

A TALE OF TWO CENTRAL BANKS: HOW THE FEDERAL RESERVE AND BANK OF
ENGLAND RESPONDED TO THE FINANCIAL CRISIS OF 2007

by

SAAD AHMAD

B.S., Kansas State University, 2008

A REPORT

submitted in partial fulfillment of the requirements for the degree

MASTER OF ARTS

Department of Economics
College of Arts and Sciences

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2010

Approved by:

Major Professor
Dr. Bill Blankenau

Copyright

SAAD AHMAD

2010

Abstract

The financial crisis that began in the summer of 2007 has greatly tested the abilities of central banks to counter financial instability and economic slowdown through traditional monetary policy. This paper will examine in detail the monetary response of both the Federal Reserve Bank of the United States (Fed) and the Bank of England to the turmoil in the financial markets. The Bank of England, which adopted inflation targeting after the Black Wednesday crisis in 1992, and the Fed, which has no such stated policy, allows us to compare two different monetary regimes in the aftermath of a crisis. To counter the financial crisis the Bank of England resorted to unconventional monetary policies that included expansion of liquidity easing operations and a policy of quantitative easing through purchase of debt securities. The Fed also made use of both traditional tools as well as more innovative measures to combat liquidity concerns in the financial market. A multitude of new programs was initiated by the Fed to supply liquidity to susceptible lending institutions and lower the spreads on commercial loans and securities. Overall, we find that the actions of the Bank of England and the Fed were effective in restoring stability to financial markets and preventing a prolonged economic depression. Further, the Bank of England's inflation targeting framework did not hinder its ability to respond to the crisis and there was no major divergence in the policy actions of the two central banks.

Table of Contents

List of Figures	v
I. Introduction	1
II. Financial crisis of 2007	2
III. Inflation targeting.....	6
IV. BoE’s adoption of inflation targeting	9
V. BoE’s monetary policy during the financial crisis.....	12
VI. Fed’s monetary policy during the financial crisis.....	19
VII. Convergence of the BoE and Fed’s monetary policy during the financial crisis	32
VIII. Conclusion	40
References.....	42

List of Figures

Figure 1. 3-month LIBOR-OIS spread	3
Figure 2. TED Spread	3
Figure 3. Change in Real GDP	5
Figure 4. Unemployment Rate	6
Figure 5. Policy Rates for the Fed and the BoE.....	21
Figure 6. Long Term Government Yields for the U.K. and the U.S.	32
Figure 7. Money Supply for the BoE.....	33
Figure 8. Money Supply for the Fed.....	33
Figure 9. Expansion of the Fed’s balance sheet.....	34
Figure 10. Asset composition of the Fed’s balance sheet.....	35
Figure 11. Expansion of the BoE’s balance sheet.....	36
Figure 12. Asset composition of the BoE’s balance sheet.....	36
Figure 13. Actual and Expected Inflation in the U.K.	40

I. Introduction

The 20th Century has seen an increased focus being put on the policies of the central bank in managing a country's economy. Economists such as Milton Friedman have shown the impact monetary policies can have in preventing prolonged recessions. Indeed Friedman and his colleague Anna Schwartz argued in their landmark book 'A Monetary History of the United States, 1867-1960' that the ineffective policies of the Federal Reserve Bank of the United States (Fed) were the primary reason for the Great Depression (Barro, 2007). The Fed had failed in controlling the money supply, which had fallen by 33% from 1929 to 1933 (Friedman, 1997). This drastic decrease in the money supply led to deflation and rising real interest rates during a depression. The Fed had also failed in its primary duty of being the lender of last resort during the Depression, which contributed to the large number of bank failures in the early 1930's (Cecchetti, 1997). Both bank failures as well as deflation would have been avoided if the Fed had pursued appropriate monetary policies (Cecchetti, 1997). These discoveries have led central banks all over the world to take a more active role as stewards of the economy and use monetary policy to combat the twin problems of inflation and unemployment.

The financial crisis that began in the summer of 2007 has greatly tested the ability of central banks to manage economic fundamentals through skillful monetary policy (Demirguk-Kunt and Serven, 2010). Before the financial crisis, belief had been growing in the powers of central banks to reduce economic volatility of business cycles by influencing short-term interest rates. Accordingly, central banks could lower interest rates to spur aggregate demand during a weak economy and increase interest rates as the economy got overheated. However, as the credit crunch intensified, such normal monetary policies were found to be ineffective in countering the panic within the banking sector. The Fed led by Ben Bernanke, a student of the Great Depression, decided to undertake more drastic steps to generate liquidity in the economy. These included bailing out financial firms like Bear Sterns & AIG and establishing programs for direct provision of credit to non-financial institutions (Demirguk-Kunt and Serven, 2010).

Other central banks around the world, including the Bank of England (BoE), also had to resort to unorthodox measures to deal with the financial crisis. The BoE, which had adopted inflation targeting in 1992, gives us the opportunity to compare two different monetary regimes in the aftermath of a crisis. This paper will examine in detail the monetary responses of both the

Fed and the BoE and their effectiveness in dealing with the financial crisis. Section II of the paper looks at the financial crisis of 2007 and its impact on the American and British financial markets. Section III gives a brief overview of inflation targeting while section IV deals with the BoE's implementation of the inflation targeting framework. Section V looks at the BoE's monetary conduct during the crisis including unconventional policies such as liquidity operations and quantitative easing. In section VI we look at several of the Fed's new initiatives and their effectiveness in managing the crisis. Section VII will be a comparison of the monetary policies of the Fed and the BoE and the role inflation targeting played during the crisis. Finally Section VIII will be our conclusion.

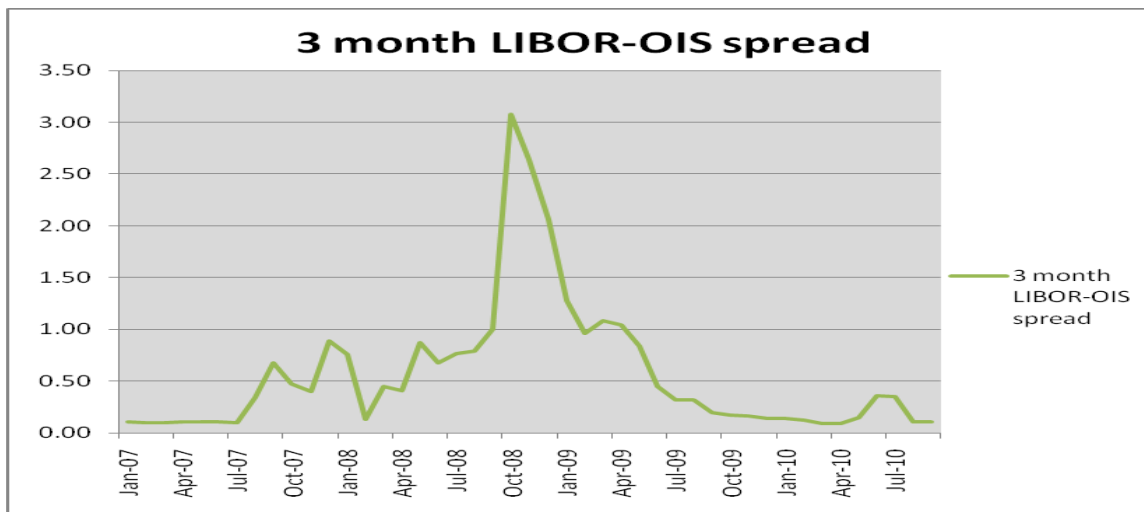
II. Financial crisis of 2007

The subprime mortgage collapse in the U.S. housing sector during 2007 was a major contributing factor in the global financial crisis (Caballero and Krishnamurthy, 2008). Excessive lending to financial participants under loose oversight conditions led to an influx of subprime mortgages in the financial markets (Mamun et al., 2010). Mortgage brokers lent to homeowners with incomes and assets too low to sufficiently cover their mortgage payments (Poole, 2010). Banks and other financial institutions lulled by the high credit ratings and generous returns began to heavily invest in mortgage backed securities (MBS) (Poole, 2010). Mortgages both prime and subprime were considered safe investments since the housing boom and period of low interest rates allowed borrowers to refinance or sell the house to cover the original mortgage (Poole, 2010). However defaults started to rise as the housing market leveled off in 2006 and adjustable rate mortgages increased with interest rates. In the summer of 2007, banks and other financial institutions started to take in huge losses as these loans started to default (Mamun et al., 2010). Overall the increased securitization of different asset classes, growth of private capital funds, greater integration of global capital markets and increased demand for derivative securities led to the severity and complexity of the financial crisis of 2007 (Mamun et al., 2010).

In August, 2007, worried investors jumped to the U.S. treasury market for safety and created a credit crunch in the financial markets (Cecchetti, 2009). The financial uncertainty regarding banks' subprime assets and higher credit risk were major reasons for the lack of liquidity in capital markets (Cecchetti, 2009). Banks became hesitant in lending to each other and started to stockpile cash reserves in order to survive the crisis. The result was a freeze in

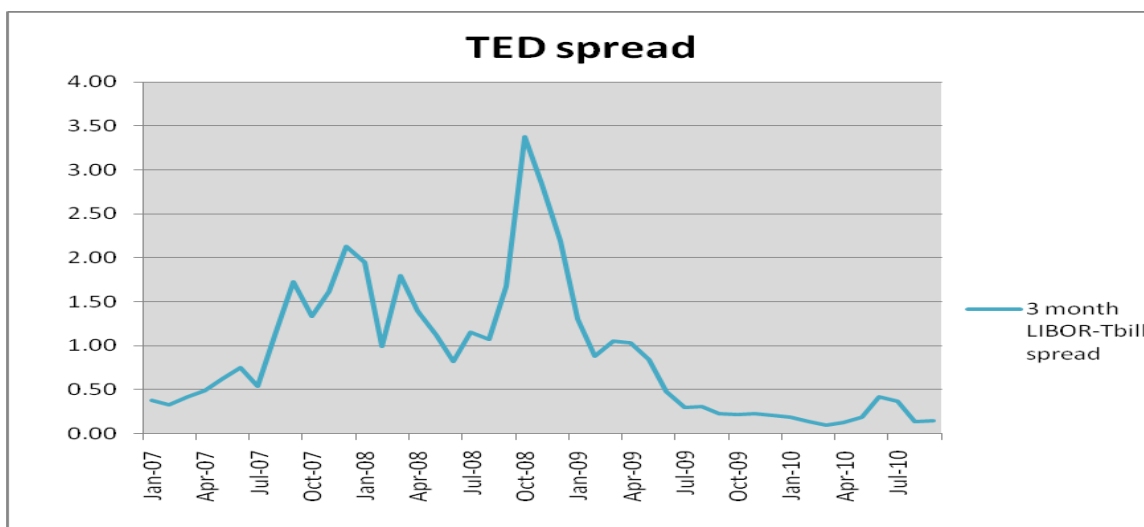
interbank lending indicated by a severe spike in the spread between the 3 month London Inter-Bank Offered Rates (LIBOR) and the overnight indexed swap (OIS) rate during this period (Figure 1). LIBOR is used in the determination of a wide range of consumer and corporate loans and thus a prolonged period of high rates would have severe consequences for the broader economy (McAndrews et al., 2009). Figure 2 shows the TED spread which is the spread between the 3 month LIBOR and the 3 month U.S. treasury bill, another useful indicator of stress in the financial markets.

Figure 1. 3-month LIBOR-OIS spread



Source: British Bankers Association and the Federal Reserve Bank of St. Louis

Figure 2. TED Spread



Source: British Bankers Association and the Federal Reserve Bank of St. Louis

In mid-March, 2008, the financial crisis intensified as Bear Stearns, a major Wall Street investment bank was unable to get short term loans to conduct day- to- day operations (Mamun et al., 2010). Rumors of possible liquidity problems at the bank were a major reason for the lack of short term financing at secured terms (Mamun et al., 2010). A Bear Stearns bankruptcy would have been disastrous for the financial markets as the firm had \$14.2 trillion of estimated value in derivative contracts with thousands of counterparties (Cecchetti, 2009). The Fed decided to intervene by providing an emergency loan to Bear Stearns using the power of Article 13(3) of the Federal Reserve Act (Cecchetti, 2009). The loan, along with taking credit risk for some of their riskier assets, facilitated the JP Morgan Chase purchase of Bear Stearns (Poole, 2010). The Bear Stearns bailout is considered the end of the first phase of the financial crisis (Poole, 2010).

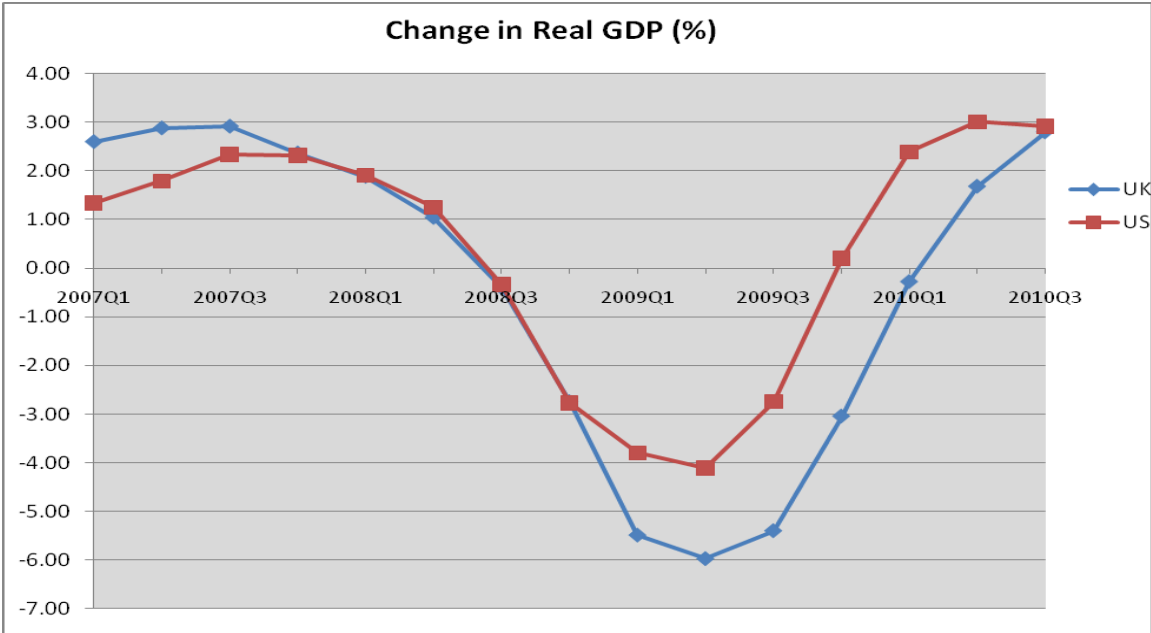
The Bear Stearns bailout provided some relief to shaky financial markets but there was more trouble on the horizon. Lehman Brothers, the biggest underwriter of mortgage bonds took huge losses and was forced to declare bankruptcy on the 15th of September 2008 (Mamun et al., 2010). Lehman had initially hoped for a buyer but lack of intervention from the Fed and the U.S. Treasury discouraged other financial institutions from undertaking the purchase of Lehman's risky assets. The collapse of Lehman was a huge blow to the financial system and market strains went from serious to devastating (Poole, 2010). On the day after Lehman's bankruptcy the Fed was forced to provide emergency loans to insurance giant AIG which had provided credit default swaps to financial institutions that wanted to hedge their investment risk in subprime mortgages (Mamun et al., 2010). The Fed bailout was necessary to shore up other institutions which would have suffered huge losses if AIG had defaulted on its insurance obligations. Still an extreme flight to safety in the days following was seen as investors placed their assets in U.S. treasuries (Poole, 2010).

The financial crisis spread to the European and Asian banking systems and led to a global decline in output and employment (Poole, 2010). The excess securitization by U.S. financial institutions was driven in large part by the greater demand for foreign investors to convert their surplus savings into safe U.S. debt instruments (Caballero and Krishnamurthy, 2008). The rapid growth of exports from Asia, especially China and India, had led to a sustained buildup of savings for these countries which then flowed back to the U.S. and other developed economies (Gieve, 2009). The rising global imbalances led to a situation where the U.S. financial sector was taking on greater leverage to sell more debt instruments to foreign investors looking

for safe investment opportunities (Caballero and Krishnamurthy, 2008). Thus massive losses in the U.S. subprime sector quickly spread to foreign banks in the U.K., Switzerland and Germany who had invested heavily in subprime mortgage securities (Gieve, 2009). The reverberation of the U.S. mortgage industry collapse was eventually felt by the entire interconnected global financial system (Gieve, 2009).

The global financial crisis led to severe deflationary pressures as the world economy was confronted with weak asset prices, highly leveraged banks that were vulnerable to bank runs and reduced aggregate demand (Meier, 2009). Economies in U.S., Japan and Euro zone along with U.K. witnessed a severe recession as output decreased (Figure 3) and unemployment levels started to rise (Figure 4). Countries that had seen a large debt build up like the U.S. and the U.K. were especially hard hit by the financial crisis with U.K.’s Gross Domestic Product (GDP) falling by more than 5% in the last quarter of 2008 and first quarter of 2009 (Bean, speech). This was the largest 6 month decline in U.K.’s GDP since 1955 and indicated the severity of the British recession (Bean, 2009).

Figure 3. Change in Real GDP



Source: Economist Intelligence Unit

Figure 4. Unemployment Rate



Source: Economist Intelligence Unit

Central banks now would need strong policy measures to both restore stability in financial markets and lessen the impact of the recession. We begin our discussion of the BoE’s monetary policy by first giving an overview of inflation targeting.

III. Inflation targeting

Mishkin (2000) describes inflation targeting as a strategy that includes public announcement for medium term inflation targets and an institutional commitment to price stability by ensuring that inflation is close to the announced target. Inflation targeting also includes setting policy instruments by using all available economic information and brings increased transparency and accountability of central banks (Mishkin, 2000). The 1970s and early 80s had seen persistent inflation in Western societies driven in large part by higher government expenditures (Barro, 2007). As the economic costs of inflation increased, several Western countries such as New Zealand, U.K and Australia adopted inflation targeting as their monetary policy framework.

Monetary policy has usually been divided into two opposing strategies: ‘rule’ where policy makers must follow a certain set of guidelines to conduct monetary policy or ‘discretion’ in which central banks are flexible to pursue appropriate policies in response to changing

economic conditions (Bernanke and Mishkin, 1999). Fixed rules are seen as problematic since they limit abilities of central banks to respond to extraordinary events. Inflation targeting if viewed as a rule, would restrict central banks from focusing on other important economic variables such as output and employment and thus lead to less than desirable economic outcomes. Further an exclusive focus on inflation targets would make the economy more volatile in the face of supply shocks such as a weather catastrophe or large changes in fuel prices. Given these factors there has been considerable opposition to inflation targeting among central bankers. However Bernanke and Mishkin (1999) argues that the view of inflation targeting as a fixed rule is misleading given the actual experience of inflation targeting countries. Instead inflation targeting should be seen as constrained discretion in which central banks are constrained from following policies with adverse long run consequences but still maintain flexibility in unforeseen and exigent economic periods. Inflation targeting in practice allows central banks to use structural and subjective economic models to determine policies needed to attain inflation targets (Arestis and Mihailov, 2009). Further inflation targeting gives central bankers considerable discretion to respond to the current unemployment rate and other short run developments (Bernanke and Mishkin, 1999). A flexible inflation targeting that incorporates central bank's judgment and model uncertainty is widely seen by most economists as the optimal monetary policy (Arestis and Mihailov, 2009).

Inflation targeting allows central bankers to be more explicit in their goals for monetary policy and so reduces the uncertainty associated with future inflation rates (Walsh, 2009). Uncertainty over future price levels hinders long term savings and investment decisions, increase risk premiums on nominal financial and labor agreements and creates more short term price volatility (Bernanke and Mishkin, 1999). The public more easily understands inflation targeting than other monetary strategies and this results in higher confidence in the central bank's long run inflation goals (Gavin, 2004). The increased transparency helps to alleviate future concerns over inflation and gives workers and businesses accurate pricing information for future contracts (Gavin, 2004). So a credible inflation targeting regime will have more success in reducing the economic costs of inflation uncertainty.

Inflation targeting also requires that the central bank give emphasis to communications with the general public (Walsh, 2009). Central banks have started to publish inflation reports that clearly express their views on past and future performance of inflation targeting policy (Mishkin,

2000). Inflation targeting allows the public to evaluate the central bank's commitment and ability to meet previously announced targets. A central bank that is successful in meeting previous targets gains more credibility with the public and there is an increased support for its monetary policies and political independence (Sims, 2003). Public trust helps the central bank during an aggregate supply shock when a focus on long term inflation level would lead to lost economic output (Bernanke and Mishkin, 1999). An inflation targeting framework would convince the public that the central bank will reduce the sudden increase in inflation gradually over time and that the supply shock will not lead to a permanent increase in price level. Thus a credible inflation targeting policy will make it easier to achieve and sustain low inflation levels and reduce economic volatility during supply shocks (Walsh, 2009).

An explicit inflation target increases the accountability of the central bank and reduces the risk of the bank falling in the time inconsistency trap (Gavin, 2004). The short run tradeoff between employment and inflation may give some central banks an incentive to pursue politically expedient expansionary monetary policies that increase output at the cost of long term inflation (Gavin, 2004). However inflation targeting will discourage such policies as central banks will be required to publish both the short term benefits and long run costs to the public and thus limit short run opportunism (Bernanke and Mishkin, 1999). Inflation targeting allows central banks to stand up to political pressures and makes it clear to the public that monetary policy can manage inflation but has little impact on economic growth, employment and productivity levels in the long run (Mishkin, 2000).

Concerns with inflation targeting

One of the main objections to inflation targeting is that it would impact the flexibility of policy makers to deal with economic problems. A rigid focus on an inflation target would hinder the central bank from responding to economic fluctuations and thus lead to more short term output volatility (Mishkin, 2000). Central banks that adopt a horizon of two or more years for their inflation targets (Mishkin, 2000) will have less flexibility in dealing with large and persistent shocks. A large shock will move inflation target from desired level and the central bank will not be able to minimize both output and inflation fluctuations. Further this time horizon does not take into account business cycles and their associated economic volatility (Meyer, 2004). A rigid inflation targeting framework prevents central bank from keeping

inflation levels higher than target and thus hinders its ability to deal with the economy during a recession (Meyer, 2004).

However in practice central banks have followed a more flexible inflation targeting framework in order to balance the dueling responsibilities of controlling inflation and reducing economic volatility (Walsh, 2009). Generally speaking, inflation targeting central banks are given latitude in meeting inflation targets when faced with unexpected shocks and disturbances to the economy and so are able to pursue a more optimal monetary policy (Walsh, 2009). We now look at the BoE's decision to move towards inflation targeting and the features of the new monetary policy regime.

IV. BoE's adoption of inflation targeting

Black Wednesday

Before 1992 British monetary policy had been tied to the European Exchange Rate Mechanism (ERM) as a way to achieve stability in both currency and price levels (Cobham, 1997). ERM was a system created in 1979 to reduce volatility in the European exchange rates by requiring member countries to manage their currency in a fixed range. British policy makers believed that ERM membership would give a clear indication to the markets of intended government policy, reduce the volatility of sterling against other ERM currencies, and constrain the price- and wage-setting behavior of firms and workers (Cobham, 1997). Their optimism was initially justified as the pound remained stable while inflation fell from peak of 10.4% in the quarter before entry to 3.6% in 1992 (Cobham, 1997). However this period of stability was short lived as the ERM came under heavy attack from speculators in the summer of 1992.

Germany during this period had been practicing tight money policy by raising interest rates to counter inflation (Cobham, 1997). This had led the U.S. dollar to depreciate against the German deutschmark (DM) since investors were selling dollars for deutschmarks. Since Britain was in the ERM, the pound sterling had also seen considerable appreciation against the dollar. This proved to be a major problem for British policy makers since exports to America were a major source of revenue.

The depreciation of the dollar made British products more expensive to American consumers and led to a decrease in British exports. There was a growing push within Britain for a devaluation of the currency in order to remain competitive in international trade. Investors

sensing an impending policy change began to sell their holdings of pounds at an accelerated pace (Hansell, 1992). The BoE tried to resist this downward pressure by buying pounds as well as raising interest rates from 10 to 12% in hopes of calming the market (Hansell, 1992). These efforts ultimately proved futile and on the 16th of September, 1992, the BoE was forced to abandon the ERM and devalue the pound. The pound dropped 7% from DM 2.8 to DM 2.6 (Vickers, 1998) and the U.K.'s membership in the ERM had unceremoniously ended. The U.K. Treasury estimated that the total cost from devaluation of the sterling following Black Wednesday was about £3.4 billion (Tempest, 2005).

Move towards inflation targeting

The financial devastation from Black Wednesday forced the U.K. to abandon the ERM and look at other measures to achieve price stability. They turned to inflation targeting as a way to ensure that price levels remained steady over time. The adoption of an inflation target showed that policy makers were serious with their commitment to price stability (Mishkin and Posen, 1997). The U.K.'s checkered history of trying and abandoning regimes in the post-Bretton Woods period along with the recent currency devaluation after the Black Wednesday crisis had seriously hurt British monetary credibility (Mishkin and Posen, 1997). Targeting inflation was seen as a way to restore investors' confidence in the British economy and allow the U.K. to move forward from the financial wreckage of Black Wednesday.

The announcement of an inflation target of 1 to 4 percent took observers by surprise as there had been little public discussion on the part of either the Treasury or the BoE about setting inflation targets during the ERM era (Mishkin and Posen, 1997). The adoption of an inflation target had two common features and one modification with respect to the monetary regime of ERM membership. First, there was no change in the overall objective of monetary policy to combat price instability. The explicitness of this goal and its supremacy, however, had increased during the 90s. Even after the pound's exit from the ERM, the government wanted to remain in charge of monetary regulation and only desired an escape from the conflict between the German and British business cycles that had been prevalent in the previous. Second, the monetary strategy must have credibility with the public through transparent communication of targets and achievements of policy (Mishkin and Posen, 1997). This as mentioned in Section III is a notable feature of a credible inflation targeting regime.

The main change for the U.K., having abandoned both monetary and exchange rate targets was the strategic decision not to employ any intermediate target variable in the setting of policy (Mishkin and Posen, 1997). Although money growth and exchange rates would be monitored by the BoE, they would not be the sole basis for policy determination. This is made quite clear in the then BoE's Governor Robin Leigh-Pemberton's speech in which he states that, *"Experience leads us to believe that monetary policy cannot be conducted with reference to a single target variable. The overriding objective of monetary policy is price stability. Therefore policy must be conducted with reference to our expectations of future inflation"* (Mishkin and Posen, 1997). Thus targeting inflation rather than focusing on other variables like exchange rates became the primary tool of the BoE in achieving price stability.

The new monetary framework

In 1997, the British Parliament gave operational independence to the BoE in conducting monetary policy (Vickers, 1998). The key decision of setting short term interest rates was delegated to the new Monetary Policy Committee (Vickers, 1998). The MPC was now seen as independent from political pressures and leading to a more credible monetary process (Bean, 2004). Upon this announcement long term inflation expectations fell by 0.5% and were followed by further gains over the subsequent months as inflation expectations decreased considerably over this period (Bean, 2004).

The MPC is composed of nine members--five internal Bank officials and four external members chosen for their relevant knowledge and experience—and they are publicly accountable for meeting the inflation target (Lomax, 2005). To achieve this price stability the MPC targeted the annual rate of retail price inflation (RPIX) excluding mortgage interest payments at 2.5% (Vickers, 1998). In December 2003 the MPC moved towards the consumer price index (CPI) and the central target was now set at 2% with a 1% tolerance range (Angeriz and Arestis, 2007). Thus the MPC is given some latitude when intended inflation rate is not at 2% since exogenous shocks and fluctuations in the economy can cause actual inflation to deviate from intended target (Angeriz and Arestis, 2007). This gives the MPC some discretion in dealing with economic volatility (Bean, 2004). Finally, the MPC must support the government's overall economic objectives such as growth and employment as long as it does not hinder their primary goal of price stability (Vickers, 1998).

Flexibility in meeting economic goals

The BoE, like other central banks, pursues its inflation goal at the lowest cost to real output even if it means that it would take a longer time period to achieve price stability (Mishkin and Posen, 1997). Therefore a gap exists between the claims and reality of inflation as a sole goal even under an inflation targeting regime. In essence inflation targeting in the U.K. is really a statement about the objectives of monetary policy maker rather than a detailed mechanism on achieving an inflationary objective (Bean, 2004). The BoE is thus closer to a flexible inflation targeting framework discussed in Section III and in direct contrast to the notion that MPC is rigid and inflexible in conducting monetary policy (Bean, 2004).

The financial crisis greatly tested the inflation targeting framework that had performed relatively well during the preceding era witnessed by low inflation and global economic stability (Walsh, 2009). Central bankers would need greater discretion in order to contain the global financial panic and thus threaten the credibility of future inflation targets (Arestis and Mihailov, 2009). There are also concerns that an inflation targeting framework may work only during favorable economic conditions and fail to be effective in times of deep financial crisis and global economic turbulence (Arestis and Mihailov, 2009). In light of these questions we examine the BoE's conduct of monetary policy in the financial crisis of 2008.

V. BoE's monetary policy during the financial crisis

The BoE quickly found itself in the forefront of the financial crisis as British banks had a large exposure to U.S. subprime securities in their investment portfolios (Gieve, 2009). Financial troubles at Northern Rock, a major U.K. mortgage provider, led the BoE to provide emergency liquidity assistance (Lastra, 2008). However this did little to quell the panic among depositors and a bank run was started on Northern Rocks' branches (Lastra, 2008). On the 17th of September, 2007, the British Government announced that it would guarantee all deposits at Northern Rock and effectively stopped the bank run (Lastra, 2008). The bank run became a source of considerable embarrassment for British policy makers and showed that the public was losing faith in the financial system (Hodson and Mabbett, 2009). Urgent action particularly from the BoE would be required to restore financial stability.

As the financial crisis intensified, the BoE began to discover that usual monetary policy tools such as lowering interest rates through open market operations had little effect in relieving

market strain (Gagnon, 2010). Continuous cuts to interest rates did little to stem investors' worries over the collapse of the mortgage industry and long run stability of the financial system (Gagnon, 2010). The BoE reached the lower threshold of interest rates as the bank rate (interest rate the BoE charges banks for overnight lending) was reduced from 5.75% in November, 2007, to 0.50% in March, 2009 (Hodson and Mabbett, 2009). The BoE recognized that they needed other policy measures and initiatives to deal with the unparalleled instability in the markets. The BoE's programs were split into those that provided liquidity to banks and those that were intended to increase monetary aggregates through a policy of quantitative easing. We first look at some of the programs created to address the liquidity concerns of U.K. banking institutions. These programs were intended to provide liquidity to the markets and did not present a significant change in the implementation of monetary policy (Joyce et al., 2010).

Liquidity Programs

(1) Special term auctions

On the 19th of September, 2007, the BoE announced that it would conduct auctions to provide funds to financial institutions in exchange for a larger range of collateral than those acceptable in the BoE's open market operations (Quarterly Bulletin, 2007). These auctions were intended to reduce the liquidity strains in the domestic financial system. The BoE offered € 10 billion in four auctions to be held from September to October, 2007, with average loan duration of 3 months (Quarterly Bulletin, 2007). However a drop in the interbank lending rate and fears over publicity of participation led banks to avoid the auctions and thus no funds were distributed through this facility (Quarterly Bulletin, 2007).

(2) Adjustments to open market operations

On the 12th of December, 2007, the BoE announced that it would make certain changes to its short term repurchase agreement (repo) procedures which were used to conduct open market operations. The aim of these changes was to increase liquidity in the money markets and assist banks with their liquidity constraints (Quarterly Bulletin, 2007). The BoE expanded the amount of reserves available to banks in repo operations and expanded the eligible collateral to include AAA residential mortgage-backed securities and covered bonds (Cross et al., 2010). As the troubles in the financial system continued in 2008, the BoE expanded the size and frequency of the repo operations and accepted securities backed with commercial mortgages and corporate bonds (Cross et al., 2010). The BoE also participated in a currency swap with the Fed to provide

dollar financing to domestic banks in exchange for a wide variety of collateral (Quarterly Bulletin, 2008). The total proceeds distributed through this program reached \$86 billion at its peak and helped reduce the shortage of U.S. dollars in the U.K. banking system (Cross et al., 2010).

(3) Special Liquidity Scheme

In April 2008, the BoE launched the Special Liquidity Scheme (SLS) that allowed member institutions to swap certain MBS with high credit ratings for gilt securities (securities that have been issued by the U.K. Treasury). A 'haircut' was levied on these securities which meant that the BoE would take in collateral with larger market value than the amount being lent to the member banks (Cross et al., 2010). The haircut was implemented to protect the BoE from losses in the event of a counterparty default and was based on the market volatility of the underlying collateral (Cross et al., 2010). Further an extra haircut of six percentage points would be levied on non-sterling denominated securities to also account for currency risk and exchange rate volatility.

The collapse of the asset backed securities markets had made these securities temporarily illiquid and thus this program was designed to increase liquidity in the asset portfolios of British banks (Cross et al., 2010). Bank were also required to pay a fee to use this program and only the MBS that were on the banks' balance sheets at the end of 2007 were accepted as collateral (Cross et al., 2010). The swaps under the SLS were renewable for up to a three year period and the program concluded in January 2009. Overall gilts of face value of £185 billion were lent under this program and helped supply liquidity to at risk banks.

(4) Discount Window Facility

In October 2008, the BoE created the Discount Window Facility (DWF) as a new and permanent facility to give liquidity support to U.K. banking institutions (Cross et al., 2010). The DWF allows banks to borrow gilts against a wide range of collateral at fees that are based on the type of collateral and size of drawing (Quarterly Bulletin, 2008). However banks with serious solvency problems were not eligible to borrow from this facility (Quarterly Bulletin, 2008). The terms of the DWF were planned to reduce incentives for commercial banks to take on liquidity risk in the future as well as protect the BoE from substantial losses (Cross et al., 2010). Normal transactions under DWF were to be for 30 days with the BoE retaining the option to extend this duration in periods of great financial stress (Quarterly Bulletin, 2008). The BoE intended the

DWF to be an enduring mechanism to deal with systematic liquidity concerns during periods of financial turmoil (Quarterly Bulletin, 2008).

Policy of quantitative easing

‘Quantitative easing’ refers to an expansionary monetary policy where the focus is on the quantity rather than the price of money (Benford et al., 2009). The BoE decided to pursue quantitative easing through large scale purchase of public and private assets thus increasing monetary aggregates and weaken deflationary pressures in the economy (Benford et al., 2009). The purchase of financial assets from the private sector was expected to boost nominal spending and lead to an increase in asset prices that had fallen dramatically during the financial crisis (Benford et al., 2009). The financial assets purchased under this program included gilts, corporate bonds and commercial paper (Benford, 2009). The purchase of corporate bonds and commercial paper was also expected to provide a price floor for financial securities (Bean, 2009) and reduce the financing costs for businesses through lower spreads (the premium investors charge for holding riskier assets). Quantitative easing through asset purchases was also expected to encourage more investors to enter the market and thus increase the amount of credit in the economy (Meier, 2009). Quantitative easing would also result in higher reserves for domestic banks and make them more willing to extend loans to consumers and businesses and thus boost aggregate demand in the economy (Dale et al., 2010). The extra reserves would also contribute to a decline in the interest rates that banks charge one another and increase supply of credit in the lending system (Bean, 2009). Finally, quantitative easing would influence expectations that inflation will remain within target levels and that economic climate will improve in the following years (Dale et al., 2010). Higher consumer and business confidence over economic conditions is more likely to boost spending and will lead to a faster economic recovery (Benford et al., 2010).

Asset Purchase Facility

On the 19th of January, 2008, the BoE announced the creation of the Asset Purchase Facility (APF) to conduct the policy of quantitative easing (Benford et al., 2010). Initially the purchase of private sector assets was funded by the issuance of gilts by the Debt Management Office as the BoE only wanted to improve credit conditions in the financial markets (Cross et al., 2010). In March 2009, the MPC made the decision to conduct monetary policy through APF and so the purchase of assets was now financed by the creation of central bank reserves (Benford et al., 2010). The MPC announced that it would purchase £75 billion in assets and that amount was

later extended to £200 billion as the economic conditions continued to deteriorate (Joyce et al., 2010). The assets were to be purchased by a separate subsidiary of the BoE and the U.K. Treasury would cover any potential losses incurred by this facility. The assets eligible to be purchased under APF included investment grade commercial paper, high quality corporate bonds, and gilts (Benford et al., 2010). We now look at the mechanism of APF in each of the above markets.

i. Gilt purchases

The BoE purchased conventional gilts with maturity ranging from 5 to 25 years through reverse auctions where banks and securities dealers submitted prices to sell specific quantities of gilts (Joyce et al., 2010). The BoE also allowed financial firms with noncompetitive bids to sell their gilts at the average successful price in the reverse auction (Benford et al., 2010). The gilts purchased through reverse auctions have contributed to an enormous proportion (more than 97%) of the assets acquired under quantitative easing (Meier, 2009). By the end of the first quarter, 2010, the BoE had purchased about £198.3 billion worth of gilts under the APF. The large purchase of gilts through APF allowed the BoE to inject a significant amount of cash in the private sector and improve market liquidity without assuming a large amount of credit risk (Meier, 2009). Further the gilt purchase would lead to a general portfolio rebalancing in the economy as investors shift their funds from low yield gilts to other higher yield asset classes like corporate bonds and equities (Meier, 2009). So gilt purchases would increase demand for high yield assets, raise their prices and generate a positive wealth effect in the economy (Meier, 2009).

ii. Commercial paper purchases

The BoE provided a window each business day for companies to either issue commercial paper directly to the APF or for investors to sell their holdings of previously issued commercial paper (Benford et al., 2010). The BoE purchased the commercial paper at a minimum spread over risk free rates and the aim was to direct funds to corporations in urgent need of short term financing (Quarterly Bulletin, 2009). In order to be eligible, commercial paper had to have a maturity of up to 3 months and issued in Sterling by a non bank corporation that played an important role in the British economy. During the peak of the crisis the BoE held about £2.25 billion of commercial paper, which accounted for a third of the U.K.'s total commercial paper

market (Benford et al., 2010). There have been signs of success as market yields for commercial paper have been below the threshold established under this program (Meier, 2009).

iii. Corporate bond purchases

The focus of the BOE's Corporate Bond Secondary Market Scheme was to facilitate activity in secondary bond market that had become distressed during the financial crisis (Quarterly Bulletin, 2009). The BoE made regular purchases of a wide range of corporate bonds through reverse auctions (Quarterly Bulletin, 2009). Corporate bonds had to be investment grade and be issued in Sterling by firms in the non banking sector to be eligible for purchase (Benford et al., 2010). The purchase of high quality bonds was expected to reduce the spread between corporate and government bonds and improve domestic firm's access to capital financing (Quarterly Bulletin, 2009). Auctions would also provide asset pricing information to investors and reduce the uncertainty over the market values of corporate bonds (Benford et al., 2010). The BoE's corporate bond portfolio under APF peaked at £1.5 billion at the end of 2009 (Quarterly Bulletin, 2009).

Effect in the gilt market

The BoE's APF as mentioned above was primarily implemented through the purchase of conventional gilts with a maturity between 5 and 25 years. The BoE's announcement of APF on the 5th of March, 2009, took markets by surprise and gilt yields fell by around 105 basis points in the following weeks (Meier, 2009). Other considerations such as improving U.K. financial markets, new information regarding the U.K.'s substantial budgetary needs and higher inflation level than expected led to an upward pressure on long term gilt yields and by the end of May, 2009, they had returned to their pre-quantitative easing levels (Meier, 2009). Still Meier (2009) by looking at the bond yields for other advanced economies such as U.S., Germany and Switzerland in the same time period concluded that U.K.'s quantitative easing had the effect of reducing yields by around 35-60 basis points.

Joyce et al. (2010) conducted an event study analysis to study the effect quantitative easing announcements had over immediate gilt yields and OIS rates in the market. Their goal was to capture only the market's direct reaction to the BoE's quantitative easing announcements from other factors that have a role in the determination of gilt yields. They settled on a two day window so that the market could both evaluate the news in an adequate manner and not be affected by other extraneous events. They looked at the response of individual gilts to six

quantitative easing related news events. They found that the largest two day yield movements occurred on the 11th of February, 2009, when the BoE gave strong indication to undertake quantitative easing, and on the 5th of March, 2009, when the details of APF were first released to the public. The remaining four announcements that took place later were widely anticipated by the market and had little impact on gilt yields.

Using their event study framework they examined the changes on the BoE's estimated zero coupon yield curve and so a better indication of the overall impact the APF had on the U.K. term structure. Summing those reactions they found that the quantitative easing related news had an overall reduction of around 100 basis points with reactions varying between 55 and 120 basis points for different gilt maturities. A significant amount of this reduction in gilt yields was due to corresponding changes in the gilt yield- OIS spread. The OIS rate is a measure of the risk free rate and movements in the gilt yield-OIS spread represent the effects of portfolio rebalancing in an economy. Thus the impact on gilt yields was dominated by the portfolio rebalancing effect as investors took revenue from gilt sales and used it to purchase assets that provided higher yields. \

Effect in the corporate bonds market

The APF's purchase of gilts and the corporate bond greatly impacted the corporate bond market. A reduction in gilt yields through quantitative easing lowered corporate bond yields for a given spread. Further the BoE's corporate bond facility reduced the spread by providing bondholders with a willing buyer (Meier, 2009). Joyce et al. (2010) found that the combined effect of the BoE's quantitative easing announcements was a reduction of 70 basis points for sterling denominated investment-grade corporate bond yields. The effect was greater on non investment grade corporate bond yields which fell by 150 basis points with even the spread being reduced by 75 basis points. The reduction in spread showed that investors were charging a smaller premium for non investment- grade corporate bonds in the aftermath of quantitative easing. Further the corresponding yields for U.S. and Euro dominated corporate bonds fell only around 23 and 11 basis points showing that the reduction in sterling bond yields was a function of the BoE's quantitative easing policy (Joyce et al., 2010). The BoE's thus achieved some success in bringing stability to the domestic corporate bond market (Meier, 2009).

Impact on liquidity

The APF has also improved liquidity in the gilt and corporate bond markets (Joyce et al., 2010). Quoted bid-ask spreads in the gilt market reflect transaction costs and usually increase

during periods of low liquidity. These spreads had risen following the bailout of Bear Stearns bailout and the collapse of Lehman Brothers. The APF reversed this trend and the quoted bid-ask spreads started to contract towards the end of 2009. Liquidity in the corporate bond market also improved as the median bid-ask spread for corporate bonds fell following the launch of the BoE's corporate bond facility. These spreads continued to see a decline during the BoE's purchase of gilts under quantitative easing (Joyce et al., 2010). Portfolio rebalancing from the BoE's gilt purchases and the corporate bond facility both played an important role in improving liquidity in the corporate bond market (Meier, 2009).

Synopsis of the BoE's response

The expansion of the BoE's liquidity operations and the policy of quantitative easing was undertaken to mitigate the turmoil in markets caused by the global financial crisis (Cross et al., 2010). The BoE's liquidity operations provided liquidity to financially susceptible domestic banks and assisted in the banking sector's recovery from the credit crisis (Fisher, 2010). The BoE's quantitative easing policy has also led to an improvement in credit markets with rising asset prices and declining spreads (Meier, 2009). Further the inflation targeting framework has given the BoE more credibility in the management of long run inflation rates as shown by the appreciation in sterling and the constrained expectation of future inflation rates during this period (Meier, 2009). The BoE's unconventional monetary policies did not generate expectations of high inflation in the future and thus the BoE maintained price stability in the economy, an overriding goal of monetary policy (Meier, 2009). We now turn to the Fed's conduct of monetary policy during the financial crisis.

VI. Fed's monetary policy during the financial crisis

The normal tools at the Fed's disposal to conduct monetary policy are open market operations, the discount rate (the rate at which commercial banks can borrow from the Fed) and establishing the reserve requirement for U.S. banks. The Fed has not utilized the reserve requirement in the 21st century and it was not used during the current crisis (Cecchetti, 2009). Open market operations allows the Federal Open Market Committee (FOMC), the Fed's main policy making body, to set a target for the federal funds rate which is the interest rate that banks charge one another on overnight loans (Cecchetti, 2009). The Fed then uses daily adjustments in its treasury holdings and repo agreements to keep the federal funds rate at the target level

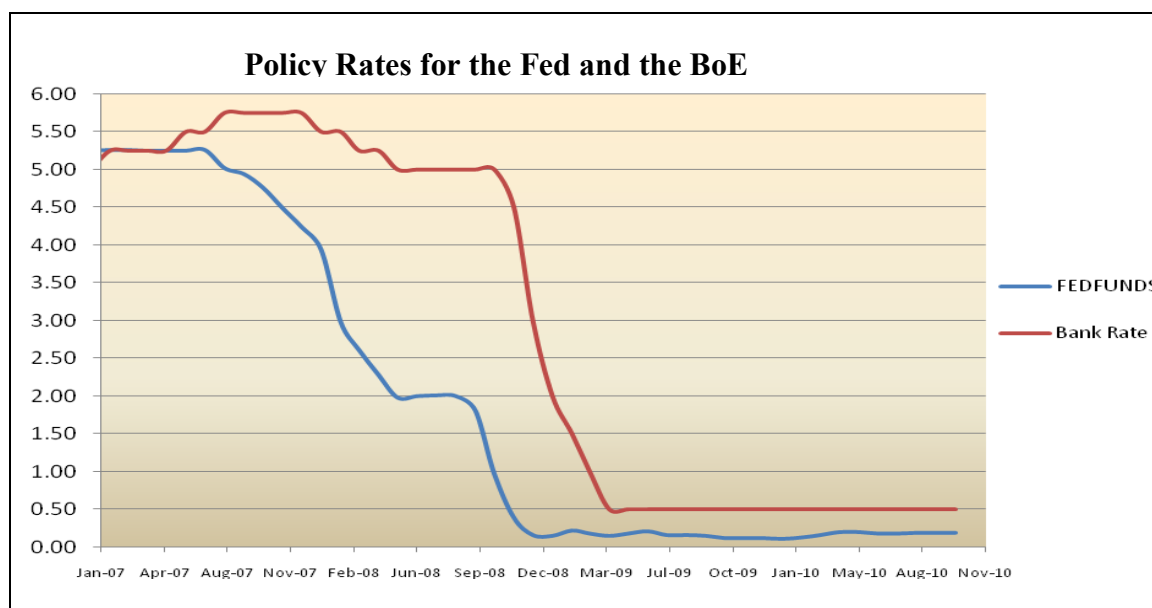
(Cecchetti, 2009). Banks can also borrow directly from the Fed at the discount rate which is usually set 100 basis points higher than the federal funds rate (Cecchetti, 2009). This allows the Fed to serve in its role of lender of last resort and maintain adequate liquidity in financial markets. We will first look at Fed's use of these traditional tools in dealing with the crisis.

In the early stages of the crisis the Fed like the BoE pursued conventional monetary policy by cutting both the federal funds rate and the discount rate to spur lending in the financial market (Figure 5). From August, 2007, to May, 2008, the Fed cut the federal funds rate by 3.25 percentage points which was accompanied by a corresponding cut in the discount rate (Cecchetti, 2009). Further the discount rate was now only 50 basis points higher than the federal funds rate and banks were also able to borrow funds for a maximum of 30 days (Wheelock, 2010). A deep cut in both rates should theoretically have alleviated the credit crunch by allowing banks to borrow from the Fed at the lower discount rate and thus overcome liquidity constraints. Further banks could use the lower federal rates to increase their profitability through the 'maturity transformation' process: getting short term funds and making long term loans (Cecchetti, 2009).

However, these measures were proven ineffective as banks did not borrow from the discount window at the levels needed to reduce the credit crunch in the market. Indeed the spread between U.S. treasuries and agency debt worsened through the winter of 2007 and spring of 2008 (Cecchetti, 2009) as investors continued to place their funds in the safer treasury bonds. The FOMC continued to cut rates in 2008 and by December 2008 the federal funds rate was set in a target range of 0 to 25 basis points, effectively reaching the lower bound (Wheelock, 2010). Further the discount rate was set at 25 basis points higher than the federal funds and the duration was increased from 30 to 90 days (Cecchetti, 2009). However in late 2007, policy makers at the Fed like the BoE began to realize that traditional monetary policies alone would not be useful in combating the credit crisis. The Fed's board members including Bernanke were well versed in the history of Great Depression and the dangers of a passive monetary policy in the face of a severe economic downturn. Bernanke (2000) lays this clear when he states "*But Roosevelt's specific policy actions were, I think, less important than his willingness to be aggressive and experiment – in short, to do whatever it took to get the country moving again. Many of his policies did not work as intended, but in the end FDR deserves great credit for having the courage to abandon failed paradigms and to do what was needed to be done*" (Kroszner and Melick, 2010). Thus the Fed led by Chairman Bernanke embarked on a set of ambitious and unprecedented programs to counter the financial

crisis that appeared to be leading the U.S. economy to another depression (Kroszner and Melick, 2010).

Figure 5. Policy Rates for the Fed and the BoE



Source: Bank of England and the Federal Reserve Bank of St. Louis

The Fed's nontraditional response can be categorized separately as direct lending to sound financial institutions, easing liquidity in the credit markets and purchasing long term securities (Ansari, 2009). In particular the Fed created a number of new programs that were intended to expand the class of financial institutions receiving support, broaden the collateral eligible to receive Fed's support and lengthen the duration of this support (Kroszner and Melick, 2010). The Fed also played a key role in the bailout of Bear Stearns and AIG as well as offered support to the commercial paper sector. Finally the Fed has also tried to influence long term interest rates through purchase of MBS and longer term treasury bonds (Cecchetti, 2009). The interconnectivity in the financial markets and large number of asset backed securities in bank's balance sheets meant that the Fed would have to provide long term support to prevent large scale financial turmoil (Kroszner and Melick, 2010). We will briefly look at some of these programs and the role each program played in easing the financial crisis.

Term Auction Facility

The Term Auction Facility (TAF) was a way for banks to borrow from the Fed without having the stigma attached with discount window borrowing (Wheelock, 2010) as well as getting a loan with a longer maturity. The idea was to pump reserves in the system by allowing banks to get loans directly from the Fed. Through TAF, the Fed would auction off predetermined amounts of funds to banks over a certain time frame with banks bidding the rate they would pay on these loans (Cecchetti, 2009). The procedures of TAF ensured anonymity for participating institutions and allowed banks to avoid disclosing their urgent need of funds in public (Wheelock, 2010). Not surprisingly banks were willing to use TAF and outstanding borrowing peaked at \$500 billion in March 2009 (Kroszner and Melick, 2010). TAF thus provided funds to banks that had been in most need of funding (Cecchetti, 2009).

TAF was created in part to reduce the liquidity premium on short term loans which had risen as banks faced greater uncertainty over short term funding needs in a volatile financial climate (McAndrews et al., 2009). Even banks with adequate reserves were not willing to issue short term loans over the fear that funding would not be available for their future needs (McAndrews et al., 2009). TAF reduced banks' uncertainty over future funding requirements as banks now had another avenue available to access short term loans. This encouraged banks to end their accumulation of reserves and start lending to other banks.

The rules of TAF also allowed banks to receive funds against collateral like asset-backed securities, which had uncertain market value and would be insufficient collateral under normal circumstances. So in essence the Fed was providing capital support to borrowing banks by allowing them to meet liquidity constraints as well as giving them much needed time to accurately value assets and not be forced to sell them in a down market (Cecchetti, 2009). TAF, by meeting banks' immediate concerns over short term financing provided much needed relief to the vulnerable financial lending system (McAndrews et al., 2009). TAF's success was evident as the spread between the 3 month LIBOR and the 3 month treasury bill rate started to decrease from December, 2007, to February, 2008, (Cecchetti, 2009).

McAndrews et al. (2009) conducted an econometric test to see if TAF announcements and operations had a statistically significant effect on the LIBOR-OIS spread. OIS contracts carry little credit risk since only interest payments are exchanged and so no loss of principal occurs in the event of a counterparty default. The difference between the LIBOR and OIS rate

can thus be seen as a combination of the liquidity and risk premium of the loan. Under an efficient market hypothesis, announcements over TAF would impact the market's liquidity risk and these announcements can be further categorized as initial announcement of the program, modifications in the total amount available during auctions, and the frequency of future auctions. TAF operations would also resolve any funding uncertainty for market participants by completing the allocation of funds at the end of the auction. During their econometric analysis they assumed that a change in the LIBOR-OIS spread was linearly related to the TAF dependent indicator variable, lag of the LIBOR-OIS spread and a proxy variable that measured credit risk. Their regression result showed that a cumulative reduction of over 50 basis points in the LIBOR-OIS spread could be attributed to TAF announcements and operations. Thus TAF was a valuable tool that the Fed used to alleviate liquidity concerns in the financial markets (McAndrews et al., 2009).

Swap lines with other central banks

During this same period the Fed also established swap lines and reciprocal currency arrangements with other central banks as there was a strong demand for dollars among foreign commercial banks (Wheelock, 2010). In December 2007, the Fed started to supply dollars to the European Central Bank and Swiss National Bank who then auctioned off those funds to their domestic banks (Wheelock, 2010). More lines were established with other central banks as the crisis intensified in the fall of 2008 (Kroszner and Melick, 2010). The swap agreements were structured such that an equivalent amount of foreign currency was provided by foreign central banks in return of dollars and this foreign currency was placed in special accounts at foreign central banks. The foreign central banks bore full responsibility for dollars withdrawn from the Fed and interest earned from lending these dollars to their domestic institutions. These conditions served as a deterrent for excessive drawing and an incentive to end the swaps as the financial markets became stable (Kroszner and Melick, 2010).

Coffey et al. (2009) found that during this period there was a statistically significant breakdown in the covered interest parity (CIP) relationship which states that the interest return on holding \$1 in a U.S. account is the same as converting the \$1 into a foreign currency and then holding it in a foreign account. They measured the deviation from the CIP as the difference between the U.S. dollar rate implied by the CIP from the euro-U.S. dollar currency markets and the actual benchmark U.S. dollar LIBOR rate. They found that this difference had been close to 0

in normal financial times but started to rise in the early stages of financial crisis and finally increased to over 200 basis points by the end of September, 2008. In general slight deviations from CIP would result in arbitrage transactions in the foreign currency markets until the CIP relationship is restored. The large and sustained deviation of CIP seen during the financial crisis was a direct consequence of the greater demand of U.S. dollars that limited investors' borrowing of dollars for potential arbitrage opportunities. Greater uncertainty over the credit worthiness of the counterparty was another factor for the CIP deviations as previously safe cash flows become more risky in financially turbulent periods. So both the lack of short term funding and elevated counterparty credit risk contributed to the lack of arbitrage transactions in the currency markets (Coffey et al., 2009).

The Fed had established currency swaps as a means to supply dollars and provide liquidity in foreign lending markets. Thus currency swaps would also ease the funding constraints for arbitragers in international markets and allow them to make currency transactions that would reduce the CIP deviation. Their regression analysis found that announcements and actual operations related to the swap program were effective in reducing the deviation by an average of 3 basis points from the 23rd of May, 2008, to the 15th of September, 2008. The Fed's announcement in October, 2008, to end the cap on the swap amounts resulted in a further reduction of 55 basis points. Thus the announcement days along with the days of the auction for the swap had a significant impact in restoring the CIP relationship (Coffey et al., 2009). Overall these swap lines allowed the Fed to provide assistance to overseas financial institutions via foreign central banks (Kroszner and Melick, 2010) and helped alleviate the global credit crunch (Sarkar, 2009).

Assistance to primary dealers

A tremendous scarcity was seen in U.S. treasuries during the crisis as investors continued to prefer U.S. treasuries over other more risky securities. Large financial institutions such as primary dealers hold different types of securities and make active use of the repo markets to meet their short term financing needs (Cecchetti, 2009). However by March, 2008, anxious investors created such a shortage in U.S. treasuries that the rate on overnight repo fell to 20 basis points. A low repo rate suggests that investors were willing to hold treasuries for minimal compensation (Cecchetti, 2009). The shortage led primary dealers to default on transactions as they were unable to provide promised securities (Mamun et al., 2010). Primary dealers routinely agree to

sell or deliver a security that they do not own in the belief that they will be able purchase the specific security in time for the transaction (Cecchetti, 2009). The increased illiquidity in the repo market greatly hurt primary dealers and was identified as a major cause for the financial troubles at Bears Sterns (Mamun et al., 2010).

The Fed launched the Term Securities Lending Facility (TSLF) to counter the shortage of U.S. treasuries in the financial markets. Primary dealers had traditionally been able to borrow treasuries on an overnight basis from the Fed for a fee (Cecchetti, 2009). TSLF made certain changes to this existing arrangement by extending the borrowing period to 28 days (Mamun et al., 2010). Further the collateral accepted was broadened to include AAA rated MBS which allowed primary dealers to engage in more transactions (Cecchetti, 2009). In essence the Fed was exchanging U.S. treasuries for MBS whose market had collapsed (Sarkar, 2009). Through TSLF, the Fed was able to inject liquidity in the repo markets and provide assistance to primary dealers (Mamun et al., 2010).

The Fed also launched the Primary Dealer Credit Facility (PDCF) to provide a similar avenue for the 19 primary dealers as was available to member banks (Mamun et al., 2010). PDCF gave primary dealers access to overnight federal funds at the same rate that was paid by depository institutions (Kroszner and Melick, 2010). Unlike TSLF, the PDCF could be used on a daily basis and primary dealers were able to borrow on a broader range of collateral (Mamun et al., 2010). These programs led to a reduction in the spread between the MBS repo rate and the U.S. treasury repo rate, showing a considerable easing of financial stress in the markets (Ansari, 2009).

Mamun et al. (2010) conducted an econometric test to see the effect TSLF and PDCF had on the different sectors in the financial services industry. Using market returns they were able to determine if the Fed's new initiatives were successful in creating a wealth effect for the financial institutions. The financial institutions tested included banks, insurance companies, brokerage firms, savings & loans institutions and primary dealers. They found that the Fed's announcement of TSLF had a positive impact only on the portfolio of S&L institutions which can be attributed to a positive market spillover. Also the creation of PDCF had a statistically significant positive wealth effect for the portfolios of primary dealers and brokerage firms showing that PDCF was able to address some of their liquidity concerns. Finally the Fed's announcement to expand these facilities generated a positive wealth effect for the respective portfolios of banks, S&Ls and

primary dealers. Thus Mamun et al. (2010) showed that both TSLF and PDCF helped primary dealers overcome liquidity challenges and assisted the overall financial services industry.

Intervention in Bear Stearns and AIG

The near collapse of Bear Stearns and AIG was a major shock to the financial system and forced the Fed along with U.S. Treasury to take an active role in the management of these two institutions. In March, 2008, Bear Stearns liquid assets had dropped from \$18 billion to \$2 billion and the firm was unable to get short term funding to conduct operations (Cecchetti, 2009). The Fed realized that Bear Stearns was of a part of an interconnected financial network and its sudden collapse would have adverse consequences for the whole financial world (Wheelock, 2010). Article 13(3) of Federal Reserve Act gives the Fed the authority in extreme circumstances to make loans to any person, institution and partnership to stabilize the financial system (Wheelock, 2010). The Fed made use of this power to provide Bear Stearns with \$12.9 billion in emergency funding (Cecchetti, 2009). Further, the Fed and the Treasury helped broker a deal that allowed JP Morgan to buy Bear Stearns. Under the deal the Federal Reserve Bank of New York would provide a 10 year \$29 billion loan at the discount rate to hold \$30 billion worth of Bear Stearns owned MBS (Cecchetti, 2009). Thus the Fed would take a loss if the holding of MBS was later valued at an amount less than \$29 billion (Cecchetti, 2009).

The Fed's actions to manage the Bear Stearns crisis were not popular; especially its decision to take collateral MBS that had uncertain value in the aftermath of the housing crisis. However it was the U.S. Treasury and not the Fed that was taking on the credit risk and thus the potential loss from this transaction (Cecchetti, 2009). Any losses were to be taken out from net earnings that the Fed has to transfer to the Treasury at the end of each fiscal year (Cecchetti, 2009). So the U.S. Treasury was responsible for the subsidy implicit in the loan that was needed to facilitate JP Morgan's purchase of Bear Stearns.

The Fed also acted in a proactive manner when AIG, one of the largest insurance companies in the world faced serious financial difficulties and got close to insolvency (Kroszner and Melick, 2010). AIG had sold a large number of credit default swaps to financial firms that wanted to insure their holdings of MBS from potential losses. The collapse of the mortgage markets had made AIG's reserves inadequate and there were serious concerns about their ability to honor all prior commitments (Kroszner and Melick, 2010). AIG suffered a downgrade in its credit ratings and was unable to meet collateral requirements for its exposure in the credit default

markets. The Fed stepped in and first made a secured loan of \$85 billion to AIG at a rate of 850 basis points above the 3 months LIBOR rate (Wheelock, 2010). The Fed also provided funding to buy \$22.5 billion worth of residential MBS and 30 billion worth of collateralized debt obligations from AIG (Kroszner and Melick, 2010). The Fed's actions along with the U.S. government's Troubled Asset Relief Program (TARP) helped stabilize AIG and allowed it to pay the claims on its credit default swaps.

The Fed faced unprecedented scrutiny over its role in the bailout of Bear Stearns and AIG. There were fears that the Fed has lost its ability to play a constructive role in private sector solutions for failing institutions (Cecchetti, 2009). Further the Fed's actions increases moral hazard in the financial markets as lenders will be willing to make riskier loans to firms in the belief that they will be bailed out in adverse circumstances. However if the Fed had let Bear Stearns and AIG collapse then their numerous counterparties would have also suffered tremendous losses and would have produced tremendous instability to the financial system. Further in the case of AIG, state insurance regulators would have had to put underlying insurance companies into receivership which would have nullified the insurance policies of millions of customers and small businesses (Kroszner and Melick, 2010). Thus the Fed was forced to act in the case of Bear Stearns and AIG to prevent a systematic collapse of financial markets.

Term Asset-Backed Lending Facility

In November, 2008, the Fed again used the Section 13(3) provision to create the Term Asset Backed Lending Facility (TALF) (Wheelock, 2010). The U.S. Treasury and Fed were both involved in the TALF (Wheelock, 2010) and it gave the Federal Reserve Bank of New York the authority to provide non-recourse loans (borrowers not personally liable) to holders of newly issued AAA rated asset backed securities (ABS). The structure of TALF was such that U.S. Treasury would provide capital as protection against future losses and this allowed the Fed to accept wide range of collateral and for longer durations (Kroszner and Melick, 2010). The goal of TALF was to revive private lending through easing securitization of loans made to consumers and small business (Sarkar, 2009). Further TALF, by providing liquidity to these lenders, was expected to increase the value of existing loans that had been adversely affected by the financial uncertainty in the lending markets (Sarkar, 2009). William Dudley (2009), President of the Federal Reserve Bank of New York succinctly summarizes the objective of TALF in his statement *“By providing non-recourse, term financing for new AAA-rated consumer asset-*

backed securities to investors, the TALF essentially provides the balance sheet capacity necessary to facilitate the continued flow of credit to households and businesses.”

TALF had an immediate effect on stabilizing the ABS markets with a significant reduction seen in the spreads over ABS and LIBOR (Kroszner and Melick, 2010). TALF has led to an increase in the issuance of ABS and by March, 2009, supported half of all issued consumer ABS (Dudley, 2009). TALF also spurred demand for commercial MBS and led to an increase in the prices of these securities (Kroszner and Melick, 2010). The market for MBS is an important source of funding to refinance commercial loans in the future and a dormant market will aggravate the drop in commercial real estate prices and lead to more loan defaults and greater stress on bank capital (Dudley, 2009). The implementation of TALF has led to normalization in the MBS markets and essential towards a future recovery of the housing industry.

Role in the commercial paper market

Money market mutual funds (MMMF) prefer commercial paper as it gives them the opportunity to earn a decent return for very limited credit risk. The market for commercial paper has grown from \$558 billion in 1990 to \$1.97 Trillion in 2007 showing their appeal to both investors and corporations (Kacperczyk and Schnabl, 2010). Initially the subprime mortgage crisis affected the asset backed commercial paper markets as investors became concerned about the value of the collateral and mortgage related assets that were being used in these securities. MMMF started to avoid asset backed commercial paper due to greater perceived risk and this reduced demand led the spread between asset backed commercial paper and federal funds rate to rise from an average of 3 to 46 basis points in the span of a year. Overall from August, 2007, to August, 2008, the value of asset backed commercial paper market fell from 1.18 trillion to 789 billion, a drop of nearly 33% (Kacperczyk and Schnabl, 2010). The crisis further intensified with the bankruptcy of Lehmann Brothers as Primary Reserve Fund, a major MMMF announced that it owned more than \$785 million of Lehmann commercial paper (Kacperczyk and Schnabl, 2010). The net asset value of Primary Reserve Fund quickly fell below \$1, a crucial mark since all MMMF try to maintain a \$1 net asset value in order to resemble high yield bank accounts. Nervous investors led a run on the MMMF with an overall redemption of \$300 billion made in the 3rd week of September, 2008 (Kroszner and Melick, 2010). A flight to quality was also seen as MMMF responded to this crisis by reducing their CP allocation and increasing their holdings of U.S. treasuries and agency debt (Kacperczyk and Schnabl, 2010). This left banks and financial

institutions cut off from a reliable source of funding and strengthened the already severe credit crunch in the financial system and reduced lending to consumers and corporations.

The Fed acted in an aggressive manner after the Lehmann bankruptcy to prevent a complete collapse in the commercial paper markets and policy measures included deposit insurance for MMMF, purchase of commercial paper and capital support to struggling financial institutions (Kacperczyk and Schnabl, 2010). In this regards, the Fed launched the Asset Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF) on the 19th of September, 2008, which provided commercial banks nonrecourse loans to purchase high quality asset backed commercial paper from MMMF at their amortized value (Kroszner and Melick, 2010). The dual goal of the program was to increase liquidity of MMMF, who were facing large number of redemptions as well as give price support to asset backed commercial paper. Both these measures were necessary to persuade MMMF of the long term validity of asset backed commercial paper market and thus resume their market position as providers of short term funding to financial institutions (Kroszner and Melick, 2010).

On the 7th of October, 2008, the Fed also started the Commercial Paper Funding Facility (CPFF) to make direct purchases of three month unsecured and asset backed commercial paper from eligible U.S. issuers (Kroszner and Melick, 2010). The CPFF was designed to purchase commercial paper from any seller and thus reduce the financing strain for new issuers. The interest rate used to discount financial and corporate commercial paper was the OIS rate plus a premium of 200 basis points (Kroszner and Melick, 2010). By early December, 2008, the CPFF held \$335 billion of commercial paper and the Fed thorough AMLF and CPFF had become the single largest buyer of commercial paper (Kacperczyk and Schnabl, 2010).

Both AMLF and CPFF had an immediate impact as the large scale purchase slowed the drop in new issuances and relieved investors' uncertainties over valuation in the commercial paper markets (Kroszner and Melick, 2010). The value of outstanding commercial paper recovered to pre-crisis levels as corporations became more confident of being able to get short term funding. The spread between the commercial paper yield and federal funds rate also saw a significant decrease as the panic in the market subsided (Kacperczyk and Schnabl, 2010). Thus the Fed was successful in restoring confidence for market participants and allowed the commercial paper market to resume its critical role in the financial system.

Influencing long term interest rates through credit easing

The Fed also took measures to direct the long term interest rates through the purchase of longer maturity U.S. treasuries, agency debt from government sponsored entities and MBS that were guaranteed by Fannie Mae, Freddie Mac and Ginnie Mae (Kroszner and Melick, 2010). The purchase of these assets was financed by an expansion in money supply and suggests that the Fed had begun to implement a policy of quantitative easing (Meier, 2009). However the Fed itself has characterized this program as a policy of credit easing that is intended to relieve the stress on certain specific credit markets (Tempelman, 2009). Still the expansion of the reserves at the Fed during 2009 showed that this program was actually a combination of both quantitative and credit easing (Tempelman, 2009).

Initially the Fed had announced the purchase of \$600 billion of MBS but in March, 2009, this program was extended to \$1.75 trillion and now included long term U.S. treasuries (Gagnon et al., 2010). The overall objective of this program was to lower long term interest rates so that companies would be more willing to borrow for investment projects and provide greater credit support to the badly hit mortgage sector (Tempelman, 2009). The Fed's purchase of MBS was expected to reduce the costs for home loans and increase the availability of credit to new home buyers (Wheelock, 2010). Through this program the Fed acquired \$850 billion worth of MBS and \$150 billion worth of agency debt while the percentage of U.S. treasuries with maturity greater than 5 years has risen from 20% of Fed's total U.S. treasuries holdings in August 2007 to 45% in December, 2009 (Kroszner and Melick, 2010).

Effect

Gagnon et al. (2010) used a time series analysis to find the effect the Fed's purchases under quantitative easing had on the 10-year term premium (compensation investor demands for holding the longer maturity asset). They specified a model that explained the term premium using variables like unemployment gap and core CPI inflation to capture the business cycle effect and the 6 months realized daily volatility in the 10 year treasury yield to capture the uncertainty present in economic fundamentals. The last explanatory variable was the net public sector supply of longer term U.S. debt securities expressed as a percentage of nominal GDP. The net supply of long term debt securities was expressed as both an unadjusted and as a 10 year equivalent which converted the outstanding stock of debt securities into an amount of 10 year U.S. treasury securities having the same portfolio duration. The model was estimated on monthly

data from January 1985 to June 2008 thus ending before the Fed's first announcement to purchase long term debt securities. The expectation was that a reduction in supply caused by the Fed's purchase would lower term premiums on debt securities and stimulate economic activity.

Under their econometric analysis Gagnon et al. (2010) found that a one percent increase in ratio of the stock of long term U.S. debt securities over nominal GDP led to a statistically significant increase of 6.4 basis points in the 10 year term premium when an adjustment had been made on the maturity duration. The Fed through February, 2010 has purchased an equivalent of \$850 billion in debt securities with a 10 year duration, nearly 6% of nominal GDP in the fourth quarter of 2009. Thus their model implies that the Fed's purchases reduced the 10 year term premium by 38 basis points. Overall they found that the Fed's purchases had led to a reduction between 30 and 100 basis points depending on the specific econometric model being used.

The Fed's asset purchases have led to greater liquidity in mortgage securities market and removal of assets with high prepayment risk from private portfolios (Gagnon et al., 2010). This reduction in the term premium in mortgage markets has been crucial in boosting the housing market and creating the necessary environment for a broader economic recovery (Wheelock, 2010). Further the number of mortgage borrowings also saw an increase showing that more credit was being made available in the housing sector (Kroszner and Melick, 2010). The increase in the growth of monetary aggregate through this policy of quantitative easing has also helped diminish the prospects of long term deflation within the economy (Wheelock, 2010).

Synopsis of Fed's Response

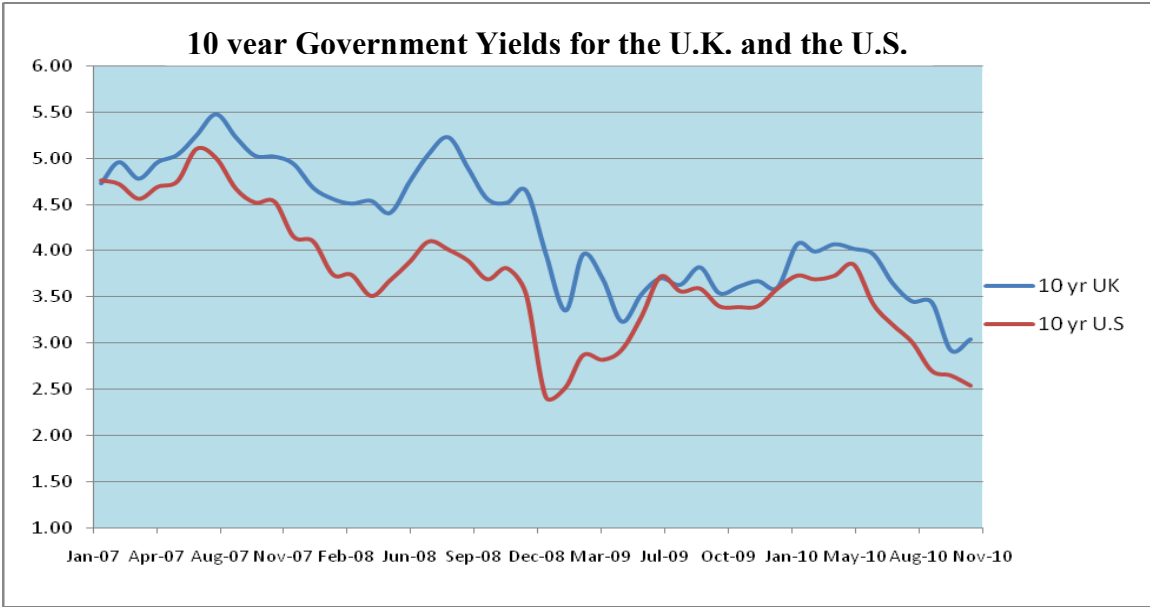
The financial crisis of 2007 was one of the biggest challenges faced by the Fed since the Great Depression of 1929-33 (Wheelock, 2010). The crisis caused a sharp drop in the value of assets for a great number of institutions and placed the whole financial system on the verge of collapse (Sarkar, 2009). The Fed believed that the crisis was sparked by concerns over liquidity and counterparty credit risk and that it needed to act in an aggressive manner to counter the financial crisis (Sarkar, 2009). The Fed made use of both traditional tools and more innovative measures to combat liquidity concerns in the financial market (Sarkar, 2009). It seems clear that policy makers at the Fed were determined to not repeat the mistakes made during the Great Depression when the Fed allowed the money supply to collapse and remained passive during the failures of large financial institutions (Wheelock, 2010). Throughout the current crisis the Fed

continued to supply liquidity to susceptible lending institutions and bring the spreads down on commercial loans so that markets could again function in an efficient manner (Wheelock, 2010). On balance, the combination of Fed's conventional and unconventional monetary policies played a large role in preventing the recession of 2007 from turning into a prolonged economic depression (Kroszner and Melick, 2010).

VII. Convergence of the BoE and Fed’s monetary policy during the financial crisis

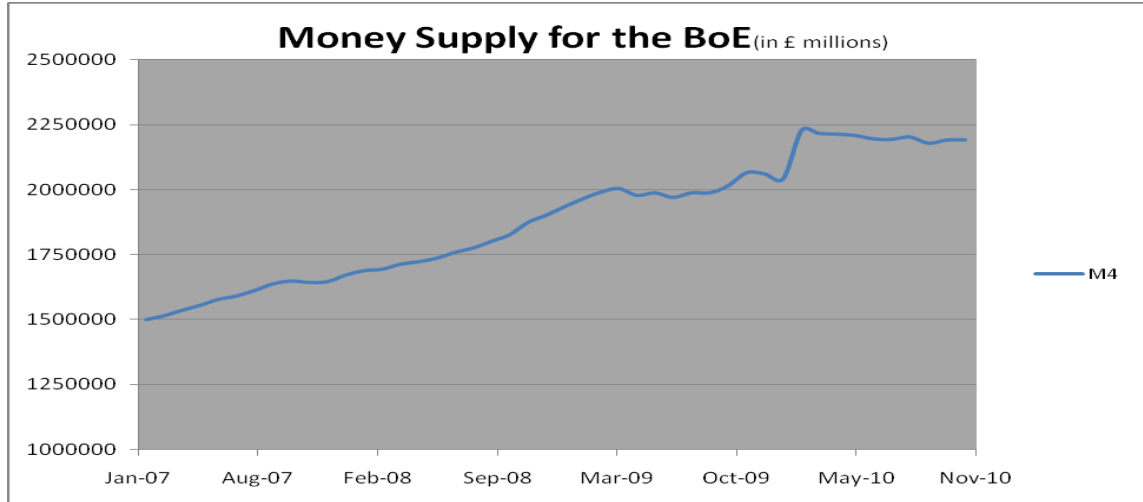
In Sections V and VI we have described in detail the programs and facilities the BoE and the Fed launched to alleviate the financial strain on markets following the upheaval in the U.S. subprime mortgage sector. Both banks sharply cut interest rates and undertook a series of unconventional monetary policies from increasing the size and scope of liquidity facilities to implementing a policy of quantitative easing by making large scale purchases of corporate and long term government bonds. Figure 6 shows the impact quantitative easing had on long term government bond yields for both countries. Figures 7 and 8 show the money supply for both the U.K. and the U.S. economies.

Figure 6. Long Term Government Yields for the U.K. and the U.S.



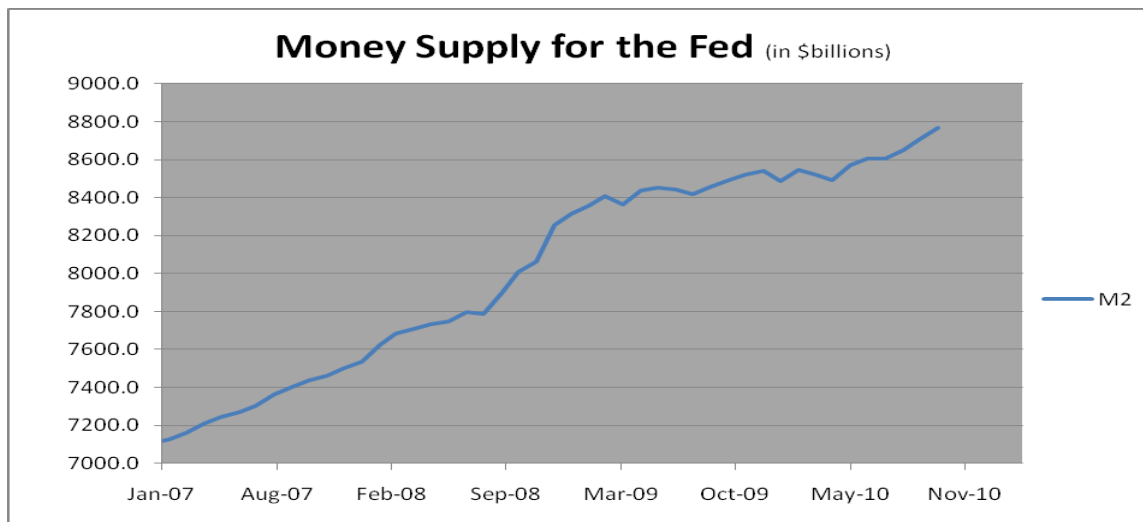
Source: Bank of England and the Federal Reserve Bank of St. Louis

Figure 7. Money Supply for the BoE



Source: Bank of England

Figure 8. Money Supply for the Fed



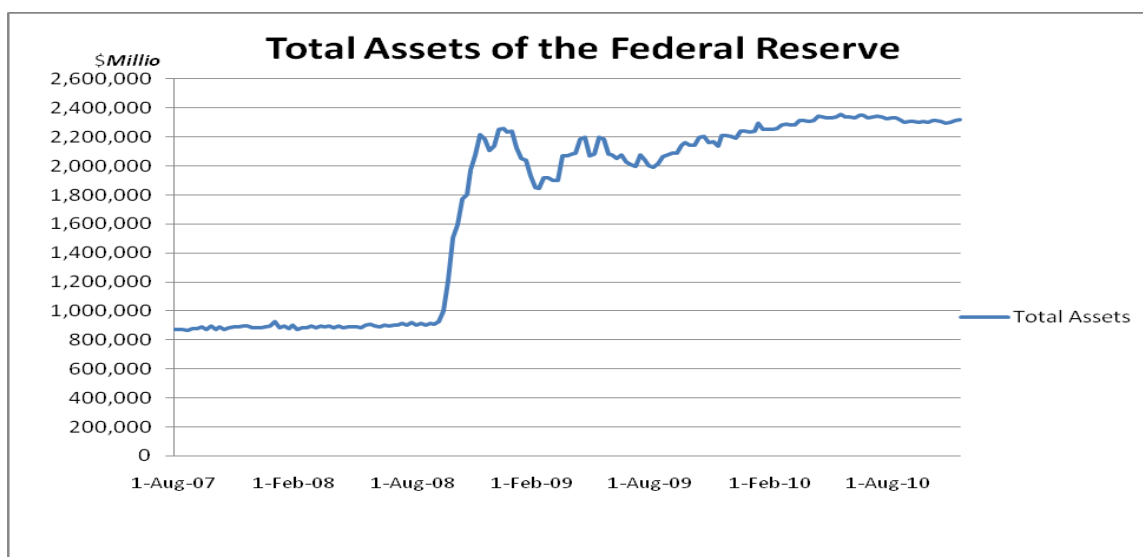
Source: Federal Reserve Bank of St. Louis

Still, there are slight differences with the Fed's asset purchase program more expansive in nature and the targeted assets included MBS and government sponsored agency debt (Lenza et al., 2010). The size of the Fed's asset purchase program is also larger with purchases of securities expected to reach 15% of 2008 U.S. GDP (Meier, 2009). The BoE's purchase on the other hand is expected to reach 9% of 2008 U.K. GDP and with assets limited to commercial paper, corporate and government bonds (Meier, 2009). The BoE's asset purchases were also

much more concentrated towards gilts and accounted for 97% of all APF holdings. On the other hand U.S. treasuries only accounted for 21% of the Fed's total asset purchases (Meier, 2009). These discrepancies, however, are more a result of the cross national variations in the financial structure of the two countries with the U.S having more developed commercial paper and corporate bond markets in contrast to the U.K. that still relies on a more banking dominated financial system (Lenza et al., 2010).

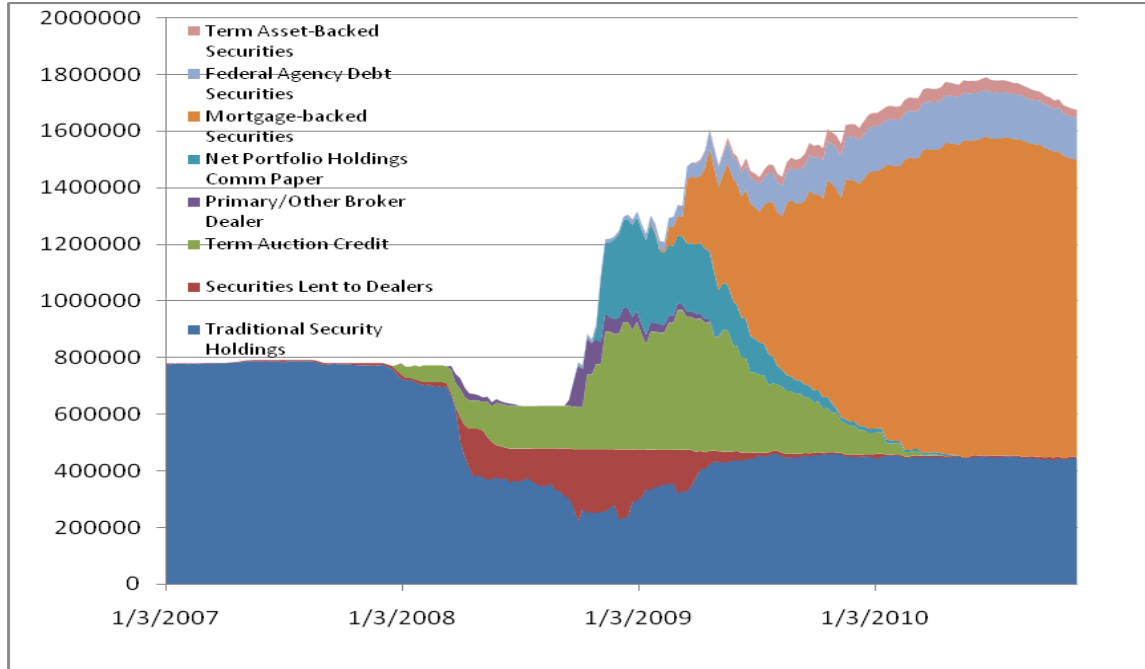
The similarity in monetary policy during the financial crisis is clearly reflected in the balance sheets of both central banks (Lenza et al., 2010). The balance sheets for the Fed and the BoE underwent significant changes as both central banks began to use unconventional monetary policies to reduce the strain on financial markets following the sudden collapse of Lehman Brothers. The Fed saw an increase in its liabilities as bank reserves began to rise following the launch of new liquidity programs. As the crisis progressed, the Fed's decision to purchase securities directly from specific financial markets under the program of credit easing had the effect of expanding (Figure 9) and changing the composition of the Fed's asset holdings (Figure 10). Further the currency swap made with other central banks also increased the Fed's total assets during this period. Reflecting these changes, the Fed's holdings of U.S treasuries declined from 90% of total assets in 2007 to 20% in 2008 while an increase was seen in the Fed's holdings of corporate bonds, commercial paper, agency backed debt and MBS (Tempelman, 2009).

Figure 9. Expansion of the Fed's balance sheet



Source: Federal Reserve Board of Governors

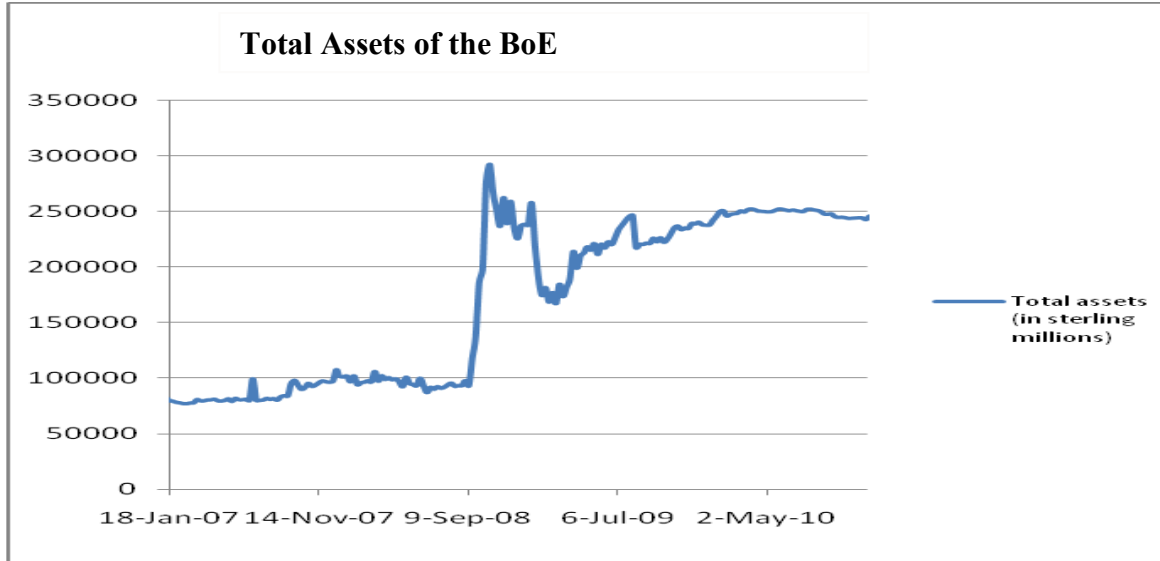
Figure 10. Asset composition of the Fed's balance sheet



Source: Federal Reserve Board of Governors

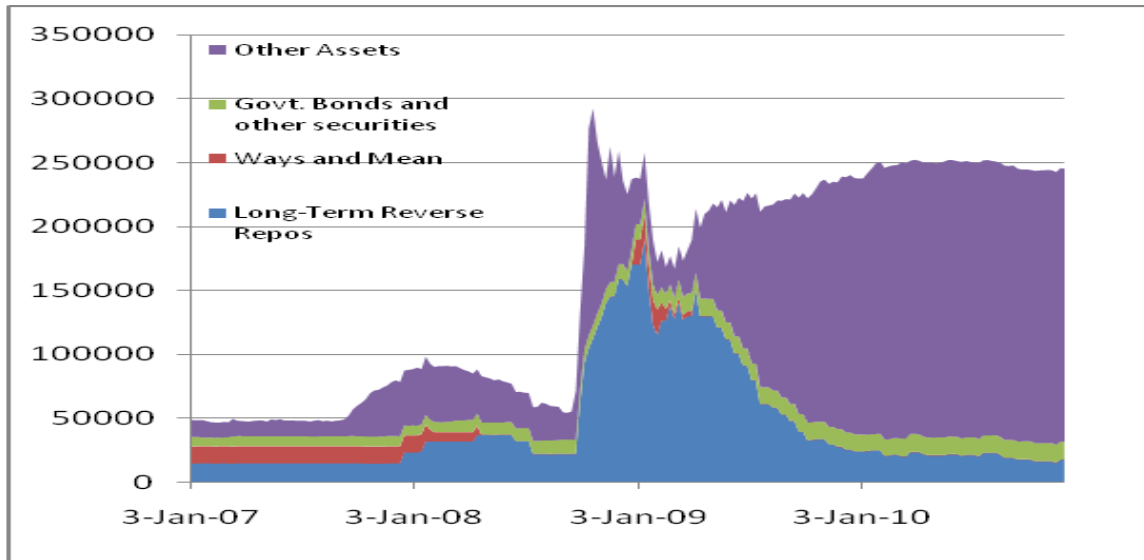
Figure 11 shows that the BoE like the Fed also saw an expansion of its balance sheets during the crisis (from 4% of annual nominal GDP before the crisis to over 16% during the crisis). This expansion was a direct result of programs like the discount window facility and asset purchase facility that had been introduced by the BoE to restore stability in the credit markets (Cross et al., 2010). The discount window program and other liquidity measures shifted the composition of the collateral in the BoE's balance sheets towards higher risk assets like asset backed securities and covered bonds (Cross et al., 2010). Figure 12 shows the shift that policy makers at the BoE made from long term repos to large scale assets purchases as a main apparatus to conduct unconventional monetary policy (Lenza, et al., 2010). Most of the assets purchased by the BoE were financed by the creation of new central bank reserves and thus resulted in a significant increase in the BoE's overall liabilities (Cross et al., 2010).

Figure 11. Expansion of the BoE's balance sheet



Source:Bank of England

Figure 12. Asset composition of the BoE's balance sheet



Source:Bank of England

This convergence in monetary policy for the BoE and Fed is surprising given that they operate under different monetary frameworks (Cuaresma, 2008). As mentioned in Section IV the BoE follows an inflation targeting framework to conduct monetary policy. The Fed on the other hand does not have an explicit monetary policy target rule and the overall goal of monetary

policy is low unemployment, stable growth, price stability and moderate long term interest rates (Paez-Farrell, 2009). Such a broad set of policy goals allows the Fed conduct monetary policy without having to use an explicit and well defined strategy in its decision making process (Cuaresma, 2008). Thus it would be reasonable to expect that the Fed would have more flexibility in dealing with unexpected economic shocks such as the current financial crisis than the BoE. However the previous sections show that both central banks had similar monetary policies during the financial crisis. The rest of the section will try to find a possible explanation for this convergence in monetary policy.

Taylor rule to analyze monetary policy response

In 1993, John Taylor proposed a rule that policy makers at the central bank could use to adjust nominal interest rates in an efficient and systematic manner to deal with changes in expected inflation levels and increasing output gap (Orphanides, 2007). One way to express the Taylor rule is

$$i_t = r^* + \pi_t + \alpha_\pi (\pi_t - \pi^*) - \alpha_y (y_t - y_t^*) \quad (1)$$

Here i_t stands for the policy rate in the period, r^* is the long run real equilibrium interest rate, π_t and π^* represent the current and target rates of inflation while y_t and y_t^* denote current and potential output. Taylor choose a value of 0.5 for the alpha parameters and a 2% rate for the real equilibrium interest rate and target inflation (Wieland, 2009). Taylor found that using these parameter values adequately described the Fed's behavior in the late 1980s and early 1990s (Orphanides, 2003). The Taylor rule thus provides a simple and clear framework to analyze and discuss monetary policy practices (Orphanides, 2003). Our goal now is to see whether the Taylor rule can help explain the monetary policy responses of the Fed and the BoE during the financial crisis.

Taylor rule for the Fed

An optimal monetary policy near the lower bound of interest rates should focus more on the quantity of money than the level of interest rates (Wieland, 2009). Asset purchases undertaken by a central bank expands the money supply in the economy and is a useful tool to counter deflation. It is also increases the aggregate demand through the wealth and portfolio rebalancing effect and facilitates a quicker economic recovery. Further Wieland (2009) found that the optimal monetary policy should be non linear, justifying a more rapid expansion of the central bank's balance sheets during periods of near zero interest rates.

We could apply the Taylor rule in equation (1) to see the prescribed interest rate for the Fed in the first quarter of 2009. The consumer price index (CPI) and the output gap were -0.2% and -4.1% for the U.S economy in the first quarter of 2009 (Wieland, 2009). So using equation (1) tells us that the Fed should set an interest rate of -1.3% in the first quarter of 2009. Since the Fed could not lower nominal interest rates below the zero lower bound it began to expand the monetary base through credit easing. Fed's purchase of securities led to an increase in their prices and generated a positive wealth effect for holders of these securities during the crisis (Wieland, 2009). Thus the Taylor rule as suggested by equation (1) supports the Fed's decision to expand its balance sheet and conduct credit easing to both stimulate the economy and provide support to certain credit markets.

Taylor rule for the BoE

Martin and Milas (2010) tried to use a Taylor rule to model the interest setting behavior of the BoE during the financial crisis. Monthly U.K. data from 1992-2009 were used to estimate the policy rule during this period. They used a Taylor rule in which interest rates are set with reference to expected inflation and output gap one period in the future expressed as

$$i_t = r + \pi^T + \frac{\delta \alpha_r \alpha_y}{\lambda_i} E_{t-1}(\pi_{t+1} - \pi^T) + \frac{\delta \lambda_y \alpha_r}{\lambda_i} E_{t-1}(y_{t+1}) \quad (2)$$

Here i_t is the policy rate, r is the equilibrium real interest rate, π is the inflation rate, y is the output gap, π^T is the target inflation rate, δ is the discount factor and α_r , α_y and λ are the given parameters. In their econometric model they replaced expected inflation and output gap with actual values to see if the BoE followed this rule during the 1992-2009 time periods. i_t was measured as the BoE's policy rate while π was given by the RPIX measure of inflation for the 1992-2003 time period and was replaced by the CPI inflation rate for the 2004-2010 time period. Thus the inflation target was set at 2.5% for the 1992-2003 period and at 2% for the 2004-2010 period. The output gap was measured as the proportional difference between actual GDP and its trend as forecasted by the Hodrick and Prescott model.

Martin and Milas (2010) first estimated their econometric model on the pre crisis period that ended in April, 2007. They found that the estimates for the parameters of inflation and output gap were significant showing that policy makers at the BoE adjusted interest rates to changes in inflation and the output gap. However when the entire data set was used the model showed that inflation is now no longer a significant factor in the determination of interest rates. These results suggest that the BoE clearly changed monetary policy at the start of the financial

crisis which was further confirmed by the use of the Quant-Andrews Breakeven test which detected a single structural break in April 2007 for the full data sample.

In order to account for this shift in monetary policy Martin and Milas (2010) developed another model that could explain the BoE's monetary policy in periods before and during the financial crisis. They used a regression switching model which used a measure of financial stability as an explanatory variable and allowed the policy rule to change when there was a high level of probability that the economy will witness a financial crisis. The spread between Libor and U.S. federal funds rate was used as a measure of financial stability in the model. The empirical results for this model were statistically significant and did a better job of fitting the entire data set. They found that the policy makers at the BoE respond to inflation in periods of financial stability but ignore inflation during a financial crisis. Martin and Milas (2010) concluded that the BoE discarded the inflation target during the crisis and instead focused on a policy of lowering interest rates to generate greater financial stability.

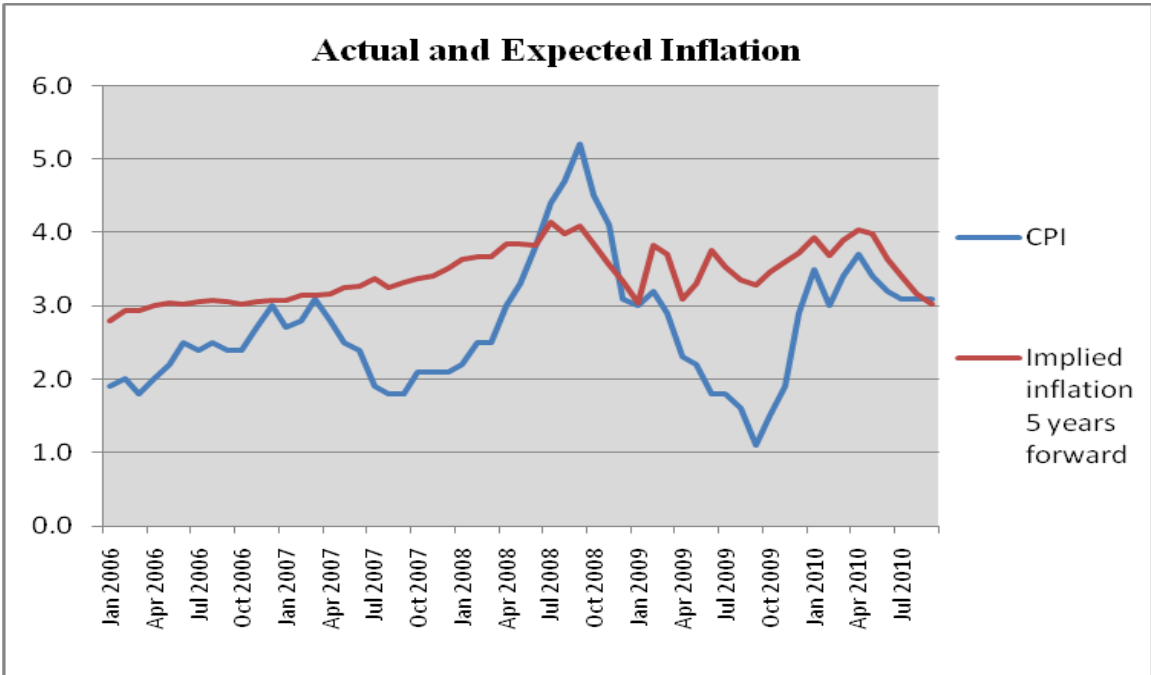
Role of inflation targeting

The lack of response to inflation seems to suggest that the policy makers at the BoE abandoned inflation targeting during the financial crisis (Martin and Milas, 2010). However the BoE follows a flexible inflation targeting framework that had been described in Section III and thus policy makers have greater discretion in times of economic volatility. The financial crisis was a tremendous shock to the British economy and urgent interest rate cuts were needed to counter a severe drop in aggregate demand. A large drop in aggregate demand would have led to a downward pressure on the domestic price level and so steep cuts in interest rates were required to prevent a large and prolonged deviation of inflation from the target in the future (Martin and Milas, 2010).

Indeed Dale et al. (2010) argue that the inflation targeting framework brought transparency and accountability to monetary policy and allowed the BoE to take bold and unprecedented actions in response to the financial crisis given its potential to significantly push inflation below the desired target. A flexible inflation targeting framework allowed the BoE to be more aggressive in cutting interest rates during the financial crisis. Further there was no spike seen in future expectations of inflation as seen in Figure 11, demonstrating that the markets continued to have complete confidence in the BoE's inflation targeting framework. The BoE's policy of quantitative easing was also a feature of the flexible inflation targeting framework and

showed that the BoE was willing to take all necessary actions to both stimulate economy and keep long term inflation within the targeted range (Dale et al., 2010). It also helps explain the similarity in monetary policy seen for the Fed and the BoE during the current crisis. Both the Fed and the BoE tried to use all monetary policy tools at their disposal to lessen the economic impact of the financial crisis and bring stability to the financial markets.

Figure 13. Actual and Expected Inflation in the U.K.



Source: Bank of England

VIII. Conclusion

Central banks all over the world faced tremendous pressure in dealing with the global financial crisis of 2007. This paper examines the monetary policy of the Fed and the BoE, two central banks that were in the forefront of the financial crisis. Both central banks found that the reduction in the policy interest rates did little to alleviate the stress in financial markets and thus a series of unconventional monetary policies were developed to effectively address the situation. These unconventional policies were generally divided into liquidity support to vulnerable financial institutions and expansion of money supply through asset purchases.

The BoE's chief tool in conducting unconventional monetary policy was the APP. The APP was mainly used to purchase longer maturity gilts and improved the functioning of credit markets. A normalization was seen in asset prices and credit spreads as the market reacted positively to the BoE's policy of quantitative easing. Further, future expectation of inflation has remained stable during this period, an important consideration for policy makers given the BoE's inflation targeting framework.

The Fed was a little more innovative in its response to the credit crunch in the immediate aftermath of the financial crisis. TAF was the Fed's signature program and provided short-term loans to banks reducing their uncertainty over future funding requirements. Announcements and operation under TAF is believed to have led a decrease of over 50 basis points in the LIBOR-OIS spread. The Fed also pursued a policy of credit easing under which asset purchases were targeted in certain specific financial markets. The Fed's AMLF and CPPF were used to increase the purchases of commercial paper and were extremely successful in stabilizing the commercial paper market. The Fed also purchased longer maturity debt securities and had the effect of reducing the 10 year term premium by around 30-100 basis points. Throughout the current crisis the Fed, remained determined to avoid the policy mistakes made during the Great Depression and aggressively deal with the financial instability.

The BoE and the Fed although having different monetary frameworks had a similar monetary response during the financial crisis. Taylor rules showed that the BoE did not respond to inflation during the crisis leading to the suggestion that the BoE had in effect abandoned inflation targeting all together. However, the BoE pursues a flexible inflation targeting framework that gives policy makers latitude to respond to exogenous shocks to the economy. Thus the BoE used the inflation targeting framework to both deal with the short term financial instability and anchor future expectations of inflation. The performance of the BoE's inflation targeting framework under a severe financial crisis bodes well for other central banks including the Fed that may want to adopt an inflation targeting regime in the future.

Overall both the BoE and the Fed through use of conventional and unconventional policies were able to restore some semblance of order in a turbulent and volatile financial system. Despite their evident success in restoring financial stability both the BOE and the Fed still face challenges as they try to lead their respective economies from the most damaging global recession seen since the Great Depression.

References

- Bank of England. 2007. "Markets and operations." *Quarterly Bulletin*, 47(4), 490-510.
- Bank of England. 2008. "Markets and operations." *Quarterly Bulletin*, 48(4), 364-381.
- Bank of England. 2009. "Markets and operations." *Quarterly Bulletin*, 49(4), 258-271.
- Angeriz, Alvaro, and Philip Arestis. 2007. "Monetary Policy in the UK." *Cambridge Journal of Economics*, 31(6), 863-884.
- Arestis, Philip, and Alexander Mihailov. 2009. "Flexible Rules cum Constrained Discretion : A New Consensus in Monterey Policy." *Economic Issues*, 14(2), 27-54.
- Barro, Robert J. 2007. "Milton Friedman: Perspectives, Particularly on Monetary Policy." *Cato Journal*, 27(2), 127-134.
- Bean, Charles. 2004. "Inflation Targeting: The UK experience." *Perspectiven der Wirtschaftspolitik*, 5(4), 405-421.
- Bean, Charles. 2009. Speech given at Cutlers' Feast at Cutlers' Hall, Sheffield.
- Benford, James, Stuart Berry, Kalin Nikolov, Chris Young, and Mark Robson. 2009. "Quantitative Easing." *Quarterly Bulletin*, 49(2), 90-100.
- Bernanke, Ben, and Frederic S. Mishkin. 2007. "Inflation targeting: A new Framework for monetary policy?" *Monetary Policy Strategy*. Cambridge: MIT Press.
- Caballero, Ricardo J., and Arvind Krishnamurthy. 2008. "Global Imbalances and Financial Fragility." *American Economic Review*, 99(2), 584-588.
- Cecchetti, Stephen G. 1997. "Understanding the Great Depression: Lessons for Current Policy." National Bureau of Economic Research Working Paper 6015.
- Cecchetti, Steven G. 2009. "Crisis and Response: The Federal Reserve in the Early Stages of the Crisis." *Journal of Economic Perspectives*, 23(1), 51-75.
- Cross, Michael, Paul Fisher, and Olaf Weeken. 2010. "The Bank's balance sheet during the crisis." *Quarterly Bulletin*, 50(1), 34-42.
- Cobham, David. 1997. "Inevitable disappointment? The ERM as the framework for UK monetary policy 1990-92." *International Review of Applied Economics*, 11(2), 213-228.
- Coffey, Niall, Warren B. Hrungrung and Asani Sarkar. 2009. "Capital constraints, counterparty risk and deviations from covered interest rate parity." Federal Reserve Bank of New York, *Staff Reports*, 393.
- Cuaresmo, Jesus, and Ernest Gnan. 2008. "Four Monetary Policy Strategies in Comparison: How

- to Deal with Financial Instability." *Monetary Policy & the Economy*, 3, 65-102.
- Dale, Spencer, James Proudman, and Peter Westaway. 2010. "The inflation targeting regime in the United Kingdom: a view from Threadneedle Street." *Oxford Review of Economic Policy*, 26(1), 3-14.
- Demirguc-Kunt, Ash, and Luis Servén. 2010. "Are all the sacred cows dead? Implications of Financial crisis for macro- and financial policies." *The World Bank Research Observer*, 25(1), 91-124.
- Dudly, William. 2009. "A preliminary assessment of the TALF." Speech made at Securities Industry and Financial Markets Association and Pension Real Estate Association's Public-Private Investment Program Summit, New York.
- Friedman, Milton. 1997. "John Maynard Keynes." *Economic Quarterly*, 83(2), 1-23.
- Gagnon, Joseph E. 2010. "Monetary Response to the Financial Crisis of 2007-08: The Case for Further Action." Presented at An Ocean Apart? Comparing Transatlantic Response to the Financial Crisis conference.
- Gagnon, Joseph E., Matthew Raskin, Julie Remache, and Brian Sack. 2010. "Large-Scale Asset Purchases by the Federal Reserve: Did They Work?" Federal Reserve Bank of New York, *Staff Reports*, 441.
- Gavin, William T. 2004. "Inflation Targeting." *Business Economics*, 39(2), 30-37.
- Gieve, John. 2009. "Learning from the Financial Crisis." *Economic & Financial Modeling*, 16(3), 127-138.
- Hansell, Saul. 1992. "Taming the Trillion-Dollar Monster." *Institutional Investor*, 26(13), 33-39.
- Hodson, Dermot, and Deborah Mabbett. 2009. "U.K. Economic Policy and the Global Financial Crisis: Paradigm Lost?" *Journal of Common Market Studies*, 47(5), 1041-1061.
- Joyce, Michael, Ana Lasaosa, Ibrahim Stevens, and Mathew Tong. 2010. "The financial market impact of quantitative easing." Bank of England Working Paper 393.
- Kacperczyk, Marcin, and Philipp Schnabl. 2010. "When Safe Proved Risky : Commercial Paper during the Financial Crisis of 2007-2009." *Journal of Economic Perspectives*, 24(1), 29-50.
- Kroszner, Randall S., and William Melick. 2010. "The response of the federal reserve to the

- recent banking and financial crisis." Presented at An Ocean Apart? Comparing Transatlantic Response to Financial Crisis conference.
- Lastra, Rosa M. "Northern Rock, UK bank insolvency and cross border bank insolvency." *Journal of Banking Regulation*, 9(3), 165-186.
- Lenza, Michele, Huw Pill, and Lucrezia Reichlien. 2010. "Monetary policy in exceptional times." Centre for Economic Policy Research Discussion Paper 7669.
- Lomax, Rachel. 2005. "Inflation targeting in practice: models, forecasts, and hunches." *Atlantic Economic Journal*, 33(3), 251-266.
- Martin, Christopher, and Costas Milas. 2010. "Financial Stability and Monetary Policy." Rimini Centre for Economic Analysis Working Paper Series 1210.
- Mamun, Abdullah, Kabir Hassan, and Mark Johnson. 2010. "How did the Fed do? An empirical assessment of Fed's new initiatives in the financial crisis." *Applied Financial Economics*, 20(1), 15-30.
- McAndrews, James, Asani Sarkar, and Zhenyou Wang. 2009. "The Effect of the Term Auction Facility on the London Inter-Bank Offered Rate." Federal Reserve Bank of New York, *Staff Reports*, 335.
- Meier, Andre. 2009. "Panacea, Curse or Nonevent? Unconventional Monetary Policy in the United Kingdom." IMF Working Paper 09163.
- Meyer, Lawrence H. 2004. "Practical Problems and Obstacles to Inflation Targeting." *Federal Reserve Bank of St. Louis Review*, 86(4), 151-160.
- Mishkin, Frederic S. 2007. "Why the Federal Reserve Should Adopt Inflation Targeting." *Monetary Policy Strategy*. Cambridge: MIT Press.
- Mishkin, Frederic S., and Adam S. Posen. 1997. "Inflation targeting: Lessons from Four Countries." National Bureau of Economic Research Working Paper 6126.
- Orphanides, Athanasios. 2003. "Historical Monetary Policy Analysis and the Taylor Rule." *Journal of Monetary Economics*, 50(5), 983-1022.
- Paez-Farrell, Juan. 2009. "Monetary policy rules in theory and practice: evidence from the U.K. and the U.S." *Applied Economics Taylor and Francis Journal*, 41(16), 2037-2046.
- Poole, William . 2010. "Causes and consequences of the Financial Crisis of 2007-2009." *Harvard Journal of Law and Public Policy*, 33(2), 421-441.

- Sarkar, Asani. 2009. "Liquidity risk, credit risk, and the federal reserve's response to the crisis."
Financial Markets and Portfolio Management, 23(4), 335-348.
- Sims, Christopher. 2004. "Limits to Inflation Targeting." *The Inflation Targeting Debate*.
Chicago: National Bureau of Economic Research.
- Tempest, Matthew. 2005. "Treasury papers reveal cost of Black Wednesday." *The Guardian*.
- Vickers, John. 1998. "Inflation targeting in practice: the UK experience."
Conference on Implementation of Price Stability, Frankfurt, Germany.
- Walsh, Carl E. 2009. "Inflation Targeting: What Have We Learned?"
International Finance, 12(2), 195-233.
- Wheelock, David C. 2010. "Lesson Learned ? Comparing the Federal Reserve's Responses to
The Crisis of 1929-33 and 2007-2009." *Federal Reserve Bank of St. Louis Review*,
92(2), 89-108
- Wieland, Volker. 2009. "Quantitative Easing: A Rationale and Some Evidence from Japan."
National Bureau of Economic Research Working Paper 15565.