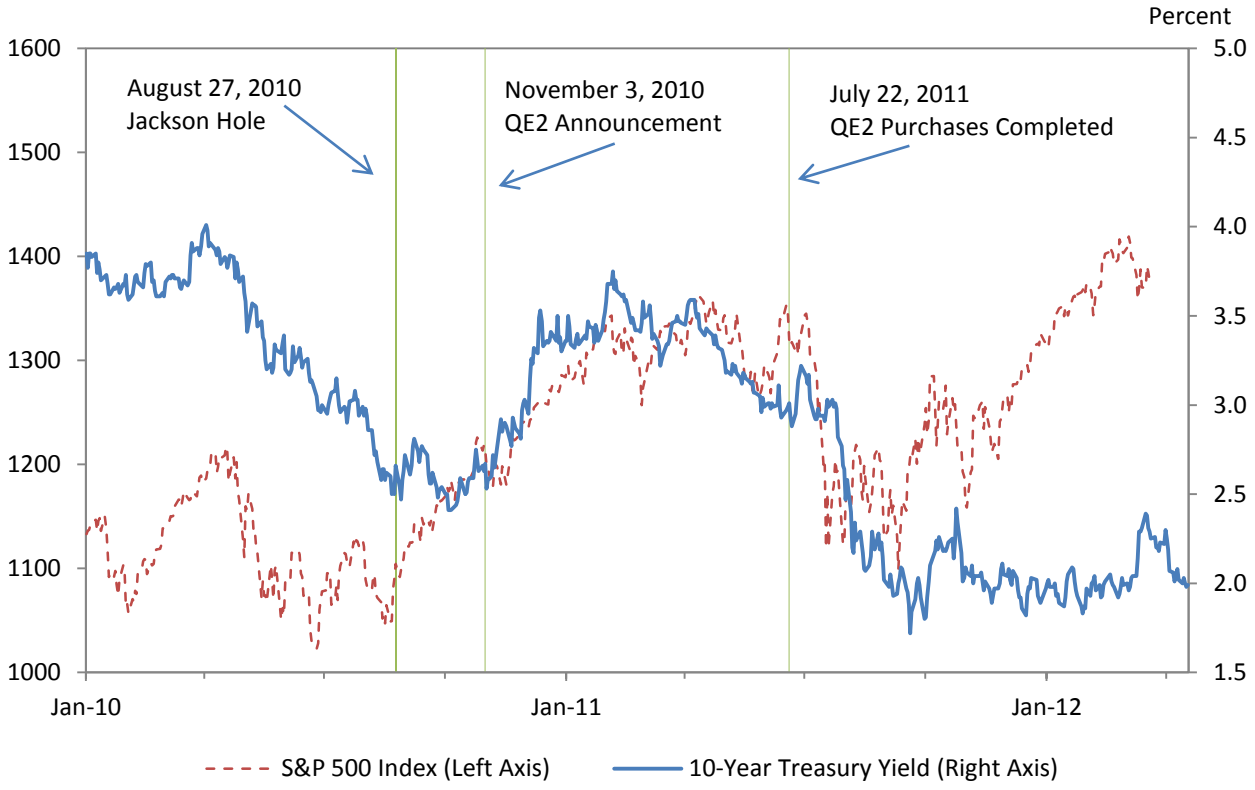
Source: Harvard "The State of the Nation's Housing" Report, 2010
Note: High (low) risk loans are to borrowers with credit scores under 690 (above 750) and have loan-to-value ratios above 85% (below 75%).

Figure 15. FHA Credit Score Data for Insured Mortgages



Source: Harvard "The State of the Nation's Housing" Report, 2010
Note: FHA data exclude records with no credit score information.

Figure 16. Stocks and Yields around QE2



Source: Federal Reserve