

Unconventional monetary policy at the zero nominal bound

A case study of United States, United Kingdom and Japan

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Abstract

The objective of this paper is to assess unconventional monetary policy at the zero nominal bound: First, we assemble a framework for implementing and evaluating unconventional monetary policy. Second, we use the framework to conduct three detailed case studies on unconventional policy responses in Japan, United States and United Kingdom. Third, we make a cross-country analysis of the development in key macroeconomic variables after the adaption of unconventional monetary policies.

We find that unconventional monetary policy responses by the Federal Reserve Bank of the United States and the Bank of England during the financial crisis of 2007-09 have succeeded to a greater extent in fighting deflationary pressures than earlier unconventional policies by the Bank of Japan.

Our analysis suggests that unconventional monetary policy responses should be adapted to the particular circumstances in each country to have their full effect. In addition, unconventional policy should be pre-emptive, timely and aggressive in order to signal a credible commitment from the central bank. However, there is great uncertainty about the effect of unconventional monetary policy at the zero nominal bound and policymakers cannot fine-tune their response.

Structural factors in the economy may be a hindrance for the effect of unconventional monetary policy. In particular, we find that financial sector structural problems need to be addressed, but that this is not necessarily a task for central banks. Further on, we argue that unconventional policy responses beyond the traditional role of central banks should be considered carefully in the future, as this may threaten central bank independence in the long run.

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This paper is written as a part of our Master of Science in Economics and Business Administration at the Norwegian School of Economics and Business Administration, within the specialization in Financial Economics.

The choice of unconventional monetary policy as the theme for our thesis is related to our interest for modern macroeconomic and monetary policy theory. We have both followed the development of the financial crisis of 2007-09 closely, so it was a natural to choice of topic for our thesis. As unconventional policy responses have rarely been tried before, we decided to focus our attention on discovering what the rationale behind the policies were, and uncovering whether they have actually given the desired effect. Our wish was to apply a theoretical framework to a “real world” case, and thus test our own understanding of modern monetary policy.

Writing this thesis has been fun, but at times challenging. As there is no textbook on unconventional policy, the process of finding and selecting literature has been extensive. Finding the right approach to the topic was not straightforward, and it took some time before we were both satisfied. However, we believe the process have helped us gain insight into the problem and helped improve the final product.

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1. INTRODUCTION

1.1 The financial crisis of 2007-09 and unconventional monetary policy responses

Before the onset of the financial crisis of 2007-09 it seemed that the conduct of monetary policy was becoming quite uneventful. The period was by many referred to as “the great moderation” due to the remarkable decline in macroeconomic volatility since the mid 1980s. Ben Bernanke (2004) highlighted the important role monetary policy had played in the process of stabilizing both output and inflation. With the combination of low and stable inflation in most OECD countries and tranquillity in financial markets, the practise of monetary policy appeared to be reduced to the application of a few key principles. However, the dramatic development of the financial crisis spurred unconventional policy responses from central banks all over the world. Suddenly, the conduct of monetary policy was anything but boring.

Under normal economic conditions policymakers are usually able to achieve the objectives of monetary policy through the setting of a short term nominal interest rate. By *normal times* we mean times when the *zero nominal bound* on interest rates is not binding. Conventional monetary easing is thus done by lowering the target for the policy rate. The financial crisis of 2007-09 is unique in the number of countries that experienced their policy rates decline to near zero. When interest rates are zero or close to zero, additional stimulus cannot be provided by lowering interest rates. This means that the limits of conventional monetary policy were reached at an early stage in the course of the recent financial crisis: Further monetary stimulus had to be obtained by using unconventional policy tools. With target rates reduced to zero, a rich public debate emerged about whether monetary authorities were out of ammunition at the zero nominal bound.

Unconventional monetary policies come in many forms. We have divided the unconventional policies into four main categories following the example of Bernanke et al. (2004): First, a central bank can use communication policies to shape the public’s expectations about future setting of the policy rate. Second, through quantitative easing the central bank can increase the size of the central bank’s balance sheet beyond the level

needed to set the short term policy rate at zero. Third, a central bank can try to affect the relative supply of securities held by the public through shifting the composition of its balance sheet, also called credit easing. Fourth, we discuss the possibility central banks have to act as a “lender of last resort”. We define this as providing short-term liquidity to depository institutions and other financial institutions beyond traditional liquidity management operations. In this paper we discuss each of the four strategies in detail.

The transmission mechanism of monetary policy is affected by the zero nominal bound, and this was reflected during the financial crisis of 2007-09. Reduction of policy rates by central banks often failed to be reflected in a decline of market rates. In some cases, a *credit crunch* developed with tightening credit conditions and limited loan supply. Consequently, a switch to unconventional policy has in part been motivated by the severe turmoil in credit markets. We argue in this paper that a financial sector crisis may by itself provide rationale for launching unconventional policies even before interest rates hit the zero lower bound.

Our main focus in this paper is on the recent monetary policy responses from three prominent central banks: The Bank of Japan, The Federal Reserve Bank of the United States and the Bank of England. Before the onset of the financial crisis of 2007-09, Japan was the only country to have applied unconventional monetary policy in practise. The Bank of Japan introduced its quantitative easing policies in March 2001 to fight the deflationary pressures that had characterized the country’s economy since the bursting of the asset price bubble in the early 1990s. The unconventional monetary policies in Japan contain important lessons for those who want to understand the monetary policy responses during the financial crisis of 2007-09. The Federal Reserve and the Bank of England have in our opinion been the most imaginative and aggressive in their policy responses during the financial crisis of 2007-09. Thus, our motivation for examining these central banks is their active pursuit of unconventional monetary policy. Furthermore, by comparing the policy responses of three countries a more comprehensive picture of how unconventional monetary policy works can be obtained.

The contribution of this paper is threefold: First, we construct a *theoretical framework* for implementing and evaluating unconventional monetary policy. Second, we use the framework to conduct three detailed *case studies* of unconventional monetary policy in Japan, United States and United Kingdom. Third, we conduct a *cross-country analysis* of the relative policy effects in the three countries. In particular, we look at development in

consumer prices, broad monetary aggregates, bank lending, inflation expectations, real GDP and the level of inflation targets.

There is significant disagreement about the way unconventional monetary policy works, and whether these policies are able to fight recessionary pressures. Additional uncertainty is provided by what Friedman (1961) referred to as “the long and variable” lags of monetary transmission. The monetary stimulus during the financial crisis of 2007-09 has been quite extraordinary, and some have expressed concern regarding an acceleration of the inflation rate in the future. Timing the exit from unconventional policies poses additional challenges for monetary authorities, a subject we also discuss in this paper.

There is no doubt that recent experiences have given policymakers reason to question the established “truths” in the conduct of monetary policy. We believe this will give rise to much academic research and debate in the time to come. Monetary policy will probably never be the same again.

1.2 Objectives and structure

The rest of the paper is structured as follows: The main purpose of section 2 and 3 is to present a frame of reference for evaluating unconventional monetary policy. In our opinion, an understanding of conventional monetary policy is necessary in order to grasp the idea of unconventional monetary policies. In section 2 we present monetary policy and its principles in general, and section 3 is dedicated to the inflation targeting framework for monetary policy.

Unconventional monetary policy at the zero nominal bound is the topic of section 4. Further on, in section 5, we discuss the transmission mechanism of monetary policy, with an emphasis on the credit channel view and how unconventional policies are expected to stimulate economic activity.

Section 6 is dedicated to three detailed case studies of unconventional monetary policy implementation in Japan, United States and United Kingdom. We use a similar structure in all three cases to allow for transparency and a more rigorous cross-country comparison. The section concludes by discussing exit strategies and longer term issues related to the implementation of these policies.

In section 7 we conduct a cross-country analysis of the three countries. A majority of previous studies on unconventional monetary policy focus on policy implementation in a single country. Our intention by comparing policies across countries is to obtain a more comprehensive understanding of the effects of unconventional monetary policies. This cross-country analysis is mainly graphical and descriptive, with an emphasis on how key macroeconomic variables have developed *after* adopting of unconventional policies.

We argue that observing the development in key macroeconomic variables can point to whether policy efforts are working as intended. Also, a comparative analysis between countries may indicate if some policies that worked in one country are failing in another country. This can provide a signal to policymakers that the course of policy must be changed, or that there are other underlying problems in the economy that prevent policy from being successful. Finally, section 8 concludes and suggests areas for further research.

A weakness of our analysis is that we cannot claim that the observed development in macroeconomic variables is due to monetary policy alone, that is, the analysis does not prove a causal relationship. To be able to such make causal conclusions, a formal statistical analysis is necessary. Also, we will never know how economic development would have proceeded in the absence of unconventional monetary policy. At time of writing this paper, unconventional monetary policies have been pursued for a little over a year in both the UK and the US. As monetary policy affect output and inflation with a considerable time lag, it is still too early to evaluate the full impact of unconventional policies on macroeconomic data. Thus, our results are preliminary and should be interpreted as tentative.

A further challenge for an empirical assessment is provided by the fact that there are numerous other factors and policy measures that affect the economy simultaneously. For instance, policymakers initiated wide-ranging fiscal stimulus packages at the same time as monetary policies became highly accommodative. Thus, the marginal effect of unconventional monetary policies is difficult to quantify.

The distinction between monetary and fiscal policy is straightforward in principle. Monetary policy is usually conducted by the central bank, and the main instruments are changes in the rate of interest and money supply. Fiscal policy is normally the responsibility of the government. It comprises public spending and taxation, in addition to any other government income or assistance to the private sector. While the central bank can “print money” to

finance its activities, fiscal policy is usually financed through issuance of government bonds or levying taxes. However, reality can be more confusing. Arguably, as an example, outright purchases of government bonds by the central bank blurs the separation of monetary and fiscal policies. We choose to limit our discussion to monetary policy actions alone, as addressing fiscal responses would merit a paper of its own. Still, we briefly discuss some implications of the increased interaction between monetary and fiscal authorities in section 6.6.4.

Currently, traditional principles of monetary policy are being applied in innovative ways. Monetary authorities almost certainly also assess and reconsider the effect of their unconventional monetary policy responses for every new step they take. The theory on unconventional monetary policy has not been tested extensively in practice, and there are few empirical studies that can confirm or contradict the predicted effects. Therefore, we argue that conducting case studies and comparing the relative policy effects can contribute to the understanding of unconventional monetary policy at the zero nominal bound.

2. THEORETICAL FRAMEWORK: MONETARY POLICY

2.1 Definitions of monetary policy

"The term "monetary policy" refers to the actions undertaken by a central bank, (...) to influence the availability and cost of money and credit to help promote national economic goals."(The Federal Reserve Bank 2010a)

This definition is provided by the United States Federal Reserve Bank, which was given the responsibility for setting monetary policy in the US by the Federal Reserve Act of 1913. The Bank of England defines promoting and maintaining monetary and financial stability as its core purposes (Bank of England 2010a), where monetary stability is defined as *stable prices and confidence in the currency*. The following explanation is given for this objective:

*"A principal objective of any central bank is to safeguard the value of the currency in terms of what it will purchase. Rising prices – inflation – reduces the value of money. Monetary policy is directed to achieving this objective and providing a framework for non-inflationary economic growth. As in most other developing countries, monetary policy **usually** operates in the UK through influencing the price of money – the interest rate"* (The Bank of England 2010b)

In the following sections we look at the rationale behind these policy objectives, and develop a theoretical framework for evaluating monetary policy.

2.2 The goal of monetary policy

Monetary policy is a part of economic policy. The ultimate objective of economic policy is to guarantee and enhance the citizens' welfare (Svensson 2002). This ultimate objective is often expressed as a number of separate goals that contribute to the citizens' welfare: efficient resource utilization, full and stable employment, high economic growth, price stability, equitable distribution of wealth and income, regional balance and environmental protection. In this context there are limitations to what objectives that can and should be assigned to monetary policy.

The present consensus is that monetary policy is the most direct determinant of inflation, and that low, stable inflation is important for market driven growth. In addition, out of all the tools available to the government for influencing the economy, monetary policy has proven to be the most flexible instrument for achieving medium-term stabilization objectives (Bernanke et al. 1999). The question then becomes how to balance “monetary stabilization”, aimed at stabilizing inflation at a low level, and “real stabilization”, aimed at stabilizing output.

Monetary policy works largely through its influence on aggregate demand in the economy. It has little impact on the trend path of supply: GDP grows in the long run as a result of supply-side factors in the economy that are beyond the control of monetary policy. Some important supply-side factors are: Technical progress, capital accumulation and the size and quality of the labour force. In the long run monetary policy determines the nominal or money values of goods and services – the general price level. An equivalent way of making the same point is that monetary policy determines the value of money: Movements in the general price level indicate how much the purchasing power of money has changed over time. In this sense inflation is a monetary phenomenon (Bank of England 2001; Friedman 1963).

However, monetary policy changes can have an effect on real activity in the short to medium term. And although monetary policy is the dominant determinant of the price level in the long run, there are many other potential influences on price level movements at shorter horizons. Monetary policy affects economic activity and inflation through several channels, which are known collectively as the “transmission mechanism” of monetary policy. We will discuss the transmission mechanism in more detail in section 5.

Potential GDP is the level of output where firms work at normal-capacity, and are under no pressure to change output or product prices faster than the expected rate of inflation. The difference between actual GDP and potential GDP is known as the “output gap”. Booms in the economy that take the level of output significantly above its potential level are usually followed by a pick-up of inflation, and recessions that take the level of output below its potential are generally associated with a reduction in inflationary pressure (Bank of England 2001).

The Bank of England Monetary Policy Committee (2001) has estimated that on average it takes up to about one year in the United Kingdom and other industrialized economies for a

monetary policy change to have its peak effect on demand and production and yet another year for these activity changes to have their full impact on the inflation rate. To complicate things further, the impact of a monetary policy change will also be influenced by other factors such as consumer confidence, the stage of the business cycle, events in the world economy and expectations about future inflation. These other influences are beyond the direct control of monetary authorities. Consequently, monetary policy is subject to long, variable and uncertain time lags (Friedman 1961).

2.3 The Phillips curve – a trade-off between unemployment and inflation?

The Phillips curve, named after the work of A.W Phillips (1958), suggests that there is a long run tradeoff between inflation and unemployment. The implication is that a policymaker will have to choose between two competing goals, inflation and unemployment, and decide how high an inflation rate that is acceptable to achieve a lower unemployment rate.

In the 1960s and 1970s, fiscal and monetary policy activism aimed at bringing the economy to low levels of unemployment. This was followed by an acceleration of inflation to double digit levels in the 1970s in the United States and other industrialized countries (Mishkin 2007b). At the same time, both Milton Friedman (1968) and Edmund Phelps (1968) argued that there was no long run tradeoff between unemployment and the inflation rate; in their view the economy would gravitate towards the natural rate of employment no matter what the rate of inflation was. Thus, the long run Phillips curve would be vertical, and attempts by policymakers to lower unemployment below the natural rate would only result in higher inflation

The Friedman-Phelps natural rate hypothesis was immediately influential (Mishkin 2007b). A key element in the natural rate hypothesis was that sustained inflation can initially confuse firms and households, but in the long run sustained inflation will not boost employment because *expectations* of inflation would adjust to a higher level of inflation. We look into the role of expectations in monetary policy below in section 2.4.

2.4 The role of expectations

Agents' expectations about the future are important for many of their current decisions. Consequently, future development of the economy is to a considerable degree affected by current expectations about future developments. One example is wage formation, where expectations about future inflation and labour demand strongly affect the contracted wage for the contract period, which in turn affect the realized inflation. Another example is bond rates and other asset prices, where interest rates vary with expected future inflation, since bondholders want to be compensated for the depreciation caused by inflation

It is generally argued that it is not the short term interest rates but rather long term interest rates and yields that are of importance to investment and borrowing decisions. The *yield curve* can be seen as the market's expectations about future interest rates given the current market conditions. This relationship is also referred to as the term structure of interest rates. The expectations hypothesis state that the yield curve reflects investors' expectations of future nominal short-term interest rates. If the yield curve is upward sloping investor's expect interest rates to rise in the future. However, interpretation of the yield curve is not straightforward. The yield curve is partly determined by other factors such as various risk premiums and investor preferences (often called preferred habitat) (Bodie et al. 2009). This ambiguity of the yield curve may amplified by uncertainty in markets, especially during episodes like the financial crisis of 2007-09.

Expectations were long assumed to be exogenous or static by policymakers. A common assumption was that the expected future price level was equal to today's price level, regardless of the development of the economy. A development was the introduction of adaptive expectations in the 1960s, where agents were assumed to form their expectations about what happened in the future based on what has happened in the past. This implied that if inflation had been higher than what expected in the past, agents revised their expectations of future inflation, using a backward-looking method.

Robert Lucas (1976) introduced rational expectations in a series of papers in the 1970s, and demonstrated that the public and the markets' expectations about policy actions have important effects on almost every sector of the economy. Lucas argued that economic agents will always try to anticipate *future* policy moves when forming expectations and taking actions. This makes expectations of future policy relevant for today's consumption and

investment decisions and creates room for strategic interaction. The theory of rational expectations emphasizes that economic agents should be driven by optimizing behaviour, using all available information. A fundamental insight is that expectations about future monetary policy have an important impact on the development of economic activity. As a result, the systematic components of policymakers' actions, i.e. the components that can be anticipated, play a crucial role in the conduct of monetary policy. Thus, *management of expectations* with respect to future policy has become a central element of monetary theory (Mishkin 2007b). A common assumption in recent models of monetary policy is that monetary policy actions that do not affect expectations simply do not matter (Friedman 2004).

Expectations of future inflation matter in two important areas: First, they influence the level of real interest rates and so determine the impact of any specific nominal interest rate. Second, expectations influence price setting and wage-setting and so feed through to actual inflation in subsequent periods.

The expected future real interest rate, r , is considered to be the relevant measure for decisions regarding investment and consumption, and is defined as the nominal interest rate less inflation expectations: $r = i - \pi^e$. The real interest rate matters because rational agents, who are not credit-constrained, will typically base their investment and saving decisions on real, rather than nominal interest rates. For such individuals, the real interest rate is the measure for comparing the value of consumption today with desired consumption in the future. A decision is then made based on the "time value of money". For credit-constrained individuals, who cannot borrow enough today to finance the desired consumption level, nominal interest rates also matter through the effect on cash flow (Bank of England 2001).

2.5 The costs of inflation

Inflation is defined as a general rise in prices of goods and services over a period of time. Today, most economists agree with Milton Friedman's view that "*inflation is always and everywhere a monetary phenomenon*" (Friedman 1963), as long as inflation is referring to a sustained increase in the price level in the long run (Mishkin 2007a).

Inflation may distort the allocation of resources through three main channels: First, high inflation undermines the role of money as a medium of exchange, and creates distortions by

raising the opportunity cost of holding cash and other non-interest bearing assets. This is sometimes referred to as shoeleather costs. Second, inflation acts as an implicit tax on capital. As the tax system is not perfectly indexed, inflation can distort saving and investment decisions, due to the fact that taxes are levied in nominal terms rather than inflation-adjusted or real value terms (Mishkin 2008c). Third, some firms face costs when changing their prices. Thus, an increase in the general price level tends to cause undesirable movements in relative prices, which may lead to an inefficient allocation of resources.

The costs of inflation also arise from uncertainty or variability, rather than from its actual level. For example, uncertainty about inflation exacerbates the volatility of relative prices (reducing the information content of prices) and increases the riskiness of non-indexed financial instruments and contracts set in nominal terms (Bernanke et al 1999). Unanticipated inflation has an undesired effect by causing redistributions of wealth from lenders to borrowers. In addition, some households do not fully understand the implication of a general trend in prices, and this *nominal illusion* may make financial planning more difficult (Mishkin 2007b).

Extremely rapid “of out of control” inflation is called *hyperinflation*. When prices increase extremely rapidly, money holdings lose their value. Hyperinflation can quickly lead to a loss of confidence in a country’s currency, and cause a search for other forms of money that are a better store of value. Hyperinflation can be caused by governments when they “print money” to cover their costs. In such a case they try to extract large amounts of seigniorage, defined as revenue from money creation (Krugman 2010). As we discuss later, a fear during the financial crisis of 2007-09 has been that the stimulus provided by unconventional monetary policy will lead to accelerated rate of inflation in the future.

Akerlof, Dickens and Perry (1996) argue that a *too low* level of inflation (in their view below 2 %) produces inefficiency and will result in an increase in the natural rate of unemployment. The reason is that downward rigidity of nominal wages indicates that reductions of real wages can occur only through inflation. The implication is that a very low rate of inflation might prevent real wages from adjusting downwards in response to declining labor demand in certain industries and regions (Ito and Mishkin 2004).

2.6 The costs of deflation

Deflation is defined as a persistent decline in the general price level for goods and services over time. A widespread decline in prices can have a significant negative impact on economic activity. Deflation can be relatively harmless if prices lift real income and hence spending power. However, deflation is usually caused by a collapse in aggregate demand, excess capacity and a shrinking money supply (Bernanke 2002). This type of deflation is more damaging than inflation, as it causes a downward spiral that can be hard to escape: The expectation that prices will be lower may encourage consumers to delay purchases, depressing demand and forcing firms to cut prices by even more

Falling prices inflate the real burden of debt through increasing the real interest rate. In a period of sufficiently high deflation the real cost of borrowing can become prohibitive. Although this poses challenges for prospective borrowers, the burden of inflation is greater for households and firms with *existing* debt contracts at the onset of a deflationary period. Thus, deflation can be particularly dangerous for economies with a high debt levels. With a lower price level, and debt fixed in nominal terms, the real burden of debt necessarily increases. This is especially important for debt contracts with a long maturity: Value of debt is predetermined in nominal terms, while the nominal value of household income and firm revenue will fall in line with the general price level. Thus, unexpected deflation has the effect of shifting resources from borrowers to lenders.

From a macroeconomic point of view, losses by borrowers could be offset by gains to lenders since unexpected deflation is just a wealth transfer, or a zero-sum result. However, this is not the case since deflation can lead to financial instability and potential large costs for the economy. Fisher (1933) called this phenomenon *debt deflation*, and pointed at the phenomenon as a major source for the economic downturn during the Great Depression. The transfer of resources from debtors as a result of deflation means that they suffer a loss of net worth and a deterioration of their balance sheets. With less net worth, there is a decline in the amount of collateral a lender can grab if the borrower's investments turn out badly, and the reduction in collateral therefore increases the consequences of adverse selection because losses from defaults are likely to be more severe. The moral hazard perspective also contributes as the borrower has an incentive to take on excessive risks when they have less to lose if the investment fails. The deflation driven adverse selection and moral hazard can be followed by a failure of financial markets to allocate capital to productive uses, resulting in a

decline in investment and lower economic activity (Ito and Mishkin 2004). This line of argumentation is comparable to the credit channel view that will be discussed in section 5.1.

To sum up, wealth transfers caused by deflation are not neutral because they interfere with the effective functioning of the capital markets. Deflation is undesirable in a situation such as the financial crisis of 2007-09, because it prevents the real interest rate from falling sufficiently to stimulate an economic recovery. If a substantial deflation is expected, the real interest rate will be positive even if the nominal interest rate has hit the zero nominal bound. This can be described as a “deflation trap” in which the economy operates below capacity and where investment is discouraged due to the deflationary environment (Ito and Mishkin 2004). Ideally, the real interest rate should be very low, possibly even negative, to stimulate economic activity. This insight is important for the design of unconventional monetary policies at the zero nominal bound that discussed in section 4.

2.7 The time-inconsistency problem and institutional design for central banks

An important development resulting from the rational expectations hypothesis was the discovery of the time-inconsistency problem (Kydland and Prescott 1977; Barro and Gordon 1983). The time-inconsistency problem can arise if monetary policy conducted on a discretionary, day-by-day basis leads to worse long-run outcomes than could be achieved by committing to a policy rule. In particular, policymakers may find it tempting to exploit a short-run Phillips curve trade-off between inflation and unemployment, despite the fact that private sector agents will adjust expectations to anticipate the expansionary policy. The result is higher inflation with no short-run increase in employment. In other words, without a commitment mechanism, monetary policy makers will find themselves unable to *consistently* follow an optimal plan over time; the optimal plan can be *time-inconsistent* and so will soon be abandoned (Mishkin 2007b).

The implication of the time-inconsistency problem is that policymakers can often achieve their goals more efficiently by giving up some of their flexibility and committing credibly to

fixed policy rule¹. A rule for monetary policy can be implemented in several ways, and a notable example is the inflation targeting framework, discussed in section 3 below. Under an inflation targeting regime a central bank commits to achieving a (usually numerical) target for inflation in the medium term. An explicit target or rule to guide monetary policy decisions can strengthen central bank credibility, particularly as a central bank can be held accountable if it fails to achieve its target.

The time-inconsistency problem has led to important insights regarding institutional design for central banks. The most significant is probably research showing that central bank independence is very important in maintaining low inflation. Allowing the central bank to be instrument independent, i.e. to control the setting of monetary policy instruments, can help insulate them from short-run political pressures to exploit the Phillips curve trade-off between employment and inflation and thus avoid the time-inconsistency problem.

Instrument independence also makes it more likely that the central bank will be forward-looking and adequately allow for the long and variable lags of monetary policy when implementing policy changes. When central banks in industrialized countries are ranked from least legally independent to most legally independent, the inflation performance is found to be best for the countries with the most independent central banks.²

Although there is a strong case for instrument independence, the same is not true for goal independence, i.e. the ability for the central bank to set its own goals for monetary policy. In a democracy the public exercises control over government actions and policymakers are accountable. This requires that the democratically elected government should set the goals for monetary policy (Mishkin 2007b).

2.8 Commitment to a nominal anchor

Today, commitment to a nominal anchor is regarded to be crucial for successful monetary policy outcomes. A nominal anchor can be implemented through stabilisation of measures such as the inflation rate, the money supply, or an exchange rate. An institutional

¹ The discovery of the time-inconsistency problem led to an extensive debate of “Rules vs. Discretion” in monetary policy, see for example Barro (1986).

² See for example Allesina and Summers (1993), Chukierman (1993; 2006) Fisher (1994) or Forder (2000)

commitment to a nominal anchor provides a counterbalance to the time-inconsistency problem because it makes it clear that the central bank must focus on the long run, and resist the temptation to pursue short-run expansionary policies that are inconsistent with the nominal anchor (Mishkin 2007b). Commitment to a nominal anchor also leads to policy actions that promote price stability, which helps promote economic efficiency and growth.

The commitment to a nominal anchor can also help to stabilize inflation expectations, which reduces the likelihood of “inflation scares” in which expected inflation rates shoot up (Goodfriend 1993). Inflation scares lead to undesirable economic outcomes because the rise in inflation expectations often causes both higher *actual* inflation and a monetary policy tightening to get inflation back under control. This combination can often result in declines of economic activity.

The above mentioned reasons highlight commitment to a nominal anchor as a crucial element in the successful management of expectations. A successful commitment to a nominal anchor has been found to produce not only more stable inflation, but also lower volatility in output fluctuations. (Mishkin 2008b)

3. THEORETICAL FRAMEWORK: INFLATION TARGETING

Inflation targeting is a framework for monetary policy characterized by the public announcement of official quantitative targets (or target ranges) for the inflation rate over one or more time horizons, and by explicit acknowledgement that low, stable inflation is monetary policy's primary long run goal (Bernanke et al. 1999). An important distinction to make is that inflation targeting is a *framework* rather than a *rule* for monetary policy.

The inflation-targeting framework serves two important functions (Bernanke et al 1999):

- i. Improving communications between policy-makers and the public
- ii. Providing discipline and accountability in the conduct of monetary policy

These two underlying principles are also important when nominal short term interest rates hit the zero lower bound. We will discuss this topic further in section 4.

3.1 Empirical studies of inflation targeting and inflation in OECD countries

Inflation targeting was first adopted as a monetary policy strategy by New Zealand in March 1990, and has since been adapted by additional 23 countries (Mishkin 2007b). Although inflation targeting is a popular monetary policy strategy, empirical studies like Ball and Sheridan (2003), who compare seven OECD countries that adopted inflation targeting in the early 1990s and thirteen that did not, have found no evidence that inflation targeting improves a country's economic performance as measured by behaviour of inflation, output or interest rates. However, Ball and Sheridan (2003) find no arguments *against* inflation targeting either, and suggest that the benefits depend on factors that are not measured in the study. This is supported by Bernanke et al. (1999) who argues that inflation targeting may be desirable for political rather than economic reasons, as it creates more open policymaking by making "*the role of the central bank more consistent with the principles of a democratic society*" (p. 333).

In general, there have been significant changes in the inflation performance of OECD countries in the recent decade. In the late 1970s many OECD countries were experiencing double-digit inflation rates, while today most OECD countries have inflation rates around the two percent level. The volatility of inflation has also fallen dramatically. A concern has been that low and stable levels of inflation might have been achieved at the expense of higher volatility in output. However, output volatility has also declined in most OECD countries over the same time period (Mishkin 2007b).

Table 1 – Average annual inflation in OECD countries (excluding high inflation countries) 1971-2009

Time Period	Average annual consumer prices	Standard deviation of average annual consumer prices
1971-1979	8,7	2,7
1980-1989	5,8	3,3
1990-1999	2,8	1,2
2000-2009	2,5	0,8

Source: OECD Statistics

3.2 The inflation-targeting framework and its principles

A definition of inflation targeting is typically expressed in terms of a monetary policy framework based on the adoption of a monetary policy rule in which forecasts of future inflation play a central role, either in the form of an instrument or a target rule. An instrument rule expresses the monetary policy instrument as a simple and usually linear function of deviation of key macroeconomic variables, generally inflation and the output gap, from their target levels. There are two types of instrument rules, an *outcome*-based rule (where the instrument is a function of currently observable variables) or a *forecast*-based rule (where the instrument is an explicit function of the current forecast for key variables in the future).

Svensson (2007) characterizes an inflation-targeting framework by:

- i. An announced numerical target for inflation
- ii. An implementation of monetary policy that gives a major role to an inflation forecast, also called “inflation forecast targeting”
- iii. A high degree of *transparency* and *accountability*.

In addition, we argue that flexibility should be added as a fourth principle in the inflation targeting framework:

- iv. *Flexibility* in the conduct of monetary policy

The elements of the inflation targeting are often complementary, and their effects interact in the conduct of policy.

An inflation targeting central bank has to decide on a price index whose rate of change is to be targeted. For maximum transparency, the price index should be one that people are familiar with and that is broad-based, accurate and timely (Bernanke et al. 1999). To avoid distortions a measure of “core” inflation is often preferred. Core inflation excludes changes in items that experience volatile price movements, such as food and energy prices. So far, all inflation targeting central banks have chosen to measure the rate of inflation by reference to some version to the consumer price index (CPI).

The announced numerical inflation target is typically around 2 percent at an annual rate for CPI, or a core CPI, in the form of a range; or a point target with a range/tolerance interval of plus/minus one per cent; or a point target without any explicit range. In practise the difference between the measures does not seem to matter for the outcome. The reason for an inflation target around 2 per cent is the need for a safety margin against deflation combined with possible measurement errors in the chosen price index (Issing 2004). In the United Kingdom the inflation target is two percent, at an annual rate for the CPI index. The target is symmetric, meaning that inflation above the target is considered to be just as bad as inflation below the target.³

³ For a more detailed description of the UK inflation target see King (2004a)

An important argument against an inflation target of zero or close to zero is that undershooting a zero inflation target (i.e. deflation) is potentially more costly than overshooting a zero target by the same amount. Thus, it is potentially beneficial to have a buffer against deflation. In addition, the fact that a central bank announces an inflation target, and is accountable for achieving this target, means that it will be under greater pressure to fend off deflation. It is interesting to note that the European Central Bank chose a target of inflation *between zero and two percent* when introducing inflation targeting in 1999. This objective was modified in 2003 to “*maintain inflation rates below, but close to, two percent*” (Issing 2004). This target is still not symmetric, but to a greater extent allows for a safety margin against the risk of deflation.⁴

As all inflation-targeting central banks give weight to both stabilizing inflation around the inflation target and stabilizing the real economy, inflation targeting is seldom “strict” but rather “flexible” inflation targeting. Stabilizing the real economy is often done, implicitly or explicitly, through stabilizing a measure of resource utilization such as the output gap between actual output and “potential” output (Svensson 2007).

As there is a lag between monetary-policy actions and its impact on the central bank’s target variables, monetary policy can be more effective when guided by forecasts. Therefore, the inflation targeting framework usually gives a central role to forecasts of inflation and other target variables, such as output. A fitting description is *forecast targeting*, that is, setting the instrument rate (deciding on an interest-rate path) in a manner so that the forecasts of the target variables conditional on that interest rate path “look good”. To be more specific, it means a forecast for inflation and resource utilization that as effectively as possible stabilizes inflation around the inflation target and resource utilization around its normal level and, in the event of conflicting objectives, achieves a reasonable compromise between inflation stability and resource utilization (Svensson 2002).

Inflation targeting is characterized by a high degree of *transparency*. This emphasis is based on the insight that monetary policy to a large extent is “management of expectations”.

⁴ For a more detailed discussion regarding the ECB inflation targets see Issing (2004)

Transparency is defined as clear and timely communication of policy objectives, plans, and tactics to the public. Among the goals of policy transparency are heightening of public understanding of what monetary policy can and cannot do; the reduction of economic and financial uncertainty; and the strengthening of the accountability to the government and the general public (Bernanke et al 1999). Transparency can improve private-sector information, reduce uncertainty about central-information and policy intentions, and therefore contribute to better economic decisions by economic agents. Transparency is typically achieved by publishing a regular monetary-policy report that includes the central bank's forecast of inflation and other variables, a summary of its analysis behind the forecast, and the motivation for its policy decisions. In addition, some central banks also provide information on and forecasts of its likely future policy decisions (Svensson 2010).

A high degree of transparency is considered essential to achieve *credibility*. The credibility of the inflation targeting regime can be measured by the closeness of private-sector inflation expectations to the inflation target. This is often referred to as whether inflation expectations are “anchored” among the public.

A high degree of credibility allows for greater *flexibility* in order to stabilize the real economy (Svensson 2002). As an example, the Bank of England (2010c) highlights that “*the aim is to set interest rates so that inflation can be brought back to target within a reasonable time period without creating undue instability in the economy*”. Thus, flexibility can be seen as the ability of central banks to react effectively to short-run macroeconomic developments within the broad constraints imposed by the inflation-targeting framework (Bernanke et al 1999).

Accountability is also considered as central to inflation targeting. A high degree of accountability is an important component in strengthening the incentives faced by inflation-targeting central banks to achieve their objectives. Transparency is again crucial, as it permits a more effective external scrutiny and evaluation of monetary policy and thereby improves the incentive of central banks to achieve their targets.

Until now, we have mainly considered the modern framework for monetary policy “in normal times”. With normal times we mean times when the zero lower bound is not binding. We now turn to the issue of conducting monetary policy in “non-normal” times. An

important difference for the conduct of monetary policy occurs when the policy rate used by the central bank reaches the zero nominal bound. In such times a central bank must apply other policy tools than the short term nominal interest rate. This is indeed what has happened recently: Since the start of the recent financial crisis in 2007, many prominent central banks have lowered their target rate close to zero and turned to unconventional measures.

3.3 The Taylor Rule

The recognition that economic outcomes depend on expectations of monetary policy suggests that policy evaluation requires the comparison of economic performance under different monetary policy rules. The Taylor rule (Taylor 1993) describes monetary policy as setting an overnight bank rate in response to the deviation of inflation from its desired level or target (inflation gap) and the deviation of output from its natural rate level (output gap). The Taylor Rule can be written as follows:

$$i = r^* + \pi + 0.5(\pi - \pi^*) + 0.5(y - y^*)$$

Where

i = The nominal policy rate

r^* = The equilibrium short-term rate

π = The annual inflation rate

π^* = The inflation target

$(\pi - \pi^*)$ = The inflation gap

$(y - y^*)$ = The output gap

The coefficients of 0.5 on each gap is based on Taylor's original specification, but can be changed to reflect the relative preferences of the central bank. The "Taylor Principle" can be described most simply by saying that stabilizing monetary policy must raise (lower) the nominal interest rate by more than the rise (decrease) in inflation. In other words, inflation will remain in control only if real interest rates rise in response to a rise in inflation (Mishkin 2007b).

Even though the Taylor principle can be a guideline for interest rate decisions, it may not be sufficient to determine interest rates alone. Changes in the policy rate affect the economy on

a broad basis, and other aspects should also be taken into consideration. When the short term interest rate approaches the zero nominal bound, applying a standard policy rule such as the Taylor rule is problematic.

4. THEORETICAL FRAMEWORK: UNCONVENTIONAL MONETARY POLICY AT THE ZERO NOMINAL BOUND

Ever since Keynes (1936) presented the idea of a liquidity trap, economists have wondered whether monetary policy becomes impotent at the zero nominal bound. A “liquidity trap” is a situation where demand for money becomes infinitely elastic, meaning that further injections of money will not serve to reduce interest rates. As nominal interest rates cannot be negative, little additional stimulus can be obtained by lowering interest rates further when interest rates are zero or close to zero. The question then becomes whether it is possible to affect aggregate demand through channels other than the short term nominal interest rate.

When the short term nominal interest rate reaches zero, a central bank must rely on unconventional policy alternatives to stimulate the economy. Before the financial crisis of 2007-09, these unconventional policies were mostly of academic interest and rarely applied in practice, with the exception of Japan. We will discuss the Japanese experience with unconventional policies in detail in section 6.2. A distinguishing feature for many of the these policies is that central banks use their balance sheet actively to affect market prices and conditions, instead of the short term nominal interest rate. These policies can be described respectively as *balance sheet policies* and *interest rate policies* (Borio and Disyatat 2009).

Much of the literature on unconventional policy measures is based on Krugman et al. (1998), where the authors point out that low inflation expectations (or even expectations about deflation) prevent the real interest rate from falling sufficiently to stimulate aggregate demand. Consequently, they argued that a central bank should stimulate the economy by raising the market’s expectations about future inflation. However, the authors are not very specific how this can be achieved in practise.

A more practical view is presented by Bernanke et al. (2004) who discuss three alternative and potentially complementary monetary policy strategies when short term nominal interest rates are zero or close to zero:

- i. Using communication policies to shape the public's expectations about future setting of the policy rate
- ii. Increasing the size of central bank's balance sheet beyond the level needed to set the short term policy rate at zero (quantitative easing)
- iii. Shifting the composition of the central bank's balance sheet in order to affect the relative supplies of securities held by the public (qualitative easing or credit easing)

In addition to these three strategies, we wish to discuss the possibility central banks have to act as lenders of last resort, providing liquidity directly into the banking system.

- iv. Acting as a lender of last resort: Provision of short-term liquidity to depository institutions and other financial institutions beyond traditional liquidity management operations

We wish to address this last policy option separately, since we argue later in this paper that the credit channel, and banks in particular, play an important role in the transmission mechanism of monetary policy, perhaps even more so when the zero nominal bound is hit. In fact, financial stability concerns may provide rationale to start with unconventional monetary policies even before the target rate reaches zero. In the subsequent sections we discuss the above-mentioned strategies in detail.

4.1 Communication policies

When discussing easiness or tightness of monetary policy, one should remember the distinction between real and nominal interest rates discussed in section 2.4. Even when nominal interest rates are zero, the real interest rate may be high due to deflationary conditions.

Further on, it is generally argued that it is not the short term interest rates but rather long term interest rates and yields that are of importance to investment and borrowing decisions. Also, pricing of long-lived financial assets, such as equities and mortgages, depends on both the current short term interest rate, as well as the entire future path for the short term interest

rates. This is often referred to as the term structure of interest rates. Financial conditions, which play a crucial role in the monetary transmission mechanism, thus depend on the entire expected future path of short term interest rates (Bernanke et al. 2004).

Central banks have little direct control over long term interest rates. However, they can *indirectly* influence long term interest rates and yields on various financial assets by communication. By actively trying to shape the public's expectation about the future path for short term interest rates central banks may to some extent gain control over longer term interest rates. Eggertson and Woodford (2003) argue in context of their general equilibrium model, that when the zero nominal bound is hit, this *is essentially the only policy tool* central bankers have at their disposition. Even though the short term nominal interest rate is zero, additional stimulus can be provided by committing to a low interest rate policy over a longer term than previously expected. A credible commitment to a low interest rate policy should in turn lower yields throughout the term structure and support investment activity and asset prices.

How can monetary authorities commit to low interest rate policy in a matter that is perceived as credible by the public? Bernanke and Reinhart (2004) discuss that a commitments to low interest rate policy in the future can be done unconditionally or conditionally. *Unconditional commitment* means that a central bank pledges to hold the short term nominal interest rates low for a given period of time, for example a calendar year. A *conditional commitment* does not link the policy to a fixed period of time, but rather to economic conditions. A central bank may pledge to hold the short term interest rate low until sustained economic growth or some other measurable effect is observed. As economic conditions can change rapidly, central bankers have traditionally applied conditional commitment in the conduct of monetary policy.

Alternatively, Clouse et al. (2000) suggest that central banks could commit credibly to a low interest rate policy by issuing options. Such options would have an upper ceiling for the nominal short term interest rate, and if interest rate rose beyond this limit at expiration date, purchasers of these options would profit at the expense of the central bank. Bernanke (2002) proposes similarly, that a central bank can announce a low interest rate ceiling for government bonds up to a certain maturity, and then commit to buy an unlimited volume of

those bonds. This can directly depress the long term interest rates, though, in theory the central bank may end up buying the whole existing stock of bonds.

Eggertson and Woodford (2003) emphasize the importance of a central bank committing in advance to a policy rule, such as the Taylor rule. The problem is, however, to design a rule that can be applied both in normal conditions as well as when there is a risk for hitting the zero nominal bound.

Central banks have become more predictable the recent years, reflecting factors like increased transparency and perhaps an explicit policy framework such as inflation targeting. In addition, central banks actively communicate their view on the outlook for the economy and the implications for monetary policy. Bernanke et al. (2004) suggest that importance of central banks' communication may be elevated in times when nominal interest rates are zero or close to zero. Similarly, the importance of transparency in the conduct of monetary policy might be heightened in such circumstances, as public understanding of the central bank's actions can have significant implications for policy effectiveness.

Krugman et al. (1998) argue that the optimal way to escape from a liquidity trap is to generate expectations of a higher future price level and thereby expectations of higher than normal future inflation. Svensson (2003) argues in a similar fashion that price level expectations are the real problem in a liquidity trap, not expectations about future short term interest rate level per se. Even though the central bank may be able to depress long term nominal rates by communication policies, low inflation expectations may cause the real interest rate to be too high to stimulate the economy. Hence, Svensson suggests that in a liquidity trap when zero lower bound is strictly binding, central banks should induce the private sector to expect a higher price level in the future. This will reduce the real rate of interest even though the nominal rate of interest is unchanged. In assessing policy alternatives, the focus should be on how effective different policy alternatives are on affecting expectations about the future price level.

In contrast to Krugman et al. (1998), Svensson (2003) provides practical advice on how policymakers can induce the private sector to expect higher price level in the future. As mentioned earlier, any nominal quantity could serve as a nominal anchor for the economy. Svensson (2003) suggests that when zero lower bound is binding, monetary authorities could

apply the nominal exchange rate as an alternative target or instrument for the central bank. He argues that “the foolproof way” to escape from a liquidity trap involves, first, an announcement and implementation of a price level target. Second, a depreciation of the currency and a peg consistent with the price level target. Third, an exit strategy should be in place when the price level target has been reached. The idea behind this is precisely to influence the private sector’s expectation about the future price level, so that the real interest rate falls and economy expands out of the liquidity trap.

4.2 Quantitative easing

There are many different characterizations of quantitative easing policies. Bernanke et al. (2004) describe quantitative easing as policies that increase the size of the central bank’s balance sheet beyond the level needed to set the short term nominal interest rate at zero. In contrast, according to Bank of England’s definition, quantitative easing means that central banks buy public and private sector financial assets using central bank money (Benford et al. 2009). Others have defined quantitative easing more loosely as asset purchases financed by an expansion of the money supply, or as any monetary policy action that leads to an increase in reserve balances and the monetary base, regardless of if the level of reserves is explicitly targeted or not.⁵

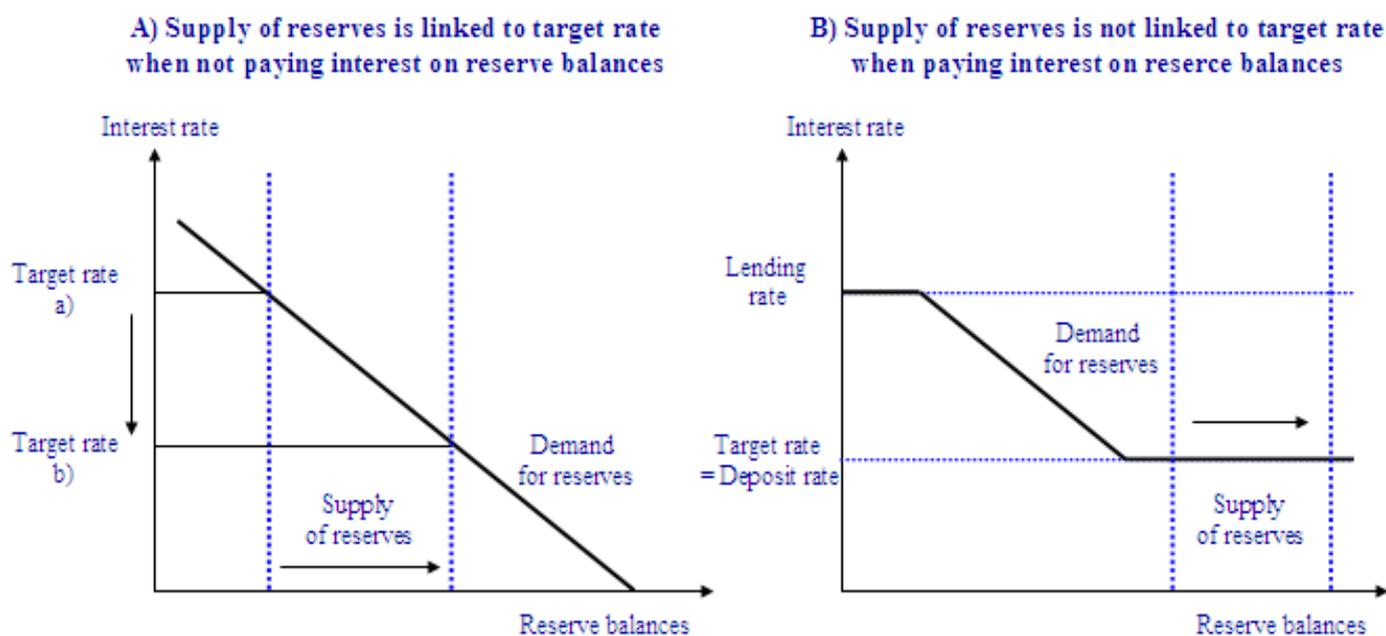
Regardless of the definition one chooses to use on quantitative easing, such a policy will always lead to an increase in the level of bank reserves and the central bank’s balance sheet, at least temporarily. It is important to notice that such “balance sheet policies” can be executed independently of interest rate policies as long as central bank has the means to decouple the two policies. There are essentially two alternative ways of achieving this. The first is to pay interest on reserve balances depository institutions hold in the central bank. The other alternative is to engage in offsetting operations that sterilize the impact of the operations on the amount on bank reserves (Borio and Disyatat 2009)

We have illustrated the two alternative policy regimes in Figure 2. In scenario A) monetary authorities do not pay interest on reserve balances. Thus, holding excess reserves at the

⁵ See for example Meier (2009), Auerbach and Gale (2009), Krugman (2009) and Taylor (2009)

central bank represents an opportunity cost to depository institutions. This provides incentives for depository institutions to minimize their holdings of reserves. Central banks control the short term nominal interest rate by either draining or injecting reserves into the banking system through open market operations. Supply of reserves is thus inherently interconnected with the prevailing interest rate level. This scenario is consistent with the Bernanke et al. (2004) definition of quantitative easing: Central banks can increase the overall level of reserves beyond of what is necessary to keep the short term nominal interest rate at zero.

Figure 1 – Relationship between the target rate and level of bank reserves in two alternative policy regimes



Sources: Adopted from Keister et al. (2008), Demilrap and Jordà (2001)

In scenario B) reserve balances are remunerated, and the deposit rate is normally equivalent to the central bank's target rate. This deposit rate creates a natural floor for market interest rates: No bank will lend to other banks in the interbank market to a lower rate of interest than the deposit rate. In this policy regime, the target rate for the short term nominal interest rate can be set independently of the amount of bank reserves. By paying interest on reserve balances central banks effectively decouple their balance sheet policies and the interest rate policies. As a result, central banks can increase the supply of reserves without driving market interest rates below the target.

Quantitative easing policies lead to an increase in the level of bank reserves and the monetary base, at least temporarily. The different definitions in the literature seem to be influenced by the country-specific choice of monetary policy regime and whether the increase in reserve balances is regarded to be the goal of the policy or merely a by-product. Further confusion is provided by the term “credit easing”, a subject we return to in the next section, where central bank purchases are directed at specific private asset markets rather than the more traditional government securities market.

The transmission mechanism through which quantitative easing policies affect economic activity is highly uncertain. A point that should be highlighted is that quantitative easing policies may be complementary to communication policies in the shaping of private sector expectations of future short term interest rate or the price level. As money growth has historically been followed by an increase in the price level, at least in the longer run,⁶ market participants may come to expect a higher future price level. Similarly, if a central bank commits to target bank reserves at a higher level than necessary to keep the interest rate at zero in the future, that promise is equivalent to holding the short term nominal rate at zero. Thus, quantitative easing can provide a visible signal to the public about the central bank’s intention for future policies and thus make the low interest rate policy more credible (Bernanke and Reinhart 2004). We will discuss the potential transmission mechanism of quantitative easing policies in detail in section 5.2.

Inflation targeting as a framework for monetary policy has been implemented in several countries over the last decades, as discussed in section 3. Eggertson and Woodford (2003) question whether inflation targeting is appropriate when the zero lower bound is hit, since they argue that inflation targeting is based on the idea that there is always a level of nominal interest rates that allow the inflation target to be hit. However, it can be argued that the inflation target is symmetric: If the inflation is expected to be below the target and interest rates are already close to zero, additional measures should be applied to bring the inflation back to target. Quantitative easing causes the money supply to grow, which is then expected to boost nominal spending and price growth. In addition, quantitative easing policy may signal a great willingness to the public to break from traditional and more cautious policies

⁶ See for example McCandless and Weber (1995) or King (2002)

in order to reach the specific inflation target. Consequently, inflation targeting is not necessarily conflicting with the principles for unconventional monetary policies.

There is relatively little empirical evidence on whether quantitative easing policies and expansion of the monetary base will help the economy expand out of a liquidity trap. This is in part due to the limited experience with such policies. Eggertson and Woodford (2003) argue that neither the extent of quantitative easing policies nor the nature of the assets central banks purchases has any effect on either inflation or real activity. They claim, however, that such policies can be important in affecting future expectations about policy and the path for the nominal short term interest rate.

4.3 Composition of the central bank balance sheet

Central banks typically hold various kinds of assets in their balance sheets, and they are active participants in many financial markets. Thus, central banks can shift the composition of their balance sheets in order affect the *relative* supplies of securities held by the public. If risk and liquidity differ between securities in a sense that investors do not regard them as perfect substitutes, then in principle, changes in relative demands and supplies have the potential to affect relative security prices. In frictionless financial markets relative changes in supply and demand of securities would have only a limited effect. In a world where various kinds of transaction costs and market imperfections exist, a central bank's transactions may indeed influence term premiums, liquidity premiums and risks associated with different securities. By shifting the composition of its holdings, a central bank may be able to influence overall yields of financial assets (Bernanke et al. 2004).

Credit easing, or qualitative easing, is a term that has become widely known during the financial crisis of 2007-09. Under credit easing, a central bank purchases targeted assets or specific segments of the private debt and securities market. The goal is to alter the composition of private sector balance sheets by changing the central bank's exposure to private sector claims. Credit easing can be implemented in a number of ways: For example through modifications of collateral, maturity and counterpart terms, or by providing loans and acquiring private sector claims, such as equities. (Borio and Disyatat 2009)

Credit easing can be done in a sterilized matter, meaning that central banks sell an equal amount of its assets to offset the monetary base expansion. When credit easing is not sterilized, it resembles quantitative easing in many ways. As mentioned in the previous section, there are various definitions on quantitative easing policies, and some of the definitions overlap with the definition of credit easing. Credit easing does not explicitly target bank reserves, but as the case in the recent financial crisis, the by-product of these policies is often a substantial increase in the amount of excess reserve balances.

Changing the composition of a central bank's portfolio has implications for the risk profile of the portfolio. By purchasing assets that contain market or credit risk, the central bank is effectively increasing its exposure to risk that was previously held by private sector agents. We will discuss the practical implications of this in section 6.6.3.

4.4 Lender of last resort

Central banks act as the lender of last resort, meaning that they can issue credit when no one else is willing or capable of doing this. The principles for lender of last resort were presented originally by Bagehot (1873), when he pointed out that that *“in a crisis, the lender of last resort should lend freely, at a penalty rate, on the basis of collateral that is marketable in the ordinary course of business when there is no panic”*. The basic idea is that *solvent* institutions that are temporarily illiquid should be provided funds to prevent them from failing. Insolvent institutions should be liquidated or sold in the market place letting owners and unsecured debt holders bear the losses (Fischer 1999).

The importance of lender of last resort is often elevated in times of financial crisis: The systemic nature of the financial sector entails that panics spread rather rapidly. In such circumstances, central banks should apply measures to stop the financial panic from spreading. Ideally, the existence of lender of last resort could prevent panics from starting in the first place.

The role as the lender of last resort represents an additional policy tool for monetary authorities when short term nominal rates are zero. By this we mean that they can provide short term liquidity to depository institutions and other financial institutions beyond traditional liquidity management operations. However, following the argumentation above,

financial sector panics can provide rationale to launch unconventional monetary policies even before the short term nominal interest rate hits the zero nominal bound.

Depository institutions hold reserves in the central bank to settle payments with other banks and to meet customer demand for withdrawals. In some countries there are also certain reserve requirements banks must fulfil. Thus, there is a need for banks and other financial institutions to actively manage their liquidity positions.

In theory, if a depository institution has a short term liquidity shortage at a given point in time it has two possibilities: First, it can try to get a loan in the interbank market, where commercial banks borrow and lend money to each other. The interest rate in this market is often called the money market interest rate. Supply and demand for liquidity then determines the equilibrium money market interest rate (Mork 2008).

Second, commercial banks can try to obtain liquidity directly from the central bank. Different central banks use different liquidity management operations to provide sufficient funds into the banking system. The most common instruments are repurchase agreements (repos), collateralized loans and standing facilities. In normal conditions, liquidity management operations are applied in order to bring the short term money market rate, typically an overnight rate, to the target rate and to enable monetary policy decisions to break through in financial markets (Borio and Disyatat 2009). Central banks control the total supply of bank reserves in circulation, and only when a central bank is a counterpart in a financial transaction will the total amount of liquidity change in the interbank market. The purpose of the interbank market is then to reallocate the total liquidity across the market participants. Thus, in normal conditions liquidity management operations play purely technical and supportive role in implementing of monetary policy.

Standing facilities, such as the discount window in the US enable commercial banks to get a loan from the central bank overnight whenever necessary to an interest rate set by the central bank. To be eligible for such a loan, banks must provide collateral for the loan in the form of securities or bonds. The range of approved collateral varies between different countries and central banks. In some countries, for example in the USA, there has been a certain stigma associated to needing to take up such loans, so these standing facilities are not used to a great extent in normal conditions.

Liquidity management operations are used actively in normal conditions, so they are not unconventional policies per se. However, the existing policies can be applied in an unconventional matter if conditions in financial markets should require this. First, central banks can lengthen the maturity of loans or repo-contracts they provide to commercial banks. This makes banks confident that they will have the necessary liquidity during the term of the loan or the repo-contract. Second, as collateral is required for transactions with the central bank, and there is a limited supply of approved collateral, central banks can widen the range of accepted collateral in providing loans and repo-contracts. This entails that more liquidity can be injected in the banking system for a given supply of collateralizable securities. Third, central banks can widen the range of their counterparts. Even though central banks traditionally only provide liquidity for depository institutions, it is possible to expand the liquidity management operations to include other financial institutions or market participants. This third aspect is often referred to as credit easing, which was discussed in the previous section.

Even when the policy rate is set to zero, central banks can inject extra liquidity directly into the banking system, or more broadly to financial markets. As banks become more liquid and their holdings of excess reserves increase, they should become more willing to provide loans to the public. This applies particularly if liquidity constraints are the main factor limiting loan provision to the public. Holding reserves at the central bank represents an alternative cost for commercial banks, as they could have been invested elsewhere at a higher return. Even though some central banks pay interest on all the reserves held at the central bank there could still be higher returns to be earned elsewhere.

In implementing liquidity management operations, and acting as a lender of last resort, a central bank must balance two, sometimes conflicting, aspects. The central bank's role as a lender of last resort is important to facilitate confidence in financial markets, and to smooth the functioning of the interbank market. These aspects are central for financial stability considerations. On the other hand, too extensive liquidity injections from the central bank can severely hamper the effective functioning of the interbank market reducing incentives for the banks to reallocate funds within the banking system. An important mechanism to prevent such a development is to price central bank liquidity injections with a premium above market prices. Furthermore, when depository institutions are aware that central banks

stand ready to step in as lender of last resort this may create incentives for banks to take on greater risks (Fisher 2009).

Providing liquidity directly to depository institutions differs from quantitative easing policies in one important aspect. By providing liquidity into the banking system, the central bank only increases the monetary base and the amount of reserves held at the central bank. Broader money aggregates do not grow until banks decide to provide loans to the public. Quantitative easing and unsterilized credit easing, where central banks buy securities directly from the private sector (non-depository institutions), increases both the monetary base and broader monetary aggregates at the same time.

Finally, addressing banking sector liquidity needs is not necessarily enough by itself to stimulate the economy out of a liquidity trap. Additional policy measures are most probably necessary in a situation where the zero lower bound is binding. We argue in section 5 that banks play an important role in the transmission mechanism of monetary policy, and addressing banking sector liquidity needs is probably a prerequisite to address financial stability considerations and to fight recessionary pressures effectively. This implies that the lender of last resort policy alternative should be seen as an important complement to the other unconventional policies.

4.5 Summary of the non-standard measures of monetary policy at the zero nominal bound

Central banks are not necessarily out of ammunition when the zero lower bound is hit. Although non-standard policies described above may affect prices and yields of financial assets, there is considerable uncertainty about the size and reliability of these effects under the circumstances prevailing near the zero lower bound (Bernanke et al. 2004). Knowledge about the possible effects of these policies is important in order to guide policy in times when the zero bound is hit, as it is currently in the US and the UK. This knowledge is of importance also in normal times when choosing the long run inflation target, as the choice of the target is dependent on the risk of hitting the zero nominal bound. Low inflation is preferable, but it also raises the risk that adverse shocks will drive interest rates to zero. The

more confident central bankers are that there exist tools to escape from a liquidity trap, the less need there will be to maintain an “inflation buffer” (Bernanke et al. 2004).

One danger in the aggressive monetary policy responses is that they might “de-anchor” inflation expectations. As discussed earlier in section 3.2, flexibility requires that inflation expectations are well anchored within the agents of the economy. Therefore, aggressive and pre-emptive easing of monetary policy can be counterproductive if these actions cause an increase in inflation expectations (Mishkin 2009).

With the exception of Japan, unconventional monetary policies have been rarely applied in practise. This entails that the credibility of the policies is not established with the public. Consequently, monetary authorities have little room to “fine-tune” unconventional monetary policies. By this we mean that that unconventional policy measures cannot be adjusted very precisely to obtain the desired effect. This is partly due to the uncertainty surrounding the transmission mechanism of unconventional monetary policies. We discuss the transmission mechanism of these policies in detail in section 5.

It should also be noted that since the credibility of unconventional policies is yet to be established, previous “track records” of central banks may become particularly important. If a central bank has a high degree of credibility due to historical monetary policy performance, unconventional monetary policies may be more effective in “managing expectations”.

5. THEORETICAL FRAMEWORK: THE TRANSMISSION MECHANISM OF MONETARY POLICY

The transmission mechanism of monetary policy refers to “... *the various channels by which the discretionary actions of the monetary authorities feed through, ultimately, to the rate of change in the price level*” (King 2004b).

Rather than focusing on the traditional view of the transmission mechanism, we choose to discuss the credit channel view.⁷ This is because many have pointed out that the transmission mechanism of monetary policy may differ substantially near the zero bound compared to normal conditions.⁸ The importance of the credit channel is also likely to be elevated in times of financial sector distress. In our opinion, understanding of non-standard policies requires knowledge about the credit channel view and vice versa.

5.1 The credit channel view and the external finance premium

The “gaps” in the traditional transmission mechanism have led to economists focusing their attention towards frictions and imperfections in the credit markets in order to explain how monetary policy works its way through in the economy. These mechanisms are often referred to as the credit channel of monetary policy. This channel is usually not thought of as a free-standing alternative to the traditional transmission mechanism, but rather a set of factors that complement and amplify the traditional interest rate effects (Bernanke and Gertler 1995).

The credit channel view tries to answer the question of how financial positions of lenders and borrowers affect aggregate spending in the economy. The starting point of the credit channel analysis is the external finance premium - the difference in cost between funds

⁷ See for example Mishkin (2007) Chapter 23, pp. 583-609 and Bank of England Monetary Policy Committee (2001) for discussion about the traditional transmission mechanism of monetary policy

⁸ See for example Meier (2010)

raised externally and funds generated internally. In a world where credit markets function in a frictionless way without any transaction costs or informational problems, lenders should be indifferent to the source of their financing. However, in reality lenders do care where their financing comes from due to various frictions in financial markets. The size of the external finance premium reflects these imperfections, such as search costs in finding suitable lenders, costs of monitoring and assessing information about credit quality. Imperfections in the credit market are a result of asymmetric information, and these imperfections drive a wedge between the expected return received by lenders and the costs faced by potential borrowers. Preferences for internal and external source of finance, and changes in the availability and cost of them can therefore have important economic effects (Hall 2001).

Moreover, changes in monetary policy can affect the size of the external finance premium through its potency to affect the relative cost of obtaining funds externally versus internally (Bernanke and Gertler 1995). In theory, lowering the short term nominal interest rate has a tendency to lower the external finance premium and vice versa.

The possible linkage between monetary policy and the credit channel can be analyzed from two aspects. First, *the balance sheet channel* stresses the potential impact monetary policy has on balance sheets and income statements of borrowers. The second linkage, *the bank lending channel*, addresses the potential effects that monetary policy actions have on the supply of loans by depository institutions. Decrease in either supply or demand for loans is then expected to lead to reduced investment and consumption.

5.1.1 Balance sheet channel

The balance sheet channel is based on the idea that the external finance premium should depend on the financial position, or the net worth, of the borrower. Net worth is often defined as the sum of the borrower's liquid assets and marketable collateral. The greater the net worth of the borrower, the lower should the external finance premium be. Greater net worth enables the borrower to either self-finance a greater share of the project or offer more collateral to guarantee for the liabilities. This is supposed to reduce the conflict of interest between the lender and the borrower. Thus, fluctuations in the financial positions of borrowers have potential to affect spending and investment decisions in the economy. It has also been argued that endogenous pro-cyclical behaviour of borrowers' balance sheets has

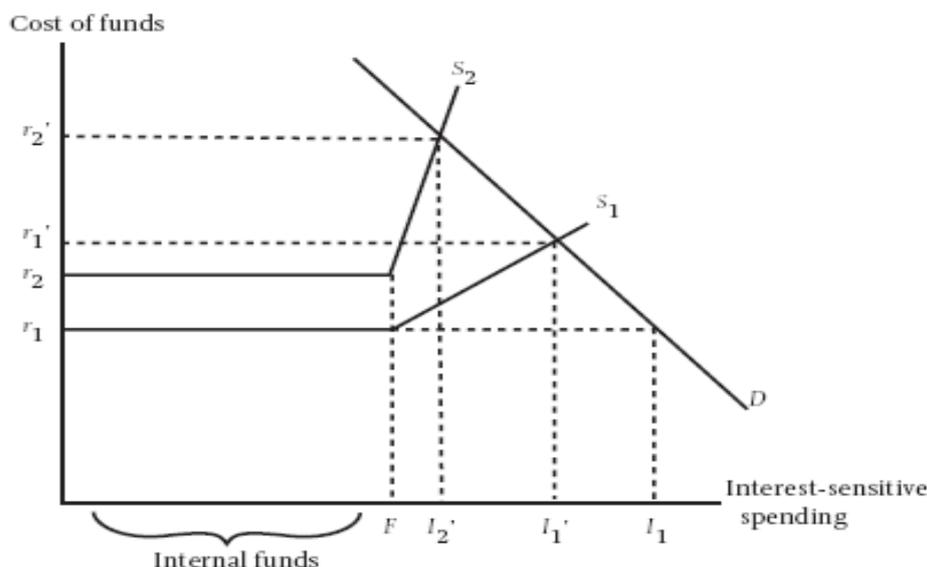
the ability to amplify business cycles. This effect is referred to as the “financial accelerator”, and many empirical studies have found evidence of the existence of this effect.⁹

How can monetary policy affect the financial position, or net worth, of borrowers? First, tightening of monetary policy through increasing the short term nominal interest rate increases the debt service costs of firms and households. This weakens the net cash flow of borrowers who have outstanding short term or floating debt. Second, rising interest rates are often associated with declining asset prices, which in turn reduces the value of the borrower’s collateral. Tighter monetary policy can also reduce consumer spending, which may lead to firms having weaker revenues. As various costs are fixed in the short run, weaker revenue will lead to reduced profits and weaker financial position over time.

Hall (2001) illustrates the credit channel and external finance premium in a simple framework. For financing needs up to F borrowers can use internal funds to an opportunity cost r_1 . In the absence of informational problems, borrowers would demand $I_1 - F$ of external funds. However, external funds are charged with a premium reflecting costs related to the agency problem and asymmetric information. The premium is assumed to rise as the share of total external finances increases due to the fact that higher leverage and limited liability increase the borrower’s incentives to take risks. Lenders require compensation for this additional risk, which results in S_1 to be upward sloping beyond F . The difference $r_1' - r_1$ reflects the external finance premium. A rise in interest rates as a consequence of tightening of monetary policy, for example from r_1 to r_2 , can reduce cash flow or the value of the borrower’s collateral as discussed earlier. As a result, finance supply may become S_2 , which is steeper than S_1 . This simple framework illustrates the link between borrowers’ financial positions, agency costs and the cost of external finance.

⁹ See for example Bernanke and Gertler (1989) and Bernanke et al. (1996)

Figure 2 – The Credit channel: Financial conditions and the marginal cost of finance



Source: Hall (2001)

The economic behaviour of firms and households should depend partly on their ability to smooth the cash flow drop. Firms with relatively easier access to external finance should be less affected by monetary shocks as they can soft the drop in cash flow by increasing their short term borrowing. There is some empirical evidence to support this view. According to Gertler and Gilchrist (1994) small manufacturing firms that have poorer access to credit markets are relatively more affected by monetary tightening, as they have to cut production and work hours more compared to larger firms. Households may also try to smooth their consumption by short term borrowing, for example by using credit cards.

5.1.2 Bank lending channel

Monetary policy may also affect the supply of credit, in particular loans from commercial banks. Banks have specialized in overcoming some of the asymmetric information problems and frictions in credit markets. Furthermore, in many countries bank loans are the dominating source of external finance. Shocks to commercial banks' balance sheets that impair their ability to provide loans to the public may therefore be an important contributor in the transmission mechanism of monetary policy (Bernanke and Gertler 1995).

Commercial banks must find funding for the loans they provide to the public. This means that they have to actively manage their balance sheets and liquidity positions – just like any

other business. An increase in the cost of obtaining these funds should, in theory, reduce the supply of loans from commercial banks and increase the external finance premium.

How can monetary policy affect the supply of loans by commercial banks? When central banks pursue contractionary monetary policy by draining reserves from the system, it compromises banks' ability to raise funds that can be used as reserves. As mentioned earlier, in some countries banks have reserve requirements they must fulfil. Even in countries where there are no such requirements, banks need to hold a certain amount of liquid reserves for payment settlement purposes.

Kishan and Opiela (2000) conduct a study where they segregate banks by asset size and by capital leverage ratio. They find evidence that small, undercapitalized banks may not be able to offset the drain in reservable deposits due to contractionary monetary policy. Consequently, their supply of loans is more sensitive to monetary policy actions than of larger and well-capitalized banks. Similarly, Kashyap and Stein (2000) argue that monetary policy has a relatively larger effect on banks with less liquid balance sheets, where liquidity is measured by the ratio of securities to assets.

Hall (2001) argues that small firms and households are particularly dependent on loans from commercial banks. For these groups, it is the interest rates charged on bank loans rather than market rates or rates charged by other financial intermediaries that matter. Also, if banks should reduce their supply of loans or increase the external finance premium, the spending of this type of borrowers may be relatively more effected. Even though they may not be totally shut off from credit, but they may incur additional costs in finding new source of financing. Larger firms that have access to other kinds of credit are relatively more able to find alternative sources for external finance. The significance of the bank lending channel hence depends on whether bank loans are imperfect substitutes for other forms of finance.

A tightening in loan supply under the bank lending channel is often referred to as "credit crunch". What characterises a typical credit crunch is that changes in official interest rates no longer summarizes changes in the cost of finance for certain borrowers. Bank loan rates may move in the opposite direction as official rates, and the supply of bank loans may be rationed or stopped all together.

Supply of bank loans may also be reduced due to non-monetary shocks. For example, loan losses or a fall in bank equity prices may reduce bank capital. Similarly, changes in banking

regulation may reduce a bank's capital adequacy. Banks may face an upwards sloping supply of external finance as do other businesses, meaning that they cannot replenish capital easily. When bank lending is restricted by economic or regulatory capital, the term usually used is "capital crunch." Some have argued that bank lending channel effects arise from episodic non-monetary shocks rather than a continuous feature of the transmission mechanism. Banks' risk appetites, desire for liquidity and conditions in the financial markets may also be an important factor determining supply of bank loans. Hence, it may be bank willingness – rather than capacity - that changes unexpectedly and reduces the supply of bank loans to borrowers of unchanged risk. This event is sometimes called "market credit crunch" (Hall 2001).

The relative importance of the balance sheet and bank lending channels is difficult to quantify empirically, but it is likely that both play an additional role in the monetary transmission mechanism. Bernanke and Gertler (1995) suggest that the relative importance of bank lending channel may have decreased over time due to financial innovation and deregulation. In our opinion the latest financial crisis has shown that the bank lending channel is alive and well indeed. We discuss these channels further in sections 5.2.5 and 5.2.6.

5.2 Transmission mechanism of unconventional monetary policies

The theory underlying quantitative easing is often based on the assumption that money and other financial assets are imperfect substitutes. Money is highly liquid, but earns very little interest (usually assumed to be equal to zero). Other non-monetary assets such as bonds and equities provide greater returns, but they are less liquid compared to money.

In general, unconventional monetary policies affect economic activity through altering the structure of private sector agents' balance sheets or by altering expectations (Bernanke et al. 2004). In the next sections we will present the theoretical background for this statement, and discuss how quantitative and credit easing policies can affect nominal spending and the price level.

5.2.1 The buffer stock theory of money demand

The buffer stock theory of money demand assumes that companies and households have a target level for the money balances they hold. The target level is defined in terms of real money balances that represent the purchasing power of money. Companies and households are willing to deviate from their target level for money balances temporarily in the short run and hold money as “a buffer”. However, over time they will try to return to their target level. Individual's expectations about future inflation thus imply a path for future money balances (Berry et al. 2007).

If individuals and companies hold excess money balances in the medium term, they will try to get rid of these by buying goods and services (or by repaying loans). This circulation of money within the economy will lead to greater demand for goods and services. This will in turn lead to increased inflation over time. Rising prices bring the value of real money balances down restoring the balance between money demand and supply (Berry et al. 2007).

Given that the buffer stock theory of money demand holds in practice, keeping other factors constant, increasing the money supply by buying financial assets from the private sector should create excess money balances among the agents in the economy, and thus lead to greater nominal spending and greater inflation in the future.

The effect on nominal spending and inflation is dependent on how the individuals and companies react to the increased money supply. If the increase in money supply is accompanied by an increase in the money demand (increase in the target level for money balances) then the excess money can be absorbed passively in money balances. In this case, the implications for nominal spending and inflation are less clear cut and increasing money supply may not succeed in stimulating economic activity and raising the price level.

5.2.2 The portfolio rebalancing theory

The portfolio rebalancing theory relies on the assumption that money and other non-money assets such as bonds and stocks are imperfect substitutes. When a central bank buys assets in the market, the price of these assets is expected to increase. A corporation or an individual, who sells the asset to the central bank, receives money for the transaction and increases his money holdings. If this money is not perceived as a perfect substitute for the sold asset, there is an excess of money in the portfolio. In order to rebalance the portfolio, the excess money can be used to buy other financial assets. This circulation of excess money balances within the financial sector is then expected to bid up other asset prices as well. Increased prices lead to lower yields and lower costs of raising finance for corporations and individuals (Benford et al. 2009).

5.2.3 The risk taking channel

Borio and Zhu (2008) stress the impact policy actions may have on the risk preferences and risk tolerance of the private sector. They argue that this risk-taking channel is a potentially important complementary factor in the monetary transmission mechanism. In this context, quantitative easing or credit easing may remove some of the risky assets from private sector portfolios resulting in easier funding conditions. Agents in the private sector may then perceive the riskiness in their portfolios to be reduced. This may encourage further risk taking and “search for yield”- behaviour bidding up asset prices.

5.2.4 Transaction costs

Transaction costs and other frictions in asset markets can also lead to different kind of assets being imperfect substitutes. This could add to the value placed on liquid instruments such as money. In particular, transactions costs can prevent some people from switching money into

higher-yielding but less liquid assets such as bonds or equities (Berry et al. 2007). To the extent that increased money supply reduces transaction costs in various asset markets, quantitative easing may have an effect on relative prices of different financial assets.

5.2.5 Credit channel effects – The balance sheet channel

The balance sheet channel is based on the idea that the external finance premium depends on the financial position of borrowers (refer to section 5.1.1). If central bank asset purchases increase the net worth of borrowers, then increase in the money supply can support economic activity.

In our view, there are potentially two mechanisms connecting increased money supply with net worth of borrowers. First, central bank asset purchases can increase the value of various financial assets thereby increasing value of the borrower's collateral. This has the potential to reduce the external finance premium. Second, if increased money balances lead to higher nominal spending in the economy, firms can experience greater cash flows increasing their net worth. This latter effect assumes that increased money supply is not absorbed passively in the money balances of individuals and firms.

5.2.6 Credit channel effects – The bank lending channel

As a consequence of quantitative easing or unsterilized credit easing, commercial banks end up with higher reserve balances at the central bank. *Ceteris paribus*, increased liquidity should encourage the banks to lend more to corporations and individuals. As a result of holding more liquid assets banks should also be relatively more willing to hold more illiquid assets, for example mortgages, than they otherwise might have been (Benford et al. 2009). More bank lending should encourage investment and consumption leading to higher nominal spending.

5.2.7 The fiscal channel of quantitative easing

The fiscal channel for quantitative easing relies on the observation that sufficiently large monetary injections will materially relieve the government's budget constraint, permitting tax reductions or increase in government spending without increasing public holdings of government debt (Bernanke et al. 2004). Auerbach and Obstfeld (2005) provide a detailed

analysis of both macroeconomic and welfare effects of the fiscal channel and find that these effects are potentially quite substantial. For this channel to work, it is vital that the central bank commits to maintain some parts of its quantitative easing in the future as the economy recovers, and that this commitment is received as credible by the public.

This illustrates the point that there is a potential link between unconventional monetary policies and fiscal policy

The fact that fiscal policies and unconventional policies can become “interconnected” due to adaptation of unconventional monetary policies can pose additional challenges for policymakers. We discuss this topic further in section 6.6.4.

5.2.8 The signaling channel of quantitative easing and the role of expectations

Monetary policy has in many ways become management of expectations, as discussed in section 2.4. Central bank communication and the role of expectations may be even more important in times when the zero lower bound is hit. Using unconventional measures may signal the central bank’s intentions for future monetary policy. Also, these measures may signal the central bank’s willingness to do whatever it takes to reach the goals of monetary policy.

Quantitative easing and unsterilized credit easing increase the overall money supply in the economy. Money growth has historically been followed by inflationary pressures, inducing private sector agents to expect higher future inflation. Higher inflation expectations should then reduce the real rate of interest that in turn stimulates aggregate demand.

5.2.9 How successful are quantitative easing and credit easing policies expected to be?

In general, there is great uncertainty about the effects of quantitative easing and credit easing on real economic activity and asset prices, as well as on inflation. There are few examples in the past of unconventional monetary policies, so it is hard to estimate the quantitative impact of such policies ex-ante. Furthermore, the effects in the short run may be very different from

the long run. Some are also worried that quantitative easing in the UK and the US will work “too well” in a sense that the policy leads to an acceleration of future inflation. Stagflation is also a concern, with high inflation rates and slow economic growth.

Whether quantitative easing and credit easing policies are successful in stimulating the economy depends on the response of the various economic agents. For asset purchase programs to be effective, *sellers* of financial assets need to buy other assets, or goods and services, with the money they receive from the transaction with the central bank. An important feature contributing to the effect of such policies is, thus, how *households and firms* respond to changes in their money balances. The impact of asset purchases can also vary relative to *from whom* the assets are purchased from: Household consumption and investment decisions may be different from, for instance, institutional investor decisions.

The effect in *capital markets* is dependent on the extent to which investors regard different financial assets as substitutes. Also, increasing availability of credit in capital markets is partly conditional on how these unconventional policies contribute to a reduction of various risk premia, in particular, liquidity and credit premia. Response from *banks* is of importance, as more liquid balance sheet should encourage issuance of bank credit. However, other factors may restrict provision of loans from the banking sector, for example insufficient capital adequacy or limited demand for bank loans in the first place.

6. CASE STUDIES: UNCONVENTIONAL MONETARY POLICIES IN JAPAN, USA AND UNITED KINGDOM

6.1 A case study approach

We will now conduct comprehensive case studies of three countries that have implemented unconventional monetary policies:

- i. Japan 2001- 2010
- ii. United States 2007-10
- iii. United Kingdom 2007-10

These case studies form the foundation for our comparative analysis in section 7, where we analyze how various macroeconomic variables have developed after the implementation of unconventional monetary policy measures.

We have chosen a case-study approach similar to Bernanke et al. (1999) in their book “Inflation Targeting”. While they compare countries that have adopted an inflation targeting framework, our focus is on implementation of unconventional monetary policies.

There are mainly two reasons for choosing a case study approach: First, at the time of writing this paper, unconventional monetary policies have been applied in practice for little over a year. Consequently, formal statistical analysis is limited by the short time period that we have to observe the effects of unconventional monetary policy.

Second, strictly quantitative methods cannot fully describe the optimal implementation of monetary policy at times when policy rate setting is constrained by the zero nominal bound. In particular, quantitative methods cannot fully address how political authorities and the public respond to such policies. By choosing a case-based approach we hope to be able to utilize more of the available information, and create a wider framework for evaluating unconventional monetary policies.

Our objective in this section is to discuss how unconventional policies were implemented in practise in Japan, United States and United Kingdom. The discussion is based on the theory of monetary policy at the zero nominal bound, and we wish to highlight *the broad features and effects* of policy implementation. We begin with the case of Japan: We examine how unconventional monetary policy was applied in practise, and assess the effectiveness of the policies based on existing empirical studies and our own observations.

Next, we turn our focus on the recent financial crisis of 2007-09 and discuss policy responses from The Federal Reserve and Bank of England. We have chosen these two central banks, because, in our opinion, they were the most aggressive and imaginative in their policy responses. Also, here we attempt to relate our discussion to theory on unconventional monetary policy. Consequently, we choose to divide the discussion into following subcategories:

1. Monetary policy regime and economic conditions prior to the crisis
2. Interest rate policies
3. Communication policies
4. Acting as a lender of last resort
5. Quantitative easing
6. Composition of the balance sheet

This division is broadly in line with the policy measures discussed under the theoretical framework for monetary policy at zero interest rates. By using a parallel structure allows us to make better generalizations and more rigorous comparisons of the recent experience of unconventional monetary policies. Finally, we argue that the similar structure of the case studies gives a better foundation for the cross-country analysis in section 7.

There exist various definitions of quantitative easing and credit easing policies as discussed in section 4.2. Sometimes the distinction between the two policies is not obvious. This represents a practical challenge in the case studies when dividing the discussion to the above mentioned subcategories. Unconventional polices have to be designed to address the specific needs of an economy while taking political and economic structures into consideration. This

can lead to countries adapting different “versions” of unconventional policies while using the same theoretical definitions. Although the case studies are based on the theoretical framework presented in the above sections, our division of the policy measures also reflects our interpretation of central bank actions.

Fiscal policy has also made important contributions to fighting recessionary pressures in the respective countries, amplifying and complementing monetary policy stimuli. However, we will not discuss fiscal policy responses in these case studies, and limit the discussion to monetary policy actions alone.

6.2 Japan's experiment with unconventional monetary policy

Prior to the global financial crisis of 2007-09, Japan was the only country to have made an attempt to use quantitative easing as a policy tool to stimulate economic activity. In fact, Japan has pursued very loose monetary policies for almost two decades. The nominal interest rates have been close to zero, combined with highly expansionary fiscal policies. Despite these efforts, Japan has not been able to achieve sustained economic recovery or growth. Indeed, Japan seems to be stuck in a liquidity trap.

Japan's experience contains lessons for those hoping to understand the financial crisis of 2007-09. Though it is not the intention to present an in-depth analysis of the causes of the Japanese deflationary experience, it is relevant to note some important characteristics of the Japanese scenario.

We will start this section by giving a brief overview of the macroeconomic conditions that led to persisting deflationary pressures in Japan. Thereafter, we will discuss the monetary policy responses of the Bank of Japan, and summarize the results of empirical studies that have tried to quantify the effects of those policies. We will also discuss the possible reasons for why unconventional monetary policy has, to a large extent, been ineffective in Japan during "the lost decade". We will mainly discuss policy responses prior to the recent financial crisis of 2007-09.

6.2.1 Monetary policy regime and economic conditions prior to the crisis

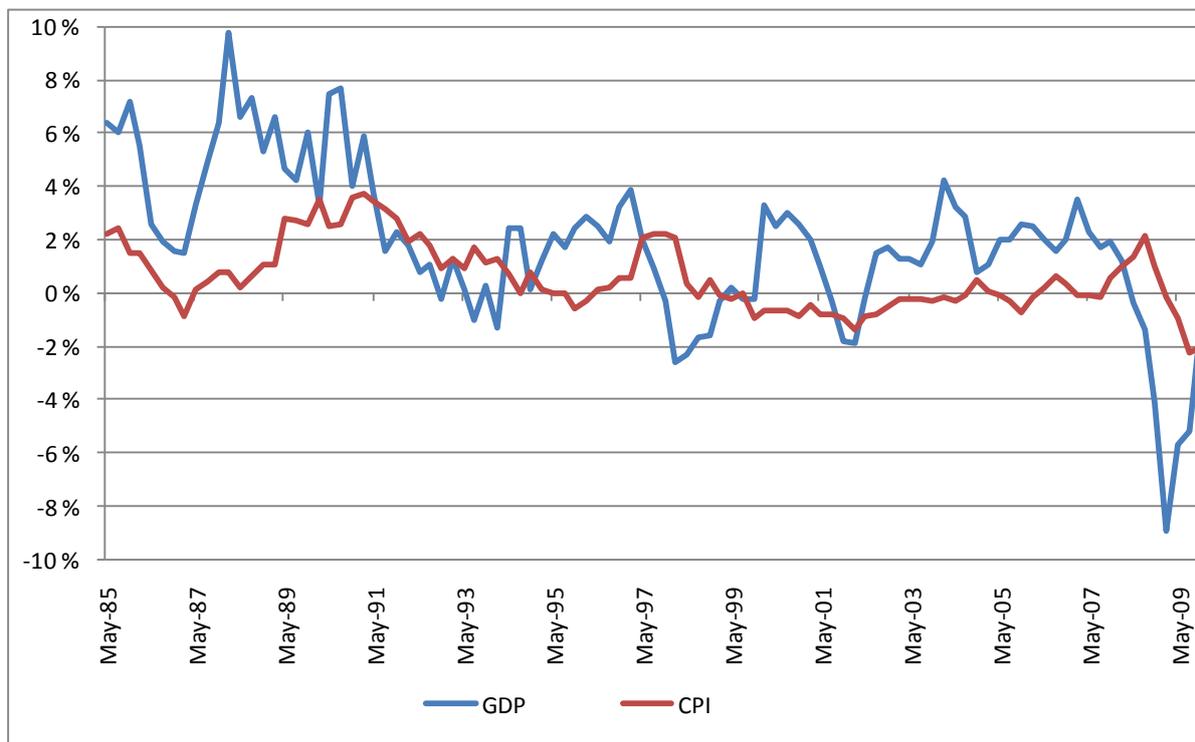
The Japanese economy experienced an extraordinary long period of economic growth in the post-war period, and in the 1980's Japan established itself as the world's second largest economy. Overheating of the economy led to a soaring of stock and real estate prices towards the end of the 1980's. This "bubble economy" was followed by a collapse in asset values, a reduced pace of economic growth, banking problems, and deflation. The Japanese economy entered a period of stagnation in 1991, and grew by a low average of 1 percent annually during the years 1992-2002. This time period has consequently been called the "lost decade" reflecting the fact that the Japanese economy was operating under its potential (Ueda 2009).

In the early 1990s after the asset bubble burst, Japan's financial sector came under increasing stress as a result of nonperforming loans. Many of these loans were extended to the construction and real estate sectors that were hit by the effects of plummeting property values. Falling land and equity prices reduced the collateral available for new loans and tightened liquidity constraints. From 1997 to 1998, Japanese financial markets suffered from a severe crisis: Banks were losing capital due to high ratios of nonperforming loans and falling asset prices. This resulted in a severe credit crunch and negative effects on aggregate demand (Ito and Mishkin 2004).

The consumer price index plummeted on the course of the 90's, as illustrated in Figure 3. Deflationary pressures have persisted for almost two decades despite the efforts of both monetary and fiscal authorities. In fact, it seems that Japan's lost decade has turned into two lost decades. Looking at Figure 3, it seems possible that Japanese economy has entered a new era with lower steady state growth. As argued in section 2.2, long run trend growth in the economy is determined by supply side factors, which are beyond the control of monetary policy. If this is the case, growth in Japan will probably not return to its previously high levels, regardless of monetary policy actions taken by the BoJ.

Currently, the prognosis for Japanese growth is rather bleak due to the turbulent global economic outlook. As seen in Figure 3, GDP declined massively after the onset of the financial crisis. Only recently has GDP growth turned positive again. In the first quarter of 2009 the percent change in GDP from previous quarter was 1.2 percent. However, deflation has not subdued. According to the IMF, the consumer price index is expected to fall by 1.4 percent in 2010.

Figure 3 – Japan: Development in consumer price index (CPI) and gross domestic product (GDP) 1985-2009, percentage change from a year ago, not seasonally adjusted data



Sources: IMF International Financial Statistics, Cabinet Office Japan

The Bank of Japan became independent first in April 1998, when the new Bank of Japan Act came into effect. The new law changed the institutional balance of power between the central bank and the Ministry of Finance, and ensured the central bank goal and instrument independence with respect to inflation. Under the new legislation the Bank of Japan's official mission is to *"maintain price stability and to ensure the stability of the financial system"* (Bank of Japan 2010). The act does not specify an explicit target for inflation.

Political factors in part contributed to the granting of independence to the central bank. The finance ministry had failed to effectively address financial-sector weaknesses, and the suspicion was that an independent central bank might have responded more aggressively to the asset bubble of the late 1980s (Obstfeld 2009).

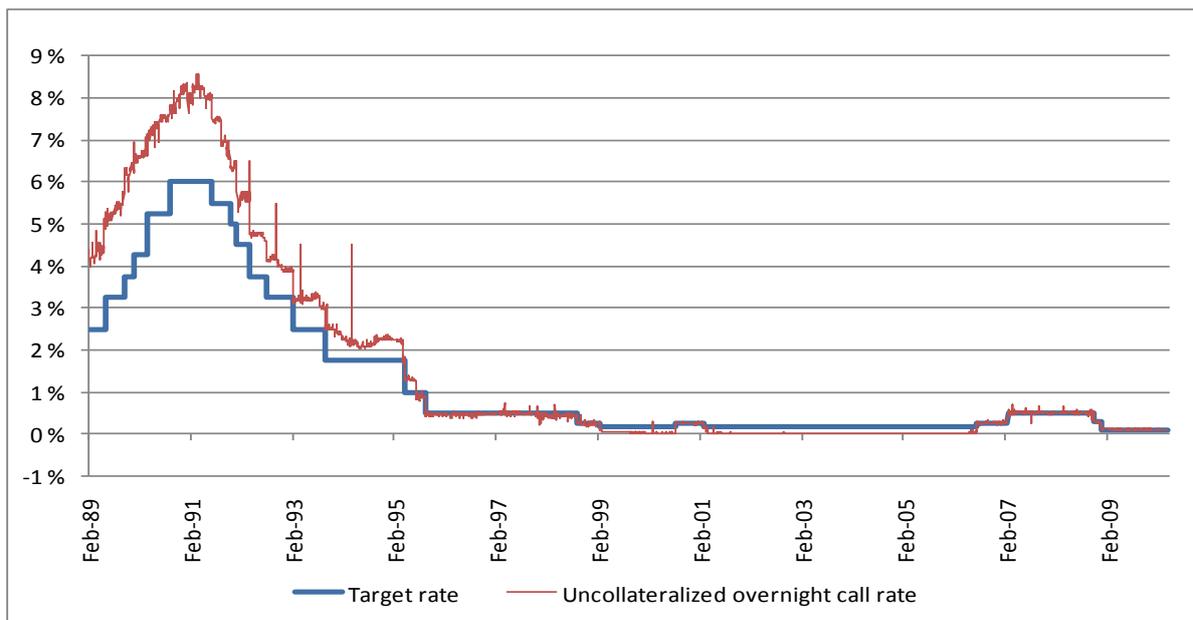
In the next sections we turn to policy responses from the Bank of Japan since the bursting of the asset price bubble in the early 1990s.

6.2.2 Interest rate policy

Bank of Japan's main operating target is the uncollateralized overnight call rate. As a response to the rapidly worsening macroeconomic conditions, the Bank of Japan cut its target rate gradually but steadily after the collapse in asset prices.

During 1995 the call rate was reduced to as low as 0.5 percent, leaving little room for further reductions. In autumn 1997, Japan's economy started to deteriorate further, largely under the influence of financial system disturbance due to non-performing loans and failure of large financial institutions. In February 1999 the call rate was reduced to 0.02 percent and Bank of Japan introduced what is called zero interest rate policy (ZIRP) committing to hold the target rate close to zero.

Figure 4 – Japan: Development in the target rate and uncollateralized overnight call rate 1989-2010, daily quotations



Source: Bank of Japan

Concerned about the negative side-effects of holding the short nominal interest rate at zero for an extended period of time, the BoJ subsequently reversed ZIRP policy in August 2000 and increased the call rate to 0.25 percent. As the Japanese economy deteriorated shortly afterwards as a consequence of the global “it-sector bubble”, monetary authorities “reversed the reversal” and returned to the zero interest rate policy in March 2001. At that time the

central bank also announced also that ZIRP would be supplemented with quantitative easing policy, and targeting of bank reserves rather than the collateralized overnight call rate.

The ZIRP was once again ended in July 2006, when BoJ raised the call rate to 0.25 percent. The call rate was increased further to 0.50 percent in March 2007, before it was reduced again in 2008 after the emergence of the global financial crisis.

Since the collapse in asset prices in the early 1990's, the Japanese economy has been characterized by several deep cyclical downturns with some modest short-lived economic recoveries (Kimura and Small 2004). To break from the deflationary spiral, unconventional monetary policy measures were adopted. In the subsequent sections, we will give an overview of the more unconventional policy responses carried out by monetary authorities in Japan.

6.2.3 Communication policies

When announcing the zero-interest rate policy in February 1999, Bank of Japan stated that the call rate would be held low *“until deflationary concerns are dispelled”* (Kimura et al. 2003). This unconditional commitment linked to inflation prospects had the intention to depress long term interest rates and give a signal to the public that monetary authorities were prepared to hold the short term nominal interest rates low for an extended period of time.

This signal of low future target rate was contradicted by the temporary ending of ZIRP in August 2000.¹⁰ When returning to the zero interest rate policy in March 2001, the Governor Hayami announced that ZIRP would only be abandoned in the future when the rate of CPI inflation was *“stably”* at a positive value (Obstfeld 2009). The credibility of this signal was strengthened to a certain extent by introducing the new quantitative easing policies: BoJ promised to hold the level of current account balances well above required reserves until deflation would be brought to an end.

Some criticism can be made regarding the communication from Japanese monetary authorities during this time period. First, policy statements from BoJ could be interpreted in a way that the high level of policy stimulus would be withdrawn as soon as measured

¹⁰ BoJ explained that the reason for the ending of zero interest rate policy was the potential negative side effects related to holding the short term nominal interest rate at zero for an extended period.

inflation returned to positive values. No explicit commitment was made by monetary authorities to maintain inflation at a positive rate in the longer run. Bernanke (2003) argues that it might have been helpful for the Japanese economy if the zero interest rate policy had been accompanied by more explicit communication about what would happen after the deflationary period ended.

Second, some critics have pointed out that Japan could have benefited from introducing an explicit inflation target or a range.¹¹ As discussed previously in section 3.2, a quantitative inflation target has shown to be a valuable tool for communication in many countries: By clarifying the objectives of the central bank, an explicit inflation target can help to focus and anchor inflation expectations, reduce uncertainty in financial markets, and improve credibility of the central bank. According to Auerbach and Obstfeld (2005) imperfect credibility of the BoJ was indeed part of the explanation to why prices responded sluggishly to the highly stimulating policy measures. Introducing an inflation target means also that if BoJ was unable to reach the target, monetary authorities would be held accountable for this. At least, they would need to communicate their view of why inflation target had not been reached. This can in turn strengthen incentives to fight deflation.

Others have pointed out that introducing an inflation target in Japan may not have been enough given Japan's history of persisting deflation. According to Svensson (2004) the private sector in Japan did not find it credible that the monetary base expansion would be permanent. Consequently, quantitative easing policies did not influence people's expectations about the future price level. A more suitable strategy for Japan to "escape from a liquidity trap" might thus have been a publicly announced, gradually rising price-level target described briefly in section 4.1.¹²

Regardless of the criticism, there is some empirical evidence that this "management of interest rate expectations" was successful in Japan in a sense that communication has had a significant effect on term structure of interest rates. Baba et al. (2005) conclude tentatively that BoJ's monetary policy has worked mainly through the commitment channel since

¹¹ See for example Bernanke (2003), Auerbach and Obstfeld (2005).

¹² See for example Bernanke (2003), Svensson (2004) for a detailed discussion of how to carry out an price level target.

1999.¹³ The commitment affected expectations about the future short term nominal interest rate, which in turn, depressed medium and long term yields. Bernanke et al. (2004) also find that longer term yields were lower than they would have been in the absence of non-standard policies. However, their event study also suggests that monetary authorities have been less successful in influencing monetary policy expectations by communication and monetary policy statements. This finding may reflect the credibility problem discussed above, or the fact that BoJ gained independence first in 1998 lacking a trustworthy “track record”.

Despite the commitment to zero interest rate policy, deflationary pressures persisted. Okina and Shiratsuka (2004) point out that even though commitment to ZIRP succeeded in depressing longer term yields it was unable to reverse deflationary expectations in financial markets. This finding supports the view that it is not expectations about the future short term nominal interest rate that matter per se, but rather expectations about future inflation and price level.

6.2.4 Quantitative easing policies

In Japan, financial institutions hold current account balances (CABs) at the central bank. In contrast to many other countries, CABs are not held solely by depository institutions. Bank of Japan does not pay interest on reserve balances meaning that it is costly for financial institutions to hold excess reserves.

BoJ’s quantitative easing policy consisted of three components. First, BoJ announced that it would target the outstanding balance of current accounts held at the central bank instead of the call rate. In practise, this is equivalent to targeting bank reserves at a level well above needed for keeping the call rate at zero. When BoJ adopted this new main operating target, it raised the target level of the current account balance to around JPY 5 trillion. This was about JPY 1 trillion larger than before the change in regime. Monetary authorities increased the target for reserves over time ending on a target level of 30 to 35 trillion in January 2004. To put this into perspective, the amount of required reserve balances was equal to JPY 6 trillion at the time (Baba et al. 2005).

¹³ Oda and Ueda (2005), Okina and Shiratsuka (2004) and Ugai (2006) reach similar conclusions in their studies.

Second, to achieve the targets for the current account balances, BoJ shifted its asset purchases from short term government debt towards long term Japanese government bonds. The purpose of policy was to inject liquidity into financial markets, which on turn would initiate portfolio-rebalancing effects. Furthermore, the vast provision of liquidity was aimed at making money market participants feel more secure about the availability of funds, thereby preserving financial market stability. Consequently, the Bank increased its outright purchases of long term government bonds from JPY 400 billion to JPY 600 billion per month in August 2001, and thereafter to JPY 800 billion in December, and further to JPY 1.2 trillion in October 2002 (Ito and Mishkin 2004).

Third, the central bank announced that it would continue with these new procedures until the year-on-year increase in the consumer price index became stably zero or above. This “commitment effect” was discussed in the previous section.

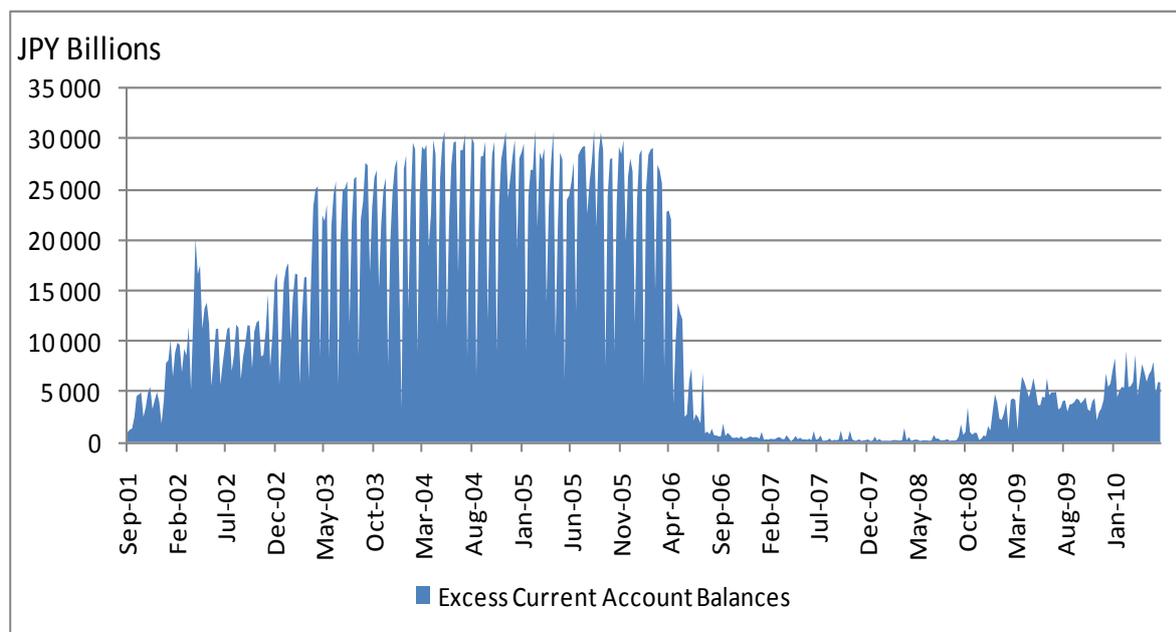
In general, since 1998 BoJ has expanded the supply of liquidity to financial institutions whenever there were signs of financial market instability. They started to provide longer term funding for banks, and extended the range of approved collateral and range of counterparts. Since 1998, commercial banks have been able to use commercial paper as collateral to obtain funds from the central bank. In 1999 the terms were expanded further, and BoJ started to accept asset-backed securities as collateral. The purpose of the extensions in counterpart terms was to improve liquidity in targeted markets, and reduce issuance costs of these securities. Shortly after introducing its quantitative easing policies, BoJ also established a Complementary Lending Facility for financial institutions. This standing facility enabled the central bank to extend collateralized loans at the request of counterparties to the official discount rate. The purpose of the facility was to support the implementation of quantitative easing policies and help policymakers meet the targets for the current account balances. These policy measures can be regarded as a combination of credit easing and the central bank acting as the lender of last resort. However, the ultimate goal of these policies was to support the quantitative easing framework.

Over time BoJ has also expanded the range of purchased assets: In December 2002, it started buying equities held by commercial banks, in order to further reduce the market risk that was associated with these stocks. In June 2003, the BoJ started purchasing asset-backed securities, including asset-backed commercial paper, mainly backed by assets related to small and medium-sized firms (Kimura and Small 2004). These aspects of quantitative

easing are similar to credit easing, where central bank purchases are targeted at specific market segments.

Since the late 1990's, commercial banks in Japan have held relatively vast amounts of excess reserves at the central bank. According to Ogawa (2004) there are primarily two factors that contributed to the accumulation of CABs at the central bank during this period: First, the low levels of the call rate reduced the opportunity cost of holding reserve balances, and, thus, encouraged financial institutions to hold them. The second relevant factor is the instability of the financial system, and in particular, banks' fragile financial health. An increase in the ratio of bad loans in banks' portfolios since 1990's provided incentives to hold excess reserve balances for precautionary reasons.

*Figure 5– Japan: Excess current account balances held at the Bank of Japan 2001-2010*¹⁴



Source: Bank of Japan

There exist various empirical studies that aim at quantifying the effects of Japan's quantitative easing policies. Baba et al. (2005), and Kimura and Small (2004) argue that open market operations alleviated the impaired credit intermediation in the financial system - at least in the less damaged parts of the financial system. Baba et al. (2005) find that credit spreads in high-rated corporate bonds and commercial paper were reduced after the

¹⁴ Data for the current account balances is not available prior to September 2001

adaptation on of ZIRP. However, the issuance of these kinds of securities has not increased. The reductions in risk premia have neither appeared to have resulted in significant monetary easing. This implies that the risk taking ability of the financial sector was still impaired: Reductions in risk premia in high-grade corporate debt market did not spread into other markets, for example to increased bank lending.

This finding is supported by Kimura and Small (2004), who argue that portfolio rebalancing effects resulting from central bank purchases of long term government debt reduced risk premia in government bonds markets and high grade corporate bond markets. However, quantitative easing policies might have had adverse affects by increasing risk premiums in equities and low-grade corporate bonds. One explanation to the weak portfolio rebalancing effect is unfavourable balance sheet positions of market participants: Fragile balance sheet positions can discourage market participants to take on additional portfolio risk. The portfolio rebalancing effects are, however, highly uncertain. Other studies have found no significant effect of quantitative easing policies on portfolio rebalancing. Portfolio rebalancing effects are also found to be small relative to the commitment effect that was discussed in the previous section.¹⁵

Baba et al. (2005) find that increased money supply and accumulation of CABs reduced spreads in the interbank market in Japan. This development is somewhat similar to the current financial crisis, as central bank liquidity injections have been associated with reduced interbank spreads.¹⁶

Quantitative easing policies were discontinued in March 2006, as core CPI had returned to positive value in the latter half of 2005. After the global crisis of 2007-09 hit the Japanese economy, quantitative easing policies were not reintroduced in the same fashion as in 2001 (Morgan 2009). Instead, BoJ adopted a number of measures similar to credit easing. For example, BoJ has increased its outright purchases of commercial paper and started to accept BBB-rated corporate bonds as collateral to promote the functioning of these specific markets. Banking sector liquidity needs were addressed by the BoJ by establishing a new

¹⁵ For example Oda and Ueda (2005) and Ugai (2006)

¹⁶ See for example Ait-Sahalia (2010)

complementary deposit facility.¹⁷ This may suggest that the Bank of Japan does not have much confidence in the efficacy of “traditional” quantitative easing policies which typically include large purchases of government debt and an explicit targeting of bank reserves.

6.2.5 Summary and discussion of the Japanese example

To sum up the Japanese case, there is some empirical evidence from Japan that unconventional monetary policy can have positive effects in financial markets by reducing risk spreads or by depressing long term interest rates. There seems to be a consensus that the *commitment effect* had the largest impact on longer term yields in the Japanese case. However, the link between financial market responses and aggregate macroeconomic variables remains highly uncertain: Reduction in long term yields seem not to have been sufficient to affect deflationary pressures or real GDP growth. Also, positive effects in some financial markets have not spread to more damaged parts of the financial systems. The fact that unconventional monetary policy has not led to sustained growth in Japan is by itself enough to cast doubt on the effectiveness of such policies.

The Japanese experience seems to contradict the view that inflation is “*always and everywhere a monetary phenomenon*”. Despite vast increases in the money supply and the monetary base, inflation has remained modest for nearly two decades. The purpose of this section is to discuss possible reasons for why unconventional monetary policies, and quantitative easing in particular, did not ease deflationary pressures in Japan.

Structural problems

Some observers of Japan blame monetary authorities for failing to react promptly and aggressively enough, both as asset prices exploded upward in the late 1980s and when they plummeted afterwards.¹⁸ However, deflation may not be the main cause for the stagnation of the economy, but rather a manifestation of more fundamental problems: Failure to address structural problems in both public and private sector is possibly the underlying explanation.

¹⁷ See for example Shirakawa (2010) for a further discussion about Bank of Japan’s response to the financial crisis of 2007-09

¹⁸ See for example Obstfeld (2009)

In particular, structural problems in the banking sector and the problem related to the non-performing loans were left unattended for the most part during the “lost decade”.

It can be argued, that expansionary monetary policy has mainly been used to address financial stability concerns in the short run, whereas policymakers should have focused more on long run challenges of the economy. Since addressing structural problems is outside the scope of monetary policy tools, it is not surprising that monetary policy has “failed“ to reach its objectives.

Demographic challenges pose an additional problem for Japan: The population is aging rapidly, and it is estimated that by 2030 over 30 percent of the population in Japan will be of 65 years of age or older.¹⁹ Private savings rates have traditionally been high in Japan, reflecting perhaps the structure of the social security system and the public pension system. Preference for high personal savings contributes to lower aggregate demand hindering the impact of any expansionary policy.

However, high personal savings rates but may also entail “hidden” incentive structures: Excessive inflation is very disadvantageous for people with high levels of saving deposits, as it reduces the real value of money over time. In fact, individuals who wish to live off on their personal savings at a later date, for example after retirement, may *prefer deflation*. Put differently, deflation makes the aging population richer whereas high inflation rates would wipe out their savings. The effect of such incentives is hard to quantify, but it can be assumed that the aging population of Japan wishes to exert its influence on policymakers to avoid high levels of future inflation.

To reduce private savings rates, reforms are needed both in the social security system and in the pension system. Consequently, the prolonged stagnation of Japanese economy can be regarded as a byproduct of policymakers failing to address overall structural problems.

Transmission mechanism of monetary policy and banking sector problems

Some economists argue that monetary policy became ineffective in the 1990’s because the traditional transmission channel from the interest rate policy to the real economy was no

¹⁹ Statistical Handbook of Japan

longer operational.²⁰ Thus, more attention should have been given to the credit channel view of the transmission mechanism. Nagahata and Sekine (2002) find that decline in the net worth of borrowers had a negative effect on investment. They also find that lenders' net worth has exerted significant negative effects on the investment of firms without access to the bond market.

The development in Japan is also consistent with the "debt deflation" mechanism presented in section 2.6. Deflation leads to a transfer of resources from debtors to creditors, which in turn results in a deterioration of the borrowers' balance sheets and a decline in net worth. The deflation driven problems then lead to lower investment and economic activity.

In addition, the bank lending channel has been impaired due to non-performing loans: Insufficient capital adequacy, rather than liquidity constraints, was probably one of the main reasons why banks had to cut their lending to new investments - a classical example of a "capital crunch". This argument is supported by the empirical study of Morsink and Bayoumi (2001), who argue that banks have played an important role in transmitting monetary shocks to economic activity in Japan. Thus, it seems that both lenders' and borrowers' balance sheets were important factors explaining the ineffectiveness of monetary policy. Bank loans are traditionally an important source of finance in Japan, reflecting perhaps a lack of alternatives. Consequently, the failure to address the balance sheet problems in the banking sector can be seen as one of the reasons why unconventional monetary policies did not lead to positive rates of inflation.

Credibility of the Bank of Japan

The Japanese monetary policy can be criticized for being non-transparent: There is no explicit inflation target or commitment to a policy rule that could guide expectations in the longer run. There is relatively little communication about the outlook for the economy and how monetary policy will respond to various economic developments. Transparency is essential to obtain credibility, as discussed in section 3.2. Credibility in turn makes monetary policy more influential. The fact that monetary policy has not been very influential in Japan indicates that BoJ lacks credibility.

²⁰ See for example Ito and Mishkin (2004), Kimura et al. (2003)

In addition, monetary policy responses have at times been very inconsistent. Zero interest rate policy was introduced in February 1999 only to have been abandoned a little more than a year later. Also, the fact that quantitative easing policies have not been introduced in a similar fashion in the current financial crisis illustrates that monetary authorities lack confidence in their own policies. The “track-record” of the Bank of Japan is rather bleak since gaining its independence in 1998. Thus, it is not surprising that economic agents are not responding to the stimuli measures in a manner that is consistent with the theory of unconventional policies. Following this argumentation, it seems that one of the main reasons why unconventional monetary policies failed in Japan is due to the fact monetary authorities were unable to affect *expectations* about future inflation. This is consistent with Friedman’s (2004) statement that “monetary policy that does not affect expectations simply does not matter”. The monetary authorities in Japan showed no real commitment in a sense that they were willing to “whatever it takes” to bring deflation to an end.

Japan’s experience suggests that once the economy hits the zero lower bound, there are significant limitations to what monetary policy can achieve. However, Japan has often been an “outlier” in terms of macroeconomic policy behaviour. Institutional and political factors may explain why some policies that fail in Japan can be effective in other countries and vice versa. This implies that the Japanese experience of unconventional monetary policy can be used as a reference point for policymakers who wish to implement similar policies in their home countries, but country comparisons should be done with caution.

In the next sections we turn our focus to the recent financial crisis of 2007-09, and discuss monetary policy responses from two prominent central banks: The Federal Reserve Bank of the United States and Bank of England.

6.3 The financial crisis of 2007-09: A short introduction

It is not the purpose of this paper to analyze in detail the reasons for the current financial crisis. However, an understanding of the origins and broad development of the financial crisis of 2007-09 will be useful for understanding why certain monetary policy responses were preferred over other alternatives.

The years preceding the financial crisis were characterized by an unusual period of low macroeconomic volatility. This probably reduced the perceptions of risk, while low interest rates gave incentives for “search for yield” type of behaviour. Financial innovation increased the availability of credit and contributed to rising asset prices, which in turn increased value of collateral and allowed credit constrained households and firms to borrow more. (OECD 2010)

The recent financial crisis has many features in common with previous financial crises, and three important precipitating factors can be pointed out: First, mismanagement of financial innovation. Second, an asset-price bubble that burst. And third, a deterioration of financial institutions’ balance sheets (Mishkin 2009). The crisis initiated substantial and wide-ranging responses from central banks’ around the world, that reflect in part the fear of possible large and adverse effects from the financial sector.

The origin of the financial crisis of 2007-09 was the American subprime housing market. A Housing prices started to fall in the US already during 2006, which initiated the fall in prices of mortgage-backed securities and raised suspicion about the underlying value of the assets. Due to widespread use of securitization, many financial institutions were exposed to the potential losses. The lack of market transparency in the mortgage-securities market led to doubt about counterpart solvency. As a consequence, financial conditions and especially bank funding markets began to deteriorate rapidly.

The systemic nature of the crisis was demonstrated by the collapse of large financial institutions like Bear Sterns March 2008, and especially the bankruptcy of Lehman Brothers in September 2008. After the Lehman collapse the financial crisis intensified with sharp falls in asset prices, historically high interest spreads on lending and a tightening of bank lending conditions. As a result, financial conditions began to have a substantial negative impact on real economic activity (OECD 2009).

The financial crisis was characterized by a breakdown in interbank markets: Especially after the Lehman Brothers bankruptcy commercial banks became immensely concerned about securing their own liquidity situation. They were also uncertain about the solvency of their counterparts. As a consequence, banks were unwilling to extend loans and funding to each other in the interbank market. Commercial banks started to “hoard for liquidity” resulting in a highly dysfunctional allocation of funds within the banking system. The response by monetary authorities have partially been targeted to compensate for the liquidity shortfall and restore normal market functioning.

Many central banks started to reduce their target rates aggressively shortly after the start of the financial turmoil. As the short term nominal interest rate was starting effectively to approach the zero lower bound, some central banks’ acted quickly to counter the fear that monetary policy was left powerless. Both Federal Reserve and Bank of England initiated extensive quantitative easing and credit easing policies. In the following sections we will elaborate on how these policies were implemented in practise.

Before we start our discussion of unconventional monetary policy responses in UK and US, it is interesting to note that no country has yet applied Svensson’s (2004) advice on the optimal way to escape from a liquidity trap in practise. This approach involves elements of “beggar-thy-neighbour” policy through the depreciation of a country’s currency. Such a policy could be particularly effective in small open economies. However, it seems that the stigma associated with adopting “beggar-thy-neighbour” policies has effectively discouraged central banks from adopting such policies during the recent financial crisis.²¹ This may be due to the global nature of the crisis, which arguably created a need for joint cross-country effort to counter the possibly adverse effects of collapse in global financial markets. An example of a joint cross-country effort is central bank liquidity swaps: the Federal Reserve became the “world’s lender of last resort” providing much needed US-dollar liquidity to financial markets around the world.

²¹ One exception to such a “beggar-thy-neighbor” policy is China, who has been accused of keeping their currency at an artificially low level to stimulate their export-driven growth. However, this policy has not been initiated to fight recessionary pressures due to the financial crisis or to “escape from a liquidity trap”.

6.4 The Federal Reserve's responses to the financial crisis of 2007-09

6.4.1 Monetary policy regime and economic conditions prior to the crisis

The Federal Reserve has not implemented explicit inflation targeting framework, nor stated an explicit target for inflation. Under the Federal Reserve Act 2A it is stated that the goal of monetary policy is “*to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates.*”

Even though there is no explicit target for inflation in the U.S, achieving low inflation is nonetheless one of the three main goals of the Fed. Some have even argued that, in fact, Fed has adopted an “implicit inflation target”.²²

According to National Bureau of Economic Research, the US business cycle peaked in December 2007. Housing prices had started to deteriorate already during 2006. In August 2007 an increase in subprime mortgage defaults led to a sharp fall in the price of mortgage-backed securities and raised suspicions about the value of the underlying assets. (Reis 2010) The crisis took a turn for the worse after Lehman Brothers filed for bankruptcy on the 15th of September 2007 - the largest company ever in the US history to fail. In the months that followed the US stock market plunged, and most measures of risk, volatility and liquidity spreads increased to unprecedented levels. Housing prices continued to deteriorate, and in December 2008 the Case-Shiller home price index reported its largest price drop in history. Unemployment began to rise steadily from 4.9 percent in December 2007 to over 10 percent in October 2009. Output declined sharply in the 1st quarter in 2008 (Reis 2010).

The current recession is indeed regarded to be the deepest since World War II. Due to the severity of crisis, extraordinary policy responses have been adopted. According to chairman Bernanke, the Federal Reserve's responses can be divided broadly into three groups: Interest rate policy, quantitative easing policy and credit policy. Compared to Bank of England, the Federal Reserve has focused heavily on non-bank credit markets as well as on operations involving private sector securities. The varying emphasis reflects, in part, differences in

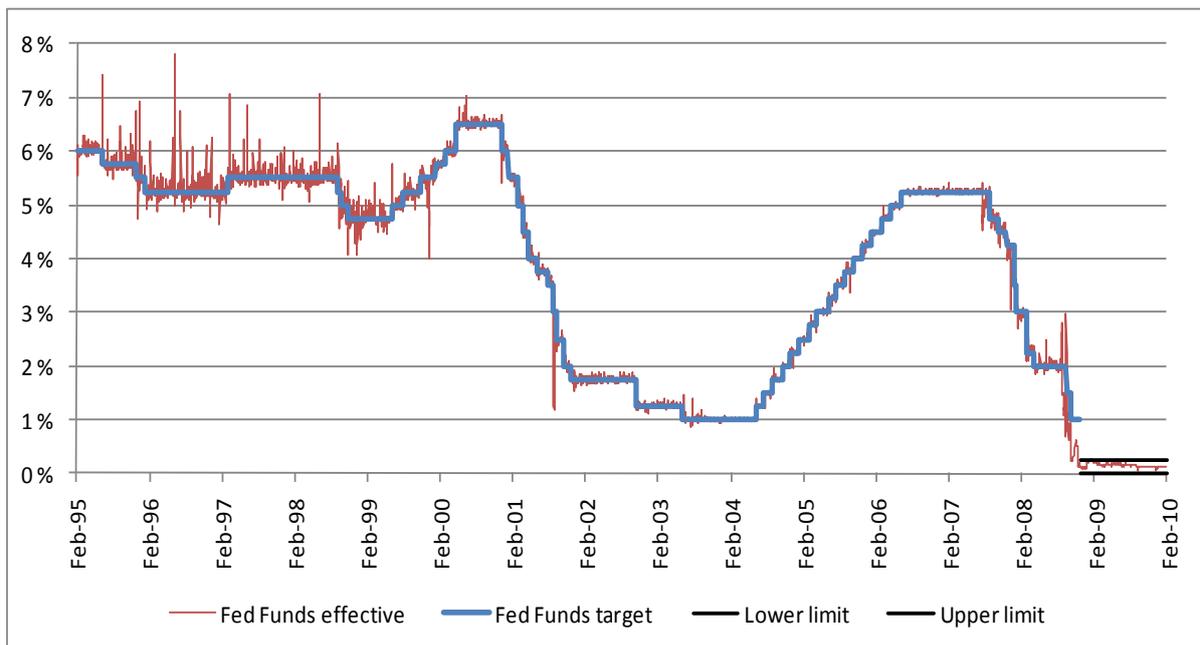
²² See for example Meyer (2004)

financial structures. For example, more direct intervention in the non-bank credit markets in the United States is consistent with the country's predominantly market-based system (Borio and Disyatat 2009).

6.4.2 Interest rate policy

Starting from a target rate of 5.25 percent for the first half of 2007, the federal funds rate was effectively cut to zero by the end of 2008. This reduction can be regarded as an extraordinary aggressive easing in the stance of monetary policy. In December 2008, the Fed also discontinued to announce a target for the federal funds rate. Instead, the target was announced as a range, and since then the federal funds rate is to lie within the range of 0% and 0.25%. The Federal Market Open Market Committee has stated that it intends to keep the federal funds rate close to zero for the foreseeable future.

Figure 6 – USA: Development in Federal Funds rate target and Federal Funds rate effective 1995-2010, daily quotations



Source: The Federal Reserve Board

Financial Times reported on its web site, quoting an internal Federal Reserve analyst that the appropriate level of interest rate to stimulate the American economy would be minus 5 percent according to a Taylor rule approximation. As the short term nominal interest rate reached the near zero bound (and since it is not feasible to target an interest rate of minus 5 percent), the Federal Reserve initiated aggressive and imaginative policy responses to boost

the bank funding and other credit markets. Most of these measures are unconventional in a sense that they have never before been tried in practise in the United States.

Many of the policy responses are in line with the unconventional policy measures that were described in section 4. In the following sections we analyze the Fed's response in light of possible policy actions that can be undertaken even though the short term nominal interest rate is close to zero.

6.4.3 Communication policies

Federal Market Open Market Committee (FOMC) stated in March 2009 that “...*economic conditions are likely to warrant maintaining the federal funds rate at exceptionally low levels for an extended period.*” (Bernanke 2009b)

This signals that the FOCM intends to keep the federal funds rate close to zero for the foreseeable future. As discussed in section 4.1, the intention of such an announcement is to depress longer term interest rates, and affect the public's expectations about the future path for the short term nominal interest rate.

However, the FOMC has not stated explicitly how long the interest rates will be held low. Thus, they have made a conditional commitment: Keeping the short term nominal interest rate at low levels is not linked to fixed period of time, but rather to economic conditions. The FOMC has neither been explicit about which economic variables they focus on in determining when it is time to raise the target rate again. However, Chairman Ben Bernanke has hinted in his testimony to the House of Representatives that “...*economic conditions, including low rates of resource utilization, subdued inflation trends, and stable inflation expectations...*” are important in evaluating the stance of monetary policy.

In section 4.1 we described some more “radical” measures that can be applied to commit credibly to a low interest rate policy, such as issuing options or committing in advance to a policy rule. Neither the Federal Reserve nor Bank of England has made use of these measures under the current crisis.

The Fed can be criticized for not being more explicit about how long the “extended period of time” for low interest rate policy is expected to last. Similarly, they could be less discretionary in their communication about which economic variables they focus on in determining the stance of the interest rate policy. More open communication can increase

confidence in the low interest rate policy, and depress long term interest rates further. As mentioned earlier, quantitative easing in Japan worked mainly through the commitment channel since the adaptation of ZIRP. This empirical finding should encourage policymakers to seek more explicit commitment strategies.

Similarly, at the time when the Federal Reserve established its quantitative easing and credit easing facilities, no explicit commitment was made regarding how long these facilities would be maintained. Also, the Fed can be regarded as more vague compared to Bank of England in defining their operational target under these new policies.²³

We have argued previously, that the public's understanding of the policymaker's actions is probably especially important when implementing unconventional monetary policies. This requires active communication and transparency from monetary authorities. In late 2007 the Federal Reserve started to prepare more frequent forecasts covering longer time horizons and explain those forecasts to the public. In January 2009, the policymakers also added information about the levels to which economic growth, inflation and the unemployment rate were expected to converge to in the long run (Kohn 2010). These efforts can have contributed positively to public understanding of monetary policy goals.

It is an interesting empirical question whether communication by the Federal Reserve has indeed contributed to lower yields during the recent financial crisis. Some preliminary event studies suggest that the expected path of policy rates moved downwards when the FOCM announced in March 2009 that target rate would be held low for an "extended period" (Kohn 2010). However, this statement coincided with the announcing of expansion in the asset purchase program, so the marginal effect of the statement alone is hard to quantify. In addition, yields on Treasury securities were probably depressed additionally as international investors "flew to safety" and withdrew their funds from other securities markets and placed them to US Treasury securities instead. We return to this subject in section 7.6.

²³ BoE has stated that the operational target is still reaching the inflation target of 2 percent and quantitative easing is just another way of reaching this goal

6.4.4 Acting as a lender of last resort

The Federal Reserve implemented a number of programs designed to support the liquidity of financial institutions and promote improved conditions in financial markets. The new liquidity and credit programs led to significant increase in the size of the Fed's balance sheet accompanied by a change in the composition of assets held over time as well.

In the US, commercial banks hold reserve balances in order to fulfil reserve requirements and make interbank payments. Required reserves are calculated according to an average of a two week maintenance period with respect to the banks liabilities. Prior to October 2008, these reserves were not paid interest on, which implies that the supply of reserves was interconnected with the prevailing interest rate level. Hence, open market operations have traditionally played a crucial role in implementing monetary policy. The Federal Reserve announces a target rate for federal funds market (interbank market in the US), and ensures by open market operations that the market clears to this rate every day.

However, in October 2008 the Fed started paying interest on both required and excess reserves. Since December 2008 the interest rate paid to reserve balances had been equal to 0.25 percent. The reason for this policy initiative was to make the distinction between interest rate policies and balance sheet policies: By paying interest on reserve balances the Fed could increase the overall money supply and still have control over the federal funds rate. Shortly afterwards, the Fed announced the introduction of their large scale asset purchase programs.

In the following sections we will describe in detail how the Federal Reserve conducted its role as a lender of last resort. The descriptions of the facilities are in general based on Cecchetti (2009) and on the definitions used by the Federal Reserve in their home page.

Lending facilities to depository institutions

The discount window is a lending facility designed to provide short term credit for depository institutions. The existing facilities were used actively during the crisis to provide liquidity directly to the banking system. Since 2003 depository institutions have had access to three programs within the discount window facility, each with its own interest rate: *Primary credit*, *secondary credit* and *seasonal credit*. The conditions related to these facilities were somewhat modified during the crisis. All loans are fully secured by collateral.

Under the *primary credit program*, which is the Federal Reserve's main program within the discount window facility, loans are extended for a very short period of time, usually overnight, to depository institutions in generally sound financial position. Prior to the crisis, the primary credit rate was usually set 100 basis points above the Federal Funds target rate. In August 2007 as a response to the tightening credit conditions, the Federal Reserve reduced the spread between the primary credit rate and the target rate to 50 basis points. The Fed also began to allow the provision of primary credit for terms as long as 30 days. In March 2008 the spread was reduced further to 25 basis points, and the term was extended to a maximum maturity of 90 days. More recently, the conditions for primary credit have been tightened again to as a response to normalized financial conditions. In February 2010 the term was set again to overnight, and the spread was increased to 50 basis points.

Depository institutions that are not eligible for primary credit may apply for *secondary credit* to meet short term liquidity needs. The discount rate is typically 50 basis points above the primary rate. *Seasonal credit* is extended to relatively small depository institutions that have repeated intra-year fluctuations in funding needs, such as banks in agricultural communities. The interest rate for seasonal credit is an average of selected market rates.

Historically, there has been a certain stigma associated to borrowing at the discount window as this was interpreted as a sign of weakness in the financial markets. These concerns have previously deterred depository institutions from borrowing at the discount window when it in fact would have been appropriate to do so. This in turn has hampered the ability of the discount window to buffer shocks to the interbank market.

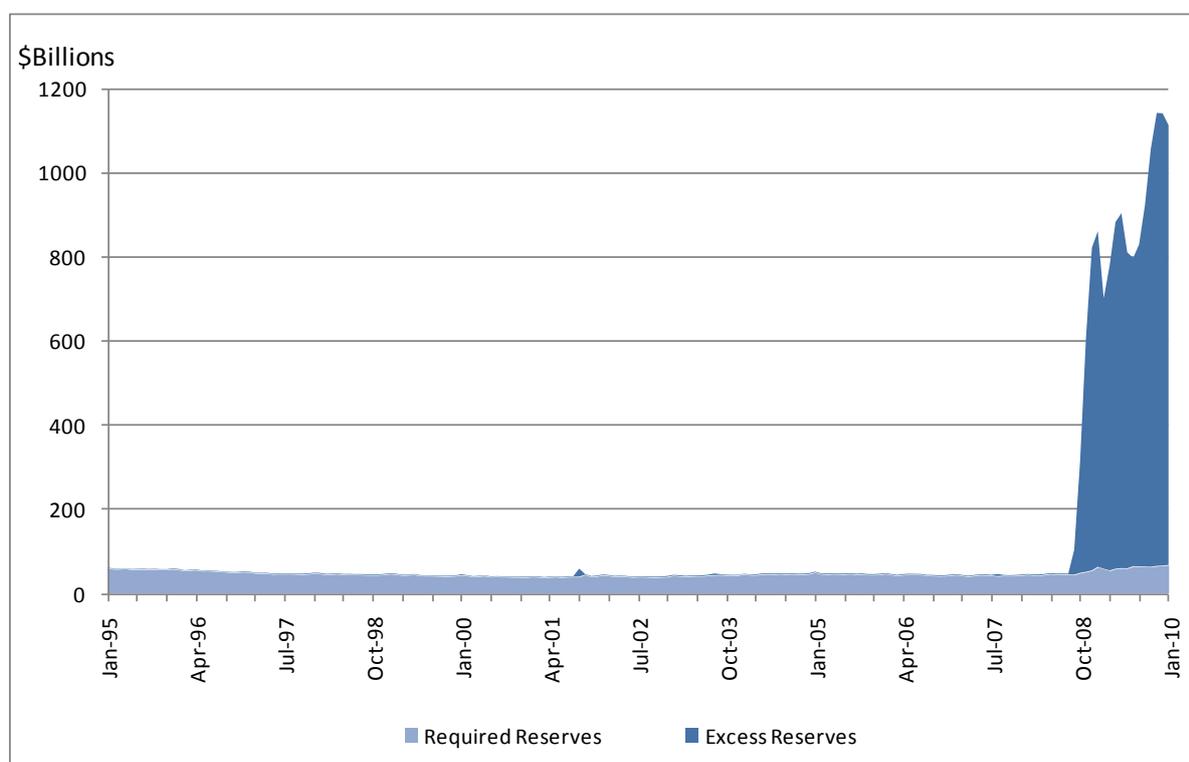
In the course of 2007, it became evident that additional reserves were needed to be injected into the banking system to alleviate pressures in bank funding markets. In December 2007 the Federal Reserve established *Term Auction Facility* (TAF) to supply additional reserves to the banking system and, to a certain extent, to remove the stigma associated to borrowing from the central bank. All depository institutions that were eligible for primary credit could participate in the TAF auctions. Through the end of 2009, the TAF program made available funds of 28-day and 84-day maturity, at an interest rate that was determined by the auction.

The TAF program has gradually been reduced in scope as conditions in funding markets have improved. The size and maturity of the auctions were reduced throughout 2009, and in

January 2010, the Federal Reserve announced that the final TAF auction would be conducted on March 8, 2010.

Due to the comprehensive provision of liquidity to depository institutions and their desire to “hoard for liquidity”, the level of excess reserves commercial banks hold at the Fed rose substantially. Even though the conditions in the funding markets have improved and some of the liquidity facilities have been shut down, depository institutions still choose to operate with excess reserves. Possible reasons for this are that holding reserves no longer represents as large an opportunity cost as before, since banks receive interest on all reserve balances they hold at the central bank. Similarly, there may be few profitable investment or lending opportunities: The returns from alternative financial investments with low risk, such as money market and Treasury securities, are currently modest, so holding reserves at the Fed may represent the most profitable investment opportunity for many depository institutions. Holding reserves at the Fed does not expose the depository institution to any risk at all, which may be desirable in the current situation as many commercial banks are replenishing their capital base after writing off large losses.

Figure 7 – USA: Required and excess reserves of depository institutions at the Federal Reserve 1995-2010



Source: Federal Reserve Bank of St. Louis

The Fed also established various lending and credit facilities to other financial institutions and investors expanding their traditional role as the lender of last resort. Table 2 presents a quick overview of all the liquidity facilities that were established as a response to the financial crisis. This policy is generally referred to as credit easing by the monetary authorities in the US, but we choose to discuss these facilities under this section. We return to credit easing and the composition of the Fed's balance sheet in section 6.4.6.

Lending facilities to other financial institutions and investors

Discount window is traditionally only available for depository institutions. In the course of the financial crisis, it became apparent that also other financial institutions were in need of liquidity provisions from the central bank.

The Federal Reserve conducts its open market operations through primary dealers. In normal times, the Federal Reserve Bank of New York operates a Securities Lending program for primary dealers. The purpose of this program is to provide a temporary source of Treasury and agency securities to primary dealers in order to promote the smooth clearing of these security markets. Securities are awarded to primary dealers based on competitive bidding in an auction held each business day. As this program proved to be insufficient during the financial turmoil, the Federal Reserve established programs aimed easing the financial constraints of primary dealers.

The Primary Dealer Credit Facility (PDCF), announced in March 2008, is an overnight loan facility to provide funding for primary dealers, who traditionally cannot borrow funds from the Federal Reserve. Loans through this program were fully secured by collateral with appropriate haircuts, meaning that the value of the collateral exceeds the value of the loan. Initially, approved collateral was restricted to investment-grade securities. However, in September 2008 the eligible set of collateral was broadened to match the types of instruments that can be pledged in the repurchase agreement systems of the two major clearing banks. This facility was closed in February 2010.

Term Securities Lending Facility (TSLF) is a weekly loan facility that provided loans of Treasury securities for one month using less liquid assets as collateral. Loans were awarded to primary dealers based on a competitive auction. The goal was to support liquidity of primary dealers and foster the functioning of financial markets and collateral markets more generally. This facility was also closed in February 2010.

To promote functioning of key credit markets, the Federal Reserve established programs that allowed direct lending to central borrowers and lenders in financial markets. Relative to the Fed's short-term lending to depository institutions, these programs are rather unconventional for a central bank to undertake.

Commercial paper is a key source of short term credit for many American companies. Rates in these markets spiked in the course of the crisis, and it became almost impossible for even high-quality firms to get financing for more than a period of 5 days. This exposed investors and firms to significant roll-over risk. *Commercial Paper Funding Facility* (CPFF) was established to address this kind of risk and to improve the overall functioning of the commercial paper market. Under this facility, the specially created limited liability company CPFF LLC purchased three-month unsecured and asset-backed commercial paper directly from eligible issuers. This program was closed down in February 2010.

Commercial paper markets rely heavily on money market mutual funds as investors. A day after the Lehman Brothers bankruptcy the oldest money market fund in the United States, Reserve Primary Fund, “broke the buck” and failed to maintain an asset value of 1\$ per share. This event triggered a run on other mutual funds. To prevent fire sales of fund assets and subsequent collapse in the commercial paper market, the Fed established two programs aimed at stabilizing the money market mutual fund market: *Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility* (AMLF) and *Money Market Investor Funding Facility* (MMIFF). These programs ended the runs to mutual funds to a large degree. Both programs have effectively been shut down at the current date.

Term Asset-Backed Securities Loan Facility (TALF), on the other hand, was aimed at restoring securitization markets that were virtually shut down during the crisis. Under the TALF, eligible investors may borrow with a term up to five years to finance their holdings of AAA-rated tranches of selected asset-backed securities. All TALF loans are overcollateralized.

Table 2 – USA: Overview of the facilities the Federal Reserve established during the financial crisis

Announcement date	Facility	Purpose of the Facility	Notes
12-Dec-07	Term Auction Facility (TAF)	Supply reserves to depository institutions by an auction mechanism, remove the stigma associated to discount borrowing	Last auction in March 2010
11-Mar-08	Term Securities Lending Facility (TSLF)	A weekly loan facility that provided loans of Treasury securities to primary dealers using less liquid assets as collateral. The goal was to promote liquidity in Treasury and other collateral markets and foster the functioning of financial markets more generally	Closed in February 2010
16-Mar-08	Primary Dealer Credit Facility (PDCF)	An overnight loan facility to support the liquidity of primary dealers, who traditionally cannot borrow from the Federal Reserve	Closed in February 2010
22-Sep-08	Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF)	A lending facility that financed the purchases of high-quality asset-backed commercial paper (ABCP) from money market mutual funds by U.S. depository institutions and bank holding companies. Aim was to foster liquidity in the ABCP market and money markets more generally	Closed in February 2010
07-Oct-08	Commercial Paper Funding Facility (CPFF)	Enhance liquidity situation in the commercial paper markets, provide short term financing to corporations	Closed in February 2010
21-Oct-08	Money Market Investor Funding Facility (MMIFF)	Provide liquidity to U.S. money market mutual funds and certain other money market investors, thereby increasing their ability to meet redemption requests and increase their willingness to invest in money market instruments, in particular commercial paper	Expired in October 2009
25-Nov-08	Term Asset-Backed Securities Loan Facility (TALF)	A funding facility that issues loans with a term of up to five years to holders of eligible asset-backed securities (ABS). The TALF is intended to assist the financial markets in accommodating the credit needs of consumers and businesses of all sizes by facilitating the issuance of ABS collateralized by a variety of consumer and business loans;	Planned to be closed in June 2010
1-Jul-09	Term Securities Lending Options Program (TOP)	Enhance the effectiveness of the TSLF by offering additional liquidity during periods of heightened collateral market pressures	Closed in February 2010

Source: The Federal Reserve, Cecchetti (2009)

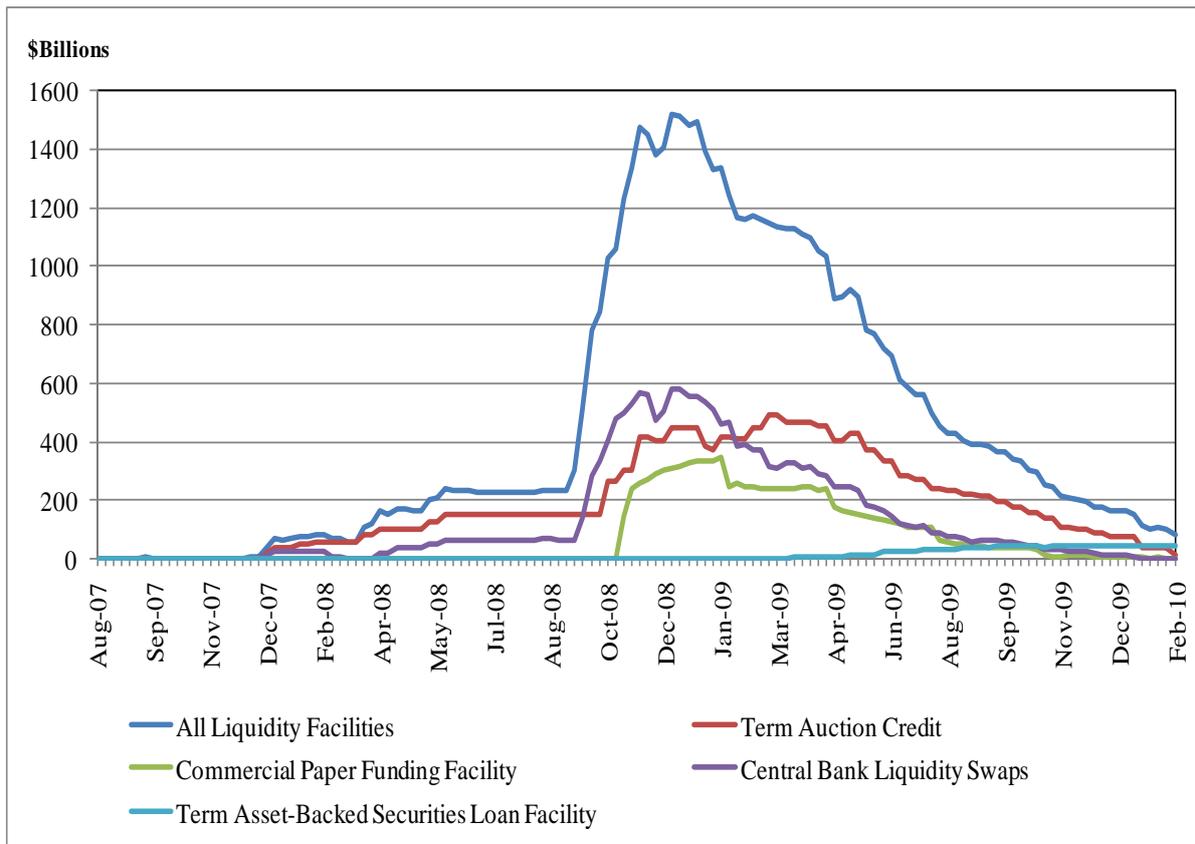
Central bank liquidity swaps

In addition to acting as a lender of last resort to American financial institutions, the Federal Reserve also became “the worlds” lender of last resort. Liquidity pressures in financial markets were not limited to the United States, and international funding markets are often based on dollar denominated securities and derivatives. As reallocation of funds within the interbank market was impaired and banks were unwilling to extend loans to each other, the supply of US dollars dried up in the marketplace.

To prevent intense strains in the global dollar funding markets from spilling over to U.S. markets, the Federal Reserve entered into bilateral currency swap agreements with 14 central banks around the world. These swap arrangements assisted foreign central banks in their provision of dollar liquidity to banks in their jurisdictions. Swap agreements had maturities ranging from overnight to three months, and were designed in such a matter that the Federal Reserve was not exposed to any foreign exchange or credit risk. The goal these swap agreements was to inject US dollars into the global banking system and to unfreeze the interbank markets. The Federal Reserve also announced liquidity swap lines with Bank of England, the European Central Bank, the Bank of Japan, and the Swiss National Bank in order to provide foreign currency for American financial institutions. However, these swap lines were not drawn upon. The central bank liquidity swaps expired in February 2010.

Figure 8 illustrates the development in the various liquidity facilities over time. Total credit outstanding under all programs has fallen sharply from a peak of over \$ 1400 billion to well below \$ 200 billion in February 2010.

Figure 8 – USA: Development in liquidity facilities 2007 -2010²⁴



Source: The Federal Reserve Board, Statistical Release H.4.1

Support to specific institutions

The Fed acted also as a lender of last resort by issuing credit to specific financial institutions that were considered systematically important. These institutions were Bear Sterns in March 2008 and American International Group (AIG) the day after Lehman Brothers bankruptcy in September 2008. The support to specific financial institution was to large degree coordinated with the Treasury.

²⁴ All Liquidity Facilities includes: Term Auction Credit; primary credit; secondary credit; seasonal credit; Primary Dealer Credit Facility; Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility; Term Asset-Backed Securities Loan Facility; Commercial Paper Funding Facility; and central bank liquidity swaps

6.4.5 Quantitative easing

In the second half of 2008, when the Federal Funds rate had effectively reached the near zero bound, monetary authorities decided to provide additional stimulus by large scale asset purchase programs. At first, the purchases were limited to debt of government sponsored enterprises (GSEs) and mortgage-backed securities that were guaranteed by these enterprises. Later on, the program was extended to include purchase of longer term Treasury securities.

In practise, the purchase of securities to the Fed's portfolio is conducted by open market operations. The Federal Reserve makes the distinction between temporary and permanent open market operations: Temporary open market operations are a part of the daily liquidity management operations of the Federal Reserve. They are conducted by primary dealers to address reserve needs that are regarded to be transitory in nature. The operations are typically conducted as repurchase agreements (repos) or reverse repurchase agreements. In practise, repos are equivalent to a collateralized loan from the central bank and represent "business as usual". Permanent open market operations, on the other hand, are outright purchases of certain securities that are absorbed in the Federal Reserve's portfolio. In normal times they are applied to accommodate the longer-term factors driving the expansion of the Federal Reserve's balance sheet, mainly the trend growth in currency in circulation. However, during the recent crisis, permanent open market operations were used to implement quantitative easing policies.

Agency Mortgage-Backed Securities Purchase Program

Following the steep declines in housing prices throughout 2007 and 2008, the Federal Reserve considered it to be essential to stabilize the housing market. In November 2008, the Fed announced that it would purchase large amounts of federal agency debt from Fannie Mae, Freddie Mac and the Federal Home Loan Banks. In addition, the Federal Reserve announced that it would buy mortgage-backed securities (MBS) that are fully guaranteed by Fannie Mae, Freddie Mac, and Ginnie Mae. The program was established with the explicit goal of reducing the mortgage rates and thereby increasing the availability of credit for the purchase of homes (Stroebel and Taylor 2009). The initial plan was to buy up to \$100 billion in government-sponsored enterprise (GSE) debt and up to \$500 billion in mortgage-backed securities.

Purchase of Government debt

In March 2009, the Federal Reserve expanded the program to include purchase of longer term Treasury securities. It announced that it would buy up to \$300 billion of longer-term Treasury securities in addition to increasing its purchases of GSE debt and mortgage-backed securities by respectively \$100 billion and \$750 trillion (Reis 2010). The purpose of this expansion to Treasury securities was both to increase the overall money supply the economy and to depress longer term yields and interest rates. Such a policy can thus be seen as complementary to communication policies that signal to the public that the nominal short-term interest rate will be held low for an extended period of time. Furthermore, depressing long term interest rates was also expected to contribute to lower mortgage rates thereby supporting the much troubled housing market (Stroebel and Taylor 2009).

Figure 9 – USA: The Federal Reserve’s holdings of assets held outright due to the asset purchase program



Source: The Federal Reserve Board, Statistical Release H.4.1

Similarly to the liquidity facilities, quantitative easing programs have been gradually reduced in scope. In August 2009, the FOMC announced that it would gradually slow the pace of its purchases of Treasury securities in order to promote a smooth transition in markets. In September 2009, they made a similar announcement regarding the purchases of agency and

agency mortgage-backed securities. The full amount of \$300 billion Treasury security purchases were finally completed in October 2009. In November 2009, the Federal Reserve announced that the total purchases for agency debt would be \$175 billion, somewhat less than anticipated, reflecting the limited availability of agency debt.

Some preliminary empirical studies try to quantify the effect of these large scale asset purchase programs. Gagnon et al. (2010) find that asset purchases conducted by the Fed led to significant reductions on long term interest rates in a range of securities, including securities that were not included in the purchase programs, such as corporate bonds and interest-rate swaps. However, they argue that these reductions in interest rates reflected primarily lower risk premia rather than lower expectations of the future short term nominal interest rate.

One of the goals of the asset purchases of federal agency debt and mortgage-backed securities was to lower the cost of home financing. Stroebe and Taylor (2009) examine the quantitative impact of these purchases, and find that the initial announcement of the program seemed to have reduced mortgage spread after controlling for changes in prepayment and default risk. However, they do not find any separate effect of the size of the stock of MBS purchased by the Fed.

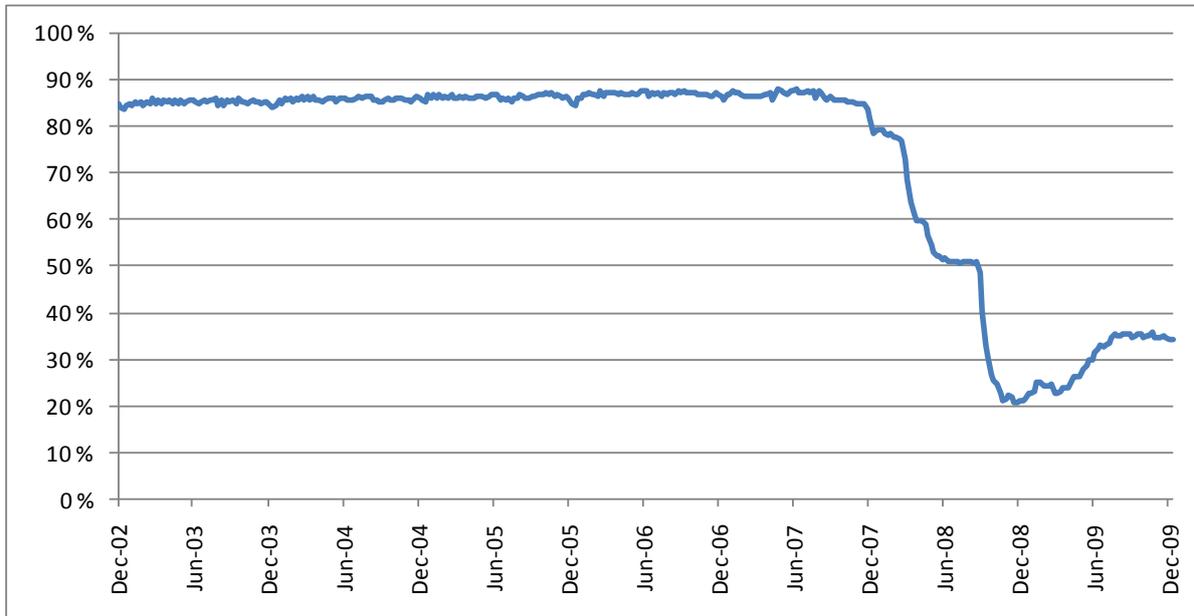
6.4.6 Composition of the balance sheet

As a consequence of the various policy responses, the both the size and composition of the Fed's balance sheet have changed radically on the course of the crisis. From October 2008, when Fed stopped sterilizing its open market operations, until January 2010 total assets of the Federal Reserve's have increased from approximately 900 billion USD to well over 2000 billion. The level of securities held outright has increased considerably due to the large scale asset purchase programs.

Prior to 2007, the Fed primarily held Treasury bills and other Treasury securities on the asset side of its balance sheet. During the last two years it has switched towards holding many other types of assets as well and, more recently, toward securities with longer maturity. As can be seen in Figure 10, the ratio of all U.S Treasury bills and Treasury securities held by the Fed relative to its total assets has decreased significantly due to unconventional policy responses. The same development can also be seen from Figure 11 that illustrates

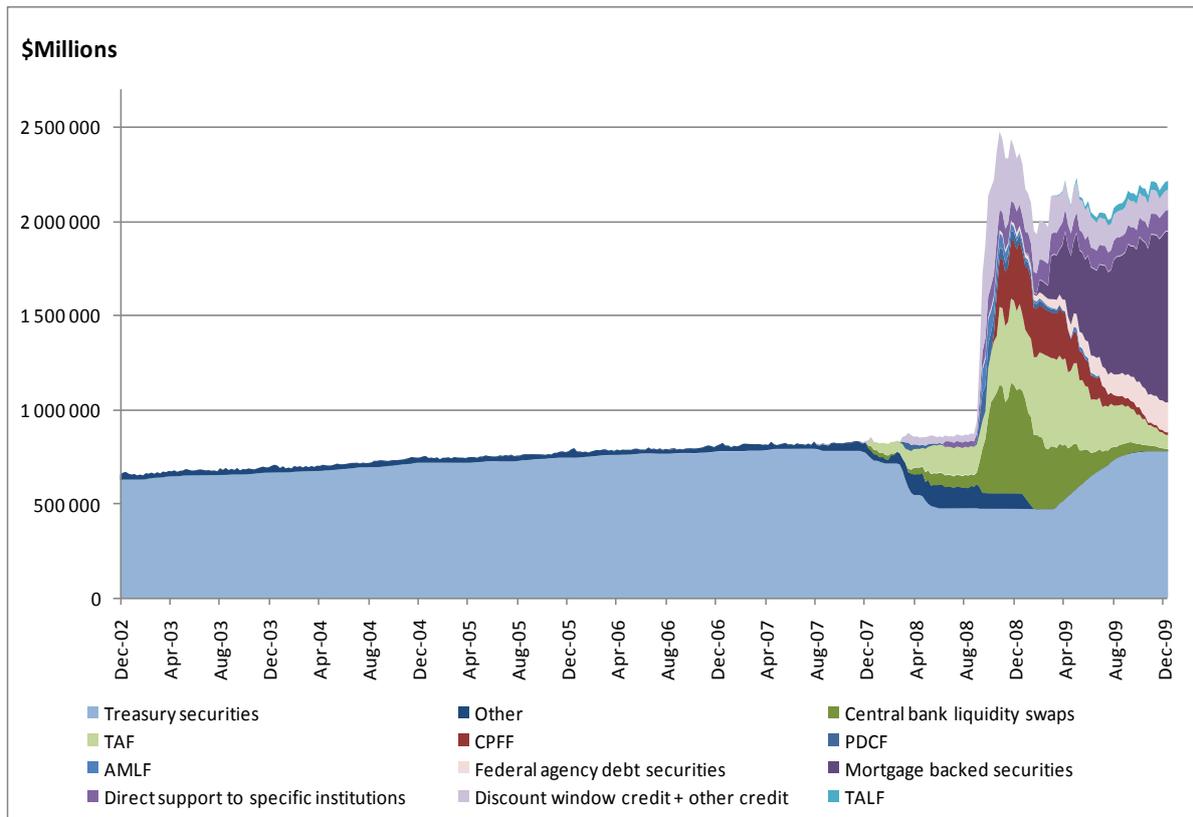
composition in the asset side of the Federal Reserve's balance sheet during the recent financial crisis.

Figure 10 – USA: The Federal Reserve's outright holdings of Treasury Securities as a fraction of its total assets



Source: Federal Reserve Board, Statistical Release H.4.1

Figure 11 – USA: Composition of the Federal Reserve’s assets side of the balance sheet



Source: Federal Reserve Board, Statistical Release H.4.1

Is credit easing, in fact, quantitative easing?

The Fed uses the definition credit easing when referring to their various liquidity facilities that were established as a response to the crisis. These facilities were discussed in detail in section 6.4.4. However, some of these credit facilities resemble quantitative easing in many ways.

The Fed argues that in pure quantitative easing the focus of policy is the quantity of bank reserves, whereas the composition of loans and securities on the asset side of the central bank's balance sheet is incidental. In contrast, under credit easing the central bank is acting as a lender of last resort providing liquidity to markets that have become dysfunctional, or that are operating poorly. The main focus of the credit easing approach is on the mix of loans and securities that the Fed holds, and on how this composition of assets affects credit conditions for households and businesses (Bernanke 2009a).

Earlier in section 4.2, we discussed the various definitions of quantitative easing policies. According to the BoE's definition, quantitative easing means that central banks buy public and private sector financial assets using central bank money. Using such a definition, one could also classify some of the Fed's liquidity facilities as quantitative easing policies. In particular, the facilities that were directed at providing liquidity directly to borrowers and investors in key credit markets could fall into this category.

In section 5.2 we described some of the possible transmission mechanisms of quantitative easing policies. Even though the Fed insists that credit easing facilities are not quantitative easing policies per se, we feel that, in practice, they do include some of the essential elements of modern quantitative easing. These interventions are not sterilized, resulting in an increase in both the Fed's balance sheet and the monetary base. These facilities entail a direct provision of money to the public sector changing the composition of their portfolios, at least temporarily. This has the potential to trigger, for example portfolio, rebalancing effects or adjustments in the holdings of "real money balances" as discussed in section 5.2.1.

Thus, we argue that the Fed's asset purchase facilities can be classified as quantitative easing policies when using a more "broad" definition of quantitative easing.

6.5 Bank of England's response to the financial crisis of 2007-09

6.5.1 Monetary policy regime and economic conditions prior to the crisis

Inflation targeting was adapted as a monetary policy strategy in the aftermath of the speculative foreign exchange crisis in September 1992 in order to strengthen the credibility of monetary policy and restore a nominal anchor for the economy (Bernanke et al. 1999).

To understand the implementation of monetary policy in the United Kingdom it is useful to examine the recent history of the Bank of England (BoE): Prior to gaining its independence in 1997 the bank had little control over the instruments of monetary policy. Monetary policy was conducted by the Chancellor of the Exchequer instead. Until 1997 the Bank of England was limited to exerting its influence over monetary policy through forecasting inflation and assessing past inflation performance, which it communicated through public recommendations. In doing so it acted as a “counter-inflationary conscience” for the Chancellor of the Exchequer (Bernanke et al. 1999). After gaining independence, the Bank of England continued to focus on communicating the monetary policy strategy to the public and emphasising commitment to price stability

Today the Bank of England practises flexible inflation targeting. Conventional policy at the BoE aims at setting the target rate in order to bring the inflation back to target within reasonable time without causing undue instability in the economy. The inflation target of two percent is a point target, but with “thresholds” on both sides. If inflation falls below one percent or rises above three percent the Governor of the Bank must write an open letter to the Chancellor explaining the reasons for the deviation and how the Bank intends to bring the inflation back to target (Bank of England 2010c).

The Bank of England had prior to the financial crisis of 2007-09 highlighted the dangers posed by the growth in the size and complexity of the financial sector in their public communication (King 2009). Broad money grew at an annual rate of almost 10 percent from 2002 to 2007. In addition, credit expanded much more rapidly than nominal income and lending to the private sector more than doubled in the five years to 2007. The development of securitization was an important factor behind boosted lending. Domestic economic growth

had been fuelled by the credit cycle and rising asset prices. The housing cycle had been particularly intense, as nominal house prices more than tripled in the ten years to their peak in the second half of 2007 (OECD 2010).

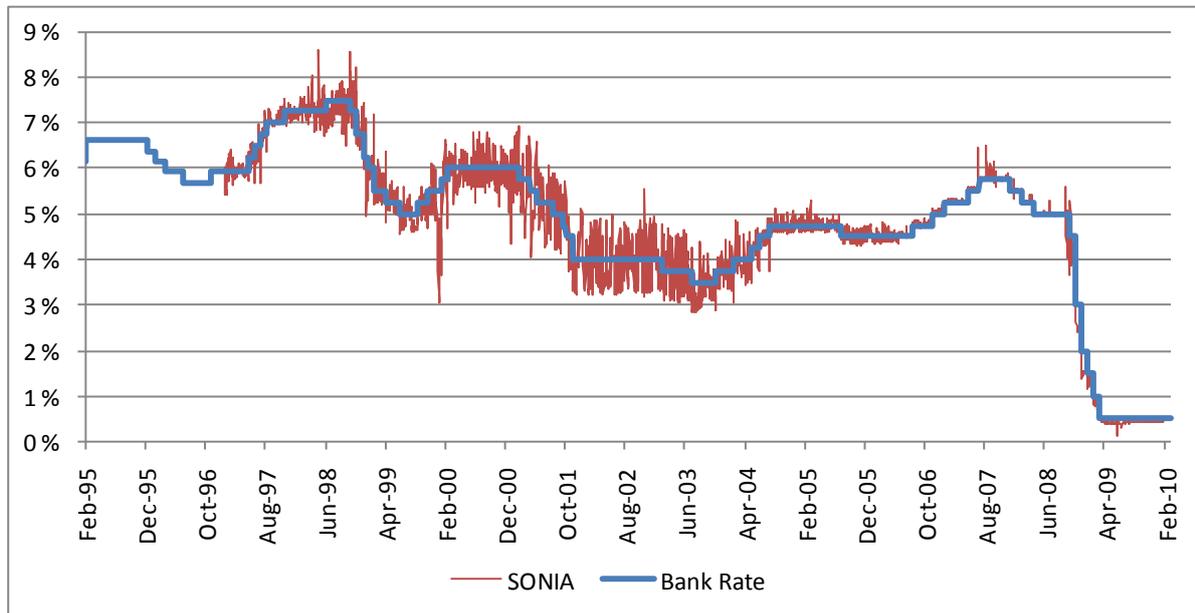
The business cycle began to turn in 2007 as turmoil hit international financial markets, and peaked in early 2008. A year later real GDP had declined by over 4 percent and a further decline was expected (OECD 2010). As the United Kingdom is a very open economy, developments in global financial markets have a significant impact on economic development.

The actions taken by the Bank of England to support the economy during the financial crisis are *“truly, historically massive – both in terms of liquidity insurance and operations and monetary policy”* (Fisher 2009). The next sections are dedicated to describing these massive policy responses from the Bank of England.

6.5.2 Interest rate policy

The BoE’s Monetary Policy Committee (MPC) conducts monetary policy by setting the Bank Rate, which is the target rate that the BoE remunerates reserves and provides short-term funds to banks. The policy rate was lowered gradually from 5 percent to 0.5 percent between October 2008 and March 2009. This is the lowest level of the Bank Rate since the Bank of England was founded in 1964 (Guardian 2009).

Figure 12 – UK: Development in the Official Bank Rate and SONIA 1995-2010, daily quotations²⁵



Source: Bank of England Statistics

The MPC has communicated that 0.5 percent is the floor for the policy rate, as lower rates are viewed as potentially counterproductive. The main reason for this is an institutional feature of UK retail financial markets: Many lending products are indexed to the bank rate and with commercial deposit rates already close to zero the MPC was concerned that further bank rate cuts would squeeze lenders' interest margins and as a result further tighten credit supply (Meier 2009).

After the floor for policy rate was reached in March 2009, further monetary stimulus had to be provided by unconventional means. Consequently, at the same time as the last cut in the bank rate, the Bank of England announced the introduction of their quantitative easing programme, which will be discussed in section 6.5.5.

²⁵ SONIA = Sterling Overnight Interbank Average (available since January 1997)

6.5.3 Communication policies

The Bank of England has traditionally had a strong focus on communication. Also, throughout the financial crisis the Bank has emphasized the importance of clear communication, highlighting the importance of public understanding of unconventional monetary policy.

However, BoE has not made any explicit commitment to keep interest rates low for an extended period of time. The BoE does principally neither publish target rate projections nor comment on likely future policy rates (as the Fed has done recently and the BoJ did under ZIRP ten years ago). The BoE publishes detailed projections of inflation and GDP growth, but there is no explicit communication regarding the future level of the bank rate. In our view, this weakens the potential of communication to shape expectations about the future setting of the policy rate.

However, the MPC came close to communicating its outlook for policy rates in the May 2009 inflation report, by indicating that it expected inflation to remain below the 2 percent target through mid-2012 “*on the assumption of an unchanged monetary policy stance*” (Meier 2009). This provided an indirect signal to the market that the MPC did not anticipate rate increases for a while under its main scenario.

Regardless of implementation of more unconventional monetary policies, the objective of BoE still remains reaching the inflation target in the medium term. According to BoE, communication of commitment to the inflation target is a crucial element in ensuring the effectiveness of monetary policy. By demonstrating that the MPC will do whatever it takes to meet the inflation target, expectations of future inflation should remain anchored to the target when there is a risk that they may otherwise have fallen. Even with nominal interest rates fixed at very low levels, sufficiently high inflation expectations will keep real interest rates a lower level encouraging greater spending (Benford et al. 2009).

When introducing the Asset Purchase Programme in March 2009, the Governor of the Bank of England Mervyn King emphasised the importance of operating the Asset Purchase Facility in an open and transparent manner. To fulfil this transparency requirement the Bank of England has published the *Asset Purchase Facility Quarterly Report* shortly after the end of each quarter since 2009. The report gives an overview of the transactions made as part of

the facility and evaluates policy effectiveness. The report complements the usual information given on the MPC's monetary policy decisions in the BoE Inflation Report.

6.5.4 Acting as a lender of last resort

The Sterling Monetary Framework (SMF) is the means by which the BoE implements monetary policy, and offers liquidity to the banking system. Using the framework the BoE controls the amount of liquidity in the economy consistent with monetary policy objectives. The liquidity management operations provide temporary, short-term liquidity assistance to commercial banks to help minimize disruptions in the liquidity and payments services. The framework does not provide medium- or long term funding to the banking sector in normal times.

To understand the implication of the changes in the BoE liquidity provisions during the financial crisis of 2007-09 it is important to understand how the bank undertakes this function in normal circumstances. The Sterling Monetary Framework was revised and introduced in its current form in May 2006 with three main elements: Reserve accounts, standing facilities and open market operations (Fisher 2009). The combined operations have the goal of keeping overnight and other short term interest rates broadly in line with the bank rate. The functioning of the SMF is summarized in Table 3 below.

Table 3 – UK: Overview of the Bank of England Sterling Monetary Framework

Reserve Accounts	<p>Commercial banks choose voluntary reserve targets at the start of each monthly maintenance period between MPC meetings. The voluntary targets are a unique feature of the UK system.</p> <p>Reserves are remunerated at bank rate as long as they average within a narrow range around their target.</p> <p>Commercial banks choose the level of reserves on a daily basis.</p>
Operational Standing Facilities	<p>Operational Standing Facilities can be used by reserve account holders in case of operational disruption or exceptional volatility in overnight interest rates.</p> <p>Reserve account holders can both borrow and lend unlimited amounts overnight to the BoE via Operational Standing Facilities, but at a penal rate compared with bank rate.</p> <p>Provided that banks are able to meet their individual reserve targets, this framework provides incentives for participants to arbitrage and minimise any difference between market rates and Bank Rate.</p>
Open Market Operations (OMOs)	<p>Through OMOs the BoE provide sufficient liquidity to the system to enable banks to collectively meet their targets for reserve accounts.</p> <p>OMOs are ordinarily the balancing item on the balance sheet and their size reflects all the day-to-day sterling flows across the Bank's balance sheet.</p> <p>OMOs take the form of loans against high quality collateral for a fixed term. In principle, these loans could be made via short-term operations. However, implementation of efficient monetary policy does not require the Bank to roll over its entire stock of loans each week. Therefore, parts of the loan issues are provided by instruments of a longer maturity.</p> <p>As of January 2006, the Bank started to offer longer-term repo operations at market rates for three, six, nine or twelve month maturities. In January 2008, the Bank began to conduct purchases of UK government bonds, as a device to match the duration of the note issue with even longer duration assets.</p>

Source: The Bank of England, Fisher (2009)

The financial market turmoil led to illiquidity in the interbank market from August 2007, and some UK banks were particularly exposed due to their heavy reliance on short term market financing rather than deposits (OECD 2009). In response to the stresses in the bank funding markets from August 2007 onwards, UK banks voluntarily chose to hold more reserves. In September 2007, the commercial banks in the UK collectively raised their targets by £ 1.1 billion. However, Bank of England regarded this as insufficient for maintaining liquidity in the markets. Thus, BoE expanded its lending operations beyond the amount needed for banks to meet their targets, and during September 2007 an additional £ 9 billion was injected. At the same time BoE widened the target ranges for reserves that were remunerated reserve in order to not penalise commercial banks for holding reserves in excess of their voluntary targets. As the financial crisis evolved, BoE started to pay interest to *all* reserve balances held at the central bank.

It should be noted that the limited use of the Standing Facilities during the financial crisis indicates that there is a certain “stigma” related to use of the facility by depository institutions (OECD 2010).

Extended collateral three-month repo OMOs

As the financial crisis progressed during the autumn of 2007, it was clear that the lack of liquidity in market was preventing UK banks from funding themselves through normal means. To begin with, the BoE provided additional three month repos against wider collateral but at a penalty rate, through four auctions of £ 10 billion each. However, the UK banks showed little interest towards these auctions. By December 2007 the conditions in the bank funding markets had become even more constrained. As a consequence the BoE offered additional three month repos against even wider collateral without a penalty rate. The extended collateral included AAA Residential Mortgage Backed Securities (RMBS) and covered bonds.

When the conditions in the funding markets deteriorated further as the financial crisis evolved, the BOE offered these extended collateral long-term repos in greater size, at greater frequency and with an even wider eligible collateral including securities backed by commercial mortgage assets and corporate debt. The outstanding stock peaked in January 2009 at £ 180 billion (Fisher 2009).

Special Liquidity Scheme

In April 2008 BoE introduced the Special Liquidity Scheme (SLS) to improve the liquidity position of the UK banking system. The purpose of the scheme was to allow banks and building societies to swap high-quality, but temporary illiquid, mortgage-backed securities and other securities for more liquid UK Treasury bills. The liquidity in interbank money markets was severely reduced and interbank lending rates had risen sharply above policy rates. This reflected a lack of trust between depository institutions, due to uncertainty about the scale of losses on holdings of US subprime mortgages and the lack of transparency about the distribution of losses across institutions.

The three key principles of Special Liquidity Scheme were:

- i. Large scale (it peaked at £ 185 billion)
- ii. Medium term horizon of up to 3 years
- iii. Avoid inappropriate future incentives for bank action (“moral hazard”), as only assets already on commercial banks’ balance sheets at the end of 2007 were eligible.

Reflecting the current state of the funding markets, all the main UK banks agreed to take part in the scheme. The SLS swaps were structured similar to stock lending transactions, with banks paying a fee for the funds they borrow. The swaps do not occur directly on the central bank balance sheet as funding for the SLS swaps came from issuing UK Government Treasury bills. The collapse of Lehman Brothers in 2008 and the following strain in the markets resulted in an extended drawdown period from October 2008 to the end of January 2009.

Discount Window Facility

The Discount Window Facility (DWF) was introduced in October 2008 as a new and permanent liquidity insurance facility. Like Special Liquidity Scheme the transactions under the discount window do not appear on the central bank balance sheet. Through the DWF banks and building societies can borrow long term government securities against a wide range of collateral, at fees ranging from 50 to 400 basis points or higher than the bank rate reflecting the type of collateral and the size of the institution’s DWF exposures. In “exceptional” circumstances the DWF can also provide cash to depository institutions, but

such a decision will be made by discretion on a case-by-case basis. Four types of collateral are eligible:

- i. Highly rated sovereign bonds
- ii. Other high quality debt that is tradable in liquid markets
- iii. High quality debt and other transferable instruments not tradable in liquid markets
- iv. “Own name” instruments

Responding to market needs, the BoE expanded the drawing period to 364 days in January 2009, in addition to the standard option of 30 days.

One of the main goals of the discount window facility was to discourage imprudent liquidity management by commercial banks in the future. The introduction of the facility was a significant change in the BoE operational framework, as it is a new, permanent public facility. The basic principle for the DWF is that the BoE must be able to value and manage the associated risks with any collateral admitted as eligible. In the event of counterparty default, the BOE will take ownership of associated collateral. “Own-name collateral”, which is assets generated by the borrowing bank, has the highest fee. Careful management of the discount window facility by the BoE is critical, as allowing for wider ranges of collateral changes the risk in the central bank balance sheet.

Central bank liquidity swaps at the Bank of England

Poor liquidity in inter-bank funding markets became more acute and widespread from September 2008, and as a result the BoE established a swap facility with the Fed to be able to offer dollar funding to commercial banks. The central bank liquidity swaps have previously been discussed in more detail under section 6.4.4.

The one-week Bank of England bill

Until March 2009, the flexibility in the existing monetary policy framework was sufficient to implement monetary policy, with the exception of draining excess liquidity. As extra liquidity was injected to the banking system in a large scale during the autumn of 2008 there was more central bank money in the system than was needed to meet the demand for banknotes and reserve accounts. The liquidity insurance operations were creating a challenge for monetary policy control. The one-week Bank of England bill was introduced as a new

instrument to enable draining of liquidity from the system. The one-week bill was offered at Bank Rate, in a weekly tender. The offering peaked on January 8th 2009, when over £100 billion of bills were issued. During the asset purchase program, one-week bills were charged at variable rate (Fisher 2009).

To sum up, BoE's role as a lender of last resort has been rather limited, mainly consisting of extensions of already existing facilities. The average maturity of reverse repo operations has increased since the beginning of the financial crisis, but the Bank has not deviated from the usual auction format, thus letting market forces determine the prices of longer-term funding sources. A more significant change is the widening of the accepted collateral under the 3-month reverse repo operations, which, along with the Special Liquidity Scheme, directly addressed the shortage of standard collateral and the resulting squeeze on bank's term funding.

In our view, this reflects hesitation on Bank of England's behalf to extend beyond their traditional role. This indicates that the liquidity provisions were not aimed directly at stimulating aggregate demand, but rather to preserve the operation of the banking system. Similarly, the relaxed collateral requirements for repurchase agreements are likely targeted at keeping the SMF operational and securing short-term lending to banks at the bank rate when banks run out of standard collateral (Meier 2009).

6.5.5 Quantitative Easing

In March 2009 Bank of England announced an asset purchases programme of £75 billion financed by the issuance of central bank reserves. The creation of reserves is mentioned explicitly and seems to be regarded as central a part of the quantitative easing strategy in the UK.

When announcing the quantitative easing policy the Bank of England stated that it simply shifted the instrument of monetary policy from the policy rate, which is the price of money, to the quantity of money provided. BoE also clarified that its policy objective remained unchanged and it considered influencing the quantity of money directly as a different means for reaching the inflation target.

The BoE Asset Purchase Facility (APF) was established as a subsidiary of the Bank of England on January 30th 2009. This was before the bank rate had reached its lower bound of

0.5 percent. The initial purpose of the facility can be thought of as sterilized credit easing, conducted alongside conventional monetary policy: The objective was to improve liquidity in central markets and increase flow of corporate credit, through making selected purchases of high-quality private sector-assets. The purchases were initially financed by the issuance of treasury bills. The facility was authorized to buy commercial paper, corporate bonds, government-guaranteed bank bonds, asset-backed paper from viable securitization structures, and syndicated loans (Meier 2009; BOE Quarterly Report APF Q1 2009). In February 2009, the BoE started buying unsecured corporate bonds, focusing on the primary market.

The Asset Purchase Facility is a separate legal entity with indemnity assurance from the Treasury for potential losses. In principle the operational responsibility could have been assigned to any other institution with adequate technical expertise.

In March 2009 the scope of the Asset Purchase Facility was extended to function as an explicit monetary policy tool. As of March 2009 asset purchases were financed through issuance of base money instead of Treasury bills. In exercising this option the BoE effectively embarked on a strategy of quantitative easing. The APF was initially authorized to buy assets up to a total of £ 150 billion, where £ 50 billion were designated to private sector assets. The total amount was later extended to £ 200 billion.

Bank of England has expressed that the aim of the Asset Purchase Facility is to be a ready buyer if needed. Even if actual purchases are relatively small, the knowledge that the Bank stands ready to purchase assets should increase investor confidence and support asset prices. Thus, the asset purchase facilities for commercial paper and corporate bonds need not necessarily be extensive in order to be effective (Benford et al. 2009).

Under the quantitative easing strategy BoE continued purchases of private sector assets, including both unsecured commercial paper and investment-grade corporate bonds. The BoE's stated that the purpose of the purchases was to improve market functioning, reduce illiquidity spreads, catalyze new issuance, and thus boost private market activity (Meier 2009).

As seen in Table 4 below, the purchases in the targeted private credit markets have been relatively limited. The majority of quantitative easing purchases have consisted of reverse auctions for gilts (UK government bonds), with targeted residual maturities between 5 and 25 years. At the end of the first quarter of 2010, the gilt holdings in the facility amounted to

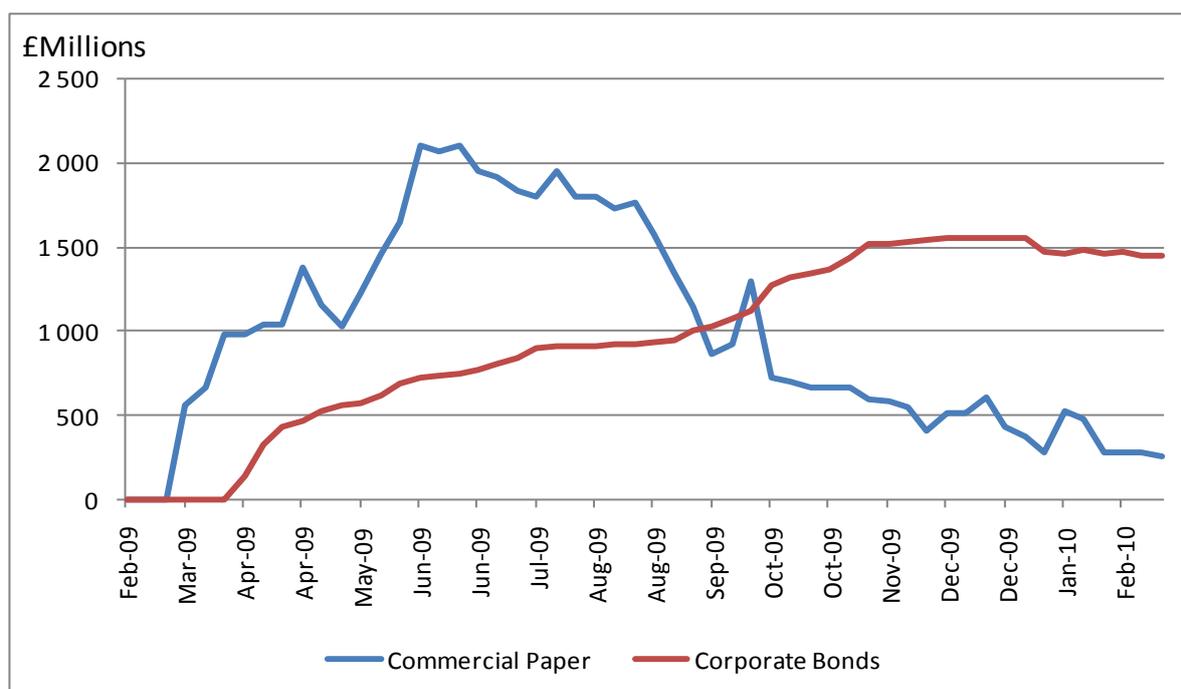
99 % of total holdings. The development in weekly holdings in the APF can be seen in Figures 13 and 14 below. It is interesting to note the significant difference between the quantities purchased: While holdings of commercial peaked at about £ 2 billion and corporate bonds peaked at about £ 1.5 billion, the holdings of gilts have reached a total amount of about £ 198 billion. The composition of the asset purchases reflects the BoE goal of injecting a significant amount of liquidity into private sector portfolios over a short time horizon without exposing the central bank to extensive credit risk.

Table 4 – UK: Overview of assets held by the Asset Purchase Facility in April 2010

APF Purchases (£ millions)	
Gilts	£198,275
Commercial Paper	£50
Corporate Bonds	£1,338
Total	£199,663
Gilt Purchases (percentage of total purchases)	99%

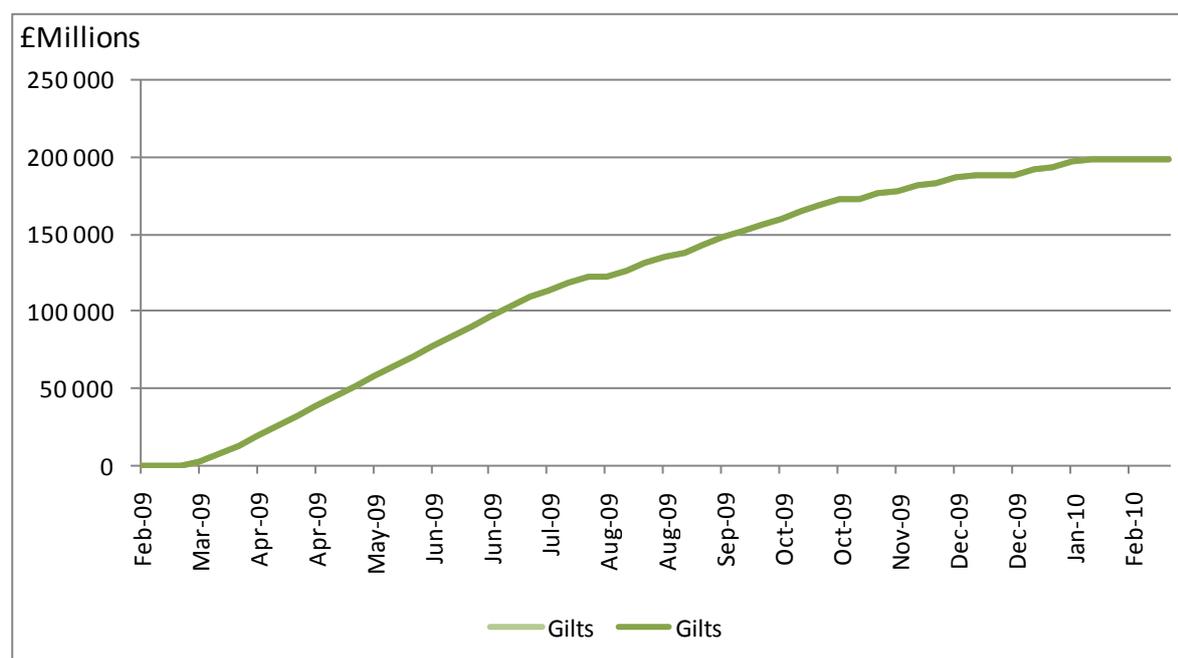
Source: BoE Asset Purchase Facility Quarterly Report, Q1 2010 26 April 2010

Figure 13 – UK: Bank of England weekly asset purchases of commercial paper and corporate bonds



Source. Bank of England

Figure 14 – UK: Bank of England weekly asset purchases of gilts



Source: Bank of England

As a result of the large scale asset purchases commercial banks ended up holding vast amounts of excess reserves. As BoE started to remunerate *all* reserve balances, depository institutions could easily hold reserves in excess of their voluntary targets.

The initial decision to undertake a quantitative easing programme suggests a clear quantitative reference to the relationships between narrow money, broad money and nominal demand. To begin with the BoE set out to purchase £ 75 billion of assets in the period from March 2009 to June 2008. This was calibrated to make up for a projected shortfall in nominal demand of about the same amount (5 percent of GDP), based on an assumed marginal money multiplier and velocity of money equal to one (Meier 2009). There is significant empirical and theoretical uncertainty surrounding this assumption and the transmission mechanism of quantitative easing, and relying on such a theoretical relationship can be seen as quite controversial. The MPC have not referred to this relationship in any public communication since.

In the UK quantitative easing has effectively been put to a halt since February 2010, as all purchases after this date have been sterilized. In March 2010 the Monetary Policy Committee announced that the full amount of asset purchases would be held at £ 200 billion. Recently only small, selected and sterilized purchases of corporate debt have been made. This strategy is consistent with what the BoE calls “acting as market maker of last resort”, in

order to maintain market stability and prevent financial conditions from disturbing the wider economy.²⁶

To examine the preliminary results of the quantitative easing strategy, we look at the latest Asset Purchase Facility Report from the Bank of England.²⁷ Corporate bond spreads have decreased by a cumulative 200 basis points since the BoE introduced its asset purchase facility. Credit default swaps on corporate bonds in the UK have been at a historically high level since the collapse of Lehman Brothers in 2008, but are now back to a more normal level.

The BoE commercial paper and corporate bond purchases were designed to buy limited amounts of eligible bonds through auctions, as long as the spreads offered by sellers were above an undisclosed reservation level. Primary market spreads for commercial paper have mostly remained below the spreads offered by the BoE during the first quarter of 2010. Thus, market solutions have recently been more attractive than the solution offered by the central bank.

The market for commercial paper has been liquid enough to enable most issuers to obtain funding of the size and maturity requested. However, the outstanding amount of commercial paper has been declining almost continuously since the end of 2008 and continued to decline during the first quarter of 2010. This reflects to a large degree a fall in the demand for short term funding. In comparison, issues of corporate bonds in the first quarter of 2010 were below the level of a year ago, but above the historical average.

It is difficult to determine the specific impact of the quantitative easing strategy. The BoE's asset purchases have coincided with a general recovery of asset prices and a decline in risk spreads. Thus, the developments have occurred against a broader backdrop of financial market stabilization (Meier 2009). This makes it difficult to ascertain the specific effect of the APF asset purchases.

²⁶ For a more detailed description of the results see BoE Asset Purchase Facility Report Q1 2010.

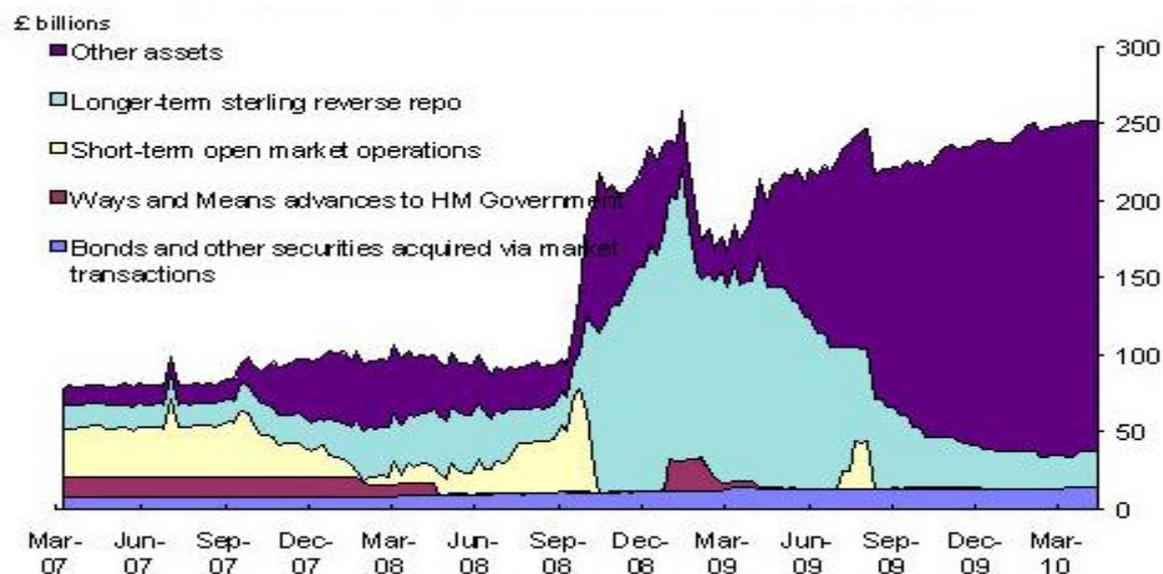
6.5.6 Composition of the balance sheet

Normally, the size and composition of the balance sheet does not play an independent role in the implementation of monetary policy. By setting interest rates the Bank of England determine the price of money, and supply the quantity of money consistent with that price. Until the Asset Purchase Facility was introduced, the actions taken by the Bank of England had mainly consisted of liquidity management operations.

The implementation of the unconventional monetary measures during the financial crisis of 2007-09 has undoubtedly influenced the Bank of England balance sheet, reflecting the extraordinary policy measures that have been adapted. The larger scale of activities and the wider range of collateral have also increased the riskiness of the BoE balance sheet, and thus raise the importance of good risk management.

The development of the consolidated BoE balance sheet is illustrated in Figures 15 and 16. The significant increase in other assets in Figure 15 below since March 2009 is mainly caused by the asset purchases under the Asset Purchase Facility.²⁸

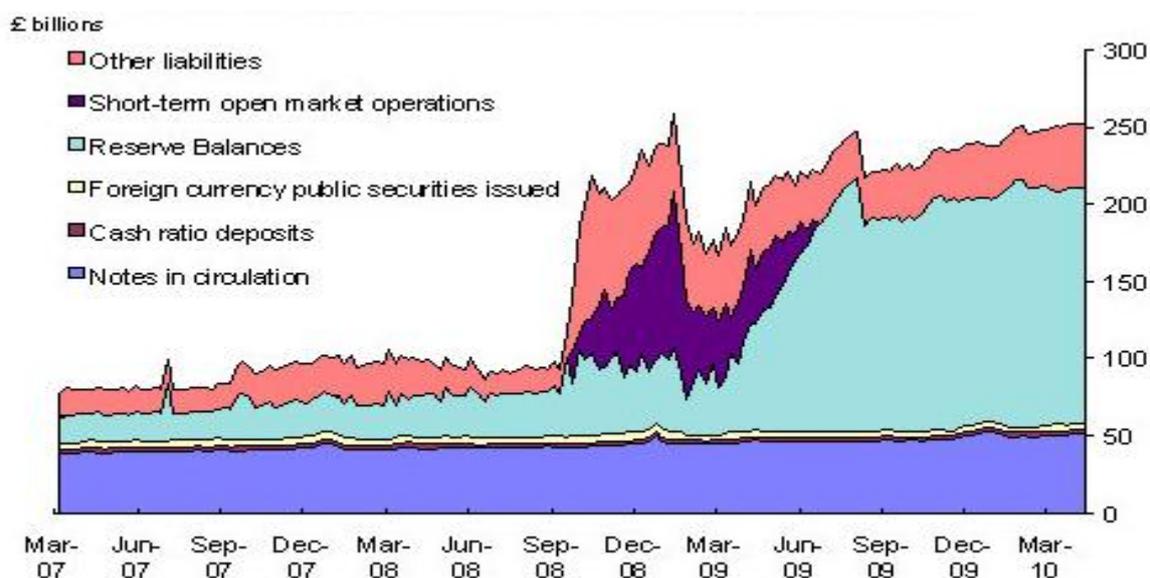
Figure 15 – UK: Bank of England consolidated balance sheet: Assets



Source: Bank of England

²⁸ The accounts of the Bank of England Asset Purchase Facility Fund (BEAPFF) are not consolidated with those of the Bank of England, but the BEAPFF is financed by loans from the Bank of England and those loans are included in other assets in figure 15.

Figure 16 – UK: Bank of England consolidated balance sheet: Liabilities.



Source: Bank of England

Despite the large scale of asset purchases, the Bank of England has been pursuing a relatively cautious approach to credit risk. As Meier (2009) points out, this is apparent from:

- i. The quantitative emphasis on government bond purchases
- ii. The focus of private sector asset purchases on a few selected credit markets, with clear limitations for credit risk.
- iii. The design of the private sector asset purchases as a backstop, which puts the BoE into a position of marginal facilitator, rather than a significant provider of credit.

The two last points are highlighted by the scope of private sector asset purchases, as they are significantly below the Treasury authorization of a maximum amount of £ 50 billion. Even considering the more limited size of nonbank credit markets in the UK relative to the US, it can be argued that the APF underexploites its scope for direct financial support to the real sector.

To sum up, the Bank of England has implemented unconventional monetary policy with a broad scope during the financial crisis of 2009-07. However, the BoE have shown conservatism with regards to implementation of unconventional policies: The APF is a separate legal entity with indemnity for losses from the Treasury. The BoE has not taken

much credit risk through the asset purchase facility. Nevertheless, extensions of eligible collateral have increased the credit risk of the BoE portfolio. The liquidity provisions from BoE have mainly been based on the already existing frameworks. Thus the BoE has not gone far beyond its traditional role as a “lender of last resort”.

6.6 Exit strategies and longer term issues regarding unconventional monetary policies

There is no doubt that monetary policy responses by Fed and BoE have been highly accommodative the last couple of years. As the economy recovers, it is necessary to tighten monetary conditions to prevent the development of inflationary pressures. In order to do so, central banks need tools to reverse the monetary stimulus.

Two key dimensions for the timing of an exit strategy are, first, the appropriate level of interest rates, and second, the desired central bank balance sheet structure. The interest rate level is likely to be dictated by considerations about the traditional inflation output trade-off. The central bank balance sheet structure, on the other hand, is likely to be influenced by considerations of market impact and potential disruptions that an unwinding might cause (Borio and Disyatat 2009). Speed and sequencing of monetary action throughout the exit phase might also be crucial. The matter is complicated further by the uncertainty surrounding the transmission mechanism at the zero lower bound.

6.6.1 Inflationary pressures and excess reserves in the banking system

Excess reserves in the banking system represent a potential threat to accelerated inflation. This threat can be realized *if* depository institutions use the reserves to support a rapid increase in lending. As the economy recovers, central banks need to drain some of the reserves in a timely matter. The more confident the public is that central bank has the tools available to reverse the stimulus, the less fearful should the public be that the unconventional policy will lead to excessive inflation.

A tightening of monetary policy can either be done by raising the target rate or by selling assets back to the market, or by a combination of the two. Still, the overall size of the balance sheet may remain larger than the pre-crisis levels for a long time, to a large extent because banks may chose to hold higher reserve balances than before the crisis.

Paying interest on banks' holdings of reserve balances can be a useful tool to control future inflationary pressures, as it allows central banks to decouple their balance sheet policies and

interest rate policies. By increasing the interest rate paid on reserve balances, a central bank is effectively putting upward pressure on the short term nominal interest rate. This system enables central bank to raise the target rate should inflationary concerns require this, while still operating with excess reserves in the banking system. Thus, the path of the short term interest rate can be set independently of the level of reserves.

However, in the presence of large excess liquidity balances, an increase in the policy rate can be less contractionary than usual, as the increased remuneration on reserve balances boost bank profits and lending at a time where the central bank objective is a tightening of the policy stance (Meier 2010).

Excess reserve balances will be reduced automatically as some of the longer term assets Fed and BoE owns mature or are prepaid (Bernanke 2010). Also, most of the extraordinary liquidity facilities are priced at a premium above market prices, meaning that these facilities will automatically unwind as they become less attractive compared to market solutions. Both BoE and Fed have applied this strategy in pricing of their liquidity injections.

The level of excess reserves in the banking system, both in the US and UK, reflects the size of the central banks' liquidity provisions, but does not necessarily imply that they will have an effect on bank lending as we discuss in section 7.3. If financial conditions improve, and the need to drain excess liquidity becomes urgent, both Fed and BoE can use existing facilities, such as reversed repurchase agreements to drain liquidity from the banking system. Alternatively, central banks can sell assets from their portfolios in the open market. This would decrease both the level of reserves and the size of central banks' balance sheet. It should also be noted that central banks are currently developing new tools to be able to drain reserves from the banking system in a timely matter. An example of such an innovation is the one-week bill of the BoE.

The Japanese example gives confidence that it is possible to reverse the large monetary stimulus without much disruption in financial markets. The exit from quantitative easing in Japan was announced in March 2006 and conducted in a well-managed fashion and in just 3-4 months. As the BoJ had clarified the economic conditions that would warrant a termination of the strategy, the economic agents were probably able to predict the approximate timing of the termination of the policy. The rapid exit was carried out mainly by selling the most flexible assets on the balance sheet, which were treasury bills purchased from the banking

sector. BoJ also chose to reduce its holding of long term government securities slowly, in order not to disturb supply and demand conditions in Japanese bond markets. The reduction of excess reserve balances is also evident from Figure 5.

The BoJ highlighted in their communication that the termination of quantitative easing would not be followed by any sudden policy changes and that the policy rate adjustment would proceed gradually, while also taking the conditions in interbank market into consideration (Shiratsuka 2010). To sum up, there seems to be a consensus that the Japanese exit strategy was a success.

After the Great Depression in the 1930's, there were similar concerns about inflation and excessive reserve balances in the banking system in the US. At the time the proposed solution was to increase reserve requirements. Such a policy indirectly discourages bank lending in an effort to reduce deposits. Thus, increased reserve requirements pose an effective tax on bank lending, indicating that this kind of policy should not be implemented in the current situation (Wheelock 2009).

6.6.2 Effective functioning of the interbank market

Since the onset of the financial crisis, central banks have become more active as lenders of last resort, providing liquidity to the banking system and to financial markets in general. This raises the question whether such central bank interference can endanger the effective functioning of interbank markets in the future.

Excessive amounts of reserves, and the fact that these reserves now earn interest at the Fed and BoE, may reduce the banks' incentives to lend to each other. The market for bank funding may thus become less effective as market participants learn to rely more heavily on central banks as the lenders of last resort. Government support and interventions may also distort competition among market participants. An important mechanism to prevent such a development and to encourage market solutions is to price central bank liquidity injections with a premium. This is indeed what has been done by both the BoE and the Federal Reserve.

In Japan, financial institutions became increasingly dependent on central bank liquidity provisions after the change in monetary policy regime. This is illustrated by the fact that outstanding amounts of the uncollateralized call market fell from around 20 trillion yen in

early 2001 to 3.4 trillion in December 2002 (Shiratsuka 2010). The Japanese money markets have not recovered fully to this date, as the outstanding amounts are still considerably lower than in the 1990s and in the early 2000s.

This development in Japan may be due to policy rates being effectively zero during the quantitative easing period. A consequence of this policy was that commercial banks had difficulties covering their transaction costs when dealing in the interbank market.²⁹ In the current crisis, both the Federal Reserve and the BoE have set the effective floor of policy rates slightly above zero, allowing banks to cover their trading costs. In addition, central bank liquidity provisions were priced at a premium, encouraging a return to market solutions. However, the impact of central bank interventions to interbank market functioning cannot be fully evaluated before market conditions has been “back to normal” for a while.

Another concern regarding the banking system is the problem of moral hazard: Central banks have demonstrated that they are willing to step in as the lender of last resort and use extensive measures to restore financial stability. This may give financial institutions incentives to increase their risk exposure, and be less prudent when it comes to liquidity management in the future. However, the extensive focus on financial sector regulation from other regulatory authorities recently might be a counterbalance to this development.

6.6.3 Increased financial risk in the central bank’s portfolio and independence of the central bank

The size and composition of central banks’ balance sheet have changed significantly during the recent financial crisis. The comprehensive asset purchases and extensions in approved collateral have undoubtedly increased the riskiness of the portfolio held by both Fed and BoE.

By absorbing risks that were previously held by the private sector central banks are exposed to the risk of suffering significant capital losses over time. This case is the most obvious in private securities, which carry credit and market risk. In addition, Treasury securities entail interest rate risk since the possibility of higher interest rates in the future may cause the price

²⁹ A numerical example of the failure to cover trading costs in the Japanese interbank market can be seen in Baba et al. (2005; pp.16)

of these bonds to fall. Even though these losses would initially only appear in the books, they might be realized once the central bank starts unwinding its earlier monetary expansion by reselling some of the assets into the market. Capital losses may, in turn, undermine the independence of the central bank as discussed comprehensively by Stella (2008). If losses are substantial enough, the government may need to recapitalize the central bank.

The respective Treasury departments in US and UK have become large creditors of the central banks' since the onset of the financial crisis of 2007-09. As a large creditor, the Treasury departments might also try to increase their influence on policy in the central banks. This is particularly true for both the United Kingdom and the US as these countries are running large current account deficits. This may create a political pressure to “monetize” the debt by holding interest rates low for an extended period. Lower interest rates also facilitate the government's funding needs.³⁰ Empirical studies have shown that the inflation outcomes are improved significantly when monetary policy is conducted by an independent central bank. Thus, any explicit or implicit threat to central bank independence should be taken seriously, following the reasoning in the discussion of institutional design for central banks from section 2.7.

6.6.4 Time-inconsistency and role of different political authorities

The financial crisis has demonstrated that the role of the central bank and the Treasury can become more interconnected due to adaptation of unconventional monetary policies. For instance, the Federal Reserve provided support to specific financial institutions in cooperation with the Treasury. Also, the Bank of England's asset purchase facility was insured against losses by the Treasury. These examples illustrate that unconventional policies create the need to coordinate actions with fiscal authorities. Consequently, the distinction between monetary policy and fiscal policy becomes less clear cut. The joint efforts probably had positive effects in the short run, but the future implications are not obvious.

This raises the issues of proper roles and mandates for the central bank and for the Treasury in the case of future crisis. Central banks have traditionally acted as lender of last resort providing liquidity to illiquid but solvent institutions (refer to discussion in section 4.4).

³⁰ See for example Hoenig (2010) for a more detailed discussion about threats to central bank independence

However, in principle, any institution with the necessary competence can be assigned this task. Thus, the role as lender of last resort could just as well be given to the Treasury. The most important distinction would be how liquidity injections were financed: Central banks can finance their liquidity injections by “printing money” whereas Treasuries would have to issue government debt. The fact that it is more convenient to create currency has led to central banks often absorbing this particular role.

During the financial crisis of 2007-09 it was not always clear whether it was the Treasury or the central bank that acted as lender of last resort. An illustrative example of this is the joint efforts of the Federal Reserve and the Treasury in saving specific institutions. In our view, roles of different policymakers should be clarified further in case of future crisis. Is it for example appropriate, that central banks provide emergency aid for some institutions while excluding others? Furthermore, who is the correct political authority to make such decisions? These questions are poorly addressed in the current political and legal framework.

Since central banks traditionally act as lender of last resort they have also been assigned the responsibility of maintaining financial stability. In our view many central banks have recently pursued unconventional monetary policies with the explicit goal of stabilizing financial markets, perhaps emphasizing less their commitment to price stability. This can raise some important issues regarding “time-consistency”. By this we mean that even though policymakers announce in advance that they will follow a certain policy, they may be tempted to deviate from this policy at a later date. The time-inconsistency problem was discussed in section 2.7.

An illustrative example of this is the current development in the Euro-area: Greece is currently experiencing massive problems due to an accumulation of excessive public debt. The Maastricht Treaty includes a so called “no bailout” clause, which stipulates that neither the European Union as a whole nor the individual member states are liable for the commitments of other member states (González-Páramo 2006) Consequently, the European Central Bank has no obligations to bail out Greece in their current situation. However, in practise ECB is doing exactly that! It is currently accepting Greek junk-bonds as collateral, providing cheap funding for banks in Greece. ECB also started to purchase covered bonds issued by Greece. The justification for such actions is provided by financial stability considerations and the possibility for contagion risk within the financial system. However, it seems clear that the no bailout clause was time-inconsistent.

Time inconsistency is also related to discretion: In our view unconventional policies require more discretion making them more subject to credibility problems. As we discussed earlier in section 4.5, credibility of unconventional policies is yet to be established. However, policy makers should keep in mind that credibility is lost faster than it is gained.

In the next section, we analyze how various macroeconomic variables have developed since the adaptation of unconventional monetary policies, and discuss possible reasons for this development.

7. COMPARATIVE ANALYSIS AND DISCUSSION: RELATIVE POLICY EFFECTS IN JAPAN, USA AND UNITED KINGDOM

In evaluating the effectiveness of unconventional monetary policy we choose to focus on the development in broader macroeconomic variables, rather than focusing on specific asset markets. Our analysis is mostly descriptive and graphical, and investigates how various macroeconomic variables have developed *after* the implementation of unconventional monetary policies.

Even though policy rates are still at a historically low level in the United States and United Kingdom, quantitative easing policies have been gradually phased out after reaching the targeted level of purchases. However, the large amount of asset purchases and liquidity provisions will probably continue to provide stimulus to the economy for some time to come.

The policy responses from Bank of Japan, Federal Reserve and Bank of England have several common aspects, but as we have tried to point out in the case studies, there are some distinguishing features in each country. In general, these differences arise not because central banks have different objectives, but because they face different economic and political environments. Examples of this are the types and origins of the shocks hitting the economy, the structure of the financial system, and institutional arrangements of the central bank.

The decline in US housing prices is a noteworthy example of a shock hitting the economy. This initial shock spread to broader financial markets due to widespread securitization of mortgages. The Fed responded to counter this particular shock by actively buying mortgage-backed securities and federal agency debt, with the explicit goal of reducing the cost of home financing. Even though housing prices declined in the United Kingdom as well, the BoE response had more to do with the second-order effects of the initial housing shock.

An example of a structural difference between the US and UK is the relative importance of credit markets. The Fed has interacted more actively in credit markets, while the BoE has largely been focused on the government bond markets. We have argued above that the reason for the limited BoE intervention in credit market is, in part, hesitation to deviate from its traditional central bank role. However, another reason for the more active Fed

participation in broader financial markets is due to the relative importance of these markets as a source of finance in the US. Thus, structural differences affect optimal policy responses from central banks.

The Bank of England practises flexible inflation targeting with a stated objective of reaching the inflation target of two percent in the medium term. Achieving low inflation is one of the three main goals of the Fed, but there is no explicit quantification of the target for inflation. This represents an institutional difference between the Bank of England and the Federal Reserve. As mentioned earlier, an inflation target can serve as an anchor for inflation expectations in the long term. Even though the Fed has shown commitment to price stability in the past, the adoption of unconventional policies can cause some confusion about where inflation is headed in the long run.

Compared to the Japanese case, the Fed and the BoE have acted in an earlier stage, cutting interest rates pre-emptively to signal a commitment to both monetary and real stabilization. In addition, financial system problems have been addressed at an earlier stage, hindering adverse effects of a potential financial market break down. As we have argued above, the importance of the credit channel in the transmission mechanism of monetary policy is likely to be elevated during times of financial distress. Thus, a breakdown in the functioning of financial markets and in the banking sector can be a hindrance for the impact of quantitative easing policies.

The BoJ and the Japanese government waited until the mid 1990s before they took action against the serious financial system problems. By the time unconventional monetary policy tools were first employed in Japan, the economy was already in a liquidity trap. It can be argued that by failing to take action at an earlier stage the BoJ lost its credibility with the public, who no longer believed that the central bank was committed enough to bring the economy out of the liquidity trap. As a result, the extensive policy measures failed to stimulate aggregate demand. This highlights the point made by Friedman (2004) that monetary policy that does not influence expectations simply does not matter.

7.1 A comparative approach

Next, we turn to a comparative analysis of the policy effects in Japan, United States and United Kingdom. In particular we look at the development in consumer prices, broad monetary aggregates, bank lending, inflation expectations and real GDP after the implementation of unconventional monetary policies. As a concluding remark we consider if central banks should increase their inflation target to avoid the zero nominal bound in the future.

To get an overview of the development in central macroeconomic variables we reset the data series, and set period zero at the day, quarter or month of the official announcement of a quantitative easing policy. The choice depends on the frequency of the relevant data set.

For Japan the zero point is 19th of March 2008 when BoJ announced the return to zero interest rate policy and adopted a quantitative easing strategy with a targeting of bank reserves, rather than the collateralized overnight call rate. In the case of the United States the zero point is set to 15th of October, when the Fed stopped sterilizing its open market operations. Similarly, for the United Kingdom the zero point is 5th of March 2009, the day when bank rate was cut to 0.5 percent accompanied by an announcement of asset purchases financed by the issuance of central bank reserves. A shared feature of the development after these zero dates is the substantial expansion of reserve balances and the monetary base.

Our analysis does not imply a causal relationship, that is, we cannot claim that the observed development is due to monetary policy alone. To be able to such make causal conclusions, a formal statistical analysis is necessary. At time of writing this paper, unconventional monetary policies have been pursued for a little over a year in both the UK and the US. Because of the fact that monetary policy affects output and inflation with a considerable time lag, we feel that it is still too early to evaluate the full impact of unconventional policies on macroeconomic data. Thus, our results are preliminary and should be interpreted as tentative.

Further challenges to an empirical assessment are provided by the fact that there are numerous other factors and policy measures that affect the economy simultaneously. For example, policymakers initiated wide-ranging fiscal stimulus packages at the same time as monetary policies became highly accommodative. This implies that the marginal effect of unconventional monetary policies is difficult to quantify. An additional problem in

evaluating the successfulness of unconventional policies is that we cannot know how the development would have been in their absence.

However, we hope that observing the development in key macroeconomic variables can point to whether policy efforts are working as intended. Also, a comparative analysis between countries may indicate if some policies that worked in one country are failing in another country. This can give policymakers a signal that the course of policy must be changed, or that there are other underlying problems in the economy that prevent policy from being successful.

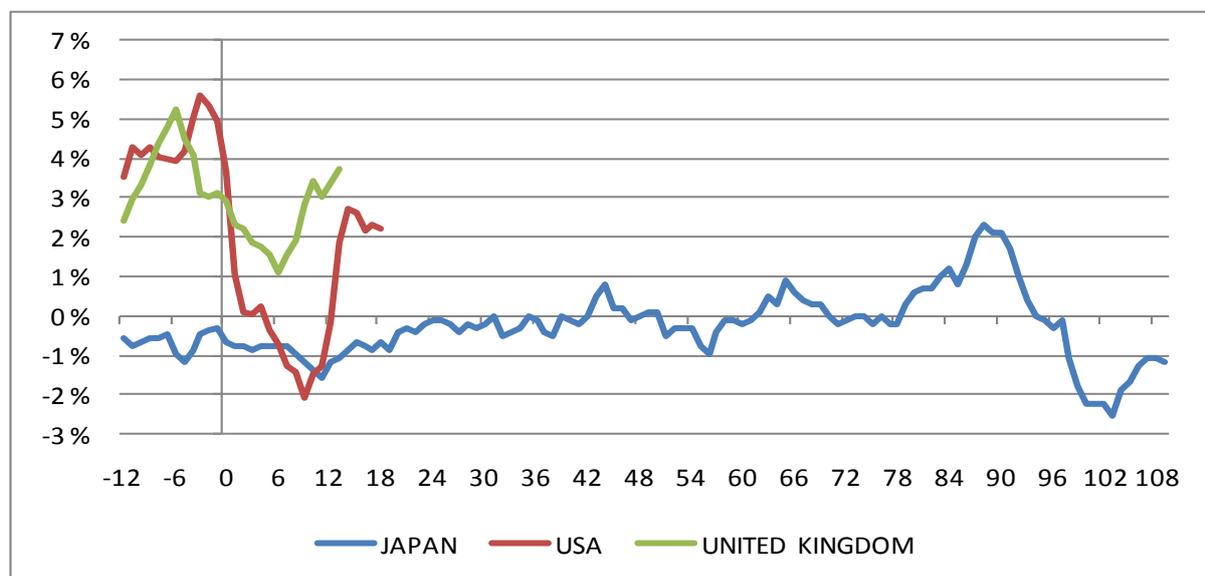
7.2 Consumer price index

Several empirical studies confirm the long term relationship between money growth and inflation.³¹ Quantitative easing policies have been pursued for little over a year both in USA and United Kingdom. As mentioned previously, it takes about two years for monetary policy to have its full effect on inflation. Even though the estimated effect is valid for the effects of “conventional” interest rate policy, it is reasonable to assume that the full effect of unconventional policy is not evident yet.

Figure 17 illustrates the development in consumer price index after monetary authorities started to expand the monetary base. The CPI indices had started to decline in the US and UK already before the adaptation of quantitative easing policies. The significant expansion in the monetary base had no *instant* positive effect on inflation, which is not surprising given the above mentioned time lags.

³¹ See for example McCandless and Weber (1995) or King (2002)

Figure 17 – Comparative analysis: Annual Consumer Price Index, percentage change from year before, monthly data



Source: OECD Statistics

Approximately six months after the adaptation of quantitative easing policies in the UK and US, the consumer price index started to climb upwards again. Especially in the United Kingdom, policymakers have been concerned about this development. In a speech held at the end of January 2010, Bank of England Governor, Mervyn King, predicted that CPI inflation is likely to overshoot three percent for a while. However, this increase is mainly caused by temporary factors such as currency depreciation and an increase in the value added tax rate.³² This example illustrates the difficulty in assessing the marginal impact of the central bank asset purchases: There is a wide range of other policy measures and economic developments that affect the economy and the general price level.

In Japan, consumer prices responded sluggishly even after March 2001: CPI development became positive first three and half years (43 months) after the change in policy regime. Even then the growth in CPI was moderate – the year on year percentage change exceeded one percent first after seven years since the beginning of quantitative easing policies.

³² The value added tax rate was temporarily decreased in the UK during the financial crisis, as a part of fiscal policy to increase spending and consumption.

Regardless of the driving forces behind the development in consumer prices in the US and UK, the fact that consumer prices are responding positively, gives confidence that these countries can avoid the “deflation trap” experienced in Japan.

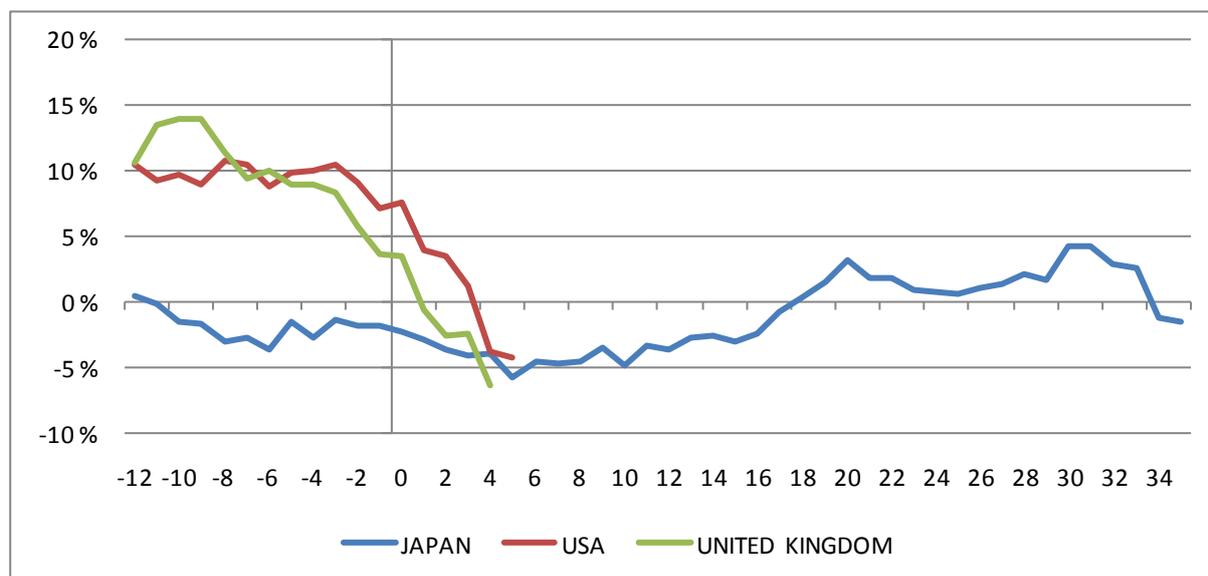
7.3 Issuance of bank loans

Central banks are the sole providers of base money. However, commercial banks have the ability to create broad money by issuing loans to firms and households. Thus, creating base money can be regarded as expansionary if it induces commercial banks to issue new loans to the private sector. We examine broad money growth in the next section.

The level of bank reserves has increased dramatically in all three countries since the adaptation of unconventional monetary policies. This reflects the increased provision of liquidity to the banking sector due to financial stability concerns, as well as increased willingness of banks to hold on to reserves at the central bank. Although central bank liquidity operations have been reduced in scope as financial market conditions have normalized, many banks still wish to operate with excess reserve balances.

However, as Figure 18 below illustrates, provision of bank loans has been decreasing rapidly since the onset of the financial crisis of 2007-09. This kind of development is often seen in recessions, especially when financial sector distress is involved.

Figure 18 – Comparative analysis: Issuance of bank loans, percent change from year before, quarterly data, not seasonally adjusted



Sources: Bank of England, The Federal Reserve Board, Bank of Japan

One of the goals of the liquidity programs was to secure that commercial banks would remain sufficiently liquid to be able to lend to creditworthy customers. The Federal Reserve has been especially criticized for the fact that massive policy responses and money injections to the economy have not led to increased bank lending. Instead, the extra liquidity has been absorbed passively as excess reserves at the central bank.

However, the main reason for this downturn in lending activity is not necessarily liquidity constraints. Banks may have tightened their loan standards as they are replenishing their capital base. There might also be less profitable investment opportunities in the overall economy and less demand for bank loans in general. In addition, the financial sector became highly leveraged in the years preceding the financial crisis. A natural de-leveraging process entails a shrinking of commercial bank balance sheets and a more limited issuance of credit to customers.

The development in bank lending activity is a typical example of the credit channel view: Decreasing asset prices reduced the value of collateral that can be pledged for a loan, and a slowdown in aggregate demand led to a drop in firm cash flows reducing their net worth. In other words, the borrower's balance sheets worsened. This reduction in borrowers' net worth was not caused directly by monetary policy, but rather by an exogenous shock. Similarly, the financial position of lenders worsened as the cost of obtaining funds increased. An

illustration of this is the freeze in interbank markets after the Lehman Brothers bankruptcy, when it became virtually impossible for banks to obtain loans from other banks.

It appears that unconventional monetary policies and excess liquidity provisions have not increased bank lending. However, it can be questioned whether this was the purpose in the first place. The initial goal of the liquidity management operations was probably to hinder a total collapse in the financial markets, rather than directly increase bank lending. Banks must themselves evaluate creditworthiness of potential loan takers, and if liquidity shortages are not the underlying reason for reduced bank lending, then increasing liquidity will not boost bank lending. If inadequate capital ratios are the main constraint in bank lending activity, then banks need to be recapitalized either by public or private funds. Alternatively, if the riskiness in the bank's portfolios is the main reason for tightened credit standards, then bad assets must be removed from their portfolios or handled in another matter. The recent financial crisis of 2007-09 likely contained elements of both the "capital crunch" and the "market credit crunch", and the combination of these resulted in the observed slowdown in bank lending activity.

The Japanese example illustrates the importance of dealing with structural problems within the banking sector. We argued in section 6.2.5 that the failure of policymakers to deal with non-performing loans at an early stage in Japan is probably one explanation behind the anaemic economic growth in Japan since the bursting of the asset price bubble. However, addressing structural problems in the economy, like recapitalizing banks and removing bad assets from the banks' portfolios *is not the job for monetary authorities*. Neither conventional nor unconventional policies are of help in these matters, as central banks simply lack the tools for addressing such problems. Also, in many countries, existing central bank mandates prohibit monetary authorities from taking action with regards to such concerns.

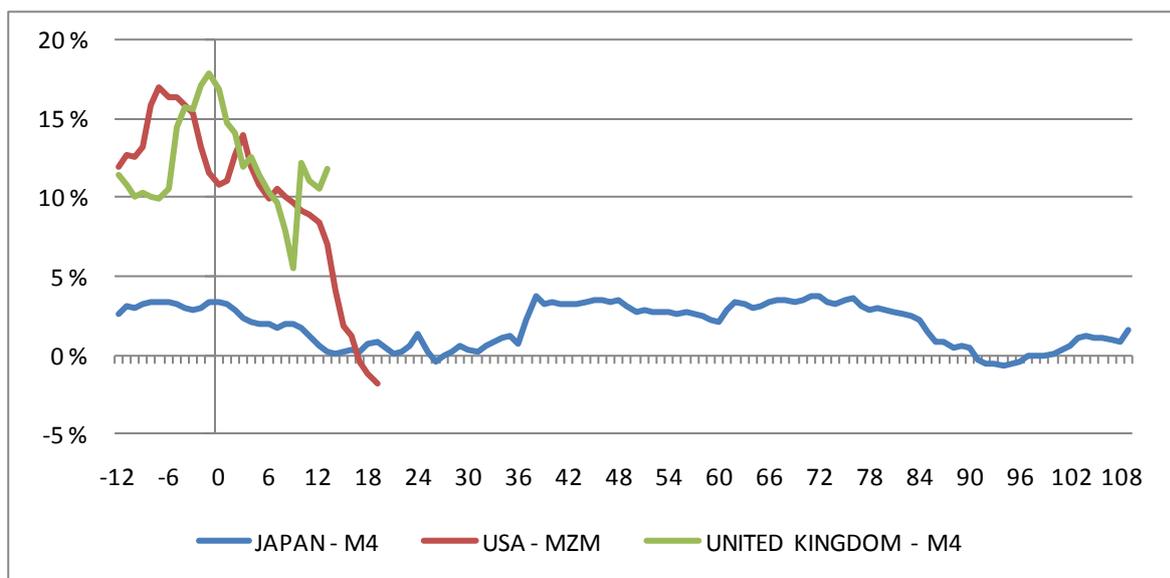
Finally, as we have mentioned previously, financial sector distress can by itself provide rationale to launch unconventional monetary policies even before the zero nominal bound is hit. This is due to the potential adverse effects financial sector troubles can have on real activity.

7.4 Broad money growth

Both the Bank of England and the Federal Reserve have bought assets outright from the private, non-banking sector. This should directly increase the broad money growth as private sector agents receive money from the transaction.

Figure 19 illustrates the development in broad money since the adaptation of quantitative easing policies in Japan, US and UK. Definitions of the monetary aggregates that are used can be found in Appendix 1. From the chart it can be observed that the months following adaptation of quantitative easing policies were characterized by a reduced rate of broad money growth in all three countries.

Figure 19 – Comparative analysis: Growth in broad monetary aggregates, percent change from year before, monthly data (not seasonally adjusted)



Source: Bank of England, The Federal Reserve Bank of St. Louis, Bank of Japan

As discussed in the previous section, bank loan issuance has decreased rather dramatically since the onset of the financial crisis. This explains partly why broad money has not grown as a response to the vast monetary stimulus. However, some of the assets are purchased directly from non-depository institutions. This should directly increase broad money growth as firms and household receive money from the transaction.

This effect becomes smaller if increased money holdings are used to repay loans. This could be a part of the explanation to why asset purchase programs have not led to a significant

increase in broad money growth: The years preceding the start of the financial crisis were characterized by a low risk environment that gave incentives for increased leverage. For example, from the early 1990s until the start of the financial turmoil in 2007, total debt in the United Kingdom relative to GDP almost doubled. Around two-thirds of the increase in total debt was accounted for by lending to the financial sector (King 2009). It is reasonable to expect that private sector agents and financial institutions are now deleveraging their positions by repaying loans.

Growth in M4 in the United Kingdom has showed some signs for recovery during the last couple of months. This has been accompanied by growth in the consumer price index as well, which was discussed in previously. On the contrary, broad money growth has not yet shown similar signs of recovery in the US.

7.5 Inflation expectations

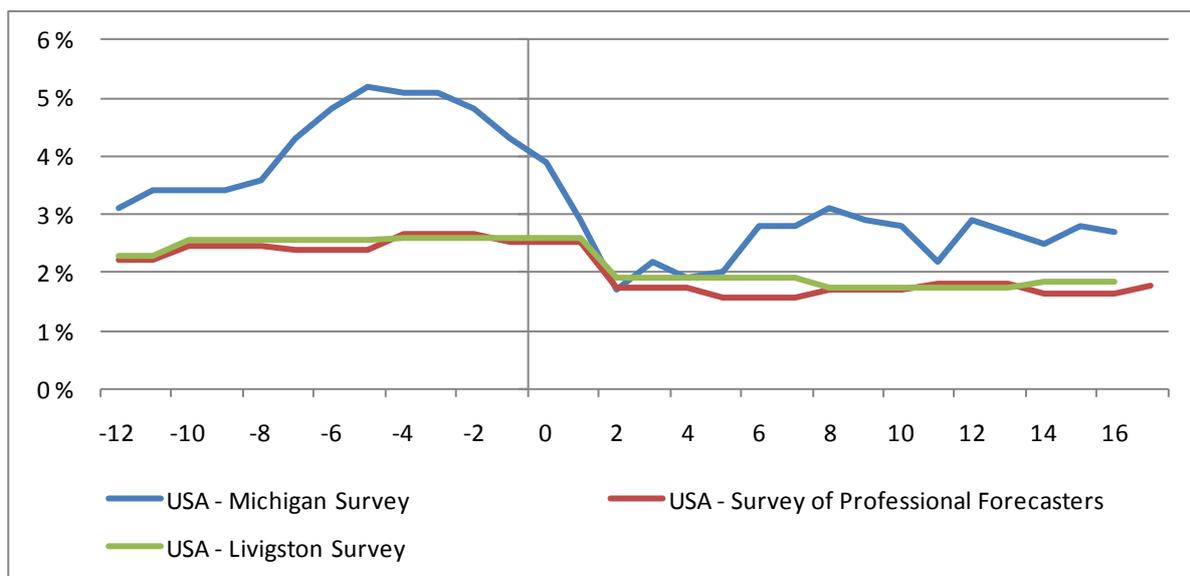
We have argued throughout this paper that “management of expectations” is an important element in modern monetary policy. Also, many of the unconventional monetary policy measures that were described in section 4 work through effecting expectations. Credible commitment to low future interest rates should affect market participants’ interest rate expectations and depress long term yields. We return to this subject in the next section. We have argued in section 4.2 that quantitative easing policies through increasing the money supply can have an impact on inflation expectations as money growth has historically been accompanied by inflationary pressures. *Higher* inflation expectations should depress the real rate of interest, which in turn should stimulate investment and the economy in general.

Even though it is important to prevent expectations of deflation, a sizeable increase in inflation expectations can have counterproductive effects. As discussed in the theoretical framework, the flexibility to stabilize the real economy requires that long run inflation expectations are “well anchored” among the agents in the economy. In particular, increased inflation expectations can increase the inflation risk associated with nominal bonds. This increase in risk premia will raise long term yields and counteract, for example, the commitment effect, where central banks pledge to hold their target rates low for an extended period of time.

Figure 20 and 21 plots one year inflation expectations in the USA and United Kingdom since the adaptation of quantitative easing policies. Inflation expectations are, of course, hard to measure reliably as they cannot be observed directly. Different methods and surveys have their advantages and disadvantages. Before interpreting the data, some words describing the selected surveys are in place.

We have chosen to include three surveys in the graph for USA: Livingston Survey, Survey of Professional Forecasters and University of Michigan Survey. For United Kingdom we were able to find two measures of inflation expectations: the NOP Survey conducted by the Bank of England and the YouGov/Citigroup Survey. Unfortunately, we were not able to find any measures for inflation expectations for Japan. A more detailed description of the surveys can be found in Appendix 1.

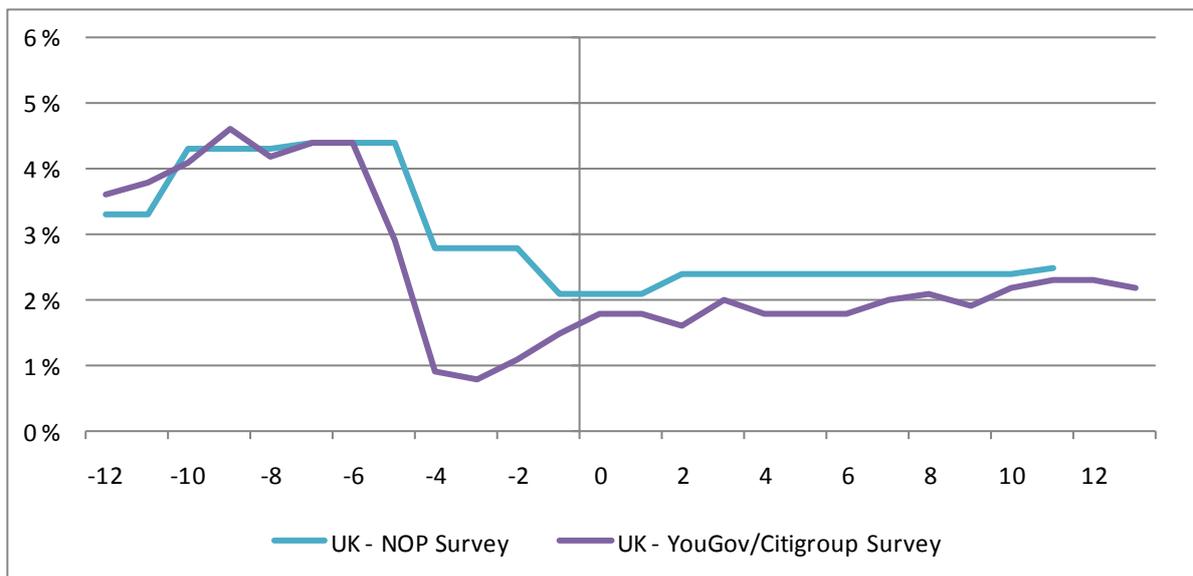
*Figure 20 –Comparative analysis: Forecasts for the annual average rate of inflation over the next 12 months in the United States*³³



Sources: Federal Reserve Bank of Philadelphia, University of Michigan

³³ The x-axis is in monthly format. Quarterly and semi-annually surveys are transformed to months by keeping the level constant between survey dates.

Figure 21—Comparative analysis: Forecasts for the annual average rate of inflation over the next 12 months in the United Kingdom³⁴



Sources: Bank of England, Citigroup

In the US, the monthly Michigan consumer survey started to fall before the introduction of unconventional policies. The Livingston Survey that is conducted semi-annually and the Survey of Professional Forecasters that is conducted quarterly, both show a decline in December survey 2008. However, later surveys after the zero point show no significant decline. Annual inflation is still expected to be close to 2 percent in the US. In the UK both surveys started to fall before the zero point. The YouGov/Citigroup survey was even below one percent a few months before the start of quantitative easing. However, also in the UK short term inflation expectations have stabilized around 2 percent.

It appears that there currently is relatively little danger of deflationary expectations in the short run in these countries. This may indicate that the unconventional monetary policies at least prevented the short run inflation expectations from falling further.

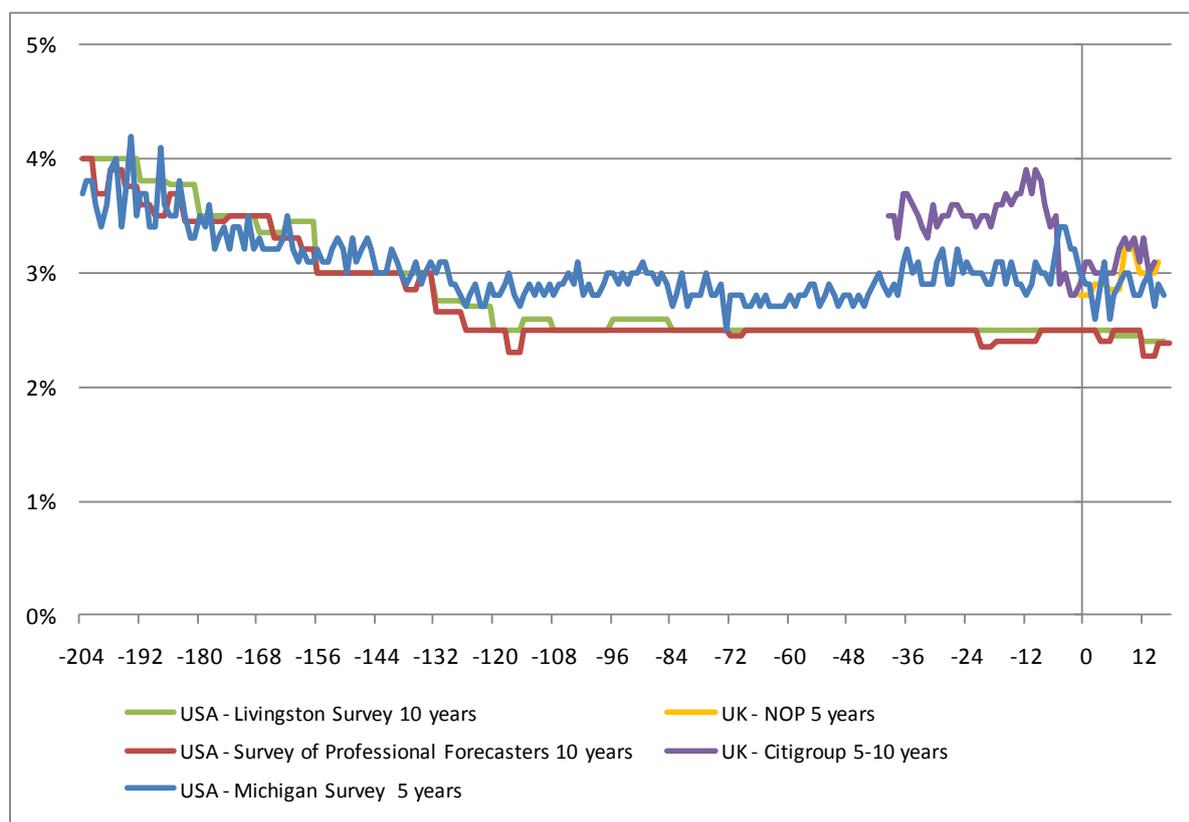
Long term inflation expectations reflect to some extent the credibility of the central bank, and whether inflation expectations are well anchored within the public. The United Kingdom has implemented an explicit inflation targeting framework. Credibility of the policy can be

³⁴ The x-axis is in monthly format. Quarterly surveys are transformed to months by keeping the level constant between survey dates.

evaluated by examining whether the public's inflation expectations remain anchored to the target. The US have not adopted such explicit frameworks, but still, stable and low inflation expectations can be regarded as an essential aspect of monetary policy.

Figure 22 illustrates long run inflation expectations for the US and United Kingdom. For the US we have included observations since 1991, as this illustrates the downward trend in long run inflation expectations during the last two decades. The Citigroup survey in the United Kingdom has only been conducted since 2005, so no data is available prior to this. Similarly, the NOP survey has only included long run inflation forecasts since February 2009, so we only have 6 observations of the survey at the current date.

Figure 22 – Comparative analysis: Forecasts for the annual average rate of inflation over the next 5-10 years



Sources: Federal Reserve Bank of Philadelphia, University of Michigan, Citigroup

Figure 22 shows that long term inflation expectations have shown a steady downward trend since the early 1990's in the US. The forecasted average-annual 10-year growth rate for inflation has fallen from levels of approximately four percent in the 1990's to approximately

2.5 percent in 2010. The 5-year inflation expectations in the Michigan survey are slightly higher than the other surveys throughout the time period.

The downward trend in the long run inflation expectations since the 1990s probably reflects the fact that many central banks, including the Federal Reserve, have been successful in bringing down inflation during the last decades. Also, this development may reflect increased transparency in conducting monetary policy and more communication from monetary authorities.

Long term inflation expectations also show relatively little variability in the US during the last decade (-120 months), indicating that inflation expectations have been relatively well anchored among the American public. There is no observable sharp increase in the long run inflation expectations after Fed stopped sterilizing its open market operations. This suggests that public has not yet “lost faith” in the Fed’s ability to control inflation in the future.

The YouGov/Citibank survey for the United Kingdom illustrates that longer term inflation expectations started to fall prior to the zero point, from levels of approximately 4 percent to just below 3 percent. More recently, they have climbed upwards again, and are currently slightly above 3 percent. 5-year inflation expectations from the NOP-survey are broadly in line with the recent development in YouGov/Citibank survey: Longer run inflation expectations were slightly below 3 percent until the end of 2009, while the two last observations in the NOP survey have been situated marginally above 3 percent

These inflation expectations are somewhat higher than the inflation target of 2 percent of the Bank of England. This may reflect the fact that inflation has been higher than the target during years before financial crisis. The fact that inflation expectations are higher than the target raises doubt whether the public has confidence in the inflation target. This may signal that the central bank has challenges with respect to its credibility.

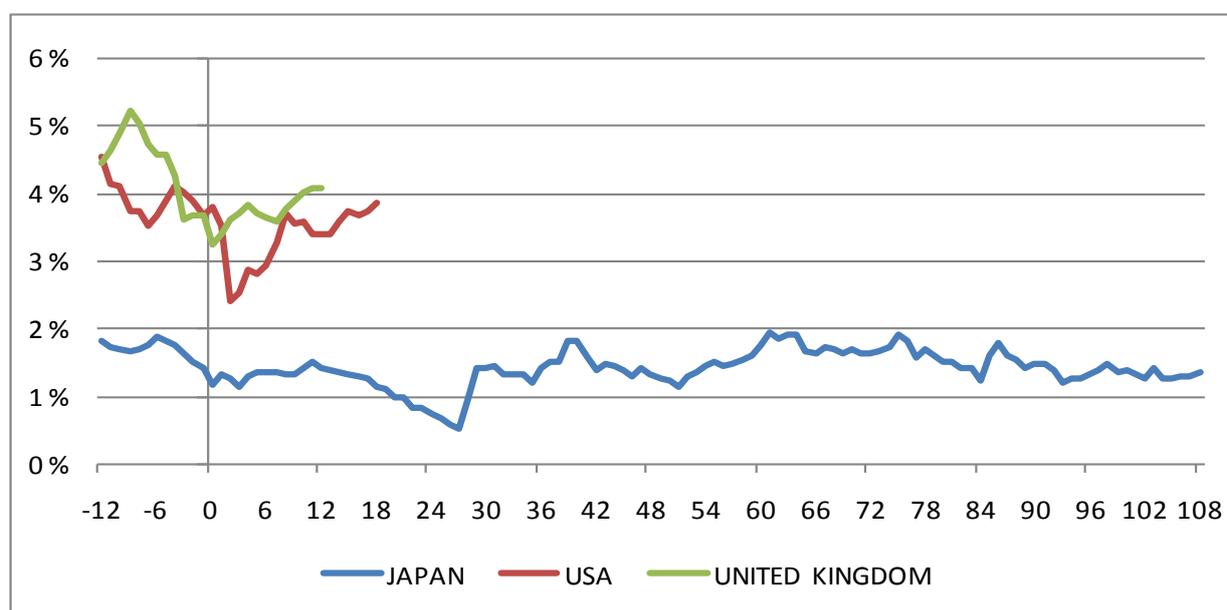
7.6 Long term yields

Commitment from the central bank to lower future interest rates should depress long term yields. This effect depends on how credible the commitment is perceived to be as discussed previously in section 5.1. We have plotted yields on 10-year government bonds in Figure 23,

and, once again, the zero point in the graph represents the month when quantitative easing policies were adopted.

As discussed previously, empirical studies have found that the commitment to low interest rate policy had a significant effect on long term yields in Japan. It can be seen from Figure 23 that yields on 10-year government securities were also somewhat reduced in the US and United Kingdom after unconventional monetary policy tools were taken into use. However, yields had started to decline already before adaptation of unconventional monetary policies. Neither the Federal Reserve nor the BoE has made any explicit commitment to holding interest rates low for a specific period of time. Bank of Japan was much more explicit in its promise to hold the call rate at zero when announcing its quantitative easing policies in March 2001. Perhaps reflecting this “weaker” form of commitment to low future interest rates, the yields on 10-year government securities have not been reduced further in the US and UK.

Figure 23 – Comparative analysis: Yields on 10-year government securities, monthly average



Source: OECD Statistics

The effect seems to be relatively larger for the US than for the UK based on this simple illustration. We suspect that this may be due to the “flight to safety” –effect that was mentioned earlier in this paper. After the Lehman Brother’s bankruptcy, international investors became immensely concerned about the risk in their portfolios. As a consequence

they sought liquid and low-risk alternatives for their investments. USA has a very deep and liquid market for government securities, and they are regarded close to risk free as the government debt is nominated in US dollars. This resulted in many international investors wanting to invest in US government securities in the turmoil period.

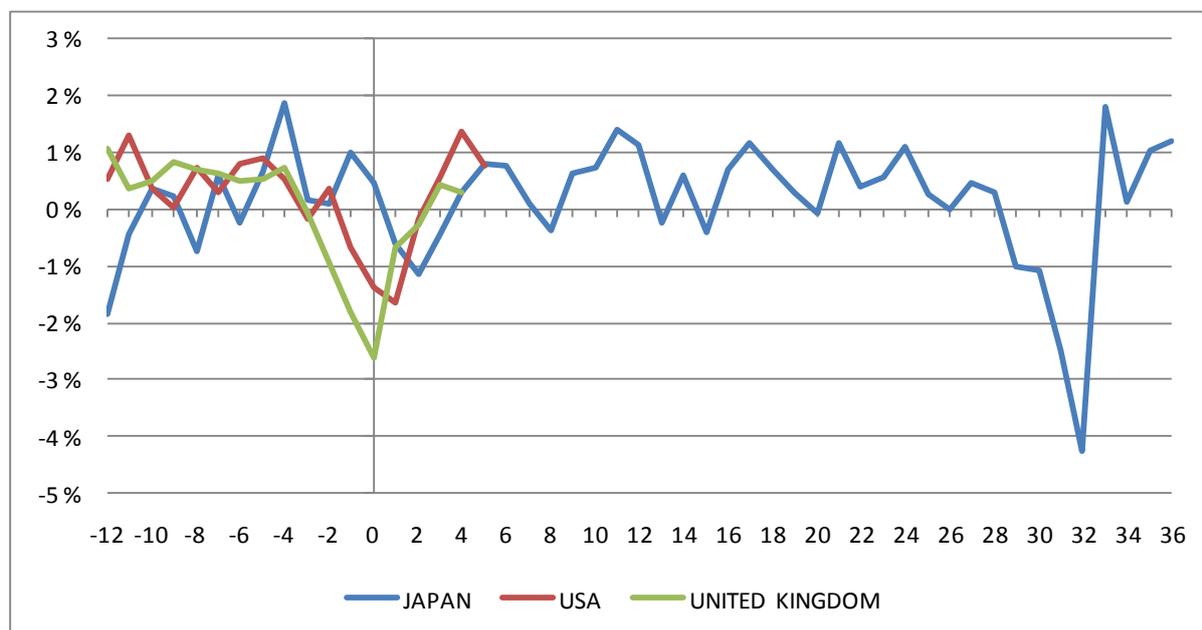
Figure 23 also illustrates that long term yields on government bonds have risen somewhat during the last couple of months. This may reflect the improved outlook for the world economy and expectations about higher future short term interest rates. In the UK, increase in consumer prices may induce market participants to expect that BoE will increase the target rate sooner than what was expected in the first place.

7.7 Real GDP growth

Although monetary policy in the long run affects only nominal variables, it can have an effect on real activity in the short and medium term. As mentioned earlier in section 2.2, interest rate decisions have their fullest effect on output with a lag of one year, compared to inflation where the lag is around two years. However, these estimates are valid for interest rate effects of traditional monetary policy. The transmission mechanism and lags of unconventional monetary policies are more uncertain.

Figure 24 illustrates the growth in real GDP since the introduction of unconventional monetary policies. Real GDP growth is undoubtedly a key macroeconomic indicator, as it offers a summary of total economic activity in a country. It can also provide some guidance to whether accommodative policies have started to “work their way through” in the economy.

Figure 24 – Comparative analysis: Real GDP growth from previous quarter, seasonally adjusted data



Source: OECD Statistics

Figure 24 shows that in all three countries real GDP growth was declining sharply at the time when unconventional monetary policies were first introduced. However, the downward developed bottomed at the time, or shortly after, these new policy measures were implemented. Currently, real GDP growth from previous quarter is positive in all three countries.

In the US, real GDP growth reached its bottom in the summer of 2009, after which growth has picked up again. Some have forecasted that the US economy will have returned to its pre-recession peak in real GDP by the end of second quarter in 2010.³⁵ Real GDP growth is important in the official dating of US business cycles by the National Bureau of Economic Research (NBER). NBER has, however, not made an official statement at the time of writing this paper that US economy is out of a recession.

The British economy emerged from recession in the fourth quarter of 2009 with a real GDP growth of 0.4 percent. This was only two quarters after implementing quantitative easing strategies. The development in real GDP has been rather sluggish since, with a growth of 0.3

³⁵ See for example article in *The Economist*, April 17, 2010.

percent in the first quarter of 2010. Even though the growth rate has turned positive, the *level* of real GDP is still 0.2 percent lower than in the first quarter of 2009 according to the Office for National Statistics. Household expenditure was 0.5 percent lower in the first quarter of 2009 than a year before. Gross fixed capital investment grew by 1.5 percent the same quarter, and is still 5.7 percent lower than in the first quarter of 2009. Inflation is picking up again as discussed previously in section 7.2. This raises concern over possible stagnation of the British economy, with high inflation rates and low economic growth. However, in our opinion this is not the fault of monetary policy, but rather it shows the limitation of monetary policy with regards to structural factors. The UK has a fiscal deficit of about 11 % of GDP, and a fiscal consolidation is likely to be unavoidable. As long as the uncertainty around the fiscal deficit and government action persist, a recovery of the UK economy may be subdued.

In Japan, real GDP grew with an average rate 1 percent during the “lost decade” of 1992-2002. The growth has also been rather anemic after the quantitative easing framework was implemented. Having said that, it appears that real GDP growth became “less negative” after implementation of these policies. Growth rates from previous quarter were only slightly negative during the cyclical downturns. This development was ended suddenly by the global financial crisis, when real GDP growth in Japan declined by more than 4 percent in just one quarter.

A tentative conclusion can be drawn from these observations. It appears that all three countries returned, at least temporarily, to positive growth rates by four quarters after adoption of unconventional monetary policies. Of course, there are other factors besides monetary policy that have contributed this development. However, it seems at the present time at this time that joint policy efforts were successful in stabilizing real economy. At least, the data indicates that policy efforts hindered a further fall in real GDP.

7.8 Should central banks increase their inflation targets?

A discussion that has emerged in the aftermath of the financial crisis of 2007-09 is whether central banks should reconsider the level of their inflation target. For inflation targeting central banks the usual goal is an inflation rate of 2 percent as measured by a CPI index. The Federal Reserve has not adopted an explicit inflation target, but seems to agree with the current consensus that inflation should be both low and stable.

Why should policymakers adopt a higher target for inflation? The idea behind increasing the inflation target is that lower inflation rates leave less room for expansionary monetary policy in the case of an adverse shock. The major advantage with such a proposal is lower risk that monetary policy will be trapped against the zero bound. As Blanchard et al. (2010) point out, costs of higher inflation, for example 4 percent, may not be significantly higher than with the current 2 percent. Also, in theory, it should not be more difficult to anchor inflation expectations to 4 percent rather than at 2 percent.

It seems that this argument is valid in the light of the recent financial crisis: Policy rates were reduced close to zero relatively early on the course of the crisis. Consequently, unconventional monetary policies were taken into use to provide further monetary easing. Thus, it appears that an inflation target of around 2 percent did not provide an adequate cushion for the adverse shocks that led to the financial crisis of 2007-09.

Several arguments can be made against increasing the inflation target. First, several central banks have worked hard the last two decades to anchor inflation expectations among the public. In the process of increasing the inflation target, inflation expectations need to be de-anchored at least temporarily. This might take some time, and while agents are adjusting their expectations the scope of policy actions can be limited. The credibility of the central bank may also be threatened if monetary authorities should decide to raise their inflation targets, something which further limits the effect of monetary policy.

Second, inflation creates distortions in the economy as described in sections 2.5 and 2.6 when discussing the costs related to inflation and deflation. Higher inflation creates greater distortions, and may lead to more variability in the inflation rate. This may in turn lead to increased risk premia in long term bonds raising long term interest rates. In addition, at the current low level businesses and households can to large degree ignore inflation when making investment and consumption decisions. It is not clear if this is the case if inflation target is increased.

The third argument against increasing the inflation target is that a moderate increase in the targeted inflation rate may not be sufficient to avoid hitting the zero nominal bound in very severe recessions, such as the recent one. Inflation fell sharply after the onset of the financial crisis, and a moderate increase in the target would not have been enough to avoid hitting the

zero lower bound Why not then increase the inflation target additionally, for instance, to 6 or 9 percent? The point is that inflation could become hard to constrain once the target is raised.

If unconventional monetary policy is influential at the zero nominal bound, there is no need to raise the level of inflation. Our preliminary results suggest that the US and UK economies are responding to the various policy stimuli, although it is uncertain how much of the response can be credited to monetary policy measures alone. Based on this tentative conclusion, we believe that it is not necessary to consider increasing the inflation targets in these countries. With a severe adverse shock, it is not necessarily what level of inflation the crisis starts from, but rather how the policymakers *respond* that matters for the outcome.

8. CONCLUSION

In this paper we began by presenting a framework for implementation and evaluation of unconventional monetary policy at the zero nominal bound. Next, we used the framework to conduct detailed case studies of unconventional monetary policy in three countries: Japan, the United States and United Kingdom. In addition, we have made a cross-country analysis of how various macroeconomic variables have developed *after* adaptation of such policies. Our finding is that central banks are not out of ammunition when the zero nominal bound is hit. However, unconventional monetary policy is more discretionary and based on judgement. The effect of the unconventional monetary policies is to a great extent determined by whether central banks are able to react in a manner perceived as *credible* by the public.

Some preliminary results can be drawn from our case studies and the comparative analysis. First, our tentative results indicate that both the United States and United Kingdom have been able to avoid the liquidity trap that has characterized the Japanese economy almost for two decades: Both consumer prices and real GDP growth have turned to positive values after the adoption of unconventional monetary policies. We are unable to claim that this development is solely due to monetary policy actions, as fiscal policies have also been highly accommodative during the same period. However, we argue *that pre-emptive, timely and aggressive responses* from monetary authorities are important ingredients in fighting deflationary pressures.

Unconventional policy represents a *new challenge* for policymakers. It differs from conventional monetary policy with respect to both implementation and policy tools. Our analysis shows that Bank of Japan, Federal Reserve and Bank of England have combined different policy elements to achieve the desired outcome. This demonstrates that the unconventional policy responses have several interacting dimensions, and should be *combined* to achieve the necessary stimulus to the economy. Furthermore, definitions of policy elements are sometimes not distinct and thus subject to interpretation, as is the case with credit easing and quantitative easing.

Compared with standard interest rate decisions, the central banks have to *communicate* their intentions and commitment more clearly. The importance of this is apparent from the active communication policies that both the Fed and BoE have followed. In contrast, the Bank of

Japan has neither been able to commit to a consistent policy, nor to communicate its intentions in a credible way. As a consequence, it is not necessarily unconventional monetary policy per se that has failed in Japan, but rather the Bank of Japan has failed to establish the credibility of unconventional monetary policy with the public. As the Bank of Japan is not perceived to be willing to do “whatever it takes to get the job done”, the reaction from economic agents fail to occur.

As unconventional monetary policy tools have rarely been applied in practise they are also less precise. The credibility of such policy tools is not yet established, and monetary authorities cannot fine-tune their response. Compared with conventional monetary policy much greater *uncertainty* is present. The Federal Reserve and the Bank of England had to respond aggressively during the financial crisis of 2007-09 in order to convince economic agents to overcome uncertainty and expect positive inflation again. In this respect the Bank of Japan failed in several dimensions. Bank of Japan was sometimes aggressive in their response, but not in a consistent way. In addition there was no explicit target to guide inflation, and the structural problems in the banking sector were ignored for a long time.

Furthermore, both monetary stimulus and adding liquidity to ensure that the transmission mechanism is not impaired are equally important. In particular, financial distress may impair the effect of monetary policy. We argue that financial sector distress by itself may be a reason for initiating unconventional monetary policy before the zero nominal bound is hit. In contrast, if liquidity shortages are not the main restricting factor in bank lending activity, then monetary policy simply lacks the tools to directly affect credit issuance from banks. The Japanese case demonstrates the importance of addressing *structural problems* in the banking sector at an early stage. However, this is not necessarily a job for monetary authorities.

The structure of the economy and markets in Japan, United States and United Kingdom *are not always similar*, and the policies have to be adapted to the particular circumstances to have their full effect. In our view this adaption of policy tools is more important for implementation of unconventional policy than conventional monetary policy.

Some of the unconventional monetary policy responses to the financial crisis of 2007-09 were done in co-operation with other political authorities. We have argued that monetary policy responses beyond the traditional scope of central bank responsibility might threaten *central bank independence*. These joint efforts probably had positive effects in the short run,

but the future implications are not clear cut. In the case of future crisis, roles of different policymakers should be clarified further. Is it for example appropriate, that central banks provide emergency aid for some institutions while excluding others? Our opinion is that the division of responsibility in crisis situations such as the financial crisis of 2007-09 should be made more explicit to avoid situations where central bank independence is jeopardized. When central banks issue government securities to finance their operations, they will become more dependent on support from the Government, and thus potentially more influenced by the Government's opinions. With this in mind a suggestion for further research is the appropriate role and mandate for a modern central bank, and possibly a contingency plan for division of responsibility between different institutions in turbulent times such as the financial crisis of 2007-09.

Hopefully, economic conditions will not warrant the use of unconventional monetary policy in the near future. However, there is still a lot to learn from the recent experience. The "black box" of monetary transmission to the real economy during financial distress is currently somewhat of a mystery. As the full effects of the unconventional monetary policies become clear, this would be a interesting field of further research. For us, it would be interesting to know whether our tentative results point in the right direction.

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Appendix

Appendix 1: Definitions of the broad monetary aggregates in the US, United Kingdom and Japan

USA MZM (money zero maturity): Cash and currency in circulation, travellers checks, demand deposits and other checkable deposits issued by financial institutions (except demand deposits due to the Treasury and depository institutions), minus cash items in process of collection and Federal Reserve float plus savings deposits (including money market deposit accounts), minus small-denomination (under \$100,000) time deposits issued by financial institutions, plus shares in retail money market mutual funds (funds with initial investments under \$50,000), net of retirement accounts, plus institutional money market mutual funds

UK M4: The private sector (other than monetary financial institutions (MFIs)) holdings of notes and coins, sterling deposits, including certificates of deposit, commercial paper, bonds, floating-rate-notes and other instruments of up to and including five years' original maturity issued by UK MFIs, claims on UK MFIs arising from repos (from December 1995 and estimated holdings of sterling bank bills

JAPAN M4: Cash and currency in circulation, demand deposits less checks and notes held by financial institutions, time deposits, fixed savings, installment savings, foreign currency deposits, certificates of deposits, pecuniary trusts other than money trusts, investment trusts, repurchase agreements and securities lending with cash collateral, bank debentures, government bonds (including financing bills), foreign bonds and commercial papers issued by financial institutions

Appendix 2: Description of the inflation expectation surveys

In USA and UK we have focused only on quantitative surveys that ask consumers or professional economists directly for their inflation expectations. Quantitative surveys provide with specific point estimates, which are more useful for comparison purposes.

Qualitative surveys report tendencies in expectations, and have to be quantified prior to further empirical investigation. To avoid making assumptions that ignore important information in the data, we have chosen to focus only on quantitative surveys in the US and UK. For Japan, however, we were unable to find a quantitative survey and have reported a qualitative survey instead.

USA - The Livingston survey of Professional Economists

The Livingston survey of Professional Economists is a semi-annual survey conducted twice a year by Federal Reserve Bank of Philadelphia. In the survey, a panel of economists is asked to report their forecast for the consumer price index (CPI) and for 17 other macroeconomic variables for various time horizons. Forecasts are reported in levels, and prior to December 2004 the estimate levels are not seasonally adjusted. We use median values in our analysis.

To obtain forecasts for the annual average rate of growth instead of levels we apply the following formula:

$$\left[\left(\frac{\text{Forecast12Month}}{\text{Forecast0Month}} \right)^{\frac{12}{12}} - 1 \right] * 100$$

Since 1990, the survey has also included a forecast for the average annual inflation rate for the next ten years.

Livingston Survey of Professional Economists, variable descriptions

VARIABLE	DESCRIPTION
BasePeriod	Last quarterly or monthly historical value known at the time the survey questionnaire was mailed
Forecast0Month	Forecast for the month or quarter in which the survey is taken
Forecast6Month	Forecast for the month that is six quarters ahead or for the quarter that is two quarters ahead of the survey date
Forecast12Month	Forecast for the month that is 12 months ahead or for the quarter that is four quarters ahead of the survey date
BaseYear	Last annual-average historical value known at the time the survey questionnaire was mailed
Forecast0Year	Annual average forecast for the year in which the survey is taken
Forecast1Year	Annual average forecast for the next year
Forecast2Year	Annual average forecast for the year after
Forecast10Year	Forecast for annual average growth over the next 10 years

USA - Survey of professional forecasters

The Survey of Professional Forecasters is a quarterly survey conducted by the Federal Reserve Bank of Philadelphia. Participants in the survey come predominantly from the business sector and all make their living via forecasting. The survey entails forecasts for the seasonally adjusted, annual rate for *CPI inflation rate* for different time horizons. Since 2007, there are also forecasts available for core CPI inflation, PCE inflation, and core PCE inflation. We use median values in our analysis.

USA - University of Michigan Survey

In the University of Michigan Survey, a random sample of households are asked what they expect the annual inflation rate to be for the things they buy over the next year and five years respectively. The survey is conducted monthly, and the sample size is minimum 500 households. We use median values in our analysis.

The Michigan Survey focuses on consumer expectations, and the respondents have no special expertise or sophistication in forecasting inflation. This raises the question of how reliable the results of the survey are. Empirical evidence suggests, however, that the median survey response from the Michigan survey has been historically at least as accurate of a forecast of future inflation as those produced by professional forecasters.³⁶

United Kingdom – NOP Survey

The Bank of England NOP Survey aims to provide information on inflation expectations and to gauge public understanding of the monetary policy framework. Bank of England has commissioned a market research agency, Gfk NOP, to conduct the survey in each quarter since 1999, in February, May, August and November. Each survey covers around 2000 individuals, with an additional 2000 taking part in an extended survey each February.

The participating individuals are asked several questions, among others about how they think prices of goods and services have changed over the past twelve months and how they expect them to change over the year ahead. The survey is also used to assess how well the Bank of England's inflation target is understood by the public.

Longer term inflation expectations have been included in the survey since February 2009, with additional questions about expected price changes in two and five year's time. It is important to note that the respondents are not asked about a specific inflation measure, such as the CPI or Retail Prices Index. We use median values in our analysis.

³⁶ See for example Mankiw et al. (2004)

YouGov/CitiGroup Inflation Expectations Tracker

The survey is conducted by the research company YouGov in collaboration with CitiGroup. It has been conducted on a monthly basis since late 2005, with a survey sample of about 2000 individuals. The survey asks about the expected change in consumer prices of goods and services, rather than CPI inflation in particular. Both inflation expectations for the year ahead and inflation expectations over the longer term (5 – 10 years ahead) are polled. Results are given as a median value.