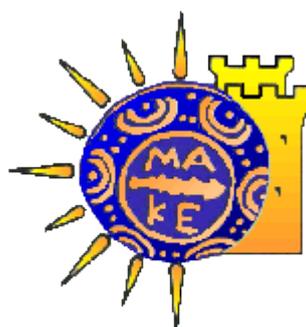


ALTERNATIVE MONETARY POLICY TOOLS DURING THE GREAT RECESSION



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Abstract

The ever-increasing use of non-conventional monetary policy instruments has led to intensified interest in their effects on real economy. Taking this as my starting point, this paper aims to shed light on this question. Using a Structural VAR model for the Euro area during the period of 2003 until the first semester of 2017, I found that the implementation of Quantitative Easing was positive for the real economy, as it prevented a further reduction of real output and warded off the risk of disinflation.

KEYWORDS: QUANTITATIVE EASING, UNCONVENTIONAL
MONETARY POLICY, SVAR, EURO AREA, ECB

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Chapter 1

Introduction

Up until the Great Recession, as the financial crisis of 2007-2009 is called, there was a consensus in respect of the monetary policy implementation across central banks in major countries. Policymakers having understood the importance of a low and stable inflation, they soon made it their essential goal. In order to achieve the target inflation level, central bankers conduct their policy stance by setting a target for the “policy rate”¹, at which they provide funds to banks on the interbank market (the market for central bank reserves). This approach is referred to as “interest rate policy”.

Due to the “interest rate policy” the implementation of monetary policy is quite straightforward. First, central bankers decide the desirable level of the policy rate and conduct this information to the public by announcing it and explaining how it will help the economy, if it is achieved. This information is first transmitted to the interbank market, where central bank can steer interest rates, under the constraint of its independence on monetary policy issues and its monopoly power over the issuing money. Thereinafter, the liquidity management operations, which are designed to ensure the effectiveness of this interest rate (Borio and Disyatat, 2010), take place.

These changes in the official rate, however, set a transmission mechanism in action beyond the banking system. Particularly, the combination of controlling short-term nominal interest rates and the lagged inflation expectations’ adjustments permit central banks to control at least the short to medium term real interest rate. The latter will affect saving and investment decisions of households and firms as well as banks’ willingness to lend². Thus, through “interest rate policy”, central banks are capable of reaching their primary objectives and influence real economy (inflation and output levels) (Fawley and Neely, 2013).

This technique worked well enough until the recent financial crisis struck. The persistent economic depression and deflation that came after the crisis brought central banks in front of new, unprecedented challenges. Having as a purpose to deteriorate the economic decline, they immediately respond by aggressively cutting the policy rates. But reaching the zero lower bound (ZLB) combined with

¹ Policy rate is the short-term nominal interest rate (usually overnight) which is used by central banks to carry out or signal its monetary policy stance, such as the key interest rate in the case of European Central Bank.

² Many banks use the policy rate as a reference rate to decide the terms of their lending and deposit offers i.e. the cost of money in the real economy.

the impaired interbank lending channel, i.e. the disconnection between policy rates and market rates made it clear that further implementation of conventional measures was impossible. Hence, policymakers decided to reinforce the panoply of monetary policy instruments by adding balance sheet policies, forward guidance and negative interest rates³, the so-called unconventional monetary policies.

This turnaround in monetary policy had three core goals, as the Former President of the European Central Bank (ECB), Mr. Jean-Claude Trichet (2012)⁴ noted. First of all, the new measures would support the financial sector's functioning. Additionally, they would assure the real economy's activity and finally, they would assign the role of conventional measures in preserving the price stability over the medium term.

In spite of the broad use of them the last years, there is nothing like an overall acceptable definition of what unconventional monetary policy is. Consequently, I will adopt the approach of Cecioni et al. (2011) who defines as non-standard measures "any policy intervention that aims to rectify a malfunctioning of the monetary transmission mechanism or to provide further stimulus to the economy when the official interest rates reach the zero lower bound". Another distinguishing feature of these policies is that, the main tool in conducting the policy stance is not policy rate anymore, but through its balance sheet, central bank seeks to directly intervene in the impaired markets (Borio and Disyatat, 2010).

Despite these common, theoretical characteristics, however, there is no standardization in implementing the unconventional monetary policies and it is easy to understand the reason. The differences in the structures of the financial systems, the varying severity of the economic slump in each case, as also the divergent role that each central bank has as a jurisdiction institution are some features that provoke this heterogeneity.

The first central bank, which applied the experiment of unconventional monetary policy, was the Bank of Japan (BoJ) in the 1990s. The combination of deflation and the ZLB forced the BoJ to turn to new, pioneer monetary policies. The beginning was the introduction of zero interest rate policy in 1999. After seven years of unconventional monetary policy application, containing a short pause (only 7 months) and a large number of non-standard measures, the economy managed to get back on recovery rates.

However, the global economic turmoil after the Lehman Brothers' collapse in 2008 forced the "leader in unconventional policies" (i.e. the BoJ) to reinforce once

³ In this analysis I will not examine the impacts of forward guidance or negative interest rates, rather than focusing on the effects of balance sheet policies, and specifically to quantitative easing.

⁴ Speech held at the IJCB conference on March 23-24, 2012.

again its toolkit with non-standard measures. The last 8 years, it has introduced several unconventional tools, e.g. QQE1, QQE2 etc. and it will not stop doing so until there will be no danger that threatens the target set for price stability.

As the first economy struck by the financial crisis of 2007, the US economy is a great example to study the quantitative easing and other unconventional measures implementation. Watching the forthcoming economic turbulence, the Federal Reserve proceeded with an “exceptionally rapid and proactive” (Bernanke, 2009) cut of federal funds target rate, which was constrained near zero by December 2008. Therefore, US policymakers had to find new ways to respond and protect their economy. This was the starting point for implementing QE.

The very first implementation lasted 17 months (November 2008-July 2010) where the Fed spent \$2.1 trillion on asset purchases. The second round was introduced only 3 months after the first was ended. Through the programme, the Fed purchased \$600 billion in longer-dated securities until July 2011, when it was brought to an end. After two QE rounds, the yield curve became the main target. For this reason, Operation Twist Programme undertook to put downward pressure to it through asset purchases that was targeting to the maturity of the assets. In September 2012, it was combined with the third round of QE and after 25 months of implementation, the Fed announced its ending.

No QE programme has been used since then and the federal funds target rate is gradually rising.

Another central bank that turned to QE when its policy rate reached its effective lower bound was the Bank of England. Thus, in March 2009, after a further reduction of Bank Rate (at the level of 0,5%) the MPC introduced the first QE programme, which included asset (mainly gilts) purchases. After almost a year of implementation and some raises to the amount of the purchases, the programme totally cost £200 billion. As the risk of a failure to achieve the inflation target was removed, the MPC considered it was time to stop QE1. Nonetheless, QE came back in October 2011 to revoke the forecasts for inflation fall. During QE2 BoE spent £375 billion on asset purchases.

The June of 2016 was to become a benchmark, as British people voted to leave the European Union. As a consequence, the UK economy was disrupted, calling for new measures. The new package of measures included further liquidity support by using both conventional and unconventional tools. Since economic indicators show that the UK economy is on recovery path, the MPC decided to continue the use of the existing programme, letting QE to continue playing an important role on monetary policy transmission.

The last central bank that turned to QE, even it was the first to respond to the global financial crisis is the ECB. By May 2009, the Euro area policy rate had been cut by 325 basis points to a level of 1%; it was not enough to overturn the

economic turmoil though. As a consequence, the ECB reinforced the “Enhanced Credit Support” policy, which includes asset purchases with a variety of maturities and eligible collaterals, as well as swap agreement with other central banks. Even it had a positive impact on the Euro area economy the sovereign debt crisis in 2010 addressed a new set of risks on the achievement of price stability. That was when the ECB implemented another round of non-standard measures such as the CBPP2 or the SMP, aiming to reassure investment about the future of the euro and abolish the redenomination risk.

Until the summer of 2014, the ECB had to confront another enemy. This time, disinflation pressures started to menace the mandate of price stability. For this reason, the ECB introduced new measures (TLTROs, DFL and EAPP), which used more activate the ECB’s balance sheet, in conjunction with forward guidance to restore inflation to sound paths. On the last meeting, on December 2016, the Governing Council announced that they are willing to continue implementing these measures until there is no reason for concern about the path of inflation.

It has become evident that the global financial crisis was the reason for change in conducting the monetary policy. Naturally, the broad use of non-standard measures is of increasing interest to researchers, who developed a vast literature in order to examine their effects either on interest rates, or on the real economy. Unfortunately, the most researches focus on the former (as data are easier to be found) and consequently there is a lacuna about their impacts on real economy.

Having it as a starting point, this paper tries to fill this gap in a double way. First, I am trying to present and to exam the unconventional monetary policy measures of the four major economies, Japan, the Unites States of America (USA), the United Kingdom (UK) and the Euro area in a theoretical level. After this, the paper continues to the empirical analysis of Quantitative Easing effects on the Euro area. In order to do so, I use a Structural Vector Autoregressive (SVAR) model of 5 variables for the Euro area during the sample period from January 2003 to July 2017, which tries to capture the effects of unconventional monetary policy through the volume of bank credit, i.e. the volume of MFI loans to the private and non-financial sector.

The analysis starts by defining and documenting what unconventional monetary policy is, as well as presenting a comprehensive description of the transmission mechanism through which asset purchases affect financial markets and communicate to the real economy. All these constitute chapter 2. Chapter 3 continues by providing a theoretical analysis of all the unconventional measures that took place in the four major economies after the outbreak of the 2007-2009 financial crisis, while chapter 4 contains a reference of the relative literature. Chapter 5 continues by analyzing the dataset used in this paper, as also the methodology followed. In chapter 6, empirical results are reported and finally chapter 7 brings down the curtains of the analysis.

PART A

THEORETICAL ANALYSIS

Chapter 2

Unconventional Monetary Policy Measures

*“Ἐς δὲ τὰ ἔσχατα νοσήματα αἱ ἔσχαται θεραπείαι ἐς ἀκριβεῖν,
κράτισται.”⁵*

-Hippocrates, 460-357 BC

The outbreak of 2007-2009 financial crisis and its devastating impact on the economy left no room for further implementation of conventional monetary policy. Once the zero lower bound had been reached, as well as the connection between official interest rates and market rates was lost⁶, it was obvious to policymakers that they were in front of an exceptional situation, and in an analogy to what Hippocrates⁷ claimed, this situation called for exceptional measures that could support the functioning of financial markets.

By using non-standard measures, the focus of monetary policy shifted from setting the price of money to setting the quantity of money. In order to do so, central banks started to implement “balance sheet policies” with which they started actively varying the size and composition of their balance sheets.

For the purpose of better understanding, it was considered to be more appropriate, analysis to start with the exposition of the key features of non-conventional tools.

2.1 Characterizing Unconventional Monetary Policy

A question that has been raised by the use of unconventional tools is how we can distinguish them from the classical application of monetary policy. Lenza et al. (2010) tried to give an answer. As they asserted non-standard measures can be categorized according to three characteristics: (a) the impact of these measures on central bank

⁵ “But for extreme illnesses, extreme remedies, applied with severe exactitude, are the best”. Hippocrates, Aphorism 6. (The English translation was made by: <http://www.translatum.gr/>).

⁶ Banks became afraid of high credit and liquidity risks, so they stopped lending its other in the interbank market. As a consequence, short-term interest rates in the interbank market could not reflect central bank’s monetary policy stance any more.

⁷ Hippocrates (460-357 BC) is the “Father of Modern Medicine” and the founder of the “Hippocratic School of Medicine”. He lived at the Age of Pericles (Classical Greece).

balance sheet, (b) the counterparties of the unconventional transactions, as well as (c) the purpose for which these measures are implemented (see figure 01).

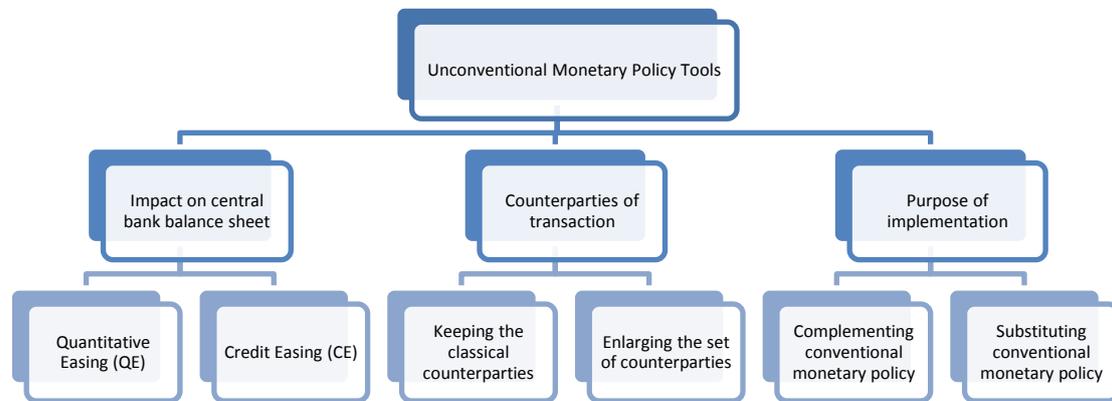


Figure 01: Classification of Unconventional Monetary Policy Tools

2.1.1 Impact on central bank balance sheet

By focusing on the balance sheet, central bankers tried to stimulate and provide further accommodation to the economy by directly affecting long-term interest rate, as the short-term was constrained near zero. However, there are distinctions between the policies that the balance sheet constitutes their main tool, as some of them affect the size, while others its composition. Thus, there is quantitative and qualitative/credit easing, respectively.

Even there is not a specific definition about what is quantitative easing (QE), we could say that QE is all these large-scale asset purchases that are financed by the issuance of central banks (Bowdler and Radia, 2012). Specifically, QE expands the size of the central bank balance sheet, and as a consequence the monetary base, while, on the liabilities side, this expansion is expressed by an accumulation of central bank reserves – under the constraint of perfectly elastic banknotes provision (Lenza et al, 2010). In conclusion, QE is reflected on the size of central bank balance sheet and not on the composition, which remains intact.

Although, anyone could claim that pure QE⁸ does not differ from “normal” open market operations, it would be mistaken to believe that it is a conventional way of implementing monetary policy. This is why; QE directly affects the quantity of money by liquidity injections, rather than the price of money by variations in policy rates. Yet, another substantial difference is the fact that now central banks expand their purchases to non-traditional assets, such as long-dated government securities or

⁸ Woodford (2012) defined pure QE as the policy of purchasing short-dated government securities and expanding the monetary base.

corporate bonds. This happened because the effectiveness of QE may depend on what assets and in what quantities are purchased (Bowdler and Radia, 2012).

On the other hand, qualitative/credit easing (CE) is quite the opposite. CE policy focuses on the composition of assets (loans and securities) that central bank holds and on how this mix affects credit conditions for households and firms. Transactions accomplished in the limits of CE leave the total size of central bank balance sheet unchanged.

2.1.2 Counterparties of transactions

In normal times, central banks conduct their monetary policy stance through the banking sector, as banks form the “regulated institutions central to the payments system and credit creation” (Lenza et al, 2010). However, when such a severe crisis struck there is nothing normal! Depending on the intermediate objectives of the unconventional measures (to replace or re-activate the impaired market), central banks have even to rethink their counterparties. This is illustrated by two examples.

At the beginning of the recent crisis the most of the non-standard measures aimed to provide further credit to banks, so as to maintain their lending levels to non-financial sectors, which would support private and public spending i.e. central banks wanted to re-activate the harmed markets through banking system. In that stage, there was no need to turn to new counterparties, so they continued to cooperate only with banks.

On the other hand, as the economic turmoil did not retrieve, banks wanted to hold more assets and lent lesser, irrespective of how low was the policy rate. In that point, the banking sector was not transmitting the monetary policy stance to real economy, so central banks had to replace it and through asset purchases programmes to directly intervene into the damaged markets.

2.1.3 Purpose of use

Another divergence point between the non-standard measures is the reason for which they are applied. In times where the ability of using further conventional tools is lost, non-standard measures are implemented to help central banks to conduct their monetary policy stance to economy. In such cases, unconventional measures can be thought of as complements of the standard tools, as they will have a supportive and parallel role (Trichet, 2012).

To the contrary, reaching the point where reduction of the official rate is forbidden, central banks start to carry out measures with the intention of contributing directly to the pursuit of price stability (Trichet, 2012). In this sense, these measures are substituting the use of policy rates fluctuations and they are substitutes of conventional policy tools.

Despite their theoretical classification, it is difficult to categorize non-standard measures that have been used by central banks along these dimensions. As we will

discuss in chapter three, each central bank had to adjust the measures taken in the context of a non-conventional policy to its unique characteristics (main objectives, economic environment, restrictions, etc.). Thus, a great number of different policy tools were in combat of the crisis response, so that to overturn the decline in economic activity and correct the malfunctioning financial markets.

2.2 Transmission Mechanism

As it was mentioned above, central banks turn to quantitative easing when further short-term interest rate cuts are not a possible solution. Due to this process, policymakers have the chance to directly affect the long-term interest rates. But how does this policy transmit to the real economy?

In our framework, there are four main channels through which the monetary policy stance is transferred to asset prices and finally, to real economy: signaling, portfolio rebalancing, market functioning/liquidity premia and credit/bank lending channel.

Important part of the monetary policy transmission process is the communication to the public of future large-scale purchase operations. This is represented by the “signaling channel”, which in general contains any information that an economic agent may obtain on the future course of monetary policy (Joyce et al., 2011b). The first step is made by central banks, by sharing information with the public about their future plans in order to achieve their fundamental objective, i.e. the inflation target. For example, a large long-term asset purchase will be central bank’s commitment of low, future interest rates, as alternatively it will have to front significant losses (Hausken and Ncube, 2013).

At this point, it is useful to mention that this mechanism is only effective when inflation expectations are well anchored to inflation target. Otherwise, inflation expectations could be negative, as it was possible for inflation to fall below the target (Joyce et al., 2011b). Hence, this channel can be used by central banks in order to restore confidence in the markets and alter public expectations about future monetary policy (Cecioni et al., 2011).

Through the “portfolio rebalancing channel”, the central bank operations conducted within the framework of QE tend to increase the prices of the assets that are being purchased, and also the prices of their close substitutes. Under the constraint of imperfect substitutability between long-term gilts and money, the sellers will be willing to rebalance their portfolios so as to find a closer substitute. The quest for more profitable holdings will lead to an increase in the demand for other assets and so will their prices. Increases in prices will, in turn, lower yields that mean lower borrowing cost for firms and households. Due to the favorable conditions, spending boosts and economy stimulates. This procedure will stop only when prices reach the point where investors are willing to keep all available assets and money.

When central banks accept to enter the game and participate in transactions, increase the liquidity held by investors by enlisting non-standard measures, e.g. purchases of long-term securities, with the issuance of bank reserves (Hausken and Ncube, 2013). The increasing liquidity will reduce premia for illiquid assets and via this “market financing/liquidity premia channel” trading will be encouraged. Thus, the presence of an active central bank in the market may improve market functioning.

The last channel to which I will refer to is the credit/bank lending channel. The higher level of liquid assets that can be generated through purchases of non-bank holdings will improve the liquidity of the banking sector. This will permit banks to boost the lending volume, which will create funding opportunities for both households and businesses. Consequently, spending will be encouraged, asset prices will be increased and economic conditions will be improved.

Chapter 3

Four stories of Unconventional Monetary Policy

Economies with different structures and characteristics need different crisis responses to effectively deal with economic fluctuations. For example, the Bank of Japan and the European Central Bank used measures that focused on lending to private financial institutions, as they are bank-central economies. In opposition, the Federal Reserve and the Bank of England's measures rely more on bond purchases, as these economies are market-central. Despite, whatever structural differences, however, all four banks had one common target: to maintain price stability and help inflation return to sound pace.

This section reports on all the different tools that have been used by each of the four major central banks, i.e. the Bank of Japan (BoJ), the Federal Reserve (Fed), the Bank of England (BoE) and the European Central Bank (ECB).

3.1 The case of the Bank of Japan

The first central bank, which applied the experiment of unconventional monetary policy, was the Bank of Japan (BoJ) at the end of the 1990s that is before the global financial crisis of 2007 erupts. In the 1990s the Japanese economy had to deal with declining economic growth and inflation. In addition to these, the Japanese financial crisis of 1997 led the inflation rate below zero percent. That was when the BoJ reacted with a massive policy rate cut, which reached the level of 0.25%. Hence, the combination of deflation and zero lower bound left BoJ no other choice but to turn to non-conventional methods.

This new monetary phase started in February 1999 when the BoJ announced the implementation of the zero interest rate policy (ZIRP). Under its scheme, the BoJ would supply the markets with excess funds⁹ and as a consequence the uncollateralized overnight call rate would be driven to a level of about 0 percent. In April 1999 the BoJ supplemented its monetary policy toolkit by qualitative forward guidance, by which the BoJ declared its intention to keep up with the ZIRP until there are no deflationary concerns. By August 2000, the economy had returned to a recovery path, so BoJ stopped using the ZIRP.

⁹ The funds in the market would be more than that were necessary for financial institutions to meet their reserve requirements.

However, the dot-com bubble that blew up in the United States in early 2000s, affected the Japanese economy, returning it to economic slowdown. In March 2001, the BoJ turned once again to non-standard measures and implemented both quantitative easing and forward guidance¹⁰. Up until January 2004, the BoJ had gradually increased its goal for current account balances to about 6-7% of nominal GDP (that is in numbers 30 to 35 trillion yen). Evenly, the year-on-year rate of change in the CPI turned positive and it met its forward guidance condition¹¹. Thus, in March 2006 the BoJ ceased QE programs and in July of the same year it raised the policy rate to 0.25%.

The economy of Japan enjoyed growth and a period of calmness until the moment where a severe negative shock, because of the global financial crisis in 2008, struck its economy and as a result, the year-on-year rate change in the CPI went back to negative levels. A first attempt of BoJ to face the sharp economic downturn and enhance the monetary easing was the implementation of “Comprehensive Monetary Easing” (CME) policy¹². Under this policy, the BoJ introduced a new asset purchase program, including both private sector financial assets, such as commercial papers and government securities, under the objectives of a decline in long-term interest rates and a decrease in the risk premium. Also, in February 2012 the BoJ set a “price stability goal in the medium to long term” which is expressed in terms of the year-on-year rate of change in the CPI of 1 percent for that moment.¹³ Despite that, these measures have provided a slight easing in the financial sector, failed by reversing the effects of the crisis.

In April 2013, the BoJ innovated once again by introducing the “Quantitative and Qualitative Monetary Easing” (QQE1)¹⁴. This time, the BoJ tries to “achieve the price stability target of 2 percent in terms of the year-on-year rate of change in the consumer price index (CPI) at the earliest possible time, with a time horizon of about two years” (Monetary Policy Meeting, 2013). As its name implies, the further monetary easing will be approached, so in quantity, as in quality terms. The BoJ will increase its monetary base by 60-70 trillion yen each year for the next two years (Figure 02), i.e. it will double its monetary base, in addition to a change in the composition of asset purchases, giving more emphasis on longer-dated Japanese

¹⁰ Before continuing the analysis, it is good to refer to two points. First, the QE that was implemented by the BoJ differs from the QE that is implemented nowadays, as its main policy target was the balance of current account. Secondly, the forward guidance was linked to the actual year-to year rate of change in the CPI.

¹¹ The QE policy will be pursued until the annual rate of change in the CPI (excluding fresh food) register zero percent or above in a stable manner.

¹² Decision taken by the Policy Board of the Bank of Japan, during the Monetary Policy Meeting held in October 5, 2010. (https://www.boj.or.jp/en/announcements/release_2010/k101005.pdf)

¹³ This goal was reviewed by the Policy Board of the Bank of Japan in January 22, 2013 in order to include the price stability target. (https://www.boj.or.jp/en/announcements/release_2013/k130122b.pdf)

¹⁴ Decision taken by the Policy Board of the Bank of Japan, during the Monetary Policy Meeting held in April 4, 2013. (https://www.boj.or.jp/en/announcements/release_2013/k130404a.pdf)

government bonds (JGBs) and expand the trade of riskier assets, such as exchange-traded funds (ETFs) and Japanese real estate investment trusts (J-REITs)¹⁵.

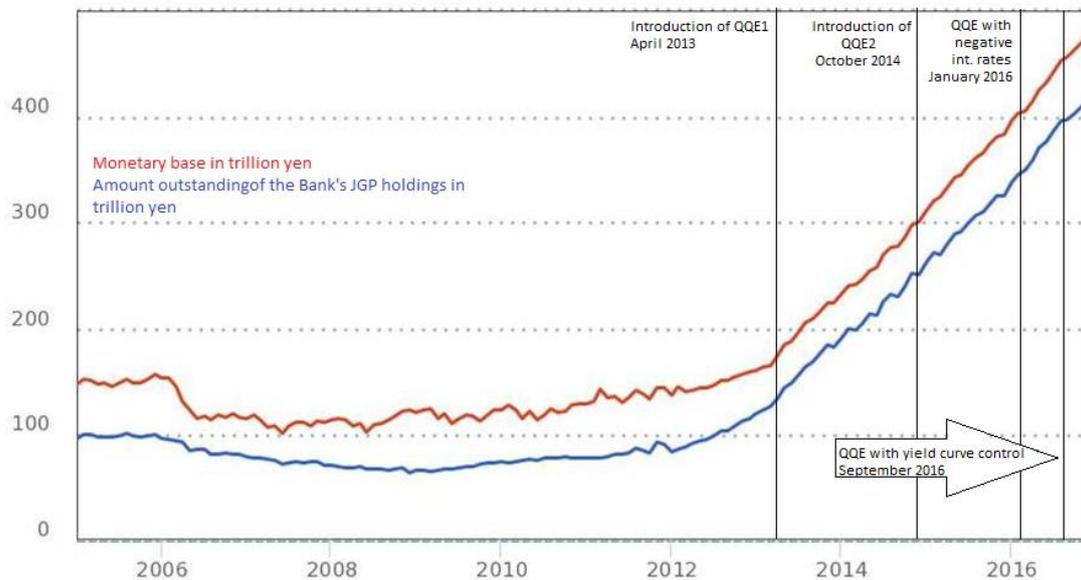


Figure 02: Japanese monetary easing efforts after the eruption of 2007-2009 financial crisis. Source: Japan Macro Advisors

One more attempt by the BoJ to achieve its goal of 2 percent inflation rate, was the decision of expanding QQE program (QQE2) in October 2014¹⁶. The expansion of the program comprises three parts. First, the BoJ will additionally increase its monetary base to a level of 80 trillion yen per year though accelerating its purchases of JGBs. It will, also, expand the average maturity of JGBs purchases in a range of 7 to 10 years. Finally, the BoJ will increase the ETFs and J-REITs purchases around three times per year.

In order to meet the ever-changing environment, the BoJ undertook another adaptation of QQE. In January 2016, the BoJ introduced the “QQE with negative interest rates” program¹⁷. The innovation this time was that, except of the quantity and quality dimensions (they remain as they were set in the previous programs) it involves an interest rate dimension. This dimension defines that the BoJ applies a negative interest rate (-0.1%) to its current account deposits. The BoJ made it clear that this program will be used for as long as needed to achieve the objective of 2% inflation rate.

¹⁵ In addition to QQE1 the BoJ decided (a) to stop the Asset Purchase Program, (b) the temporary suspension of “banknote principle, and (c) to enhance dialogue with market participants. (Source: Bank of Japan)

¹⁶ Decision taken by the Policy Board of the Bank of Japan, during the Monetary Policy Meeting held in October 31, 2014. (https://www.boj.or.jp/en/announcements/release_2014/k141031a.pdf)

¹⁷ Decision taken by the Policy Board of the Bank of Japan, during the Monetary Policy Meeting held in January 28- 29, 2016. (<https://www.boj.or.jp/en/announcements/education/oshiete/seisaku/b27.htm/>)

Of course, the decision of British people to leave European Union couldn't leave Japanese economy intact. The combination of Brexit and other unfavorable economic conditions in global level (e.g. the slowdown in emerging economies) forced the BoJ to proceed with further "Enhancement in Monetary Policy"¹⁸. Thus, the BoJ decided to increase ETFs purchases by almost 6 trillion yen per year, to implement a number of measures aiming to support "the funding in foreign currencies by Japanese firms and financial institutions" (Bank of Japan, 2016) and, finally, to continue using the previous QQE policies. However, it is surprising that, for the first time officially, announced a concerted effort by both the BoJ and the Government, so as to achieve a more dynamic effect on the economy.

Even though the implementation of QQE programmes led to the improvement of economic conditions, with Japanese economy overcome the chronic problem of deflation, the Policy Board of the BoJ found it necessary to proceed with the implementation of a new one. This programme would be a tool for the BoJ to achieve further reduction in real interest rates, via simultaneous control of both, short-term and long-term interest rates. The new programme is commonly defined as "Quantitative and Qualitative Monetary Easing with Yield Curve Control".¹⁹

Under its limits, the BoJ set a negative policy interest rate of minus 0,1 percent and, also, decided to continue with the JGBs purchases so that 10-year JGB yields will remain at a level of around zero percent. However, trying to cover every weakness of the economy new measures included in the existing toolkit,²⁰ new guidelines set for other than JGB asset purchases and finally, the BoJ strictly committed to implement this policy until the price stability target of 2 percent is achieved.

3.2 The case of the Federal Reserve

The first economy that was affected by the Great Recession was the US economy, as it first started as a subprime-mortgage crisis in US mortgage markets, hitting, consequently, many of their financial institutions. The severity of the downturn forced the policy-makers of the Federal Reserve to become more innovative and to change their practice in implementing monetary policy, maybe more than anyone else. That makes the case of the United States one of the most interesting.

The response to the crisis was immediate. Having as a goal to support real economy and avoid the consequences of the economic turbulence, the Federal Open Market

¹⁸ Decision taken by the Policy Board of the Bank of Japan, during the Monetary Policy Meeting held in July 29, 2016. (https://www.boj.or.jp/en/announcements/release_2016/k160729a.pdf)

¹⁹ Decision taken by the Policy Board of the Bank of Japan, during the Monetary Policy Meeting held in September 20- 21, 2016. (https://www.boj.or.jp/en/mopo/mpmsche_minu/minu_2016/g160921.pdf)

²⁰ In order to control the yield curve, the BoJ decided to introduce two new monetary policy tools. The first is "the fixed rate purchase operations" and the second is "the fixed-rate funds-supplying operations for a period of up to 10 years". For a detailed presentation, please see https://www.boj.or.jp/en/mopo/mpmsche_minu/minu_2016/g160921.pdf

Committee (FOMC) proceeded with a gradual, cumulative reduction in the target of federal funds rate by 475 basis points during the period of September 2007 to October 2008. At his speech in London School of Economics, Mr Bernanke, the formal Chairman of the Federal Reserve, characterized this policy response as “exceptionally rapid and proactive” (Bernanke,2009). Ongoing pressures, however, left no other choice to the FOMC than to further reduce the target of the federal funds rate reaching the point of 0 to 25 basis points in December of the same year (Figure 03).

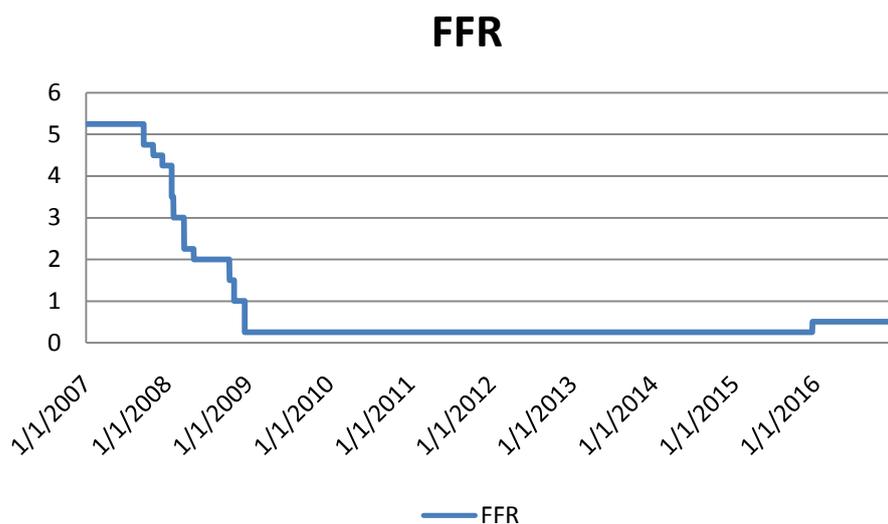


Figure 03: Federal-funds target rate (FFR), historical data from January 2007 until December 2016. Note: After December 2008 the FFR was not a specific rate level but a range. The diagram represents the highest level of the ranges. Source: FRED, created by the author.

After the last cut, the traditional monetary policy tool i.e. the federal funds rate was constrained near zero, making its use seems impossible. As a result, the Fed had to come up with new ways to provide liquidity to the system. The solution was given when the Fed started purchasing assets and other monetary instruments that were affecting the size and composition of its balance sheet. This monetary policy is popularly known as Quantitative Easing²¹, with the US economy having witnessed three rounds of it²² (Figure 04).

²¹Actually, the Fed’s new monetary policy approach differs from pure Quantitative Easing as it involves an expansion to the Fed’s balance sheet. For this reason, Mr. Bernanke characterized it as “Credit Easing”.

²² In addition to balance sheet policies, the Fed used forward guidance (statements about its future, monetary policy actions) in order to manipulate expectations in financial markets during a period of high uncertainty.



Figure 04: A timeline of QE implementation in US economy.

Source: Forbes.

The introduction of QE in US economy took place only three months after Lehman Brothers' collapse. In November 2008, Fed decided to start large-scale purchases of agency debt and mortgage-backed securities (MBS) of \$100 and \$500 billion, respectively²³. After four months, the amount of MBS and debt purchases was raised to \$850 billion, in addition to another \$300 billion, which would be used for purchases of longer-dated treasuries. In total, during the QE1 programme, the Fed spent \$2.1 trillion on purchases of MBS, Treasuries and other securities (Figure 05). The Fed announced the end of the programme in June 2010²⁴ when it found signs of steady recovery (the value of bonds, but also the price of gold went higher).

Even though, the economy kept growing after the departure of QE1, policymakers in Fed were not satisfied with the growth level, as they thought it was not enough strong. Due to QE's previous success, the Fed decided to resume it, in order to boost economic growth. Thus, in November 2010, it started the second round of QE²⁵. QE2 included purchases of longer-dated treasuries of \$600 billion which would occur by mid 2011 (Figure 05). The plan was confirmed when the Fed ended the programme in June 2011, after a further increase in gas and gold prices.²⁶

After two rounds of QE, the attention of the Fed turned to the yield curve and the Operation Twist (OT) Programme²⁷ was introduced. Under the OT, the Fed would sell

²³ Federal Reserve's announcement November 25, 2008
(<https://www.federalreserve.gov/newsevents/press/monetary/20081125b.htm>)

²⁴ It was the longest round of QE so far, lasting 17 months.

²⁵ FOMC statement November 3, 2010
(<https://www.federalreserve.gov/newsevents/press/monetary/20101103a.htm>)

²⁶ Even the programme was over; the Fed continued the purchases of securities, so as to keep a \$2 trillion balance.

²⁷ Federal Reserve's announcement September 21, 2011
(<https://www.federalreserve.gov/newsevents/press/monetary/20110921a.htm>)

its short-term treasuries and use the funds from these purchases to buy longer-term securities. More specifically, it spent \$400 billion in purchases of treasuries with maturities between 6 and 30 years and sold the same amount of treasuries with maturities up to 3 years (Figure 05). The aim behind OT was to increase short-term interest rates and lower long-term interest rates, which consequently would lower the yield curve.

In September 2012, a new round of purchases was announced. This time, the Fed would spend another \$40 billion per month in MBS, which in addition to OT funds raise the amount to \$85 billion per month²⁸ (Figure 05). The distinct point from the previous QE programmes is that QE3 had no defined timeframe for the completion of the purchases. It would be only stopped when signs of progress, in terms of price stability, are observed. However, in December of the same year a significant change fell out. The Fed decided to stop OT, which means that from that time, the whole amount of funds, i.e. \$85 billion would be used for long-term US Treasury notes²⁹. The Federal Reserve turned off QE3 in October 2014, showing no worries about the global economic weakness.

Federal Reserve Assets: Key Dates

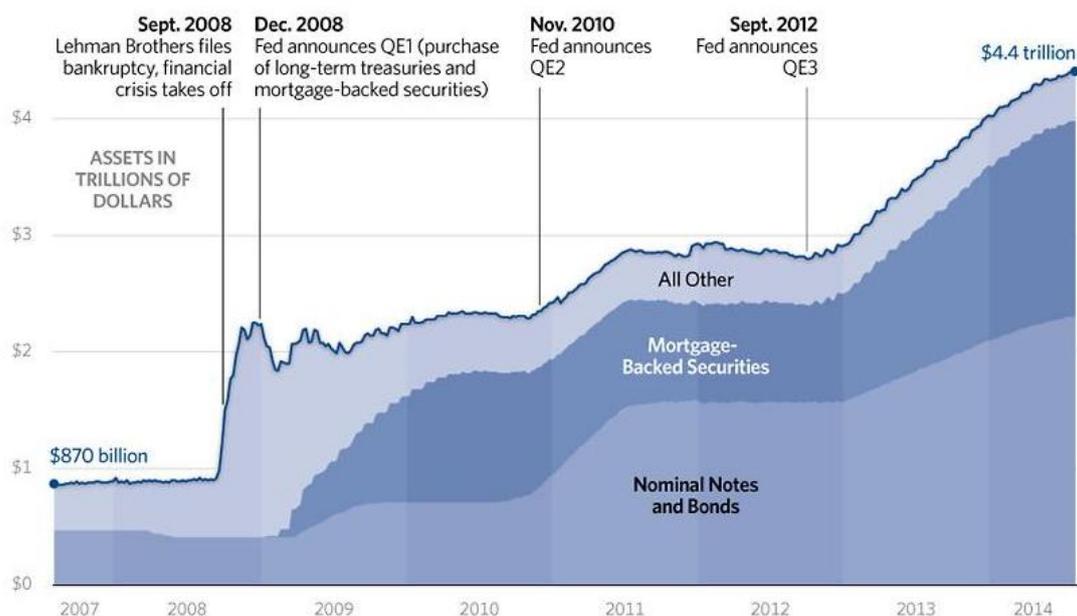


Figure 05: Federal Reserve asset composition.

Source: Board of Governors of the Federal Reserve System.

Since then, the Committee hasn't resort to QE, but it has gone on with two raises to federal-funds target rate. The first increase was in December 2015³⁰, while the

²⁸ Federal Reserve's announcement September 13, 2012
<https://www.federalreserve.gov/newsevents/press/monetary/20120913a.htm>)

²⁹ Federal Reserve's announcement December 12, 2012
<https://www.federalreserve.gov/newsevents/press/monetary/20121212a.htm>)

³⁰ Federal Reserve's announcement December 16, 2015
<https://www.federalreserve.gov/newsevents/press/monetary/20151216a.htm>)

second after one year, in December 2016³¹ by a quarter of percentage point each time, showing their confidence about economy's progress (Yellen, 2016)³². After these changes, the federal-funds target rate ranges between ½% and ¾% (Figure 03).

3.3 The case of the Bank of England

The UK's response to the 2007-2009 financial crisis was immediate, with the collapse of Lehman Brothers in autumn 2008 to constitute, once again, the benchmark in the conduct of the monetary policy. The severe outcome of the latter left policymakers in the UK no other choice than to adopt non-conventional monetary policy measures, i.e. large asset purchases (mainly of longer-term government bonds-gilts), which aim to stimulate the economy enough, so that inflation meets its 2 percent target when a further reduction in Bank Rate is not a possible option.

In early 2009, it was clear that even if there had been a very large reduction of the Bank Rate (it was cut from 5 ½% in late 2007 to 1 ½% in January 2009) (Figure 6), it was not enough to remove the substantial risk of inflation undershooting its target in the medium term. As the Monetary Policy Committee (MPC) were concerned of the consequences of a further policy rate reduction³³, realized that it was necessary to directly affect the quantity and not the price of money supplied.

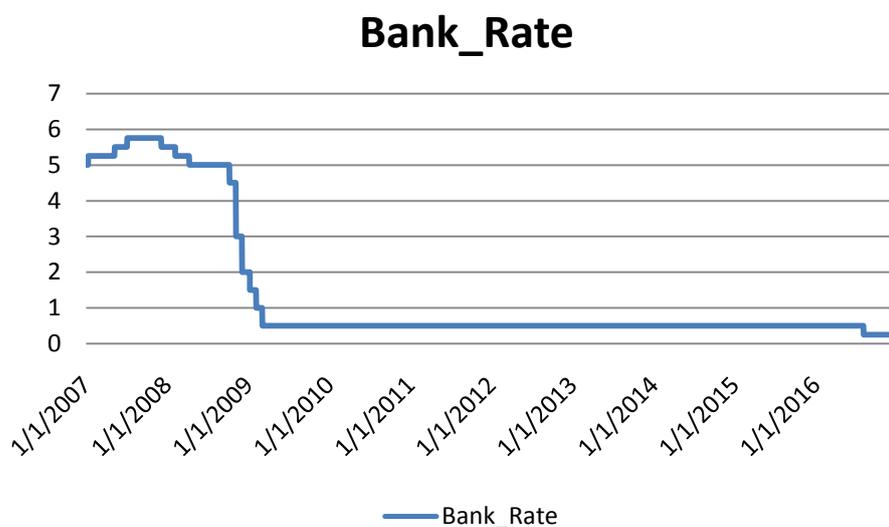


Figure 06: Bank Rate, historical data from January 2007 to December 2016. Source: Bank of England, created by the author.

The first comprehensive effort was made in March 2009, when the additional policy rate cut at the level of 0.5% was accompanied by the first Quantitative Easing

³¹ Federal Reserve's announcement December 14, 2016 (<https://www.federalreserve.gov/newsevents/press/monetary/20161214a.htm>)

³² The Wall Street Journal article December 15, 2016 (<http://www.wsj.com/articles/fed-raises-rates-for-first-time-in-2016-anticipates-3-increases-in-2017-1481742086>)

³³ As the Bank Rate had already reached its effective lower bound, the policy-makers were concerned that an additional policy rate cut could lead to the opposite results, as this would negatively affect the profits of both banks and building societies.

Programme (QE1)³⁴, which included asset purchases, mainly of government securities (gilts), amounting to £75 billion by the issuance of central bank reserves. After, almost a year of implementation and three more raises to the total amount of asset purchases (of £50, £50 and £25 billion on May, August and November 2009, respectively), MPC decided to complete the programme on February 2010, as a weak, but satisfactory economic recovery was observed and the risk of a failure to achieve the inflation target was removed (Figure 07).

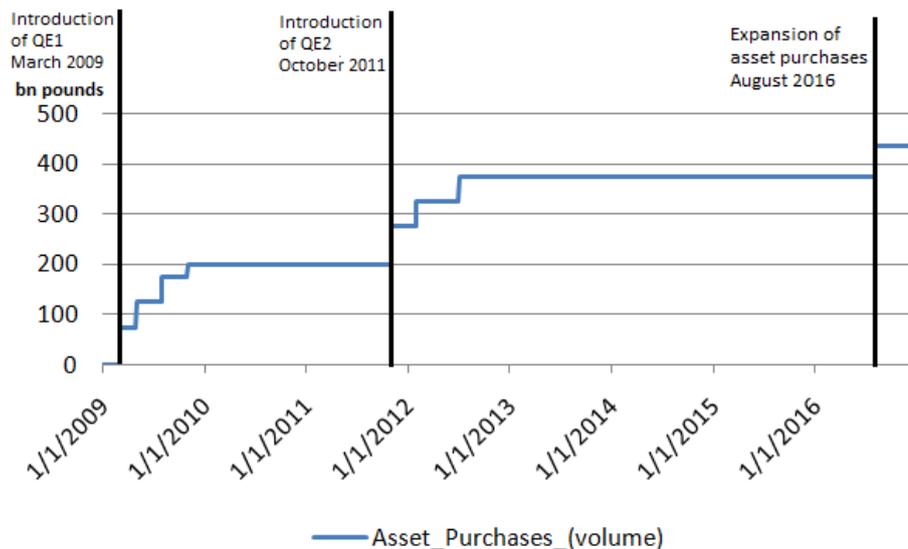


Figure 07: UK asset purchase announcements.
Source: Bank of England, created by the author.

In coming months, no significant change was observed, while economic indicators suggested a continuous, broad recovery. However, this scene changed in October 2011, where the bad economic conditions and the reduced growth rate of the global economy, led the MPC to the conclusion that inflation was likely to fall sharply during the first months of 2012. In order to deal with this problem, the Committee decided to implement another round of Quantitative Easing Programme (QE2)³⁵, which was a further finance of asset purchases for the amount of £75 billion by the issuance of central bank. In February 2012, the BoE announced another £50 billion raise, so as in July 2012, reaching the total number of £375 billion (Figure 07).

During the implementation of QE2, the Bank of England considered that it would be helpful to reinforce one more tool to boost the economic results of monetary policy. So, it turned to forward guidance (statements about its future intentions), as a way to

³⁴Decision taken by the Monetary Policy Committee of the Bank of England, during the Monetary Policy Meeting held in March 4- 5, 2009.

(<http://www.bankofengland.co.uk/publications/minutes/Documents/mpc/pdf/2009/mpc0903.pdf>)

³⁵ Decision taken by the Monetary Policy Committee of the Bank of England, during the Monetary Policy Meeting held in October 5- 6, 2011.

(<http://www.bankofengland.co.uk/publications/minutes/Documents/mpc/pdf/2011/mpc1110.pdf>)

assure public that it will insist on this monetary policy stance until there is no risk for price or financial stability. The first, such statement was on August 2013, when the MPC linked the Bank Rate to unemployment level, arguing that it would not go into any policy rate increase until unemployment rate reach to a threshold of 7% and some additional conditions will be fulfilled. On February 2014, unemployment approached the threshold level of 7% but the other conditions did not achieved, so the MPC made one more statement. This time, it argued that the Bank of England is planning to maintain the stock of the previous asset purchases at least until the first rise in Bank Rate.

Naturally, the decision of British people to leave European Union in June 2016 affected the domestic economic path, making demand weaker and unemployment higher. On the other hand, the uncertainties over future trading arrangements, as well as the large depreciation of sterling, prejudged a long period of instability. Wanting to directly stimulate the economy and avoid these negative effects of the referendum, the MPC decided at the meeting of August 2016 to implement a new, large package of monetary policy measures.

The new package of measures has three key points. The first is a further reduction of Bank Rate by 25 basis points, to a “record low” of 0.25% (Figure 06). Secondly, the MPC decided to purchase up to £10 billion of UK corporate bonds and finally, to further expand the existing QE programme by £60 billion that is a total of £435 billion, both of them are financed by the issuance of central bank reserves³⁶ (Figure 07).

Recent evidences show that economic indicators have been in a recovery path since the referendum and that this package of measures achieved to stabilize economy to a satisfactory degree. Consequently, during its last meeting on December 14, 2016, the MPC decided to continue with the existing package of measures, according to which quantitative easing play an important role in the transmission of the monetary policy stance.

3.4 The case of European Central Bank

In an environment where economies are closely interconnected, euro area was not able to avoid the adverse consequences of the global financial crisis. Even, euro zone was only indirectly affected (banks were holding toxic assets); its bank-centric structure necessitated immediate measures³⁷. ECB's response was double by both

³⁶ A detailed description of the new package of measures is given to the Monetary Policy Summary and Minutes of the Monetary Policy Committee meeting ending on August 3, 2016. (<http://www.bankofengland.co.uk/publications/minutes/Documents/mpc/pdf/2016/aug.pdf>)

³⁷ In 2007, the Euro area banking sector held almost 300 percent of Eurozone's GDP in assets. Additionally, banks constitute the main funding source for households and businesses, as banks provided them more than 70% of their external funding.

using its existing policy toolkit (conventional measures)³⁸ and introducing a number of new, extraordinary measures (non-standard measures).

(a) The global financial crisis (summer 2007-spring 2010)

Until May 2009, the Governing Council of the ECB had gradually cut its benchmark refinancing rate at 1% from 4,25% in October 2008 (a reduction of 325 basis points in just 8 months!) aiming to improve the liquidity conditions in the inter-bank lending channel (Figure 08). As, persistent economic depression and downturn inflation pressures did not fall back through the “conventional” way, the ECB announced a series of unconventional monetary policy measures under the scheme of the “Enhanced Credit Support” policy.

Mr. Trichet (2009) defined them as “the non-standard measures taken by the ECB/Eurosystem³⁹ during the financial crisis with a view to supporting financing conditions and credit flows above and beyond what could be achieved through reductions in the key ECB interest rates alone”. In order to achieve this goal, these measures were carefully designed to meet Euro area’s market needs, focusing more on the banking sector.

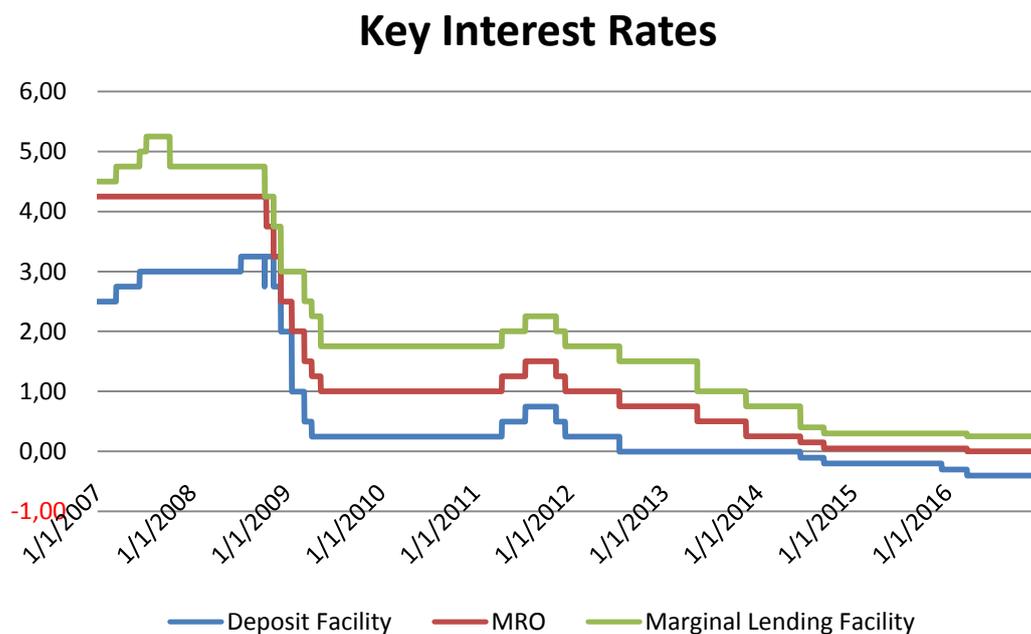


Figure 08: ECB’s rate changes. ECB uses the interest rate of the Main Refinancing Operation as its benchmark refinancing rate.

Data: ECB, created by the author

³⁸ Prior the financial crisis, the ECB used a combination of three policy instruments to contact its monetary policy stance. These instruments are the policy rates (the interest rate on the main refinancing operations MROs, the rate on the deposit facility and the rate on the marginal lending facility), the open market operations (which include the Main Refinancing Operations (MROs) with a maturity of 1 week and the Longer Term Refinancing Operations (LTROs) with a maturity of 3 months) and the minimum reserve requirements.

³⁹ Eurosystem consist of the European Central Bank and the National Central Banks of all countries-members of Eurozone.

The “Enhanced Credit Support” policy is composed of five key areas (see Table 01):

- In autumn 2008, the ECB adopted the “fixed-rate full allotment” policy in all its refinancing operations irrespective of the assets’ maturity. Under this policy, the ECB would provide unlimited liquidity to the banking system. More specifically, the ECB would cover its counterparty’s needs of funds at the lowest cost of borrowing, under the constraint of adequate collateral. The programme’s goal was to restore the credit flows in the interbank market, which, by extension, would permit banks to maintain their funding to households and businesses.
- To achieve greater easing for credit conditions in banking sector, the ECB decided to expand the asset’s list that were eligible as collaterals. Under this enlargement, the ECB made lending conditions more favorable for the banks (permitted them to refinance less liquid assets) during the crisis. Actually, evidences show that this measure was effective “in insuring against a systematic liquidity threat” (Trichet, 2009).
- Additionally, the uncertainty that dominated credit conditions in the longer-term composed a limited factor for banking planning. Consequently, banks preferred to diminish their lending to private and public sectors and keep the money as deposits in accounts with the European Central Bank. Realizing this weakness, the ECB extended the Long-Term Repurchase Operations’ (LTROs) maturity firstly to up to six months in November 2008 and later, in July 2009 to up to one year. Thus, in a more certain environment, banks will be able to provide more credit to the real economy than otherwise.
- The ECB, also, created swap lines⁴⁰ with other central banks, such as the BoE, the Bank of Canada, but mostly the Fed. The purpose of these lines was to relieve tensions in the funding markets by providing European banks liquidity in foreign currencies without affecting its foreign reserves. This measure constitutes a global effort to ease liquidity tensions.
- Finally, at its meeting on May 2009, the Governing Council of the ECB decided to put outright purchases of covered bonds⁴¹ into action. The “Covered Bond Purchases Programme” (CBPP1) was introduced in July 2009. Its main objective was to encourage financial institutions to keep lending money to non-financial sectors through further easing their funding conditions. After almost a year of implementations and €60 billion worth of outright purchases both in primary and secondary markets, CBPP1 achieved to restart activity in primary markets of covered bonds. As a result, the ECB decided to terminate it, holding, however, the assets bought under CBPP1 until maturity.

⁴⁰ For the definition of the currency swap lines please see: https://www.ecb.europa.eu/explainers/tell-me-more/html/currency_swap_lines.en.html

⁴¹ As covered bonds are a key factor in financing banks and real economy in the Euro area, as well as their higher security level (they have government bonds, mortgages and other safe assets as collaterals) than other assets e.g. Asset Backed Securities, made them an excellent tool for the transmission of the ECB’s monetary policy into real economy.

ENHANCED CREDIT SUPPORT		
PROGRAMME	DATE OF INTRODUCTION	AIM
1)Fixed-rate tenders with full allotment	October 2008	To ensure the effectiveness of the monetary policy transmission
2)Enlargement of the asset's list that are acceptable as collateral	December 2008	To ease banks' liquidity constraints during the crisis
3)Lengthening of the maturities of refinancing operations. First, to up to 6 months and later to up to 1 year	November 2008 & June 2009	To make banks' liquidity horizon longer and less uncertain
4)Swaps agreements, particularly with the Fed	September 2008	To provide liquidity to foreign currencies
5)Outright purchases of covered bonds (Covered Bond Purchases Programme)	July 2009	To help banks to manage the maturity mismatch in their balance sheets.

Table 01: "Enhanced Credit Support" policy-key areas.

(b)The Euro area sovereign debt crisis (spring 2010-summer 2014)

The extreme policy rate cut in combination with the "Enhanced Credit Support" policy that was implemented during the first years of the economic turmoil seemed to work well enough against the economic and financial instability. Yet challenges became more intricate in 2010, when the financial crisis evolved into a sovereign debt crisis⁴² in the Euro area, threatening once again the financial stability.

The institutional weaknesses of Euro area, those were uncovered after the outbreak of the sovereign debt crisis required simultaneous actions both in monetary and fiscal terms. First, the ECB responded, initiating additional measures to its previous "Enhanced Credit Support" policy and later, the Head of State and Government of the Euro area agreed, on October 2011, taking a comprehensive set of measures⁴³. They both aimed to protect bank lending conditions and restore confidence among financial market participants.

⁴² In late 2009, five member states of Eurozone (Greece, Spain, Ireland, Portugal and Cyprus) admitted that they were not able to cover their government debts and rescue their troubled banks without the assistance of the ECB, the IMF or such other financial institution. This revealed the negative feedback loop between sovereign and banks i.e. sovereign risk affects banking risk and vice versa. For more details on how the banking crisis unfolded in the sovereign debt crisis, please see: http://ec.europa.eu/economy_finance/explained/the_financial_and_economic_crisis/why_did_the_crisis_happen/index_en.htm

⁴³ Main goal of this chapter is to present the measures taken by the ECB in order to deal with the "multi-layered" crisis that started after 2007. Thus, I will not go into further analysis of the measures taken by the Head of State and Government of the Euro Area. For a detailed description, please see the Euro summit statement (October 26, 2011): https://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/125644.pdf

The Securities Markets Programme (SMP) comprises the first ECB's attempt to fight against the tensions in the Eurozone sovereign debt markets. It was announced on May 10, 2010⁴⁴. In a few words, the SMP included government bond purchases, in the secondary markets, with a maturity of up to 10 years so as to reduce the level and the volatility of the sovereign bonds yield, and also, the risk of speculative attacks on the most vulnerable economies. The interesting point is that the ECB did not announce a specific set of characteristics (such as the total amount of the purchases or its duration) for this programme while it was active!

Additionally, during 2010, the inflation in Euro area was above the target of 2%, so policymakers were worried about the inflationary pressures that the new purchases could create. Furthermore, for the ECB, the SMP was not a tool for injecting liquidity in the economic system, as it aimed to “restore an *appropriate monetary transmission mechanism*”⁴⁵. These two factors, was the reason that the Eurosystem used a series of re-absorbing operations in a weekly basis, the “weekly fine tuning liquidity-absorbing operations”, so that to fully sterilize the programme's purchases and leave ECB's balance sheet unaffected.

The end of the programme came on September 6, 2012. The ECB announced that it will keep the existing securities in the SMP portfolio to the maturity, continuing the liquidity-absorbing operations. On June 10, 2014 terminated, also, the weekly fine tuning liquidity-absorbing operations as inflation came back to levels below 2%.

Except the government bond market, the sovereign crisis significantly affected the covered bond market too. Thus, the Governing Council at its meeting on October 6, 2011, decided to launch another round of Covered Bond Purchase Programme (CBPP2), which would have the same objectives as the first.

Under its scheme, the Eurosystem would purchase covered bonds worth €40 billion in primary and secondary markets, from November 2011 until October 2012. Indeed, the CBPP2 was completed on October 2012. However, the total nominal amount of the purchases under the CBPP2 was only €16,4 billion. Finally, in its announcement, the ECB made it clear that it will hold the assets purchased until their maturity.

Background to the CBPP2, the ECB also made two massive LTR operations, the first on December 2011 and the second on February 2012. This time, the maturities of the assets purchased were increased to up to 36 months, providing the banking system with an even longer-term liquidity of more than €1 trillion.

The first semester of 2012 was crucial to the conduct of monetary policy in the euro area. On one hand, the borrowing cost for the euro area banks dependent on the respective country, thereby making the transmission of the monetary policy

⁴⁴ Except of the SMP, the Governing Council also decided to adopt a number of additional liquidity-providing operations and also, reactivate swap lines with the Fed.

⁴⁵ ECB, press release on May 10, 2010:

<https://www.ecb.europa.eu/press/pr/date/2010/html/pr100510.en.html>

ineffective. On the other hand, investors started pricing “redenomination risk”⁴⁶ in the government bond markets. As a result, government bond spreads in euro area started to increase rapidly.

The ECB ought to intervene quickly to pursue its mandate of price stability. In July 2012, the President of the European Central Bank, Mr. Mario Draghi, stated that “*the ECB is ready to do whatever it takes to preserve the euro*”⁴⁷. This intention became widely detected when on September 2012 Mr. Draghi announced the Outright Monetary Transactions (OMT) programme. Through the OMT, the ECB aimed to eliminate investors’ fear of the reversibility of the euro and restore the deteriorations in the government bond markets.

The OMT can be described as an improved version of the SMP. First of all, as the SMP did, the OMT involves government bond purchases (but this time the maturity ranged from over 1 to up to 3 years) in the secondary markets, without specifying a particular amount for the transactions. Additionally, the purchases that will take place under the programme will be fully sterilized by liquidity-absorbing operations. The key difference between the two programmes is that in order for the governments to have access to the OMT, they have to sign a Memorandum of Understanding (MoU) with the European Commission. The MoU will contain an economic reform programme, designed according to the needs of each country that the government must follow in order to return to fiscal sustainability⁴⁸.

Due to very strict limitations posed, the OMT never activated. Nevertheless, only its announcement was capable of reassuring investors about the future of the euro. As a result, the redenomination risk decreased and so did the government bond spreads in the Eurozone.

Despite the positive effects of OMT on government bond markets, Germany did not agree with its use, as it claimed that this programme exceeds the limits of ECB in conducting its monetary policy stance and leads to the direct financing of sovereign debt. Thus, they took the case to the European Court of Justice. On July 2015, the court decided in favor of the ECB^{49,50}.

An unfavorable economic environment prevailed in the middle of 2013, where money markets were vulnerable and interest rates were significantly raised. Furthermore, the policy rate was near the ZLB (0,5%), making an additional reduction of the policy

⁴⁶ The redenomination risk reflected the investors’ fear that one or more member state(s) of Eurozone will have to leave euro and thus, the latter will stop being (at least in its current compositions) the currency of the purchased bonds. For this reason, they wanted an interest rate that will compensate them.

⁴⁷ <http://www.telegraph.co.uk/finance/financialcrisis/9428894/Debt-crisis-Mario-Draghi-pledges-to-do-whatever-it-takes-to-save-euro.html>

⁴⁸ For a detailed analysis of the technical features of OMT, see: http://www.ecb.europa.eu/press/pr/date/2012/html/pr120906_1.en.html

⁴⁹ [Judgment of the Court](#) June 16, 2015

⁵⁰ For more details on this issue, please see: [The ECB's OMT compatibility with the EU law](#)

rate unwanted. It was then that the ECB realized that besides the existing measures, which provided markets with liquidity, it should find a way to influence the money market expectations about the future path of the key interest rates. That's why, the Governing Council of the ECB announced on July 4, 2013, the introduction of forward guidance. Through it, the ECB tries to anchor the monetary policy implementation with the key interest rates and the overall outlook for inflation.

Concerning the conventional monetary policy, the years after the evolution of the sovereign debt crisis, it continued to play an important role in conducting the monetary policy stance. In 2011, there were evidences that inflation accelerates in the Euro area, so the ECB increased the key interest rates' level by 25 basis points once in April and again in July of the same year, with the benchmark refinancing rate reaching the level of 1,25%. But for the next two years, the ECB moved to continuous policy rate⁵¹ reductions by 25 basis points each time (November 2011, December 2011, July 2012, May 2013 and finally, November 2013) until it reached the level of 0.25%. (Figure 08)

(c)Disinflationary Pressures (summer 2014 – winter 2016)

The positive results observed in the economy after the implementation of the above programmes, such as the decrease in sovereign bond yields were disrupted by the summer of 2014. This time, the ECB except the risk of not being able to serve its main objective of price stability, it had to face the risk of a “too prolonged period of low inflation”⁵² (Praet, 2016). Provided that the policy rate was near the ZLB since July 2012, policymakers had only the choice to turn to non-standard policy measures. Thus, they designed a new set of programmes, which would cover all the impaired segments of the Euro area economy. In order to have better results, the ECB expanded also forward guidance, so as to anchor the new asset purchases to the inflation target of nearly 2% in the medium-term.

Targeted longer-term refinancing operations (TLTROs)

Trying to reassure the banking system, so banks stimulate their lending to real economy, the ECB announced on June 5, 2014, that the maturity of its LTROs will be further extended to up to four years. These operations became known as “Targeted Longer-Term Refinancing Operations” (TLTROs). They were called “targeted”, as each bank could borrow an amount dependent on its lending profile i.e. the loans to non-financial corporations and households, excluding loans to households for house purchase that it provided until the day of the TLTRO.

The first announcement of TLTROs included two series that would be conducted on September and December 2014. All assets purchased under this programme will not

⁵¹ To describe the policy rate changes, we use MRO rate as a proxy, as it is the interest rate used by ECB in all its programmes.

⁵² For more details as regards to the disinflationary pressures in the euro area, please see: <https://www.ecb.europa.eu/press/key/date/2014/html/sp140526.en.html>

attain their maturity until September 2018, while their interest rate would be based on the MRO's interest rate plus an additional one. Furthermore, the banks participating in the TLTROs would be able to borrow more funds during March 2015 to June 2016 in a quarterly base.

The second round of TLTRO programme was announced on March 10, 2016. TLTRO II consists of four operations that will take place every three months, from June 2016 until March 2017. The main characteristics remain the same as before, with the only difference that in TLTROs II the interest rate will be also tied to the bank's lending profile (the more loans to non-financial private sector, the more attractive terms). It will serve as an incentive to banks to provide more funds to real economy, so that the transmission monetary policy mechanism is repaired.

Negative Deposit Facility rate (DFL)

Despite the great effort of the ECB to provide the banking system enough liquidity, financial institutions preferred to keep their excess cash with the ECB. In order to discourage banks from holding the extra liquidity, the ECB gradually reduced its key interest rates even the ZLB had been reached.

However, banks did not change their behavior and coupled with disinflationary pressures, made the idea of imposing negative rates plausible. In June 2014, "the European Central Bank became the first major monetary institution to venture below zero"⁵³ by reducing the rate of interest of the deposit facility from 0 percent to minus 0,1 percent, keeping the MRO's rate at the positive level of 0,15 percent. The expectations were that banks would not be interested in keeping the extra money and they would lend it to the non-financial sectors as cheaply as possible.

Since then, three further reductions have been accomplished⁵⁴ and now the deposit facility rate is minus 0,40 percent. In fact, during the last press conference on December 8, 2016, Mr. Draghi announced the ECB's intention to maintain the levels of the key interest rates at current or lower levels for a fairly long period.

Expanded Asset Purchase Programme (EAPP)

This term represents all the asset (private and public sector securities) purchases, undertaken by the ECB, in its effort to tackle the deflationary pressures. More precisely, it consist of four programmes, the third round of the Covered Bond Purchase Programme (CBPP3), the Asset-Backed Securities Purchase Programme (ABSPP), the Public Sector Purchase Programme (PSPP) and the Corporate Sector Purchase Programme (CSPP). Figure 09 represents the extension of asset purchases after the adoption of the EAPP.

⁵³ Randow, J. & Kennedy, S.: "[Negative Interest Rates: Less Than Zero](#)" Bloomberg, June 6, 2016.

⁵⁴ September 10, 2014: the deposit facility rate reduced to -0,20%
December 9, 2015: the deposit facility rate reduced to -0,30%
March 16, 2016: the deposit facility rate reduced to -0,40%

ECB asset purchases, bn EUR

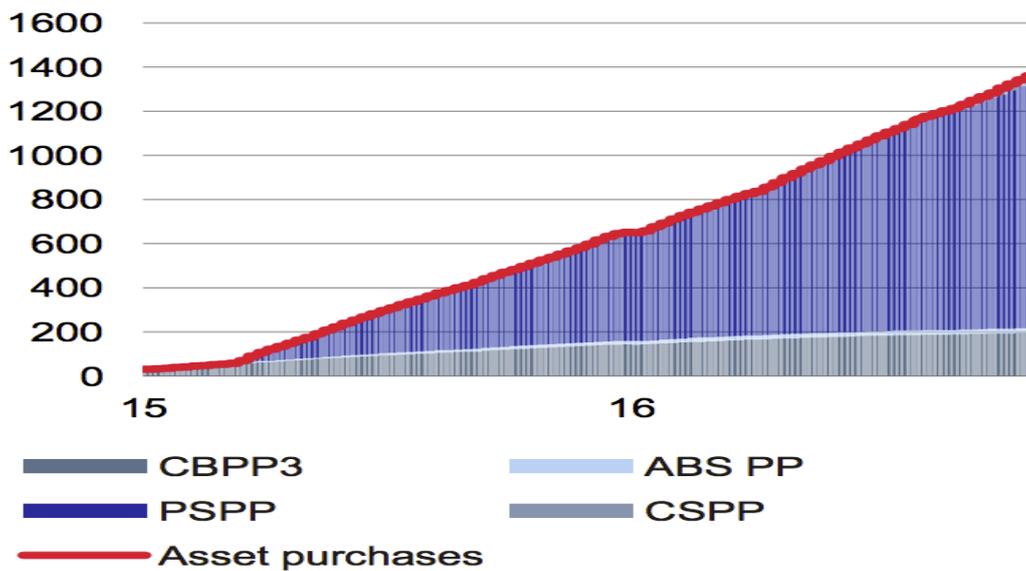


Figure 09: Volume of asset purchases through EAPP during 2015-2016. Source: Business Insider, Deutsche Bank.

The CBPP3 was implemented in accordance with its previous rounds. The purchases under its scheme started in October 2014. Firstly, it was intended to last until September 2016, but in January of 2015 it became a part of the EAPP framework, so its duration expanded until the end of 2017. As of December 2016, over €200 million of covered bonds have been purchased through the programme.

ABSPP was used as a policy tool for further credit provision to real economy. It began in November 2014 and aims to stimulate credit securitization (i.e. increase the volume of asset-backed securities in the economy) and support its sale. These purchases will develop a cycle of continuous funding of new assets that means more money into the markets. Nonetheless, in order the purchases to be safe, the ECB has defined a series of strict restrictions as regards the eligible ABS. For this reason, there is a small amount of ABS purchases, just over €20 million in December 2016.

In January 2015, the Governing Council conducted an expansion to its asset purchase programme, which would include a new programme of central governments, agencies and European institutions' bond purchases with a maturity range from one to thirty years. This programme is known as PSPP. Besides, the ECB leaves the jurisdiction to National Central Banks to decide the use or not of reverse auctions⁵⁵ as a complement of public sector purchases. Under the three programmes (CBPP3, ABSPP and PSPP), the ECB planned to purchase €60 million per month.

⁵⁵ The central banks of France, Nederland and Latvia used reversed actions for a trial period of three months. The overall outcome was positive, so the ECB support their use from some NCBs. For more details on the PSPP, see: <https://www.ecb.europa.eu/mopo/implement/omt/html/pspp.en.html>

The last programme under EAPP is called CSPP. It was introduced on March 2016, while it first launched in June of the same year. As its name implies, the CSPP composed of purchases of corporate sector bonds issued by non-bank corporations established in Eurozone with a remaining maturity from six months to thirty years. Until December 2016, almost €50 million purchases have been conducted.

Generally, through the EAPP, the ECB aims to purchase €80 million per month in private and public sectors⁵⁶. The programmes will be pursued until the end of 2017 or whenever the Governing Council considers that the inflation has return to a steady course towards the objective of nearly 2% in the medium-term.

⁵⁶ Before April of 2016, the total amount of the purchases was €60 billion.

The ECB's unconventional monetary policy-timeline

The financial crisis's response (2007-2010)

- Sep. 2008: Swap lines with other central banks, especially with the Fed
- Oct. 2008: Fixed-rate full allotment
- Nov. 2008: Lengthening of refinancing operations' maturity to up to 12 months
- Dec. 2008: More assets eligible for collaterals
- May 2009: Covered Bond Purchase Programme (CBPP1)

The sovereign debt crisis's response (2010-2014)

- May 2010: Securities Market Programme
- Oct. 2011: Covered Bond Purchase Programme (CBPP2)
- Sept. 2012: Outright Monetary Transactions
- July 2013: Forward Guidance

Disinflationary Pressures' response (2014-2016)

- Jun. 2014: Targeted Long-Term Refinancing Operations (TLTROs)
- Jun. 2014: Negative Deposit Facility rate (DFL)
- Jan. 2015: Expanded Asset Purchase Programme (EAPP)
 - 1)Oct. 2014: Covered Bond Purchase Programme (CBPP3)
 - 2)Nov. 2014: Asset-Backed Securities Purchase Programme (ABSPP)
 - 3)Jan. 2016: Public Sector Purchase Programme (PSPP)
 - 4)Mar. 2016: Corporate Sector Purchase Programme (CSPP)

Chapter 4

Literature Review

The monetary policy measures that were implemented to address the global financial crisis of 2008 and the sovereign debt crisis in the case of the ECB were designed with a specific purpose and for a limited use. Nevertheless, the extensive ongoing, as the unprecedented brunt of the economic turmoil, made it clear that these policy tools have come to stay, at least until economy returns to rates that were before the Great Recession. As a result, researchers, policymakers, but also the public developed a great interest in these tools, as they wanted to know the impact of unconventional monetary policies on financial markets and the real economy. To satisfy this “interest”, a vast literature has been developed, so in theoretical, as in empirical level. Purpose of this chapter is to briefly present this literature.

There are two ways to approach the empirical analysis. The first is to study the effects of non-standard monetary policy on financial variables. A major effort was made by Krishnamurthy and Vissing-Jorgensen (2011), who, through an event study methodology, showed that the implementation of the two rounds of credit easing (LSAP1 and LSAP2) had a positive effect on US interest rates. Specifically, their study shows a decline in interest rates, which, however, differs across the kind of assets that are purchased and between LSAP1 and LSAP2. Thus, they conclude that it is “inappropriate to focus only on treasury rates as a policy target because quantitative easing works through several channels that affects particular assets differently”.

Carpenter et al. (2013) provide a comparative analysis of the effects of QE on US and EA economies by the use of a simultaneous equation approach where they separately modeling loan supply and demand. Their main finding is that unconventional monetary policy measures helped bank funding volatility to decline, which resulted in an increased loan supply in both economies. So, they argue that there is an active “bank liquidity risk channel” that works as a complement in the transmission of the monetary policy.

On the other hand, Creel et al. (2015) use a two-step procedure to identify the impact of ECB’s monetary policy (conventional and unconventional) on interest rates and lending volumes in the four largest economies in the Euro area (Germany, France, Italy and Spain) during the recent financial crisis. Initially, they try to calculate data series of interest rates and unconventional policy shocks and later they enter these estimated series into a country-specific structural VAR. The results give evidences of an effective transmission mechanism between ECB rate and interest rates. Yet, the

evidences are not equally strong for the transmission channel of ECB rate to volumes. Therefore, an uneven effect of unconventional policy is observed.

The other way is to focus the analysis on the effects of non-standard monetary policy measures on macroeconomic variables. Kapetanios et al. (2011) tried to shed light on this issue by using three different models for UK economy. The analysis starts with a large Bayesian VAR model with 43 variables during the period of April 1993 to September 2010. Later, a change-point SVAR (MSVAR) model of 6 variables is implemented for the period February 1963 to March 2011 and finally, a time-varying parameter SVAR (TVP-SVAR) model of 4 variables for the period of 1968 Q1 to 2011 Q1 completes the research. They found out that the implementation of QE was successful for the UK case, as it had a positive effect so in real GDP level (an increase of around 1 ½ %) as in annual CPI inflation (an increase of around 1 ¼ %). Additionally, they suggest that all three models led to the same results, however, the impact was not the same.

The impact of the BoJ's QE programs are covered in Schenkelberg and Watzka (2012), who focus on the period after 1995, during which the Bank of Japan had to deal with the almost zero overnight call rate. In order to study the effects of Japanese unconventional policy, they use an SVAR approach with sign restrictions that are based on Eggertsson's (2010) New Keynesian dynamic stochastic general equilibrium (DSGE) model at the ZLB. Their results demonstrate a temporary increase on real economic activity, but inflation did not respond enough to avoid deflationary pressures. Using a different approach based on DSGE model, Chen et al. (2012) aim to estimate the performance of quantitative easing (through Fed's LSAP round 2) on US macroeconomic variables directly from the data. In detail, they use quarterly data from 1987 Q1 to 2009 Q3 for 7 macroeconomic and financial timeseries. Their results show only a slight change in GDP growth (less than 1/3 %) and even smaller change in inflation given the lack of interventions in this area. They indicate that if Fed would not have used forward guidance i.e. to keep the nominal interest rates at the ZLB for an extended period, these results would have been even smaller.

A number of studies also document the effort of ECB to handle the recent economic turmoil by the use of an unconventional monetary policy toolkit. Lenza et al. (2010), Baumeister and Benati (2010) and Peersman et al. (2011) are just some examples of detailed effort to detect the outcome of this turn in monetary policy. Lenza et al. (2010) start their analysis by a compact presentation of the ECB, Fed and Bank of England's response to the financial crisis in 2007-2009. Then, they propose an empirical analysis that would make possible to quantify this impact on Euro area in terms of spreads between ECB's key interest rate and other market rates. This approach includes two counterfactual models (a policy scenario and a no policy scenario), which are based on Giannone et al. (2009)'s Bayesian VAR. Researchers conclude that even the non-standard measures were unable to prevent the economic and financial downturn, their effect on loans and interest rates was of major importance for the stabilization of financial sector and economy as a whole.

In a different manner, Peersman (2011) uses the fact that the ECB did not respond to the recent financial crisis fully unconventionally as the starting point of his analysis. He uses a Bayesian structural VAR approach for the sample period from January 1999 to December 2009 to detect the effect of these new measures on the Euro area economy. The analysis begins with the identification of the possible “non-standard” monetary policy shocks, demonstrating that significantly affect the real economy. Thereinafter, the comparison between the non-standard monetary policy measures and the “traditional interest rate innovations” reveals similar results as regards the real economy’s impact. Peersman concludes that even both are useful tools for monetary policy implementation, their transmission mechanisms differ.

At the same time, important research has also been done from a theoretical point of view. Gros et al. (2012) use the fact that different economic and financial structures (as in Euro area – USA case) calls for different policy reactions as springboard. For this reason, they distinguish the financial crisis into two phases: 2010 is the reference point. Until 2010, both ECB and Fed shared the same objectives and, to some extent, the same tools. But, after 2010, due to the sovereign debt crisis in Europe, everything changed, so in approaching as in the effectiveness of the policy implementation. Using a different approach, Tuckwell and Mendonça (2016) also compare the two policy approaches. During this process, they found many similarities in policy tools that were adopted by both central banks, goals that these measures had to satisfy, impact on the central bank balance sheet, etc. However, they also notice the differences due to the different financial structures (American economy is market-based, while European is bank-based).

Martin and Milas (2012), unlike the common practices, have a more skeptical attitude towards QE practices. They claim that even the literature demonstrates a positive effect of QE methods on real economies (it prevented further reduction in output and inflation), more research is needed to have a clearer picture, as research efforts insofar have been focused on central banking by using similar approaches and methodologies.

PART B

EMPIRICAL ANALYSIS

Chapter 5

Data & Methodology

5.1 Data

Usually, a monetary VAR model includes three variables, an economic activity (output) variable, a variable which represents inflation and the policy rate. When researchers want to investigate the effects of unconventional monetary policy tend to use the government bond yield spread as a proxy for QE, and more rarely a number of other variables⁵⁷. Having in mind the Euro area's bank-centric economy and the fact that the ECB chiefly implemented the non-standard monetary policy actions through the banking system, I will extend the above VAR model by including a variable for the volume of bank credit, which will capture directly the effect of monetary easing⁵⁸.

More specifically, the set of variables includes the Euro area industrial production (y_t), the harmonized index of consumer prices (p_t), the 3-month Euribor (i_t), the term spread between the 10 year government bond yield and the 3-month Euribor (s_t) and finally the volume of bank credit (c_t). Industrial production and harmonized index of consumer prices (HICP) are used as proxies for output and inflation respectively. The 3-month Euribor has been used as policy rate and term spread is given by the spread between 10 year government bond yield and 3-month Euribor. The volume of bank credit represents the volume of MFI loans to the private sector adjusted for sales and securitizations⁵⁹.

The data have been retrieved by the ECB Statistical Data Warehouse. The time series of the data contains 175 monthly and seasonally adjusted observations for the period between January 2003 and July 2017. Finally, all variables are estimated in (log) levels, which allow us to take into account information in the trends (Peersman (2011), Banbura et al. (2010), Giannone et al. (2009)).

⁵⁷ See for example the paper of Kapetanios et al. (2012), who use the annual change in stock prices.

⁵⁸ Under this analysis, shocks to spreads are not interpreted as monetary policy actions.

⁵⁹ For more details see:

https://www.ecb.europa.eu/pub/pdf/other/eb201507_focus04.en.pdf?cecb6da0183e28ebc8f31419f49175ea

5.2 Econometric Framework

In the 80s, Sims (1980) introduced Vector Autoregressive (VAR) models, as an alternative to traditional large-scale dynamic simultaneous equation models. An important element of the success of these models is the fact that they handle all variables in the same way that is as endogenous. This is principal in a monetary environment where it is rather impossible for anyone to find a truly exogenous variable that can be used as an instrument (all financial/monetary variables are endogenously determined to some extent).

However, even VAR models can trace out the effects of monetary policy innovations on the economy; they have the disadvantage that they cannot be estimated by Ordinary Least Squares (OLS) methodology due to the identification problem of the system⁶⁰. In the direction of solving this malfunction Structural VAR (SVAR) models were developed. These models impose additional restrictions based on economic theory or prior knowledge to identify the system.

Thus, the analysis is based on a 5-variable Structural Vector Autoregressive (SVAR) model of order p given by the following structural form:

$$A_0 Y_t = \mu + \sum_{j=1}^p A_j Y_{t-j} + \varepsilon_t \quad (1)$$

where ε_t represents the 5 dimensional vector of the structural shocks of the model and captures the effects of a monetary shock on the economy, $E(\varepsilon_t \varepsilon_t') = I$. Y_t is a (5×1) vector of endogenous variables. More specifically, it contains the natural logarithm of output ($\ln(y_t)$), the level of inflation (p_t), the natural logarithm of the volume of bank credit ($\ln(c_t)$), the level of policy rate (i_t) and the level of term spread (s_t). μ is a (5×1) intercept vector and A_0 is a (5×5) matrix of structural coefficients.

Equation (1), however, cannot be estimated by Ordinary Least Square (OLS) method, as the estimations will be suffering from simultaneous equation bias⁶¹. Thus, we have to change its form.

Premultiplying (1) by A_0^{-1} gives

$$Y_t = \alpha + \sum_{j=1}^p B_j Y_{t-j} + u_t \quad (2)$$

Where $\alpha = A_0^{-1}\mu$, $B_j = A_0^{-1}A_j$ and $u_t = A_0^{-1}\varepsilon_t$ is the reduced-form innovations. This is the reduced form of the baseline 5-variable VAR model.

Yet, u_t has no direct economic interpretation and as a consequence the model's interpretation is meaningless. But as we can notice there is a linear relation between

⁶⁰ For a detailed description of the problem, see Enders, (2015), "Applied Econometric Time Series", Fourth Edition, Wiley, page 315

⁶¹ When the right-hand side variable is not truly exogenous, the OLS parameter estimations will be biased, i.e. systematically wrong.

structural (ε_t) and reduced-form innovations (u_t) and this linear relation will give the solution in this problem.

For a more appropriate solution I model the residuals based on the AB model as follows:

$$Au_t = Be_t \quad (3)$$

In order for the system to be just-identified, $2k^2-1/2k(k+1)$ restrictions have to be imported into matrices A and B (Lutkephol, 2005). Following the existing literature, output and inflation do not respond contemporaneously to a monetary shock (Sims, 1986; Bernanke and Blinder, 1992, Rotemberg and Woodford, 1998; and Christiano et. al., 2005). Additionally, call rate does not respond to shocks on spreads or other monetary policy actions (Baumeister and Benati, 2010). On the other hand, the MRO rate and the volume of the ECB's total assets respond instantly to a shock in industrial production (Kremer, 2015).

Under these assumptions the SVAR model is estimated for the sample period January 2003 to July 2017. Based on Akaike Information Criterion, two lags of the endogenous variables are selected as optimum for the analysis.

Chapter 6

Empirical Results – Impulse Response Analysis

Panel A in Appendix 1 displays the graph of the impulse response function for an unconventional monetary policy shock. However, the analysis will be focused only on the effects of an unconventional shock on real economy variables, that is output (y_t) and inflation (p_t).

As figure 10 shows the effect of the unconventional monetary policy shock on industrial production which I use as a proxy for output follows the existing literature results suggesting a positive reaction of output to an expansionary unconventional monetary policy shock. Specifically, the shock is characterized by a positive impact on industrial production from the first month and remains positive for the whole study period. The impact reaches a peak of 0.003% after 6 months.

Figure 11 plots the impulse responses for a non-standard monetary policy shock on inflation. The effect is obvious from the first month; it is positive and gradually increases until the seventh month when it stabilizes at a maximum level of 6%. This effect persists until the end of the sample. Although, the effect of the shock on the inflation seems to be mild, it is positive and thus comes to a line with similar literature.

Summing up, these results indicate that unconventional monetary policy which was implemented on Euro area through the banking system was successful as it had a positive impact on the economy. It was essential for the economy as it was a means to prevent a further reduction in the output level and also the danger of a continuously decreasing inflation rate or even disinflation.

Response to Structural One S.D. Innovations ± 2 S.E.

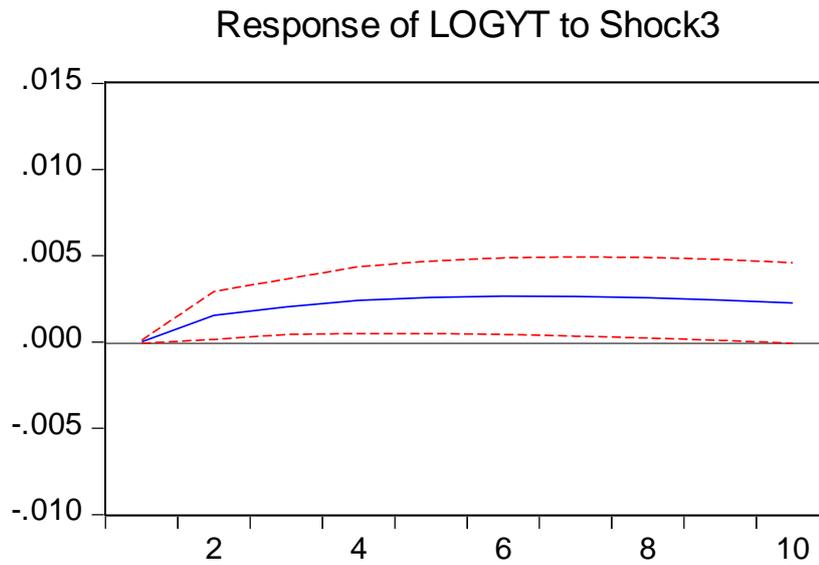


Figure 10: Impulse Response of output to a shock to the volume of bank credit.

Response to Structural One S.D. Innovations ± 2 S.E.

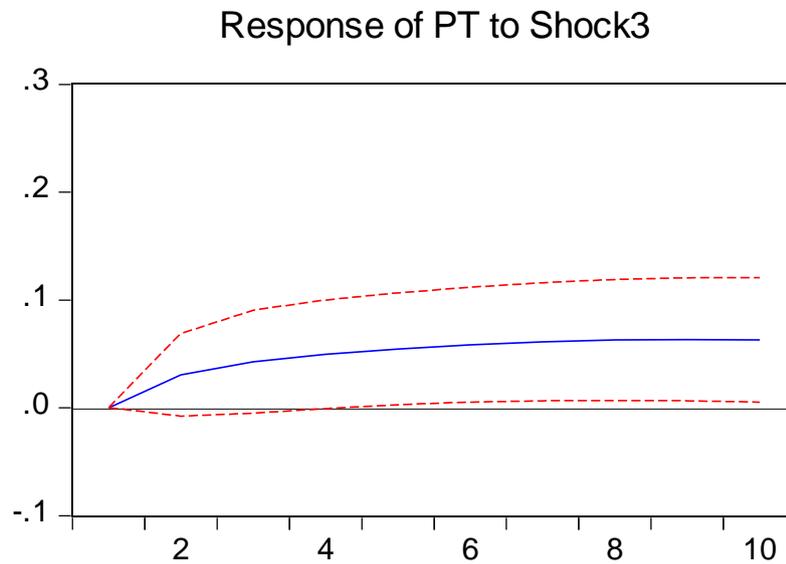


Figure 11: Impulse Response of inflation to a shock to the volume of bank credit.

Chapter 7

Conclusions

This study assesses the performance of monetary policy actions during the Great Recession and sheds light on the question of the successful use of non-standard monetary policy instruments.

The focus of the whole project is the action of the four largest central banks (Bank of Japan, Federal Reserve, Bank of England and European Central Bank) during the period of 2008 to 2017, i.e. the period after the Lehman Brothers' collapse. As chapter 1 reveals, there are common theoretical characteristics of the so called unconventional monetary policy tools, however the different structures and needs of every financial system led each central bank to turn to different measures. The theoretical analysis followed in this paper reveals the positive effects of unconventional monetary policy on each economy preventing a further economic slowdown.

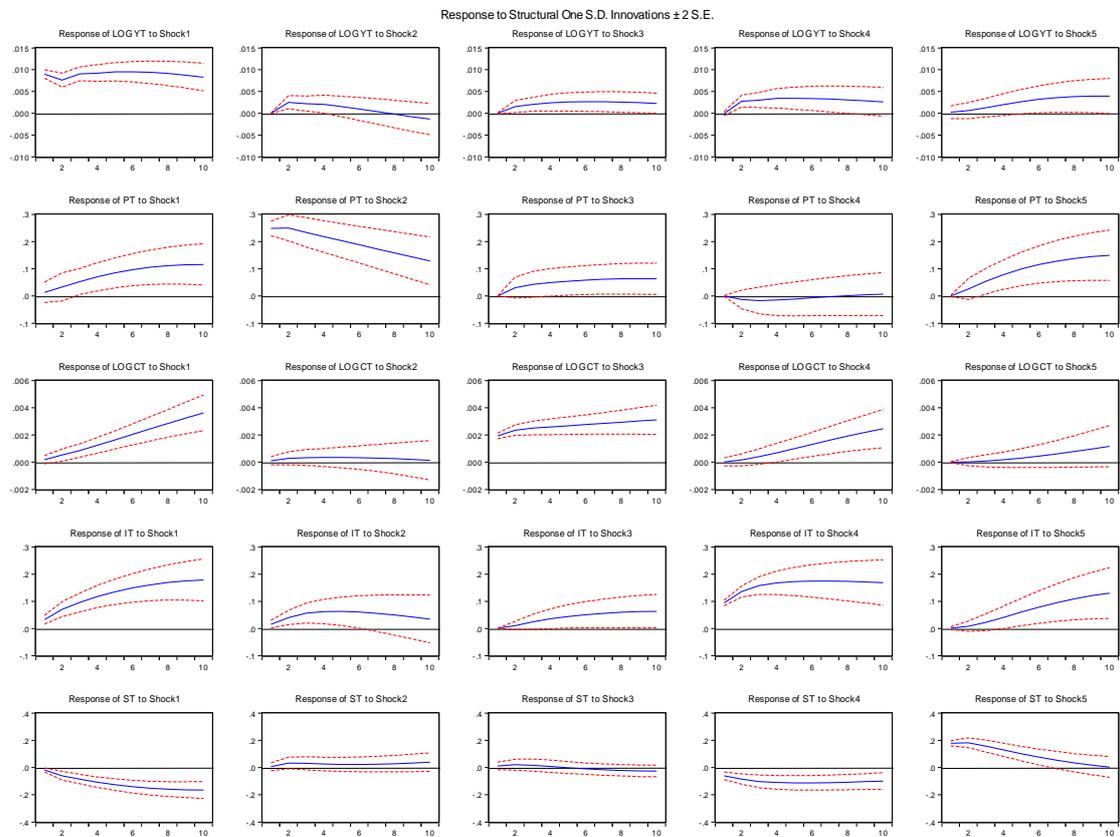
On the other hand, for the Euro area I propose a Structural Vector Autoregressive (SVAR) model which includes industrial production, HICP, 3-month Euribor and term spread of 10-year government bond yield to 3-month Euribor as the basic variables, while our instrument to measure the effects of the unconventional monetary policy is the volume of bank credit, i.e. the volume of monetary financial institutions to the non-financial corporations. The reason why I use this variable is the fact that the Euro area economy is a bank-centric system and the ECB focused on implementing its monetary policy through the banking system. Additionally, the dataset starts from January 2003 and reaches July of 2017, so it captures the whole time span of the economic turmoil.

The model's estimates suggest that the effects of a shock on the volume of bank credit had a positive impact on real economy so in terms of production as in terms of prices. These results are much in line with what literature claims for the transmission of non-standard monetary policy. Overall, results indicate that even unconventional monetary policy instruments were unable to prevent the economic slowdown they have managed to reduce the negative consequences on the global financial crisis, helping the financial system and real economy stabilize.

Appendix 1

Panel A: Impulse Response Analysis

A structural shock on the unconventional monetary policy tool (represented by c_t).



References

Baumeister, C. and Benati, L. (2010). *Unconventional Monetary Policy and the Great Recession – Estimating the Impact of a Compression in the Yield Spread at the Zero Lower Bound*, European Central Bank Working Paper No. 1258, October 2010. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1691633

Bernanke, S., B. (2009). *The Crisis and the Policy Response*. Speech at the Stamp Lecture, London School of Economics, London, England, January 13, 2009. Available at: <https://www.federalreserve.gov/newsevents/speech/bernanke20090113a.htm>

Borio, C. and Disyatat, P. (2010). *Unconventional Monetary Policies: An Appraisal*. The Manchester School, Volume 77, August 2010, pp 53-89. Available at: <http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9957.2010.02199.x/full>

Bowdler, C. and Radia, A. (2012). *Unconventional Monetary Policy: the assessment*. Oxford Review of Economic Policy, Volume 28, Number 4, 2012, pp. 603–621. Available at: <http://oxrep.oxfordjournals.org/content/28/4/603.full.pdf+html>

Cecioni, M., Ferrero, G. and Secchi, A. (2011). *Unconventional Monetary Policy in Theory and in Practice*. Bank of Italy Occasional Paper No. 102, September 2011. Available at: <http://poseidon01.ssrn.com/delivery.php?ID=163082093087069064071102119005080113125002071065025035011068112075029118002013101074036063099027006049113024126013111069122097126001025021028019006028123028068023035036063003116027031073095120110126071027073124119111100127027077088096116095089006070&EXT=pdf>

Chen, H., Cúrdia, V. and Ferrero, A. (2012). The macroeconomic effects of large –scale asset purchase programmes. The Economic Journal, 122 (November), F289-F315. Available at: <http://onlinelibrary.wiley.com/doi/10.1111/j.1468-0297.2012.02549.x/epdf>

Claeys, G. and Leandro, A. (2016). *The European Central Bank's Quantitative Easing Programme: Limits and Risks*. Bruegel Policy Contribution, Issue 2016/04, February 2016. Available at: http://bruegel.org/wp-content/uploads/2016/02/pc_2016_04.pdf

Cœuré, B. (2013). *Outright Monetary Transactions, one year on*. Speech at the conference “The ECB and its OMT programme organized by Centre for Economic Policy Research, German Institute for Economic Research and KfW Bankengruppe, Berlin, Germany, September 2, 2013. Available at: <https://www.ecb.europa.eu/press/key/date/2013/html/sp130902.en.html>

Cœuré, B. (2016). *Assessing the implications of negative interest rates*. Speech at the Yale Financial Crisis Forum, Yale School of Management, New Haven, U.S.

state of Connecticut, July 28, 2016. Available at:
<https://www.ecb.europa.eu/press/key/date/2016/html/sp160728.en.html>

Creel, J., Hubert, P. and Viennot, M. (2015). *The Effect of ECB Monetary Policies on Interest Rates and Volumes*. Journal of Applied Economics, Volume 48, 2016 – Issue 47. Available at:
<http://www.tandfonline.com/doi/abs/10.1080/00036846.2016.1158923>

ECB (2014). *The ECB's Forward Guidance*. Monthly Bulletin, pages 65-73, April 2014. Available at:
https://www.ecb.europa.eu/pub/pdf/other/art1_mb201404en_pp65-73en.pdf

European Central Bank, *Transmission Mechanism of Monetary Policy*. Available at: <https://www.ecb.europa.eu/mopo/intro/transmission/html/index.en.html>

Fawley, B. and Neely, C. (2013). *Four Stories of Quantitative Easing*. Federal Reserve Bank of St. Louis Review, January/February 2013, 95(1), pp 51-88. Available at: <https://research.stlouisfed.org/publications/review/13/01/Fawley.pdf>

Federal Reserve. *The Federal Reserve's response to the financial crisis and actions to foster maximum employment and price stability*. Last update: June 4, 2015. Available at: https://www.federalreserve.gov/monetarypolicy/bst_crisisresponse.htm

González-Paramo, M., J. (2011). *The ECB and the sovereign debt crisis*. Speech at the XXIV Moneda y Crédito Symposium, Madrid, Spain, November 4, 2011. Available at:
https://www.ecb.europa.eu/press/key/date/2011/html/sp111104_1.en.html

González-Paramo, M., J. (2011). *The ECB's monetary policy during the crisis*. Speech at the Tenth Economic Policy Conference, Málaga, Spain, October 21, 2011. Available at: <http://www.bis.org/review/r111024b.pdf>

Gros, D., Alcidi, C. and Giovanni, A. (2012). *Central Banks in Times of Crisis: The Fed vs the ECB*. CEPS Policy Brief, No. 276, 11 July 2012. Available at: <https://www.ceps.eu/publications/central-banks-times-crisis-fed-vs-ecb>

Hausken, K. and Ncube, M. (2013). *Quantitative Easing and its impact in the US, Japan, the UK and the Europe*. Springer Briefs in Economics, Springer.

Joyce, M., Lasosa, A., Stevens, I. and Tong, M. (2011a). *The Financial Market Impact of Quantitative Easing in the United Kingdom*. International Journal of Central Banking, September 2011. Available at:
<http://www.ijcb.org/journal/ijcb11q3a5.pdf>

Joyce, M., Miles, D., Scott, A. and Vayanos, D. (2012). *Quantitative Easing and Unconventional Monetary Policy – an Introduction*. The Economic Journal, 122, (November), F271-F288. Available at:
<http://onlinelibrary.wiley.com/doi/10.1111/j.1468-0297.2012.02551.x/epdf>

Joyce, M., Tong, M., & Woods, R. (2011b). *The United Kingdom's quantitative easing policy: Design, operation and impact*. Bank of England Quarterly Bulletin, 51 (3), 200–212. Available at:
<http://www.bankofengland.co.uk/publications/Documents/quarterlybulletin/qb110301.pdf>

Kapetanios, G., Mumtaz, H., Stevens, I. and Theodoridis, K. (2012). *Assessing the economy-wide effects of Quantitative Easing*. The Economic Journal, 122 (November) F316-F347. Available at: <http://onlinelibrary.wiley.com/doi/10.1111/j.1468-0297.2012.02555.x/full>

Kohn, L., D. (2010). *The Federal Reserve's Policy Actions during the Financial Crisis and Lessons for the Future*. Speech at the Carleton University, Ottawa, Canada, May 13, 2010. Available at: <https://www.federalreserve.gov/newsevents/speech/kohn20100513a.htm>

Krishnamurthy, A. and Vissing-Jorgensen, A. (2011). *The Effects of Quantitative Easing on Interest Rates: Channels and Implications for Policy*. NBER Working Paper Series, No. 17555, October 2011. Available at: <http://www.nber.org/papers/w17555>

Lenza, M., Pill, H. and Reichlin, L. (2010). *Monetary Policy in Exceptional Times*. European Central Bank Working Paper Series, No 1253, October 2010. Available at: <http://economicpolicy.oxfordjournals.org/content/25/62/295.abstract>

Lenza, M., Pill, H. and Reichlin, L. (2010). *Monetary Policy in Exceptional Times*. European Central Bank Working Paper, No 1253, October 2010. Available at: <http://economicpolicy.oxfordjournals.org/content/25/62/295.abstract>

Lyonnet, V. and Warner, R. (2012). *Lessons from the Bank of England on "quantitative easing" and other "unconventional" monetary policies*. International Review of Financial Analysis Volume 25, December 2012, pages 94-105. Available at: <http://www.sciencedirect.com/science/article/pii/S1057521912000737>

Peersman, G. (2011). *Macroeconomic effects of unconventional monetary policy in the Euro area*. ECB, Working Paper Series, No 1397, November 2011. Available at: <https://www.ecb.europa.eu/ecbwp1397>

Praet, P. (2016). *The ECB's monetary policy response to disinflationary pressures*. Speech at ECB and Its Watchers XVII conference organized by Center for Financial Studies, Frankfurt, Germany, April 7, 2016. Available at: <https://www.ecb.europa.eu/press/key/date/2016/html/sp160407.en.html>

Schenkelberg, H. and Watzka, S. (2012). *Real effects of quantitative easing at the zero lower bound – structural VAR-based evidence from Japan*. Journal of International Money and Finance 33 (2013) 327-357. Available at: http://ac.els-cdn.com/S0261560612002215/1-s2.0-S0261560612002215-main.pdf?_tid=1a940598-9455-11e6-a03d-00000aacb360&acdnat=1476700572_f726b4e2db6cfb94be75dc58e90d0b6f

Trichet C., J. (2009). *The ECBs enhanced credit support*. Speech at the University of Munich, Munich, Germany, 13 July 2009. Available at: <https://www.ecb.europa.eu/press/key/date/2009/html/sp090713.en.html>

Trichet, J., C. (2013). *Unconventional monetary policy measures: Principles – conditions - Raison d'etre*. International Journal of Central Banking, January 2013. Available at: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.296.8914&rep=rep1&type=pdf>

Tuckwell, C. and Mendonça, A. (2016). *The Global Crisis and Unconventional Monetary Policy: ECB versus Fed*. Working Paper CESA CSG 141/2016. Available at: <https://pascal.iseg.utl.pt/~cesa/images/files/wp141.pdf>

Ugai, H. (2016). *Effects of Quantitative Easing Policy: A Survey of Empirical Analysis*. Bank of Japan Working Paper Series No.06-E-10, July 2006. Available at: <http://edwesterhout.nl/wp-content/uploads/2016/03/wp06e10.pdf>

Weal, M. and Wieladek, T. (2016). *What are the macroeconomic effects of asset purchases?* Journal of Monetary Economics, Volume 79, May 2016, Pages 81-93. Available at:

<http://www.sciencedirect.com/science/article/pii/S0304393216300101>

Wu, J., C. and Xia F., D. (2016). *Measuring the Macroeconomic Impact of Monetary Policy at the Zero Lower Bound*. Journal of Money, Credit and Banking, Vol.48, No.2-3 (March-April 2016). Available at: file:///C:/Users/user/Downloads/WU_et_al-2016-Journal_of_Money,_Credit_and_Banking.pdf