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The Six-Year Hangover: An Assessment of the Effectiveness of Unconventional Monetary Policy in Dealing with Debt Overhang within the U.S. Economy

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The Six-Year Hangover:
*An Assessment of the Effectiveness of Unconventional Monetary Policy in
Dealing with Debt Overhang within the U.S. Economy*

By

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Submitted in partial fulfillment
of the requirements for
Honors in the Department of Economics

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Abstract

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After the Financial Crisis of 2007 to 2008, the Federal Reserve and the federal government used monetary and fiscal policy to buoy the economy out of the recession, but the Fed had to turn to non-standard forms of monetary policy, or unconventional monetary policy. The Federal Reserve used forward guidance, quantitative easing, and the maturity extension program to: lower interest rates, raise inflation expectations, and increase GDP. Six years after the Financial Crisis, the Federal Reserve has begun to taper from unconventional monetary policy. Yet, there has been much debate as to whether unconventional monetary policy is effective or not, and whether the Federal Reserve used these policies for “too” long.

This paper argues that debt overhang is preventing unconventional monetary policy from being effective. Debt overhang is a debt burden that is so great that an entity cannot take on additional debt to finance future projects. For instance, when the housing bubble burst, home values dropped below the mortgage value leaving individuals with less equity, even negative equity, contributing to debt overhang. Through regression and graphical analysis, the results indicate that unconventional monetary policy stimulates investment and consumption, while debt overhang has a significant impact on investment and consumption. Therefore, the low interest rate environment that the unconventional monetary policy creates is not stimulating investment and consumption because market participants are trying to save money.

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Chapter 1

Introduction

Although the tapering of quantitative easing began in December 2013, the Federal Reserve is still using unconventional monetary policies. On January 28, 2015, the Federal Reserve noticed that labor markets have been strong and investments have been increasing. However, the FOMC also stated, “The committee continues to see the risks to the outlook for economic activity and the labor market as nearly balanced.”¹ This means that they expect inflation to decline further in the near term. Consequently, the Federal Reserve maintained that it continues to target interest rates at 0 to a ¼ percent and holding of agency debt, mortgage-backed securities, and Treasury securities at auction until inflation climbs up to two percent.

Nevertheless, why, after six years since the Great Recession, is the Federal Reserve still not taking its foot completely off the pedal of unconventional monetary policy? At the Senate Banking Committee, Janet Yellen stated, “There has been important progress. However, despite this improvement, too many Americans remain unemployed or underemployed, wage growth is still sluggish and inflation remains well below our longer-run objective.”² This paper argues that debt overhang constrains many Americans from being able to participate in normal consumption and investment behavior, resulting in a slow economic recovery. Thus, while the Federal Reserve

¹ Board of Governors of the Federal Reserve System. FOMC. *Press Release. FRB: --FOMC Statement— January 28, 2015.* <<http://www.federalreserve.gov/newsevents/press/monetary/20071212a.htm>>.

² Applebaum, Bynyamin. "Fed's Janet Yellen, in Testimony, Counsels Patience on Interest Rate Increase." *The New York Times*, February 24, 2015. http://www.nytimes.com/2015/02/25/business/economy/fed-chief-yellen-testifies-before-congress.html?_r=0.

continues to implement unconventional monetary policy, debt overhang prevents this policy from being effective.

Debt overhang is a term used to describe a debt burden that is so great, an entity cannot take on additional debt to finance future projects. Debt overhang is measured in one of two ways: a ratio of $\frac{debt}{income}$ or a ratio $\frac{net\ assets}{income}$. After the financial crisis, there were serious changes to individuals' balance sheets, due to a multitude of events. In the years before the crisis, there was a flood of irresponsible mortgage lending in America. Loans were lent out to "subprime" borrowers with poor credit histories who struggled to repay their loans. These risky mortgages were passed on to financial engineers at big banks, who put these mortgages together in pools masked them as low-risk, high yielding securities, and then sold them to investors. However, these high yielding, supposedly "safe assets," like mortgage-backed securities, were not stable investments. In 2006, when home values dropped, people could no longer pay their mortgages, so mortgage-backed securities dropped in value, and safe CDOs became worthless, despite the ratings agencies' seal of approval. As a result, complex chains of debt between counterparties spread and Americans and financial institutions were left with huge amounts of debt.

Conventional monetary and fiscal policies were implemented in mid- 2007 and 2008 to buoy the sinking ship of the American economy. The fiscal efforts to end the recession and jump-start the recovery were built around a series of stimulus measures. First, income tax rebate checks were mailed to households in early 2008 to increase Americans' disposable income. Then, the Emergency Economic Stabilization Act of 2008 was enacted in response to the subprime mortgage crisis. Within this legislation was the Troubled Asset Relief Program (TARP), which authorized the United States Secretary

of Treasury to spend up to \$700 billion on distressed assets, such as mortgage-backed securities, and supply cash directly to the banks. The funds to purchase distressed assets were mostly redirected to inject capital into banks and other financial institutions, while the Treasury continued to examine the usefulness of targeted asset purchases. Next, the American Recovery and Reinvestment Act (ARRA) passed in early 2009. The economic stimulus package with an estimated cost of \$787 billion was later revised to be \$831 billion between 2009 and 2011. The Act included direct spending in infrastructure, education, health, energy, federal tax incentives, and expansion of unemployment benefits and other social welfare provisions.³

In conjunction with fiscal efforts, the Fed lowered interest rates aggressively in 2008 to decrease interest rates, increase GDP, and decrease unemployment rates. However, by adopting a near-zero interest rate policy in 2008, there was a liquidity trap, where monetary policy was not translating to increased price level. Therefore, the Fed had to implement nonstandard forms of monetary policy to fulfill their goals. The Fed's policies were broken down as such: first, the communication policies using forward guidance gave people confidence in the economy. Second, the Fed increased the size and the composition of its balance sheet. This has been done by large-scale asset purchases, referred to as quantitative easing, of Treasury securities, agency debt securities, and agency mortgage-backed securities. Lastly, through the Fed's "Maturity Extension Program," the central bank was able to purchase \$667 billion in long-term U.S. treasury securities and sell an equivalent amount of short-term Treasury securities. Table 1 indicates the various rounds of unconventional monetary policy.

³ "Estimated Impact of the American Recovery and Reinvestment Act on Employment and Economic Output from October 2011 Through December 2011." *CBO*, 2012.
<http://www.cbo.gov/sites/default/files/cbofiles/attachments/02-22-ARRA.pdf>.

Table 1: Implementation of Unconventional Monetary Policy

Date	Announcement
December 2007 to November 2008	Created various emergency liquidity facilities in response to the financial crisis.
October 6, 2008	Began paying interest on bank reserves.
November 25, 2008	Large scale asset purchases of up to \$100 billion of U.S. agency debt and \$500 billion of mortgage-backed securities (MBS).
December 16, 2008	Reduced federal funds rate to a range of 0% to 0.25%; anticipated "exceptionally low" federal funds rate would likely be maintained "for some time."
March 18, 2009	Large scale asset purchases which, combined with Nov. 2008 announcement, totaled \$300 billion of U.S. Treasury securities, \$200 billion of U.S. agency debt (later revised to \$175 billion), \$1.25 trillion of MBS over about one year (popularly known as "quantitative easing"); anticipated "exceptionally low" federal funds rate would likely be maintained "for an extended period."
August 10, 2010	Following completion of large scale asset purchases, maturing assets would be replaced with U.S. Treasury securities to prevent the balance sheet from shrinking.
November 3, 2010	Large scale asset purchases of \$600 billion of U.S. Treasury securities over eight months (popularly known as "QEII").
August 9, 2011	Set a target date (mid-2013) for period Fed anticipated it would keep the federal funds rate at "exceptionally low levels"; the Fed subsequently moved back the target date incrementally to mid-2015.
September 21, 2011	Maturity Extension Program (popularly known as "Operation Twist"), under which Fed purchased \$400 billion long-term U.S. Treasury securities, and sold an equivalent amount of short-term Treasury securities over nine months. Began rolling over existing agency debt and MBS into new agency MBS (instead of U.S. Treasury securities).
January 25, 2012	Set "longer-run goal" of 2% inflation; public release of FOMC members forecast of "appropriate" federal funds target.
June 20, 2012	Extended and expanded the Maturity Extension Program to an additional \$267 billion of Treasury securities, through the end of 2012.
September 13, 2012	Announced large scale asset purchases of \$40 billion of Agency MBS per month for unspecified duration (popularly known as "QE3").
December 12, 2012	Announced that the Fed would continue purchasing \$45 billion of Treasury securities per month after the expiration of the Maturity Extension Program; changed the threshold for ending "exceptionally low levels" of the federal funds rate from "at least through mid-2015" to "at least as long as the unemployment rate remains above 6-1/2 percent," contingent on low inflation.
December 18, 2013	Announced that the Fed would begin to "taper off" its securities purchases, initially reducing monthly purchases by \$10 billion.

Source: The Federal Reserve

1.1 The Federal Reserve Unconventional Actions

These policies were used before in the U.S., although not to the same degree as the recent crisis, economic literature has found that unconventional monetary policies are effective in times of economic crisis. Bernanke and Reinhart (2004) point out that when a central bank can no longer stimulate aggregate demand by further interest-rate reductions, the central bank must rely on “nonstandard” policy alternatives, or unconventional monetary policy. They discovered that these policies affect asset prices and yields, and as a result increase aggregate demand. Ultimately, the theories that Bernanke and Reinhart analyzed in their 2004 paper, led Bernanke to implement these policies in 2008.

As chairman of the Federal Reserve, Bernanke was concerned with providing liquidity to the economy, to ensure that GDP would grow, and unemployment rates would decline. Gambacorta, Hofmann, and Peersman (2013) found significant results with the implementation of unconventional monetary policy. They found that when expansionary unconventional monetary policy is applied, there is a substantial, and temporary rise in economic output and prices. To increase output and prices, it was important for the Federal Reserve to decrease interest rates to stimulate this output. In particular, Krishnamurthy and Vissing-Jorgensen (2011) examined the effects of quantitative easing on lowered interest rates, which influenced preferences for safer assets, higher expectations of inflation, and lower corporate bond risk

Aside from just using quantitative easing (QE) as a way to influence macroeconomic behavior, the FOMC forward guidance was also a beneficial tool for the Federal Reserve to use. Campbell, Evans, Fisher, and Justiniano (2012) empirically illustrated that FOMC policy announcements substantially decrease Treasury bond rates,

increase corporate borrowing rates, and influence private macroeconomic forecasts. Thus, forward guidance is a great tool for the Federal Reserve to use, in addition to quantitative easing.

Although financial institutions were stabilized and some positive outcomes affected the economy, literature suggests that unconventional monetary policy was not fully effective. These policies seemed to have lost steam around 2010 and 2011. Putnam (2013) states that the Fed's QE programs from 2011 onward did little to nothing in assisting the U.S. economy. He found that economic growth remains constrained because the shock of the earlier financial panic left long-lasting changes to risk preferences. Thus, it is because of these negative signals that economic confidence has been diminished.

Labonte (2014) argues that the sluggish rate of economic recovery raises questions about the optimal approach to monetary policy. Labonte suggests that monetary policy alone is not powerful enough to return the economy to full employment after a severe financial crisis. Labonte specifically argues that the Fed continued to pursue these policies in spite of modest improvements, such that inflation has increased, but has not reached its two percent target. Friedman (2014) also argues that fiscal policy was not fully utilized after the financial crisis, which could have stimulated jobs and wage growth more quickly. Friedman (2014) and Labonte (2014) both agree that unconventional monetary policy has led to above-average growth in the money supply, posing a threat to price stability in the future.

1.2 The Aftermath of Debt Overhang

Additional literature has suggested that because of debt overhang; the Federal Reserve did not need to pump liquidity into financial markets for six years. Martin Wolf

(2014) explains that there is a misconception of what type of crisis erupted in 2008. The economists identified the financial crisis with old-fashioned bank runs by depositors. Instead, the crisis was not a crisis of confidence, but a crisis of indebtedness. In the aftermath of the financial crisis, Paul Krugman (2009) explains more explicitly how recovery is bound to be a prolonged process. He states that the global credit system is in a state of paralysis and two things need to be addressed. The first is that credit needs to be flowing and the second is that spending needs to be stimulated. Credit has been flowing due to the Fed pumping liquidity into the economy, but to increase consumer spending, more needs to be done. Krugman stresses the importance of very large fiscal stimuli, insisting that infrastructure, healthcare, education, and autos are big enough to overwhelm systemic and psychological depression.

Boshara and Emmons (2013) discuss how the Great Recession of 2007 to 2009 was damaging to household balance sheets. In particular, they examined the importance of sound financial footing to families at the micro-level and the importance of healthy household balance sheets to the economy. The lack of savings and assets can hurt future consumption and security. They consider the huge declines in asset values and net worth as one of the shocks that threw the economy into a recession. In addition, the liability side of household balance sheets could be a future detriment to the economy, in regards to default and deleveraging.

This paper will thus tie together unconventional monetary policy and debt overhang, and discuss their relationship after the financial crisis. Ultimately, if debt overhang is preventing nonstandard forms of monetary policy from being effective. The next chapter provides an overview of the relevant literature on the effectiveness of

unconventional monetary policy and the effects of debt and deleveraging. The third chapter is an analytical framework of debt overhang, unconventional monetary policy, and fiscal policy. The fourth chapter examines the relationship between unconventional monetary policy and debt overhang, through the graphical and regression analysis of this relationship. The fifth and final chapter concludes the study and discusses how unconventional monetary policy effectiveness is hampered due to the terms of debt overhang.

Chapter 2

Literature Review

This chapter outlines the literature discussing unconventional monetary policy and debt overhang. However, before the relationship between unconventional monetary policy and debt overhang can be explained, it is imperative to note how central banks orchestrate monetary policy. The first section, *Conventional Monetary Policy*, explains how a central bank determines the size and the rate of growth of the money supply, which in turn affects interest rates to either stimulate GDP or slow down inflation. The second section, *Unconventional Monetary Policy Fundamentals*, discusses the various ways that make unconventional monetary policy effective. In addition, this section will discuss the weaknesses of these policy instruments. The third and final section, *The Ties Between Debt Overhang and Unconventional Monetary Policy*, explains the role that debt and debt overhang play in the financial crisis, both before and after.

2.1 Conventional Monetary Policy

There are two channels in which monetary policy is executed, one is through instruments and the other is through monetary targets. Instrument tools are tools used by the central bank to adjust price or quantity to affect GDP, unemployment, and inflation; while monetary targets are assigned variables by the central bank that they cannot set directly, but over time can exert substantial influence over the economy.

Friedman (1988) details how the instruments and targets of monetary policy affect the economy in direct and indirect ways. For example, instruments of monetary policy include: the reserve requirements or portions of deposits that banks must maintain, either in their vaults or on deposit, at a Federal Reserve Bank; open market operations which

varies the supply of such reserves through buying and selling securities; the discount rate, which is the interest rate charged by the Federal Reserve to depository institutions on short term loans; lending reserves directly to banks; and/or regulating aspects of banking and financial activities. These policies influence interest rates and money supply, which in turn affects the economy. For example, expansionary open market operations can affect aggregate demand and supply during periods of recession. For instance, when the Fed buys Treasury bonds it increases the money supply. This shifts the demand for bonds and raises the price of bonds, reducing the interest rate. The lower interest rate stimulates investment, reduces the demand for and increases the supply of dollars in the currency market. The combined impact of greater investment and net exports will shift the aggregate demand curve to the right. This example of open market operations is illustrated in Appendix A to show how interest rates and the money supply affect output and price level.

In addition to instruments, targets of monetary policy are used when the central banks use the liability side of the balance sheet, like bank reserves, the monetary base, and currency, to indirectly affect the economy over a certain horizon of time. This influences other factors that affect GDP, unemployment and inflation. For instance, when an expansion in the monetary base gives financial institutions the ability to loan out more money, this indirectly stimulates investment because the commercial banks' willingness to lend should increase individuals' willingness to invest. Friedman states, "This realization of the intermediate target is then part of the information set underlying the choice of a final value for the policy instrument." Thus, these monetary policy tools are useful when other policy actions take too long to affect economic behavior. The next

section highlights the needs for non-standard forms of monetary policy when the Federal Reserve cannot decrease interest rates anymore through its normal tools.

2.2 Unconventional Monetary Policy Fundamentals

Before Ben Bernanke became Chairman of the Federal Reserve, he published numerous academic articles. Bernanke's particular interest was in the economic and political events of the Great Depression. Much of his work is inspired by the monetarist theory of Milton Friedman. Friedman rejected the use of fiscal policy as a tool of demand management.⁴ He wrote extensively on the Great Depression, or as he called it, the Great Contraction. Friedman argued that it had been caused by an ordinary financial shock whose duration and seriousness were greatly increased by the subsequent contraction of the money supply.

Due to the misguided policies of the directors of the Federal Reserve, the Fed was tightening and depriving banks of liquidity, where it instead should have loosened and pumped money into the system. For example, Friedman and his colleague, Anna Schwartz, noted that one of the first stages of contraction had severe implications on the economy. From the spring of 1928 to the crash of October 1929, the Fed raised the discount rate and decreased the holdings of government securities. This tightening of policy, although intended to put an end to stock market speculation, was inevitably followed by falling prices and weaker economic activity. From the cyclical peak in August 1929 to the crash in October 1929—production, wholesale prices, and personal income fell at an annual rate of 20 percent, 7.5 percent, and 5 percent, respectively.⁵

Friedman maintained that monetary mechanics are very important to stabilize the

⁴ "Milton Friedman (1912-2006)." *The Concise Encyclopedia of Economics*. Liberty Fund.

⁵ Bernanke, Ben. "On Milton Friedman's Ninetieth Birthday." Speech, At the Conference to Honor Milton Friedman from The Federal Reserve Board , Chicago , November 8, 2002.

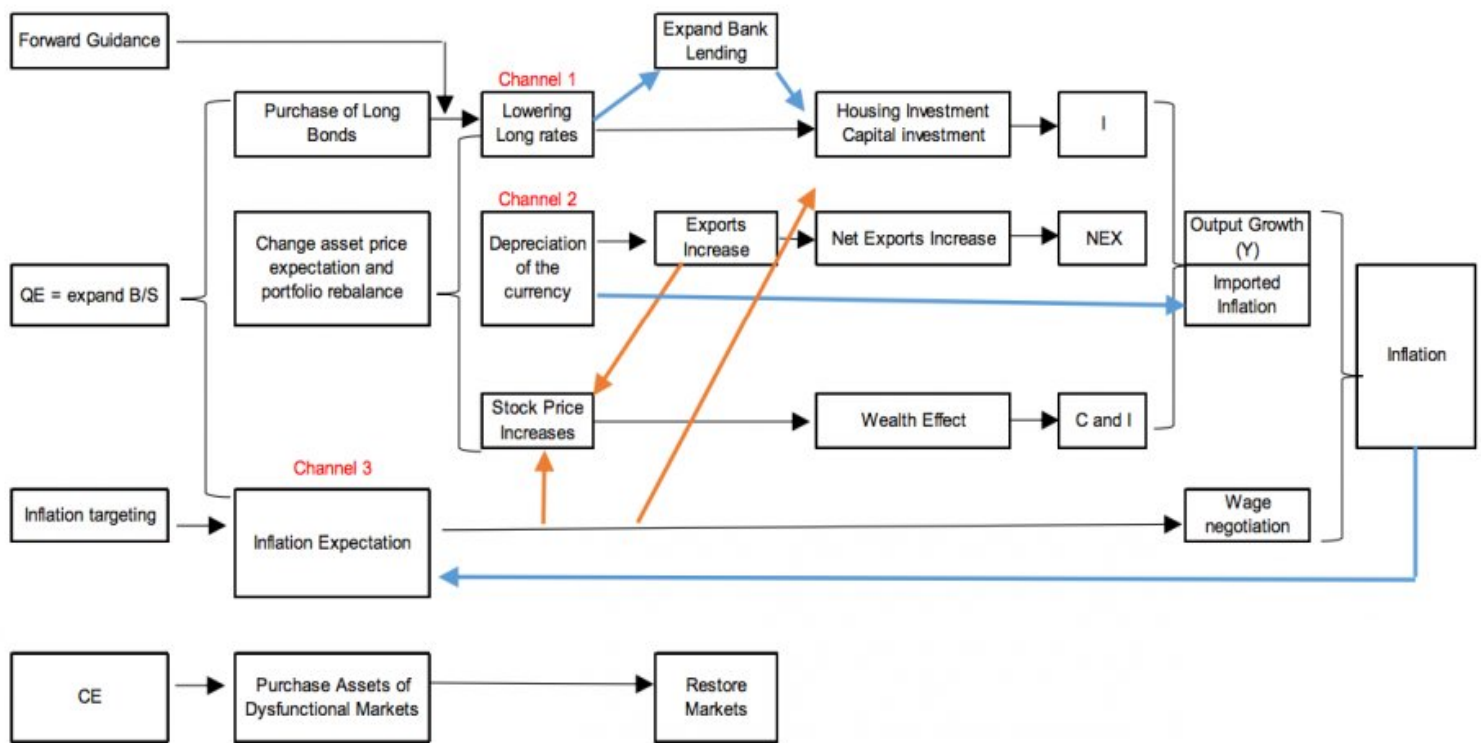
economy, and keep people afloat in an economic crisis. As Ben Bernanke stated on Friedman's ninetieth birthday, "I would like to say to Milton and Anna: Regarding the Great Depression. You're right, we did it. We're very sorry. But thanks to you, we won't do it again."

Therefore, in a crisis like the Great Depression, monetary policy is an important foundational instrument to stabilize the economy. Bernanke and Reinhart (2004) also point out that when a central bank can no longer stimulate aggregate demand by further interest-rate reductions, the central bank must rely on "nonstandard" policy alternatives, or unconventional monetary policy. They examined how implementing communication policies leveraged the effectiveness of other unconventional monetary policies, like the size and change in the composition of the central bank's balance sheet through the targeted purchases of long-term bonds as a means of reducing the long-term interest rate. All of these factors were used to shape public expectations about the future course of interest rates. For instance, lower interest rates keep individuals investing and consuming goods and services. At the time of this publication, they looked at three recent episodes of economic crisis in the U.S. and Japan to provide important insight on the potential effectiveness of various nonstandard policies. They discovered that these policies may affect asset prices and yields, and consequently, aggregate demand.

They noted that these policies used in the U.S. were significantly effective for their intended outcomes. For instance, quantitative easing was used in the debt buybacks of late 1990s, the massive purchase of U.S. Treasury securities between 2000 and 2003, and the Fed's target purchases of U.S. Treasuries as an anti-deflationary measure in 2003. The event-study analyses of these episodes, as well as the comparison of actual Treasury

yields during these periods, suggest that large changes in the relative supplies of securities have significant effects on their yields. Most importantly, they found that shaping investor expectations through the Federal Reserve’s communication is an effective strategy in persuading the public that the policy rate will remain low for a longer period of time. Central bankers thus can reduce long-term rates and can increase activity in the economy. Figure 1 shows the intended effects of unconventional monetary policy to increase investment, consumption, and exports, which ultimately increase output growth, inflation, and wages.

Figure 1: Transmission Mechanism of Unconventional Monetary Policy



Source: World Economic Forum

After analyzing economic theory and adhering to Milton Friedman’s ideology, Bernanke implemented unconventional monetary policies in 2008. Gambacorta, Hofmann, and Peersman (2013) also found significant results with the implementation of

unconventional monetary policy. After, central banks exhausted their conventional methods, interest rates reached the zero-lower bound. Gambacorta, et al were interested in the effects of unconventional monetary methods during the crisis period. They found that when expansionary unconventional monetary policy is applied, there is a substantial, temporary rise in economic output and prices. These results suggest that the unconventional monetary policy measures adopted by central banks in the wake of the global financial crisis provide temporary support to their economies.

In particular, Krishnamurthy and Vissing-Jorgensen (2011) examined the elements of quantitative easing (QE), and specifically, the effects of purchasing various long term Treasuries and bonds on interest rates. They explained that the Fed's success is based on many facets. The first is large asset purchases, which signal that the Fed will be involved in supporting the economy for an extended period of time. The second is to change investor preferences from long-term duration to short-term duration, by decreasing long-term yields, investing in more liquid assets, and investing in safer assets. The third is to decrease default and risk premium and to increase inflation expectation. With these measurements, they were able to inspect if QE was effective.

Their results reveal particular details about each round of QE. They found that QE1 involved large purchases of agency mortgage-backed securities, which reduced the price of mortgage-specific risk. While QE2 involved only Treasury purchases and left a substantial decrease on Treasury and Agency bond rates, as well as had smaller effects on mortgage-backed security rates and corporate rates. QE1 affected the equilibrium price for mortgage-specific risk and decreased the default and risk premium for corporate bonds contributing to lower corporate rates. Ultimately, yields on medium and long

maturity safe bonds fell because of demand for safe nominal assets. The Fed purchases of mortgage-backed securities reduced the supply of such assets and thus increased the equilibrium of safety-premium. Yet both QE1 and QE2, with evidence from inflation swap rates and IPS, increased inflation expectations; thus QE was effective in reducing interest rates, lowering risk, changing investing behavior, and raising inflation expectation.

Another implementation of unconventional monetary policy is the FOMC public statements, or forward guidance, which can “substitute for lower interest rates at the zero lower bound.”⁶ Campbell, Evans, Fisher, and Justiniano (2012) empirically illustrate the responses of asset prices and private macroeconomic forecasts to FOMC forward guidance, both prior to and since the recent financial crisis. Their results indicate that the FOMC has extensive experience successfully forecasting its intended adjustments to evolving macroeconomic conditions, thereby providing additional policy accommodation. For example, they show that surprises associated with FOMC policy announcements substantially influence Treasury bond rates, corporate borrowing rates, and private macroeconomic forecasts. Yet, news of substantial monetary tightening raises interest rates as expected, while also raising inflation forecasts and lowering unemployment forecasts. Thus, while forward guidance is not entirely a sure way of predicting economic outcomes, it is an important tool for the central bank to convey reliable information about future monetary policy actions and influence market participants.

⁶ Campbell, Jeffrey R., Charles L Evans, Jonas D.M. Fisher, and Alejandro Justiniano. "Macroeconomic Effects of FOMC Forward Guidance." *Brookings Papers on Economic Activity*, 2012, 1-77. <http://www.brookings.edu/~media/projects/bpea/spring-2012/2012a_evans.pdf>.

After the financial crisis, Chodorow-Reich (2012) discovered a positive correlation between a direct credit supply to financial institutions and the employment for non-financial firms. The major institutional failures during the financial crisis, from the fall of assets of the Bear Stearns and BNP Paribas funds to the bankruptcy of Bear Stearns, Lehman Brothers, and AIG, all resulted from exposure to real estate, mortgage securities, and funding structure. Following these market events, the Federal Reserve and federal government reacted with certain bailout policies. These policies included: an \$85 billion loan from the New York Federal Reserve Bank to the insurer AIG; the forced sales of the investment bank, Merrill Lynch and the commercial bank, Wachovia; and direct capital injections by the federal government into major financial institutions through the TARP. Chodorow-Reich argues that those relief efforts were necessary, because if banks did not have the ability to lend, financial and non-financial firms' interest rates on loans would increase, and thus affect the employment at institutions. In his sample, he found that the withdrawal of credit accounts resulted in one-third to one-half of the employment decline at small and medium sized firms in the year following the Lehman bankruptcy. In addition, Chodorow-Reich (2014) discovered how unconventional monetary policies helped to stabilize the financial sector and the economy after the financial crisis. In particular, Chodorow-Reich found that in the winter of 2008 to 2009 unconventional monetary policy was effective when it came to stabilizing financial institutions after the financial crisis. It had a strong, stabilizing impact on banks and especially on life insurance companies. The results were consistent with the positive effects on legacy asset prices and future business. Chodorow-Reich states, "The positive effects on life insurers, in particular, suggest a recapitalizing channel

of monetary policy.” So, unconventional monetary was important in supplying financial institutions with liquidity.

Although unconventional monetary policy was crucial in the initial downfall of the economy during the financial crisis, there are still some weaknesses to these policies. Some literature suggests that unconventional monetary policy seemed to have lost steam around 2010 to 2011. Putnam (2013) states that the Fed’s QE programs from 2011 onward did little to nothing in assisting the U.S. economy. He found that economic growth remains constrained because there are long-lasting changes to risk preferences from the shock of the earlier financial panic. Due to those negative signals, it in turn affects economic confidence. For instance, the continuation of zero short-term interest rates, expansion of QE, and lower long-term rates can have a very depressing impact on certain demographics, in terms of their savings and consumption behavior, in the aftermath of a financial crisis.

For example, many retirees and pension funds depend on fixed income investments as a source of income. Reducing rates paid on short-term and cash equivalent investments reduce individual’s income because of the lower expected returns from their retirement portfolio. This forces current and future retirees into a state of decreased consumption as a means to increase savings. In essence, zero short-term rate policies coupled with QE and lower long-term rates imply a redistribution of wealth away from savers and into the hands of borrowers. However, these borrowers, especially corporate borrowers, are not likely to expand their businesses during periods of heightened uncertainty, regardless of how low the interest rates may be. Putnam argues that the

sensitivity of the economy, during the post-crisis recovery phase, must be at the heart of any QE efficacy evaluation.

In addition, Chodorow-Reich (2014) mentioned that the Fed is potentially losing its control over the policies that influence the economy, because some of the policies did not produce their intended result. One example of an unsuccessful unconventional monetary policy is the Maturity Extension Program, implemented after QE II. Ma (2013) explains that the Maturity Extension Program or “Operational Twist,” was intended to lower long-term interest rates. In this operation, the Fed sold short-term Treasury bonds and bought long-term Treasury bonds, which pressured the long-term bond yields downward and the short-term bond yields upward. Unlike QE, the Maturity Extension Program had no effect on the size of the Fed’s balance sheet, bank reserves, or the monetary base. This is because it is constrained in size by the amount of short-term securities the Fed holds. Operation Twist was intended to drive down long-term interest rates, so there would be more of an incentive for short-term investments, and most importantly no long-term risk to the central bank’s balance sheet. Ma states, “In terms of unemployment, inflation rate reductions, and the promotion of economic growth, the effects of Operation Twist are not significant.” Based on Ma’s data, the results indicate that Operation Twist was ineffective at increasing short-term interests rates, thus not aiding in the boost of economic output.

Furthermore, other literature suggests that there are big picture weaknesses to unconventional monetary policies. These faults are not only causing problems for the future economy, but are not addressing the current problem of debt overhang. Labonte (2014) argues that the sluggish rate of economic recovery raises questions about the

optimal approach to monetary policy. Labonte suggests that unconventional monetary policy alone is not powerful enough to return the economy to full employment after a severe financial crisis. What is particularly interesting about Labonte's argument is that the Fed continued to pursue these policies in spite of modest improvements. Although the unemployment rate has been on a downward trajectory, the inflation rate has remained below the 2 percent target. These slow improvements raise concerns and long-term consequences arise, because unconventional policy has led to above-average growth in the money supply, which arguably poses a threat to price stability.

In terms of interest rates, Labonte argues that it is less clear if QE has successfully executed the reductions of other private interest rates to thereby stimulate economic activity. That is because the spread between corporate and Treasury bonds remains greater than it was in the years before the crisis. Labonte states, "It should be noted that announcement effects measure what financial markets believe that QE will do to interest rates *ex ante*, and not what QE has done to interest rates *ex post*." This indicates that lowering nominal interest rates are not actually causing a decrease in real interest rates. Labonte explains that \$1 trillion in asset purchases only reduced long-term interest rates by a range of 0.25 percentage points to 1.72 percentage points. Another example of inefficiency is the QE goals of inducing spending and discouraging saving. One economic problem is when the economy is far below full employment, which has been the case since the financial crisis and there is not enough spending in the economy to utilize the economy's productive capacity. If QE "worked," the evidence would presumably be higher interest rates, higher inflation, or higher inflation expectations.

Labonte argues that overall, unconventional monetary policy results have not worked and the Fed should have looked for policies that did work.

2.3 The Ties Between Debt Overhang and Unconventional Monetary Policy

Perhaps unconventional monetary policies were the wrong tools used to fix the economic problem. Wolf (2014) explains that there is a misconception of what type of crisis erupted in 2008. He states that there is a fallacy of misplaced concreteness. The central bank identified the financial crisis with old-fashioned bank runs by depositors, but such bank runs have become outdated because of deposit insurance. Wolf explains that by 2008, depository institutions were no longer the dominant form of financing. Instead, finance increasingly saw the prevalence of “shadow-banking.” These financial intermediaries involved in facilitating the creation of credit across the global financial system, yet they were not subject to regulatory oversight. The shadow banking systems are embedded in regulated institutions that participate in unregulated activities. So, after the financial crisis, businesses and households were exposed to debt, leaving the economy to the possibility of a self-reinforcing downward spiral. Thus, this crisis was not a crisis of confidence; but a crisis of indebtedness, as a result running more debt to ease consumer worries is not that effective in supporting Americans on their road to recovery from this debt hangover.

For instance, Koo (2013) also emphasizes that the wrong policies were used during the wrong time. He explains that during a crisis, monetary policy is highlighted for profit maximization, and fiscal policy is necessary for debt minimization. Although interest rates were low and there was plenty of liquidity, private households were not interested in borrowing. For example, the U.S. private sector went from a net borrower of

funds with 5.3 percent of GDP in Q4 2008 to a net saver of funds with 8.4 percent of Q1 GDP in 2010, despite the lowest interest rates in U.S. history. This stagnant or negative credit growth meant that the liquidity injected by the central banks could not enter the real economy to support private sector activities. Koo explains that indebtedness nullifies the efforts of unconventional monetary policy.

Similarly, Friedman (2014) also criticizes unconventional monetary policy. Although unconventional monetary policy is a “fashionable tool,” it is not necessarily an effective one. He thinks that fiscal policy was not fully utilized and monetary policy was completely exhausted. He is concerned that central banks hold large amounts of assets because there has only been attention directed at short-term results of monetary policy. The long-term consequences have been forgotten about, like the consequence of running a high debt. In addition to this, central banks have massive liabilities on their balance sheet, which could cause serious issues and instabilities for the economy in the future. As a result, there could be long-term problems when it comes to unwinding unconventional monetary policy. For example, the economy is operating with a central bank’s balance sheet that is distorted and can potentially cause another recession.

These long-term consequences are touched upon when Putnam (2013) discusses the other negative implications of unconventional monetary policy. Putnam explains that the Fed’s exit from QE is likely to be highly complex. He describes a number of problems; involving delays in returning to a more traditional short-term interest rate policy, dramatically diminished contributions to the U.S. Treasury from central bank net earnings, and the potentially large unrealized portfolio losses. For example, the Fed’s substantial amount of unrealized losses on its portfolio could exceed \$62 billion paid-in

and equity capital, making the Fed essentially insolvent. In addition, over time as the U.S. Congress increases its oversight concerning the size of the Fed's balance sheet, the Fed might lose some of their autonomy

Krugman and Eggertsson (2012) also think that there will be difficulties when it comes to unwinding unconventional monetary policy, there will be a deleveraging shock, which will increase the confusion regarding policy implementation, more so than usual. They also discovered, when viewed through the lens of their model, many of the usual rules of macroeconomics become reversed, because the past recession was driven by debt. They use the term "paradox of toil" and "paradox of flexibility," because unconventional monetary policy attempts to encourage Americans into consumption, but Americans want to save due to their debt. So while aggregate demand and supply is suppose to shift out, increasing output and prices, in actuality it can reduce output, and flexible wages can increase unemployment. This phenomenon studied indicates that wage and price flexibility do not facilitate recovery from recessions during a liquidity trap, but actually impair them. However, Krugman and Eggertsson explain that expansionary fiscal policy should be effective in combatting those impacts. Government spending would increase the price level and increasing aggregate supply. Thus fiscal expansion will be able to sustain output and employment while private balance sheets are repaired, and the government can pay down its own debt after the deleveraging period has come to an end.

What is the significance of a financial crisis and debt overhang? They are both systemic and psychological repercussions of the risk that is debt. The OECD (2012) report made clear some of the problems with running a high debt. High debt can create

vulnerabilities, exposing households, firms, and governments to solvency problems. Balance sheet vulnerabilities can also lead to self-fulfilling runs or sudden stops of normal economic output, and foreign capital flows could dry up. Moreover, when corporate and household debt is so high, a shock can induce forced cuts in investment, employment and consumption with negative implications for government revenues and spending. In addition, when asset prices move they can amplify shocks and macroeconomic instability.

The OECD explains that the vulnerabilities created by debt, and the interconnections between sectors, can transcend across these sectors. Typically, debt builds up most rapidly in the private sector; therefore, when the economy enters a recession, private-sector debt as a share of GDP decelerates or declines, raising the risk of a recession and an economic crisis. The question arises as to how monetary and financial market policy should react to the buildup in debt. The recent crisis highlights just how costly and worrisome running a large debt can be. The OECD states, “The aim is to address households whose debt levels are clearly unsustainable, while maximizing returns to creditors by putting reasonable claims on debtors. In the United States, there are differences in the ability of borrowers to walk away from mortgages. Where this is possible, default rates on loans are higher.” Therefore, policies need to approach debt in a way that reduces or eliminates the debt entirely. Yet, to approach debt with a monetary or fiscal policy route depends on the situation and the type of debt.

Boshara and Emmons (2013) discuss how the Great Recession of 2007 to 2009 was damaging to household balance sheets. In particular, they examine the importance of sound financial footing to families at the micro-level and the importance of healthy

household balance sheets to the economy. For example, households with savings may have fewer day-to-day financial worries, allowing them to be more future-oriented in their economic and social decision-making. Conversely, the lack of savings and assets can hurt the future consumption and security of the family. Boshara and Emmons state, “Seventy percent of workers report withdrawing money from college and retirement accounts in order to make ends meet, and these withdrawals will likely lead to losses of wealth in future years.”⁷ These changes in household balance sheets, defined as wealth effects, have short-term and long-term repercussions on the economy. For instance, declining wealth in households decreases consumer spending, such that an unexpected decline of 1 percent in house prices results in about a 0.10 percent in permanent decline of consumer spending, while a 1 percent increase in house prices results in only about a 0.03 percent increase in consumer spending.

Therefore, when studying the Great Recession and the following weak recovery, Boshara and Emmons believe that negative household wealth effects played an important role. They consider the huge declines in asset values and net worth as one of the shocks that threw the economy into a recession. In addition, the liability side of household balance sheets could be detrimental to the economy in regards to default and deleveraging. In terms of default, the large concentration of excess debt can have negative implications to the economy. For example, in 2008 and 2009, real GDP fell 0.3 and 3.1 percent, which was worse than predicted. This means that when it comes to deleveraging, households will be too concerned with paying down debt that they will

⁷ Boshara, Ray, and William Emmons. "After the Fall, Rebuilding Family Balance Sheets, Rebuilding the Economy." *Federal Reserve of St. Louis Annual Report 2012*. Federal Reserve of St. Louis, May 23, 2013. <<https://www.stlouisfed.org/annual-report/2012/essay-1>>.

increase their savings. As a result, when household debt becomes so large, they will choose to save over consume, and it will in turn suffocate economic growth. Boshara and Emmons suggest that policy responses involving debt restructuring can alleviate some of the burdens weighing heavily on the economy.

In the aftermath of the financial crisis, Paul Krugman saw a return of depression economics. Krugman (2009) explains more explicitly how recovery is bound to be a prolonged process. He states that the global credit system is in a state of paralysis and reform of the weakness that made the crisis is essential. However, two things need to occur for the economy to escape the recession. Firstly, credit needs to be flowing and secondly, spending needs to be stimulated. Credit has already been flowing, due to the Fed pumping liquidity into the economy, but to increase spending more needs to be done to stimulate individual consumption behavior. Krugman stresses the importance of very large fiscal stimuli: in infrastructure, healthcare, education, and autos, insisting that these responses are big enough to overwhelm systemic and psychological economic depression.

2.3 Conclusions

The literature review explains how unconventional monetary policy made it possible for the Federal Reserve to further fuel the economy after conventional monetary policy was stuck in the zero-lower bound interest rate. Although unconventional monetary policy helped to stimulate GDP through lower interest rates and increased credit, there were no substantial effects in the real economy, because it is possible that the wrong policy tools were implemented for a misdiagnosed problem. Households are carrying large amounts of debt, and the Federal Reserve's continuation of unconventional

monetary policy is not helping those households to revert back to the normal consumption and saving preferences. The next chapter will further discuss the implications of debt overhang, unconventional monetary policy and fiscal policy after the financial crisis.

Chapter 3

Analytical Framework

The literature review explained how after the housing bubble burst and the stock market fell, the Federal Reserve used many facets of conventional and unconventional monetary policy to keep the economy afloat. The federal government even bailed out banks and offered relief packages. This chapter will try to explain that the problems of the financial crisis were misdiagnosed. It was not a crisis of confidence but rather a crisis of debt. This chapter will examine some of the foundational elements in understanding the relationship between debt overhang and unconventional monetary policy after the financial crisis. The first section, *Wealth Effects*, examines debt overhang, how it is measured and how it is impacted by the financial crisis. The second section, *Unconventional Monetary Policy*, looks at the risk and liabilities of the Federal Reserve's balance sheet associated with unconventional monetary policy. Although these stresses on the Federal Reserve's balance sheet are intended to lower interest rates, decrease unemployment, and increase GDP; they can also have negative and long-term consequences to the balance sheet. The third section, *Fiscal Policy*, examines the policies enacted by the government and what the government could have done to accomplish more.

3.1 Wealth Effects

Wealth effects are the change in spending, because of perceptions of wealth. People typically spend more overall when one of two things are true: when people are actually richer or when people perceive themselves to be richer. For example, when an individual's income increases or when the assessed value of an individual's home

appreciates, and the fiscal amount of their liabilities do not change, then this can result in an increase of an individual's net worth. These changes in an economic agents' wealth can lead to an increase in the amount of consumption. So, a household's consumption is determined by its income (actual and expected), wealth, preferences, and its return on savings. Thus, the uncertainty faced by a household also plays a role in consumption, as does its ability to borrow.

Debt, on the other hand, does not typically exert an independent influence on consumption in traditional models. Yet, borrowing is presumed to vary with consumption, as the latter rises and falls in reaction to changes in its determinants. Debt overhang is a debt burden that is so great that an entity cannot take on additional debt to finance future projects. Krugman (1988) explains that debt overhang discourages future investment, since all earnings from new projects would have to go to existing debt holders, leaving little incentive for the investor to attempt to finance future projects. The crisis emerged during the early to mid-2000s where many people took advantage of rising home prices, easy credit conditions, and acquired large loans. After the financial crisis, the problems of debt were exposed due to the housing market bubble burst and people were eventually left with considerable debt overhangs.

The housing bubble was characterized by higher rates of household debt, lower savings rates, higher rates of home ownership, and of course, higher housing prices. Furthermore, it was fueled by low interest rates and large inflows of foreign funds that created easy credit conditions. Figure 2, highlights the appreciation of households,

reaching its peak in 2006. However, by 2008, household value declined by 20%.⁸ When the value of a home drops below the size of the mortgage, a borrower could have zero to negative equity. As a result, homeowners were left with few choices. They could be constrained to large mortgage payments for a house that is below the value of the mortgage, or a homeowner could walk away from their home, or opt for a foreclosure. Nevertheless, the latter two options also cause negative, long-term effects on their credit score, which could in turn affect their credit card debt.

Figure 2: The Rise and Fall of Housing Prices



Source: The Economist

When the house loses value and a homeowner's mortgage is more than the value of the house, depending on the individual's balance sheet, the homeowner goes into zero or negative equity. Table 2 shows an example of a homeowner's balance sheet before the housing bubble burst, while Table 3 indicates that when the house value drops 29 percent,

⁸ "A Helping Hand to Homeowners." The Economist. October 25, 2008. Accessed March 11, 2015. <http://www.economist.com/node/12470547>.

the homeowner's net worth drops from \$100,000 to \$0. This has a dramatic impact on a consumer's consumption and saving behavior. These tables illustrate debt overhang. Debt overhang is measured in one of two ways: a ratio of $\frac{debt}{income}$ or a ratio of $\frac{net\ assets}{income}$. These fluctuations in an individual's debt and net assets can severely reduce net worth. In addition, these changes to an individual or businesses' balance sheet affect the spender's consumption and saving behavior.

Table 2: Homeowner's Balance Sheet Pre-2006 (In Thousands of Dollars)

Assets		Liabilities	
House	\$350	Mortgage	\$300
Treasuries	\$150	Credit Card	\$50
Checking Account	\$10	Car Loan	\$15
Savings Account	\$15	Student Loan	\$85
Art Collection	\$5		
Car	\$20		
<i>Total</i>	<i>\$550</i>	<i>Total</i>	<i>\$450</i>
		Net Worth	\$100

Table 3: Homeowner's Balance Sheet After 2006 (In Thousands of Dollars)

Assets		Liabilities	
House	\$250	Mortgage	\$300
Treasuries	\$150	Credit Card	\$50
Checking Account	\$10	Car Loan	\$15
Savings Account	\$15	Student Loan	\$85
Art Collection	\$5		
Car	\$20		
<i>Total</i>	<i>\$450</i>	<i>Total</i>	<i>\$450</i>
		Net Worth	\$0

Dynan (2012) found highly leveraged households had larger declines in spending than their less leveraged counterparts, even though there were smaller changes in net worth. This suggests that their debt weighed on their consumption beyond what would

have been predicted by wealth effects alone. In addition, many households found themselves underwater due to the fact that their mortgages often came to exceed the value of their homes, and they had limited, if any, ability to borrow more money, refinance their mortgages, or sell their homes. In the face of such a financial shock to their net worth, it made it difficult for homeowners to make their (relatively high) mortgage payments. Dynan states:

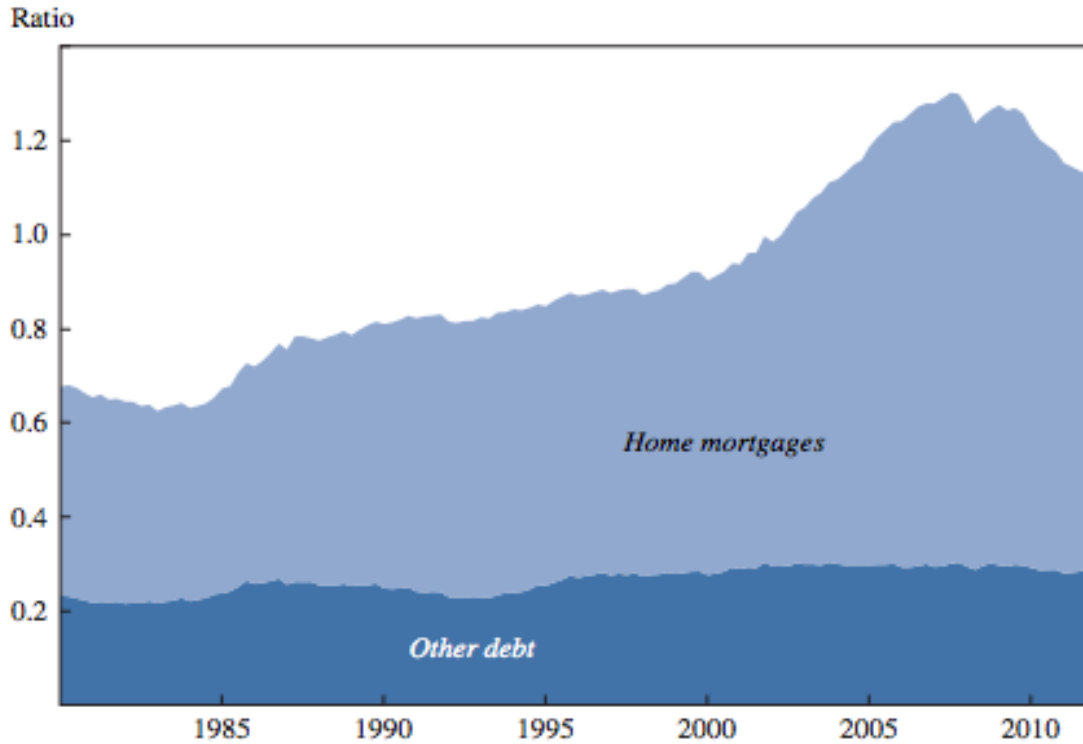
Household's mortgage leverage ratio of 10 percent is associated with a reduction in annual consumption growth of a few tenths of a percentage point. With the roughly half of Americans who have mortgages experiencing considerable jumps in leverage as a result of the roughly one-third decline in home prices nationwide, one might conclude that excessive leverage is having a noticeable (albeit modest) damping effect on aggregate consumption growth.

Despite the efforts of the central bank and the government, important financial strains persisted. Dynan found that there was essentially no reduction of debt between 2009 and 2011. The sample of homeowners reported that they were somewhat or very likely to have problems making their mortgage payments over the coming year. Furthermore, Dynan found that it might take many years for some households to reduce their leverage to pre-crisis norms. The effects of deleveraging on the economy could thus persist for some time to come. Dynan's results reiterate how inhibiting it is for debtors to continue with normal consumption behavior, when they already have overhanging payments due to mortgage debt.

After the financial crisis, mortgage debt is still one of the largest contributors of debt for households. Figure 3 illustrates household debt as a ratio compared to disposable income. Although mortgage debt is a large composition of debt overhang, it is not the only type of debt. Other household debt includes personal, credit card, and student loan

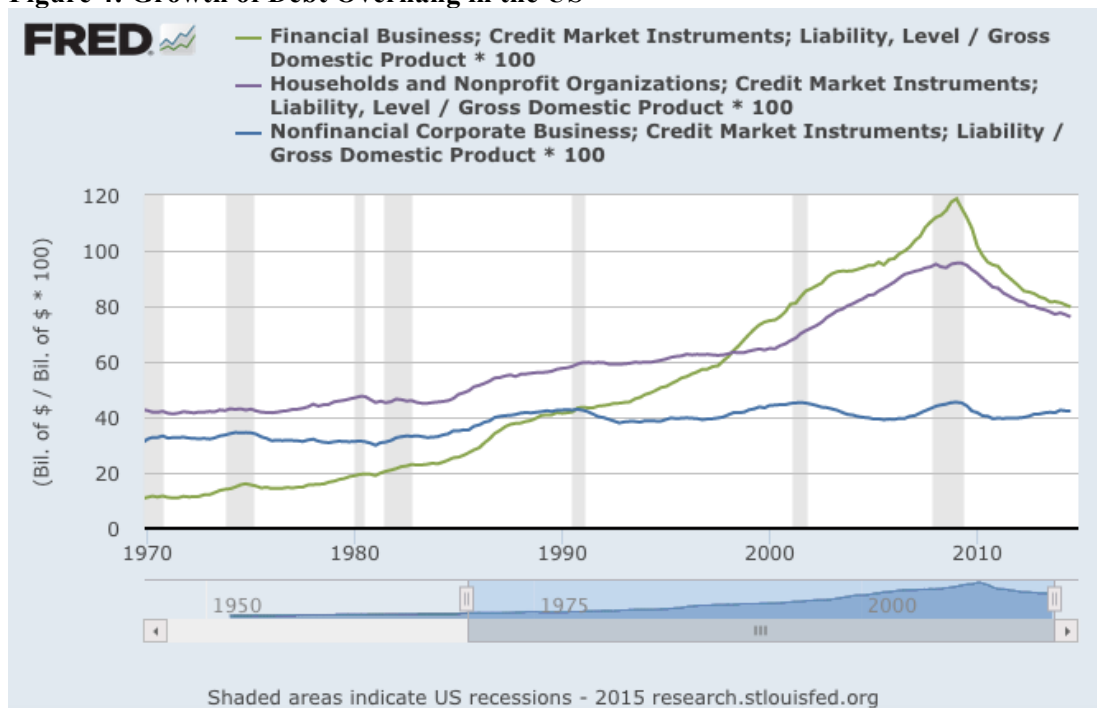
debt. Figure 4 measures debt overhang in the United States. This chart shows household debt in terms of a percentage of the United States GDP. It also compares household debt to financial and nonfinancial corporate business debt. Both charts illustrate how debt has grown significantly since the financial crisis.

Figure 3: Aggregate Ratio of Household Debt to Disposable Personal Income, 1980–2011Q4



Source: Dynan (2012) calculations from Flow of Funds (Federal Reserve) data and National Income and Product Accounts (Bureau of Economic Analysis) data.

Figure 4: Growth of Debt Overhang in the US



Source: St. Louis Federal Reserve

Dynan (2012) also mentions when policymakers gauge whether additional fiscal and monetary stimulus is needed, they must understand how the still-elevated level of aggregate household leverage affects the underlying strength of the economy. Moreover, a better understanding of the implications of high leverage might shed light on the benefits of specific policy interventions. Dynan notes how some analysts have argued for improvements in programs that allow “underwater” borrowers to refinance, so that more households can benefit from the low mortgage rates that have resulted from accommodative monetary policy. Other analysts have advocated for reducing mortgage principal in order to revive the economy. The next two sections will highlight how monetary and fiscal policies are only getting at the surface of the true underlying economic issue: debt overhang.

3.2 Unconventional Monetary Policy

The Federal Reserve operates with a sizable balance sheet that includes a large number of distinct assets and liabilities. The Federal Reserve's balance sheet contains a great deal of information about the scale and scope of its operations. Over recent years, the development and implementation of a number of new lending facilities to address the financial crisis have increased the complexity of the Federal Reserve's balance sheet. In the literature review, Krugman et al (2012) and Putnam (2013) suggest that there are long-term risks to the economy with such an unprecedented growth in the balance sheet.

There are a number of factors affecting the Federal Reserve's balance sheet. On the asset side, there are both direct and indirect operations. In the current circumstances, direct factors include: holdings of Treasury, agency, mortgage-backed securities, discount window lending, lending to other institutions, assets of limited liability companies (LLCs) that have been consolidated onto the Federal Reserve's balance sheet, and foreign currency holdings associated with reciprocal currency arrangements with other central banks (foreign central bank liquidity swaps). For instance, after the financial crisis many depository institutions were short on liquidity. Thus, the Federal Reserve set discount window lending for eligible institutions to have access to primary credit, secondary credit, and seasonal credit, providing these institutions liquidity on a short-term basis with a low interest rate. In addition, the Federal Reserve's largest component on the asset side of the balance sheet has been through the transactions of large-scale asset purchases of mortgage-backed securities, corporate bonds, and treasury securities by the various rounds of QE

One of the indirect factors that affect assets include the Federal Reserve Bank of New York’s holdings of securities on behalf of foreign official and international institutions. Market participants often look for trends in these data to gauge foreign demand for U.S. Treasury and agency securities. Another indirect factor that affects assets includes the securities that the Federal Reserve lends from its portfolio of Treasury securities and federal agency debt securities to foster efficient and liquid trading in the market. When securities are lent, they continue to be listed as assets of the Federal Reserve because the Federal Reserve retains ownership of the securities. Figure 5a details the asset side of the Federal Reserve’s balance sheet and Figure 5b highlights when QE was executed.

Figure 5a: Selected Assets of the Federal Reserve

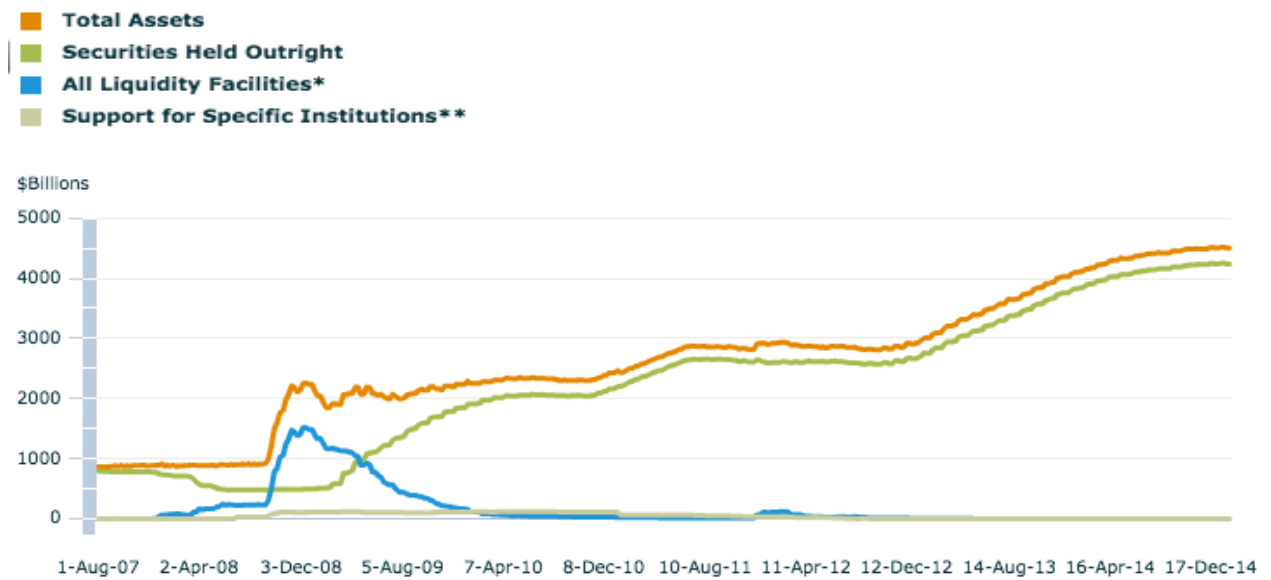
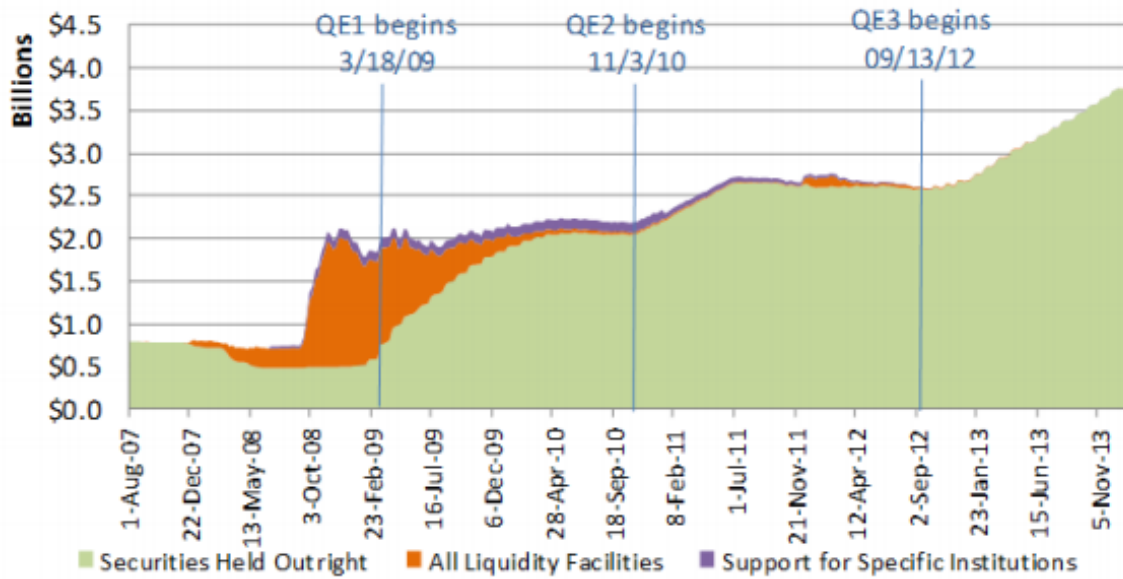


Figure 5b: Selected Assets of the Federal and QE executions



Source: Federal Reserve

The graphs detail the changes the Federal Reserve balance sheet experienced during and after the financial crisis. For example, the level of securities held outright declined at the end of 2007 and into 2008. As the Federal Reserve sold Treasury securities to accommodate the increase in credit extended through liquidity facilities, the various liquidity facilities significantly slowed down over the course of 2009. The level of securities holdings has risen significantly since 2009, principally reflecting purchases of Treasury, agency, and agency-guaranteed mortgage-backed securities under QE announced by the FOMC.

There are many components on the liability side of the Federal Reserve balance sheet, as well. For instance, U.S. currency has historically been the largest liability for the Federal Reserve. The quantity of Federal Reserve notes held by the public has grown over time. The increase in Federal Reserve notes reduce the quantity of reserve balances held by depository institutions and push the federal funds rate above the target set by the FOMC. To prevent that outcome, the Federal Reserve engages in open market operations

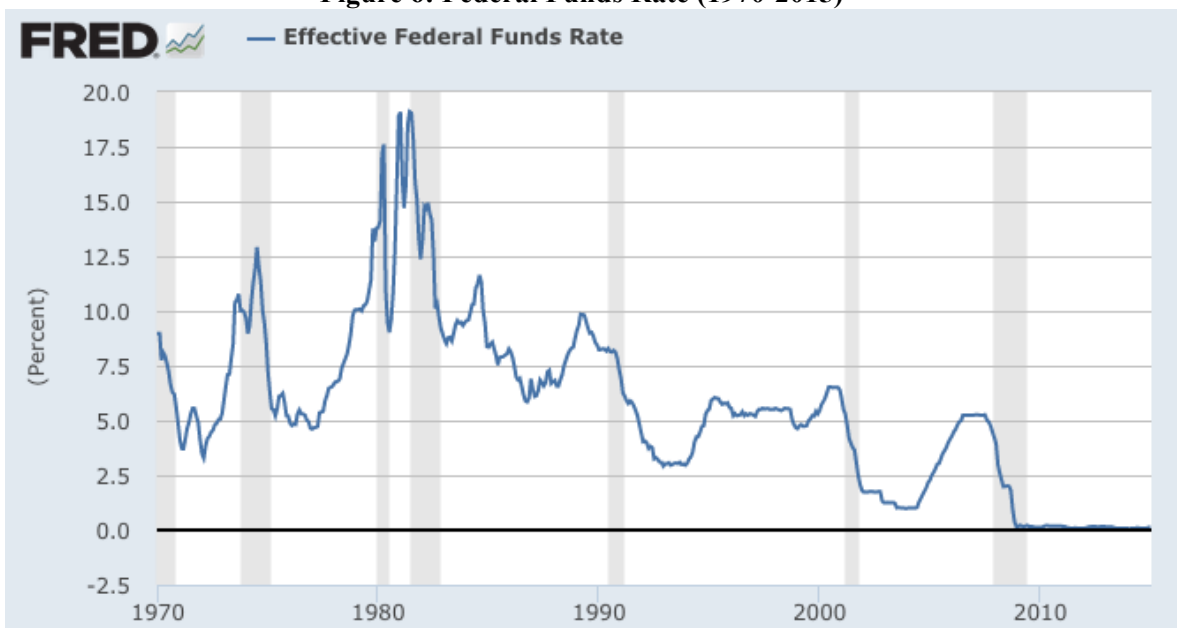
to offset the reduction in reserve balances.

The Federal Reserve also conducts reverse repurchase agreements (reverse repos or RRP) by selling Treasury securities and federal agency debt securities to counterparties who agree to sell them back to the Federal Reserve on a stated future date. During non-recessionary periods, the Federal Reserve executes occasional reverse repos with primary dealers; these transactions temporarily reduce the supply of reserve balances and thus help bring the federal funds rate back up to the target set by the FOMC. During the fall of 2008, the Federal Reserve executed a sequence of overnight reverse repos with primary dealers, as part of its response to the financial crisis. These transactions offset a modest amount of the reserve balance increase that resulted from the expansion of the Federal Reserve's liquidity facilities. Yet, an even more important effect of these transactions was to make more Treasury securities available to private agents so that they can use the securities as collateral in money market transactions and thereby improve the functioning of the money markets.

Deposits of depository institutions are borrowed or lent in bank funding markets, such as the federal funds market. Those transactions move funds from the lender's Federal Reserve account to the borrower's account, but do not change the total amount of balances that the banking system holds at the Federal Reserve Banks. Therefore, the deposits of depository institutions play a role in regards to open market operations. This is because the Fed decreases the sales of securities to decrease the level of deposits of depository institutions, so depository institutions will increase loans to investors and consumers. In times of crisis, the FOMC may set a lower federal funds rate target to spur greater economic activity.

The federal funds rate is the central interest rate in the U.S. financial market. It influences other interest rates such as the prime rate, which is the rate banks charge their customers with higher credit ratings. Additionally, the federal funds rate indirectly influences longer-term interest rates such as mortgages, loans, and savings, all of which are very important to consumer wealth and confidence. In Figure 6, it shows how the Federal Reserve has targeted the federal funds rate to be close to zero since 2008.

Figure 6: Federal Funds Rate (1970-2015)



Source: St. Louis Federal Reserve

Figure 7a, details how since the Great Recession, the liabilities side of the balance sheet has grown significantly over time, especially with the amount of currency in circulation. Moreover, Figure 7b details when QE was executed.

Figure 7a: Liabilities on the Federal Reserve Balance Sheet

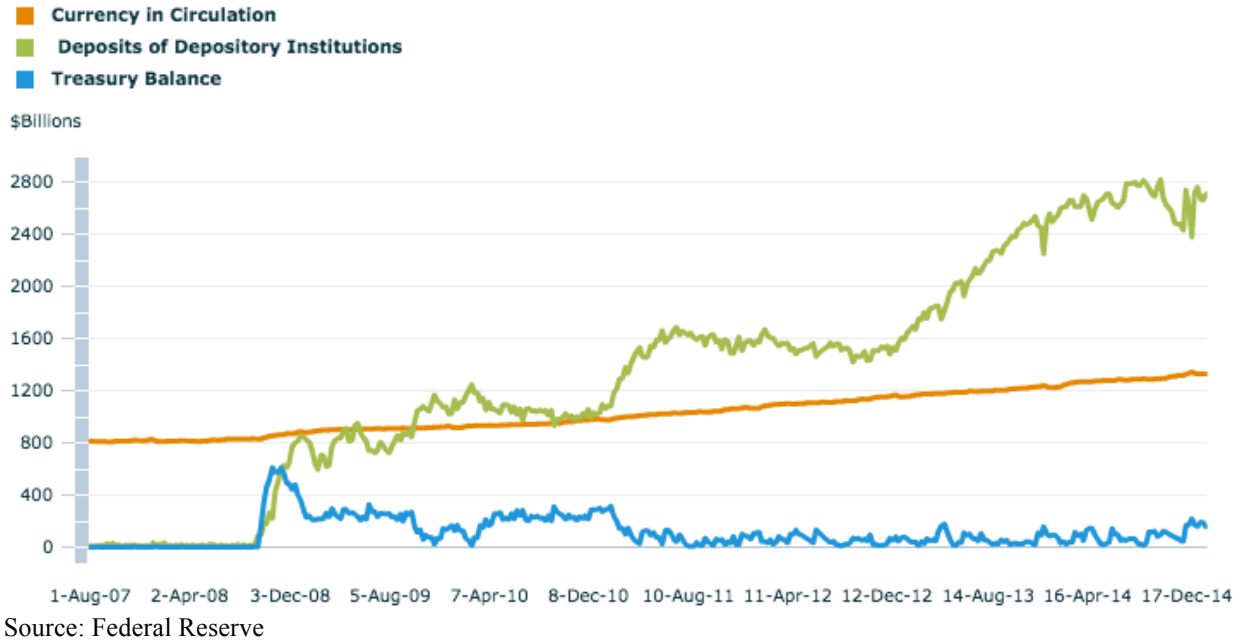
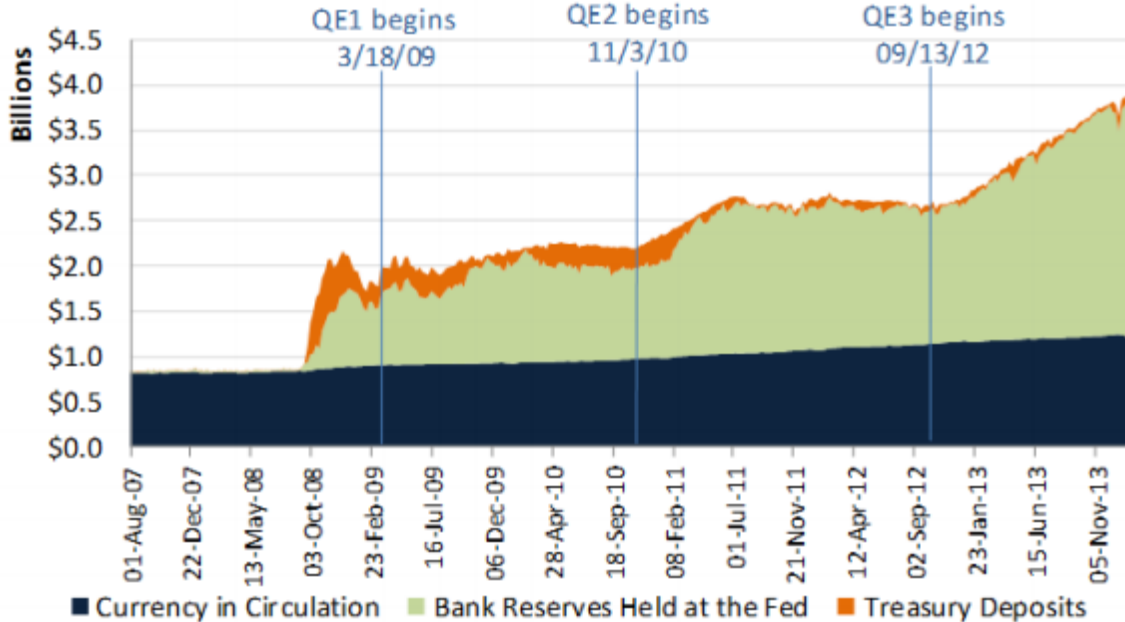


Figure 7b: Liabilities on the Federal Reserve Balance Sheet and QE executions



Although unconventional and conventional monetary policies have been exhausted, as Friedman (2014) and Krugman et al (2012) have expressed, there are concerns with these large financial pressures on the balance sheet of the central banks. Krugman and

Eggertsson (2012) in particular notice that the current economic conditions of low interest rates and low inflation will be problematic for macroeconomic management when it comes time to unwind unconventional monetary policy. Based on Krugman and Eggertsson (2012) study, they use Fisher, Minsky, and Koo analysis to explain how three problems could occur. According to Fisher (1933), deflation could occur and Minsky (1986) states that debt will keep rising for private individuals. As a result of debt and deflation, a balance sheet recession could occur, because such a distress on balance sheets will prevent individual spending due to debt. They argue that if a slump is to be avoided, the government should spend more to compensate for the fact that debtors are spending less; yet even a zero nominal interest rate may not be low enough to induce the needed spending, so fiscal policy must be used.

3.3 Fiscal Policy

While the central bank acted as a “lender of last resort,” the Federal government bailed out some banks and implemented policies to balance the distressed economy. The Emergency Economic Stabilization Act of 2008, sometimes referred to as the bailout of the U.S. financial system, was a law enacted in response to the subprime mortgage crisis, authorizing the United States Secretary of the Treasury to spend up to \$700 billion on distressed assets, especially mortgage-backed securities, and to supply cash directly to the banks.

Within this policy was the Troubled Asset Relief Program (TARP), a program that purchases distressed assets as an additional way to inject capital into banks and other financial institutions, while the Treasury continued to examine the usefulness of targeted asset purchases. An important goal of TARP was to encourage banks to resume lending

again at levels seen before the crisis, both to each other and to consumers and businesses. As banks gain increased lending confidence, the interbank lending interest rates (the rates at which the banks lend to each other on a short term basis) should decrease, further facilitating lending. If TARP can stabilize bank capital ratios, it should theoretically allow them to increase lending, as opposed to saving cash, to mitigate future unforeseen losses from troubled assets. The government hoped that the increased lending would equate to “loosening” of credit, ultimately to restore order in the financial markets and improve investor confidence in financial institutions and the markets.

The Emergency Economic Stabilization Act also provided additional benefits to individuals. Those benefits provided the alternative minimum tax (AMT) relief, energy tax credits, and disaster relief for individuals. It also extended the availability of the exclusion from gross income of discharges of qualifying mortgage debt and several other provisions affecting individuals that expired at the end of 2007 or were scheduled to expire at the end of 2009.⁹

Critics of the Emergency Economic Stabilization Act point to two issues: moral hazard and the increased deficit for the U.S. government. Moral hazard occurs when one party takes on more risks because someone else bears the burden of those risks. Moral hazard also arises when the party with more information about its actions or intentions has a tendency or incentive to behave inappropriately from the perspective of the party with less information. Neil Barofsky, special inspector general for TARP, states that TARP largely spared, “Executives, shareholders, creditors and counter parties,

⁹ Cohen, Gary N., and Todd A. Richardson. "Effects of Emergency Economic Stabilization Act Provisions on Individuals." *Journal of Accountancy*, 2009. [://www.journalofaccountancy.com/news/2009/jan/eesaffectsonindividuals.html](http://www.journalofaccountancy.com/news/2009/jan/eesaffectsonindividuals.html).

reinforcing that not only would the government bail out the largest institutions, but would do so in a manner that would do little harm to the responsible stakeholders.”¹⁰ Barofsky states that TARP and the Emergency Economic Stabilization Act perpetuate the legacy of “Too Big to Fail”. Although, moral hazard has been a negative externality of this legislation, for the purposes of this paper, this subject will not be investigated any further. Instead, this paper will focus on the importance of federal government intervention and the issues of the federal bailout cutting into the federal deficit.

In February 2009, Congress also passed the American Recovery and Reinvestment Act. This legislation is commonly referred to as the “stimulus” or the “stimulus package.” The goals of this act were to create new jobs and save existing ones, encourage economic activity and invest in long-term growth, as well as to promote unprecedented levels of accountability and transparency in government spending. These goals were going to be accomplished by tax cuts and benefits for millions of working families and businesses, funding for entitlement programs, like unemployment benefits, and funding for federal contracts, grants and loans. Spending estimates for the act were approximately \$787 billion, but in 2011, the expenditure was raised to \$840 billion.

Paul Krugman argues that there was not enough stimulus or government money spent on the bailout. He explains that the American Recovery and Reinvestment Act, “...was too small and too short-lived given the depth of the slump: stimulus spending peaked at 1.6 percent of GDP in early 2010 and dropped rapidly thereafter, giving way to a regime of destructive fiscal austerity. And the administration’s efforts to help

¹⁰ "Criticism of TARP 'Moral Hazard' Unfair, U.S. Official Say." Bloomberg.com. March 30, 2011. <http://www.bloomberg.com/news/articles/2011-03-30/criticism-of-tarp-moral-hazard-unfair-u-s-official-says-1->.

homeowners were so ineffectual as to be risible.”¹¹ The Recovery Act never reached that level of spending; even if tax cuts of dubious effectiveness were included, it only briefly grazed that target in 2010, before rapidly fading away. Krugman also argues that even TARP did not cost enough money.

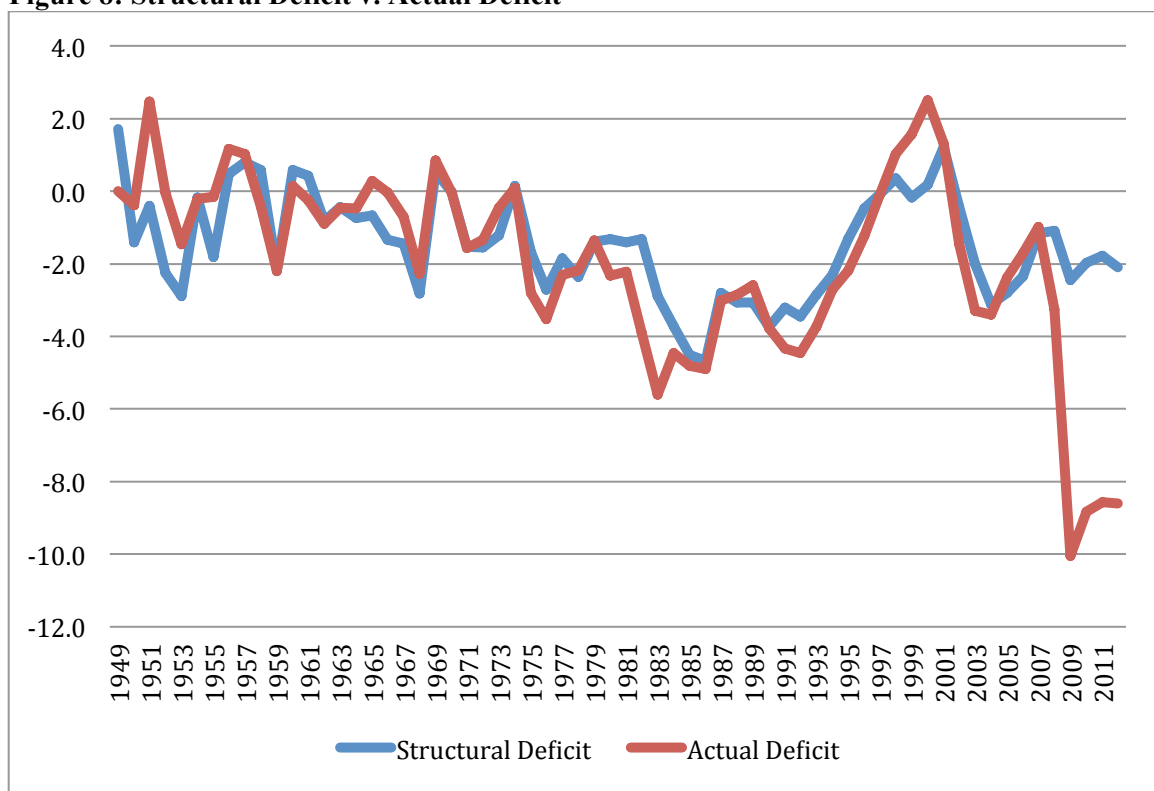
As a result, Krugman is highly critical of politicians for not pumping more money into the Recovery and Reinvestment Act. Krugman is specifically critical of Timothy Geithner’s position on the stimulus. Geithner states, “\$800 billion over two years was considered extraordinarily aggressive, twice as much as a group of 387 mostly left-leaning economists had just recommended in a public letter.” Krugman claims that he and other economists argued that the package was actually too small. The economists’ letter called for spending amounts of \$300 to \$400 billion per year. The Recovery Act never reached that level of spending; it only briefly grazed that target in 2010, before fading away.

So why is there is a discrepancy between too much government money and not enough? That is because economists are looking at structural deficit compared to the current budget. The U.S.’s current budget deficit fluctuates sharply due to economic conditions, while structural budget deficit is the difference between government spending and revenues when the economy is stable. The cyclical deficit, like spending money on economic recovery, will take care of itself as the economy recovers. Instead, the government should only concentrate on long-term pressures on the structural budget deficit. For example, spending on unemployment insurance is highly cyclical, whereas spending on veterans’ health care and Social Security payments are mostly structural.

¹¹ Krugman, Paul. "Does He Pass the Test?" The New York Review of Books. July 10, 2014. <http://www.nybooks.com/articles/archives/2014/jul/10/geithner-does-he-pass-test/>.

The ideal solution would be to organize a reduction of the structural deficit over a decade through increases in tax revenue and cuts to spending. Figure 8 illustrates the difference between actual deficit and structural deficit. According to this data, the structural deficit is roughly 2 percent of GDP. The structural deficit indicates that larger amounts of stimulus spending would have been attainable for the U.S. government during the financial crisis.

Figure 8: Structural Deficit v. Actual Deficit



Source: Evan Soltas Compiled data from Congressional Budget Office

Conclusion

Although, monetary and fiscal policy was expanded to help the economy, the Great Recession, was not a crisis of confidence, but a crisis of debt. At banks, federal deposit insurance assures depositors that they will not lose their money, preventing bank runs. Although shadow banks do not rely on traditional deposits, instead these banks like

Lehman Brothers, raise money through various forms of short-run borrowing eventually found themselves suffering from banks runs- yet, the actions of the Federal Reserve and the government were able to stabilize financial markets. However, the issue of debt overhang is still lingering in the economy. After the financial crisis, households were left with large mortgage debt and other personal debt. The only way to stimulate real wages, consumer spending and GDP is through debt relief and fiscal stimulus. With the continuation of unconventional monetary policy pumping through the economy, these low interest rates and low prices could possibly raise the risk for deflation, more debt, or another recession.

Chapter 4

Empirical Analysis

This next section analyzes the relationship between debt overhang and unconventional monetary, and whether unconventional monetary policy is effective in dealing with debt overhang. As touched upon earlier, unconventional monetary policy lowers interest rates and provides liquidity to financial institutions, stimulating GDP. The first section, *Graphical Analysis*, is a foundation for the following subsections. These graphs detail the components of GDP and the relationship to interest rates, before and after the financial crisis. The second section, *Interest Rate Channel*, examines whether the decreased interest rates significantly affected consumption and investment. The third section, *Credit Channel*, studies if the Federal Reserve's expansion of the balance sheet significantly affected consumption and investment. The final section, *Interpretation*, examines the big picture meaning of the regression results. Although, unconventional monetary policy provides liquidity to financial institutions and creates a low interest rate environment to stimulate consumption and investment, debt overhang also affects consumption and investment, which can morph the environment that the Federal Reserve is trying to create. Thus, debt overhang is significantly affecting consumption and investment.

4.1 Graphical Analysis

This section looks at the big picture changes of how consumption, net assets as a percentage of disposable income, and investment were affected before and after the financial crisis. With these representation established, the next two sections examine how unconventional monetary policy's interest rate and credit channel increases consumption

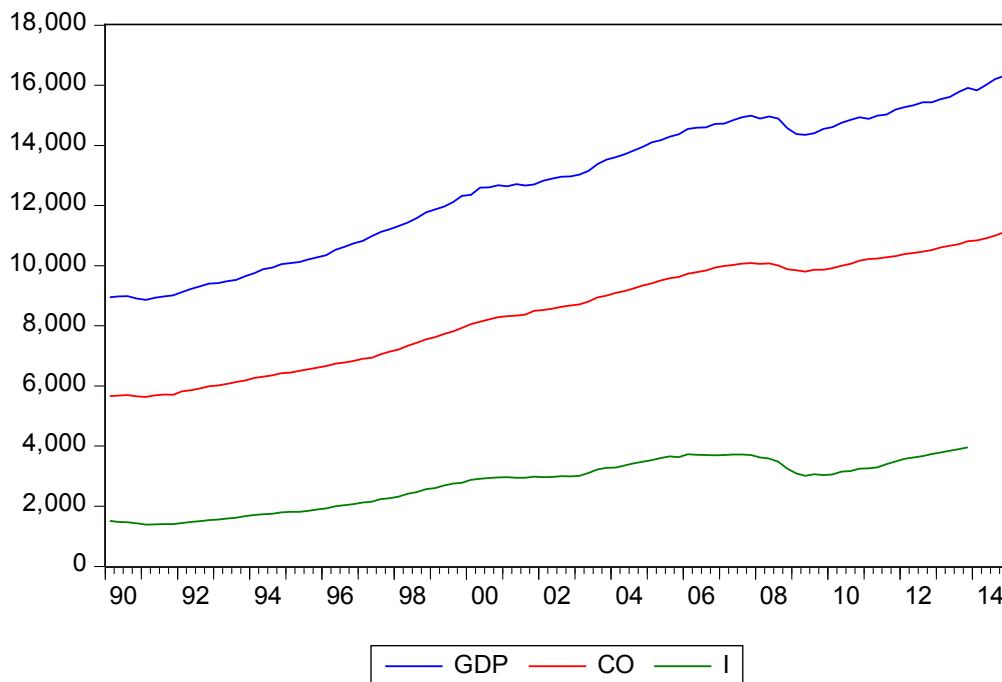
and investment. The data used for this analysis was collected from the Federal Reserve's database. The quarterly data was collected from 1990 to 2014, to encompass not only the Great Recession, but also non-recessionary periods in the U.S. economy.

The reason why it is important to be concerned with consumption and investment is that they are the largest components of GDP. The expenditure equation for GDP is:

$$Y = C + I + G + (X - M)$$

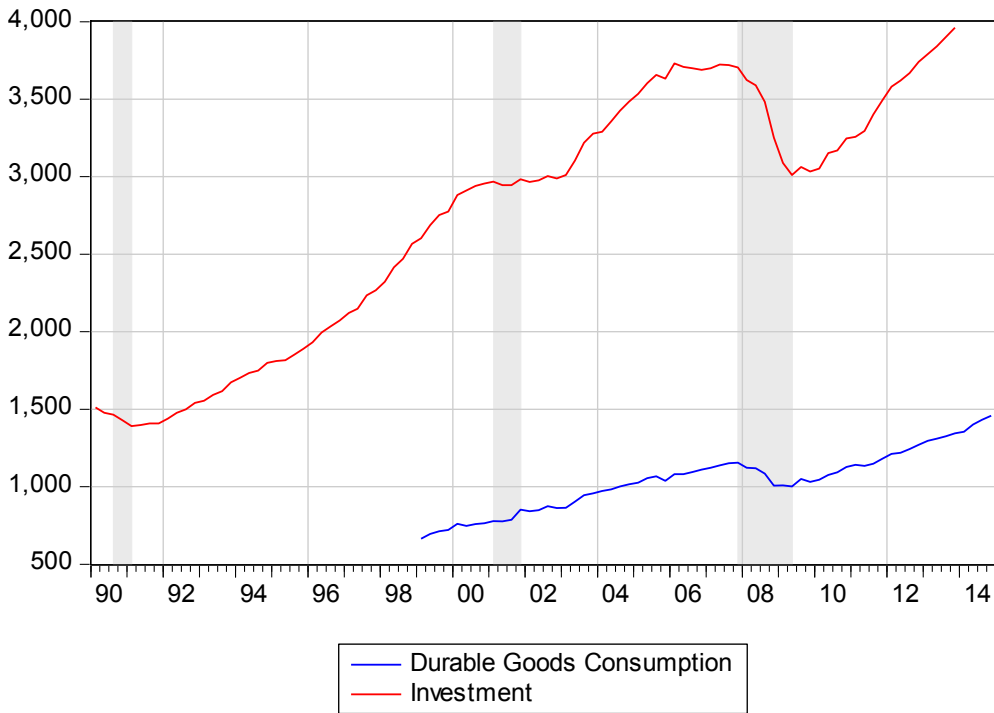
From this equation the economy can be broken down as such: where Y is GDP; C is consumption the largest component of the economy including household final consumption expenditures, like goods and services; the second largest component is I , or investment of businesses into physical capital, such as building a new building; G is government spending; $(X-M)$ is net exports. Figure 9a highlights how much consumption and investments make up GDP.

Figure 9a: GDP, Investment, and Consumption (1990-2014)



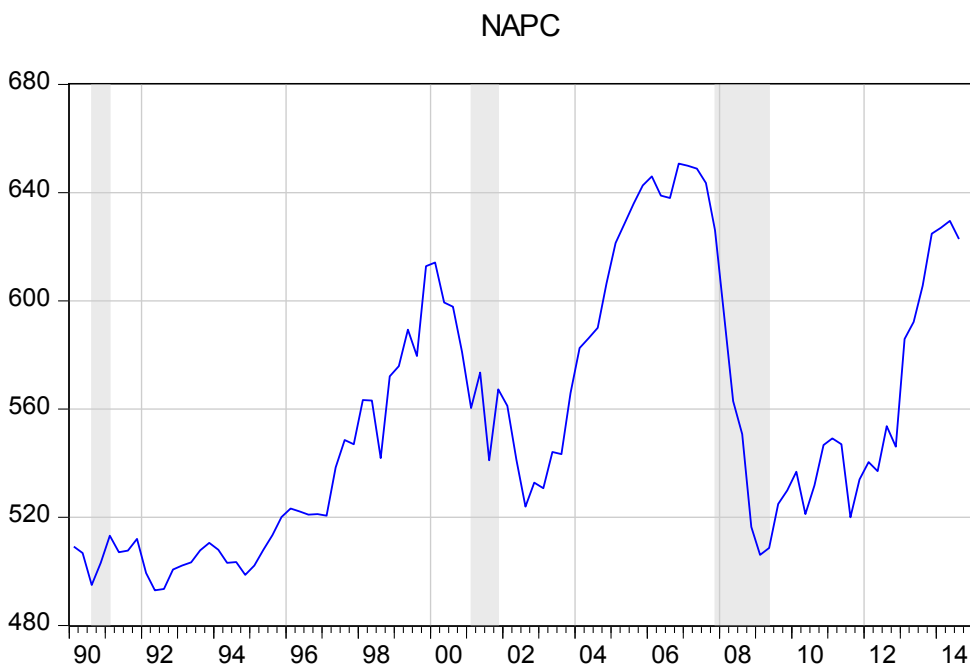
Since consumption and investments are the largest component of GDP, it will be beneficial for this analysis to see the effects of consumption and investment before and after the financial crisis, and to see if the inverse relationship remains between interest rate, consumption and investment. Figure 9a also illustrates how the Great Recession affected GDP and its constituents. Since 1990, there has been constant growth, but when the financial crisis hit in Q4 of 2007 it negatively influenced GDP, consumption, and investment. From 2008 to 2009: *GDP* fell -1.53 percent, *C* fell -0.97 percent and *I* fell -9.31 percent. In the regression analysis sections, the dependent variables will be investment and consumption of durable goods, because these variables are sensitive to low interest rate and an abundant credit environment. Figure 9b, highlights how the financial crisis impacted investment more than consumption of durable goods.

Figure 9b: Investment and Consumption of Durable Goods



It is also important to examine how consumption is affected by individual balance sheets. For instance, when an individual has more net assets they are more likely to consume durable goods like cars or other big-ticket items, while businesses make investments into their homes or businesses. Figure 10 details net assets as a percentage of disposable income. It is interesting to note that right before the housing bubble burst in 2006, net assets as a percentage of disposable income was at its height of 651 percent of disposable income and then it fell to 506 percent in Q1 of 2009, falling 22 percent or an average of -6.85 percent a year. This indicates that not only did individual's net worth fall, but also their debt grew. In addition, this graph shows that net assets have not returned to the level it was at in its zenith from 2006 to 2007. The data also indicates that net assets as a percentage of disposable income has fallen on average of -3.36 percent from 2012 to 2014. For the regression analysis, this data will be used as a variable of debt overhang.

Figure 10: Net Assets as a percentage of Disposable Income



Although the graphs seen thus far highlight how consumption, investment and individual balance sheets were affected after the financial crisis, but how does that affirm whether unconventional monetary policy was effective or not? Well in previous chapters, it was explained that unconventional monetary policy is supposed to lower interest rates to ultimately stimulate investment and consumption, particularly consumption of durable goods. Figure 11 and Figure 12 show how there is an inverse relationship between interest rates and investments, where lower interest rates creates an environment where individuals or businesses are more apt to take out loans and invest in physical capital. Figures 13 and 14 assess the correlation between investment and interest rates.

Figure 11 is a graph of real total investment versus the prime rate. Again real total investment is the total investments in the economy that businesses invest into physical capital. The prime rate is the base rate that banks use to set the price or interest rate on many of their commercial loans and some of their consumer loan products. Economic theory explains that as interest rates decrease investments should increase. Case in point, between 2000 and 2004, where the prime rate decreased on average -9.70 percent and real total investment increased on average 4.66 percent. However, this theory was not significant during the financial crisis from 2007 to 2009 as the prime rate dropped to -23.92 percent and has stayed at the 3.25 percent level, where investments fell -6.16 percent.

Figure 11: Real Total Investment vs. Prime Rate

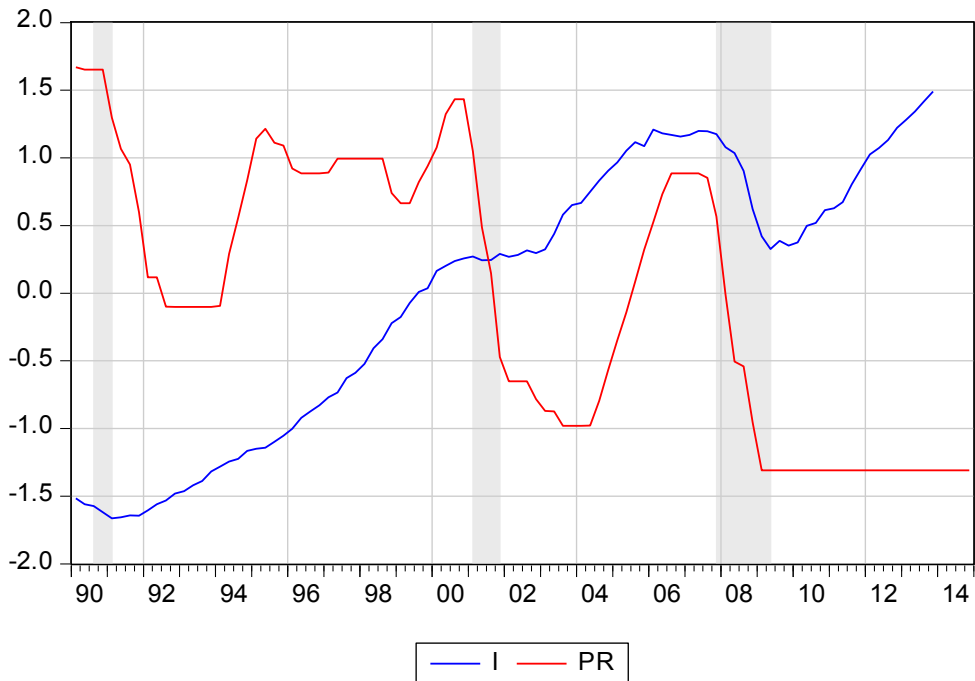
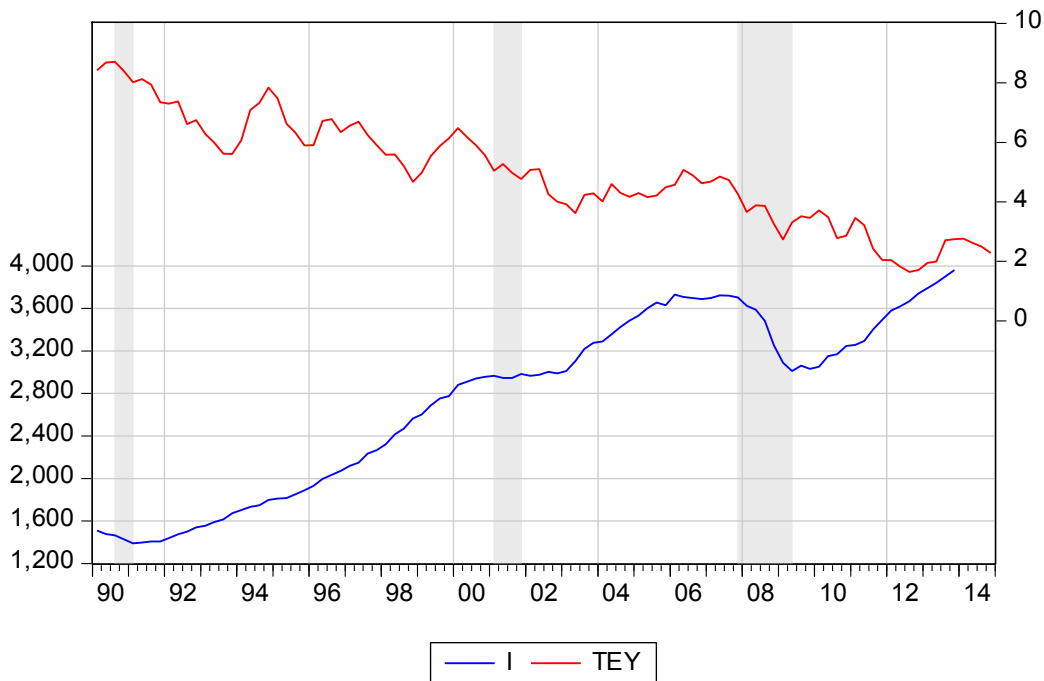


Figure 12 shows a similar relationship between real total investment and the 10-year Treasury rates. The 10-year rates are closely tied to long-term interest rates, as a result we can see if the investment and interest rate relationship is significant in the long run. Figure 12 shows a similar relationship as shown in Figure 11, for instance between 2007 and 2009, when the 10 year interest rate fell -11.79 percent and investments also fell -6.16 percent.

Figure 12: Real Total Investment v. 10 year



Although both graphs show how investment increased after 2008, the inverse relationships are not that significant after the financial crisis. Figure 13a is a scatter graph of real investment and the 10 year treasury rate between 1990 Q1 to 2007 Q3, right before the Great Recession, and the graph shows a significant relationship between low interest rates stimulate higher levels of investment, and higher interest rates lower the levels of investment. However, Figure 13b shows the relationship after the financial crisis from 2007 Q4 to 2014 Q14, and the graph is less significant. There is not a strong correlation relationship between interest rates and investment.

Figure 13a: Investment v. 10 year ('90 Q1- '07Q3) Figure 13b: Investment v. 10 year ('07Q4- '14Q4)

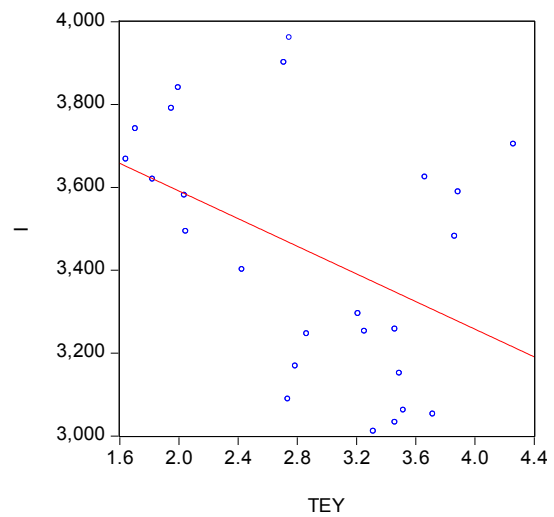
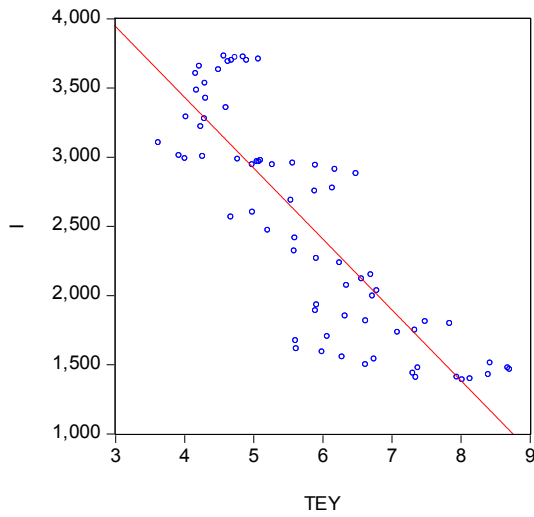


Figure 14a: Investment v. r ('90Q1- '07Q3)

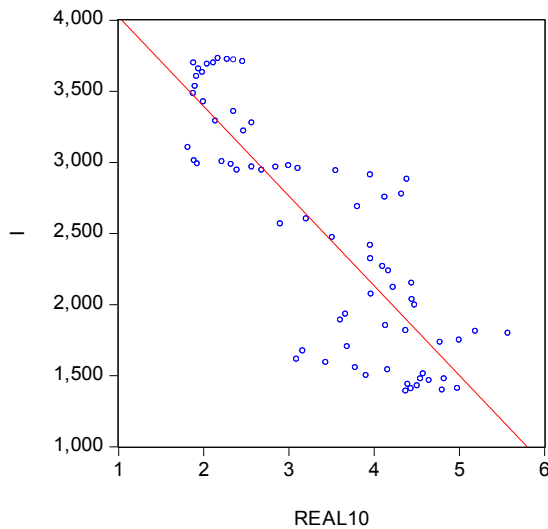
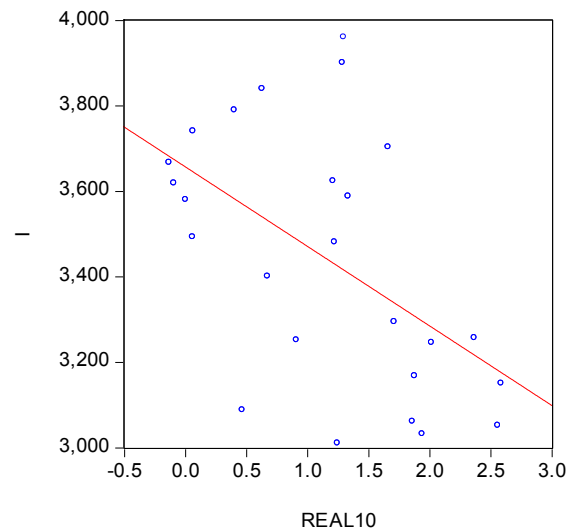


Figure 14b: Investment v. r ('90Q1- '07Q3)



To reinforce this argument, a scatter plot was designed to show the relationship between real investments and real interest rates. Real interest rates are the interest rates that have been adjusted to remove the effects of inflation to reflect the real cost of funds to the borrower, and the real yield to the lender. The real interest rates or (r) is calculated by using the Fisher equation, which states that the real interest rate is approximately the nominal interest rate minus the inflation rate, or in this case 10-year treasury yields less

inflation rate. Figure 14a shows the strong inverse relationship between real investment and real interest rates between 1990Q1 and 2007Q3. Similarly to Figure 13b, Figure 14b also shows how this relationship falls apart. Although, this is not a definitive explanation that unconventional monetary policy is ineffective, it does suggest that unconventional monetary, a policy that lowers interest rates, does not have a strong correlation in increasing investments after the financial crisis. As a result, there must be other factors affecting this relationship, so the next two subsections will delve into the significance of these other variables.

4.2 Interest Rate Channel

Although the scatter plots and graphs give a good physical representation of what is going on, through regression analysis there is a better understanding of the significance of unconventional monetary policy. The interest channel examines how monetary policy changes nominal interest rates and price level, subsequently affecting output and employment. According to times of recession, a decline in the long-term real interest rates reduces both the cost of borrowing and the money paid on interest-bearing deposits. Therefore, the low interest rate environment encourages household spending on durable goods, as well as increased investing by investors. The rise in investments and durable goods purchased, boosts the level of aggregate demand and employment. Krishnamurthy and Vissing-Jorgensen (2011) investigated how quantitative easing affects various interest rates and the impact of macroeconomic behavior. They argued that QE signals a decrease in nominal interest rates, an increase in inflation expectations, and a decrease in corporate bond default risk. As a result encouraging market participants to invest and consume.

In examining real investment, there will also be a comparison to consumption of durable. Therefore, the first regression is to examine the relationship between real investment and real interest rates. In a low interest rate environment, it is assumed that businesses would be more apt to invest in certain aspects of their enterprise, like taking out a loan to expand their building, to buy new equipment, etc. Thus, it is expected that there would be a significant relationship between real investment and real interest rates. The equation below measures investment as the dependent variable compared to real interest rates, the change in GDP and net asset as a percentage of disposable income. The equation:

$$I = \beta_0 + \beta_1 real10 + \beta_2 \Delta GDP + \beta_3 NAPC$$

Table 4 shows that real interest rates and net assets as a percentage of disposable income are significant, whereas the change in GDP is not that significant. Although the results intuitively make sense, where real interest rates inversely effect investment and net assets directly affect investment, it does not pass the Durbin Watson test. The results indicate that the coefficients are inflated because of autocorrelation.

Table 4: Investment and Interest Rate

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-930.3883	349.9830	-2.658381	0.0093
REAL10	-381.8874	19.18133	-19.90933	0.0000
D(GDP)	0.359773	0.318187	1.130695	0.2612
NAPC	8.549687	0.595321	14.36147	0.0000
R-squared	0.919812	Mean dependent var		2759.731
Adjusted R-squared	0.917168	S.D. dependent var		808.3797
S.E. of regression	232.6554	Akaike info criterion		13.77819
Sum squared resid	4925698.	Schwarz criterion		13.88572
Log likelihood	-650.4639	Hannan-Quinn criter.		13.82164
F-statistic	347.9446	Durbin-Watson stat		0.584033
Prob(F-statistic)	0.000000			

For comparison, it would be compelling to compare Table 4 to the consumption of durable goods and interest rate relationship. For example, if individuals were in an environment of low interest rates, they might be more responsive to buying a home, a car, or a washing machine. Therefore, Table 5 compares consumption of durable goods to real interest rates, a change in GDP, and net assets as a percentage of disposable income:

$$COD = \beta_0 + \beta_1 real10 + \beta_2 \Delta GDP + \beta_3 NAPC$$

These results are also strong, the coefficients are statistically significant and the R-squared close to one. Although, the regression does not pass the Durbin Watson test, the other components of these results are significant.

Table 5: Consumption of Durable Goods and Interest Rates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	413.4468	165.0440	2.505070	0.0150
REAL10	-160.4460	11.71812	-13.69213	0.0000
D(GDP)	0.264363	0.133509	1.980118	0.0524
NAPC	1.578512	0.293096	5.385648	0.0000
R-squared	0.769867	Mean dependent var		1031.570
Adjusted R-squared	0.758165	S.D. dependent var		189.0894
S.E. of regression	92.98800	Akaike info criterion		11.96420
Sum squared resid	510159.4	Schwarz criterion		12.10028
Log likelihood	-372.8725	Hannan-Quinn criter.		12.01772
F-statistic	65.79100	Durbin-Watson stat		0.495417
Prob(F-statistic)	0.000000			

Appendix C uses variations of the regressions in Table 4 and Table 5 to resolve autocorrelation. Autocorrelation occurs for a variety of reasons, there could not enough dependent variables in the equation, perhaps the wrong model is being used, or there is a time series difference in the data. However, using methods such as lag effect for interest rates, first-order autoregressive process, and logarithmic functions could help correct this error. As seen in Appendix C, the significance of the coefficients were worse when the adjustments for autocorrelation was taken into account, so Table 4 and Table 5 are the

most significant results. For the next subsection, Appendix D will also examine the problem of autocorrelation

These regressions shown in Table 4 and Table 5 indicate that real interest stimulates investment and consumption of durable goods. It is also important to note that net assets as a percentage of disposable income, the indicator of debt overhang, are also statistically significant on investment and consumption of durable goods. Although unconventional monetary policy created a low interest rate environment to increase investment and consumption, it is important to note that wealth effects are statistically significant to these outputs. As a result, unconventional monetary policy alone cannot stimulate consumption and investment behavior

4.2 Credit Channel

The credit channel of monetary policy transmission is an indirect amplification that works with the interest rate channel. The credit channel affects the economy by altering the amount of access credit firms and/or households have to these funds. After the financial crisis, it was important for central banks to create liquidity for financial institutions. The Federal Reserve increases the availability of credit, and thus increases agents' spending and investment behavior, leading to an increase in output. Chodorow-Reich (2012) explains that credit matters because it not only allows interest rates to remain low for loans, but Chodorow-Reich also found that lender health has an economically and statistically significant effect on employment. If credit is contracted from businesses, due to financial institutions' lack of liquidity, it will negatively influence employment at non-financial firms.

As a result, the Federal Reserve's balance sheet has been exceedingly expanded due to unconventional monetary policy to stimulate the economy and to provide credit to financial institutions. The assets and liabilities are a good measurement of unconventional monetary policy, but another measurement of unconventional monetary policy that is beneficial for this channel of analysis, is the monetary base. Monetary base is the portion of the commercial banks' reserves with the central bank, plus the total currency circulating in the public and held at banks. An increase of the monetary base, like the one after the financial crisis, will typically result in a much larger increase in the supply and demand of deposits through the banks' loan making or the money multiplier. As a result, banks will be more likely to give out loans, stimulating consumption and investment. With this much liquidity at financial institutions, there should be a significant relationship between consumption and investment, and the Federal Reserve's balance sheet and monetary base.

However, Hubbard (1995) explains two ways in which having credit is not enough to stimulate investment and consumption. For instance, if financial institutions have credit available through open market operations, it does not mean they will lend it out to borrowers. Especially after an economic crisis, banks are potentially more reluctant due to the risk and cost of lending. Secondly, an individual's economic situation affects their accessibility to credit or their willingness to take out credit. For example, an adverse shock to a borrower's net worth increases the cost of external finance and decreases the ability of the borrower to implement investment, employment and production plans. Hubbard states, "Developing ways to incorporate borrower heterogeneity in both economic models of money and credit and in forecasting is an important, practical task

for economic modelers and policymakers.”¹² As a result, the regressions will examine if unconventional monetary policy, in terms of increasing credit, will positively stimulate consumption and investment.

Table 6 and Table 7 represent real investment in relation to monetary base and real investment compared to the assets and liabilities of the central bank’s balance sheet. Table 6 measures investment based on real interest rates, net assets as a percentage of disposable income and monetary base. The real interest rate coefficient should be negative, while net assets and monetary base should be a positive coefficient:

$$I = \beta_0 + \beta_1 real10 + \beta_2 napc + \beta_3 mabase$$

Although the regression does not pass the Durbin Watson test, the coefficients are statistically significant and the R-squared is almost at one; Appendix D shows other regressions that compensate for autocorrelation, but Table 6 is the most statistically significant result.

Table 6: Investment and Monetary Base

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1543.522	360.2564	-4.284510	0.0000
REAL10	-316.2719	26.56963	-11.90351	0.0000
NAPC	9.140154	0.552323	16.54857	0.0000
MOBASE	0.000130	4.28E-05	3.035369	0.0031
R-squared	0.927388	Mean dependent var		2746.732
Adjusted R-squared	0.925020	S.D. dependent var		814.1376
S.E. of regression	222.9306	Akaike info criterion		13.69237
Sum squared resid	4572219.	Schwarz criterion		13.79922
Log likelihood	-653.2338	Hannan-Quinn criter.		13.73556
F-statistic	391.6700	Durbin-Watson stat		0.531529
Prob(F-statistic)	0.000000			

¹² Hubbard, R. Glenn. "Is There a “Credit Channel” for Monetary Policy?" *National Bureau of Economic Research*, 1994. <http://www.nber.org/papers/w4977.pdf>.

Table 7 is a regression model that measures real investment to the balance sheet of the Federal Reserve. The regression measures real investment to real interest rates, net assets as a percentage of disposable income, and the Federal Reserve's assets and liabilities. Real interest rates and the liability coefficient should be negative, while net assets and the assets coefficient should be a positive coefficient.

$$\log(I) = \beta_0 + \beta_1 real10 + \beta_2 \log(napc) + \beta_3 bass + \beta_4 liab$$

Table 7: Investment and the Federal Reserve Balance Sheet

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.810199	0.340306	5.319327	0.0000
REAL10	-0.047867	0.005997	-7.981975	0.0000
LOG(NAPC)	1.002670	0.053030	18.90768	0.0000
BASS	5.89E-07	5.95E-07	0.990232	0.3282
LIAB	-5.78E-07	6.03E-07	-0.959227	0.3434
R-squared	0.910078	Mean dependent var	8.148250	
Adjusted R-squared	0.900855	S.D. dependent var	0.078966	
S.E. of regression	0.024864	Akaike info criterion	-4.444116	
Sum squared resid	0.024111	Schwarz criterion	-4.241367	
Log likelihood	102.7706	Hannan-Quinn criter.	-4.368927	
F-statistic	98.67694	Durbin-Watson stat	1.374793	
Prob(F-statistic)	0.000000			

This regression comes close to passing the Durbin Watson test, where interest rates and net assets are statistically significant, but the coefficient for the Federal Reserve's assets and liabilities are not statistically significant. This could be because the Federal Reserve balance sheet is a representative of so many facets of unconventional monetary policy that these variables could not be statistically significant compared to real investment or there are not enough variables in this model. The only significant coefficients are net assets as a percentage of disposable income and real interest rates. These results reiterate the results in the interest rate channel, that individuals balance sheet are important to investment.

Table 8a, 8b, and 9 will makes similar comparisons as that in Table 6 and Table 7, but the dependent variable is consumption of durable goods. Table 8a measures the regression of consumption of durable goods based on real interest rates, net assets as a percentage of disposable income and monetary base. Real interest rates coefficient should be negative, while net assets and monetary base should be a positive coefficient.

$$COD = \beta_0 + \beta_1 real10 + \beta_2 NAPC + \beta_3 mobase$$

Table 8a highlights that the variables fit the regression line and the coefficients are statistically significant except for β_0 , yet the results are still inflated because of the Durbin Watson Test.

Table 8a: Consumption and Monetary Base

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	151.5658	112.3416	1.349151	0.1824
REAL10	-97.78705	10.40803	-9.395350	0.0000
NAPC	1.630358	0.194948	8.363026	0.0000
MOBASE	9.00E-05	1.05E-05	8.607608	0.0000
R-squared	0.891201	Mean dependent var		1031.570
Adjusted R-squared	0.885669	S.D. dependent var		189.0894
S.E. of regression	63.93668	Akaike info criterion		11.21505
Sum squared resid	241186.0	Schwarz criterion		11.35112
Log likelihood	-349.2741	Hannan-Quinn criter.		11.26857
F-statistic	161.0943	Durbin-Watson stat		0.477981
Prob(F-statistic)	0.000000			

Although, additional tables of the regression are kept in Appendix D and Table 8b real interest rates and β_0 are not significant, however this table highlights how this regression was adjusted for autocorrelation and the results are more significant.

Table 8b: Consumption and Monetary Base with AR(1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	214921.8	31231707	0.006882	0.9945
REAL10	0.431007	6.608931	0.065216	0.9482
NAPC	0.616587	0.166299	3.707691	0.0005
MOBASE	-7.41E-05	2.41E-05	-3.077367	0.0032
AR(1)	0.999925	0.010975	91.11322	0.0000
R-squared	0.990351	Mean dependent var		1037.498
Adjusted R-squared	0.989674	S.D. dependent var		184.6357
S.E. of regression	18.76181	Akaike info criterion		8.778731
Sum squared resid	20064.31	Schwarz criterion		8.950274
Log likelihood	-267.1407	Hannan-Quinn criter.		8.846083
F-statistic	1462.653	Durbin-Watson stat		2.133624
Prob(F-statistic)	0.000000			
Inverted AR Roots	1.00			

Table 9 represents the strongest results from this regression analysis. The equation examines the connection of consumption of durable goods dependent on real interest rates, net assets as a percentage of disposable income, assets and liabilities

$$COD = \beta_0 + \beta_1 real10 + \beta_2 napc + \beta_3 bass + \beta_4 liab$$

Table 9 shows that the coefficients are statistically significant and that there is a strong R-square, furthermore, the equation almost passes the Durbin Watson Test. Consumption of durable goods in relation the Federal Reserve's balance sheet is more significant than Table 8a and Table 8b. Table 9 results are also more interesting than Table 6 and Table 7, indicating that consumption of durable goods are more sensitive to the credit available at financial institutions than investment. However, overall both investment and consumption of durable goods are responsive to net assets as a percentage of disposable income. Similar to the interest rate channel results, the Federal Reserve actions of for creating liquidity are statistically significant factors for stimulating consumption and investment, but the coefficients are so small that they do not directly impact consumption and investment.

Table 9: Consumption and The Federal Reserve Balance Sheet

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.298319	0.322793	4.022143	0.0002
REAL10	-0.035979	0.005965	-6.031458	0.0000
LOG(NAPC)	0.871198	0.050325	17.31149	0.0000
BASS	4.40E-06	5.55E-07	7.916443	0.0000
LIAB	-4.37E-06	5.61E-07	-7.784759	0.0000
R-squared	0.955690	Mean dependent var		7.012826
Adjusted R-squared	0.951470	S.D. dependent var		0.114033
S.E. of regression	0.025121	Akaike info criterion		-4.429932
Sum squared resid	0.026505	Schwarz criterion		-4.233108
Log likelihood	109.1034	Hannan-Quinn criter.		-4.355866
F-statistic	226.4654	Durbin-Watson stat		1.159489
Prob(F-statistic)	0.000000			

4.3 Interpretation

What is the significance of these results? In the presence of unconventional monetary policy, the low interest rate environment increases consumption and investment; while the actual changes in the central bank's balance sheet are statistically significant do not directly impact consumption and investment. Ultimately, these results in essence address the core concept of debt overhang. All of these tables show that the coefficient for NAPC (net assets as a percentage of disposable income) is positive and significant. Before explaining these results further, it is also important to point out that some of these diagnostics are questionable and some of the other coefficients (like real interest rate and monetary base) signs change. These inefficiencies are explained due to auto correlation inadequacies in the data. For instance, the Durbin Watson is not passed in the results, although Appendix C and D try to accommodate for this error, it was difficult to fix autocorrelation. This means that the t-statistics of the results are

overestimated, and hence a regression that appears to be significant may not be so. The estimated variances of the parameters could be biased and inconsistent.¹³

However, the results of NAPC are robust with respect to all model specifications. For example, Table 9 details these results and provides explanations for the thesis. For instance, all else equal controlling for real interest rates, a one-unit decrease in the interest rate, increases the consumption of durable goods by 36 billion dollars. In addition, when NAPC increase by 1%, consumption of durable goods increases by 0.87%. To further suggest how important net assets are to consumption is to exam the financial crisis period from 2007 to 2008, where net asset fell 20 percent and from the result indicated in Table 9 would correlate to a decreased consumption of durable goods by 17 percent. This highlights the phenomenon of debt overhang after the financial crisis and those impacts on consumption. Yet, the changes of the Federal Reserve's balance sheet have no major, direct affect on consumption of durable goods. In regards to the assets of the Federal Reserve's balance, a one-unit increase in the assets on the Federal Reserve's balance sheet only increases consumption of durable goods by 4,400 dollars. These results indicate that unconventional monetary policy in regards to the change of the central bank balance sheet are not as significant as compared to net assets and real interest rates.

As discussed in the beginning of this chapter, consumption and investment are large components of GDP, roughly 80 percent. Figure 9b illustrates how from 2007 to 2008, investment declined more than consumption of durable goods. To study this further, Table 10 and Table 11 compares investment and consumption of durable goods

¹³ Ramanathan, Ramu. "Chapter 9: Serial Correlation." In *Introductory Econometrics with Applications*, 380-383. 5th ed. San Diego, California: South-Western, 1989.

to unconventional monetary policy, interest rates, and GDP. The equation for Table 10 is shown as:

$$I = \beta_0 + \beta_1 real10 + \beta_2 NAPC + \beta_3 d(GDP) + \beta_4 mobase$$

Table 10: Investment, Monetary Base, and GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1600.114	385.3060	-4.152840	0.0001
REAL10	-302.5576	28.28824	-10.69553	0.0000
NAPC(-1)	9.058846	0.588100	15.40359	0.0000
D(GDP(-1))	0.533947	0.302495	1.765145	0.0810
MOBASE	0.000170	4.32E-05	3.946068	0.0002
R-squared	0.930955	Mean dependent var		2773.376
Adjusted R-squared	0.927852	S.D. dependent var		801.6392
S.E. of regression	215.3238	Akaike info criterion		13.63389
Sum squared resid	4126426.	Schwarz criterion		13.76917
Log likelihood	-635.7927	Hannan-Quinn criter.		13.68853
F-statistic	300.0028	Durbin-Watson stat		0.526929
Prob(F-statistic)	0.000000			

The equation for Table 11:

$$COD = \beta_0 + \beta_1 real10 + \beta_2 NAPC + \beta_3 d(GDP) + \beta_4 mobase$$

Table 11: Consumption of Durable Goods, Monetary Base, and GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	184.9961	119.5947	1.546859	0.1272
REAL10	-96.75884	11.06712	-8.742914	0.0000
NAPC(-1)	1.549217	0.203583	7.609759	0.0000
D(GDP(-1))	0.097632	0.095421	1.023165	0.3104
MOBASE	9.40E-05	1.06E-05	8.897238	0.0000
R-squared	0.895901	Mean dependent var		1038.225
Adjusted R-squared	0.888844	S.D. dependent var		194.9921
S.E. of regression	65.01054	Akaike info criterion		11.26188
Sum squared resid	249355.8	Schwarz criterion		11.43054
Log likelihood	-355.3802	Hannan-Quinn criter.		11.32832
F-statistic	126.9425	Durbin-Watson stat		0.557258
Prob(F-statistic)	0.000000			

These results, although adjusted for autocorrelation, are still slightly inflated due to failing the Durbin Watson test. However, the results show something very interesting, that the coefficients of the independent variables for investments are larger and more

statistically significant than the coefficients of the independent variables for consumption of durable goods. For example in Table 10, all else equal, a one-unit decrease in the interest rate increases investment by 302.56 billion dollars. Moreover, all else equal, a one-unit increase in NAPC increases investment by 9.06 billion dollars. Conversely, Table 11 shows that, all else equal, a one-unit decrease in real interest rates increases consumption of durable goods by 96.76 billion dollars, and a one unit increase in NAPC increases consumption of durable goods by 1.55 billion dollars. The results show that investors are more concerned with GDP and NAPC. As a result, when a crisis hits not every aspect of the economy is not equally affected. Thus, debt overhang affects various aspects of the economy preventing unconventional monetary policy to not be as effective.

Chapter 5

Conclusion

The focus of this study was intended to examine whether or not unconventional monetary policy was effective in combatting debt overhang. Over the course of this analysis, the results indicate that unconventional monetary policy was effective in stimulating consumption and investment behavior. Yet, the results also indicate that debt overhang is statistically significant to the other effects of output, in particular investment and consumption of durable goods.

This paper examines a very nuanced relationship, while there has been plenty of literature about unconventional monetary policy and debt overhang, this relationship has never been examined closely. Bernanke (2004) and Krishnamurthy and Vissing-Jorgensen (2011) maintain that unconventional monetary was an important facet of the recovery of the U.S. economy to stabilize the economy and increase consumption and investment; which to some degree was necessary, so the economy would not react like it did during the Great Depression. However, many economists as Labonte (2014) and Friedman (2014) explain that it has been a slow recovery for the economy and it will continue to be slow to return to the level it was at in 2007. Krugman and Eggertsson (2014) claim that because of debt spreading after the financial crisis, it has morphed the expected macroeconomic outcomes of monetary policy and creating a slow economic recovery. Furthermore, Boshara and Emmons (2013) explain that because individual's net worth have been negatively impacted from the financial crisis, and that some consumers are not being able to consume and invest because of the debt overhang, which slows down the growth of the economy.

Although there are some shortcomings to this analysis; such as the simplicity of the regression, the autocorrelation of the data, however, the contribution of this paper shows debt overhang has a significant impact on investment and consumption behavior. Indicating that unconventional monetary policy alone does not reduce the significance of debt overhang. As a result, it is important that the Federal Reserve and the U.S. Federal Government reexamine the alternative avenues to stimulate consumption and investment, possibly through fiscal stimulus, debt forgiveness or restructuring of mortgages.

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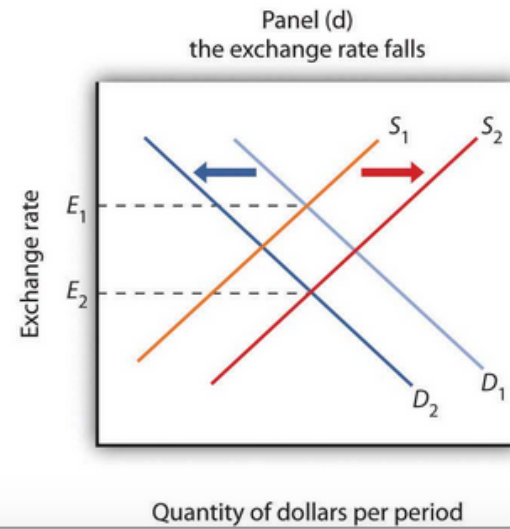
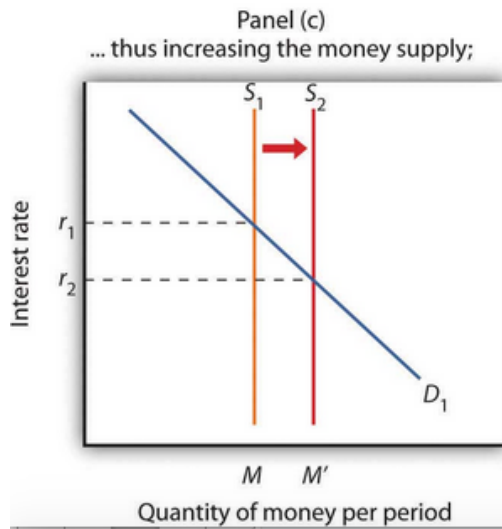
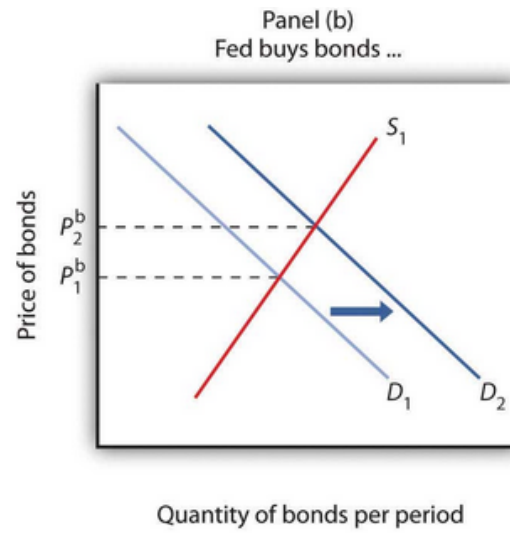
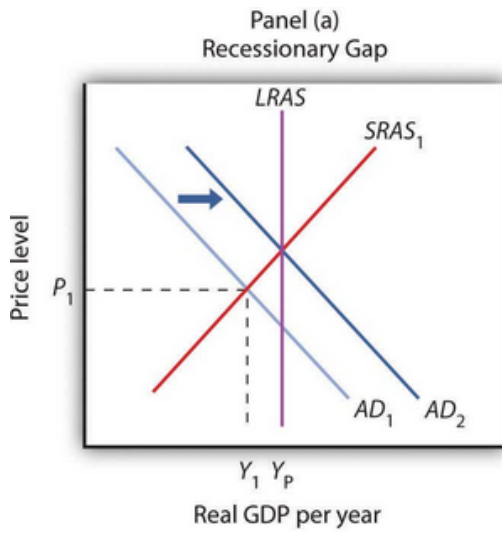
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Appendix A



Appendix B

Calculations for pages 51-52

	Average Annual Rates, Per Year			
	C	I	GDP	NAPC
2008-2009	-0.97%	-9.31%	-1.53%	-10.18%
2007-2009	0.10%	-6.16%	-0.43%	-6.85%
2012-2014	2.24%	7.34%	2.32%	-3.36%

Calculations for pages 53-54

	Average Annual Rates, Per Year		
	Prime Rate	10 Year Bond	I
2000-2004	-9.70%	-4.88%	4.66%
2007-2009	-23.92%	-11.79%	-6.16%

Appendix C

I. Investment Regressions and Interest Rate Channel

Table C.1 results to do not make equation more statistically significant, also GDP should not be a negative coefficient

Table C.1 is accounting for lag in real interest rates

Dependent Variable: I

Method: Least Squares

Date: 03/05/15 Time: 20:17

Sample (adjusted): 1990Q2 2013Q4

Included observations: 95 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1026.098	375.4151	-2.733235	0.0075
REAL10(-1)	-369.0486	20.29296	-18.18604	0.0000
D(GDP)	-0.138656	0.335467	-0.413324	0.6803
NAPC	8.746378	0.637524	13.71929	0.0000
R-squared	0.907329	Mean dependent var		2759.731
Adjusted R-squared	0.904274	S.D. dependent var		808.3797
S.E. of regression	250.1091	Akaike info criterion		13.92286
Sum squared resid	5692464.	Schwarz criterion		14.03040
Log likelihood	-657.3361	Hannan-Quinn criter.		13.96632
F-statistic	296.9912	Durbin-Watson stat		0.552947
Prob(F-statistic)	0.000000			

Table C.2 results also do make it more significant, actually, it is less than Table 4.

Table C.2 log application

Dependent Variable: LOG(I)

Method: Least Squares

Date: 03/05/15 Time: 20:22

Sample (adjusted): 1990Q2 2013Q4

Included observations: 95 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.130426	1.078618	-3.829368	0.0002
REAL10	-0.150142	0.009641	-15.57295	0.0000
D(GDP)	0.000189	0.000159	1.188434	0.2378
LOG(NAPC)	1.965737	0.169480	11.59867	0.0000
R-squared	0.880373	Mean dependent var		7.873105
Adjusted R-squared	0.876430	S.D. dependent var		0.330507
S.E. of regression	0.116182	Akaike info criterion		-1.426130
Sum squared resid	1.228335	Schwarz criterion		-1.318598
Log likelihood	71.74115	Hannan-Quinn criter.		-1.382679
F-statistic	223.2332	Durbin-Watson stat		0.388107
Prob(F-statistic)	0.000000			

II. Consumption of Durable Goods and Interest Rate Channel

Coefficients are not correct, real10 should be negative, and real10 and GDP are not significant.

Table C.3 AR(1)

Dependent Variable: COD
 Method: Least Squares
 Date: 03/04/15 Time: 11:51
 Sample (adjusted): 1999Q2 2014Q1
 Included observations: 60 after adjustments
 Convergence achieved after 11 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1366.149	749.1513	1.823595	0.0736
REAL10	0.185832	7.178688	0.025887	0.9794
D(GDP)	0.019056	0.026033	0.732017	0.4673
NAPC	0.636073	0.179989	3.533946	0.0008
AR(1)	0.984683	0.015031	65.50927	0.0000
R-squared	0.987731	Mean dependent var		1024.883
Adjusted R-squared	0.986839	S.D. dependent var		173.8413
S.E. of regression	19.94351	Akaike info criterion		8.903340
Sum squared resid	21875.91	Schwarz criterion		9.077869
Log likelihood	-262.1002	Hannan-Quinn criter.		8.971608
F-statistic	1106.964	Durbin-Watson stat		2.309896
Prob(F-statistic)	0.000000			
Inverted AR Roots	.98			

Table C.4 Lag of interest rates

Dependent Variable: COD
 Method: Least Squares
 Date: 03/05/15 Time: 20:31
 Sample: 1999Q1 2014Q1
 Included observations: 61

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	525.4170	172.6648	3.042988	0.0035
REAL10(-1)	-146.5692	12.21830	-11.99588	0.0000
D(GDP)	0.049408	0.139423	0.354375	0.7244
NAPC	1.361296	0.307640	4.424971	0.0000
R-squared	0.724323	Mean dependent var		1018.967
Adjusted R-squared	0.709814	S.D. dependent var		178.4717
S.E. of regression	96.14085	Akaike info criterion		12.03283
Sum squared resid	526854.6	Schwarz criterion		12.17125
Log likelihood	-363.0013	Hannan-Quinn criter.		12.08708
F-statistic	49.92122	Durbin-Watson stat		0.436474
Prob(F-statistic)	0.000000			

Table C.5 Log

Dependent Variable: LOG(COD)

Method: Least Squares

Date: 03/05/15 Time: 20:34

Sample: 1999Q1 2014Q1

Included observations: 61

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.970724	1.124908	1.751898	0.0852
REAL10	-0.158067	0.012508	-12.63764	0.0000
D(GDP)	0.000191	0.000141	1.355140	0.1807
LOG(NAPC)	0.824769	0.178152	4.629566	0.0000
R-squared	0.743071	Mean dependent var		6.910585
Adjusted R-squared	0.729548	S.D. dependent var		0.183020
S.E. of regression	0.095179	Akaike info criterion		-1.802783
Sum squared resid	0.516369	Schwarz criterion		-1.664365
Log likelihood	58.98488	Hannan-Quinn criter.		-1.748536
F-statistic	54.95041	Durbin-Watson stat		0.451434
Prob(F-statistic)	0.000000			

Appendix D

I. Investment Regressions and Credit Channel

Table D.1 Investment with lag effect

Dependent Variable: I
 Method: Least Squares
 Date: 03/05/15 Time: 23:17
 Sample (adjusted): 1990Q2 2013Q4
 Included observations: 95 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1523.019	397.3898	-3.832556	0.0002
REAL10(-1)	-307.0104	29.51114	-10.40320	0.0000
NAPC	9.072288	0.602535	15.05687	0.0000
MOBASE	0.000134	4.73E-05	2.828528	0.0058
R-squared	0.914659	Mean dependent var		2759.731
Adjusted R-squared	0.911845	S.D. dependent var		808.3797
S.E. of regression	240.0151	Akaike info criterion		13.84047
Sum squared resid	5242260.	Schwarz criterion		13.94801
Log likelihood	-653.4225	Hannan-Quinn criter.		13.88392
F-statistic	325.1017	Durbin-Watson stat		0.504915
Prob(F-statistic)	0.000000			

Table D.2 Investment with AR(1)

Dependent Variable: I
 Method: Least Squares
 Date: 03/05/15 Time: 23:21
 Sample (adjusted): 1990Q2 2013Q4
 Included observations: 95 after adjustments
 Convergence achieved after 12 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1964.968	2948.950	-0.666328	0.5069
REAL10	6.963761	11.96681	0.581923	0.5621
NAPC	1.283207	0.353061	3.634524	0.0005
MOBASE	-0.000249	5.70E-05	-4.365735	0.0000
AR(1)	1.007924	0.005533	182.1560	0.0000
R-squared	0.996862	Mean dependent var		2759.731
Adjusted R-squared	0.996722	S.D. dependent var		808.3797
S.E. of regression	46.28193	Akaike info criterion		10.55858
Sum squared resid	192781.5	Schwarz criterion		10.69299
Log likelihood	-496.5324	Hannan-Quinn criter.		10.61289
F-statistic	7146.784	Durbin-Watson stat		1.124294
Prob(F-statistic)	0.000000			
Inverted AR Roots	1.01			
	Estimated AR process is nonstationary			

Table D.3 with lag effect

Dependent Variable: I

Method: Least Squares

Date: 03/05/15 Time: 23:51

Sample (adjusted): 2003Q1 2013Q4

Included observations: 44 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	198.8614	242.3812	0.820449	0.4169
REAL10(-1)	-140.2782	24.99530	-5.612184	0.0000
NAPC	5.770472	0.373050	15.46837	0.0000
BASS	0.002086	0.002441	0.854459	0.3981
LIAB	-0.002037	0.002472	-0.824060	0.4149
R-squared	0.870990	Mean dependent var		3467.783
Adjusted R-squared	0.857758	S.D. dependent var		270.3990
S.E. of regression	101.9809	Akaike info criterion		12.19409
Sum squared resid	405604.2	Schwarz criterion		12.39684
Log likelihood	-263.2700	Hannan-Quinn criter.		12.26928
F-statistic	65.82548	Durbin-Watson stat		0.841897
Prob(F-statistic)	0.000000			

II. Consumption of Durable Goods and Credit Channel

Table D.4 With Lag Effect

Dependent Variable: COD

Method: Least Squares

Date: 03/06/15 Time: 00:09

Sample (adjusted): 1999Q1 2014Q3

Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	193.1596	121.8385	1.585374	0.1182
REAL10(-1)	-92.04028	11.23837	-8.189825	0.0000
NAPC	1.536232	0.209020	7.349695	0.0000
MOBASE	9.32E-05	1.13E-05	8.219896	0.0000
R-squared	0.872906	Mean dependent var		1031.570
Adjusted R-squared	0.866444	S.D. dependent var		189.0894
S.E. of regression	69.10343	Akaike info criterion		11.37047
Sum squared resid	281741.8	Schwarz criterion		11.50654
Log likelihood	-354.1699	Hannan-Quinn criter.		11.42399
F-statistic	135.0744	Durbin-Watson stat		0.417901
Prob(F-statistic)	0.000000			

Table D.5 with log adjustments

Dependent Variable: LOG(COD)

Method: Least Squares

Date: 03/06/15 Time: 00:20

Sample (adjusted): 1999Q1 2014Q3

Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.362798	0.857595	1.589093	0.1174
REAL10	-0.110152	0.012501	-8.811299	0.0000
LOG(NAPC)	0.891562	0.135789	6.565766	0.0000
MOBASE	7.43E-08	1.25E-08	5.927803	0.0000
R-squared	0.845280	Mean dependent var		6.921535
Adjusted R-squared	0.837412	S.D. dependent var		0.190093
S.E. of regression	0.076650	Akaike info criterion		-2.237760
Sum squared resid	0.346634	Schwarz criterion		-2.101688
Log likelihood	74.48945	Hannan-Quinn criter.		-2.184242
F-statistic	107.4443	Durbin-Watson stat		0.392190
Prob(F-statistic)	0.000000			

Table D.6 Raw

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-13.97489	67.04291	-0.208447	0.8359
REAL10	-39.85792	7.169353	-5.559486	0.0000
NAPC	1.642414	0.104071	15.78169	0.0000
BASS	0.003822	0.000666	5.741073	0.0000
LIAB	-0.003775	0.000673	-5.611973	0.0000
R-squared	0.950689	Mean dependent var		1117.957
Adjusted R-squared	0.945992	S.D. dependent var		129.8753
S.E. of regression	30.18243	Akaike info criterion		9.752685
Sum squared resid	38261.13	Schwarz criterion		9.949509
Log likelihood	-224.1881	Hannan-Quinn criter.		9.826752
F-statistic	202.4328	Durbin-Watson stat		1.013279
Prob(F-statistic)	0.000000			

Table D.7 with Lag

Dependent Variable: COD

Method: Least Squares

Date: 03/06/15 Time: 00:23

Sample (adjusted): 2003Q1 2014Q3

Included observations: 47 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-12.16797	72.79750	-0.167148	0.8681
REAL10(-1)	-34.73243	7.765801	-4.472484	0.0001
NAPC	1.618963	0.112476	14.39384	0.0000
BASS	0.003872	0.000722	5.365290	0.0000
LIAB	-0.003823	0.000729	-5.243325	0.0000
R-squared	0.942016	Mean dependent var		1117.957
Adjusted R-squared	0.936494	S.D. dependent var		129.8753
S.E. of regression	32.72915	Akaike info criterion		9.914697
Sum squared resid	44990.29	Schwarz criterion		10.11152
Log likelihood	-227.9954	Hannan-Quinn criter.		9.988764
F-statistic	170.5846	Durbin-Watson stat		0.753782
Prob(F-statistic)	0.000000			

D.7 With AR(1)

Method: Least Squares

Date: 03/06/15 Time: 00:25

Sample (adjusted): 2003Q2 2014Q3

Included observations: 46 after adjustments

Convergence achieved after 21 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	388.0076	283.3564	1.369327	0.1785
REAL10	3.814052	6.841688	0.557472	0.5803
NAPC	0.547013	0.188432	2.902968	0.0060
BASS	-0.000996	0.002145	-0.464082	0.6451
LIAB	0.000926	0.002144	0.432007	0.6681
AR(1)	1.031384	0.014834	69.52615	0.0000
R-squared	0.983229	Mean dependent var		1123.463
Adjusted R-squared	0.981133	S.D. dependent var		125.6429
S.E. of regression	17.25807	Akaike info criterion		8.655545
Sum squared resid	11913.64	Schwarz criterion		8.894063
Log likelihood	-193.0775	Hannan-Quinn criter.		8.744895
F-statistic	469.0165	Durbin-Watson stat		2.308736
Prob(F-statistic)	0.000000			

Inverted AR Roots

1.03

Estimated AR process is nonstationary