universität wien

MASTERARBEIT

Titel der Masterarbeit

„Assessment of macroeconomic effects of quantitative easing (QE)“

Verfasst von

Shanna Ruf BSc

angestrebter akademischer Grad

Master of Science (MSc)

Wien, 2015

Studienkennzahl lt. Studienblatt:	A 066 914
Studienrichtung lt. Studienblatt:	Masterstudium Internationale Betriebswirtschaft
Betreuer:	o. Univ.-Prof. Dipl.-Math. Dr. Jörg Finsinger

Table of contents

Table of Figures

Table of Abbreviations

ABCP	Asset-Backed Commercial Paper
ABS	Asset Backed Securities
ABSPP	Asset Backed Securities Purchase Programme
AMLF	Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility
APF	Asset Purchase Facility
APP	Asset Purchase Program
BEAPFF	Bank of England Asset Purchase Facility Fund Limited
BOE	Bank of England
BOJ	Bank of Japan
BVAR	Bayesian Vector Auto Regression
CAB	Current Accounts Balance
CBPP	Covered Bonds Purchase Programme
CCPC	Cooperative Credit Purchasing Company
CME	Comprehensive Monetary Easing
CPFF	Commercial Paper Funding Facility
CPI	Consumer Price Index
DWF	Discount Window Facility
ECB	European Central Bank
ELTR	Extended Collateral Three-Month Repo
EMU	Economic and Monetary union of the European Union
EONIA	Euro Overnight Index Average
ESCB	European System of Central Bank
ETF	Exchange-Traded Funds
FAVAR	Factor-Augmented Vector Autoregression
FED	Federal Reserve
FOMC	Federal Open Market Committee
FRFA	Fixed-rate Full Allotment
GC	General Collateral
GDP	Gross Domestic Product
GFC	Great Financial Crisis
GSE	Government-Sponsored Enterprise

J-REIT	Japanese real estate investment trust
JGB	Japanese Government Bond
LIBOR	London Interbank Offered Rate
LSAP	Large-Scale Asset Purchases
LTRO	Longer-Term Refinancing Operations
MBS	Mortgage-Backed Security
MMIFF	Money Market Investor Funding Facility
MPC	Monetary Policy Commitee
MRO	Main Refinancing Operation
MS-FAVAR	Markov Switching-Factor-Augmented Vector Autoregression
MS-SVAR	Markov Switching-Structural Vector Auto Regression
NCBs	National Central Banks
NIESR	National Institute of Economic and Social Research
OIS	Overnight Index Swap
OMO	Open Market Operations
OMT	Outright Monetary Transaction
PDCF	Primary Dealer Credit Facility
QE	Quantitative Easing
QEMP	Quantitative Easing Monetary Policy
QEP	Quantitative Easing Policy
RMBS	Rated Residential Mortgage-Backed Securities
SLS	Special Liquidity Scheme
SLTRO	Supplementary Longer-Term Refinancing Operations
SMP	Securities Markets Programme
SVAR	Structural Vector Auto Regression
TAF	Term Auction Facility
TARP	Troubled Assets Relief Program
TED	Treasuries Over Euro Dollar
TSLF	Term Securities Lending Facility
TVP-SVAP	Time Varying Parameter-Structural Vector Auto Regression
VAR	Vector Auto Regression
VLTRO	Very Long Term Refinancing Operation
ZIRP	Zero Interest Rate Policy

Table of Symbols

$A_{0,s}$	Annual change in stock prices	(Kapetanios et al) [4]
A_i	Variance-covariance matrix	(Girardina, E./Moussac, Z.) [7]
a_i	Intercept	(Girardina, E./Moussac, Z.) [7]
$B_{j,s}$	Regime dependent autoregressive coefficients	(Kapetanios et al) [4]
$B_{1i}, ..., B_{pi}$	Autoregressive terms	(Girardina, E./Moussac, Z.) [6]
e_t	White-noise error term of the vector	(Kapetanios et al) [3]
e_t	Errors with mean zero	(Girardina, E./Moussac, Z.) [6]
F_t	Contemporaneous and lagged control variable	(Fratzscher et al.) [2]
M_t	Annual growth of money supply	(Kapetanios et al) [4]
MP_t=[...]	Matrix of monetary policy instruments	(Fratzscher et al.) [2]
S_t	Yield spread of 10-year government bond	(Kapetanios et al) [4]
tp_t^{10}	Ten-year yield term premium	(Gagnon et al.) [1]
v_t	Covariance matrix of the innovations	(Kapetanios et al) [4]
X_t	Observable explanatory variables	(Gagnon et al.) [1]
X_t	Data set of economic variables	(Girardina, E./Moussac, Z.) [6]
Y_t	Data set vector	(Kapetanios et al) [3]
Y_t	Monetary policy instrument	(Girardina, E./Moussac, Z.) [6]
$y_{i,t}$	Return of the banking equity index of country i	(Fratzscher et al.) [2]
y_t	Annual output increase	(Kapetanios et al) [4]
Z_{t-1}	Contemporaneous and lagged control variable	(Fratzscher et al.) [2]
Θ_0	Vector of constants	(Kapetanios et al) [3]
Θ_1	Parameter matrices	(Kapetanios et al) [3]
Θ_p	Parameter matrices	(Kapetanios et al) [3]
π_t	Annual price increase	(Kapetanios et al) [4]

1. Introduction

Financial crises happen time and again throughout different economies and over several decades. Historical perspectives showed through the appearance of substantial economic and financial crises such as Great Recession of 2008, Great Depression of 1929 or Black Monday 1987 how closely intertwined and staggeringly fragile national economies are. One of the conditions of a well functioning economy are "*well-developed, liquid and transparent credit markets"*[1]. These and some other substantial rules were neglected during last global financial crisis resulting in the Great Recession that led to financial imbalances and uncertainty in both developed and emerging economies. Several countries felt the consequences of this colossal disruption having difficulties with the access to liquidity over the interbank market.[2]

Responding to severe financial economic changes, fiscal and monitory institutions applied a range of conventional and unconventional policy measures. Once, conventional monetary policy targeting usually short-term interest rates provides no more effective results to successfully deal with incurred difficulties, it becomes necessary to adopt unconventional monetary measures that involve a direct effect on long-term interest rates. Therefore, easy money policy, being a part of unconventional monetary policy, was initiated by the leading central banks around the world in order to alleviate liquidity shortage and stabilized economic activity. On that point, "Quantitative Easing" (QE) turned to a predominant tool among the variety of unconventional monetary policies applied.[3]

In 1995 Richard Werner[4,5] first introduced the term of Quantitative Credit Easing by analyzing the stagnating and deflationary periods of Japanese economy. Prof. Werner defined Quantitative Credit Easing as a monetary instrument targeting not the expansion of money base via reserve increases, but rather focusing on credit creation

[1] Chapman, J. (2011), p. 1.
[2] Cf. Verick, S./Islam, I. (2010), p. 3 ff.; cf. Berrospide, J. (2013), p. 1.
[3] Cf. Bowdler, C./Radia, A. (2012), p. 604, 606.
[4] Cf. Werner, R. (1995).
[5] German economist, Director of International Development and founding Director of the Centre for Banking, Finance and Sustainable Development, also former Prof. of Frankfurt University. (Cf. Southampton Business School (2014): Professor Richard Werner)

in order to encourage banking sector that in turn was supposed to stimulate economic activity. Later this term became rather known as Quantitative Easing, which over last decades, was practiced as a tool expanding monetary aggregates and thereby focusing on increasing the balance sheet size and liability side of central bank.[6] In most of the literature the term Quantitative Easing is defined as set of programs of large-scale asset purchases bankrolled by expenditures of a central bank presenting at the same time expansions of its balance sheet.[7]

Although central banks of the United States (U.S.), Eurozone, United Kingdom (UK) and Japan were similar in introduction of unconventional policies, the implementation of the unconventional tools, in particular, QE differed across those major economies.[8] Quantitative easing was first introduced in Japan and later in the U.S., Eurozone and UK. It became the prevailing instrument in combating economic and financial downfall in times when central bank's monetary policy regulation via short-term interest rates faced its limits.[9]

The main focus of this work is dedicated to the one of the most controversial unconventional monetary measures – quantitative easing, applied by central banks during the recent years. The work is aimed at describing and assessing of the effects of quantitative easing used by the selected central banks. Thus, the work seeks to answer the following questions:

1. Can QE improve selected macroeconomic indicators?
2. Can there be a consistent path of conducting the policy, which can be similarly applied to another countries in an effort to achieve the same positive results?

This work will incorporate four chapters. After the introductory part, second chapter will outline the main aspects of evolution of quantitative easing as a tool for conducting the monetary policy**.** Thereby, a short overview of general economic background will be provided in order to demonstrate the necessity of central bank's

[6] Cf. Lyonnet, V./Werner, R. (2012), p. 96; cf. Werner, R. (1995), p. 1.
[7] Cf. Bowdler, C./Radia, A. (2012), p. 604.
[8] Cf. Fawley, B./Neely, C. (2013), p. 52.
[9] Cf. Joyce, M. et al. (2012), p. 272, 274.

action in introducing the non-standard monetary policy tool known as quantitative easing. Furthermore, in the following there will be presented and highlighted the underlying differences between the conventional and unconventional monetary policies. Approaching more deeply the toolkit of measures of unconventional monetary policy, the two most notable measures such as Quantitative easing and Credit easing will be described with regard to their distinctive features and, more importantly the interconnection with the expansive development of central banks' balance sheets.

Additionally, the second chapter will capture essential transmission channels, which QE works through, and will especially highlight portfolio-rebalancing, signaling and liquidity channels. Moreover, there will be described the extensive development of balance sheet size expansion by selected central banks, which addressed the consequences of financial crisis. The aim of this will be to present the comparison of the central banks' economic targets, which varied across countries and whose achievement directly depended on the extent of unconventional measures applied.

Third chapter will focus on the provision of an extensive description of the economic environment, along with severe deterioration of macroeconomic and financial indicators e.g. inflation, GDP growth, unemployment, and spreads observed in the selected countries during the financial crisis. This description of underlying stance of relevant economies will pursue the purpose of presenting initial economic and financial conditions, which induced the necessity for application of quantitative easing. Based on that, a wide range of monetary policy measures applied by main central banks with regards to economic meltdown will depict another key point, which will be covered by the third chapter.

Thereby, given the structural differences of financial systems across the countries, the extent and composition of relevant monetary measures will largely differ across central banks. Consequently, to perform an assessment of empirical research papers, chapter three will provide an overview over the relevant empirical research studies conducted to investigate the effectiveness of quantitative easing on both economic and financial markets.

Importantly, the fourth chapter will conduct assessment of effects of quantitative easing on the economy and financial markets. For this, applying data from the selected economies, there will be studied the development of key macroeconomic and financial indicators represented by inflation, unemployment, GDP and spreads.

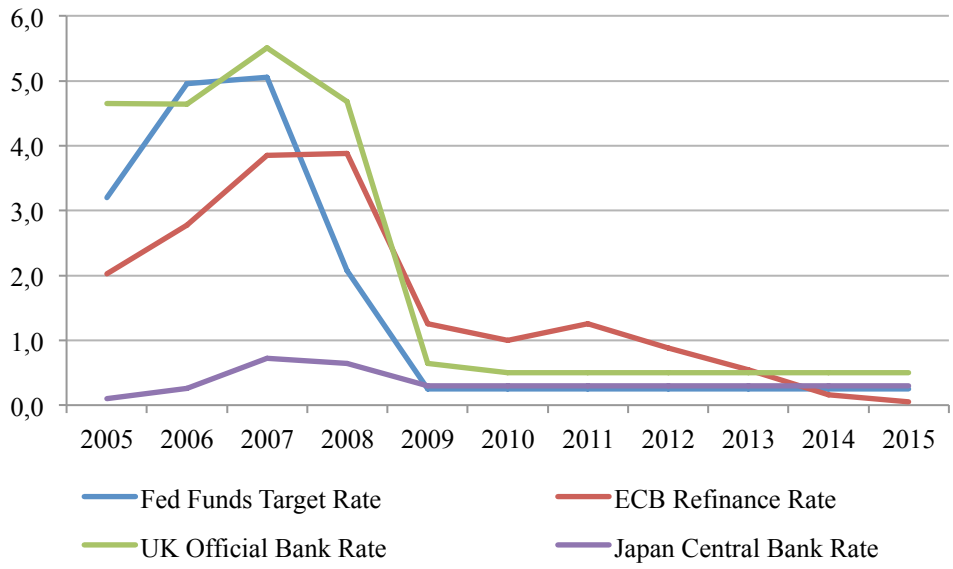
Finally, the conclusion of the research work will reassert the statement, discuss the issues and reach a conclusive statement.

2. The Main Aspects of Evolution of Quantitative Easing

In light of the financial crisis of 2008 what economists now denote the Great Recession, major central banks of advanced economies were forced to deal with the implementation of a broad variety of unconventional policy measures.[10] The purpose of these measures was to avert severe downturn of economic activity and provide necessary liquidity to financially distressed financial institutions.[11]

Since regulation and monitoring of short-term interest rates is the general and typical way of how a central bank conducts its monetary policy, starting in 2008, major central banks across the world responded with considerable short-term interest rates cuts to the worsening of financial crisis. The shifts of short-term interest rates towards the zero lower bound were first steps in approaching the less conventional monetary policy.[12]

Figure 1 – Development of the policy rates of selected central banks



Source: Federal Reserve (Fed), European Central Bank (ECB), Bank of England (BOE), Bank of Japan (BOJ).

[10] Cf. Bowdler, C./Radia, A. (2012), p. 604.
[11] Cf. Fawley, B./Neely, C. (2013), p. 53 f.
[12] Cf. Ibid., p. 51 f.

Consequently, as it can be seen from the Figure 1 above, in the summer of 2007 Fed undertook an aggressive step-down of its target federal funds rate in response to the financial crisis, which was followed by a number of programs aimed at easing financial conditions and boosting the economic activity.[13] In October 2008, ECB as well as BOE following a concerted decision entered the path of aggressive key interest rate reduction, too.[14]

Japans movement towards aggressive interest rate reduction aroused as a result of a severe economic and financial misery burdening Japan since 1990s. In response to persistent deflation and only modest GDP development, Bank of Japan (BOJ) introduced an unprecedented zero interest rate policy (ZIRP) in 1999. In course of time ZIRP was repeatedly terminated and restarted as in 2010 along with the second QE program ZIRP was reintroduced again and continued until today.[15]

Facing the bottom-bound of short-term interest rates, that were stretched to their limits in generating expected recovery, central banks decided to provide further monetary stimulus to sustain the economic growth.[16] Depending on the specificity and structure of each economy, the implementation of unconventional monetary policy measures differentiated across central banks. Thus, while U.S. and UK primarily focused on large-scale asset purchase programs (LSAPs) as suitable measure to achieve economic and financial recovery through reduction of yields, ECB and Japan, targeting particularly revival of impaired credit market and banking sector, applied a wide spectrum of liquidity and lending supporting programs within their unconventional policy measure.[17]

Next section will be highlighting difference between conventional and unconventional policy measures.

---

[13] Cf. Bernanke, B. (2009), p. 1 ff.
[14] Cf. European Central Bank (2010b), p. 65; cf. Bank of England (2008b), p. 9 f.
[15] Cf. Kurihara, Y. (2014), p. 77 f.; cf. Horioka, C. (2006), p. 1.
[16] Cf. Joyce, M. et al. (2012), p. 272, 276.
[17] Cf. Baumeister, C./Benati, L. (2010), p. 15 f.; cf. Fawley, B./ Neely, C. (2013), p. 71.

2.1 Conventional vs. Unconventional Policy Measures

Conventional monetary policy is a type of monetary policy that is conducted when the economy is not exposed to an economic shock and a normal economic environment is assumed.[18] Thereby, among all its standard instruments applied, such as standing facilities, minimum reserve etc., conventional monetary policy set off especially open market operations as major tool in implementing the monetary policy.[19]

Open market operations serve as a reliable instrument for influencing the interest rates and thus money supply in the market. In doing so, central bank is involved in an open market activity where it purchases or sales securities in order to regulate reserves and the money base, which in turn can influence the short-term interest rate in the finance market through the change of the money supply.[20]

Making use of transmission mechanisms enables central bank to transfer monetary decisions and impulses, which result from monetary policy measures in place, to the economy and affect macroeconomic policy factors.[21] Many economists refer to interest rate and credit channel, which depict most common transmission channels. By means of real interest rate channel, central bank attempts to affect both investment activity and aggregate demand.[22] Thus, widening of monetary base and money in circulation causes reduction in real interest rate consistent with reduction of cost of capital.[23]

At the same time, effects exercised on the short-term interest rates induce also changes in long-term yields, which according to the expectation hypothesis consist of average of short-term rates and risk premium. Therefore, monetary measures focusing on reduction of short-term interest rates can influence long-term interest rates and push them down.[24] As a result, arising low costs of capital lead to positive investment

[18] Cf. Smaghi, L. (2009): Conventional and unconventional monetary policy.
[19] Cf. European Central Bank: Monetary Policy Instruments.
[20] Cf. Mishkin, F. (2001), p. 439; cf. Federal Reserve (2013): Open Market Operations.
[21] Cf. European Central Bank (2010a), p. 85.
[22] Cf. Ibid., p. 86, 89.
[23] Cf. Mishkin, F. (1996), p. 2.
[24] Cf. Gagnon, J. et al. (2011), p. 6 f.

prospects allowing investors to spend more and therefore increase aggregate demand boosting the overall economic activity.[25]

Credit channel is another way used by central banks to interact with the economy. Hereby, commercial banks play an important role serving as channels for providing loans and ensuring access to financing, especially for those, who are not able to independently participate in the credit market by using stock or bond market as an alternative source of financing.[26] Consequently, increasing bank reserves as result of easing credit conditions exert direct positive influence on banks' ability to award loans. That is why banks` propensity to lend money increases banks´ and private consumers' expenditures and encourages aggregate output by enhancing investment activities.[27]

Financial and economic market impairment as consequences of a financial crisis might be the reason for the inoperability of both credit and interest rate channel. On the one side, arising distrust among banks and liquidity shortage for lending might lead to credit channel blockage.[28] On the other side, short-term interest rate set within the scope of conventional monetary policy near to or at zero might cause interest rate regulation problems due to the inability of further lowering the short-term interest rate.[29]

In particular, as short-term interest rates already hit their bottom, conventional monetary stimulus becomes no longer effective. At this point, various sources refer to an extreme case of so-called liquidity trap[30], which initially was defined by John Maynard Keynes and was later extended by renowned economists such as Milton Friedman and Paul Krugman. According to them, economy experiencing liquidity trap faces a situation, where money supply can no longer effect interest rates and consequently cannot affect aggregate spending.[31]

---

[25] Cf. Gagnon, J. et al. (2011), p. 6 f.; cf. Mishkin, F. (1996), p. 3.
[26] Cf. Mishkin, F. (1996), p. 9.
[27] Cf. Ibid., p. 9.
[28] Cf. Mishkin, F. (1996), p. 16 f.
[29] Cf. Joyce, M. et al. (2012), p. 276.
[30] Cf. Keynes, J. (1936), p. 103; cf. Krugman, P. (1998), p. 1.
[31] Cf. Mishkin, F. (2001), p. 556.

At this point, introduction of new monetary policy measures becomes necessary. Therefore, by means of the unconventional policies that encompass a range of monetary policy instruments, central banks can additionally relax financial conditions and affect directly long-term rates.[32] Unconventional policy measures entail a broad range of tools and measures in order to ease financial constraints within an ailing economy. Depending on the goals determined by central banks, a variety of unconventional policy measures can be chosen in order to target those objectives. Thus, by e.g. applying exceptional liquidity provision facilities central bank might help banks to avoid much stronger liquidity shortage problem. Simultaneously, operating through large-scale asset purchases might enable central banks to influence and lower the long-term yields.[33]

According to Bowdler and Radia, one can differentiate between *conventional* unconventional and *unconventional* unconventional monetary policies. The former expression refers primarily to implementation of QE, one instrument that depicts large-scale asset purchases conducted by the central banks aimed at changing central banks balance sheet size and targeting the long-term interest rate. The latter expression captures a set of all other programs that were introduced as a part of expansionary policy. Those policy initiatives ranged from forward guidance – "*explicit statements by a central bank about the likely path of future policy rates*"[34] to short-term and long-term liquidity provision in form of refinancing operations and credit easing measures.[35]

In next paragraph there will be discussed two most common unconventional policy measures put in focus by central banks in order to stimulate financial activity and aggregate demand operating through active altering of the composition and volume of the central bank´s balance sheets.

[32] Cf. Bowdler, C./Radia, A. (2012), p. 604 ff.
[33] Cf. Smaghi, L. (2009): Conventional and unconventional monetary policy.
[34] Cœuré, B. (2013): The Usefulness.
[35] Cf. Bowdler, C./Radia, A. (2012), p. 604, 608.

2.2 The Nature of Quantitative Easing

The term of QE that was primarily introduced by the BOJ and is nowadays synonymously used for large-scale asset purchases program consistent with expansion of the monetary base. However, the original definition came from Richard Werner, who initially defined QE as set of measures stimulating quantity of credit creation rather than money base expansion.[36] In response to Japan´s persistent economic recession, Werner proposed Quantitative Monetary Easing to BOJ, whose focus resided in creation of credit market supporting programs, which were supposed to help Japan´s economy generate growth after longstanding economic stagnation. However, despite this proposal BOJ decided to introduce monetary policy of bank reserve targeting under today commonly known term of "Quantitative Easing".[37]

As one of the unconventional measures applied by central banks across advanced economies, QE expands central banks' balance sheet size by influencing the liabilities as part of their balance sheets. Thereby, it does not reconfigure the assets side of the same balance sheet by leaving the composition of central banks asset holdings unchanged. Instead QE blows up the size of the balance sheet and expands the money base by creating increased level of central bank reserves.[38]

By applying QE, central banks aim at stimulating the aggregate demand and economic activity, when short-term interest rates hitting their zero bound constraints cannot achieve the targeted result. Thereby, central banks purchasing extensive financial assets across different segments attempt to influence the curve of yields of long term securities. Thus, induced shortage of financial assets being purchased via LSAPs leads to increase in prices of those financial assets and reduction of their interest rates.[39] Since stance of long-term rates entails investors' expectations in regard to central bank´s future actions as well as strongly affects peoples spending

[36] Cf. Werner, R. (1995), p. 1.
[37] Cf. Lyonnet V./Werner, R. (2012), p. 96; cf. Werner, R. (1995), p. 1.
[38] Cf. Lenza, M. et al. (2010), p. 9.
[39] Cf. Smaghi, L. (2009): Conventional and unconventional monetary policy; cf. Gagnon, J. et al. (2011), p. 6.

decisions, central banks sought to target long-term interest rates by overwhelmingly purchasing government bonds.[40]

This approach was implemented by major central banks and contributed to considerable expansion of their balance sheet sizes. Intensity of LSAPs depended on the conditions of the economy of a certain country related to weak demand, negative price development and rising unemployment.

2.3 Credit Easing Compared to Quantitative Easing

In practice, both Quantitative and Credit easing lead to a change of the central banks balance sheet. The conceptual difference of these two measures resides in distinct balance sheet sides, which these approaches focus on. While QE particularly influences the size and the liability side of the balance sheet, Credit easing directly addresses the asset side and the composition of the balance sheet.[41] Thereby, implementation of Credit easing measures aims at lowering the banks' funding cost and stimulating banks' lending activity by lowering yield curves and easing of credit conditions.[42]

Credit easing measures seeking to improve credit conditions may also not only change the balance sheet volume but more usually they vary the composition of assets at different maturities on the asset side. In order to influence yield curve central banks short-term asset holdings can be replaced by long-term assets, whose increased purchases might induce decrease in long-term risk premiums and flatten the yield curve on the market. Thus, this approach targets at risk-spread reduction across securities that lost their usual market in light of financial crisis.[43]

Besides asset purchases, Credit easing measures include various lending facilities and liquidity provisions programs among those Long-Term Refinancing Operations (LTROs) or Term Auction Facility, which enable central banks to organize an

[40] Cf. Federal Reserve Bank of San Francisco (2014), p. 1; cf. Engen, E. et al. (2014), p. 15.
[41] Cf. Shiratsuka, S. (2010), p. 93 ff.
[42] Cf. Shiratsuka, S. (2010), p. 93 f.; cf. Bowdler, C./Radia, A. (2012), p. 618 f.
[43] Cf. Shiratsuka, S. (2010), p. 95; cf. Smaghi, L. (2009): Conventional and unconventional monetary policy.

additional supply of liquidity straight to financially distressed institutions in order to ensure appropriate temporary financing possibilities.[44] Thus, all four central banks had applied Credit easing measures to greater or lesser extent before Quantitative easing became the leading approach. Thereby, from December 2007 Fed explicitly declared to be conducting Credit easing, while ECB officially entered the policy phase of "enhanced credit support" in August 2007. BOE and BOJ applied similar Credit easing measures for supporting credit markets, however, they did not explicitly signalize that policy conducted was directed towards Credit Easing.[45]

2.4 Transmission Channels for Quantitative Easing

In numerous papers authors refer to three particular QE transmission channels. In the following those three channels including portfolio rebalancing channel, signaling channel and liquidity channel will be presented.

2.4.1 Portfolio-rebalancing Channel

Many analysts and researchers argue that QE might primarily affect the long-term interest rates through the so-called portfolio-rebalancing channel.[46] However beforehand, it becomes necessary to take a quick look on the composition of long-term interest rate. Both risk premium, bearing additional investor risk of long-term investment, and average of prospective short-term interest rates depict the two components long-term interest rate is based on. Thereby, LSAPs operating through the portfolio-rebalancing channel do not exert effect on the prospective short-term interest rates, but directly target the risk premium. Applying LSAPs central bank adds to aggregate demand for long duration assets what leads to reduction in risk premium of long-term assets and of long-term yields accordingly.[47]

However, there is an additional spill over effect- that derives from reduction in long-tem interest rate. Low long-term yields of specific assets force investors to escape into

[44] Cf. Bowdler, C./Radia, A. (2012), p. 618 f.; cf. Bernanke, B. (2009), p. 4.
[45] Cf. Bernanke, B. (2009), p. 4; cf. Trichet, J.-C. (2009), p. 10, 12.
[46] Cf. Bauer, M./Rudebusch, G. (2013), p. 1 f.
[47] Cf. Gagnon, J. et al. (2011), p. 6 f.

higher yielding assets segments. By chasing higher returns, investors seek for suitable substitutes, which might depict corporate bonds or other risky assets. Investors' portfolio shift towards these assets raises their demand, which for its part pushes related asset prices high. In total, LSAPs contribute to flattering of yield curves across different securities reducing long-term funding cost. Such favorable financing conditions are supposed to help economy to trigger increase in aggregate demand.[48]

2.4.2 Signaling

Signaling is the second transmission channel used within QE to influence the long-term interest rates. Acting through the signaling channel, first component of long-term interest rate - average future short-term interest rates - comes into focus. Signals set by central banks via particular monetary policy measures might affect private sector´s outlook for the prospective monetary policy development. As a result, LSAP announcements serve as measures, used by central bank to signal its intention to maintain policy rates at a lower level longer lasting. By implementation of LSAPs, central bank additionally communicates its commitment towards targeting the low up to zero level of policy rates. Thus, this credible guidance by the central bank induces downwards revision of investors' expectations in regard to future short-term interest rates, which being a component of long-term interest rate can influence it accordingly. In this way, lower average expected short-term rate, resulted from credible commitment made by central bank to lower short-term rates, brings long-term rate to fall.[49]

2.4.3 Liquidity

Liquidity channel works by primarily exerting a so-called liquidity effect. Usually, this effect arises from the expansion in the money supply that in turn brings short-term interest rates downwards. Liquidity effect faces particular limitation, when short-term interest rates reach minimum levels. From then on liquidity supply provided by a central bank is not capable to exert decreasing effect on short-term interest rates. At the same time long-term interest rate, still providing positive yields, can experience liquidity effect. In other words, banks following the positive yield on assets strategy

[48] Cf. Gagnon, J. et al. (2011), p. 8.
[49] Cf. Bowdler, C./Radia, A. (2012), p. 611; cf. Bauer, M./Rudebusch, G. (2013), p. 1.

look for higher return on assets preferring long-term over short-term interest rates. Thus, growing demand for long-term securities as a result of reserves expansion induces decrease in long-term yields.[50]

Referring to another explanation of liquidity channel, LSAPs implemented by central banks have a direct effect on liquidity premia. Thus, in times of financial uncertainties and market impairments, liquidity premia for assets might increase since selling of those assets becomes more difficult. That is why asset purchases associated with reserves increase contribute to the overall demand of those securities and thereby lift up prices for purchased assets by reducing both the liquidity premia and yields.[51]

2.5 Expansion of Central Bank Balance Sheets

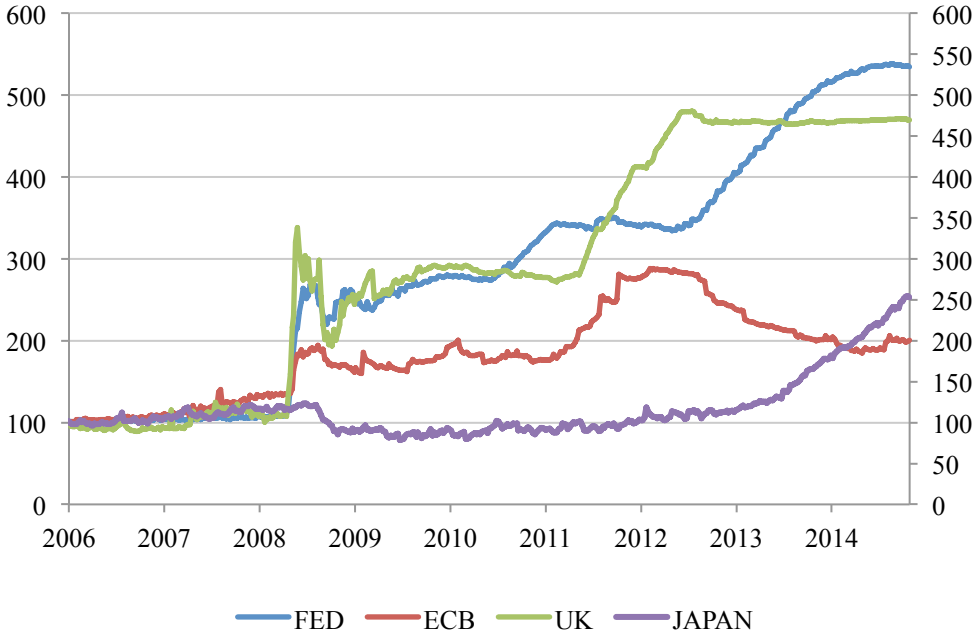
In response to the financial crisis central banks of advanced economies puffed up their central bank balance sheets extremely. Unconventional monetary policy implemented in terms of of asset purchases across different segments and maturities for the purpose of financial market and economy revival highlighted a turning point within traditional monetary policy measures previously used and contribute to significant changes in composition and enormous expansion of central bank balance sheets.[52] The following Figure 2 demonstrates the expansive central banks' monetary policy in the U.S., Eurozone, UK and Japan.

It should be mentioned that given the diversity of implemented unconventional policy measures and set monetary policy targets by the country, central bank balance sheets´ composition and expansion varied across those developed economies. Thus, while U.S. and UK explicitly targeted stimulation of aggregate demand by actively reducing asset yields on the financial market via extensive purchases of securities, ECB and BOJ, focusing on restoring of credit market impairment, had encouraged rather their banking sectors by overwhelmingly providing loans and liquidity to them.[53]

---

[50] Cf. Krogstrup, S. et al. (2012), p. 2.
[51] Cf. Bowdler, C./Radia, A. (2012), p. 611.
[52] Cf. Joyce, M. et. al. (2012), p. 272; cf. European Parliament (2014), p. 10 f.
[53] Cf. Lenza, M. et. al. (2010), p. 18 f.; cf. Fawley, B./Neely, C. (2013), p. 71.

Figure 2 – Development of central banks' balance sheets



Source: Fed, ECB, BOE, BOJ.

Market-centered financial system of the United States determined Fed´s way in conducting Quantitative easing. Thereby, Fed criticizing the importance of banks in transferring funds to the broad economy and non-financial sector chose to implement unconventional policy measures mainly and directly through financial market rather than banking system. However, at the beginning of the crisis Fed pursued the policy of Credit easing by providing extensive emergency lending facilities programs and purchasing of asset backed securities (ABS) and debt issued by agencies.[54]

In particular, these programs affected the asset side of the bank's balance sheet making it more than double so high by the end of November 2008. In 2009, Fed announced its first round of Quantitative easing, where Fed, implementing LSAP, additionally expanded its balance sheet by USD 300bn of Treasury securities, USD 175bn of agency debt and USD 1.25tn of agency mortgage-backed securities. Although the outright asset-purchasing program was declared to be terminated in fall of 2009 for

[54] Cf. Lenza, M. et. al. (2010), p. 19, 25 f.; cf. Labonte, M. (2014), p. 6.

Treasuries and in spring of 2010 for agency assets, Fed conducted additional Treasury and asset-backed securities purchases in order to maintain a constant size of the balance sheet, which was diminishing as a result of maturing securities.[55]

Between November 2010 and June 2011, slow economic recovery in the U.S. prompted the introduction of QEII, under which Fed undertook additional purchases of USD 600bn of U.S. Treasury and made an announcement on further proceeding of Treasury purchases aimed at changing the structure of maturities. In September 2012 Fed decided to provide a significant boost to the economy by targeting the improvement on the labor market and optimal price level over the medium term. For that purpose, every month USD 40bn of agency mortgage-backed and USD 45bn of long-term Treasury securities were added to Fed´s asset portfolio. After January 2014 Fed bought only USD 30bn of MBS and USD 35bn of Treasuries on the monthly basis. These LSAPs referred to QE III as their financing were conducted through the expansion of Fed' balance sheet, whose size dramatically increased in the course of the years from around USD 0.9tn in 2007 to USD 4.2tn in Summer 2014.[56]

UK´s action in regard to its extensive balance sheet expansion via LSAP could earliest be observed after the Lehman Brothers collapse and Northern Rock´s demise in 2009. However, already before that, BOE introduced a range of emergency liquidity insurance operations, i.e. longer-term repo transactions on the asset side and deposit facility on the liability side of the BOE balance sheet, which considerably contributed to its expansion. Until 2009, banks in the UK increased their reserves from GBP 16bn in July 2007 to GBP 45bn in December 2008. The provision of long-term reserves followed in January of 2009 and was underpinned by additional issuance of bills for GBP 100bn.[57] The Figure 2 highlights these developments.

BOE continued its expansive monetary policy in January 2009 with the introduction of outright asset purchases conducted by the Asset Purchase Facility Fund. From March 2009 until January 2010, BOE bought GBP 200bn medium and long-term

[55] Cf. Labonte, M. (2014), p. 6 f.
[56] Cf. Labonte, M. (2014), p. 3, 8 f.; cf. European Parliament (2014), p. 10.
[57] Cf. Lenza, M. et. al. (2010), p. 26; cf. Cross, M. et. al. (2010), p. 38.

assets, which largely consisted of UK gilts. Therewith, BOE revealed its intention to rather expand the liability side of the balance sheet.[58] Consequently, between 2011 and 2012 BOE extended its total amount of assets purchased to GBP 375bn. From 2012 on balance sheet size of BOE did not experience considerable expansion.[59]

In comparison to U.S. market-centered financial system, euro area's approach against the problem of financial market impairment and economic downturn derived from the bank-centric nature of Eurozone's financial system. It mainly contained exceptional liquidity provision procedures, which occurred in variety of liquidity innovations in particular refinancing operations i.e. repo within the ECB´s operational framework. Therefore, expansion of ECB´s balance sheet resulted mainly from the bank´s borrowings rather than asset purchases, which were less comprehensive compared to that in the U.S. or UK.[60]

From October 2008 until December 2009, ECB conducted so-called „enhanced credit support" policy by implementing fixed rate full allotment, collateral easing, Covered Bonds Purchase Programme (CBPP1) as well as Longer-Term Refinancing Operations (LTRO) and Supplementary Longer-Term Refinancing Operations (SLTRO). During this period ECB´s balance sheet expanded considerably by recording EUR 442bn in LTRO and EUR 60bn in covered bonds purchases.[61]

Hit by the sovereign debt crisis, ECB decided to introduce Securities Markets Programme (SMT) in May 2010, consistent with asset purchases of sovereign bonds of euro area member countries, whose amount added up to EUR 219.5bn in the end of 2012. However, these assets had no effect on the balance sheet since they were sterilized by the following ECB actions. Thus in 2011, ECB continued purchasing additional EUR 40bn within CBPP2. Later in 2014 further asset purchase programs on covered bonds (CBPP3) and ABS were announced.[62] By complementing OMT program in 2015, which focused on the purchase of government bond in the secondary market, ECB extended its newly initiated asset purchase program by purchasing EUR 60bn in assets monthly. These asset purchases included covered

[58] Cf. Cross, M. et. al. (2010), p. 39; cf. Lenza, M. et. al. (2010), p. 26 f.
[59] Cf. Bank of England (2012/2013), p. 1; cf. Bank of England (2013/2014), p. 3.
[60] Cf. Lenza, M. et. al. (2010), p. 18, 26; cf. Constâncio, V. (2015), p. 2.
[61] Cf. European Central Bank (2010b), p. 66 f., 71.
[62] Cf. European Central Bank (2010b), p. 72; cf. Szczerbowicz, U. (2012), p. 15 f.

bonds, ABS and government bonds and significantly contributed to the balance sheet expansion of the ECB.[63]

Japan being the pioneer in implementing unconventional measures, in particular Quantitative Easing, began its expansive monetary policy a long time ago - in the early 1990s after the asset bubble and equity market crash. Between 1992 and 1999 only, before the introduction of Quantitative Easing Monetary Policy (QEMP), Japan´s balance sheet was significantly expanded following numerous fiscal stimulus packages and asset purchases of non-performing loans.[64]

Later in 2001, BOJ initiated an unprecedented QEMP, whose focus was strongly put on increase of commercial banks current accounts balance (CAB) at the central bank. By purchasing overwhelmingly large amount of long-term Japanese Government Bonds (JBG), BOJ conducted its operation on meeting the target of CAB, which was increased from to JPY 5tn monthly[65] at the beginning of the program to JPY 35tn at the end in 2006.[66]

In 2010 reintroduction of QE so-called Comprehensive Monetary Easing along with Asset Purchase Program (APP) aimed at purchasing a wide range of assets, among others short- and long-term Japanese government bonds, risky private and public assets as well as Japanese real estate investment trusts (J-REITs) in order to flatten both long-term yields and risk premium across different asset segments. Under APP, CAB target was dramatically lifted up from JPY 35tn to JPY 101tn in 2012. Thus, Qualitative and Quantitative easing launched by BOJ in 2013 increased the amount of bonds and targeted a new goal of monetary base expansion of around JPY 60-70tn a year.[67]

After analyzing the specifics of Quantitative easing, its mechanism and application framework, the next section will particularly take on the assessment of policy measures as well as on studying the empirical research conducted on the example of the selected economies.

---

[63] Cf. European Central Bank (2015): 22 January 2015 - ECB.
[64] Cf. Chapter 3.11.-3.12.
[65] Cf. Rogers, J. et al. (2014), p. 10.
[66] Cf. Girardina, E./Moussac, Z. (2011), p. 465.
[67] Cf. Fawley, B./Neely, C. (2013), p. 73 f.; cf. Rogers, J. et al. (2014), p. 11.

3. Assessment of Economic Environment, Quantitative Easing Measures and Empirical Research in the United States, England, European Union and Japan.

The main focus of the research is aimed at the recent financial crisis. In fact, the state of the economies, including their macroeconomic situation, financial strength was largely different, which needs to be put into perspective first. Then, there will be shown measures of Quantitative Easing, which were specifically applied by the authorities. Furthermore, a detailed overview of the research papers will be provided with the focus on the particular country, highlighting the model frameworks.

3.1 Quantitative Easing in the United States: Description of Economic Environment

Financial Recession of 2008 in U.S. occurred as a result of subprime mortgage crisis that showed already in mid-2007 its first signs of unprecedented complications in the mortgage lending market. Thus, an unexpected drop in house prices implied downgrade of asset-backed securities risk.[68,69]As a result of asset price bubble bursting, emerged reassessment of mortgage-backed securities' risk had a vast impact on the whole U.S. financial market. In light of dramatically decreased asset prices and inability of financial institutions to manage their losses, a high number of banks like Bear Stearns, Lehman Brothers and Merrill Lynch announced their bankruptcy.[70]

Financial markets had immediately reflected new information inducing high volatility among security prices and among key rates such as 3-month LIBOR and interest rate of U.S. T-bill. The so-called TED spread that depicts the difference between 3-month LIBOR and 3-months U.S. Treasury interest rate and so indicates credit risk level of interbank lenders compared to the safe U.S. Treasury bill, increased to enormous 458

[68] Cf. Marshall, J. (2009), p. 7 f.
[69] Asset-backed financial instruments consisting of mortgage loans were treated as collateralized debt obligations (CDO) and spread throughout the credit market. (Cf. Dodd, R./Mills, P. (2008): Outbreak: U.S. Subprime Contagion)
[70] Cf. Marshall, J. (2009), p. 7 f.

basis points by October 10, 2008.[71] Such severe TED spread increase indicated ultimate credit market impairment.[72]

Resulting dysfunction of commercial paper market that commonly ensures short-term funding for the firms divested especially non-financial firms of usual liquidity access. Furthermore, the failure of interbank lending, which had resulted from the total distrust among banks, tightened supplemental funding sources for non-financial business additionally. Accordingly, economic sectors like automotive and retail experienced a sharp decline in their sales between September and October 2008.[73,74]

Burdened with debt and negative equity, private sector was lacking the incentives to borrow and spending further, but had rather focused on increased savings and deposits. This change in behavior of private sector is known as "balance sheet recession" that intensively underwent United States as well as many European countries of euro area.[75]

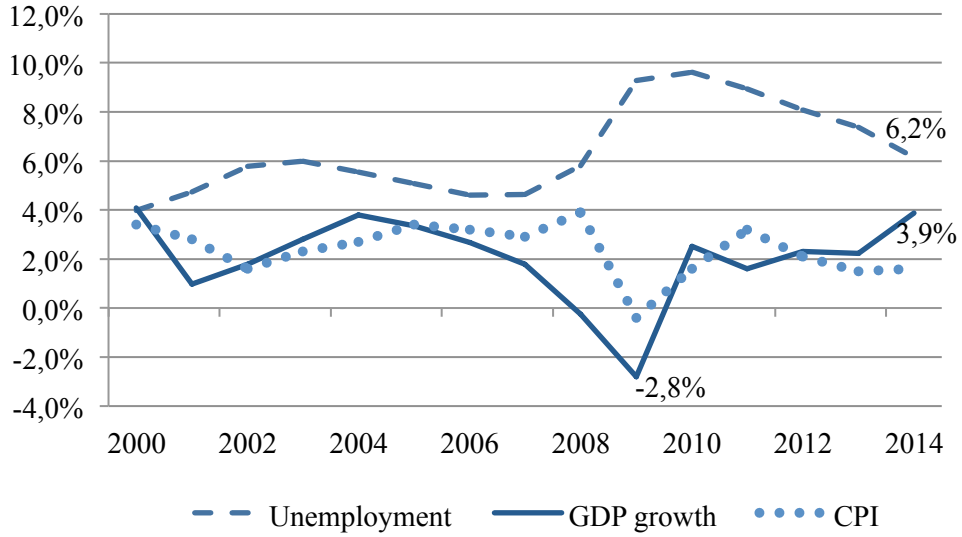
Severe downfall of U.S. economy took place at the beginning of third quarter of 2008. Thus, U.S. economy had to assess the all time low for its main economic variables. In the fourth quarter of 2008 the real GDP of U.S. economy shrank by 8.9 percent keeping the negative GDP annual rate far up to the third quarter of 2009.[76] Also, the unemployment rate faced cloudy prospects accounting in October 2009 to 10.1 percent and reaching so its critical amount that had exceeded unemployment rate of summer 2007 by twice.[77] After November 2010, where a high unemployment rate of

[71] Cf. Marshall, J. (2009), p. 8 f.; cf. Mishkin, F. (2010), p. 2 f.
[72] Cf. Federal Reserve Bank of St. Louis (2015): TED Spread.
[73] Cf. Marshall, J. (2009), p. 8 f.
[74] In 1990s, during the last financial crisis Japan, United States and the Euro area experienced a similar problem that refers to a so-called term of "balance sheet recessions". Thereby, the beginnings of the problem lay in the massive credit expansion of a specific sector. In case of the United States especially households and non-financial sectors suffered from high indebtedness. Sudden asset prices collapse had raised private sector´s liabilities and upset the equilibrium of their balance sheets. (Cf. European Central Bank (2012a), p. 98 f.)
[75] Cf. Koo, R. (2011), p. 19 f., 25.
[76] Cf. United States Department of the Treasury (2012), p. 1.
[77] Cf. Casaux, S./Turrini, A. (2011), p. 2.

9.6 percent was captured again, the U.S. unemployment rate began to fall and reached in December 2014 a value of 6.2 percent.[78]

At the same time between 2007 and 2011, the U.S. experienced only slight disinflationary development against the backdrop of a severe economic depression and high unemployment. Despite a temporary deflationary turn in 2009, where the inflation rate came to *-0.355* percent, the inflation rate in the aftermath was clearly above the zero bound and even higher as the inflation target of 2 percent, achieving the value of 3.15 percent in 2011.[79] This is shown by the Figure 3 below.

Figure 3 – Economic development in the U.S.



Source: Bloomberg.

In light of a deteriorating debt problem, U.S. also suffered from its heavy federal debt burden that currently amounts to USD 18.1tn[80] and therewith had exceeded its GDP of USD 17.4tn in 2014.[81,82]

---

[78] Cf. Federal Reserve Bank St. Louis (2015): Civilian Unemployment Rate.
[79] Cf. Federal Reserve Bank St. Louis (2014): Inflation.
[80] Cf. U.S. National Debt Clock (2015): The Outstanding Public Debt.
[81] Cf. Statista (2015): Gross domestic product.
[82] Between 1970 and 2007 the American debt had a dynamic increase in contrast to the GDP growth. In 2007, it formed a ratio of 64 percent of American GDP and over 100 percent of GDP starting from 2007. (Cf. Thornton, D. (2012), p. 442 f.)

Especially financial recession of 2008-2009 contributed a significant share to the massive expansion of the outstanding public debt, as in October 2008 United States Secretary of the Treasury had passed "The Emergency Economic Stabilization Act". According to this legislation the so-called Troubled Assets Relief Program (TARP) aimed at launching a range of investment programs supposed to bring back and ensure economic stabilization. For this purpose, alone until 2010 the U.S. government issued an amount of around USD 7.4tn Treasury bonds by excessively expanding its government debt.[83]

Facing all the economic and financial troubles investors became much more risk-averse and searched for possibilities to invest in safe assets. Thus, U.S. Treasury bonds being regarded as low risk and low default securities received an enormous popularity among investors. Shift in investments towards the U.S. Treasuries brought their yields to fall and had increased the corporate bond yields simultaneously as a result of diminishing demand for these risky assets. However, this fall in yields mainly affected short-term Treasuries by leaving behind only a slight effect on the long-term U.S. Treasuries. In the aftermath, Fed tried to achieve the same effect on long-terms Treasuries by launching the large-scale asset purchases programs.[84]

To continue with monetary policy intervention, in the next paragraph there will be discussed both main monetary policy tools, applied by Federal Reserve against the economic recession, and the nature of convectional and unconventional measures.

3.2 United States: Scale and Description of Measures Introduced

Federal fund rate depicts the main monetary policy instrument within the conventional monetary policy framework that can be regulated via open market operations such as trading of securities. Federal fund rate is the interest rate used by American financial institutions to conduct their overnight lending businesses and thus it is tightly linked with banks lending capacity and their liquidity demand. Hence,

[83] Cf. Noeth, B./Sengupta, R. (2010), p. 18; cf. U.S. Department of the Treasury (2015): TARP Programs.
[84] Cf. Noeth, B./Sengupta, R. (2010), p. 18, cf. chapter 4.4.

beginning from the August 2007, Federal Open Market Committee (FOMC) undertook rapid and decisive steps against financial crisis by influencing short-term federal fund rate.[85]

In order to realize adequate easing of financial constraints, federal fund rate was cut from 4.94 percent in September 2007 to 1.98 percent in May 2008 capturing an astonishing decrease of 296 basis points. Additionally, FOMC decreased number of other lending rates aimed at restoring the activity on the credit market. This interest rate reduction gave U.S. economy temporary support, however in the long run it did not provide the necessary defense against deteriorating liquidity problems and overall financial markets turbulences.[86]

Despite loose liquidity path through to financial institutions, the provision of loans to the private sector did not take place. FOMC has been keeping federal fund rate within a range of 0 and 0.25 percent for 6 years now, signalizing economic unreadiness for the interest rates liftoff. Facing limits of conventional monetary and zero bound interest rate policy applied, FOMC decided to focus on non-standard monetary policy measures for boosting the economy.[87]

In further step of its easing monetary policy, Fed targeted at ensuring accommodative access for financial institutions to the short-term liquidity. According to Bernanke all the measures introduced by Fed, with regard to the purpose mentioned above, were part of carefully considered and purposeful Credit Easing approach that distinguished Fed´s policy from the one applied in Japan better known as QE. Instead of boosting the liability side of balance sheet by targeting banks reserves, as it was the case in Japan, Fed mainly targeted at easing of credit conditions, which on the one hand demanded accommodative facility programs and on the other hand required outright purchase programs, involving asset side expansion of Fed´s balance sheet, however.[88]

---

[85] Cf. Labonte, M. (2014), p. 1.
[86] Cf. Bernanke, B. (2009), p. 2, 4; cf. Federal Reserve Bank of St. Louis (2015): Effective Federal Funds Rate.
[87] Cf. Bernanke, B. (2009), p. 2, 4; cf. Federal Reserve (2014a), p. 12, 16.
[88] Cf. Bernanke, B. (2009), p. 4.

One of Federal Reserve´s regular channels for liquidity provision depicts so-called discount window lending that provides credit lending to the institutions.[89] In light of the funding difficulties on the credit market in 2007, Fed reduced the spread, calculated as difference between the primary credit rate and the federal funds rate, from 1 to 0.5 percent. However, this change in discount window lending was not well received by institutions, since they considered funding from the market still as a more attractive option. Then, after a significant deterioration of term funding conditions in November and early December 2007, Fed decided to alter its discount window facility and to generate a range of credit facilities by creating a set of new lending programs.[90]

3.2.1 Lending Facilities: Term Auction Facility, Term Securities Lending Facility, Primary Dealer Credit Facility

In December 2007, Fed initiated its first lending program namely Term Auction Facility (TAF). Contrary to the original discount window lending, TAF program provided termed funding to counterparties by auctioning 28-day as well as 84-day loans at the "stop-out rate" - a minimum accepted bid rate at which auction occurs - and against a wider pool of collateral. The purpose of this program was the improvement of liquidity conditions for sound companies within dysfunctional credit market.[91]

In March 2008, Fed came up with two additional liquidity support programs for triparty repurchase agreement market that had experienced enormous funding tensions. Primary dealers who usually serve as intermediaries between Federal Reserve and security market participants by providing financial services within open market operations were out of financial sources for maintaining U.S. Treasury securities market. Thus, Fed initiated both Term Securities Lending Facility (TSLF) and Primary Dealer Credit Facility (PDCF) programs.[92]

Thereby, under the TSLF, primary dealer were able to receive so-called 28-day facility. Consequently, in exchange for less liquid-eligible collateral, this loan facility

[89] Cf. Labonte, M. (2015), p. 4 f.
[90] Cf. Armantier, O. et al. (2008), p. 4.
[91] Cf. Armantier, O. et al. (2008), p. 6 ff.; cf. Federal Reserve (2009a), p. 1, 3, 5.
[92] Cf. Bernanke, B. (2009), p. 3; cf. Federal Reserve Bank of New York: Primary Dealers List.

provided primary dealers with Treasury general collateral (GC) that had included securities essential for open market operations such as Treasury bills, inflation-indexed securities and bonds.[93] At later time, Fed established PDCF conceived as an overnight loan facility allowing primary dealers lending straight from the Fed and using a much broader set of eligible collateral instead of prior required investment-grade securities. Credit facility was terminated in February 2010 after slightly mitigating the long-lasting liquidity pressure.[94]

3.2.2 Central Bank Liquidity Swap Lines

In order to normalize the global dollar funding markets that were exposed to strong fluctuations in the overseas, Fed organized liquidity swap lines among six international central banks. As a result, Dollar Liquidity Swap Lines and Foreign Currency Liquidity Swap Lines were introduced, where under these lines a prespecified amount of foreign currency could be exchanged against dollar and be later used for support the funding in dollar or in other foreign currency for U.S. institutions and institutions of counterparties.[95]

3.2.3 Troubled Asset Relief Program

In October 2008, U.S. government approved an extensive purchase program, so-called Troubled Asset Relief Program (TARP) or The Paulson Plan[96] focusing on strengthening financial institutions and improving liquidity access. Series of initiatives under TARP supposed to provide financial support to different sectors of U.S. economy. For this purpose, USD 700bn fund was provided. Especially Capital Purchase Program depicting a part of TARP enabled a large-scale purchase and management of securities rated as "troubled" or "toxic".[97]

[93] Cf. Federal Reserve Bank of New York (2009): Term Securities Lending Facility.
[94] Cf. Federal Reserve (2014): Primary Dealer Credit Facility.
[95] Cf. Federal Reserve (2014): Central Bank Liquidity Swap Lines.
[96] Cf. Fein, M. (2008), p. 34.
[97] Cf. Federal Reserve Bank of St. Louis (2013): The Troubled Asset Relief Program.

3.2.4 Large-Scale Purchase Programmes

a. Commercial Paper Funding Facility

Dysfunction of commercial paper market in the late 2008 depicted an enormous problem for U.S. economy. Commercial paper market plays a key role, being essential source of funding, among the most financial and non-financial sectors. In order to finance their business, enterprises often turn to commercial papers that allow them to borrow on the short-term basis from the market at lower cost. However, during the crisis, commercial market papers lost their attractiveness by the majority of investors and induced commercial paper market standstill. Investor´s reluctance to purchase commercial papers led to critical underfunding and shortage of credit availability for a high number of enterprises. Thus, only within a year the amount of asset-backed commercial paper in the market declined from USD 1.18tn to USD 745bn indicating perceptual fall of 37 percent.[98]

To address this problem, Fed decided to launch one of its unconventional monetary policy measures by acquiring commercial papers directly from the primary market. As a result, an adequate program referred to as Commercial Paper Funding Facility (CPFF) focusing on the purchase of high-quality, three-month commercial papers from the issuers was called into action. It aimed at providing required additional liquidity to frail institutions and unburdening them from their toxic assets. At the beginning of 2009, Fed became the sole largest purchaser acquired commercial papers of a total amount of USD 357bn.[99] Applying CPFF, Fed focused on recovery of investors' encouragement and willingness to buy commercial papers and provide their money both for short-term and long-term funding.[100]

b. Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility

At the same time, in September 2008, Fed faced another severe financial problem as one of the significant money market mutual funds (MMMF), Reserve Primary Fund,

[98] Cf. Kacperczyk, M./Schnabl, P. (2010), p. 29 ff.; cf. Bernanke, B. (2009), p. 3.
[99] Cf. Kacperczyk, M./Schnabl, P. (2010), p. 30.
[100] Cf. Federal Reserve (2014): Commercial Paper Funding Facility; cf. Bernanke, B. (2009), p. 3.

declared the state of "broke the buck" meaning that its emerging massive losses caused a sharp drop in fund´s value and pushed the value of its share below USD 1. As a result, a wave of investors overthrew MMMFs pursuing only one goal to withdraw their funds. MMMFs were confronted with a problem of bank run and being incapable to satisfy/meet investors demand for liquidity.[101] Assets to be sold, especially asset-backed commercial papers, suffered from illiquidity that was caused through increased doubts on the quality of its underlying collaterals.[102]

In response to this event and concurrently to the CPFF program, Fed initiated Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF) program targeted at elimination of illiquidity on asset-backed commercial paper market by organizing an additional liquidity supply. Consequently, Fed acted by use of so-called nonrecourse loans and facilitators in the form of U.S. financial institutions, which had received funding via fully collateralized nonrecourse loans with the purpose of acquiring ABCP from MMMFs. By these purchases Fed ensured an active market for ABCP and helped MMMFs to avoid much higher losses on the commercial paper market.[103]

c. Agency Mortgage-Backed Securities Purchase Program

In November 2008, for the purpose of further credit market stabilization, FOMC focused its attention on the backup actions for the long-term rate. Therefore, Fed decided to extend its balance sheet size by purchasing longer-term securities at a large scale. Chairman Bernanke announced in December 2008 FOMC´s intention to buy around USD 100bn in debt issued by government-sponsored enterprises (GSE) and USD 500bn in GSE mortgage-backed securities. These agency debt and agency mortgage-backed securities (MBS) referring to securities issued by federal agencies such as Fannie Mae and Ginnie Mae were bought at sizable levels.[104] Between 2009 and 2010, Fed acquired an amount of USD 1.25tn in agency MBS and USD 200bn in agency debt. Targeted objective of lowering mortgage rates was achieved, since they

[101] Cf. Kacperczyk M./Schnabl, P. (2010), p. 30 f.
[102] Cf. Ibid., p. 29.
[103] Cf. Federal Reserve (2014): Asset-Backed Commercial Paper.
[104] Cf. Bernanke, B. (2008), p. 5; cf. Federal Reserve (2014): Agency Mortgage-Backed Securities.

experienced considerable fall after the program was set into operation, what had formed a foundation for housing market recovery.[105]

d. Purchase of Long-term U.S. Treasury Bills

Chairman Bernanke´s announcement in December 2008 of the large-scale purchase of government bonds began its implementation in November 2010. Up to this moment Fed had mainly pursued its monetary policy program of credit easing, however the first signs of Quantitative Easing became visible in the early 2008 as Fed via selling of government bonds financed the large-scale purchase of less-liquid assets and thereby contributed to extension of its asset side.[106] Fed let itself finally in for the new monetary approach known as Quantitative Easing as it made its first step towards the Large Scale Purchase of agency debt and mortgage-backed securities in 2009, and entered a new round of QE2 in November 2010 by purchasing long-term U.S. Treasury bonds.[107]

During QE2 Fed intended to purchase up to USD 600bn additional government bonds with primarily longer maturity, whose overwhelmingly share contained securities at maturity between 2½ and 10 years. The QE2 program was implemented till the middle of 2011, as in September 2011 Fed continue carrying out measures of reducing long-term rates by introducing the maturity extension program called Operational Twist. As the name of the program revealed, a substantial portion of long-term government bonds was purchased being financed through the revenues generated by the disposal of USD 400bn short-term Treasury bills. Thus, Operational Twist varied from QE1 and QE2, as it depicted a sort of asset swap, where Fed purchased long-term assets by reversely selling the short-term ones. As a result, Fed´s balance sheet experienced no extension effect and did not increase its size.[108]

Fed´s intention of flattering the long-term yield under QE2 and Operational Twist had two main goals to achieve: the first and most significant one referred to the idea to

[105] Cf. Federal Reserve (2014): Agency Mortgage-Backed Securities; cf. Federal Reserve (2009): Press release.
[106] Cf. Blinder, A. (2010), p. 467 f.
[107] Cf. Ricketts, L. (2011), p. 1 f.
[108] Cf. Labonte, M. (2014), p. 8.

decrease risk premiums of long-term risky assets via sufficient reduction of riskless interest rates like U.S. Treasury bonds.[109] Holding on the assumption of portfolio balance theory regarding imperfect substitutability and announced outright purchase of government bonds, Fed expected to increase investors' willingness to purchase corporate bonds and therewith put down corporate bond yields along with their risk premiums.[110] Secondly, lowering long-term interest rates supposed to induce a reduction in the borrowing costs for the companies and private sector both to improve recapitalization conditions and stimulate consumer spending. As a result, both objectives aimed at providing strengthening impulse to the stagnated economy and aggregate demand.[111]

The third round of QE was announced in September 2012. This time Fed aimed particularly at achieving a goal of *"maximum employment and price stability".*[112] Against this background, Fed announced to additionally buy USD 40bn of agency MBS on a monthly basis. It continued further its program of average maturity extension, which was implemented through the end of 2012, in the course of which USD 267bn[113] in T-Bills was acquired. All in all, until the end of 2012, overall USD 85bn in longer-term securities per month were supposed to be added to Fed´s longer-term securities holdings and therewith to exercise a much stronger downward pressure on long-term interest rate.[114] All these actions should have been implemented until unemployment and price stability would achieve desirable development. In this sense, Fed pursued the objective of unemployment rate below 6.5 percent and in the same time allowing inflation rate to be in rage of 2.0-2.5 percent.[115]

In October 2014, new Chair of Federal Reserve Janet L. Yellen announced the end of six years lasting large-scale purchase programs, which were conducted in three rounds (QE1, QE2, QE3) and finally showed striven recovery of U.S. economy. Nevertheless, in order to provide further an accommodative monetary policy and slow

[109] Cf. Labonte, M. (2014), p. 10.
[110] Cf. Gagnon, J. et al. (2011), p. 7 f.
[111] Cf. Blinder, A. (2010), p. 466 f.
[112] Federal Reserve (2014a), p. 12.
[113] Cf. Federal Reserve (2013): Maturity Extension Program.
[114] Cf. Federal Reserve (2012): Press release.
[115] Cf. Federal Reserve (2012): Minutes of the Federal Open Market Committee.

crossover towards tightening monetary policy, Fed left the federal fund rate unchanged ranging between 0 and 0.25 percent.[116]

3.3 Evaluation of The Relevant Research Papers and The Empirical Results

In this section, there will be presented some relevant research papers conducted empirical results with focus on economic development and quantitative easing in the United States.

A broad analysis of the empirical and analytical scientific research shows that Gagnon et al. contributed a significant part to the fundamental research on the field of quantitative easing, especially emphasizing the impact of central bank's instruments of monetary policy in reducing risk premia through various transmission channels.[117] Furthermore, they discussed Fed experience with LSAP programs by describing some challenges in this regard as well as underlying mechanisms, which helped to transfer positive stimulus to the U.S. economy. Moreover, they assessed LSAP programs´ efficiency in targeting long-term assets and in flattering their yield curve. Based on the empirical research, the implied application of both even-study and time-series analysis provided empirical evidence for LSAP´s economically meaningful effects.[118]

In their research paper, authors examined to which extent communication or announcement in regard to LSAP programs implementation had an impact on interest rates and market expectations. Therefore, a set of mainly long-term yields on different financial assets[119] became the object of event study analysis. Considerations of corporate bond yields and swap rates within the variables examined aimed at determination of the responsiveness of financial assets that had not been included into LSAP programs. Responses of interest rates as a result of eight announcements made by Fed in regard to the conditions of LSAP program were observed within one-day

---

[116] Cf. Federal Reserve (2014): Press release.
[117] Cf. Kapetanios, G. et al. (2012), p. 319; cf. Joyce, M. et al. (2010), p. 8.
[118] Cf. Gagnon, J. et al. (2011), p. 5, 16.
[119] It included yields on: treasuries at two-year maturity, agency debt and treasuries at ten-year maturity, "*current-coupon thirty-year agency MBS, the ten-year Treasury term premium, the ten-year swap rate and the Baa corporate bond index."* (Gagnon, J. et al. (2011), p. 17)

windows around the announcement. But later the framework of applied event-study analysis was slightly changed in order to achieve more complete research results.[120]

Thereby, on the one hand authors observed, instead of eight announcements, all FOMC´s statements made between November 2008 and January 2010 leaving the one-day response window untouched. On the other hand, they experimented with one-day response window extending it to two days and left event set unchanged. As opposed to event study analysis focusing on effects resulted from announcement of LSAP, time series analysis used in the second part of Gagnon et al. et al. research aimed at gauging the responsiveness of ten-year term premium arisen from asset purchases themselves.[121]

For this purpose, authors made use of ordinary least squares regression model, where tp_t^{10} denoted ten-year yield term premium, while X_t depicted different observable explanatory variables.[122]

$$tp_t^{10} = \mathrm{X}_t \beta + \varepsilon_t \qquad [1]$$

In order to illustrate historical variation in term premium, authors´ set of observable variables required inclusion of relevant explanatory variables that at the same time captured effects of changes in unemployment gap, core CPI inflation, long-run inflation disagreement, *"six-month realized daily volatility of the on-the-run ten-year Treasury yield"* [123] and represented longer-term debt securities.[124]

Both approaches provided significant results highlighting the importance of LSAP programs for the U.S. financial market in reducing long-term interest rates. As the result showed, after the announcement of LSAP programs all the examined interest rates experienced a strong backdrop. Of particular significance here is the generated evidence for LSAP´s large impact on swap rate and the investment grade corporate bond yields of Baa credit quality, on those assets that were not a part of LSAPs program, but whose

[120] Cf. Gagnon, J. et al. (2011), p. 16 ff., 22.
[121] Cf. Ibid., p. 22.
[122] Cf. Ibid., p. 25 f.
[123] Gagnon, J. et al. (2011), p. 26.
[124] Cf. Gagnon, J. et al. (2011), p. 26 ff.

yields were reduced considerably. Thus, the widespread and overarching effect of LSAP programs was proven.[125]

Empirical analysis of Gagnon et al. et al. revealed that asset purchases were efficient in decreasing term premium. Referring to ten-year term premium changes, LSAP had induced a substantial reduction amounted from 30 to 100 basis points. Similar and even stronger reductions in term premiums were considerably observed in both mortgage and corporate bond markets, what contributed to enhancement of the credit and money market.[126]

Another study by Chung et al. produced results confirming improvement of real GDP and other relevant macro economic variables such as labor market and prices stability by analyzing scenarios with Fed´s large-scale asset purchases and scenarios without. Using two large scale FRB/US model and simple model of portfolio balance effects authors were able to provide meaningful estimates for U.S economy.[127]

For the purpose of assessment of macroeconomic effects derived from implementation of LSAPs (LSAP 1 and LSAP 2), authors conducted simulations of the large-scale model called FRB/US model[128] helping Fed to make forecasts and analysis on U.S. economy. The model incorporated many endogenous variables, which enabled Fed to analyze different macroeconomic policies as well as their effects and exogenous shocks on aggregate demand and other related major economic variables.[129]

Additionally to this, authors established portfolio-balance effects model, which assumed that the extent of effects on long-term interest rates presents not only dependent variable of current long-term assets on Fed´s balance sheet, but is also closely linked with investors expectation about the future evolution of these assets held. The model also contained information about spread reductions of mortgage rate arising in 2009 and in the first part of 2010 and, therewith, captured achieved recovery in mortgage market resulted from extensive agency MBS purchase.[130]

---

[125] Cf. Gagnon, J. et al. (2011), p. 20.
[126] Cf. Ibid., p. 38 f.
[127] Cf. Chung, H. et al. (2011), p. 1, 5.
[128] Cf. Brayton, F. et al. (2014): The FRB/US Model.
[129] Cf. Chung, H. et al. (2011), p. 2.
[130] Cf. Ibid., p. 2 f.

Finally, results of the simulation FRB/US model and the simple model of portfolio balance effects revealed that Fed's first phase of large-scale asset purchases led to a reduction in 10-year Treasury yield inducing 0.5 percent decline. This yield downward movement was observed every time after a new phase of LSAP programs was initiated. Looking at the macro economic variables, reduction in long-term interest rates induced a positive stimulus to the economy as it triggered stock market valuations and decreased dollar's foreign exchange value in the course of time.[131]

These beneficial market conditions had a boosting effect on the level of real GDP improving it by 3 percent in the latter part of 2012. Based on this changes in the output, labor market was also facing positive prospects. According to estimations, LSAP programs should have created around 3.7 million jobs over their entire execution period. In addition, the results from the simulations were of a high relevance showing that without implementation of LSAPs core inflation would have been 1 percent lower and would have been facing deflationary problems.[132]

3.4 Quantitative Easing in the Eurozone: Description of Economic Environment

The global financial crisis of 2008 hit the euro area along with EU member states badly. It evolved into the Eurozone crisis sparking sovereign debt crisis and economic and structural commotion in the whole euro area. Eurozone faced a problem of the viability of common currency, disruptions of a single financial market and instability of architectural concept of the economic and monetary union as a whole.[133]

Rising distrust concerning financial stability and transmission mechanism led to profound impairment within interbank lending. This engendered stagnation in liquidity provision within the European bank system and exposed a high range of financial institutions to high default and insolvency risk. Different from United States, in 2008 the Eurozone possessed no banking union allowing it to regulate and supervise the entire financial sector of the 17 Member States of the Eurozone.

[131] Cf. Chung, H. et al. (2011), p. 3.
[132] Cf. Ibid., p. 4.
[133] Cf. Glencross, A. (2013), p. 4, cf. Szczerbowicz, U. (2012), p. 7.

Therefore, each national government of the Eurozone was in charge to restore and rescue its financial institutions from financial downfall.[134]

Moreover, as a result of European integration, eased bank-lending conditions within the Eurozone enabled member countries to raise more funds and increase borrowings.[135,136] Thus, already in late 2009 Greece became the first country announcing its difficulties to maintain its national solvency. Only thanks to extensive bailout programs, coming from the Eurozone countries, in particular from Germany, the above-mentioned difficulties could be overcome.[137]

By late 2011 also Spain and Italy were captured by the economic and financial misery pushing both into recession.[138] Contemporary, many European countries reported a higher deficit/GDP ratio than expected. Both bad prospects in regard to banking sector recovery; rising fears about sovereign solvency and currency redenomination deteriorated the state of sovereign debt market especially of sovereign bond value.[139] In fact, severe fluctuations in annual spread on long-term government bond yields took place among European economies. Aware of sovereign credit risks, investors searched for flight-to-safety, which was found in German Bunds.[140]

Sovereign bond yield depicts one of the most important economic and financial key variables. It is essential for development of key interest rates used in the real economy, which play a major role in capital investment or spending decision-making for private consumers and firms. Since sovereign bond yield operates as an important

---

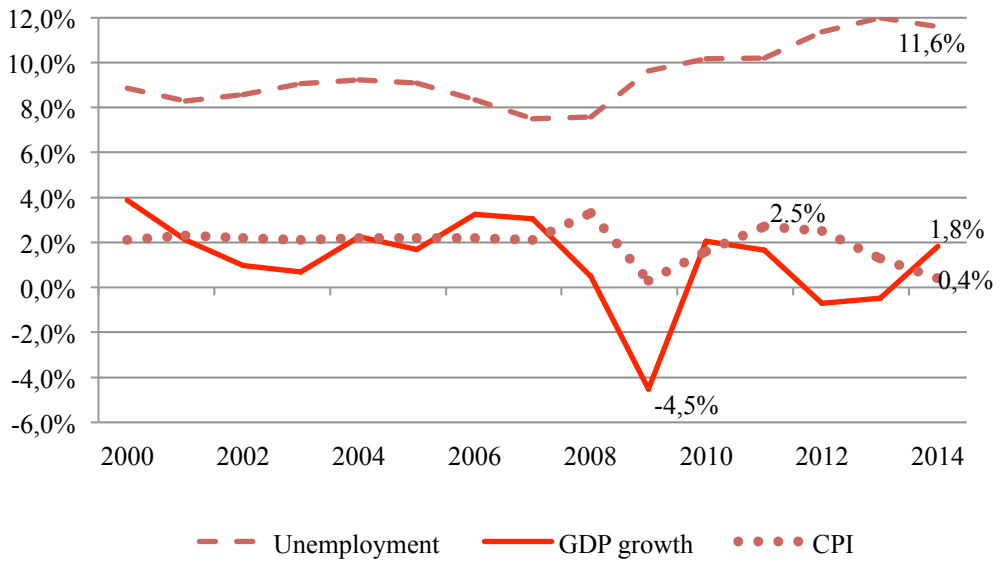
[134] Cf. Glencross, A. (2013), p. 4, 7.
[135] Cf. Lane, P. (2012), p. 52.
[136] According to the study of Lane and Pels, especially so-called credit boom development highlighted the time between 2002-2007, leading to persistent current account imbalances and deficits among the Eurozone member countries. (Cf. Lane, P. (2012), p. 53 f.; cf. Lane, P./Pels, B. (2012), p. 2).
[137] Cf. Glencross, A. (2013), p. 8 f.
[138] Cf. Ibid., p. 10.
[139] Cf. Lane, P. (2012), p. 56.
[140] Hereunto, ECB stated in its monthly Bulletin of May 2014 the fact that yields of ten-year sovereign bonds in EU member states experienced a considerable growth compared to the German ones. (Cf. European Central Bank (2014a), p. 75 f.) As a result, July 2011 sovereign spreads sharply increased for Greece, Ireland and Portugal amounting to 1.600, 1,200 and 1,100 basis points accordingly. In 2012, also Italy and Spain reached its threshold indicating sovereign spreads of 500 and 600 basis points for their long-term bonds. (Cf. European Central Bank (2014a), p. 77) Similarly, already in October 2008, spreads between refinancing key rates like 3-month Euribor and EONIA showed a significant difference highlighting record high of 156 basis points. (Cf. Smaghi, L. (2009): Conventional and unconventional monetary policy)

instrument for conducting monetary policy, the induction of unconventional monetary measures in order to normalize sovereign spreads was of a high relevance for ECB.[141]

At the beginning of 2009 covered bond market that served as the most essential and favored market for the banks funding experienced also its hard times. Thus, interbank paralyzation along with liquidity risk and overall deterioration of transmission mechanisms induced widening of covered bond spreads. In light of these events ECB saw itself forced to take hold of some exceptional monetary policies to deal with economic and financial turmoil.[142]

Undisputedly, this meltdown of financial market had a severe and unavoidable impact on the European economy. Thus, overall in the EU, GDP decreased by around 4 percent in 2009. Thereby, contraction in GDP for the euro area countries such as Germany and Italy amounted to around 5 percent, while i.e. Ireland or Finland faced dramatic GDP downturn of about 7-7½ percent.[143] This is shown by the Figure 4 below.

Figure 4 – Economic development in the Eurozone



Source: Bloomberg.

[141] Cf. European Central Bank (2014a), p. 67.
[142] Cf. Beirne, J. et al. (2011), p. 9 f.
[143] Much stronger GDP contractions experienced Baltic countries, with GDP dropping by about 14 percent in Estonia and 18 percent in neighboring countries. (Cf. European Commission (2009), p. 8)

The outbreak of financial crisis also caused an increase in unemployment of the euro area, whose rate gradually rose reaching its peak of 12.0 percent in 2013. Extreme surge in unemployment rate was observed in Greece after outbreak of the sovereign crisis in late 2009 and in Spain post 2011, whose unemployment rates increased to around 26 percent in 2013.[144,145]

Ongoing low interest rates environment and ultra low policy conducted by the ECB for several years resulted in suitable conditions for European inflation to rise. However, despite this fact, some factors led rather to disinflationary development and dampened inflation growth.[146] Since end-2011 downwards trend prevailed the European inflation development.[147] In December 2014, overall HICP inflation rate of the Eurozone approached -0.2% by making deflation to persistent problem of the euro area.[148,149]

From the late 2008 on, government debt relative to GDP continuously and steeply increased in the euro area. Thus, the strongest relative rise of about 10 percent in government debt was recorded between Q4 2008 and Q4 2009. Nowadays, government debt accounts for almost 100 percent of euro area GDP by reaching 92.1 percent in 2014 Q3.[150,151]

---

[144] Cf. Eurostat (2014): Unemployment.

[145] Especially youths suffered severely from unemployment and deterioration in the labor market in Greece, where the rate exceeded 50 percent and reached 62.5 percent, Portugal (42.5 percent), Italy (40.5) and Spain (56.4 percent). (Cf. Eurostat (2013): April 2013 Euro area)

[146] Cf. European Commission (2014winter), p. 39.

[147] Cf. European Commission (2014winter), p. 39.

[148] Cf. European Central Bank (2015): Measuring inflation.

[149] Drop in the oil prices, beginning from 2011, implied reduction in petrol prices and supplemental oil products affecting consumer price index. Moreover, downward development of energy and services prices, still low productivity growth causing negative output gap and overall weak demand sentiment had contributed to steadily falling inflation year on year. (Cf. European Commission (2014winter), p. 39 f.; cf. European Central Bank (2014): Introductory statement)

[150] Cf. European Central Bank: Government debt.

[151] Regarding specific euro area members, Greece, Italy, Ireland and Portugal revealed the highest numbers in general government gross debt as a percentage of GDP. As result in 2014, general government gross debt in Greece amounted to 175.5 percent of GDP, in Italy (132.2 percent), in Portugal (127.7 percent), in Ireland (110.5 percent of GDP). (Cf. European Commission (2014autumn), p. 71, 73, 81, 101).

Given the heterogeneity of the euro area and hence different level of sovereign indebtedness, balance sheet recession was experienced differently from one euro area country to another. Some highly indebted euro area countries that had excessively expanded their government debt and run current account deficits over several years were forced to deleveraging and to make according balance sheet adjustments while dealing with the financial crisis.[152] Against the backdrop of enormous house prices boost in 2007 and strong debt increase in private sector, that until the onset of the crisis amounted to over 100 percent of GDP in Ireland and nearly 100 percent in Spain, both countries were facing painful correction in asset prices.[153]

Next paragraph will outline the range of steps and monetary policies undertaken by the ECB to overcome the financial and debt crisis and maintain the primary objective, price stability, of the euro system.

3.5 Eurozone: Scale and Description of Measures Introduced

In view of financial turmoil, ECB intended to apply a set of conventional and unconventional monetary policy instruments. One essential tool of ECB´s toolkit in conducting monetary policy depicts steering of short-term interest rate allowing ECB to regulate and to influence economy under normal circumstances.[154] After decisive short-term interest rate increase to 4,25% in July 2008 that aimed at serving as a demonstrative backstop for the upcoming price instability, ECB resolved upon a sharp interest rate cut. Thus, in October 2008, ECB reduced the short-term interest rate profoundly and kept lowering it further throughout the months.[155]

Hence, in May 2009, interest rate achieved its all-time low of 1%. Consequently, together with the last current interest rate cut in September 2014 to 0,05%,[156] ECB introduced an additional monetary policy measure that implied reduction of deposit facility rate and therewith stimulated bank´s lending propensity. Negative deposit

[152] Cf. European Central Bank (2012a), p. 102 f.
[153] Cf. Ibid., p. 103 f.
[154] Cf. European Central Bank (2010b), p. 60 f.; cf. chapter 2.1.
[155] Cf. European Central Bank (2010b), p. 65.
[156] Cf. European Central Bank: Key ECB interest rates; cf. European Central Bank (2009b), p. 9.

facility rate of -0,10% and later on of -0,20% targeted at making parking of bank´s funds on central bank´s account less attractive due to arising financing costs. In this way ECB tried to push banks towards an active lending activity among each other.[157]

According to the study of Urszula Szczerbowicz, the non-standard operational measures launched by the ECB as result of financial and debt crisis of 2008 can be divided into three categories 1) exceptional liquidity measures, 2) collateral easing and 3) purchases of assets. These measures aimed at easing monetary conditions and providing sufficient liquidity for the banking system. In the wake of the unsuccessfully implemented conventional measures, including the extensive reduction of main refinancing rate and wide-range of measures[158] within the regular operational framework of the Euro system's instruments, ECB decided to introduce non-standard monetary policy instruments.[159]

3.5.1 Exceptional Liquidity Provision

The implementation of exceptional liquidity measures entailed a wide range of liquidity innovations provided by the ECB in order to eliminate liquidity shortage among banks and thus assure the pass through of credit to European small to medium- sized companies.[160] In this, two objectives were pursued. Firstly, exceptional liquidity provision was supposed to resolve interference on the interbank market and thus enable the provision of credits to companies and private sector via enhanced bank lending capabilities. At the same time, exceptional liquidity should stimulate overall investment activity by creating incentives for firms to buy money assets i.e. corporate bonds as result of portfolio rebalancing mechanism. According to their theory, in an environment of excess money supply demand for non-money assets increases with negatively influencing asset yields, so that instead money assets become more attractive.[161]

---

[157] Cf. European Central Bank: Key ECB interest rates.
[158] ECB´s regular operational instrument set includes: open market operation such *as "main refinancing operations, longer-term refinancing operations, fine-tuning operations, structural operations and standing facilities".* (European Central Bank: Monetary Policy Instruments)
[159] Cf. European Central Bank (2009b), p. 9.
[160] Cf. European Central Bank (2009b), p. 9 f.
[161] Cf. Szczerbowicz, U. (2012), p. 9 f.; cf. Metzler A. (1995), 54 f.

3.5.2 Fixed-rate Full Allotment

In his speech a Member of the Executive Board of the ECB argued that fixed-rate full-allotment *"is probably the most significant non-standard measure the ECB is implementing"*.[162] Starting from October 2008, ECB introduced the FRFA programs. Instead of traditionally applied variable rate tenders to steer the open market operations, FRFA had provided banks access to extensive liquidity on fixed rate tender base. Moreover, fixed rate procedure was set for all refinancing operations with duration of up to 180 days.[163]

With this operational step, ECB aimed at achieving two significant goals: 1) fixed rate implementation for both main refinancing operations with regular short-term maturity and long-term operations having usually the maturity of three months; 2) extension of the length of refinancing maturity to six month that ensured favorable lending conditions for banks.[164] Introduction of FRFA was revealed to be an effective tool for balancing out liquidity risk and to dispose uncertainties in regard to refinancing capabilities. Furthermore, it delivered ECB an informative overview of liquidity demand in the financial sector, since banks were able to signalize independently how much liquidity they required.[165]

3.5.3 Three-year Refinancing Operations (3-year LTRO)

Every bit as non-standard as FRFA was another monetary tool implemented by the ECB that depicted the long-term refinancing operations carried out in 2011 and 2012 through fixed rate tenders and extended maturity. In addition to traditional three-month liquidity-providing operations in euro conducted within the scope of regular open market operations, ECB extended its operational scope by expanding the maturity to six months in March 2008 and later to two three-year refinancing operations, both

[162] González-Páramo, J. (2011): The ECB's monetary policy during the crisis.
[163] Cf. Smaghi, L. (2009): Conventional and unconventional monetary policy; cf. Szczerbowicz, U. (2012), p. 11.
[164] Cf. Szczerbowicz, U. (2012), p. 11; cf. Smaghi, L. (2009): Conventional and unconventional monetary policy.
[165] Cf. González-Páramo, J. (2011): The ECB's monetary policy during the crisis.

maturing in 2015. The two three-year operations generated large increase in the liquidity provided, so that more than EUR 1tn was lent to the financial market.[166]

3.5.4 Liquidity in Foreign Currencies

Unprecedented subprime crisis in U.S. caused also difficulties for financial institutions in Eurozone in regard to refinancing operations and obtaining funding in foreign currencies. For this reason, supplementary to national currency, provision of liquidity in foreign currency was organized by the ECB beginning from December 2007. By use of currency swaps, on which ECB agreed with a number of central banks, among those Fed, Swiss National Bank, Bank of England, ECB enabled the inflow of money from adjacent countries and overseas to the European market. Thanks to foreign exchange swaps, banks could exchange euro against foreign currency and make use of funding in Dollar, Swiss franc and British pound. Since 2008, FRFA served as one of the prudent ways, which ECB used for allocation of foreign money to financial institutions.[167]

3.5.5 Collateral Easing

Even before the crisis ECB distinguished oneself from other central banks by much broader definition of securities eligible as collateral for banks credit operations. However, the outbreak of the crisis worsened funding activity for the most of the banks, requiring further extension of collateral framework and increase in collateral availability by the ECB.[168] Among all the loosening rules implemented, ECB decided to expand the eligibility of collateral by accepting assets collateralized in foreign currencies such as USD, JPY or GBP.[169] Moreover, it widened the eligibility list for ABS and approved the acceptance for a set of supplemental securities including credit claims, institutional debt instruments, government bonds, bank deposits or bank certificates. In order to reduce high-risk exposure of underlying assets, ECB also adapted the so-called valuation haircuts that implied devaluation of collateralized securities for the sake of risk perspective.[170]

---

[166] Cf. Szczerbowicz, U. (2012), p. 11 f.
[167] Cf. Ibid., p. 12.
[168] Cf. Ibid., p. 16.
[169] Cf. European Central Bank (2013), p. 14.
[170] Cf. European Central Bank (2013), p. 14 f.; cf. Szczerbowicz, U. (2012), p. 16 f.

3.5.6 Purchases of Assets

Against strong growing financial crunch in the euro area, ECB chose to react with a range of bond and asset purchase programs. By use of purchases of sovereign bonds, asset-backed securities and covered bond from primary and secondary markets, ECB intended to exert influence on high-risk premium contained in prices of government bonds and transmission mechanisms that did not function appropriately. Especially Securities Markets Programme (SMP) and Outright Monetary Transactions (OMT) were designated to attend to this task.[171]

a. Sovereign Bond Purchases

In May 2010, ECB introduced its first and most controversial purchase program called Securities Markets Programme (SMP). In response to intense riddance of high-default-risk Greek government bonds on the market, ECB dared to implement most unconventional monetary policy. Thus, ECB not only accepted sovereign bonds as a part of collateral within the regular refinancing operations, it participated in the purchase of the euro area debt on the secondary market by itself. Many scientists met this program with criticism. They argued that ECB was operating in an irregular mode and, with this, was acting beyond its mandate. Despite everything ECB asserted its initiative by pursing the target of maintenance of adequate sovereign bond prices, recovery of transmission channels and stabilization of the euro.[172]

In January 2011, ECB terminated temporary purchase programs and even increased base interest rate to 0.5% as a result of elusive economic stabilization. Because already in July of 2011 the euro crisis hit profoundly Italy and Spain by negatively affecting sovereign solvency and sovereign bond yields of both countries.[173] Against this background SMP had to be resumed in August 2011 again, so that from May 2010 until the end 2012, ECB purchased sovereign bonds amounting to around EUR 220bn mainly focusing on Greece, Spain, Italy, Portugal and Ireland.[174]

---

[171] Cf. European Central Bank: Open market operations; cf. Szczerbowicz, U. (2012), p. 13 f., 16.
[172] Cf. Szczerbowicz, U. (2012), p. 14.
[173] Cf. Szczerbowicz, U. (2012), p. 14; cf. European Central Bank: Key ECB interest rates.
[174] Cf. Szczerbowicz, U. (2012), p. 14 f.; cf. Eser, F./Schwaab, B. (2013), p. 1.

New inflammation of euro crisis especially in Spanish banking sector in the summer of 2012 had challenged ECB again and made the ECB to undertake some further steps. In September 2012, SMP was stopped and simultaneously announced to be replaced by another unconventional monetary program called Outright Monetary Transactions (OMT). Targeting the same goal as its predecessor SMP, OMT was designated to operate in secondary market for sovereign bonds.[175]

In comparison to SMP that was focusing on long-term bonds, OMT was designated to consider only those government bonds, which had a maturity of maximum three years. Differently from SMP, OMT underlay to no temporal and quantitative limitations. It was justified by ECB´s intention to do everything feasible to safeguard the euro from downfall. Finally, within the scope of OMT, ECB decided to be treated the same as private holders and to give up its seniority status.[176]

At the beginning of 2015, ECB announced to begin with, as in 2012 presented, OMT that were supposed to depict a part of so-called Expanded Asset Purchase Programme presumably lasting until September 2016. Additionally to the running Asset Purchase Programmes including CBPP3 and ABSPP, ECB finally introduced OMT focusing on sovereign bond purchases by primarily chasing the objective of stabilization of European inflation rate over the medium-term. Therewith, Draghi intended to address the prolonged low inflation as well as deflationary risk of the euro area.[177] These purchases aimed at expanding ECB´s balance sheet and influencing medium-term inflation expectations.[178]

b. Covered Bond Purchases (CBPP1, CBPP2, CBPP3 and ABSPP)

In May 2009, ECB announced to start outright covered bond purchases. For this purpose, the Covered Bond Purchase Programme (CBPP) aimed at improvement of

---

[175] Cf. Demary, M./Matthes, J. (2013), p. 40 f.; cf. Szczerbowicz, U. (2012), p. 15.
[176] Cf. Szczerbowicz, U. (2012), p. 15; cf. European Central Bank (2012): 6 September 2012-Technical features.
[177] Thereby, intended total amount on assets to be purchased in a month will account to EUR 60 billion. (Cf. European Central Bank (2015): 22 January 2015 - ECB)
[178] This expansive measure should achieve the inflationary goal by bringing inflation rate to its target level of close but still below 2 percent. (Cf. Draghi, M. (2015): Introductory statement)

strained covered bond market that experienced gradually withering as a result of equity abandonment induced by shift of equity towards less risky assets. It is important to highlight the important role of the covered bond market within European capital markets.[179] In contrast to other securities, especially covered bonds enjoyed popularity by investors. Relative to asset-backed securities or non-securitized assets, covered bonds offer a high extent of safety securing the credit risk by a stock of liquid assets that serve as strong collateral.[180]

Covered Bond Purchase Programme intended to pursue 3 main goals, which were part of ECB´s decision disclosure in 2009. According to this statement, Covered Bond purchases were supposed to help:

a. *"promoting the ongoing decline in money market term rates;*
b. *easing funding conditions for credit institutions and enterprises;*
c. *encouraging credit institutions to maintain and expand their lending to clients;*
d. *improving liquidity in major segments of the private debt securities market."*[181]

ECB set its first CBPP in May 2009, intervening in both primary and secondary markets. Only within one year ECB purchased covered bonds valued to EUR 60bn predominantly with maturities ranging between three to seven years. Following this, in June 2010, CBPP 1 was terminated and replaced by new Covered bond Purchase Programme 2, introduced on 6 October 2011.[182] Persistent financial instability required purchases of further EUR 40bn euro-denominated covered bonds within CBPP 2. Easing of financial tension and liquidity constraints on financial markets kept further to be the primary goal.[183]

This idea was also underpinned by Jean-Claude Trichet in 2009, who declared CBPPs as well as all non-standard measures, mentioned above, to be of clear credit easing

[179] Covered bond market is regarded as a key-funding source for European medium and long-term refinancing operations (Cf. Szczerbowicz, U. (2012), p. 15 f.).
[180] Cf. Beirne , J. et al. (2011), p. 9.
[181] European Central Bank (2009a), p. 18.
[182] Cf. Beirne J. et al. (2011), p. 5.
[183] Cf. European Central Bank (2011): 3 November 2011- ECB.

nature and a part of a so-called Enhanced credit support monetary policy. This monetary policy and its unconventional instruments differed from the ones of Fed or BOE especially in the placement of monetary focus - predominantly loosening of liquidity and funding constraints within the banking sector.[184]

Recently, ECB decided to complement its Covered Bond Programmes set by introducing the third series of Covered Bond purchases beginning from fourth quarter of 2014. Additionally to this, new Asset Backed Securities Purchase Programme (ABSPP) was supposed to be incorporated into the financial market in October 2014. Both programs served as extensions of monetary measures implemented before and aimed at continuing enhancement of transmission mechanism and additional easing of liquidity provision to the Eurozone economy.[185]

However, in 2015, in light of European deflationary development, ECB slightly shifted its attention from credit easing to pure quantitative easing. Thus, additionally to the running Asset Purchase Programmes including CBPP3 and ABSPP, ECB finally introduced OMT involving sovereign bond purchases programme by primarily chasing the objective of stabilization of inflation rate over the medium-term.[186]

In the next paragraph, there will be presented some relevant research papers with particular focus on the monetary easing measures applied in the Eurozone.

3.6 Evaluation of the Relevant Research Papers and the Empirical Results

Among many international research papers conducted on the subject of QE effects, the paper by Fratzscher et al. depicts one of the rare papers with particular focus on the euro area. For the first time, authors provided an extensive evaluation analysis in regard to the financial market effects resulted from unconventional monetary policy instruments applied by the ECB. Applying empirical approach in their research paper, authors aimed at both quantifying impacts of ECB´s unconventional policy measures,

[184] Cf. Trichet J.-C. (2009), p. 11 f.; cf. Fawley, B./Neely, C. (2013), p. 71.
[185] Cf. European Central Bank (2014): 2 October 2014 - ECB.
[186] Cf. Draghi, M. (2015): Introductory statement.

in particular SMP policy, on asset prices across European markets and examining spillover effects occurred for sovereign asset prices and investment market.[187]

Focusing on a time period between May 2007 and September 2012, authors analyzed a dataset presenting 38 countries. Daily information on different financial market variables such as interest rates, asset prices, yields as well as data on ECB´s monetary policy instruments and balance sheet features were gathered from multiple sources and complemented by the information on investment activity in portfolio equity for each of the country in order to capture the effects on capital flows.[188]

With the use of benchmark model below, authors approached the assessment of ECB´s unconventional measures. Looking at the components of the model equation, $y_{i,t}$ as a endogenous variable denoted return of the banking equity index of country i at a point in time t. Explanatory variables depicted on the one hand MP_t including information on monetary policy instruments and on the other F_t and Z_{t-1} presenting contemporaneous and lagged control variables.[189]

$$y_{i,t} = \beta \mathrm{MP}_t + \gamma_1 F_t + \gamma_2 Z_{t-1} + \varepsilon_{i,t} \qquad [2]$$

$$\text{With } \mathrm{MP}_t = \left[\mathrm{AN\_OMT}_t, \mathrm{AN\_SMP}_t, \mathrm{SLTRO}_t, \mathrm{VLTRO}_t, \mathrm{SMP}_t\right]$$

Assuming that alone the intention of ongoing SMP purchases might affect market expectations and thereby have an impact on asset price development, authors decided to investigate both effects as a result of underlying announcements and as a result of application of monetary policy instruments as such. For that purpose, authors incorporated 4 announcements ($\mathrm{AN\_OMT}_t, \mathrm{AN\_SMP}_t$) in matrix MP_t revealing ECB´s intention to initiate the QE policy in form of SMP and OMT.[190]

[187] Cf. Fratzscher, M. et al. (2014), p. 3.
[188] Cf. Ibid., p. 9.
[189] Cf. Ibid., p. 10.
[190] Cf. Ibid., p. 11.

Furthermore, authors selected dummies to capture the effects of monetary policy interventions including liquidity injection in form of Supplementary Long Term Refinancing Operations (SLTRO), Long Term Refinancing Operations (VLTRO) and asset purchases presented by SMP.[191]

According to the empirical findings generated from the benchmark equation, which encompassed overall impact of unconventional operations, ECB´s news in regard to OMP and SMP had following effects on bond market of the euro area countries. OMT announcement resulted in a total 74 basis points reduction for Italian and Spanish 10-year government bond yields and in 121 basis points after SMP announcement. At the same time, OMP announcement had an opposite effect on government bond yields of "core" euro area countries[192] inducing a total 10 basis points rise in corresponding yields and leaving same yields unchanged as a result of SMP news.[193]

Based on OMT and SMP announcement, findings on equity markets effects revealed a positive development. Thereby, both financially weaker, non-core countries, Italy and Spain, as well as highly rated European countries experienced an equity index and bank equity price increase. While Italy and Spain felt considerable enhancement of 900 basis points in equity indexes and 1400 basis points in equity prices respectively, due to OMT, and 7 percent and 15 percent respectively thanks to SMP, core countries recorded comparably only a light climb-out in this regard.[194]

Evidences generated on liquidity injections showed that SLTRO and VLTRO provided a considerable support to financial markets. Thus, by means of EUR 660bn high capital injection in 2010 within SLTRO, ECB achieved to lower 10- years sovereign spreads by 24 basis points in Italy and Spain, thereby yields of Core countries went down by 5 basis points. Ensuing extensive VLTRO programs implied an even stronger impact on yields of 10-years government dropping yields by 0.52 percent of non-core countries and by

[191] Cf. Fratzscher, M. et al. (2014), p. 12.
[192] i.e. Finland, Germany, Austria, Netherlands.
[193] Cf. Fratzscher, M. et al. (2014), p. 14 f.
[194] Cf. Ibid., p.14 f.

0.06 percent in Core European countries. Both operations strengthened equity markets and contributed to a substantial increase in equity returns.[195]

Monetary policy intervention via application of SMP purchases led also to reduction in yields by around 0.7 percent in non-core euro area countries. It has proven itself to be an effective measure in increasing equity prices across the whole Eurozone.[196] Finally, further results of the study additionally approved that if unconventional policy was not applied, sovereign bond yields of all examined European countries would have remained on a higher level.[197]

Relating to global markets effects, authors could show that ECB´s monetary policy was not only able to lower investors´ risk aversion as well as sovereign and credit risks and therewith strengthen trust into investment market, but also create positive spillover to the global financial system.[198]

In contrast to the paper above, following paper presented by Peersman focused primarily on macroeconomic effects resulted from the extension of ECB´s balance sheet in light of unconventional monetary policy. Using a range of empirical approaches among those baseline model VAR, SVAR model, extended VAR model and sensitivity analysis, author tried to identify unconventional monetary policy shocks and to analyze the impact of those effects on the broader economy.[199]

Referring to the unconventional monetary policy shocks, Peersman defined them as the innovative measures to the credit supply. In other words these measures depicted a set of monetary operations targeting improvement of money market and liquidity provision without steering ECB´s refinancing rate. All ECB´s non-standard measures applied from financial easing such as fixed rate tender with full allotment, through extension of eligible collateral, right up to intended OMT and covered bond

[195] Cf. Fratzscher, M. et al. (2014), p. 15.
[196] Cf. Ibid., p. 15.
[197] In case of Italy and Spain about 3 percent higher and for core euro area countries about 0.05 percent. (Cf. Fratzscher, M. et al. (2014), p. 16 f.)
[198] Cf. Fratzscher, M. et al. (2014), p. 30 f.
[199] Cf. Peersman, G. (2011), p. 6 ff., 20.

purchases, have contributed to loosening of credit conditions and additional liquidity supply. Their influence on macroeconomic variables was incorporated in the empirical investigation.[200]

Furthermore, Peersman determined two possible unconventional policy shocks. While the first shock referring to credit supply induced the reduction of funding risk and term spreads, "balance sheet" shock focused on significant extension of central bank´s balance sheet. Both shocks implemented a shift of the credit supply and contributed to financial market recovery.[201]

In his study Peersman found evidences for non-standard policy effectiveness in improvement of credit supply. Based on that evidence author suggested that well functioning credit channel resulted from unconventional policy shocks induced significant impact on economic activity but only of an impermanent nature, while it provided a prolonged effect on the price level. However, the first significant changes consistent with significant increase in both macroeconomic variables could be observed only one year after.[202]

Extended Covered Bond Purchase Programme introduced by the ECB in 2009 as additional measure for covered bond market revival became the main topic of analysis by the paper of Beirne et al. Authors undertook an extensive analysis in order to identify to what extent CBPP1 was an efficient instrument in stimulating covered bond market recovery and what were the effects of CBPP on primary and secondary bond markets. Thus, by examining CBPP´s effects on primary market and applying cointegration techniques, authors targeted at identifying any observable changes in overall remaining amounts including both bonds covered and uncovered.[203]

Moreover, authors attempted to approach empirical evaluation of CBPP´s effects on the secondary market. Therefore, authors made a use of both “event study” analyses

[200] Cf. Peersman, G. (2011), p. 13.
[201] Cf. Ibid., p. 24.
[202] Cf. Ibid., p. 15.
[203] Cf. Beirne, J. et al. (2011), p. 5.

and regression model helping them to evaluation covered bond market reaction towards the announcement of the CBPP across the euro area countries.[204]

As results of the study revealed, introduction of CBPP had led to a positive effect on both primary and secondary bond markets. It turned out to be efficient measure in helping to reestablish covered bond market activity by decreasing covered bond spreads and its attractiveness for investors. However, in the primary market only covered bonds experienced a new pick-up resulted from CBPP that significantly boosted the issuance of these bonds.[205]

By the help of CBPP, banks funding costs could be successfully decreased, what aroused investors interest in regard to covered bonds products as alternative funding instrument. CBPP provided a strong stimulus to the credit market of the euro area even of countries faced large sovereign and financial tensions in the financial crisis.[206]

Additionally, results in regard to reaction of covered bonds spreads after CBPP initial announcement on 7 May 2009 clearly showed that during the announcement day average daily change in German spreads contracted by 7 basis points, while days before this announcement it showed minimum up to non changes.[207] It was suggested that after the initial announcement and until June 2010 spreads of German covered bond went down by about 0.4 percent, while French covered bonds spreads declined by 50 basis points.[208] In this way, Beirne et al. approved the CBPPs effectiveness, which resulted in improved covered bond market and funding conditions.

The next paragraph will initiate discussion on the United Kingdom and the range of steps and monetary policies undertaken by the BOE in order to master the consequences of the financial crisis.

[204] Cf Beirne, J. et al. (2011), p. 5 f.
[205] Cf. Ibid., p. 5 f.
[206] Cf. Ibid., p. 24.
[207] Cf. Ibid., p. 19.
[208] Cf. Ibid., p. 21 f.

3.7 Quantitative Easing in the United Kingdom: Description of Economic Environment

In the course of financial crisis in 2008, UK experienced hard times facing financial meltdown and deteriorating economic prospects as many other European countries. Worldwide breakdown of money markets and impairment of international banking system seeded prevailing mood of uncertainty and fears among the financial sector and private households in UK.[209] Its severe turmoil began in 2007 with the failure of Northern Rock, one of the biggest banks in UK. However, beforehand in September 2007, a triggered bank run had forced Northern Rock to appeal to Bank of England for emergency financial support.[210]

Despite received liquidity assistance from the BOE, Northern Rock did not overcome its financial difficulties and finally became a subject to nationalization. Through funding shortcomings due to the failure of interbank market many companies were exposed to a high deleveraging risk. As a result, sizable equity disposal of UK´s biggest companies caused a substantial share price decline that was reflected in FTSE 100 index,[211] which experienced a fall of more than 2600 basis points in March 2009 compared to it highest value of 6930.2 basis points in December 1999.[212]

This downward development was also strongly observed in UK`s economy. Thus, between 2007 and 2009 tightening of credit market and increased borrowing costs induced the strongest output fall since the World War II amounting to 7.2 percent.[213,214]

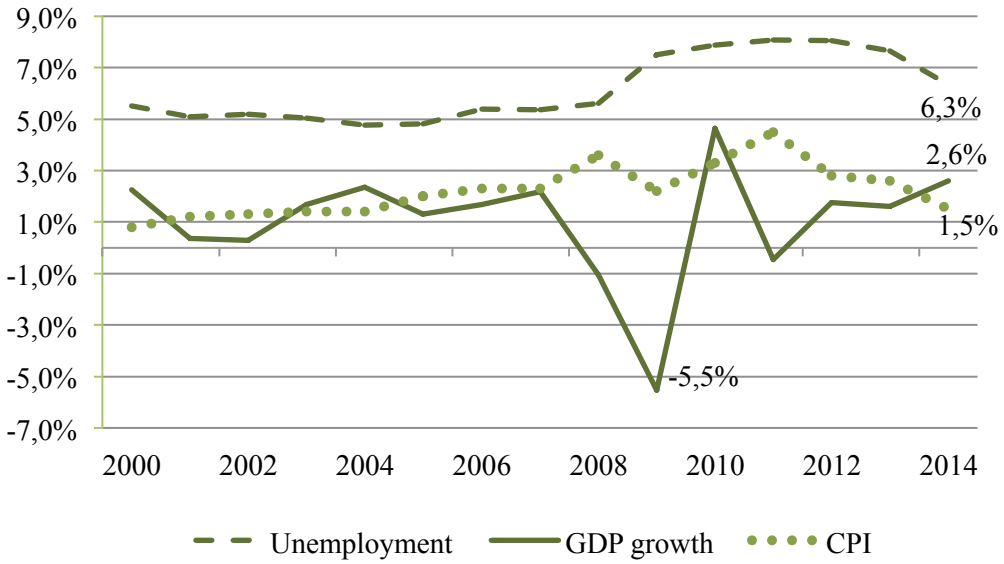
National Institute of Economic and Social Research (NIESR) stated that UK GDP growth first stagnated in March 2008 and had reached its peak contraction of 5.5

[209] Cf. Chowla, S. et al. (2014), p. 169.
[210] Cf. Shin, H. (2009), p. 101 f.
[211] Cf. Dimsdale, N. (2009), p. 2, 4.
[212] Cf. UK Finance Yahoo UK & Ireland: FTSE 100 (FTSE).
[213] Cf. Chowla, S. et al. (2014), p. 169.
[214] UK housing market as one of the most important sectors in the economy because of its steady growth in real estate prices over the years also faced the problem of housing bubble. Bursting of the housing bubble, resulted in sharp asset price fall, significantly devalued household wealth and diminished household´s consumption willingness accordingly. It is stated that during the financial crisis UK housing market was hit much stronger than in other European countries, so that between 2008 and 2010 real houses prices experienced a fall by 15 percent and residential investment decreased up to 50 percent of GDP. (Cf. Abbas, A. et al. (2014), p. 10, 12)

percent in the second quarter of 2009.[215] British economy officially entered into recession in January 2009 and influenced substantially the British labor market inducing enormous job losses, whose peak was achieved in Q1 of 2009 as the number of redundant workers increased to 2.43 million.[216,217]

In September 2008, CPI increased markedly to 5.2 percent, however in November 2009 CPI inflation showed a sharp fall to 1.1 percent capturing deterioration of credit market conditions and tightening of the money supply.[218] In the aftermath introduced measures aimed at stabilization of target inflation rate were able to push inflation rate higher to 3.1 percent in September 2010.[219] These macroeconomic developments are represented by the Figure 5 below.

Figure 5 – Economic development in the United Kingdom



Source: Bloomberg.

[215] Cf. Astley, M. et al. (2009), p. 178; cf. Vaitilingam, R. (2009), p. 10.
[216] Cf. Vaitilingam, R. (2009), p. 16.
[217] The unemployment severely hit the young people aged between 16 and 24 whose redundancy rate rose from 11.8 percent in 2008 to 17.2 percent in 2009. (Cf. Bell, D./Blanchflower, D. (2010), p. 4 f.)
[218] Cf. Bank of England (2008b), p. 5; cf. Bank of England (2009b), p. 5.
[219] Cf. Bank of England (2010), p. 7.

As the Figure 5 shows, since 2012 the stabilization of the GDP growth has been accompanied by the decline in UK's unemployment. However, it needs to be highlighted that lower CPI during 2012 and 2014 may have been limiting GDP growth development at some extent.

3.8 United Kingdom: Scale and Description of Measures Introduced

3.8.1 Liquidity Facilities

After the bank run of Northern Rock, Monetary Policy Committee (MPC) began to undertake substantial steps towards financial support by providing emergency liquidity to financial institutions lacking short-term funding. In the wake of severe tensions in the money market, in December 2007, MPC decided to modify its regular long-term repo open market operations (OMOs) and offer the so-called **Extended collateral three-month repos** (ELTRs).[220]

Thus, MPC extended the pool of its collateral eligible for 3-month repos by allowing covered bonds and highly rated residential mortgage-backed securities (RMBS) to be pledged besides high-quality sovereign securities. Later, dependent on worsening of financial situation on the money market, MPC intensified these operations in 2008 and provided more funds, much frequently and on further extended collateral basis, including mortgage and commercial backed securities as well as corporate debt.[221]

Failure of U.S. leading investment banks in 2008 forced international central banks, among others BOE, to react with additional supportive measures towards dried up lending market. As a result, in April 2008 BOE established the **Special Liquidity Scheme (SLS)** aimed at exchanging illiquid assets like high quality mortgage-backed and some other securities for liquid short-term UK gilts. So, around GBP 185bn in Treasury bills were provided to the market under this program.[222] In this way, MPC unburdened balance sheets and diversified funding source of financial institutions.

---

[220] Cf. Cross, M. et. al. (2010), p. 37.
[221] Cf. Ibid., p. 37.
[222] Cf. Bank of England (2009c), p. 1; cf. Joyce, M. et al. (2010), p. 10 f.

Facing dollar market fluctuations, in September 2008 BOE approached so-called U.S. **Dollar Repo Operations** allowing BOE to lend U.S. dollars overnight. These operations designated to provide funds in U.S. Dollar through auctions to UK companies and were enabled through a swap line arrangement between BOE and Fed. Under this swap facility program, BOE, as many other central banks, established an enhanced access to U.S. currency in turn offering its counterpart currency.[223]

Banks **Discount Window Facility** (DWF) was a further step undertaken by BOE in October 2008 in order to loose liquidity strains of short-term lending market. Similar to precedent SLS, DWF provided exchange of illiquid assets accepting even broader set of collateral. However, different from SLS, DWF offered borrowing loans on short-term basis of 30-days. DWF was designated as a sort of bridge financing and temporary financial backup until the next financing source to come for companies experiencing acute shortage in sterling liquidity.[224]

3.8.2 Short-term Rate Reduction

Simultaneously with some other central banks, BOE addressed the severe shortage in money supply and lending stagnation by reducing the Bank rate by 0.5 percent in October 2008. However, in the wake of deteriorating prospects in different economic sectors as well as weakening outlook for reaching the target inflation of 2 percent, MPC went further and decreased Bank rate firstly by 1.5 percent to 3 percent in November 2008 and additionally to 1 percent in the aftermath.[225] These reductions, along with facility programs implemented, had a downward impact on three month LIBOR rate bringing it down to 2.3 percent in January 2009, while Libor spread experienced decline to 80 basis points in September of the same year.[226]

[223] Cf. Bank of England: U.S. Dollar Repo Operations; cf. Bank of England (2008a), p.1.
[224] Cf. Fisher, P. (2012), p. 3.
[225] Cf. Bank of England (2009a), p. 6, 10.
[226] Cf. Dimsdale, N. (2009), p. 5.

3.8.3 Large-Scale Asset Purchases and Quantitative Easing

BOE made its first turn towards large-scale asset purchase programs in January of 2009, as a program of Asset Purchase Facility (APF) was introduced. Financed by a new issuance of Treasury bills and carried out by Bank of England Asset Purchase Facility Fund Limited (BEAPFF), which was extra created for this special purpose, the fund acquired sizable amount of commercial papers, corporate bonds and other high quality assets. This program focused on credit market stabilization and therewith on setting a stimulus to overall demand that both could be achieved via portfolio balance channel. Initially, an amount of up to GBP 50bn of highly quality securities should have been purchased creating additional central bank reserves.[227]

In March 2009, MPC announced to shift its monetary policy focus towards the achievement of inflation target in the medium term.[228] Thus, MPC intended to use APF to meet this goal implying the widening of the target asset amount to be purchased.[229]

Simultaneously with sharp reduction of bank rate to the all time low of 0.5 percent in March 2009 and the evidence of no additional trigger to impact the economy via short-term rate manipulation, BOE decided to pursue the long-term rate by implementing an unconventional monetary policy measure known as Quantitative Easing.[230]

Introduction of quantitative easing was undertaken within the previously implemented APF program. Thus, from March 2009 to January 2010, MPC purchased up to GBP 200bn of gilts and private assets by building central bank reserves. Thereby, BOE primarily targeted at purchasing gilts that made GBP 198bn out of total GBP 200bn. Additionally, terms of maturity were changed after August 2009 allowing MPC to consider gilts with remaining maturity of three and 25 years beside the initial 5 years.[231]

Between November 2009 and July 2012, MPC continuously extended the amount of government bonds purchased, so that at the end total value of asset purchases amounted

---

[227] Cf. Bank of England: Asset Purchase Facility; cf. Joyce, M. et al. (2010), p. 11.
[228] Cf. Kapetanios, G. et al. (2012), p. 3.
[229] Cf. Bank of England: Asset Purchase Facility.
[230] Cf. Dimsdale, N. (2009), p. 6.
[231] Cf. Joyce, M. et al. (2010), p. 11 f.

to GBP 375bn. From 2012 on, BOE left its amount of assets purchased unchanged.[232] According to Inflation Report on August 2013, MPC announced its unreadiness to decrease its stock of asset purchases until the optimal unemployment rate of 7 percent was achieved. On the contrary, it approved to undertake further asset purchases, if necessary, to bring unemployment rate downward to its target rate of 7 percent.[233]

3.9 Evaluation of the Relevant Research Papers and the Empirical Results

This section will discuss the relevant research papers and their results concerning the effects of quantitative easing on the UK economy.

Thus, the empirical study of Kapetanios et al. focused on evaluation of effects of QE on the UK wider economy, especially on the economic activity and inflation by providing an extensive estimation work. In particular, the authors applied counterfactual analysis, which in general investigates scenarios from the perspective of the question "what if". Thus, in this study authors analyzed real GDP and CPI inflation against the backdrop of how these macro economic variables would have developed, if QE had not been introduced. Conducting an additional baseline prediction, which incorporated QE, and using empirical models, including large BVAR, MS-SVAR and TVP-SVAR, results generated in counterfactual analysis and the ones from baseline prediction were then compared with each other.[234]

By means of the 3 models authors carried out counterfactual analysis in order to investigate how the UK macro economic variables were effected and if these effects were of long continuance. For the purpose of providing conditional forecasts for 2 examined macro economic variables - real GDP and CPI inflation, authors made use of econometric vector auto regression models, which allowed incorporation and analysis of a large data set and helped to find out interrelation between spreads and real economy. One of the models was the Bayesian VAR (BVAR),[235]

---

[232] Cf. Bank of England: Quantitative Easing; cf. chapter 2.5.
[233] Cf. Bank of England (2013), p. 5.
[234] Cf. Kapetanios, G. et al. (2012), p. 4 f.
[235] Cf. Ibid., p. 4, 6.

$$Y_t = \Theta_0 + \Theta_1 Y_{t-1} + ... + \Theta_p Y_{t-p} + \mathrm{e}_t \quad [3]$$

whose application enabled to capture structural change.[236] Thereby, Y_t was the vector containing data on 5-year and 10-year government bond spreads[237] and all the variables such as the factor e_t that described white-noise error term of the vector, while Θ_0 denoted a vector of constants and both Θ_1 and Θ_p referred to parameter matrices.[238,239]

Monetary policy changes, which contained both introduction of ZLB or quantitative easing policy, related structural shocks affecting aggregate demand and CPI inflation were captured in the MS-SVAR [4] and TVP-SVAR [5] models below:[240]

$$Y_t = \mathrm{c}_s + \sum_{j=1}^{K} \mathrm{B}_{j,s} Y_{t-1} + \mathrm{A}_{0,s} \varepsilon_t \quad [4]$$

$$Y_t = \mathrm{c}_t + \sum_{l=1}^{L} \phi_{l,t} Y_{t-l} + \mathrm{v}_t \quad [5]$$

where Y_t represented data set vector, which encompassed information on the 3-month Treasury bill, yield spread of 10-year government bond S_t, annual output increase y_t as well as annual price increase π_t. It also included information on $A_{0,s}$ and $B_{j,s}$, which denoted regime dependent autoregressive coefficients. While SP_t captured the information on annual change in stock prices, M_t presented annual growth in money supply. Additionally, v_t - depicted covariance matrix of the innovations presented in TVP-SVAR.[241] All in all, the BVAR model on a monthly basis observed a large set of

---

[236] Cf. Kapetanios, G. et al. (2012), p. 6, 12.
[237] Cf. Ibid., p. 20.
[238] *„The Parameter Matrices, or Parameter Index Matrices (PIM), define the set of real parameters, and allow constraints to be placed on the real parameter estimates"*. (MARK Program Help File Contents: Parameter Index Matrices (PIM))
[239] Cf. Kapetanios, G. et al. (2012), p. 12 f.
[240] Cf. Ibid., p. 14 f., 16.
[241] Cf. Ibid., p. 14, 16.

43 variables from April 1993 to September 2010. At the same time a rather smaller set of data from 1963 to 2011 on a monthly and quarterly basis was used for the SVAR models.[242]

In the first scenario referring to the baseline prediction within counterfactual analysis conducted, authors assumed the medium to long-term bond yield to be reduced by 100 basis points as a result of successful QE implementation. As opposed to the first scenario, the second one did not experience any reduction in yield spread indicating 100 basis points higher yield level compared to QE implementation scenario. Finally, authors used slope change of the yield curve as suitable measure for representing the difference between the two generated conditional forecasts with for target macro economic variables.[243]

According to the 3 time-series models applied and counterfactual analysis conducted, QE implementation consistent with 100 basis point decline in medium to long-term government bond yields provided significant economic backup for real GDP by preventing it from a much stronger fall. Considering estimated forecast in regard to the CPI inflation, a positive shock keeping CPI inflation away from a very low level and deflationary outcome was proven in light of QE implementation.[244]

Thus, average results across used empirical models revealed that compared to baseline forecast, aggregate demand, without QE application, would have been around 1.4 percent to 3.6 percent smaller, as well as CPI inflation around 1.2 percent to 2.6 percent lower. As a result, authors stated that effects on real GDP and inflation were mainly significant in the fourth quarter of 2009.[245] However, the expecting inflation and output growth based on maximum effect was observable only after 6 to 9 months for GDP and after one year for inflation since QE has been introduced.[246]

---

[242] Cf Kapetanios, G. et al. (2012), p. 18 f.
[243] Cf. Ibid., p. 19 f.
[244] Cf. Ibid., p. 21.
[245] Cf. Ibid., p. 26.
[246] Cf. Ibid., p. 21.

Another well-know empirical study of Joyce et al., with its empirical findings on QE effects, served as one of the main assumptions made for the baseline prediction of counterfactual analysis in the conducted research above.[247] Joyce et al. set focus of their research paper on the changes occurred at financial market resulted from large scale asset purchases initiated by the MPC. Thereby, given the fact that extensive asset purchase programs of MPC accounted prevailing for gilts, large-scale purchases of conventional gilts, started in March 2009, and the corresponding effects on gilt and other financial asset markets became the object of authors investigation.[248] Using 2 related empirical approaches authors aimed at gauging QE effects on asset prices, specifically on gilt yields and gilt-OIS (overnight index swap) spreads.[249]

Based on the assumption that expectation of the imminent large-scale gilt purchase program has a stronger effect on gilt and gilt-OIS spreads as the purchase program itself, authors made a use of event-study method. Event-study analysis allowed examining the market prices reaction in response to MPC´s announcement made regarding the large-scale gilts purchases. A two-day window and additionally one and three-day window were chosen as time intervals for this comparative study.[250] Furthermore, authors observed zero-coupon yield curves of Bank of England, which contained spot rates ranging between 5 and 25 years maturity in order to visualize precisely the QE effects on the term structure of gilts.[251]

The second approach helping to assess the QE effects on gilt yields was the so-called news-based calibration. Compared to event study, new-based calibration concentrated on the amount of information content contained in the announcement itself and its impact on the publicity. In order to quantify the information content for each announcement and its effect, authors used Reuters´ survey results where around 50 economists revealed their responses in regard to the total QE purchase amount. Assuming that responses of the respondents were consistent with their expectations,

[247] Cf. Kapetanios, G. et al. (2012), p. 10, 19.
[248] Cf. Joyce, M. et al. (2010), p. 5 f.
[249] Cf. Joyce, M. et al. (2010), p. 9, 15; cf. chapter 4.4.
[250] Cf. Joyce, M. et al. (2010), p. 14 f.
[251] Cf. Ibid., p. 18 f.

authors compared the expectations of respondents on total amount of QE purchases in light of two situations ex ante and ex post MPC´s decision on QE purchases.[252]

The difference between these surveys was regarded as a measure for the market reaction assuming that market by anticipating QE overstated the information in the announcement and thus induced underestimation of yields reaction on released QE information. Reuters´ survey numbers revealed that already before the actual announcement the mean of their surveys amounted to GBP 204bn and only GBP 205bn after the announcement.[253] Finally, results from the event study providing information on two-day change in zero-coupon gilt yields were compared with the new-based calibration QE measures for GDP release dates.[254]

With the use of the event study approach authors were able to find out that across all examined maturities gilt yields experienced a fall by 55 to 120 basis points as a result of the QE announcement. All in all, it was stated that QE news had a marketable effect on gilt yields by reducing them by around 100 basis points.[255] Similarly to event-study analysis, new-based calibration showed a decrease in gilt spreads amounting to 1.25 percent as well as a fall in OIS rates and gilts-OIS spread accounting for 0.45 percent and 0.8 percent based on two-day window estimation.[256]

Furthermore, authors suggested portfolio-rebalancing channel to be responsible for transferring QE effect to the financial market. Thus, six QE announcements had an immediate impact on the sterling corporate bond yields with low default risk by causing a contraction of 70 basis points and of 150 basis points for the high-risk default corporate bonds. As a result, percentage based reduction in low risk default corporate bonds spread appeared to be about 380 basis points for the time period

[252] Cf. Joyce, M. et al. (2010), p. 20.
[253] Cf. Ibid., p. 21.
[254] Cf. Ibid., p. 22.
[255] Cf. Ibid., p. 19.
[256] Cf. Ibid., p. 22.

between March 2009 and May 2010, however the study could not deliver obvious evidences that this effect could be purely deduced from the QE implementation.[257]

3.10 Quantitative Easing in Japan: Description of Economic Environment

Japan´s lost decade also known as Japan's Great Recession serves as predecessor in miniature or a lesson to be drawn when it comes to Great Recession of 2008-2009 and all the monetary policy measures applied to prevent economy from a total breakdown. In the context of lost decade, scientists often refer to markedly low growth rate of Japan´s GDP lasting over a decade and ensuing prolonged stagnation of Japan´s economy. Thus, between 1995-2002, Japan generated a GDP rate deseeding the ones of other major industrialized countries.[258]

Similar to U.S., equity and real estate bubbles depicted initial triggers for the outbreak of Japan´s financial crisis of 1990´s. So, oversupply of liquidity that was provided by the BOJ to the market in the end of 1980´s, led to economic boom but at the same time induced abnormal speculative high price development in asset and real estate market.[259] In order to cool down the occurring speculations on the stock and real estate market, BOJ decided to tighten the credit market by increasing the interest rates, what ensuing resulted in Japan´s asset and land bubble collapse in 1989 and 1990.[260]

Bursting of asset and real estate bubble caused severe plunge in stock and asset prices by dramatically reducing firms' and financial institutions' capital reserves and commercial, residential and industrial property values.[261] Moreover, commercial and residential real estate faced enormous land value losses amounting to 80 and 20 percent drop, in particular areas, compared to their peak values in 1991. This financial markets

---

[257] Same empirical results revealed slightly different evidence for the development of equity prices. In response to MPC news in February 2009, FTSE All-Share index sank by 20 basis points and ensuing by 320 basis points after a renewed QE announcement in March of the same year. However, in the aftermath until May 2010 FTSE All-Share index experienced gradual surge, but also in this case this effect was not attributable to large scale gilt purchases. (Cf. Ibid., p. 25 f.)
[258] Cf. Horioka, C. (2006), p. 1.
[259] Cf. Nanto, D. (2009), p. 3.
[260] Cf. Ibid., p. 5.
[261] In August 1992 Japan´s Nikkei index experienced a drastic fall of 50 percent and of entire 78 percent in 2002 relative to its highest value of JPY 38,917 in December 1989. (Cf. Reszat, B. (2013), p. 1; cf. Nanto, D. (2009), p. 3)

turmoil left packages of toxic securities pledged by worthless asset of financial institutions and depressed banks' business activity for substantial period of time.[262]

The intensification of the crisis and recession period began as a range of wrong monetary policy decisions made by BOJ in the long run. Despite increasing fall in stock prices, BOJ raised the discount rate from 4.75 percent to 6 percent against the background of still growing real estate prices and inflationary risk in 1990. Continuing fall in real estate prices and at the same time not timely provided monetary easing accelerated the severity of Japan´s economic crisis.[263] Gradually reduction of interest rates since 1991 and interest rates cut in the aftermath to 0.5 percent in September 1995 could no longer keep back Japan´s economy from downward spiral.[264]

Stressed by the financial crisis, Japan´s economic growth began to shrink. Thus, in the so-called bubble period, between 1980 and 1991, Japan enjoyed a stable annual average growth of 3.9 percent, but starting from 1991 and during the post-bubble period, real GDP annual growth rate began to fall and stagnated at the average level of 1.14 percent until 2003. That depicted not even a half of gross domestic product generated in the bubble period.[265]

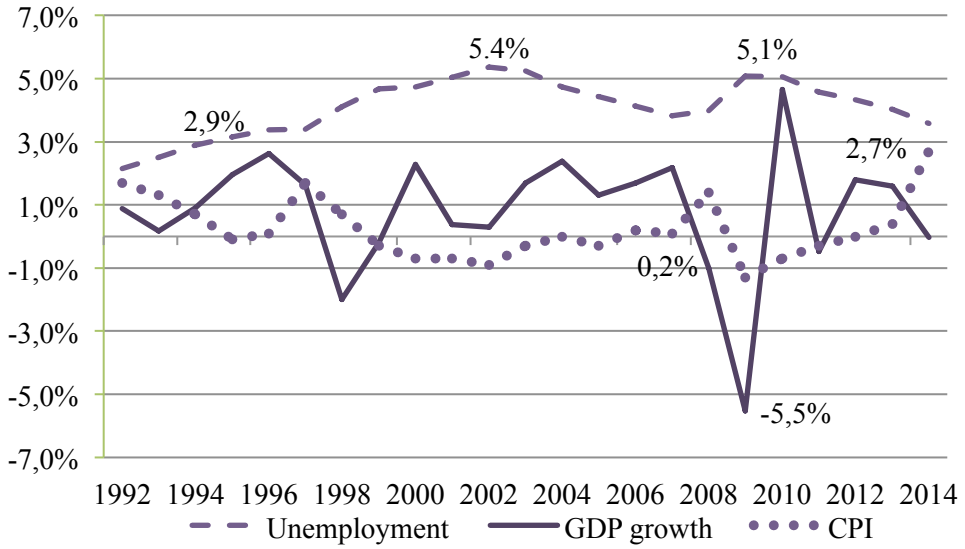
Since the early 1992 Japan´s CPI experienced a downward development by reaching 0 inflation rate in 1995 and remained persistently in the negative range since 1998.[266] At the same time, labor market marked high unemployment figures. Unemployment rate rose from 2.1 percent in 1991 to its all-time high of 5.4 percent in 2002 and later in July of 2009 again.[267] The Figure 6 below illustrates these developments.

According to scientists' opinion main reason for unemployment growth depicted limited private investments that resulted in deterioration of international

[262] Cf. Reszat, B. (2013), p. 1; cf. Nanto, D. (2009), p. 3.
[263] Cf. Makin, J. (2008), p. 1 f.
[264] Cf. Ito, T./Mishkin, F. (2004), p. 7.
[265] Cf. Horioka, C. (2006), p. 1.
[266] Cf. Ito, T./Mishkin, F. (2004), p. 7.
[267] Cf. Pablo, A./Hector, S. (2008), p. 2.

competitiveness and ensuing in absence of Japanese foreign demand.[268] Additionally, non-performing loans expanded to a big problem burdening persistently Japan´s economy. Thereby, banks kept lending to the real estate sector, despite companies' inability to meet their obligations and to pay interest rates back.[269]

Figure 6 – Economic development of Japan



Source: Bloomberg.

Analogically to U.S. recession of 2008-2009, Japan´s global financial situation in 1990s also experienced the so-called balance sheet recession, according to which especially Japan´s corporate sector, being highly leveraged by pledging its real estate properties, needed to adjust its balance sheets positions in the wake of significant asset prices changes. As a result of strong economic boom and progressive development in stock and land prices, Japan´s housing wealth to GDP increased enormously in 1980s. However, due to sharp real estate price decline corporate and private sector faced substantial wealth losses and eroding of property values. This turned both into increased tendency for savings and into aversion for private investments, what finally led Japanese economy to a strong negative wealth effect.[270]

[268] Cf. Pablo, A./Hector, S. (2008), p. 20.
[269] Cf. Ito, T./Mishkin, F. (2004), p. 7.
[270] Cf. European Central Bank (2012a), p. 96, 98 f.

Japan's accumulation of government debt began in 1992 as a result of extensive fiscal stimulus programs rolled out to combat progressively developing recession.[271] Moreover, reconstruction programs after events such as Fukushima earthquake and nuclear cataclysm in 2011 forced Japanese government to dig into public purse and expand government debt substantially.[272] In this context, issuance of new government debt depicted the necessary financing source for the fiscal stimulus initiated. Thus, in year 1990 government debt amounted to 47 percent of GDP and in 2000 it more than doubled accounting for 106 percent of GDP in the same year. Especially, the introduction of QEP in 2001 served as an enormous government debt booster, while in 1992 BOJ´s government debt amounted to only 48 percent of GDP. 16 year later, in 2008, government debt already accounted for 167 percent of GDP.[273]

In 1995 Japan´s economy gave an evidence for fragile recovery. Japan´s delayed liquidity injection programs as well as depreciation of Yen in the second half of 1995 had set necessary stimulus for boosting economy in 1996 and in beginning of 1997. However, this recovery was impermanent, since in 1997 BOJ increased prematurely consumption tax rate to 5 percent and hampered therewith already ailed overall demand.[274] Along with ensuing Asian currency crisis in 1997 and negative aggregate demand based on capital devaluation and liquidity shortage, Japan´s economy turned in 1998 to deep deflation and entered a period of economic stagnation. This introduced the onset of a persistent recession for Japan economy.[275]

3.11 Japan: Scale and Description of Measures Introduced

Japan´s asset price bubble in 1989, forced BOJ to address the problem of highly inflated equity and real estate prices with a tightening of monetary policy. This was the beginning of the asset prices market collapse that brought stock prices to a rapid fall while leaving real estate prices unchanged. In response to rising real estate prices, BOE increased official discount rate from 4.25 percent to 6.00 percent in 1990. This

[271] Cf. Nanto, D. (2009), p. 10.
[272] Cf. Societe Generale (2013), p. 2.
[273] Cf. Nanto, D. (2009), p. 10 f.
[274] Cf. Ito, T./Mishkin, F. (2004), p. 8; cf. Makin, J. (2008), p. 3.
[275] Cf. Ito, T./Mishkin, F. (2004), p. 8, 11.

measure, held until 1991, triggered real estate price decline, but also contributed to the asset price plunge in the same year.[276] In light of financial turmoil and weakening economy, BOJ decided to cut the official discount rate from 6.00 percent to 5.5 percent in July 1991 for the first time. In the course of next years through 1995 additional discount rate cuts were applied. Finally in February-March 1999 discount rate reached 0 percent.[277]

The practice of zero interest rate policy (ZIRP) pursued by the BOJ in 1999 was neither seen nor applied before by any other country. Therewith, BOJ as originator aimed at targeting deflationary problem until it was finally resolved and stimulating the growth of ailing economic.[278] In 2000, BOJ increased the interest rate to 0.25 percent as a result of overhasty conclusion made on economic improvement and decreased it one year later again for the purpose of achieving a stable inflation rate above zero.[279]

3.11.1 Non-performing Loans

In response to enormous problem of non-performing loans, Japan´s government established, in 1992, specialized company called "Cooperative Credit Purchasing Company" (CCPC) aimed at unburdening companies´ books from their non-performing loans by buying only loans backed by real estate assets. Within a year, CCPC helped to shed JPY 1.3tn in nonperforming loans and substantially reduce the total amount of all loans written off in 1993. However, despite a significant amount in non-performing loans that were purchased by the CCPC, the overall amount of non-performing loans written of throughout the time of the crisis was growing and reached its maximum of USD 318bn (JPY 37.2tn) in 2002.[280]

[276] Cf. Makin, J. (2008), p. 2.
[277] Cf. Ito, T./Mishkin, F. (2004), p. 7.
[278] Cf. Kurihara, Y. (2014), p. 77.
[279] Cf. Ito, T./Mishkin, F. (2004), p. 2 f.
[280] Cf. Nanto, D. (2009), p. 5 f.

3.11.2 Fiscal Stimulus Programs

Many scientific papers for instance Makin, John H. (2008) or ECB´s Monthly Bulletin (2012) assess BOJ´s slow and, in some respects, delayed response to financial slump. In particular, it refers to the set of financial stimulus initiated in 1992 by BOJ, two years after equity market collapsed.[281] In early 1990s, between 1992 and 1995, Japan´s government introduced stimulus packages focused mainly on public works projects and land acquisition. Thereby, in year 1993 and 1995 two fiscal stimulus packages were brought into action. All these considerable packages amounted to 14 percent of total GDP of 2000 and were provided in a form of supplementary budgets by central and local governments.[282]

After 1993, fiscal stimulus implemented along with reduction of income taxes helped Japanese economy to get back on the recovery path, but already in 1995 Japanese economy experienced a range of bankruptcies of housing and loans organizations preceded by a considerable deterioration of economic development.[283] Henceforth, the second part of the decade was prevailing highlighted by fiscal stimulus packages targeted at providing policy loans, credit lines and extensive liquidity programs to the ailing enterprises of a small and medium size as well to housing sector.[284]

The outbreak of Asian currency crisis in 1997 and some miscarried government measures towards elimination of the financial crisis i.e. premature consumption tax increase, engulfed financial sector and economy in even much deeper crisis. Japan´s government was forced to introduce a significant liquidity injection by supporting banks and Deposit Insurance Corporation of Japan with a total amount of USD 250bn (JPY 30tn). One-year later Japan´s government made another USD 14bn (JPY 1.8tn) available for banks and in 1999 it provided an additional amount of USD 62.5bn (JPY 7.5tn).[285] Fiscal packages followed after 1999 and until 2008 increased Japan´s

[281] Cf. Makin, J. (2008), p. 4; cf. European Central Bank (2012a), p. 97.
[282] Cf. Nanto, D. (2009), p. 6; cf. Brückner, M./Tuladhar, A. (2010), p. 5.
[283] Cf. Nanto, D. (2009), p. 6.
[284] Cf. Brückner, M./Tuladhar, A. (2010), p. 5 f.
[285] Cf. Nanto, D. (2009), p. 6 f.

government debt additionally, so that in 2008 its amount accounted for 167 percent of GDP depicting the main financing source for these capital injections.[286]

3.11.3 Quantitative Easing

Simultaneously to reintroduction of ZIRP in March 2001, BOJ turned to an unprecedented non-conventional policy so-called "quantitative easing" focusing on provision of extensive bank liquidity and expansion of money supply.[287] Quantitative Easing Monetary Policy (QEMP) was implemented by changing current accounts balance (CAB) of financial institutions at the central bank. Current account balance was taken as the main operating policy target and influenced by the enormous acquisition of long-term government bonds resulting later in great expansion of monetary base.[288]

QEMP adopted by the BOJ captured 3 important objectives; firstly it was supposed to replace the main operating policy goal - targeting the nominal interest rate by the focus on CAB that increased as it was already mentioned above. Secondly, by means of the QEMP, BOJ committed itself to achieve the stable zero bound and positive year on year development of the core CPI. This commitment made by BOJ for the first time aimed at making market development on the prospective track of interest rates more comprehensible. Finally, ample liquidity provision via purchases of long-term government bonds was designated to attained target level of CABs.[289]

Therefore, in March 2001 target level of CAB was increased from initially JPY 4tn Japanese government bonds (JGBs) per month to around JPY 5tn and in February of 2003 it experienced a threefold climb-out addressing worsening of economic circumstances.[290] Generally, for the purpose of the approaching the target level of CABs, BOJ mainly bought long-term JGBs of 10 and 20 years maturity, however in January 2002, it had expanded its purchase packages by 2, 4, 5 and 6-year short-term

[286] Cf. Nanto, D. (2009), p. 10.
[287] Cf. Ito, T./Mishkin, F. (2004), p. 17.
[288] Cf. Girardina, E./Moussac, Z. (2011), p. 465.
[289] Cf. Ugai, H. (2006), p. 2.
[290] Cf. Reszat, B. (2013), p. 9.

bonds.[291] At the beginning of 2004 target level of balance of the current accounts reached JPY 35tn and led additionally to decrease in uncollateralized overnight call rate that felt below 0.02-0.03 percent reached during the first round of ZIRP between 1999 and 2000. As of the end of 2005, BOJ purchased JPY 63tn in long-term JGBs and, therewith, increased monetary base significantly to JPY 117tn.[292]

Thus, over the implementation period of QE government securities including long-term government bonds and short-term government bills increased from JPY 57.7tn in 2001 to JPY 93.3tn at the end of 2006. Simultaneously, impairment of transmission mechanism as well as paralysis of the asset-backed commercial paper market forced BOJ, beginning from 2003 until 2006, to provide backup measures and implement direct purchases of short-term ABCP, longer-term ABS and stocks. However, relative to the purchase to the JGBs these operations remained by a rather minor execution.[293]

All these monetary policy operations and money supply enabled BOJ to improve core CPI growth rate, which exceeded the zero bound from November 2005 and ensuing increased up to 0.5 percent in 2006. In light of this inflationary improvement and positive prospects in regard to targets set within QEP, BOJ announced exit from QE in 9 March 2006 and turned back to its initial operating goal-targeting of uncollateralized overnight call rate and maintenance of ZIRP.[294] However in October 2010, in response to emerging financial crisis, BOJ reintroduced its second round of QE program, which was transferred in a larger and aggressive QE program (Q3) in 2013.[295]

Japan´s QE 2 referring to Asset Purchase Program (APP) depicted part of the Japan´s comprehensive monetary easing. Within the APP, BOJ aimed at making purchases across a wide range of asset segments from government bonds at short- and long-term maturity, corporate bonds to commercial papers, exchange-traded funds (ETFs) and Japanese real estate investment trusts (J-REITs). Focusing on lowering risk premia of

[291] Cf. Van Rixtel, A. (2009), p. 2.
[292] Cf. Ugai, H. (2006), p. 2.
[293] Cf. Van Rixtel, A. (2009), p. 2, 4.
[294] Cf. Ugai, H. (2006), p. 3.
[295] Cf. Andolfatto, D./Li, L. (2014), p. 1 f.

those assets, BOJ raised APPs from JPY 35tn to JPY 101tn by 2012.[296] Ensuing, Quantitative and Qualitative Monetary Easing initiated with taking on office of Haruhiko Kuroda was introduced in April 2013. Clear goal of achievement of 2 percent inflation target rate as well as yearly monetary base expansion by JPY 60-70tn became main targets of the new policy program. Additionally, BOJ extended the maturity of purchased government securities to 7 years.[297]

3.12 Evaluation of the Relevant Research Papers and the Empirical Results

In this section, there will be presented research papers including most important findings on the effects of quantitative easing in Japan.

First scientific paper depicts a research paper of Eric Girardina and Zakaria Moussac that investigated the impact of QE on real economic variables of Japanese economy such as output and price and assessed effectiveness of QEMP for overall economic stimulus and changes in transmission mechanism. For the purpose of more precise and comprehensive analysis of underlying data Girardina and Moussac decided to combine Factor-Augmented and Markov switching VAR models. This new approach called MS-FAVAR model would expand limited capacity of initial VAR approach and enable to include more relevant variables working with broader set of data series.[298]

In their research paper, Girardina and Moussac stated important role of the expectation and portfolio-rebalancing channel in influencing economy. While the expectation channel requiring government commitment in keeping the short-term interest rate at lower or close to zero level in the long run decreases the long-term interest rate, portfolio-rebalancing channel acts in light of imperfect substitution between different financial assets that induces investors to buy non-monetary assets when the money supply increases. As a result, increased purchases of non-monetary

[296] Cf. Fawley, B./Neely, C. (2013), p. 73 f.; cf. Rogers, J. et al. (2014), p. 10 f.
[297] Cf. Takahashi, W. (2013), p. 301 f.
[298] Cf. Girardina, E./Moussac, Z. (2011), p. 463.

assets led to reduction in their yields. Thus, both transmission channels cause drop in long-term interest rates encouraging for their part overall demand and price level.[299]

In MS-FAVAR model applied by Girardina and Moussac, X_t depicted data set of economic variables, while Y_t illustrated monetary policy instrument controlled by the BOJ and e_t denoted errors with mean zero. Both measures X_t and Y_t were assumed to be vectors of economic variables. Thereby, F_t, as a vector with $(K \times 1)$, unobservable factors was linked to the variables in X_t.[300]

$$X_t = \Lambda F_t + e_t \qquad [6]$$

Variables in X_t vector depicted different economic concepts including economic activity and price pressure. These variables summarized in a matrix[301] can be influenced by the development of the economy.[302] In order to capture the change inducing by the application of one of the regimes, Girardina and Moussac extend its model by Hamilton´s approach.[303]

$$Z_t = \begin{cases} \alpha_1 + \mathrm{B}_{11} Z_{t-1} + ... + \mathrm{B}_{p1} Z_{t-p} + \mathrm{A}_1 u_t & if \ s_t = 1 \\ \alpha_m + \mathrm{B}_{1m} Z_{t-1} + ... + \mathrm{B}_{pm} Z_{t-p} + \mathrm{A}_m u_t & if \ s_t = \mathrm{m} \end{cases} \qquad [7]$$

Formula above represents regimes assuming a_i to be intercept, $B_{1i}, ..., B_{pi}$ autoregressive terms and A_i variance-covariance matrix.[304] Speaking about regimes it is important to note that especially second regime, corresponding to monetary policy, is important for the analysis as it indicates the period starting from 1999 when the ZIRP along with QEMP were initiated.[305]

---

[299] Cf. Girardina, E./Moussac, Z. (2011), p. 465 f.
[300] Cf. Ibid., p. 467.
[301] S. Appendix 1.
[302] Cf. Girardina, E./Moussac, Z. (2011), p. 467.
[303] Cf. Ibid., p. 468.
[304] Cf. Ibid., p. 468.
[305] Cf. Ibid., p. 475.

Using two-step estimating approach based on principal component analysis for the data set consisting of three economic concepts in form of 3 sub-groups of factors and monetary policy instruments, Girardina and Moussac analyzed quantitative easing within a timeframe from 1985 to 2006 on the monthly base. Among with many different monetary policy instruments to be observed in order to assess the effects on monetary policy, Girardina and Moussac decided to focus on monetary base whose expansion was the main measure how BOJ conducted QE and which became the only factor to be observe in Y_t.[306]

Based on the research and analysis conducted by Girardina and Moussac, QEMP introduced by BOJ positively affected economic variables such as output and price. As a result, authors found out that during the extensive monetary programs focusing on expansion of monetary base, Japanese economic activity showed an increase exceeding the value before the introduction of QE by 3 times. However, this effect was of a transient nature lasting only 13 months. Analysis revealed that expanding of monetary base by 1 percent, being equivalent to JPY 46bn, induced growth in output of around 0.15 percent. At the same time, 100 percent increase of total stock of CABs will lead to a significant 15 percent surge in real activity. However, the significance of the generated effects held only between 6 months and a year; after 13 months observable effects continue to disappear.[307]

In regard to the price development, similar conclusion could be drawn. Different to reaction of output to expansive measures applied, price factor responded with a cumulative increase of 0.05 percent over 5 years (from 1999 until 2006) by a monetary base expansion of 1 percent. This result revealed rather smaller impact, however most probably longer executed QEPM could have generated better results.[308]

Moreover, looking at the transmission channels, Girardina's and Moussac's investigation confirmed their effectiveness in affecting long-term interest rates.

[306] Cf. Girardina, E./Moussac, Z. (2011), p. 469, 471 f.
[307] Cf. Ibid., p. 475, 477.
[308] Cf. Ibid., p. 477.

Thereby, portfolio-rebalancing channel was successful in reducing liquidity premiums and encouraging investment towards financial assets during QEMP. Likewise, expectation channel revealed its prevailing effect on long-term interest rate in second regime, however these effects became visible only after a year. From the beginning of the second year these positive effects became insignificant emphasizing also here fast impermanence of QEPM´s effects.[309] All in all, Girardina and Moussac came to the conclusion that although QEPM´s effects were short-lived, they significantly contributed to prevention of further deterioration in output and therewith to intensification of Japanese recession.[310]

While focus of Girardina's and Moussac's empirical investigation mainly depicted effects on macroeconomic variables such as economic activity and price level, Oda and Ueda took particularly the assessment of effects from ZIRP and QEMP on medium-and long-term interest yields of government bonds into account of their empirical work. High importance of these rates in the transmission mechanism and their strong validity when it comes to determination of current monetary policy conditions served as justification of their analysis.[311]

In order to test their main model assumption, Oda and Ueda used backward-looking model as one of the macro-finance models. The test particularly analyzed, if the commitment to maintain a zero rate, made within QEMP, was effective in providing the so-called "policy duration effect" that was consistent with the central bank´s commitment to maintain short-term interest rate at zero bound in the long run. This in turn influenced market expectations on the long-term interest rates and decreased them accordingly.[312]

This model enabled a separate illustration and analysis of long-term interest rate regarding the expectation and risk premium. For this purpose authors examined relevant periods of 1999/Q2-2000/Q2 and 2001/Q2-2003/Q4 by applying the

[309] Cf. Girardina, E./Moussac, Z. (2011), p. 477.
[310] Cf. Ibid., p. 480 f.
[311] Cf. Oda, N./Ueda, K. (2005), p. 1.
[312] Cf. Okina, K./Shiratsuka, S. (2003), p. 1; Oda, N./Ueda, K. (2005), p. 6, 14.

maximum likelihood method.[313] Approaching the construction of the model-based yield curve, authors complemented their estimated macro-finance model by no-arbitrage asset pricing theory.[314] Moreover, using estimates from the analysis above, Oda and Ueda performed an additional regression analysis in order to answer the question, i) whether extensive purchase programs within the QEMP had produced a signaling effect and ii) whether they were effective in decreasing risk premium of medium and long-term interest rates.[315]

Compared to the research paper of Girardina and Moussac, Oda and Ueda generated some additional and slightly different results. According to the generated result from their empirical research, commitment made within QEPM influenced market expectations of interest rates and therewith produced a commitment effect. This conclusion is justified by the fact that after commitment policy interest rates at 3-, 5-, and 10-year maturity became lower as it was the case before the commitment.[316]

On the contrary, as the estimated results on commitment effectiveness in reducing risk premium of interest rates revealed, the impact on risk premium for the 3-year and 10-year interest rate appeared was rather small. Also, perceptions made through the regression run presented similar results. Thereby, portfolio-rebalancing effect induced by increase in CABs and the purchases of JGBs showed no significance, in other words it revealed no reducing impact on risk premium factor included in medium and long-term interest rates.[317] According to authors, signaling effect was successful in keeping zero rate, however this effects was not clearly referable to such a measure as increase in CABs consistent with QEMP or good communication between BOJ and the market.[318]

[313] Cf. Oda, N./Ueda, K. (2005), p. 6 f.
[314] Cf. Ibid., p. 9.
[315] Cf. Oda, N./Ueda, K. (2005), p. 15.
[316] Cf. Oda, N./Ueda, K. (2005), p. 14.
[317] Cf. Oda, N./Ueda, K. (2005), p. 16.
[318] Cf. Ibid., p. 16 f.

4. Assessment of the Effects of Quantitative Easing

As it was already mentioned in the previous chapter, conducted empirical research on the assessment of QE effects provided empirical evidences that implied application of unconventional policy measures induces meaningful economic effects.[319] In this chapter the focus will be set on some selected macroeconomic and financial variables and their development under implementation of unconventional monetary policy. Additionally, there will be discussed to what extent QE affected these variables and if QE was an effective monetary policy measure.

4.1 Assessment of the Effects on Inflation

Price stability ensured by an optimal inflation rate depicts the primary objective[320] of many central banks around the world and was one of the main variables to be maintained or shifted towards close or to the target level of 2 percent in the period of and after financial crisis. Highly interconnected with economic activity development and country´s monetary policy, inflation rate incorporates country's financial and economic stance and reflects financial and economic headwinds a country might face.

However, quantifying effects on inflation as a macroeconomic variable cannot be proceeded with easiness since its empirical evaluation faces a specific challenge. This challenge refers to time lag occurring between monetary action that was undertaken and the final impact of this action that becomes observable on the economic variables. Delayed pass through of monetary policy decisions to inflation rate as a result of time lag factor might induce both biased starting point and biased results for empirical models.[321] Nevertheless, there is a high range of empirical work presented, in which authors assess and quantify effects of QE on macro economy by providing estimates from their empirical models.[322]

---

[319] Cf. Gagnon, J. et al. (2011), p. 5.
[320] Cf. European Central Bank (2015): Tasks.
[321] Cf. Joyce, M. et al. (2012), p. 284.
[322] Cf. Ibid., p. 284 f.

During the Great Recession in 1990,[323] related especially to Japan, and financial crisis of 2008, countries as United States, Eurozone and United Kingdom became objects of strong inflation fluctuations, whose extent depended on structural[324] and financial features of the economies. While Japan and euro area faced a problem of downward and deflationary development,[325] U.S. and UK were able to shift inflation towards relatively healthy path by applying a wide range of monetary policy measures. Based on empirical research papers that investigated effects of LSAP of government bonds and gilts on inflation and GDP, relatively differently strong but positive magnitude of the effect on CPI development was especially observed in U.S. and UK.[326]

This observation can be explained by fact that central banks of both countries openly communicated their objective to reduce long-term yields and therefore applied asset purchases programs excessively.[327] By means of those purchase programs, which captured both private and public asset segments, U.S. and UK aimed at provision of extensive liquidity to the economy and financial market in order to stimulate nominal spending and aggregate demand, which for their turn supposed to support and move CPI inflation rate towards its medium-term target.[328]

Thereby, euro area and Japan mainly targeted at improvement of credit market conditions and recovery of banking sector by following the policy path of "enhanced credit easing" done by ECB and of using increasingly bank loans approached by BOJ. Flattering the yield curve was not the initial goal of them two, what became visible in clear focus on bank support.[329]

Different analysis approaches generated different extent of the effect on the examined variable. Thus, according to the empirical estimates of Chung et al. inflation in the United States was 1 percent higher as if LSAPs, referring to the first and second

---

[323] Cf. Makin, J. (2008), p. 2.
[324] Cf. Memedovic, O./Lapadre, L. (2009), p. 3 f.; cf. Chapter 3.
[325] Cf. European Commission (2014winter), p. 39 f.; cf. Ito, T./Mishkin, F. (2004), p. 7 f.
[326] Cf. Chung, H. et. al. (2011), p. 4; cf. Wiele, M./Wieladek, T. (2014), p. 17 f.; cf. Kapetanios, G. et al. (2012), p. 4.
[327] Cf. Baumeister, C./Benati, L. (2010), p. 15 f.
[328] Cf. Joyce, M. et al.(2010), p. 5; cf. Labonte, M. (2014), p. 10 f.
[329] Cf. Fawley, B./Neely, C. (2013), p. 71.

round of QE, had not been conducted, while results of Weale and Wielade revealed a 0.38 percent increase in U.S. CPI.[330] Similarly, estimates generated by Kapetanios at al. showed that in UK annual inflation rate reached its peak effect amounting to 1.25 percentage points as a result of 1 percent decline in gilts spread, whereas Weale and Wielade study revealed positive but less significant effect of about only 0.3 percent increase in UK inflation.[331]

Weale and Wielade stated that asset purchase in UK primarily impacted UK inflation through induced changes in overnight index swap rate futures (OIS rate futures) compared to yields changes on long-term government bonds at 20 and 30 year maturity and real exchange rate changes caused in response to government bonds purchases in U.S.[332] Thus, authors designated signaling channel to have enabled QE effect to be transferred in UK, while portfolio-rebalancing channel was also determined to be important in regard to effecting inflation and output in U.S.[333]

Besides the evidences for substantial effect of QE on inflation in all countries being examined including U.S., UK, euro area and Japan, Baumeister and Benati found evidences for QE effectiveness in preventing the UK and U.S. economies from high deflation risk and economic activity breakdown based on research examining the time period between 2007-2009. Estimates revealed that induced reduction in spreads exuded a substantial encouraging power on U.S. inflation growth by boosting it towards a 1.1 percent growth at its peak time in the end of 2009.[334] As opposed to this, study conducted by Chen et al. focusing on LSAP 2 effects, found only modest until small effect on inflation.[335]

As previously already mentioned, by conducting its initial monetary policy of enhanced credit easing, the euro area was mainly focused on enhanced liquidity supply for revival of credit market and bank lending. Despite the application of

[330] Cf. Chung, H. et. al. (2011), p. 4; cf. Weale, M./Wieladek, T. (2014), p. 5 f.
[331] Cf. Kapetanios, G. et al. (2012), p. 26; cf. Weale, M./Wieladek, T. (2014), p. 5 f.
[332] S. Appendix 2.
[333] Cf. Weale, M./Wieladek, T. (2014), p. 6, 36.
[334] Cf. Baumeister, C./Benati, L. (2010), p. 23, 20.
[335] Cf. Chen H. et al. (2012), p. 313.

unconventional instruments i.e. SMP and CBPP, ECB´s monetary policy measures were less radical compared to the ones of United States and UK, whose main response to the crisis depicted asset purchases accounting for around 25 percent of lands' GDP.[336] Nevertheless, ECB´s monetary policy provided a positive effect on annual CPI as the study of Peersman approved. Examining time sample from 1999 until 2009 Peersman claimed that ECB´s unconventional monetary policy instruments initiated during the crisis induced a credit supply and balance sheet shock, which in turn were responsible for the significant permanent effect on inflation of euro area.[337]

Altavilla et al., who analyzed the impact of OMT announcement on financial and macroeconomic variables of the euro area countries, found evidence for positive and powerful effect on CPI especially for European countries e.g. Italy and Spain by noticing that these changes in inflation were similar, in regard to their extent, to those of U.S. and UK. However, results for France and Germany showed that OMT announcement had rather a small effect on consumer prices of both countries.[338]

However, from 2011euro area was facing its heaviest problem of constantly falling inflation that remained since October 2013 permanently below the 2 percent bound.[339] In response to this problem, ECB announced to introduce lately in 2012 presented OMT and to extend excessively its balance sheet by intending to purchase amount of EUR 60 billion of combined monthly public and private sector assets.[340]

Starting from 1998, Japan faced a problem of prolonged deflation period. As a result Japan conducted 3 rounds of QE to stabilize economic growth, combat deflation and stagnation of economy.[341] However, most research papers on effectiveness of QE generated different results by overwhelmingly inclining to the view that QE1 effect on inflation was rather small. Thus, Girardina and Moussac analyzing QE effectiveness for the time sample from 1985 until 2006, capturing only the first round of QE, found

---

[336] Cf. European Parliament (2014), p. 4.
[337] Cf. Peersman, G. (2011), p. 7, 15, 24; cf. European Central Bank (2015): Measuring inflation.
[338] Cf. Altavilla, C. et al. (2014), p. 14.
[339] Cf. European Parilament (2014), p. 14.
[340] Cf. Draghi, M. (2015): Introductory statement.
[341] Cf. Ito, T./Mishkin, F. (2004), p. 8; cf. Takahashi, W. (2013), p. 303.

that cumulative increase over 5 years in consumer price amounted only to 0.05 percent by 1 percent monetary base expansion.[342] According to Berkmen, reasons for such a small responsiveness lay in the impairment of the credit market, deleveraging of Japanese companies' and banks' strong reluctance for loans and lending.[343]

Berkmen's research paper extended the analyzing period and generated results on inflation development from the time period since 1998 to 2010. The results from this time sample included second round of QE implemented in October 2010 and also revealed a weak responsiveness of consumer price toward applied monetary easing and no meaningful effect on inflation expectations. Study estimates showed that expansion of Japanese current account balances by around JPY 10tn induced an increase of 0.6 percentage points in core inflation during 2 years.[344]

A possible explanation for this development in Japan Berkmen saw in so-called „flattening of the Phillips curve", which implies decreasing price sensitivity to economic activity changes or with other words refers to the situation, where in order to trigger any changes in inflation a stronger output pressure is required. [345]

However, the Figure 7 below illustrates that, after a decade of no significant price growth, from 2013 Japanese economy started responding to the extensive balance sheet expansion. Thus, with BOJ balance sheet size more than doubling in 2014 compared with 2006, the CPI began peaking up from 0.4% to 2.7% in 2013-2014.

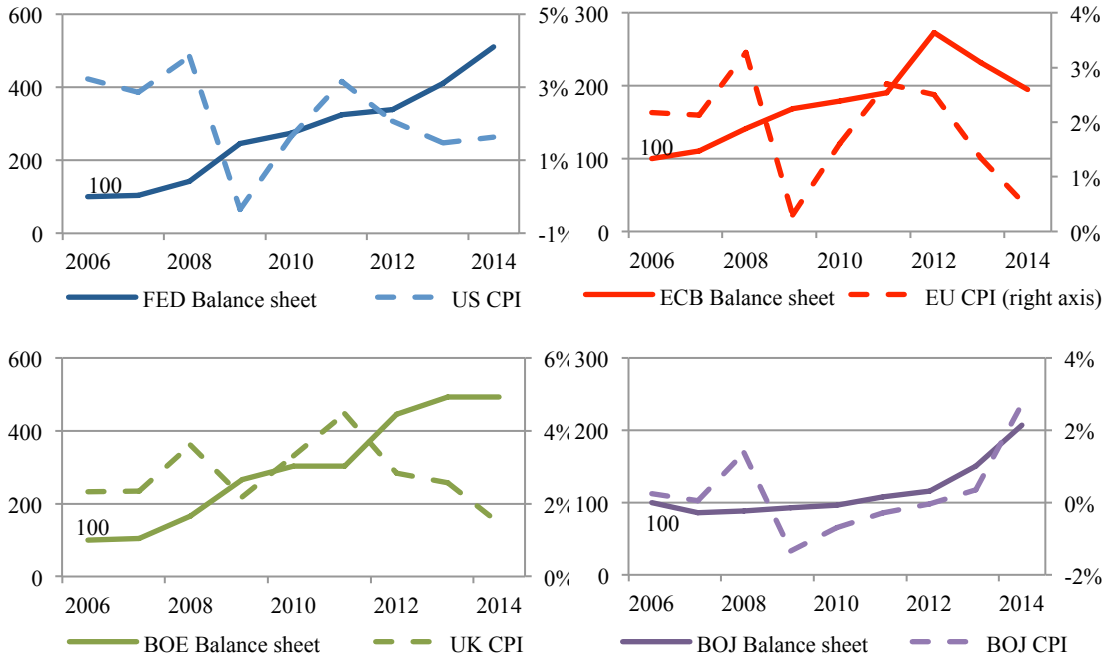
A similar positive impulse for the CPI can be seen in the US, where the CPI showed a reverse trend bottoming at 1.5% in 2013 and increasing to 1.6% in 2014, following a continuous FED balance sheet expansion.

On the contrary, the Figure 7 also displays a slightly different illustration of the same developments relevant to the UK and Eurozone. Thus, from 2012 the balance sheet

[342] Cf. Girardina, E./Moussac, Z. (2011), p. 477.
[343] Cf. Berkmen, P. (2012), p. 3.
[344] Cf. Ibid., p. 7 f.
[345] Cf. Ibid., p. 13.

size of BOE was not significantly increased and in 2014 remained at a constant level, while that of ECB was even massively declining. Looking at the development of CPI, the price growth in both the UK and Eurozone was fairly weak, showing meaningful signs of deflationary development.

Figure 7 – Development of inflation relative to the central bank balance sheet in US, UK, Eurozone and Japan



Source: Federal Reserve Bank of St. Louis, ECB, BOE, BOJ, Bloomberg.

For majority of the countries, effects on inflation become only visible after passing of particular period of time. Most research papers speak about 6 to 13 month needed until changes in monetary policy (application of specific instrument) become observable in inflation itself.[346] Indeed, this evidence proved the difficulty of time lags and delayed pass through, which was described at the beginning of this chapter.

The next section will assess the effects of quantitative easing on the unemployment and highlight its main aspects gained from the relevant research papers and related economic data.

[346] Cf. Kapetanios, G. et al. (2012), p. 21; cf. Girardina, E./Moussac, Z. (2011), p. 477.

4.2 Assessment of the Effects on Unemployment

Great Recession and a slow recovery following severely shook labor markets of the advanced economies. As a result, between 2008 and the beginning of 2011, U.S. experienced a sharp unemployment increase, whose nearly all-time high of 10.1 percent in October 2009 was only exceeded by the huge unemployment numbers during the Great Depression.[347]

As it was already mentioned in 4.1., the monetary policy of FED and BOE differentiated from that of other central banks studied in this work. In particular, among the selected central banks, only FED and BOE set and communicated a quantitative target for unemployment rate to be achieved through the monetary policies applied, while ECB and BOJ did not explicitly address unemployment.

Compared to U.S., the Eurozone faced similar unemployment development between 2008 and 2011, as the euro area suffered a sustained shock to GDP, which affected the employment significantly. However only after 2010, where the U.S unemployment rate began to reverse, the unemployment rate of the euro area reversely picked up again and reached its critical point of 12.2 percent in April 2013. Thus, the unemployment in the euro area is a complex phenomenon and appears hardy influenceable by monetary policy given both the fundamental differences across the 19 countries of the monetary union and diverge cyclical or structural labor market drivers.[348,349]

In 2011, UK´s unemployment was recorded to reach its highest rate of 8.0 percent, where especially young people were hit mostly.[350] As far as Japanese unemployment

[347] Cf. Casaux, S./Turrini, A. (2011), p. 2; cf. Federal Reserve Bank St. Louis (2015): Civilian Unemployment Rate.
[348] Cf. European Central Bank (2014): Unemployment.
[349] Cf. Thereby, Greece accounted for 27.0 percent, Spain recorded 26.8 percent and Portugal revealed a rate of 17.8 percent, representing the highest unemployment records. (Cf. Eurostat (2013): April 2013 Euro area)
[350] Cf. Eurostat (2014): Unemployment; cf. Bell, D./Blanchflower, D. (2010), p. 4 f.

rate is concerned, the respective peaks of unemployment were observed in 2002 and 2009, where the unemployment rate was above 5.0 percent in both years.[351]

As Quantitative Easing, consistent with asset purchases, is a measure primarily influencing asset price structure, positive changes in employment can be achieved through the successful increase of asset prices as a result of portfolio rebalancing effect, which leads to the rise of investors´ wealth level. Thus, spillover effect derived from the financial market and passed through to the market for goods and services is a result of the induced wealth increase. This wealth effect triggers an increased demand for more service and goods, what in turn requires additional labor force.[352] Furthermore, besides the increase of investors' wealth, asset purchases contribute to positive expectations of future higher asset prices and induce decline in interest rates that both stimulate lending activity within the economy and boost consumers' spending, what depicts one of the important preconditions for the rising employment.[353]

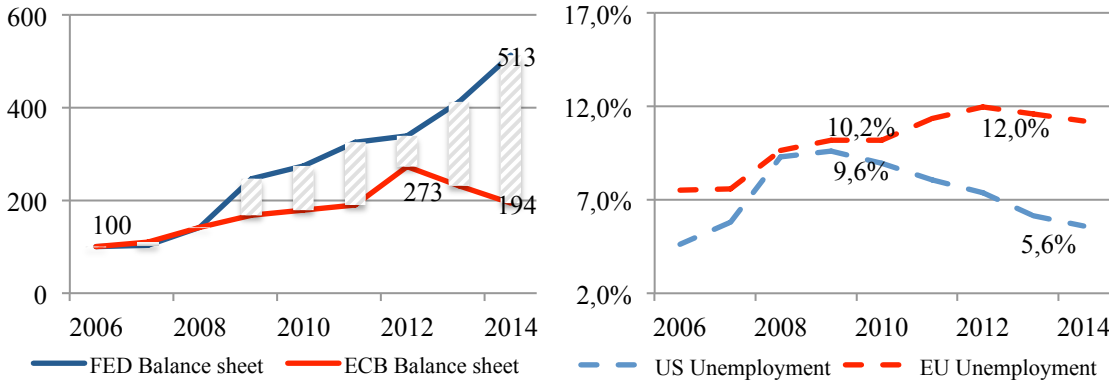
The interrelation between the unemployment rate and economic activity, particularly the growth rate, strongly depends on the observation period. While in the short-term it is rather characterized as loose and lagging, the long-term view suggests a negative correlation in favor of the improving economic activity lowering unemployment,[354] initially introduced and thereafter commonly known as Okun's law[355].

Looking at the execution of the monetary policy by FED and ECB, it is obvious that the FED recognized the necessity of the balance sheet expansion earlier and continued with its implementation through 2015. ECB, however, was rather not ready to follow the similar path of massive balance sheet expansion, despite in 2008 the unemployment rate in both the U.S. and Eurozone was similarly high. With no explicit target for unemployment rate and with the balance sheet size decreasing sizably, the Eurozone economy was not able to generate effect of wealth increase and

[351] Cf. Eurostat (2014): Unemployment.
[352] Cf. Watkins, J. (2014), p. 3 f.; cf. Friedman, M. (1969), p. 231.
[353] Cf. Watkins, J. (2014), p. 4 f.
[354] Cf. Levine, L. (2013), p. 1.
[355] The law states that, to maintain a stable unemployment rate, GDP growth, adjusted for inflation, should level the growth rate of potential output required. (Cf. Okun, A. (1962), p. 1 ff.)

the unemployment continued deteriorating, picking at 12% in 2013. The Figure 8 below outlines these developments in more details.

Figure 8 – Divergence in balance sheet expansion of FED and ECB relative to the development of unemployment

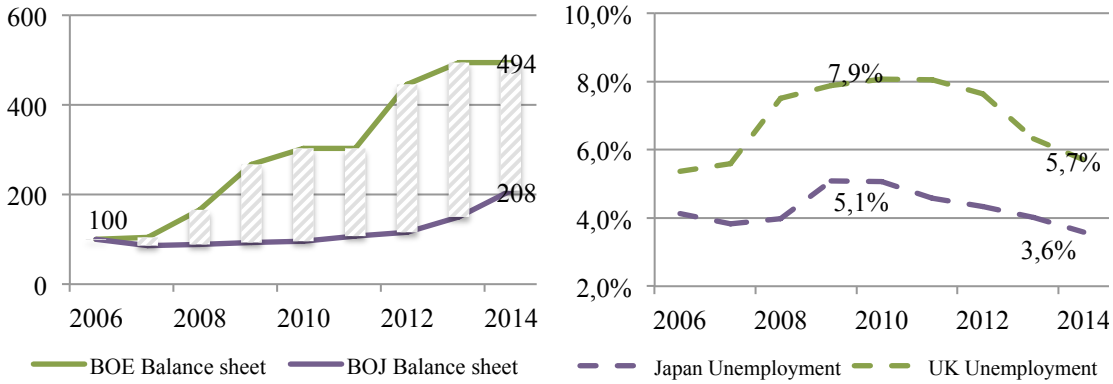


Source: Federal Reserve Bank of St. Louis, ECB, U.S. Bureau of Labor Statistics.

It is clearly seen from the above that, compared with the levels of 2006, by 2014 FED increased its balance sheet by more than 5 times, while during same time frame, ECB's balance sheet only grew by 273 percent in 2012 prior to decline to 194 in 2014. With that, the development of unemployment shows quite a different path too. Thus, the U.S. rate of unemployed labor force in 2014 was continuously declining from 2008, reaching 5.6% in 2014. This compares to the rate of unemployed labor force in the Eurozone, where the gauge was growing to its peak 12 percent in 2012 and reaching 11.2% in 2014.

While a certain relationship can be assumed from the above, the following Figure 9 cannot confirm the same divergence when looking at balance sheet expansion and unemployment development in UK and Japan. In particular, similarly to the above, with 494 percent the balance sheet expansion in the UK was very sizeable, while that with 208 percent in Japan was moderate. However, the unemployment data both for UK and Japan shows that the rate of unemployed labor force began to fall starting from 2010. An additional aspect of this development was that the unemployment in Japan appeared to have improved even at a higher rate than that in UK, leading to the conclusion that the extent of the balance sheet expansion cannot be directly translated to the labor market. Moreover, this relation can depend on the specific characteristics of labor market as well as on the composition of the assets within the balance sheet expansion.

Figure 9 – Divergence in balance sheet expansion of BOE and BOJ relative to the development of unemployment



Source: ECB, BOJ, Bloomberg.

Consequently, the link between the effects of quantitative easing and unemployment is very complex and multi-faceted. A sustainable influence on the employment and labor market is a function of a number of factors such as the unemployment drivers and integrity of the labor market.[356]

4.3 Assessment of the Effects on GDP

This section will take on the assessment of the effects of quantitative easing on the output and highlight its main development outcomes resulting from the relevant research papers and related economic data.

In light of financial crisis U.S., UK, Eurozone and Japan (lost decade) experienced a strong contraction of their economic activity. Financial market crash strongly shook the economic stability and growth of major developed countries. Thus, U.S. recorded 8.9 percent real GDP contraction at the beginning of 2008.[357] Between 2007 and 2009, UK also faced the output fall of 7.2 percent, the strongest since the World War II, while the Eurozone reported an accumulated output loss of 5 percent from the beginning of the financial crisis in Q2 of 2008.[358] Japan´s real GDP were falling since 1991 as a

[356] Cf. European Central Bank (2014): Unemployment.
[357] Cf. United States Department of the Treasury (2012), p. 1.
[358] Cf. Astley, M. et al. (2009), p. 178; cf. European Commission (2009), p. 8.

result of asset price bubble and indicated an average growth rate of 1.14 percent until 2003. In order to address the worsening of GDP growth major central banks were forced to introduce unconventional monetary policy measures, whose effect on GDP became the issue to be analyzed by the majority of research papers.[359]

Thus, most of the research studies confirm a positive effect on GDP derived from the implementation of QE for the major developed economies. Peersman, analyzing non-standard measures of ECB, found that emerging credit supply shock resulted from enhanced credit easing policy increased the economic activity in the euro area. However, these output changes were only of temporary nature and the first significant increase could be observed only after approximately 12 months, what underlines time lagging component of the pass-through.[360]

Moreover, further findings showed that OMT announcements of 2012 were encouraging especially for GDP development in Italy and Spain.[361] As opposed to this, OMT announcement induced relative moderate to small changes in GDP of France and Germany amounting to 0.46 for former and 0.34 percentage deviations for the latter country.[362] Additionally, Lenza et al. revealed that the effect on real activity was exerted rather through the change of interest rate and spreads induced by unconventional monetary tools and not through extension of broad money.[363]

Also, Girardina and Moussac came to the conclusion that although QEPM´s effects were short-lived, they significantly contributed to prevention of further deterioration in output and therewith to intensification of Japanese recession.[364]

Similar effect on GDP development was observed in U.S. and UK economies. Therefore, many research papers focused especially on the asset purchases that were

---

[359] Cf. Horioka, C. (2006), p. 1; cf. Fawley, B./Neely, C. (2013), p. 52.
[360] Cf. Peersman, G. (2011), p. 15.
[361] GDP of Spain experienced a sizeable effect of a 2.01 percentage deviations increase, while Italy recorded a 1.50 percentage deviations rise in its economic activity after OMT announcement was made.
[362] Cf. Altavilla, C. et al. (2014), p. 14.
[363] Cf. Lenza, M. et al. (2010), p. 34.
[364] Cf. Girardina, E./Moussac, Z. (2011), p. 477.

extensively conducted in both U.S. and UK. As a result, estimates of Weale and Wieladek showed that LSAP introduced in U.S. consistent with purchase of 1 percent of GDP lowered the yield curve of bond spreads and helped to provide a positive stimulus to real activity of a country indicating an increase by 0.36 percent. At the same time asset purchases (1 percent of GDP) organized in UK mainly influenced the OIS spreads. Bringing them down induced the reduction in financial market uncertainty, what provided a positive effect to real GDP amounting to 0.18 percent.[365]

Kapetanios et al. assumed effect of asset purchases in UK on real economy to be transferred via portfolio balancing channel that was strongly activated by the cumulative LSAP of GBP 200bn assets initiated in March 2009. Estimates showed that decrease of 100 basis points in gilt spreads prevented UK economy from severe economical downturn and increased real GDP leading it to its maximum effect of around 1.5 percent after a period of time between from 6 to 9 months.[366] Additionally, estimates for two rounds of QE in U.S. that were generated in research paper by Chung et al. showed that overall effect of the two LSAP induced a considerable increase in the level of GDP that accounted for nearly 3 percent.[367]

Capturing the first round of Japan´s QEMP beginning in 2001, Girardina and Moussac empirical results showed that after the first QE round ensuing positive effect on GDP occurred. This reaction of the real economy appeared to be of a moderate extent and of short-lived duration. Authors quantified the effect by analyzing to what extent GDP growth responded to JPY 4.6tn, which were used by BOJ to increase banks CABs at the beginning of first round. As result, real GDP responded to CABs increase by 0.15 percent to 0.1 percent growth, which took 6 to 12 month to become visible. However, the duration of this small effect was observable only during the first year, afterwards it lost on significance.[368]

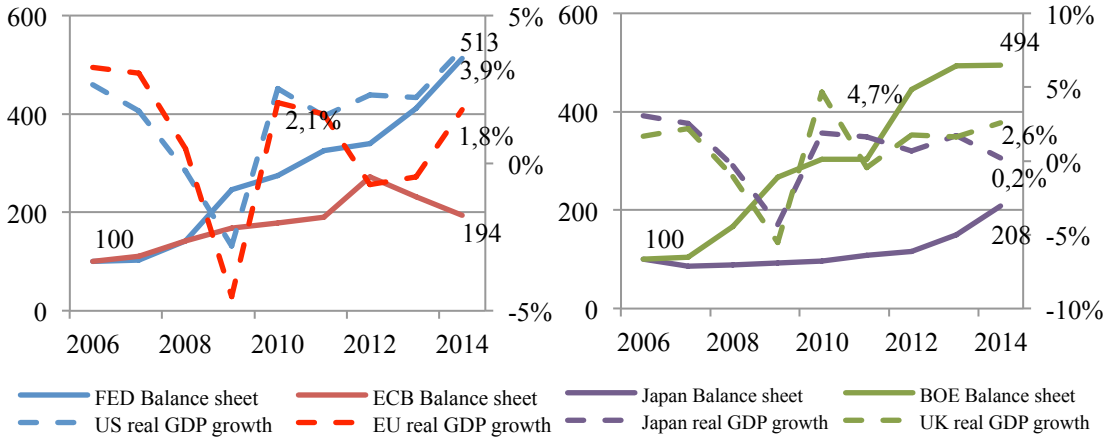
---

[365] Cf. Weale, M./Wieladek, T. (2014), p. 35 f.
[366] Cf. Kapetanios, G. et al. (2012), p. 20 f., 26 f.
[367] Cf. Chung, H. et al. (2010), p. 56.
[368] Cf. Girardina, E./Moussac, Z. (2011), p. 477.

Additional results generated by Berkmen, who incorporated the second round of QE initiated by BOJ in 2010, revealed only weak significance for the effect on real activity. Nevertheless compared to the first round QE results depicted marked an enhancement in regard to the GDP growth and thus confirmed QEPM contribution to the stimulation and support of real activity in Japan, but also to the prevention of real economy from a much stronger downturn.[369]

The Figure 10 below summaries the development of the real GDP growth relative to the balance sheet expansion across the selected central banks since 2006.

Figure 10 – Balance sheet expansion relative to real GDP growth in U.S., Eurozone, UK and Japan



Source: Federal Reserve Bank of St. Louis, ECB, BOE, BOJ, Bloomberg.

Thus, in the U.S. the real GDP started increasing from 2009 and reached 3.9 percent in 2014, while being accompanied by the continuous massive FED balance sheet expansion, as it was highlighted in the previous section. Similar trend was observed in the UK, where the relatively large BOE balance sheet expansion was combined with increasing real GDP growth.

As compared to the same development in the Eurozone, a relatively weak expansion of the ECB balance sheet induced no significant GDP growth, as from its high of

[369] Cf. Berkmen, P. (2012), p. 13.

2.1% in 2010, the real GDP growth remained weak for consecutive years between 2012 and 2013, prior to lightly reviving in 2014. Japanese economy faced a similar picture, as a moderate increase of the central bank's balance sheet did not provide enough stimulus for the economy to grow significantly.

4.4 Assessment of the Effects on Spreads

In response to the short-term interest rates that went down to its zero level and turned to be insufficient and ineffective in combating against economic downturn, major central banks of advanced economies decided to target the long-term interest rate by initiating extensive asset purchases referring to LSAP.[370] By reducing the amount of long-term assets on the market, central banks aimed at increasing their prices and thus lowering the long-term yields of these assets induced by reduction in their risk-premiums.[371]

Thus, alone employing SMP, ECB acquired EUR 220bn in government bonds of different euro area country members, while between 2009 and March 2014 Fed increased its stock of long-term Treasury bonds by accumulative USD 1.9tn and its mortgage-backed securities portfolio by USD 1.6tn. UK´s numbers of medium and long-term assets purchased amounted to GBP 375bn for the time period from January 2009 until November 2012.[372] In 2004 Japanese purchases of long-term JGBs reached its peak by setting a target level for CABs of JPY 36tn.[373] Initiation of these LSAPs was required in order to provide a substantial stimulus to economy by directly effecting different yield spreads of assets at different maturities.[374]

There has been wide range of studies focusing on assessment of QE effects on different segments of asset yields, targeted within LSAP. Various studies proved LSAPs to be a powerful instrument in reducing long-term interest rates and so flattering long-term yield curves across different assets. Thus, for example Gagnon et al. research analysis showed that, between December 2008 and March 2010,

[370] Cf. Joyce, M. et. al. (2012), p. 272, 274.
[371] Cf. Gagnon, J. et al. (2011), p. 6 f.
[372] Cf. European Parliament (2014), p. 8, 10.
[373] Cf. Berkmen, P. (2012), p. 3.
[374] Cf. Chen, H. et al. (2012), p. 289.

implemented LSAPs were successful in decreasing long-term yields of different financial assets that were part of the purchases program such as government bonds, asset-backed securities or agency MBS. However, not only those asset yields were brought to fall, but also long-term interest rates of assets, which were not included into Fed´s LSAPs i.e. swap rate and the Baa corporate bond, were similarly reduced due to overarching effect of LSAPs.[375]

This particular spillover effect was connected by Gagnon et al. with the portfolio balancing effect, which indirectly makes investors to look for substitutes with higher returns as the relative return on those purchased assets gets lower.[376] Furthermore, authors' findings revealed a significant reduction in 10-year term premium, which accounted between 30 and 100 basis points, as well as a fall in term premium in related market segments such as agency debt and agency MBS.[377]

Study of Rogers et al., dealing among others with reasoning of yields contraction across countries, analyzed to what extent central banks' commitment to future short-term rates at the zero level for longer period and direct lowering of the term risk contributed to falling yields. As Fed was mainly focusing on bonds purchases at long-term maturity, authors' estimates revealed that rates especially of 5 years and beyond recorded a significant fall indicating the effect of term premium decline consistent with portfolio rebalancing channel rather expectations hypothesis.[378]

Analyzing international spillover effects and cross border effect of QE, Chen et al. (2011), among others, focused on the U.S. term spread shock that was estimated over a horizon of five years. According to the empirical results of the study U.S. term spread shock appeared to have a remarkable impact on European, British and Japanese equity prices, which experienced rises related to that of the U.S., but not on

[375] Cf. Gagnon, J. et al. (2011), p. 19 f.
[376] Cf. Ibid., (2011), p. 8.
[377] Cf. Ibid., (2011), p. 38 f.
[378] Cf. Rogers, J. et al. (2014), p. 12.

a long-term basis, because already after a year equity prices of those advanced economies reached their initial low levels.[379]

Also, Hancock and Passmore closely studied changes in agency MBS yields and U.S. mortgage rates. They analyzed Federal Reserve MBS purchase programs launched in 2008.[380] Research estimates suggested that extensive MBS purchase program and its announcements had a considerable effect on MBS yields and mortgage rates by reducing both by about 100 basis points. Moreover, MBS purchase programs by Fed contributed to revival of adequate MBS market pricing with lower mortgage rates that were mainly established between November 2008 and first quarter of 2009.[381]

Powerful effects on yields in UK were indicated in results generated by Joyce et al. research study. Since LSAP in UK mainly focused on purchases of gilts, authors' estimates suggested a significant reaction in this asset price segment. As a result their estimates showed that average yield of gilts ranging between 5 to 25 years responded to LSAPs announcement with a 100 basis points decline, whose overwhelming amount accounted for reduction in spread.[382]

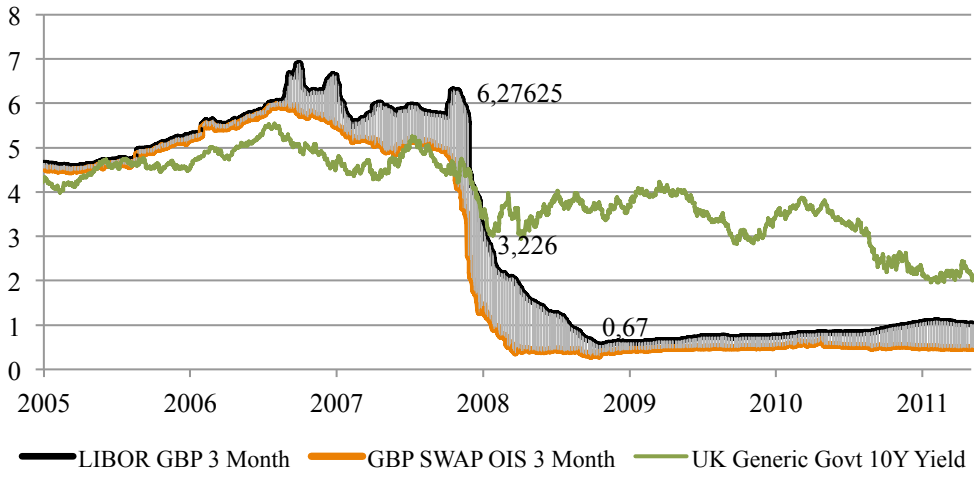
Study of Rogers et al. showed that the peak of the yield declines of UK long-term assets was induced by the QE news in March 2009 strongly effecting forward yields of 10 to 20 years, whose fall can be ascribed to the shift in term risk. Thereby, the portfolio-rebalancing channel was especially pointed out as it enabled transfer of the majority of the effect and also induced spill over effect on corporate bonds. Compared to gilts, estimates for corporate bonds revealed even a stronger effect amounted to 150 basis points yield fall in high yield corporate bonds and the total spread decline of 380 basis points in high-grade corporate bonds for the period between March 2009 and May 2010.[383]

---

[379] Cf. Chen, Q. et al. (2011), p. 21.
[380] Cf. Hancock, D./Passmore, W. (2010), p. 1.
[381] Cf. Ibid., (2010), p. 2, 14.
[382] Cf. Joyce, M. et al. (2010), p. 19, 38.
[383] Cf. Rogers, J. et al. (2014), p. 12.

Following the Figure 11 below, the Libor-OIS GBP 3 months spread showed some spikes between 2007 and 2009, peaking at nearly 300 basis points in December 2008. When comparing the development of the Libor-OIS spread to the development of the 10-year gilts yields, as illustrated by the Figure 11, it is evident that a surge of the spread between the late 2008 and early 2009 was accompanied by the massive 170 basis points drop in government bond yields. Similar movements were observed in the U.S. and Eurozone, whereas the respective Libor-OIS spread in the Eurozone was the highest among the markets observed.[384] On the other hand, the lowest Libor-OIS spread was observed in Japan.

Figure 11 – Libor-OIS GBP 3 months spread versus U.K. Generic Government Bond 10-year yield



Source: Bloomberg.

A so-called Ted spread represents a further market risk-measuring indicator. As it was mentioned earlier, in the financial crisis financial markets immediately reflected information inducing price and rates volatility. Thus, 3-month LIBOR and interest rate of U.S. T-bill, whose difference builds the Ted spread, indicated credit risk level of interbank lenders compared to the safe U.S. Treasury bill and increased to

[384] Cf. Figure 11 and Appendix 2-4.

enormous 458 basis points by October 10, 2008.[385] Such severe TED spread increase indicated ultimate credit market impairment.[386]

According to Lenza et al., spread between the EONIA and the target rate of the ECB sharply increased in the wake of financial market impairment. However, ECB´s credit easing measures, especially fixed rate full allotment procedures, managed to bring the spread between MRO rate and EONIA down by 65 basis points in 2009.[387] Furthermore, estimates generated by Fratzscher et al. also suggested that ECB´s initiated liquidity programs, i.e. SLTRO and VLTRO, induced a fall in 10-year sovereign bond spreads ranging between 24 and 52 basis points for Italy and Spain and between 5 and 6 basis points for core European countries such as Germany, Austria, Netherlands and Finland.[388]

Despite structurally different (sterilization of liquidity provided) and a rather negligible asset purchase programs (measured against GDP), compared to U.S. and UK,[389] study of Fratzscher et al. investigating effects of SMP announcement made in May 2010 and August 2011 as well as SMP conducted by ECB, revealed also powerful results. So, their results indicated 121 basis points drop in Italian and Spanish 10-year government bond yields after SMP was announced and at the same time recorded no changes for the 10-year sovereign yields of core European countries.[390] Additionally, empirical results of the same study suggested that SMP undertaken by ECB had contributed to the downward development of yields in all examined euro area countries by bringing yields of non-core euro area countries to fall by around 3 percent and of core euro area countries by 0.05 percent.[391]

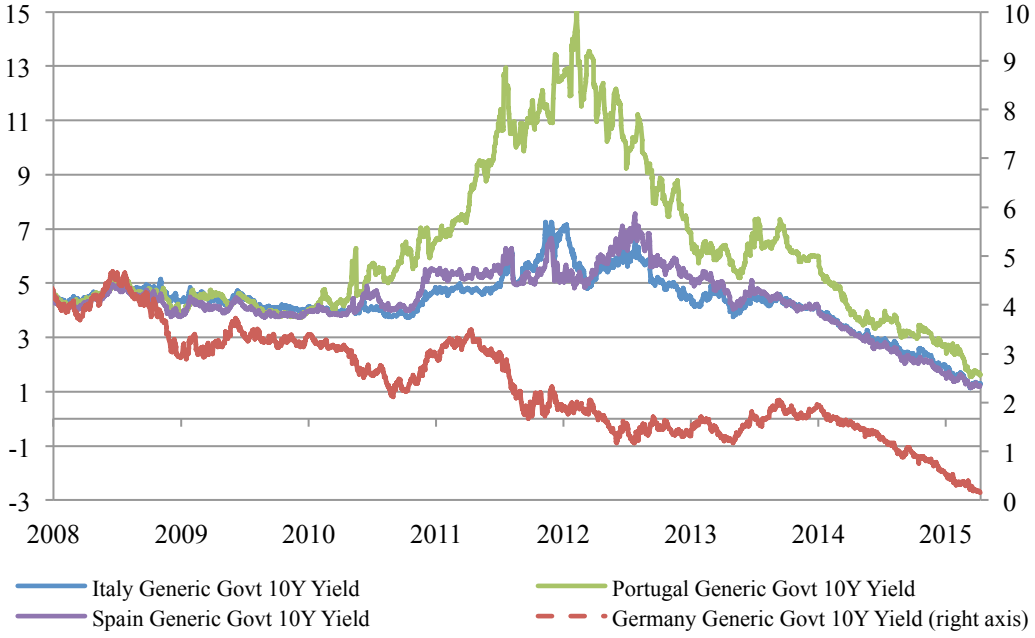
These results appeared to be justified as the SMP initiated in May 2010 focused on the purchases of sovereign bonds issued by Greek, Irish, Portuguese, Italian and Spanish, countries experiencing severe economic and financial tensions. Despite of

[385] Cf. Marshall, J. (2009), p. 8 f.; cf. Mishkin, F. (2010), p. 2 f.
[386] Cf. Appendix 5; Federal Reserve Bank of St. Louis (2015): TED Spread.
[387] Cf. Lenza, M. et al. (2010), p. 23, 29.
[388] Cf. Fratzscher, M. et al. (2014), p. 15.
[389] Cf. European Parliament (2014), p. 4, 17.
[390] Cf. Fratzscher, M. et al. (2014), p. 15.
[391] Cf. Ibid., p. 16.

SMP´s comparatively distinct effect magnitude on government bond yields, scientists agree on SMP´s effectiveness in stabilizing bond yields across European countries.[392]

Thus, in September 2012, alone the announcement of OMT induced a significant reaction of 2-years Italian and Spanish government bond yields. As a result, Altavilla et al. estimates indicated a persistent and remarkable downfall amounting to 200 basis points in 2-year bond yields and 100 basis points in 10-year yields in Italy and Spain, whereas German and French bond rates experienced only insignificant changes in light of OMT announcement.[393] This is illustrated by the Figure 12 below.

Figure 12 – Effects of SMP and OMT on the Government Bond 10-year yields of Germany, Italy, Portugal and Spain



Source: Bloomberg.

Approaching the effects of ECB´s CBPP1, authors' Beirne et al. study found that in response to CBPP announcement in May 2009 covered bond spreads experienced a drop by 40 basis points in Germany and around 50 basis points in France.[394] Thereby,

[392] Cf. Fawley, B./Neely, C. (2013), p. 72, cf. Kilponen, J. et al. (2012), p.19 f.
[393] Cf. Altavilla, C. et al. (2014), p. 8.
[394] Cf. Beirne, J. et al. (2011), p. 21 f.

looking at the euro area level, CBPP was able to decrease covered bond rates by around 12 basis points taking the same period of time.[395]

Magnitude of the effect transferred through unconventional monetary policy channels between 1999 and 2003 to Japans medium to long-term interest rates were analyzed by Oda and Ueda, whose estimates revealed an induced commitment effect that brought interest rates at 3-, 5-, and 10-year maturity to fall and appeared to be most effective ones among the others.[396] However, there were no significant findings made regarding the impact on risk premium through commitment effect. Similarly, portfolio rebalancing effect was observed to be insignificant for the 10 year interest rate estimates but rather significant for 3- and 5-year rates. In particular, this showed that BOJ's extensive CABs increase implied through JGB´s purchases were sufficient in reducing risk premia and spreads of medium-term assets.[397]

Paper by Ugai summarizing research studies that dealt with assessment of quantitative easing effects of QEP conducted between 2001 and 2006 in Japan delivered similar evidences for portfolio rebalancing channel and showed that those effects derived from purchases of JGB had rather negligible impact on JGB yields, while Ugai suggested portfolio rebalancing effect to be significant on high-grade corporate bonds.[398]

However, Japan´s second round of QE also known as New Asset Purchase Program under the Comprehensive Monetary Easing (CME) was more effective in decreasing risk premium and spreads according to study of Lam. He pointed out the difference of CME compared to QEP conducted previously. A wide range of various assets that were captured besides the JGB within asset purchase program under CME since 2009 contributed to a significant effect on Japanese financial markets and different asset yields. Thus, Lam argued that, opposed to QEP where only government bonds were purchased, asset purchase under CME additionally encompassed risky and equity

[395] Cf. Beirne, J. et al. (2011), p. 6.
[396] Cf. Oda, N./Ueda, K. (2005), p. 14.
[397] Cf. Ibid., p. 15, 17.
[398] Cf. Ugai, H. (2006), p. 21, 43 f.

related assets that were able to push the sovereign bond yields down by inducing portfolio rebalancing effect.[399]

Furthermore, empirical results of the study revealed that during the examined period from 2005 to mid-2011 both long-term securities such as 10-year government and 2-years sovereign yields experienced a fall by 24 basis points for the first one and by 14 basis points the latter. Similar results were shown on corporate bonds, which were reduced by 15 to 22 basis points throughout different investment grade securities.[400]

Additionally, estimate showed that equity markets as well as real estate investment trusts (REITs) were positively affected by showing significant surge of 5 to 7 percent in equity prices and 14 percent in REITs prices after the monetary easing evens analyzed. Thereby, Lam stressed out that announcement of new asset purchases contributed much more to the above-mentioned results than the asset purchases per se. Thus, the magnitude of the effect derived from the announcement was stronger than effect from the actual purchases.[401]

[399] Cf. Lam, R. (2011), p. 3 ff.
[400] Cf. Ibid., p. 8.
[401] Cf. Ibid., p. 9.

5. Conclusion

The study was set out to analyze and explore the effects of quantitative easing on selected economic indicators in the U.S., Eurozone, UK and Japan. The work has also sought to conclude whether unconventional tool of monetary policy, such as quantitative easing, can result in and is able to induce positive or negative effect while stabilizing the economy. The overall theoretical works on this subject are usually limited to assessment of effects on a single economy. Moreover, there have already been conducted numerous works, however, they have often provided an inconclusive statement on the direction of effects.

Specifically, the work sought to answer two of these questions:

1. Can QE improve the selected macroeconomic indicators?
2. Can there be a consistent path of conducting the policy that can be similarly applied to another countries in an effort to achieve the same positive results?

When analyzing the effects of quantitative easing, the study faced several issues, when assessing the effects, such as inflation time lag between implementation of a particular monetary policy measure and final impact on the output, structural differences in labor market across selected countries and diverse structure and size of asset purchases. In particular, these issues weakened the results prevented a consistent picture across the selected countries.

Thus, the study argues that QE can improve the selected macroeconomic indicators such as inflation, GDP growth and spreads. However, in order for the magnitude of the effects to become significant, following conditions must be met:

a. Signaling channel and portfolio rebalancing channel are necessary to influence asset price structure and to induce wealth level rise
b. Communication of a transparent policy target to the market, which is achieved rather by provision of extensive liquidity within asset purchase programs than by enhanced credit easing
c. Lowering the yield curve of bond spreads to provide a positive stimulus to the real activity

On the contrary, the study finds no significant effect of QE on unemployment, as the extent of the balance sheet expansion cannot be directly associated with the labor market development.

The work, furthermore, suggests that similar effects of QE, achieved in a single economy, will be less consistent to achieve across other countries. The reasons for these conclusions are various specific characteristics of the labor market, such as labor market integrity, as well as the composition of assets purchased within balance sheet expansion.

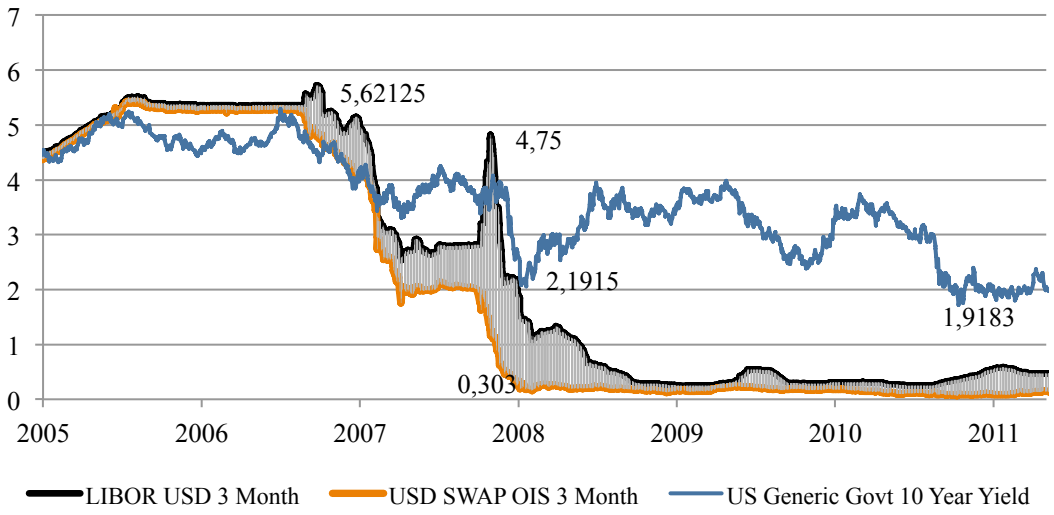
Appendix

Appendix 1

$$\begin{bmatrix} x_t^1 \\ x_t^2 \\ \dots \\ x_t^I \end{bmatrix} = \begin{bmatrix} \Lambda_1^f & 0 & \dots & 0 \\ 0 & \Lambda_2^f & \dots & 0 \\ \dots & \dots & \dots & \dots \\ 0 & 0 & 0 & \Lambda_I^f \end{bmatrix} \begin{bmatrix} F_t^1 \\ F_t^2 \\ \dots \\ F_t^I \end{bmatrix} + \begin{bmatrix} e_t^1 \\ e_t^2 \\ \dots \\ e_t^I \end{bmatrix}$$

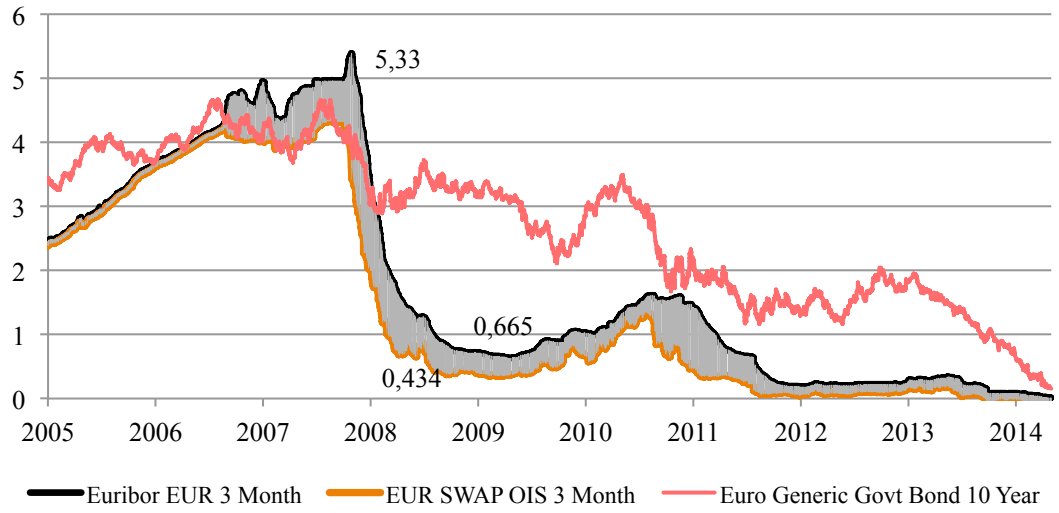
Source: Girardina, E./Moussac, Z. (2011), p. 467.

Appendix 2 – Libor-OIS USD 3 months spread versus U.S. Generic Government Bond 10-year yield



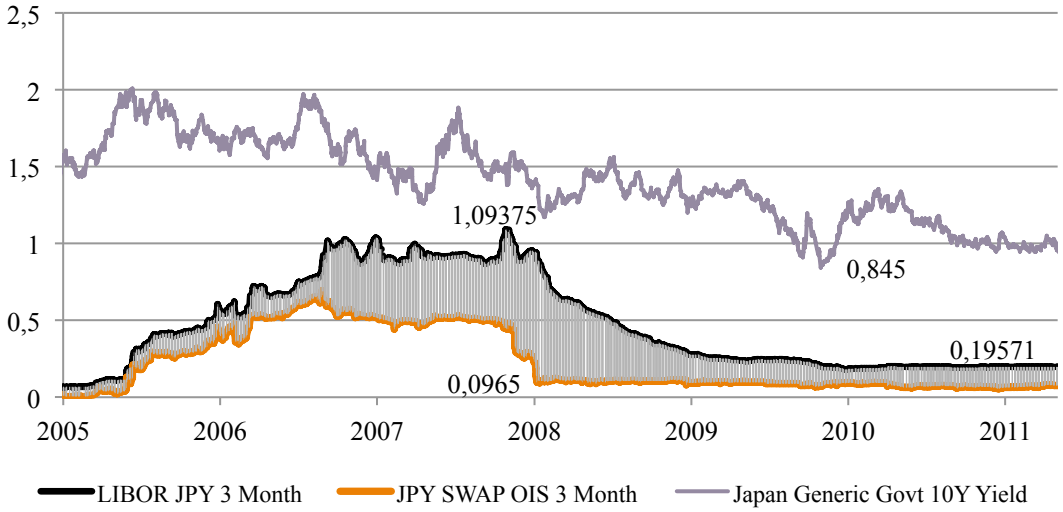
Source: Bloomberg.

Appendix 3 – Euribor-OIS EUR 3 months spread versus Euro Generic Government Bond 10-year yield



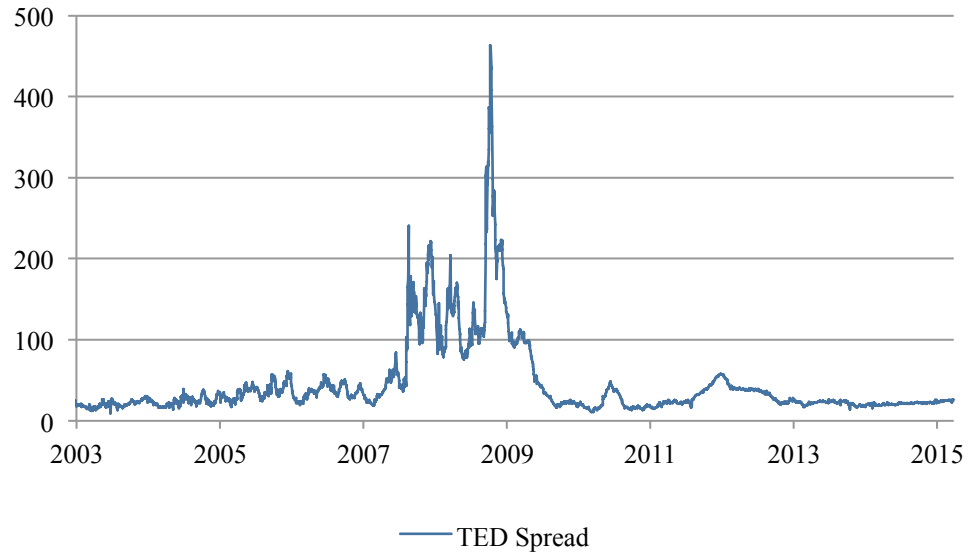
Source: Bloomberg.

Appendix 4 – Libor-OIS JPY 3 months spread versus Japan Generic Government Bond 10-year yield



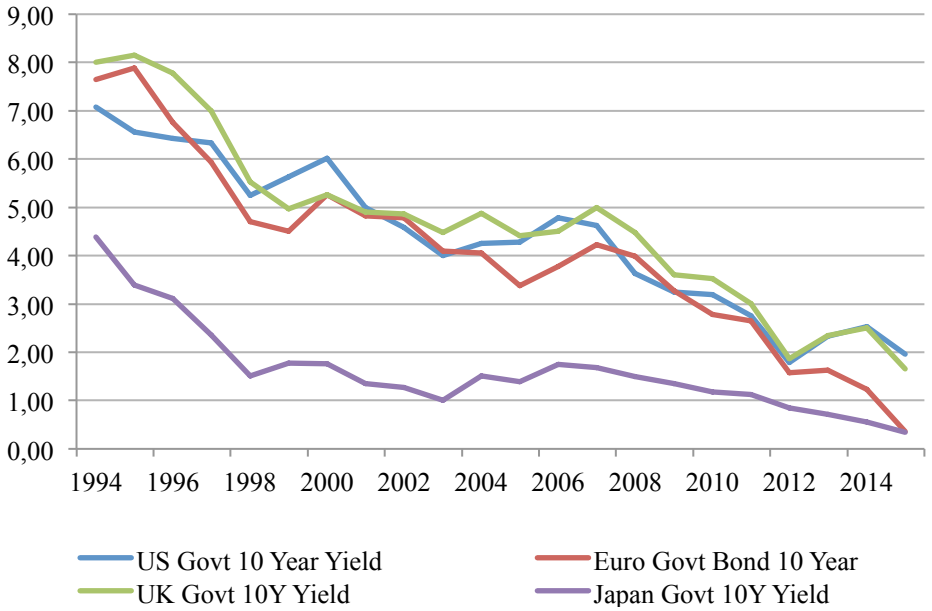
Source: Bloomberg.

Appendix 5 – Development of the Ted spread



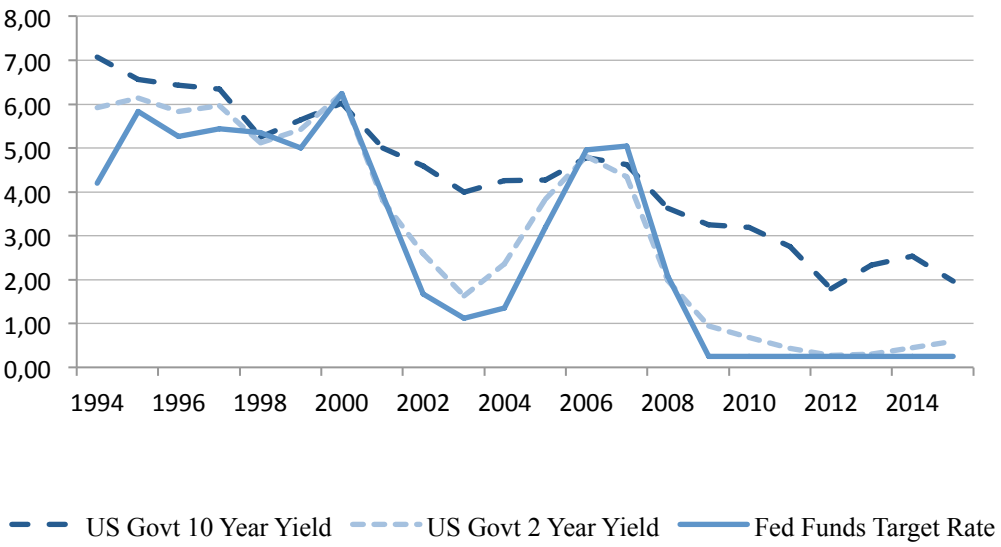
Source: Bloomberg.

Appendix 6 – Development of Government Bond 10-year yields



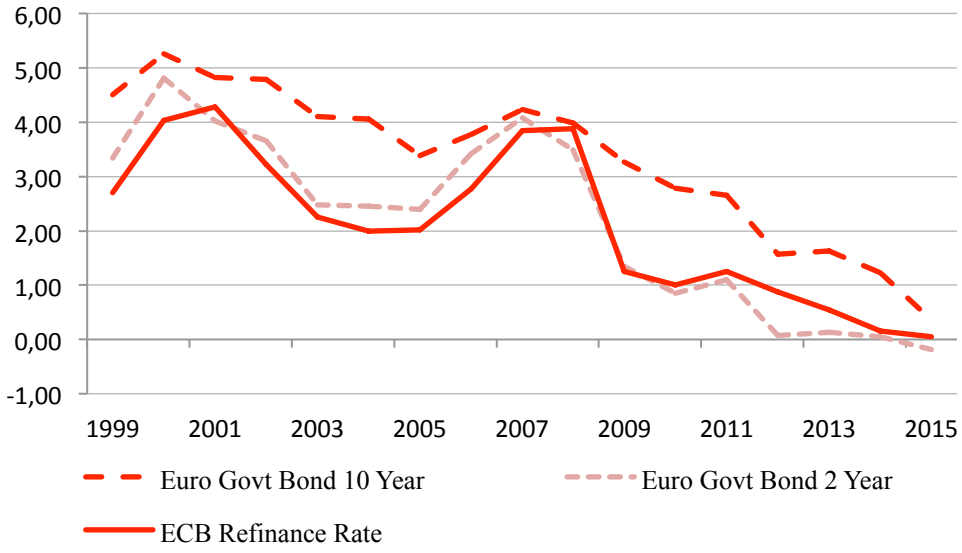
Source: Bloomberg.

Appendix 7 – Development of US Government Bond 2-year yields versus US Government Bond 10-year yields and Fed Funds Target Rate between 1994-2014



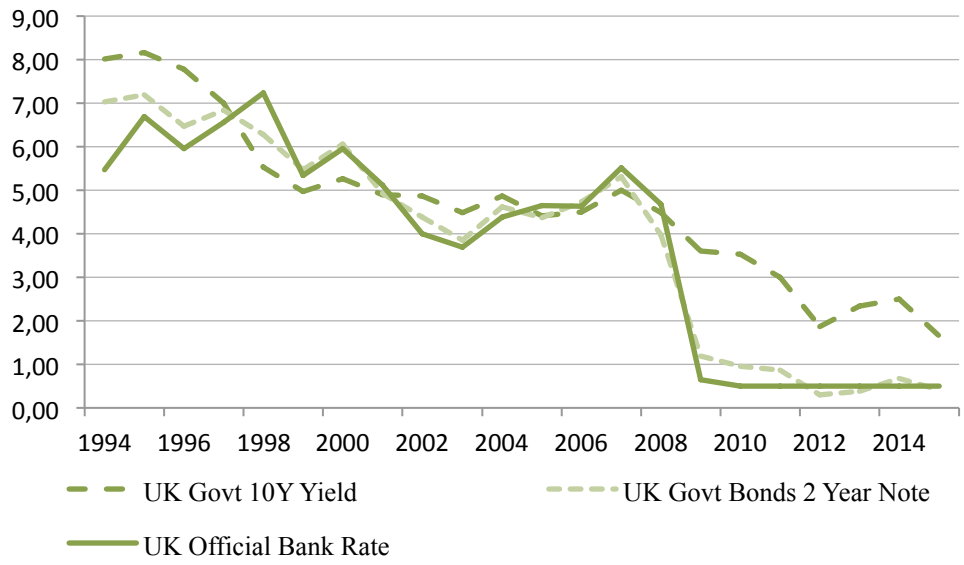
Source: Fed, Bloomberg.

Appendix 8 – Development of Eurozone Government Bond 2-year yields versus Eurozone Government Bond 10-year yields and ECB Refinance Rate between 1999-2015



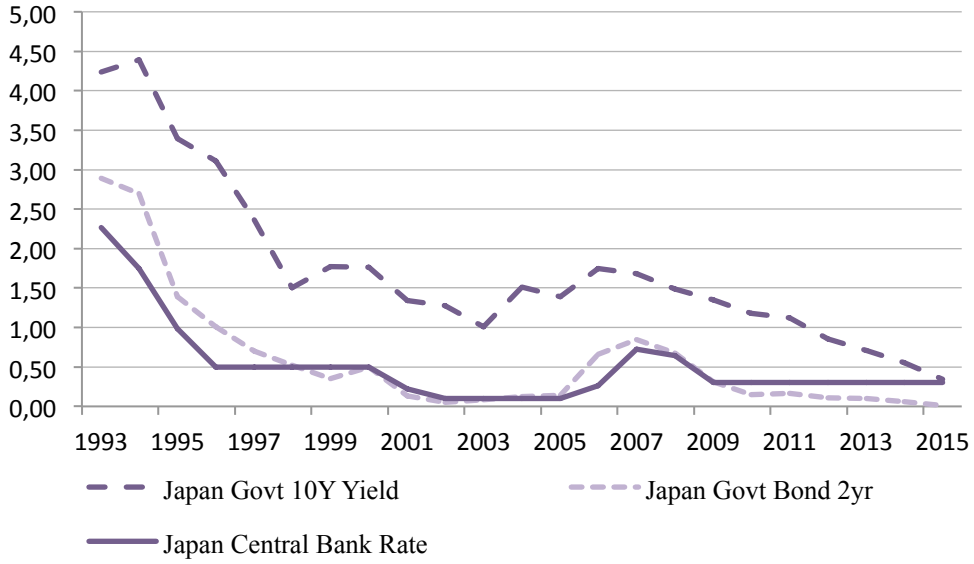
Source: ECB, Bloomberg.

Appendix 9 – Development of UK Government Bond 2-year yields versus UK Government Bond 10-year yields and UK Official Bank Rate between 1994-2014



Source: BOE, Bloomberg.

Appendix 10 – Development of Japan Government Bond 2-year yields versus Japan Government Bond 10-year yields and Japan Central Bank Rate between 1993-2015



Source: BOJ, Bloomberg.

Zusammenfassung

In der vorliegenden Masterarbeit werden Effekte von Quantitative Easing (QE) analysiert, wobei auf QE als Instrument der unkonventionellen Geldpolitik sowie auf die ausgewählten makroökonomischen als auch finanzwirtschaftlichen Indikatoren der vier wirtschafsstärksten Länder wie Vereinigte Staaten, Vereinigtes Königreich, Eurozone und Japan besonderer Fokus gelegt wird. Bei dieser Masterarbeit kommt es speziell darauf an zu bewerten, ob die Anwendung von QE gegen Wirtschaftsabschwung und andere verheerende Folgen der Wirtschafts- und Bankenkrise eine effektive Lösung darstellt.

Zu Beginn dieser Masterarbeit werden die wichtigsten Aspekte der Entwicklung von QE erfasst. Dabei wird auf folgende Themen verstärkt eingegangen: das globale Wirtschaftsgeschehen als Folge der Wirtschaftskrise, der Unterschied zwischen der konventionellen und unkonventionellen geldpolitischen Maßnahmen, der Unterschied zwischen Quantitative Easing und Credit Easing, sowie die wichtigsten Transmissionskanäle des QE und der expansiven Ausweitung der Bilanz der Zentralbanken.

Basierend auf den unterschiedlichen strukturellen und finanziellen Besonderheiten der Länder im Fokus wird im Laufe der Masterarbeit eine umfassende Beschreibung der wirtschaftlichen Lage eines jeden Landes und die Veränderung wichtiger makroökonomischer und finanzwirtschaftlicher Faktoren in Folge der Wirtschafskrise vorgenommen. Außerdem werden im weiteren Verlauf die wichtigsten geldpolitischen Maßnahmen ausführlich beschrieben, die in den jeweiligen Ländern gegen die Krisenbekämpfung angesetzt wurden. Anschließend werden relevante Forschungstudien mit ausführlicher und qualitativer Auseinandersetzung zu den Effekten von QE, samt ihren vorgestellten empirischen Modellen und bedeutenden Ergebnissen präsentiert und analysiert.

Zum Schluss dieser Arbeit werden Effekte aus den im Kapitel 3 vorgestellten Modellen aufgegriffen und deren Effektivität anhand einer umfassenden Analyse der ausgewählten Hauptwirtschafts- und Finanzindikatoren wie Inflation, Arbeitslosigkeit, Wachstumsrate des Bruttoinlandsprodukts und Spreads gemessen sowie die wichtigsten Erkenntnisse präsentiert.

Zusammenfassend ist festzustellen, dass die Intensität der Anwendung von unkonventionellen geldpolitischen Maßnahmen als auch deren Zusammensetzung sich von Land zu Land deutlich unterscheidet und in Abhängigkeit von der Spezifität und Struktur der jeweiligen Wirtschaft sowie der ökonomischen Zielsetzung realisiert wird. So versuchte z. B. Fed und die Bank of England mittels umfangreicher Wertpapierkäufe Einfluss auf die Zinsstrukturkurve zu nehmen und somit die Wirtschaftsaktivität anzukurbeln. Dagegen fokussierten sich Europäische Zentralbank und die Bank of Japan vor allem auf die Wiederbelebung des beeinträchtigten Kreditmarkts und angeschlagenen Bankensektors. Dafür haben die Zentralbanken dieser beiden Länder verstärkt eine Reihe von Liquiditätsmaßnahmen betrieben. Dies erfolgte zum Ziel, durch ausgiebige Liquiditätsversorgung die Problematik stockender Kreditvergabe sowie die Störung auf dem Interbankenmarkt zu eliminieren und somit die Realwirtschaft zum Aufschwung zu bringen.

Bei der Beurteilung von Effekten von QE auf die ausgewählten Wirtschaftsfaktoren wurde deutlich, dass Stärke dieser Effekte von bestimmten Merkmalen dieser Wirtschaftsfaktoren abhängt. Demnach führten Verzögerungseffekt von Inflation, strukturelle Unterschiede der Arbeitsmärkte der Zielländer sowie die verschiedene Zusammenstellung und Ausmaß der Wertpapierkäufe durch Zentralbanken zur unterschiedlichen Entwicklung von Inflation, Arbeitslosigkeit, Bruttoinlandsprodukt und Spreads.

Schließlich wurde erkennbar, dass QE als ein effektives Instrument zur Verbesserung der makroökonomischen Indikatoren wie Inflation, BIP und Spreads eingesetzt werden kann. Jedoch konnte der Einfluss von QE auf die Verbesserung der Arbeitslosigkeit und des Arbeitsmarktes nicht eindeutig festgestellt werden. Denn Beschäftigung stellt eine komplexe Funktion dar, die von der Integrität des Arbeitsmarktes abhängig ist und von diversen Faktoren getrieben wird, welche unter den Ländern inkonsistent sein können.

Summary

The main focus of this work is dedicated to the assessment of the effect of the most controversial unconventional monetary measures - quantitative easing (QE) on selected macroeconomic and financial indicators of the four economically most powerful countries such as United States, Eurozone, United Kingdom and Japan. The work is aimed at evaluating the effectiveness of implementation of QE in combating economical downturn and other devastating consequences derived from Great Recession and banking crisis.

At the beginning of this master thesis there is outlined the main aspects of evolution of quantitative easing as a tool for conducting the monetary policy. Thereby, the work provides description of global economic development as a result of financial crisis, difference between conventional and unconventional monetary policy measures, difference between Quantitative Easing and Credit Easing, as well as main transmission channels of QE and extensive development of central bank balance sheets of the selected countries in response to the financial crisis.

Given the structural differences of economy and financial systems across the countries, this master thesis focuses on the provision of an extensive description of the economic environment, along with severe deterioration of macroeconomic and financial indicators e.g. inflation, GDP growth, unemployment, and spreads observed in the selected countries during the financial crisis. Furthermore, in the following there is described a wide range of monetary policy measures applied by major central banks in response to the economic meltdown. Consequently, there is analyzed and presented the overview over the relevant empirical research studies, which were conducted to investigate the effectiveness of QE on economic and financial markets, along with their empirical models and generated results.

At the end of this work, effects, presented in the models previously, will be captured by measuring their effectiveness based on a comprehensive analysis of selected key economic and financial factors including inflation, unemployment, GDP growth and spreads. Finally, relying on the previous analysis, the thesis will highlight the most evident conclusions.

Overall the work shows that intensity of the application of unconventional measures and the their composition vary across countries. The realization of those unconventional measures depend on specificity, structure of a particular economy as well as economic goal pursued. Thus, while U.S. and UK attempt to achieve economic and financial recovery by applying extended large-scale asset purchase programs (LSAPs) and affecting actively yield curve, ECB and Japan apply a wide range of programs supporting liquidity and lending in an effort to eliminate existing disturbances and to stimulate economy.

When analyzing the effects of QE, the work faces several issues. Thus, the assessment faces inflation time lag between monetary action and final impact on the output, structural differences in labor market across selected countries and diverse structure and size of asset purchases. In particular, these issues lead to different developments of the key indicators such as inflation, unemployment, GDP growth and spreads.

Finally, the impact of QE on selected macro economic and financial factors, particularly inflation, GDP growth and spreads proves to be an effective instrument. However, the effect of QE on enhancement of unemployment and labor market is not clearly determined. Consequently, the link between the effects of QE and unemployment proves to be very complex and multi-faceted. Thus, a sustainable influence on employment and labor market depicts a function of a number of factors such as the unemployment drivers and integrity of the labor market.

Bibliography

Abbas, Ali, S./ Osorio Buitron, Carolina/ Denis, Stephanie/ Ishi, Kotaro/ Lama, Ruy/ Norat, Mohamed (2014): United Kingdom, International Monetary Fund, IMF Country Report No. 14/234/ July 2014, p. 5-64, Access on 08.02.2014 via http://www.imf.org/external/pubs/ft/scr/2014/cr14234.pdf.

Altavilla, Carlo/ Giannone, Domenico/ Lenza, Michele (2014): The Financial and Macroeconomic Effect of OMT Announcement, in: European Central Bank Working Paper Series No 1707/ August 2014, p. 1-23, Access on 27.02.2014 via file:///Users/secret/Quantative%20Easing/2014/4.chapter_effects/ecbwp1707.pdf.

Andolfatto, David/ Li, Li (2014): Quantitative Easing in Japan: Past and Present, in: Federal Reserve Bank of St. Louis, Economic Synopses, Number 1/ January 2014, p. 1-2, Access on 23.02.2015 via http://research.stlouisfed.org/publications/es/14/ES_1_2014-01-10.pdf.

Armantier, Olivier/ Krieger, Sandra/ McAndrews, James (2008): The Federal Reserve's Term Auction Facility, in: Federal Reserve Bank of New York, Current Issues in Economics and Finance, Volume 14, Number 5/ July 2008, p. 1-11, Access on 26.01.2015 via http://www.newyorkfed.org/research/current_issues/ci14-5.pdf.

Astley, Mark/ Giese, Julia/ Hume, Michael/ Kubelec, Chris (2009): Global Imbalances and the Financial Crisis, in: Bank of England, Quarterly Bulletin Emerging Market Economies Articles, Quarterly Bulletin 2009 Q3, p. 178-190, Access on 02.02.2015 via http://www.bankofengland.co.uk/publications/Documents/quarterlybulletin/qb090301.pdf.

Bank of England (2008a): Coordinated Central Bank Action to Improve US$ Liquidity, News Release/ 18 September 2008, p. 1-2, Access on 04.02.2015 via http://www.bankofengland.co.uk/archive/Documents/historicpubs/news/2008/054.pdf

Bank of England (2008b): Inflation Report November 2008, p. 5-52, Access on 05.02.2015 via http://www.bankofengland.co.uk/publications/Documents/inflationreport/ir08nov.pdf.

Bank of England (2009a): Inflation Report February 2009, p. 5-55, Access on 05.02.2015 via http://www.bankofengland.co.uk/publications/Documents/inflationreport/ir09feb.pdf.

Bank of England (2009b): Inflation Report November 2009, p. 5-52, Access on 08.02.2015 via http://www.bankofengland.co.uk/publications/Documents/inflationreport/ir09nov.pdf.

Bank of England (2009c): Special Liquidity Scheme/ 3 February 2009, p. 1-2, Access on 04.02.2015 via http://www.bankofengland.co.uk/markets/Documents/marketnotice090203c.pdf.

Bank of England (2010): Inflation Report November 2010, p. 5-53, Access on 12.02.2015 via http://www.bankofengland.co.uk/publications/Documents/inflationreport/ir10nov.pdf.

Bank of England (2012/2013): Annual Report 2012/2013, Bank of England Asset Purchase Facility Fund Limited, p. 1-13, Access on 21.03.2015 via http://www.bankofengland.co.uk/publications/Documents/other/markets/apf/boeapfannualreport1307.pdf.

Bank of England (2013): Monetary Policy Trade-offs and Forward Guidance/ August 2013, p. 5-44, Access on 06.02.2015 via http://www.bankofengland.co.uk/publications/Documents/inflationreport/2013/ir13augforwardguidance.pdf.

Bank of England (2013/2014): Annual Report 2013/2014, Bank of England Asset Purchase Facility Fund Limited, p. 1-13, Access on 21.03.2015 via http://www.bankofengland.co.uk/publications/Documents/other/markets/apf/boeapfannualreport1407.pdf.

Bank of England: U.S. Dollar Repo Operations, Access on 04.02.2015 via http://www.bankofengland.co.uk/markets/Pages/other/dollarrepo/default.aspx.

Bank of England: Quantitative easing - Frequently asked questions, Access on 05.02.2015 via http://www.bankofengland.co.uk/monetarypolicy/Pages/qe/qe_faqs.aspx.

Bank of England: Asset Purchase Facility, Access on 06.02.2015 via http://www.bankofengland.co.uk/markets/Pages/apf/default.aspx.

Bauer, Michael D./ Rudebusch, Glenn D. (2013): The Signaling Channel for Federal Reserve Bond Purchases, Federal Reserve Bank of San Francisco, Working Paper Series 2011-21/ April 2013, p. 1-37, Access on 10.05.2015 via http://www.frbsf.org/economic-research/files/wp11-21bk.pdf.

Baumeister, Christiane/ Benati, Luca (2010): Unconventional Monetary Policy and the Great Recession Estimating The Impact of Compression in the Yield Spread at the Zero Lower Bound, European Central Bank Working Paper Series NO 1258/ October 2010, p. 4-33, Access on 27.02.2015 via https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1258.pdf.

Beirne, John/ Dalitz, Lars/ Ejsing, Jacob/ Grothe, Magdalena/ Manganelli, Simone/ Monar, Fernando/ Sahel, Benjamin/ Sušec, Matjaž/ Tapking, Jens/ Vong, Tana (2011): The Impact of the Eurosystem's Covered Bond Purchase Programme on the Primary and Secondary Markets, European Central Bank Occasional Paper Series NO 122/ January 2011, p. 4-33, Access on 08.10.2015 via http://www.ecb.europa.eu/pub/pdf/scpops/ecbocp122.pdf.

Bell, David N.F., Blanchflower, David G. (2010): UK Unemployment in the Great Recession, National Institute Economic Review No. 214/ October 2010, access on 03.02.2015 via http://www.dartmouth.edu/~blnchflr/papers/Bell-Blanchflower.pdf.

Berkmen, Pelin, S. (2012): Bank of Japan's Quantitative and Credit Easing: Are They Now More Effective?, International Monetary Fund Asia and Pacific Department, IMF Working Paper 12/2, p. 2-16, Access on 21.02.2015 via http://www.imf.org/external/pubs/ft/wp/2012/wp1202.pdf.

Bernanke, Ben S. (2008): Federal Reserve Policies in the Financial Crisis, Chairman Speech, Board of Governors of Federal Reserve System/ December 2008, Access on 19.06.2014 via http://www.federalreserve.gov/newsevents/speech/bernanke20081201a.htm.

Bernanke, Ben S. (2009): The Crisis and the Policy Response, Chairman Speech, Board of Governors of Federal Reserve System / January 2009, Access on 19.03.2014 via http://www.federalreserve.gov/newsevents/speech/bernanke20090113a.htm.

Berrospide, Jose (2013): Bank Liquidity Hoarding and the Financial Crisis: An Empirical Evaluation, Federal Reserve Board, Washington, Divisions of Research & Statistics and Monetary Affairs, Finance and Economics Discussion Series/ November 2012, p. 1-41, Access on 14.07.2014 via http://www.federalreserve.gov/pubs/feds/2013/201303/201303pap.pdf.

Blinder, Alan S. (2010): Quantitative Easing: Entrance and Exit Strategies, in: Federal Reserve Bank of St. Louis Review, November/ December 2010, 92(6), p. 465-79, Access on 23.01.2015 via https://research.stlouisfed.org/publications/review/10/11/Blinder.pdf.

Bowdler, Christopher/ Radia, Amar (2012): Unconventional monetary policy: the Assessment, in: Oxford Review of Economic Policy, Volume 28, Number 4/ 2012, p. 603–621, Access on 10.04.2015 via http://oxrep.oxfordjournals.org/content/28/4/603.full.pdf+html.

Brayton, Flint/ Laubach, Thomas/ Reifschneider, David (2014): The FRB/US Model: A Tool for Macroeconomic Policy Analysis, Board of Governors of the Federal Reserve System, Feds notes/ April 2013, Access on 14.02.2015 via http://www.federalreserve.gov/econresdata/notes/feds-notes/2014/a-tool-for-macroeconomic-policy-analysis.html.

Brückner, Markus/ Tuladhar, Anita (2010): Public Investment as a Fiscal Stimulus: Evidence from Japan's Regional Spending During the 1990s, International Monetary Fund, Fiscal Affairs Department, IMF Working Paper/ 10/110, p. 4-30, Access on 09.02.2015 via https://www.imf.org/external/pubs/ft/wp/2010/wp10110.pdf.

Casaux, Suzanne/ Turrini, Alessandro (2011): Post-crisis Unemployment Developments:U.S. and EU approaching?, European Commission, Directorate-General for Economic and Financial Affairs, ECFIN Economic Brief, Issue 13/ May 2011, Access on 11.01.2015 via http://ec.europa.eu/economy_finance/publications/economic_briefs/2011/pdf/eb13_en.pdf.

Chapman, John L. (2011): The Importance of a Well-Functioning Monetary System to Capital Markets and Wealth Creation, Alhambra Investment Partners/ November 2010, Access on 02.04.2014 via http://www.alhambrapartners.com/2011/11/21/the-importance-of-a-well-functioning-monetary-system-to-capital-markets-and-wealth-creation/.

Chen, Han/ Curdia, Vasco/ Ferrero, Andrea (2012): The Macroeconomic Effects of Large-Scale Purchase Programmes, in: the Economic Journal, 122/ November 2012, p. 289–315, Access on 26.02.2015 via file:///Users/secret/Downloads/Chen_et_al-2012-The_Economic_Journal.pdf.

Chen, Qianying/ Filardo, Andrew/ He, Dong/ Zhu, Feng (2011): International Spillovers of Central Bank Balance Sheet Policies, Hong Kong Monetary Authority and Bank for International Settlements/ November 2011, p. 1-49, Access on 17.03.2015 via http://www.bis.org/events/cbbsap/chenfilardohezhu.pdf.

Chung, Hess/ Laforte, Jean-Philippe/ Reifschneider, David/ Williams, John, C. (2010): Have We Underestimated the Likelihood and Severity of Zero Lower Bound Events? Federal Reserve Bank Of San Francisco, Working Paper Series 2011-01/ January 2011, p. 1-56, Access on 01.03.2015 via http://www.frbsf.org/economic-research/files/wp11-01bk.pdf.

Chung, Hesse/ Laforte, Jean-Phillipe/ Reifschneider, David/ Williams, John, C. (2011): Estimating the Macroeconomic Effects of the Fed's Asset Purchases, in: Federal Reserve Bank of San Francisco, FRBSF Economic Letter 2011-03/ January 2011, p. 1-5, Access on 18.02.2015 via http://www.frbsf.org/economic-research/publications/economic%20letter/2011/january/macroeconomic-effects-fed-asset-purchases/el2011-03.pdf.

Chowla, Shiv/ Quaglietti, Lucia/ Rachel, Łukasz (2014): How have world shocks affected the UK economy? Bank of England, Bank's International Economic Analysis Division, in: Topical Articles, Quarterly Bulletin 2014 Q2, p. 167-179, Access on 02.02.2015 via http://www.bankofengland.co.uk/publications/Documents/quarterlybulletin/2014/qb14q206.pdf.

Cœuré, Benoît (2013): The Usefulness of Forward Guidance, European Central Bank Speeches/ September 2013, Access on 14.07.2014. via http://www.ecb.europa.eu/press/key/date/2013/html/sp130926_1.en.html.

Constâncio, Vítor (2015): 2015 U.S. Monetary Policy Forum Panel discussion on Central Banking with Large Balance Sheets, European Central Bank/ February 2015, Access on 23.03.2015 via https://www.ecb.europa.eu/press/key/date/2015/html/sp150227.en.pdf?67d22bd0967ef0cfc97778b23fd2635e.

Cross, Michael/ Fisher, Paul/ Olaf, Weeken (2010): The Bank's Balance Sheet during the Crisis, Bank of England, in: Quarterly Bulletin 2010 Q1, p. 34-42, Access on 04.02.2015 via http://www.bankofengland.co.uk/publications/Documents/quarterlybulletin/qb100102.pdf.

Demary, Markus/ Matthes, Jürgen (2013): EZB auf Abwegen? Teil 1: Die unkonventionelle Geldpolitik der EZB – eine Bestandsaufnahme, Institut der deutschen Wirtschaft Köln, in: IW policy paper 13/ 2013, p. 1-45, Access on 18.06.2014 via http://www.iwkoeln.de/en/studien/iw-policy-papers/beitrag/markus-demary-juergen-matthes-die-ezb-auf-abwegen-127105.

Dimsdale, Nicholas H. (2009): The Financial Crisis of 2007–9 and the British Experience, The Queen's College, Oxford University, in: Oxonomics 4, 2009, p. 1-9, Access in 01.012.2015 via http://onlinelibrary.wiley.com/doi/10.1111/j.1752-5209.2009.00026.x/pdf.

Dodd, Randall/ Mills, Paul (2008): Outbreak: U.S. Subprime Contagion, in: Finance and Development, A quarterly magazine of IMF, Volume 45, Number 2/ June 2008, Access on 12.01.2015 via http://www.imf.org/external/pubs/ft/fandd/2008/06/dodd.htm.

Draghi, Mario (2015): Introductory statement to the press conference (with Q&A), European Central Bank/ 22 January 2015, Access on 20.02.2015 via http://www.ecb.europa.eu/press/pressconf/2015/html/is150122.en.html.

Eser, Fabian/ Schwaab, Bernd (2013): Assessing Asset Purchases within the ECB´s Securities Market Programme, European Central Bank Working Paper Series No 1587/ September 2013, Access on 11.01.2015 via http://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1587.pdf.

Engen, Eric/ Laubach, Thomas/ Reifschneider, Dave (2014): The Macroeconomic Effects of the Federal Reserve's Unconventional Monetary Policies, Federal Reserve Board/ December 2014, p. 1-54, Access on 18.03.2015 via file:///Users/secret/Downloads/MacroeconomicEffectsOfTheFederalRes_preview.pdf.

European Central Bank: Monetary Policy Instruments, Access on 12.06.2014 via http://www.ecb.europa.eu/mopo/implement/intro/html/index.en.html.

European Central Bank: Key ECB Interest Rates, Access on 12.01.2015 via https://www.ecb.europa.eu/stats/monetary/rates/html/index.en.html.

European Central Bank: Open Market Operations, Access on 23.12.2014 via http://www.ecb.europa.eu/mopo/implement/omo/html/index.en.html.

European Central Bank: Government debt (consolidated) (as % of GDP), in: Statistical Data Warehouse, Access on 16.03.2015 via http://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=GFS.Q.N.I7.W0.S13.S1.C.L.LE.GD.T._Z.XDC_R_B1GQ_CY._T.F.V.N._T&

European Central Bank (2009a): Decision of the European Central Bank of 2 July 2009 on the Implementation of the Covered Bond Purchase Programme (ECB/2009/16) (2009/522/EC), in: Official Journal of the European Union/ July 2013, p. 1-175, Access on 11.01.2015 via https://www.ecb.europa.eu/ecb/legal/pdf/l_17520090704en00180019.pdf?d74bb43a6071db357e77cc2439415ebe.

European Central Bank (2009b): Governing council decision on non-standard, in: ECB's Monthly Bulletin/ June 2009, p. 5-96, Access on 10.06.2014 via https://www.ecb.europa.eu/pub/pdf/mobu/mb200906en.pdf

European Central Bank (2010a): Monetary Policy Transmission in the Euro Area, a Decade after Introduction of the Euro, in: ECB's Monthly Bulletin/ May 2010, Access on 22.07.2014 via https://www.ecb.europa.eu/pub/pdf/mobu/mb201005en.pdf.

European Central Bank (2010b): The ECB´s response to the financial crisis, in: ECB's Monthly Bulletin/ October 2010, p. 5-74, Access on 11.01.2015 via https://www.ecb.europa.eu/pub/pdf/mobu/mb201010en.pdf

European Central Bank (2011): 3 November 2011-ECB announces details of its new Covered Bond Purchase Programme (CBPP2), Press Release, November 2011, Access on 09.01.2015 via http://www.ecb.europa.eu/press/pr/date/2011/html/pr111103_1.en.html.

European Central Bank (2012a): Comparing the recent financial crisis in the United States and the Euro Area with the experience of Japan in the 1990s, in: ECB´s Monthly Bulletin/ May 2012, p. 5-112, Access on 14.01.2014 via http://www.ecb.europa.eu/pub/pdf/mobu/mb201205en.pdf.

European Central Bank (2012): 6 September 2012-Technical features of Outright Monetary Transactions, Press Release/ September 2012, Access on 10.01.2015 via https://www.ecb.europa.eu/press/pr/date/2012/html/pr120906_1.en.html.

European Central Bank (2013): Collateral eligibility requirements a comparative study across specific frameworks, in: ECB Report of collateral frameworks/ July 2013, p. 4-75, Access on 12.12.2014 via https://www.ecb.europa.eu/pub/pdf/other/collateralframeworksen.pdf.

European Central Bank (2014a): The determinants of euro area sovereign bond yield spreads during the crisis, Monthly Bulletin May 2014, p. 5-100, Access on 06.01.2015 via https://www.ecb.europa.eu/pub/pdf/mobu/mb201405en.pdf.

European Central Bank (2014): 2 October 2014 - ECB announces operational details of Asset-Backed Securities and Covered Bond Purchase Programmes, Access on 09.01.2015 via http://www.ecb.europa.eu/press/pr/date/2014/html/pr141002_1.en.html

European Central Bank (2014): Introductory statement to the press conference (with Q&A), Mario Draghi, Frankfurt am Main/ December 2014, Access on 21.01.2015 via https://www.ecb.europa.eu/press/pressconf/2014/html/is141204.en.html.

European Central Bank (2014): Unemployment in the euro area, Speech by Mario Draghi/ August 2014, Access on 20.03.2015 via https://www.ecb.europa.eu/press/key/date/2014/html/sp140822.en.html.

European Central Bank (2015): Measuring Inflation in the Euro Area: The Harmonised Index of Consumer Prices (HICP)- Annual Percentage change, Access on 18.01.2015 via https://www.ecb.europa.eu/stats/prices/hicp/html/inflation.en.html.

European Central Bank (2015): Tasks, Access on 12.01.2015 via https://www.ecb.europa.eu/ecb/tasks/html/index.en.html.

European Central Bank (2015): 22 January 2015 - ECB announces expanded Asset Purchase Programme, Press Release, Access on 01.02.2015 via https://www.ecb.europa.eu/press/pr/date/2015/html/pr150122_1.en.html.

Eurostat (2013): April 2013 Euro area unemployment rate at 12.2% EU27 at 11.0%, in: Eurostat newsreale euroindicator STAT/13/81/ May 2013, Access on 20.03.2015 via file:///Users/secret/Downloads/STAT-13-82_EN.pdf.

Eurostat (2014): Unemployment rate, 2002-2013 (%), in: Eurostat Statistics explained/ May 2014, Access on 24.03.2015. via http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Unemployment_rate,_2002-2013_(%25).png.

European Commission (2009): European Economic Forecast-Autumn 2009, European Economy10/ 2009, Access on 12.01.2015 via http://ec.europa.eu/economy_finance/publications/publication16055_en.pdf.

European Commission (2014winter): European Economic Forecast-winter 2014, European Economy2|2014, Access on 18.01.2015 via http://ec.europa.eu/economy_finance/publications/european_economy/2014/pdf/ee2_en.pdf.

European Commission (2014autumn): European Economic Forecast-autumn 2014, European Economy7/ 2014, ISSN 1725-3217, Access on 03.04.2015 http://ec.europa.eu/economy_finance/publications/european_economy/2014/pdf/ee7_en.pdf.

European Parliament (2014): The (not so) Unconventional Monetary Policy of the European Central Bank since 2008, Directorate General for Internal Policy Department A: Economic and Scientific Policy, June 2014, Access on 28.02.2015 via file:///Users/secret/Downloads/The%20(not%20so)%20Unconventional%20Monetary%20Policy%20of%20the%20European%20Central%20Bank%20since%202008%20(English)%20(1).pdf.

Fawley, Brett, W./ Neely, Christopher, J. (2013): Four stories of Quantitative Easing, Federal Reserve Bank of St. Louis/ January/February 2013, 95(1), p. 51-88, Access on 14.05.2014 via http://research.stlouisfed.org/publications/review/13/01/Fawley.pdf.

Federal Reserve (2009a): Term Auction Facility Questions and Answers/ January 2009, Access on 23.10.2015 via http://www.federalreserve.gov/monetarypolicy/files/TAFfaq.pdf.

Federal Reserve (2009): Press Release/ August 12 2009, Access on 17.12.2014 via http://www.federalreserve.gov/newsevents/press/monetary/20090812a.htm.

Federal Reserve Bank of New York: Primary Dealers List, Access on 05.08.2014 via http://www.newyorkfed.org/markets/pridealers_current.html.

Federal Reserve Bank of New York (2009): Term Securities Lending Facility: Program Terms and Conditions/ June 2009, Access on 05.08.2014 via http://www.newyorkfed.org/markets/tslf_terms.html.

Federal Reserve (2012): Press Release/ September 13 2012, Access on 01.02.2015 via http://www.federalreserve.gov/newsevents/press/monetary/20120913a.htm

Federal Reserve System (2012): Minutes of the Federal Open Market Committee/ December 12 2012, Access on 01.02.2015 via http://www.federalreserve.gov/monetarypolicy/fomcminutes20121212.htm.

Federal Reserve (2013): Maturity Extension Program and Reinvestment Policy/ August 2013, Access on 01.02.2015 via http://www.federalreserve.gov/monetarypolicy/maturityextensionprogram.htm.

Federal Reserve (2013): Open Market Operations/ February 2013, Access on 14.06.2014 via http://www.federalreserve.gov/monetarypolicy/openmarket.htm.

Federal Reserve Bank of St. Louis (2013): The Troubled Asset Relief Program-Five Years Later/ Fall 2013, Access on 03.02.2015 via https://www.stlouisfed.org/publications/central-banker/fall-2013/the-troubled-asset-relief-programfive-years-later.

Federal Reserve Bank St. Louis (2014): Inflation, consumer prices for the United States/ September 2014, Access on 24.01.2015 via http://research.stlouisfed.org/fred2/series/FPCPITOTLZGUSA.

Federal Reserve Bank of San Francisco (2014): U.S. Monetary Policy: An Introduction. Part 3: How does monetary policy affect the U.S. economy?, in: FRBSF Economic Paper Number 2004-03/ January 2004, p. 1-3, Access on 20.03.2015 via http://www.frbsf.org/economic-research/files/el2004-03.pdf.

Federal Reserve (2014a): Transcript of Chair Yellen's FOMC Press Conference/ December 17 2014, Access on 21.01.2015 via http://www.federalreserve.gov/mediacenter/files/FOMCpresconf20141217.pdf.

Federal Reserve (2014): Primary Dealer Credit Facility (PDCF)/ December 2014, Access on 21.01.2015 via http://www.federalreserve.gov/newsevents/reform_pdcf.htm.

Federal Reserve (2014): Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF)/ December 2014, Access on 25.01.2015 via http://www.federalreserve.gov/newsevents/reform_amlf.htm.

Federal Reserve (2014): Agency Mortgage-Backed Securities (MBS) Purchase Program/ December 2014, Access on 24.01.2015 via http://www.federalreserve.gov/newsevents/reform_mbs.htm.

Federal Reserve (2014): Central Bank Liquidity Swap Lines/ December 2014, Access on 27.01.2015 via http://www.federalreserve.gov/newsevents/reform_swaplines.htm.

Federal Reserve (2014): Press Releases/ October 29 2014, Access on 02.02.2015 via http://www.federalreserve.gov/newsevents/press/monetary/20141029a.htm.

Federal Reserve (2014): Commercial Paper Funding Facility (CPFF)/ February 2010, Access on 12.02.2015 via http://www.federalreserve.gov/monetarypolicy/cpff.htm.

Federal Reserve Bank of St. Louis (2015): Effective Federal Funds Rate/ April 2015, Access on 23.01.2015 via http://research.stlouisfed.org/fred2/series/FedFUNDS.

Federal Reserve Bank St. Louis (2015): Civilian Unemployment Rate/ April 2015, Access on 24.01.2015 via http://research.stlouisfed.org/fred2/series/UNRATE.

Federal Reserve Bank of St. Louis (2015): TED Spread, in: Federal Reserve Economic Data, April 2015, Access on 10.10.2015 via https://research.stlouisfed.org/fred2/series/TEDRATE/.

Fein, Melanie L. (2008): The Economic Stabilization Act 2008 and Related Government Actions in Support ofU.S. Financial System, Yale Law School/ November 2008, Access on 09.08.2014 via http://www.law.yale.edu/documents/pdf/cbl/Fein_Economic_Stabilization.pdf.

Fisher, Paul (2012): Liquidity support from the Bank of England – the Discount Window Facility, Bank of England, Speech by Fisher/ March 2012, Access on 01.02.2015 via http://www.bis.org/review/r120330e.pdf.

Fratzscher, Marcel/ Lo Duca, Marco/ Straub, Roland (2014): ECB Unconventional Monetary Policy Actions: Market Impact, International Spillovers and Transmission Channels, International Monetary Fund, 15th Jacques Polak Annual Research Conference, Washington, DC/ November 13–14 2014, Access on 17.02.2015 via https://www.imf.org/external/np/res/seminars/2014/arc/pdf/fratzscher_loluca_straub.pdf.

Friedman, Milton (1969): The Optimum Quantity Of Money/ January 2005, Access on 20.03.2015 via https://books.google.de/books?id=DZ9OTS6LbEcC&pg=PR7&lpg=PR7&dq=optimum+quantity+of+money+milton+friedman&source=bl&ots=NL0tyjA5_w&sig=06RNpQpbr0Eu0_uieG-kE7CyEho&hl=en&sa=X&ei=7qMmVYCYIIyusAHrtYCoDA&ved=0CEkQ6AEwBTgK#v=snippet&q=231&f=false.

Gagnon, Joseph/ Raskin, Matthew/ Remache, Julie/ Sack, Brian (2011): The Financial Market Effects of the Federal Reserve's Large-Scale Asset Purchases, in: International Journal of Central Banking, Vol. 7, No. 1/ March 2011, Access on 19.12.2014 via http://www.ijcb.org/journal/ijcb11q1a1.pdf.

Girardina, Eric/ Moussac, Zakaria (2011): Quantitative easing works: Lessons from the unique experience in Japan 2001–2006, in: Journal of International Financial Markets, Institutions & Money; Volume 21, Issue 4/ January 2011, p. 461– 495, Access on 13.07.2014 via http://ac.els-cdn.com/S1042443111000059/1-s2.0-S1042443111000059-main.pdf?_tid=4e5c6800-d892-11e4-b533-00000aab0f01&acdnat=1427908542_9c358b16a91fe859c775830628567f63.

Glencross, Andrew (2013): The EU Response to Eurozone Crisis: Democratic Contestation and the New Fault Lines in the European Integration, Europa-Kolleg Hamburg, Institute for European Integration, Discussion Paper No 3/13/ July 2013, Access on 03.01.2015 via http://www.econstor.eu/bitstream/10419/82634/1/766849171.pdf.

González-Páramo, José, M. (2011): The ECB's monetary policy during the crisis, Closing Speech at the Tenth Economic Policy Conference/ October 2011, Access on 09.01.2015 via http://www.ecb.europa.eu/press/key/date/2011/html/sp111021_1.en.html.

Hancock, Diana/ Passmore, Wayne (2010): Did the Federal Reserve´s MBS Purchase Program lower Mortgage Rates?, Board of Governors of the Federal Reserve System/ October 2010 Access on 26.01.2015 http://www.federalreserve.gov/pubs/feds/2011/201101/201101pap.pdf.

Horioka, Charles Yuji (2006): The causes of Japan´s lost decade: the role of household consumption, National Bureau of Economic Research Working Paper 12142/ March 2006, Access on 03.02.2015 via http://www.nber.org/papers/w12142.pdf.

Ito, Takatoshi/ Mishkin, Frederic, S. (2004): Two Decades of Japanese Monetary Policy and the Deflation Problem, National Bureau of Economic Research Working Paper 10878/ October 2004, Access on 05.02.2015 via http://www.nber.org/papers/w10878.pdf.

Joyce, Michael/ Lasaosa, Ana/ Stevens, Ibrahim/ Tong, Matthew (2010): The financial market impact of quantitative easing, Bank of England Working Paper No. 393/ August 2010, Access on 10.06.2014 via http://papers.ssrn.com/sol3/Papers.cfm?abstract_id=1638986.

Joyce, Michael/ Miles, David/ Scott, Andrew/ Vayanos, Dimitri (2012): Quantitative Easing and Unconventional Monetary Policy-An Introduction, The Economic Journal, 122/ November 2012 p. F271-F288, Access on 12.07.2014 via http://onlinelibrary.wiley.com/doi/10.1111/j.1468-0297.2012.02551.x/epdf.

Kacperczyk, Marcin/ Schnabl, Philipp (2010): When Safe Proved Risky: Commercial Paper during the Financial Crisis of 2007–2009, in: Journal of Economic Perspectives-Volume 24, Number 1/ Winter 2010, p. 29–50, Access on 22.01.2015 via http://pages.stern.nyu.edu/~sternfin/mkacperc/public_html/commercial.pdf.

Kapetanios, George/ Mumtaz, Haroon/ Stevens, Ibrahim/ Theodoridis, Konstantinos (2012): Assessing the economy-wide effects of quantitative easing, in: The Economic Journal, 122/ November 2012, p. F316–F347, Access on 03.07.2014 via http://onlinelibrary.wiley.com/doi/10.1111/j.1468-0297.2012.02555.x/epdf.

Kapetanios, George/ Mumtaz, Haroon/ Stevens, Ibrahim/ Theodoridis, Konstantinos (2012): Assessing the economy-wide effects of quantitative easing, Working Paper No. 443, January 2012, Bank of England, p. 3-41, Access on 05.07.2014 via http://www.bankofengland.co.uk/research/Documents/workingpapers/2012/wp443.pdf.

Keynes, John, Maynard (1936): The General Theory of Employment, Interest, and Money, International Relationships and Security Network, ISN ETH Zürich, Primary Sources, February 1936, p. 2-190 Access on 22.07.2014 via http://www.google.de/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0CCoQFjAB&url=http%3A%2F%2Fmercury.ethz.ch%2Fserviceengine%2FFiles%2FISN%2F125515%2Fipublicationdocument_singledocument%2F0a26b9c2-f618-4f62-a280-4144a23330e4%2Fen%2F1366_KeynesTheoryofEmployment.pdf&ei=ddXPU5_lOejY7AbY3oGYDw&usg=AFQjCNE3JqRSGq8kE7S6F8dRZFaYTZi7Kg&sig2=73Kl8tvTFb96xIPhZtX_dA&bvm=bv.71667212,d.ZGU.

Kilponen, Juha/ Laakkonen, Helinä/ Vilmunen, Jouko (2012): Sovereign risk, European crisis resolution policies and bond yields, Bank of Finland Research Discussion Papers 22/ 2012, p. 1.24, Access on 12.03.2015 via http://www.suomenpankki.fi/en/julkaisut/tutkimukset/keskustelualoitteet/Documents/BoF_DP_1222.pdf.

Koo, Richard, C. (2011): The world in balance sheet recession: causes, cure, and politics, Nomura Research Institute, Tokyo, in: real-world economics review, issue no. 58, p. 19-37, Access on 26.01.2015 via http://www.paecon.net/PAEReview/issue58/Koo58.pdf.

Krogstrup, Signe/ Reynard, Samuel/ Sutter, Barbara (2012): Liquidity Effects of Quantitative Easing on Long-Term Interest Rates, Swiss National Bank Working Papers 2012-2, p. 1-29, Access on 12.05.2014 via http://www.snb.ch/n/mmr/reference/working_paper_2012_02/source/working_paper_2012_02.n.pdf.

Krugman, Paul, R. (1998): It's Baaack: Japan's Slump and the Return of the Liquidity Trap, Brookings Papers on Economic Activity 2/ 1998, p. 137-205, Access on 12.12.2014 via http://www.brookings.edu/~/media/Files/Programs/ES/BPEA/1998_2_bpea_papers/1998b_bpea_krugman_dominquez_rogoff.pdf.

Kurihara, Yutaka (2014): Has Zero Interest Rate Policy of the Bank of Japan Influenced Financial Markets?, Journal of Finance & Economics Volume 2, Issue 2/ 2014, p. 77-85, Access on 13.02.2015 via http://www.todayscience.org/JFE/article/jfe.v2i2p77.pdf.

Labonte, Marc (2014): Federal Reserve: Unconventional Monetary Policy Options, Congressional Research Services/ February 2014, p. 1-33, Access on 19.03.2015 via http://fas.org/sgp/crs/misc/R42962.pdf.

Labonte, Marc (2015): Monetary Policy and the Federal Reserve: Current Policy and Conditions, Specialist in Macroeconomic Policy, Congressional Research Services/ February 2015, p. 1-23, Access on 11.03.2015. https://www.fas.org/sgp/crs/misc/RL30354.pdf.

Lam, Raphael, W. (2011): Bank of Japan's Monetary Easing Measures: Are They Powerful and Comprehensive?, International Monetary Fund Working Paper 11/264/ November 2011, p. 2-18 Access on 14.03.2015 via https://www.imf.org/external/pubs/ft/wp/2011/wp11264.pdf.

Lane, Philip, R. (2012): The European Sovereign Debt Crisis, in: Journal of Economic Perspectives, Volume 26, Number 3/ Summer 2012, p. 49–68, Access on 04.01.2015 via http://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.26.3.49

Lane, Philip R./ Pels, Barbara (2012): Current Account Imbalances in Europe, IIIS Discussion Paper No. 397/ April 2012, p. 1-35, Access on 04.01.2015. via http://www.tcd.ie/iiis/documents/discussion/pdfs/iiisdp397.pdf.

Lenza, Michel/ Pill, Huw/ Reichlin, Lucrezia (2010): Monetary Policy in Exceptional Times, European Central Bank, Working Paper Series, No 1253/ October 2010, p. 4-38, Access on 28.02.2015 via http://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1253.pdf.

Levine, Linda (2013): Economic Growth and the Unemployment Rate, Congressional Research Service/ January 2013, p. 1-7, Access on 23.03.2015 via http://fas.org/sgp/crs/misc/R42063.pdf.

Lyonnet, Victor/ Werner, Richard (2012): Lessons from the Bank of England on 'quantitative easing' and other 'unconventional' monetary policies, International Review of Financial Analysis, Volume 25/ December 2012, p. 94-105, Access on 13.07.2014 via http://ac.els-cdn.com/S1057521912000737/1-s2.0-S1057521912000737-main.pdf?_tid=a9490798-d868-11e4-8e45-00000aab0f02&acdnat=1427890655_a991a78d8fcbcd5476673dfcb4acacd8.

Makin, John H. (2008): Japan's Lost Decade: Lessons for the United States in 2008, American Enterprise Institute for Public Policy Research, in: Economic Outlook/ March 2008, p. 1-5, 06.02.2015. via https://www.aei.org/wp-content/uploads/2011/10/20080225_22772EOMarch_g.pdf.

MARK Program Help File Contents: Parameter Index Matrices (PIM), Access on 15.02.2015 via http://warnercnr.colostate.edu/~gwhite/mark/markhelp/parameter_matrices.htm.

Marshall, John (2009): The financial crisis in the US: key events, causes and responses, House of Commons Library, Research Paper 09/34/ April 2009, p. 2-55, Access on 13.01.2015 via http://www.voltairenet.org/IMG/pdf/US_Financial_Crisis.pdf.

Memedovic, Olga/ Lapadre, Lelio (2009): Structural Change in the World Economy: Main Features and Trends, United Nations Industrial Development Organization, Working Paper 24/2009, p. 1-52, Access on 24.02.2015 via http://www.unido.org/fileadmin/user_media/Publications/Pub_free/Structural_change_in_the_world_economy.pdf.

Metzler, Allan H. (1995): Monetary, credit and (other) transmission processes: A monetarist perspective, in: Journal of Economic Perspectives, Vol. 9, No. 4/ Fall 1995, p. 49-72, Access on 10.01.2015 via http://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.9.4.49.

Mishkin, Frederic, S. (1996): The Channels of Moneatry Transmission: Lessons for Monetary Policy, National Bureau of Economic Research Working Paper Series 5464, February 1996, p. 1-27, Access on 15.06.2014 via http://www.nber.org/papers/w5464.pdf.

Mishkin, Frederic, S. (2001): Economics of Money, Banking and Financial Markets, Sixth edition, Pearson Education, U.S., p. 3-736.

Mishkin, Frederic, S. (2010): Over the clif: from the subprime to the global financial crisis, Working Paper 16609, National Bureau of Economic Research Working Paper Series 16609/ December 2010, p. 1-32, Access on 23.01.2015 via https://www0.gsb.columbia.edu/faculty/fmishkin/papers/nberwp.w16609.pdf.

Nanto, Dick, K. (2009): The Global Financial Crisis: Lessons from Japan's Lost Decade of the 1990s, Congressional Research Service, May 2009, Access on 04.02.2015 via http://fpc.state.gov/documents/organization/125542.pdf.

Noeth, Bryan/ Sengupta, Rajdeep (2010): Flight to Safety and U.S. Treasury Securities, Federal Reserve Bank of St. Louis, in: The Regional Economist/ July 2010, p. 18-19, Access on 24.01.2015 via https://research.stlouisfed.org/publications/regional/10/07/treasury_securities.pdf.

Oda, Nobuyuki/ Ueda, Kazuo (2005): The Effects of the Bank of Japan's Zero Interest Rate Commitment and Quantitative Monetary Easing on the Yield Curve: A Macro-Finance Approach, Bank of Japan Working Paper Series No.05-E-6/ April 2005, p. 1-22, Access on 13.02.2015 via http://www.boj.or.jp/en/research/wps_rev/wps_2005/data/wp05e06.pdf.

Okina, Kunio/ Shiratsuka, Shigenori (2004): Policy duration effect under zero interest rates: an application of wavelet analysis, CESIFO Woking Paper No. 1138, February 2004, p. 1-29, Access on 15.02.2015 via http://papers.ssrn.com/sol3/papers.cfm?abstract_id=521402.

Okun, Arthur, M. (1962): Potential GNP: Its measurement and significance, Yale University, Cowles Foundation Paper 190, Access on 23.03.2015 via http://cowles.econ.yale.edu/P/cp/p01b/p0190.pdf.

Pablo, Agnese/ Hector, Sala (2008): Unemployment in Japan: A look at the 'lost decade', IESE Business School, Universitat Aut`onoma de Barcelona, Munich Personal RePEc Archive Paper No. 14332, September 2008, p. 1-23, Access on 09.02.2015 via http://mpra.ub.uni-muenchen.de/14332/1/MPRA_paper_14332.pdf.

Peersman, Gert (2011): Macroeconomics effects of unconventional monetary policy in the euro area, European Central Bank, Working Paper Series No 1397/ November 2011, p. 3-33, Access on 24.02.2015 via http://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1397.pdf.

Ricketts, Lowell, R. (2011): Quantitative Easing Explained, Research Library of the Federal Reserve Bank of St. Louis, Economic Information letter, April 2011, Access on 11.01.2015 via http://research.stlouisfed.org/pageone-economics/uploads/newsletter/2011/201104.pdf.

Reszat, Beate (2003): Japan's Financial Markets: The Lost Decade, Hamburg Institute of International Economics, Hamburgisches Welt-Wirtschafts-Archiv (HWWA), HWWA Discussion Paper 231, June 2003, p. 1-26, Access on 09.02.2015 via http://ageconsearch.umn.edu/bitstream/26335/1/dp030231.pdf.

Rogers, John H./ Scotti, Chiara/ Wright, Jonathan H. (2014): Evaluating Asset-Market Effects of Unconventional Monetary Policy: A Cross-Country Comparison, Board of Governors of the Federal Reserve System, International Finance Discussion Papers Number 1101, March 2014, p. 1-65, Access on 01.03.2015 via http://www.federalreserve.gov/pubs/ifdp/2014/1101/ifdp1101.pdf.

Shin, Hyun Song (2009): Reflections on Northern Rock: The Bank Run that Heralded the Global Financial Crisis, in: Journal of Economic Perspectives, Volume 23, Number 1/ Winter 2009, p. 101-119, Access on 01.02.2015 via http://www.princeton.edu/~hsshin/www/nrJEP.pdf.

Shiratsuka, Shigenori (2010): Size and Composition of the Central Bank Balance Sheet: Revisiting Japan's Experience of the Quantitative Easing Policy, Federal Reserve Bank of Dallas Globalization and Monetary Policy Institute, Working Paper No. 42, January 2010, p. 1-32, Access on 12.05.2014 via http://www.dallasfed.org/assets/documents/institute/wpapers/2010/0042.pdf.

Smaghi, Lorenzo, B. (2009): Conventional and unconventional monetary policy, European Central Bank, Keynote lecture at the International Center for Monetary and Banking Studies (ICMB), April 2009, Access on 10.06.2014 via http://www.ecb.europa.eu/press/key/date/2009/html/sp090428.en.html.

Societe Generale (2013): Studies Rising public debt in Japan: How far is too far?, Societe Generale Department of Economic, ECONOTE, No 21, November 2013, Access on 14.02.2015 via http://www.societegenerale.com/sites/default/files/documents/Econote/131121%20EcoNote_21_Japon_EN.pdf.

Southampton Business School (2014): Professor Richard Werner, Access on 21.11.2014 via https://www.sbs.ac.uk/academic-profiles/richard-werner.

Statista (2015): Gross domestic product (GDP) of the United States at current prices from 2008 to 2018 (in billion U.S. dollars), Access on 19.01.2015 via http://www.statista.com/statistics/263591/gross-domestic-product-gdp-of-the-united-states/.

Szczerbowicz, Urszula (2012): The ECB unconventional monetary policies: have they lowered market borrowing costs for banks and governments?, Centre d´études prospectives et d´informations internationales (CEPII), No 2012-36/ December 2012, p. 3-40, Access on 03.01.2015 via http://www.cepii.fr/PDF_PUB/wp/2012/wp2012-36.pdf.

Thornton, Daniel, L. (2012): The U.S. Deficit/Debt Problem: A Longer-Run Perspective, Federal Reserve Bank of St. Louis Review/ November/December 2012, 94(6), p. 441-455, Access on 25.01.2015 via http://research.stlouisfed.org/publications/review/12/11/Thornton.pdf.

Takahashi, Wataru (2013): Japanese Monetary Policy: Experience from the Lost Decades, in: International Journal of Business, 18(4)/ 2013, p. 288-306, Access on 12.03.2015 via http://www.craig.csufresno.edu/ijb/Volumes/Volume%2018/V184-1.pdf.

Trichet, Jean-Claude (2009): The ECB's Enhanced Credit Support, in: Cesifo Working Paper No. 2833/ October 2009, Access on 09.01.2015 via http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1500267##.

Ugai, Hiroshi (2006): Effects of the Quantitative Easing Policy: A Survey of Empirical Analyses, Bank of Japan Working Paper Series No.06-E-10 / July 2006, p. 1-53, Access on 27.02.2015 via https://www.boj.or.jp/en/research/wps_rev/wps_2006/data/wp06e10.pdf.

UK Finance Yahoo UK & Ireland: FTSE 100 (^FTSE), Access on 05.02.2015 via https://uk.finance.yahoo.com/echarts?s=^FTSE.

United States Department of the Treasury (2012): Recent U.S. economy growth in Charts/ May 2012, p. 1-13, Access on 21.01.2015 via http://www.treasury.gov/resource-center/data-chart center/Documents/20120502_EconomicGrowth.pdf.

U.S. National Debt Clock (2015): The Outstanding Public Debt as of 26 Jan 2015, Access on 26.01.2015 via http://www.brillig.com/debt_clock/.

U.S. Department of the Treasury (2015): TARP Programs, Access on 24.01.2015 via http://www.treasury.gov/initiatives/financial-stability/TARP-Programs/Pages/default.aspx#.

Vaitilingam, Romesh (2009): Recession Britain, Findings from economic and social research, Economic & Social Research Council, p. 2-48, Access on 08.02.2015 via http://www.esrc.ac.uk/_images/Recession_Britain_tcm8-4598.pdf.

Van Rixtel, Adrian (2009): The exit from Quantitative Easing (QE): The Japanese experience, International Financial Markets Division, Associate Directorate General International Affairs, Bank of Spain, Access on 14.02.2015 via http://www.law.harvard.edu/programs/about/pifs/symposia/japan/2009-japan/briefing-book/van-rixtel.pdf.

Verick, Sher/ Islam, Iyanatul (2010): The Great Recession of 2008-2009: Causes, Consequences and Policy Responses, Institut for the Study of Labor, Discussion Paper No. 4934/ May 2010, p. 3-61, Access on 04.07.2014 via http://ftp.iza.org/dp4934.pdf.

Watkins, John, P. (2014): Quantitative Easing as a Means of Reducing Unemployment: A New Version of Trickle-Down Economics, Westminster College/ January 2014, p. 2-16, Access on 20.03.2015 via file:///Users/secret/Downloads/UsingQuantitativeEasingToReduceUnem_preview%20(1).pdf.

Weale, Martin/ Wieladek, Tomasz (2014): What are the macroeconomic effects of asset purchases?, Bank of England, External MPC Unit, Discussion Paper No. 42, April 2014, p. 2-59, Access on 27.02.2015 via http://www.bankofengland.co.uk/research/Documents/externalmpcpapers/extmpcpaper0042.pdf.

Werner, Richard, A. (1995): How to Create a Recovery through 'Quantitative Monetary Easing', We must increase total purchasing power, Even economic growth of 4% is possible, Economics Classroom/ September 1995, p. 1-3, Access on 09.06.2014 via http://eprints.soton.ac.uk/340476/1/Translation_Werner_QE_Nikkei_Sep_1995_final1.pdf.

Ehrenwörtliche Erklärung

Hiermit versichere ich an Eides Statt, dass ich die vorliegende Arbeit selbstständig und ohne die Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe. Alle Stellen, die wörtlich oder sinngemäß aus veröffentlichten und nicht veröffentlichten Schriften entnommen wurden, sind als solche kenntlich gemacht. Die Arbeit ist in gleicher oder ähnlicher Form oder auszugsweise im Rahmen einer anderen Prüfung noch nicht vorgelegt worden.

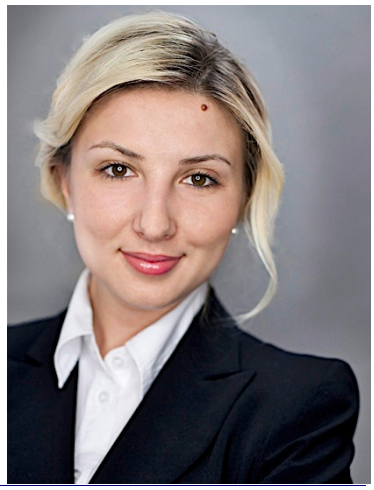
Unterschrift

Frankfurt am Main, den 30.04.2015

Shanna Ruf

Curriculum Vitae

SHANNA RUF



10/2012 – 05/2015	**University of Vienna, Austria** ***International Business Administration**, Master Studies* ▪ Majors: Corporate Finance, International Management
08/2011 – 12/2011	**San Diego State University, CA, USA** ***Economics,** semester abroad* ▪ Majors: Corporate Finance, Fiscal and Budgetary Policy, Public Finance, Supply Chain Management
04/2010 – 08/2012	**University of Cologne, Germany** ***Economics,** Bachelor Studies* ▪ Majors: Corporate Finance, Supply Chain Management
04/2009 – 02/2010	**University of Bonn, Germany** ***Economics,** Bachelor Studies*

PROFESSIONAL EXPERIENCE

08/2014 – 12/2014	**IKB Deutsche Industriebank AG, Frankfurt/Main** ***M&A Corporate Finance Real Estate**, Intern*
02/2011 – 04/2011	**Deutsche Telekom AG (DAX30), Bonn** ***Dep. Group Market Research, intern (full-time)***
08/2009 – 12/2009	**HDI-Gerling Industrie Versicherung AG, Cologne** ***Dep. Mathematics Technics, working student***

SELF-EMPLOYMENT

10/2010 – 04/2013	**Cologne Stock Market Association** ▪ Member of the organization team
09/2009 – 09/2012	**Centre for Financial Research, University of Cologne** ▪ Member of the organization team

SCHOOL

06/2008	**Elisabeth-von-Thüringen Gymnasium**, Cologne, („Abitur“)

IT-SKILLS

Microsoft Word	good skills
Microsoft Excel	good skills
Microsoft Power Point	good skills
Bloomberg	good skills

LANGUAGE SKILLS

English	fluent
German	mother tongue
Russian	mother tongue
French	good skills

HOBBYS/ INTERESTS

French language, theatre, salsa, theology, travelling

Frankfurt/Main, April the 30th 2015.