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"One of the great mistakes is to judge policies and programs by their intentions rather than their results."

Milton Friedman

Table of contents

List of tables

List of abbreviations

ABSPP	Asset-Backed Securities Purchase Program
AIG	American International Group
CBPP	Covered Bond Purchase Program
CPI	Consumer Price Index
CQS3	Equivalent to an ECAI Rating of BBB-/Baa3/BBBI
CSI	Case-Shiller Index/Indices
ECAI	External Credit Assessment Institution
ECB	European Central Bank
EU	European Union
Fed	Federal Reserve System
FOMC	Federal Open Market Committee
FRFA	Fixed-Rate Tenders, Full Allotment
GDP	Gross Domestic Product
HICP	Harmonized Index of Consumer Prices
LSAP	Large-Scale Asset Purchases
LTRO	Long-Term Refinancing Operations
MBS	Mortgage-Backed Securities
MRO	Main Refinancing Operations
NCB	National Central Bank
PSPP	Public Sector Purchase Program
QE	Quantitative Easing
QL	Quantitative Lockerung
S&P	Standard & Poor's
SMP	Securities Market Program
U.S.	United States
UK	United Kingdom
USA	United States of America

Abstract

The quantitative easing is an expansionary monetary policy applied in times of great economical distress. Notable examples of QE are found in Japan, UK and the USA. The U.S. quantitative easing lasted from November 2008 until October 2014. As of March 2015, the European Central Bank started the European version of QE. In this thesis I examined the effects of QE on house prices, interest rates, unemployment and the inflation in the USA. I analyzed data sets via regression analysis. The results suggest that, except for the inflation, QE had a significant impact on these economic indicators. I used the results to make predictions on how the QE will affect the European economy. The data analysis was preceded by a thorough theoretical research on both the U.S. and the European QE. I also made a digression on the S&P / Case-Shiller Home Price Index, which is commonly used to measure changes in the U.S. house prices.

Zusammenfassung

Quantitative Lockerung ist eine Art expansiver monetären Politik, die in Zeiten großer wirtschaftlicher Schwierigkeiten angewandt wird. Bemerkenswerte Beispiele der QL findet man in Japan, Vereinigtem Königreich und den USA. Die amerikanische quantitative Lockerung dauerte vom November 2008 bis Oktober 2014. Ab dem März 2015, hat die Europäische Zentralbank die europäische Version der quantitativen Lockerung angefangen. In dieser Arbeit untersuchte ich die Auswirkungen der QL auf Hauspreise, Zinssätze, Arbeitlosigkeit und die Inflation in den USA. Die Datensetze analysierte ich mittels der Regressionsanalyse. Die Ergebnisse deuten darauf hin, dass die QL, abgesehen von der Inflation, einen singnifikanten Einfluss auf diese wirtschaftlichen Indikatoren hatte. Aufgrund der Ergebnisse erstellete ich Prognosen über die Auswirkungen der QL auf die eruopäische Wirtschaft. Vor der Datenanalyse führte ich eine gründliche theoretische Forschung über die amerikanische und europäische QL durch. Ich machte auch einen Exkurs über den S&P / Case-Shiller Hauspreisindex, der normalerweise verwendet wird, um die Änderungen in den amerikanischen Hauspreisen zu messen.

1. Introduction

Since the beginning of the financial crisis of 2007/2008, the world markets have confronted challenges completely new to the business world. Although many economists tend to compare the current crisis to the Great Depression of 1929, especially in terms of its magnitude, it actually has a much larger impact. While the Great Depression affected by large only the American economy, the current crisis has spread throughout the entire world. World economies are interconnected on levels that were unimaginable back in 1929. What these two crises have in common is the fact that they both started as financial bubbles. The stock market bubble preceding the Great Depression ended in a crash that subdued the American economy.

The current crisis, however, was caused by a combination of many different factors, including a change in American legislation[1], low risk rates for a prolonged period of time and a huge inflow of capital into the United States. The most notable factor was, however, the U.S. housing bubble. The housing bubble started as any other financial bubble – with too much optimism regarding the future. House prices are generally on the rise, so the beginnings of the bubble were not perceived by the market right away. Instead, many international investors started putting their money into the so-called mortgage-backed securities (MBS), a type of a derivative created by American investment banks, for which the house mortgages served as the underlying. Many leading economists believed that the housing bubble could be absorbed by the market, just as the Dot-Com bubble in the early 2000s had been. The American MBS became a part of many international investors' portfolios as well, which later proved to be one of the key factors that helped spreading the financial crisis across the whole world. House prices peaked in 2006, followed by a swift decline. The MBS lost in value and were no longer considered a profitable investment, but rather a financial risk everybody wanted to get rid of. Once this realization became clear to market participants, the crisis started unfolding.

The bankruptcy of the Lehman Brothers is nowadays considered the official beginning of the crisis. In a matter of days after the bankruptcy was announced, the markets worldwide

[1] The already infamous Gramm-Leach-Bliley Act of 1999 allows merging of commercial banks, investment banks and insurance companies. This was explicitly forbidden by the Glass-Steagall Act of 1933, which was actually proposed as an answer to the Great Depression. The Gramm-Leach-Bliley Act served as the green light for big banks to act irresponsibly, causing the biggest financial crisis the world has ever seen.

crashed. Once highly regarded investments became worthless, the interbank lending stopped and the financial markets froze. In the months and years that followed central banks started intervening on the markets in order to mitigate the consequences of the financial distress.

The consequences were not only visible on the financial markets, but spread soon to the real economy. Because of the lost confidence within the banking system, the investment levels sunk, followed by decreased production and low employment rates, which eventually lead to deflationary developments.

The U.S. Federal Reserve was one of the first major central banks to start a quantitative easing program in response to the financial crisis. Other notable examples of quantitative easing come from the UK, Japan and, most recently, the EU. Since the U.S economy is rather market-based than bank-based, the Fed was conducting the program by buying securities on the market from the very beginning. In contrast, the European Central Bank has been implementing its monetary interventions by bailing out banks for a long period of time. After announcing them in January 2015, the ECB started the open market operations which are typical in QE programs. The official start was in March 2015. The U.S. quantitative easing lasted for 6 years and it is the biggest program of its kind in history. It started in November 2008 and lasted until October 2014.

In this thesis, I examined the effects of the QE on the U.S. economy, especially in terms of interest rates, money supply and, most importantly, house prices. I used data for futures on the S&P/Case-Shiller Home Price Index to determine changes in house prices relative to changes in money supply induced by the QE. I also analyzed changes in 3-month USD LIBOR and 12-month USD LIBOR rates relative to changes in money supply. Further details and analyses are discussed in Part 6 of this thesis. I drew conclusions based on these results that can be applied to the quantitative easing in the EU and the effects it will have on the European economy. Simply comparing the two programs, without taking other factors into account, is not recommendable. These factors include the differences in legislation, regulation of the fiscal system and the fact that the US economy is market-based, as opposed to the more conservative bank-based EU. Their influence on the success of the QE program is of crucial significance. In order to understand what consequences the QE might have on the European economy, it is necessary to analyze it in the context of aforementioned factors. It may be too early to make long-term predictions about the future of the USA and EU, but

assuming short-term and mid-term developments in the light of the QE could give some important insights into the mechanisms that enable the monetary policies to influence real economy.

Even though the financial crisis started off as a subprime-mortgage crisis, there has been surprisingly little research on how the QE programs influenced the house prices. One of the reasons could be the fact that the house prices comprise only a small part of the overall problem. Once the crisis spread out of the boundaries of the housing market, market participants started focusing more on other occurrences on markets, such are low credit activity, extremely low inflation or the European sovereign debt crisis.

The quantitative easing in the European Union is at its early stage, thus making it difficult to predict if the ECB will take further action on bond markets once it is finished. A strong reaction of the stock markets was notable in just couple of weeks after the program was initiated. One of the most important indices in Europe, the German DAX, skyrocketed in the second half of March 2015 reaching a maximum of almost 12.400 bps in April 2015. By the end of the month, the index fell by more than 900 bps. This change, however, had little to do with any aspect of the QE, since the European economy is currently affected by several factors, including the Greek crisis, unstable oil prices and the weakening of the Chinese economy. Bearing all of this in mind, it is actually questionable if the QE is an efficient tool to handle the European recession. It seems that the effects of such an intervention are outnumbered by factors that are beyond the control of ECB. This certainly imposes the question: is such a program actually going to bring relief to European markets?

2. Literature review

Since the beginning of the U.S. quantitative easing, several important research papers on the topic of QE have been published. During the early stages of the QE, the focus was mainly on the structure and goals of the program itself. The beginnings were marked by a rather "decide-on-the-go" approach than by a strict plan. Accordingly, the research was concerned with these topics as well. The QE was new ground for the Federal Reserve. As Blinder states it, the applied measures were reactive and institution based. Later, the securities purchases became more systematic and market-based. The goal also shifted from saving specific credit institutions to decreasing risk premiums.[2]

In a study by Gagnon et al., it is argued that large-scale asset purchases (LSAP) conducted by the Fed have decreased yields on longer-term securities as well as longer-term interest rates on a broad range of securities.[3] The same study suggests that the LSAP have spillover effects on other asset-classes, such are corporate bonds and equities. The spillover effects work by bidding up the prices on these assets, which become more desirable in the light of decreased yields on longer-term government bonds. Gagnon et al. also investigated the effects of the LSAP communication on interest rates, by analyzing their response in a one day-window, after important announcements made by the Fed. They assumed that the changes induced by the LSAP may be absorbed slower, because it is a new approach of conducting monetary policy.[4] They concluded that the LSAP programs have positively influenced the economic activity. The programs were stimulating to the mortgage market, as well as to the markets for Treasury securities and corporate bonds.[5]

In a research conducted by Chung et al., the focus was on possible macroeconomic effects of the LSAP beyond the changes in interest rates. For this purpose, they used the FRB/US model, which is a large-scale model used at the Federal Reserve to assess the effects of applied policies.[6] As in the previous study, this model implies a higher equity valuation. It also suggests that the foreign exchange value of the U.S. dollar decreases due to the LSAP, thus providing the economy with an additional stimulus. The model predicted a boost in GDP

[2] Cf. Blinder (2010), p. 469-470
[3] Cf. Gagnon et al. (2010), p. 2
[4] Ibid (2010), p. 14 and 17
[5] Ibid (2010), p. 29
[6] Cf. Chung et al. (2011), p. 2

growth, as well as the employment.[7] The effect on the price stability was an important finding. The LSAP contributed to a raise in the inflation,[8] which is extremely important, considering the fact that the crisis aftermath lead to deflationary pressures.

Krishnamurthy and Vissing-Jorgensen applied a different approach in evaluating the effects of QE on interest rates. They used the event-study methodology to come to relevant conclusions. They found that the LSAP programs work through several channels. The signaling channel works in a way that the central bank communicates its intentions regarding the monetary policy. By making a credible commitment, the Fed influences the expectations of the market. A low federal funds rate, which was set by the Fed for a prolonged period of time, lowered the expectations of interest rates on other assets as well.[9] The duration risk channel works by reducing the duration risk held by the investors. When the Fed purchases long-term Treasuries or agency debt, it causes a decrease in longer-term yields relative to short-term yields, thus changing the yield curve.[10] The liquidity channel implies an increase in liquidity held by investors.[11] Another important channel is the inflation channel, which leads to an increase in inflation expectations due to a expansionary monetary policy.[12]

Prior to the European QE[13], which started in March 2015, the ECB has conducted several liquidity providing programs. Right after the financial crisis in the USA erupted, the European markets reacted by widening the risk spreads on Euribor/overnight indexed swaps. In October 2008 the ECB announced a fixed-rate tender, full allotment operations (FRFA), meaning that banks could borrow as much as they want to, if they had proper collateral.[14]
Over the next years several programs were adopted, including the 6-month and 12-month longer-term refinancing operations (LTROs). Under normal circumstances, the LTROs have a running time of three months. In the light of the crisis, this period was extended.[15] The ECB also lowered interest rates. The financial crisis in the EU developed into a sovereign debt crisis in Spain, Portugal, Ireland and Greece. The ECB had to apply all available tools to

[7] Cf. Chung (2011), p. 4
[8] Ibid (2011), p. 4
[9] Cf. Krishnamurthy and Vissing-Jorgensen (2011), p. 218
[10] Ibid (2011), p. 219
[11] Ibid (2011), p. 220
[12] Ibid (2011), p. 223
[13] The term "QE" in this thesis refers to central bank programs which consist of outright asset purchases on the markets, including government bonds, i.e. public sector securities. Bank lending conducted by the ECB before the current QE program started are therefore not subject to further analysis.
[14] Cf. Fawley and Neely (2013), p. 57
[15] Ibid (2013), p. 62

prevent the Euro area from total collapse. Further measures included the Securities Market Program (SMP), during which the ECB engaged on the public and private debt markets, as well as the Covered Bond Purchase Program (CBPP). The CBPPs were conducted in three stages, thus we differentiate CBPP1, CBPP2 and CBPP3. The CBPP3 started during the last quarter of 2014, accompanied by another program – the Asset-Backed Securities Purchase Program (ASBPP).

A study by Fratzscher et al. offers insight into what these programs have done for the European economy so far. Their results show that the announcements of the different stages in the ECB's intervention have lowered bond yields in troubled countries, while the bond yields of highly rated countries increased. The equity indices and equity prices went up in both the troubled as well as in the stable countries.[16] Fratzscher et al. also found that the ECB's policies decreased bond spreads between the core and peripheral member states. The policies lowered market fragmentation as well.[17] The international spillover effects of the policies were noticeable. The main influence was visible on European financial markets, but these effects extended to global markets as well. They reflected in increased equity prices and lowered credit risk. However, international portfolios did not change due to the ECB's actions, i.e. the increase in prices and change in risk attitudes reflected mainly the decisions of European investors.[18]

[16] Fratzscher et al. (2014), p. 14
[17] Ibid (2014), p. 16
[18] Ibid (2014), p. 30 and 31

3. Quantitative easing in the European Union

The quantitative easing in the European Union (EU) is the ultimate measure in the battle against the soaring financial crisis. Since the beginning of the current crisis, the European Central Bank (ECB) has been serving as the lender of last resort, providing liquidity to the banks that needed it. The ECB did not act as a passive observer during the last few years, but rather tried to help the struggling European economy, primarily through bank lending and controlling short-term interest rates. The creating of liquidity "on demand" did not lead to the market response the ECB was hoping for. While many world economies that have been hit by the financial crisis are on a sure path of retrieving stability and positive growth, the European economy is still struggling. The main goal of ECB is price stability. In order to achieve this goal, the ECB has been introducing many different non-standard monetary policy measures.[19] Examples of these measures include the increase and frequency in long-term refinancing operations, while conducting all liquidity-providing operations through a fixed rate tender procedure with full allotment.[20]

Nevertheless, these measures did not succeed in solving the existing problems of low inflation, decreased public spending and weakened economy. In general, once the nominal interest rates reach zero, a central bank can no longer push them down. European interest rates are at their historic low. As of July 2013, the ECB has been applying forward guidance, which is a way of direct communication with the market and investors about the future monetary policies the central bank intends to conduct. The direct communication of central bank's intentions affects the formation of investors' expectations. One of the most important aspects of forward guidance the ECB committed to was keeping the key interest rates unchanged at the lower levels for an extended period of time.[21] There are three key interest rates set by the ECB Governing Council: the interest rate on main refinancing operations (MROs), the rate on marginal lending facility and the rate on the deposit facility, currently held at 0.05%, 0.30% and -0.20% respectively.[22]

[19] https://www.ecb.europa.eu/mopo/decisions/html/index.en.html, 10.07.2015
[20] ECB Monthly Bulletin, June 2009, p. 9
[21] ECB Monthly Bulletin, July 2013, p. 7
[22] https://www.ecb.europa.eu/press/pr/date/2015/html/pr150603.en.html, 10.07.2015

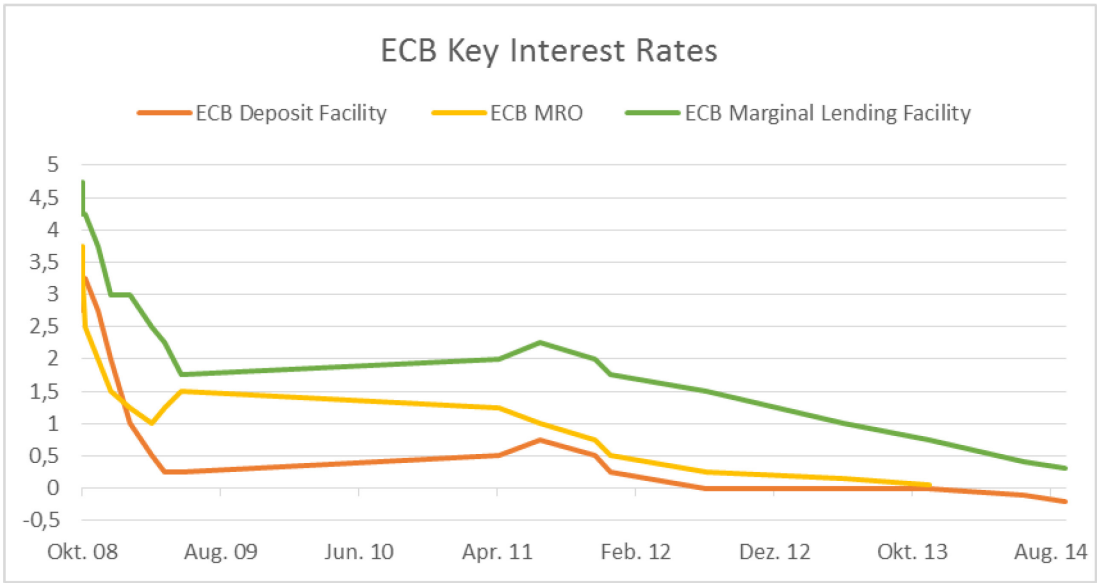

Chart 1. ECB Key interest rates from October 2008 until September 2014 (Source: ECB)

Once the standard monetary policy procedures reach their limits, the central bank is no longer able to maintain its monetary objectives. Therefore, other kinds of monetary policies are needed to tackle this issue. All measures the ECB conducted in the last few years, with the ultimate goal of ending the financial and sovereign debt crisis can be viewed as some sort of quantitative easing. Basically, any monetary policy that results in an expanded balance sheet of the central bank, due to extensive lending and/or asset purchasing can be dubbed as QE.

The "real QE" in the EU started in March 2015 and will last at least until September 2016. The ECB engages in buying public sector securities, a completely unexplored world on the conservative European soil. Unlike USA and UK, EU took this step relatively late – almost 7 years after the world financial markets crashed. The quantitative easing, also referred to as expanded asset purchase program was announced on 22 January 2015 in a press release by the Governing Council of ECB. In October 2014 the ECB started the asset-backed securities program (ABSPP) and covered bond purchase program (CBPP3), which consist of monthly purchases of up to €10 billion. While the ABSPP and CBPP3 refer to the purchase of private sector securities, the newly adopted program consists of buying public sector securities. Those are euro-denominated securities of national governments, agencies and European institutions. The public sector purchase program (PSPP) and the purchase programs started in

October last year add up to €60 billion of combined monthly purchases.[23] By the end of September 2016, the ECB balance sheet will be expanded by €1.1 trillion.
In order for the public securities to be part of the newly adopted program they must fulfill certain eligibility criteria set by the ECB Governing Council. These criteria rely on the Treaty on the Functioning of the European Union, which can be seen as a set of rules aimed at keeping financial discipline in the Euro area.

The most important eligibility criteria are concerning the collateral eligibility, maturity and the securities purchases. As it was stated in the technical annex following the press release on the PSPP: "*They [securities] fulfil the collateral eligibility criteria for marketable assets in order to participate in Eurosystem monetary policy operations, as specified in Guideline ECB/2011/14, as amended, subject to the fulfilment of the additional criteria…*"[24] These additional criteria refer to the issuer eligibility (the issuer can be a central government, certain euro area agencies and supranational agencies) and credit assessment of the securities (first-best credit assessment provided by an External Credit Assessment Institution - ECAI or at least CQS3[25] for the issuer or the guarantor). It was further stated that the securities that do not achieve the CQS3 rating will still be eligible, as long as the collateral eligibility is not determined within the context of the Eurosystem's minimum quality threshold.[26]

As for the maturity, the securities must have a remaining maturity between 2 and 30 years. The allocation of the securities purchases is to be carried out according to the capital key of the ECB. The capital key is a tool for determining the shares of individual national central banks (NCBs) in the overall capital of the ECB. It reflects the share of a certain country in total population and gross domestic product, both of which are equally weighted. The capital key gets updated every 5 years and/or whenever a new country becomes a member of the EU.[27] The Eurosystem currently consists of 19 member states[28], all of which have adopted

[23] https://www.ecb.europa.eu/press/pr/date/2015/html/pr150122_1.en.html, 10.07.2015
[24] Ibid., 10.07.2015
[25] CQS3 is equivalent to an ECAI rating of BBB-/Baa3/BBBI.
[26] Cf. https://www.ecb.europa.eu/press/pr/date/2015/html/pr150122_1.en.html, 10.07.2015
[27] https://www.ecb.europa.eu/ecb/orga/capital/html/index.en.html, 11.07.2015
[28] The EU itself consists of 28 member states, whereas 9 of them have not adopted the Euro. Those countries are: Bulgaria, Croatia, Czech Republic, Denmark, Hungary, Poland, Romania, Sweden and United Kingdom.

the Euro as their currency. Table 1[29] shows the capital key for these 19 countries, which, with the exception of Greece and Cyprus[30], participate in the QE.

National central bank	Capital key %	Paid-up capital (€)
1) Owing to rounding, the total may not correspond to the sum of all figures shown.		
Nationale Bank van België/Banque Nationale de Belgique (Belgium)	2.4778	268,222,025.17
Deutsche Bundesbank (Germany)	17.9973	1,948,208,997.34
Eesti Pank (Estonia)	0.1928	20,870,613.63
Central Bank of Ireland (Ireland)	1.1607	125,645,857.06
Bank of Greece (Greece)	2.0332	220,094,043.74
Banco de España (Spain)	8.8409	957,028,050.02
Banque de France (France)	14.1792	1,534,899,402.41
Banca d'Italia (Italy)	12.3108	1,332,644,970.33
Central Bank of Cyprus (Cyprus)	0.1513	16,378,235.70
Latvijas Banka (Latvia)	0.2821	30,537,344.94
Lietuvos bankas (Lithuania)	0.4132	44,728,929.21
Banque centrale du Luxembourg (Luxembourg)	0.2030	21,974,764.35
Central Bank of Malta (Malta)	0.0648	7,014,604.58

[29] https://www.ecb.europa.eu/ecb/orga/capital/html/index.en.html, 11.07.2015 (updated on 01.01.2015)
[30] Greece and Cyprus are part of a financial assistance program conducted by the EU and are therefore not allowed to participate in the QE at the moment.

National central bank	Capital key %	Paid-up capital (€)
De Nederlandsche Bank (The Netherlands)	4.0035	433,379,158.03
Oesterreichische Nationalbank (Austria)	1.9631	212,505,713.78
Banco de Portugal (Portugal)	1.7434	188,723,173.25
Banka Slovenije (Slovenia)	0.3455	37,400,399.43
Národná banka Slovenska (Slovakia)	0.7725	83,623,179.61
Suomen Pankki – Finlands Bank (Finland)	1.2564	136,005,388.82
Total[1]	**70.3915**	**7,619,884,851.40**

Table 1. Capital key for 19 EU member states (Source: ECB)

The Governing Council also imposes a set of rules upon the program itself. Following the main objective of ECB – the price stability, the Governing Council aims at achieving an inflation rate of approximately 2% over the medium term.[31]

One of the main rules to be followed during the PSPP is the prohibition on monetary financing. This means that no member state should be favored by the ECB. In order to achieve this, ECB is prohibited from buying securities on the primary market. This rule applies to all types of securities within the PSPP. The purchases can be made only on the secondary markets, after the market price has been formed. This way the ECB will maintain its market neutral position.[32]

Another very important aspect of the PSPP are the 25% issue limit and 33% issuer limit. The 25% issue limit means that the ECB is not allowed to buy more than 25% of an issue. This limit has been put up in order to avoid forming a blocking minority by the ECB and thus preventing monetary financing of individual countries. The 33% issuer limit means that the

[31] ECB Economic Bulletin, Issue 1/2015, p. 15
[32] https://www.ecb.europa.eu/explainers/tell-me-more/html/asset-purchase.en.html, 12.07.2015

ECB cannot buy more than 33% of one issuer's debt. Both limits are derived from the need of preventing the ECB to influence price formation on markets. They are applied to the whole portfolio of securities the ECB holds and not only to the securities acquired under the PSPP.[33]

The NCBs through which the ECB will purchase securities will conduct these purchases on their home markets. Of the total amount of securities, the ECB will purchase 8%, while the rest will be bought by NCBs. The NCBs will hold 12% of purchases in securities of European institutions. These purchases, i.e. 20% of the total amount of securities purchased under the PSPP, will be subject to loss sharing.[34] Government bonds purchased by NCBs will not be subject to loss sharing, because it would be in conflict with the prohibition of monetary financing by the ECB. Even though all purchases are to be made according to the capital key, there still exists some flexibility with regard to shares of each country in the monthly purchases. Furthermore, a certain degree of flexibility is to be taken into account within the purchases individual NCBs conduct. This means that the NCBs can choose between the government and agency securities, as long as the purchases do not compromise the overall allocation of monthly asset purchases.[35]

As already mentioned, the current asset purchase program is not the first time the ECB tried to ease financial conditions by providing liquidity. However, up until now the markets have not exactly responded to the measures taken in a way the ECB expected it. Inflationary pressures have not been strong enough and the inflation, as well as the inflation expectations, are at their historical low. The average inflation rate for 2014 was 0.4%.[36] Even though the low inflation rate for the last year could be traced back to a fall in oil prices, it is certainly not the only factor keeping the mid-term inflation expectations low as well. The Harmonized Index of Consumer Prices (HICP), which also includes food prices, services and non-energy industrial goods, has been falling since 2013 and remained low in 2014.[37]

Under such unfavorable circumstances, an expansive monetary policy through outright asset purchases is probably the only effective tool to overcome them. In normal times, the central bank controls liquidity and price stability by simply directing money supply towards desired levels. This is achieved by lending money, raising reserve requirements for banks, selling or

[33] https://www.ecb.europa.eu/press/pressconf/2015/html/is150122.en.html, 12.07.2015
[34] https://www.ecb.europa.eu/press/key/date/2015/html/sp150310_1.en.html, 12.07.2015
[35] https://www.ecb.europa.eu/mopo/implement/omt/html/pspp-qa.en.html, 12.07.2015
[36] https://www.ecb.europa.eu/press/pressconf/2015/html/is150122.en.html, 13.07.2015
[37] Cf. ECB Economic Bulletin, Issue 1/2015, p. 16

buying assets and adjusting interest rates. However, once the interest rates hit the lower bounds, there is not much the central bank can do within the conventional monetary policy frame. Quantitative easing has already been conducted in other economies – USA, Japan and UK, so it is not an unknown approach in fighting low inflation and liquidity issues.

Nevertheless, one cannot ignore the fact that the European economy is mostly bank-based. In this sense, purchases on the bond market, as a part of an unconventional monetary policy, are a novelty. Up until now, even the ECB's unconventional measures displayed certain conservatism, since they worked through bank lending against collateral, rather than through direct asset purchases.[38] Shifting the monetary interventions from banks to bond markets has direct implications on how the economy will respond. The, so called, transmission channel of bond purchases is much more complex than the mechanisms underlying other, less-sophisticated monetary measures. First of all, the outright asset purchases increase the money supply, helping to overcome the liquidity shortages. This eases the financial conditions substantially. Furthermore, the supply of securities, which are subject to these purchases, decreases, pushing their prices upwards and lowering yields. The yield curve of sovereign bonds serves as a "*bedrock benchmark indicator for pricing a vast array of credit instruments and forms of external finance for the private economy*".[39] Lower yields set incentives for investors to move away from government bonds to riskier securities. Banks, which represent the most important investor class in the European economy, follow the same logic and use the additional liquidity to supply the private and corporate sector with loans. The availability of loans leads to higher investments and in that sense to increased production. As a consequence the wages also tend to grow, which enables more consumer spending. This drives up the prices, which in turn should help achieving the ECB's goal of "*inflation of below, but close to, 2%*".[40] This phenomenon can be explained by the portfolio rebalancing effect. Under the PSPP, the original holders of securities are banks and other investors. Once the ECB purchases these securities from them, the government bonds get replaced by cash. Having too much cash at their hands is not profitable, so banks have more incentives to inject the money into the private sector.[41]

[38] Cf. Cour-Thimann and Winkler (2010), p. 2
[39] ECB Economic Bulletin, Issue 1/2015, p. 17
[40] Ibid., p. 17
[41] Cf. https://www.ecb.europa.eu/press/pressconf/2015/html/is150122.en.html, 13.07.2015

The quantitative easing has two major implications on the market: while it certainly increases the money supply available for the broader economy, it also decreases the supply of bonds on market. Bonds, and especially government bonds can be used as collateral in repurchase agreements. In order to support the liquidity of repo markets, the ECB has given a green light for securities lending of those securities being purchased under the PSPP program.[42] By supporting the repo market, the ECB increases the overall market liquidity, thus creating an environment for the quantitative easing being a success. If the QE is actually going to be a success, remains subject to a debate.

[42] https://www.ecb.europa.eu/press/key/date/2015/html/sp150310_1.en.html, 14.07.2015

4. Quantitative easing in the USA

The quantitative easing in the USA was a prompt response of the Federal Reserve to the financial crisis that hit the U.S. economy. The housing bubble was the primary cause of the crisis. The bubble started expanding as early as in 2002, but the early signs were ignored by most market participants. Many renowned economists, including the Nobel Prize winner Robert Shiller, warned the U.S. public repeatedly that the rising house prices were not justified in any way and that a crash will follow soon. The public ear did not listen, leading to an inevitable crash in housing prices in 2006. Even the current Chairwoman of the Fed, Janet Yellen, made a somewhat clumsy statement in a speech in 2005, claiming that the bursting of the housing bubble "*could be large enough to feel like a good-sized bump in the road, but the economy would likely to be able to absorb the shock*"[43]. She has been proven wrong repeatedly during the last few years, leaving enough room for skepticism that she has been the right person to be named the Chairwoman of the most influential central bank in the world.

The QE program was implemented during the term of the Chairman Ben Bernanke. The program was subject to a lot of criticism, mostly because of the fear of hyperinflation and the widening of a social gap between the rich and the poor. However, these fears have not yet been confirmed. The years that follow will show if such a bold monetary policy was a success.

There are four main stages in the U.S. quantitative easing. They are called QE1, QE2, Operation Twist and QE3 and they refer to different time periods when the monetary policy was implemented. While each of these stages aimed at the ultimate goal of achieving monetary and economic stability, they showed some notable differences in terms of size and types of securities that were purchased. The QE1 took place from November 2008 until March 2010. The QE2 was conducted in the period from November 2010 to June 2011. It was followed by the so called Operation Twist or Maturity Extension program, in the time from September 2011 to June 2012. In September 2013 the Fed announced the final stage in the QE program – the QE3.[44] QE3 ended in October 2014. Although there have been certain

[43] http://www.frbsf.org/our-district/press/presidents-speeches/yellen-speeches/2005/october/housing-bubbles-and-monetary-policy/, 20.07.2015
[44] Fawley and Neely (2013), p. 61

speculations that an additional stage (QE4) will be introduced, the Fed has not yet made such announcements.

4.1. QE1

The quantitative easing 1 or QE1 was the first part of a 6 year long journey during which the Fed quadrupled its balance sheet. In September 2008, before Lehman Brothers was declared bankrupt, total assets in Fed's balance sheet were just below $900 billion. By the end of the QE journey in October 2014, the Fed held more than $4.4 trillion worth of assets.

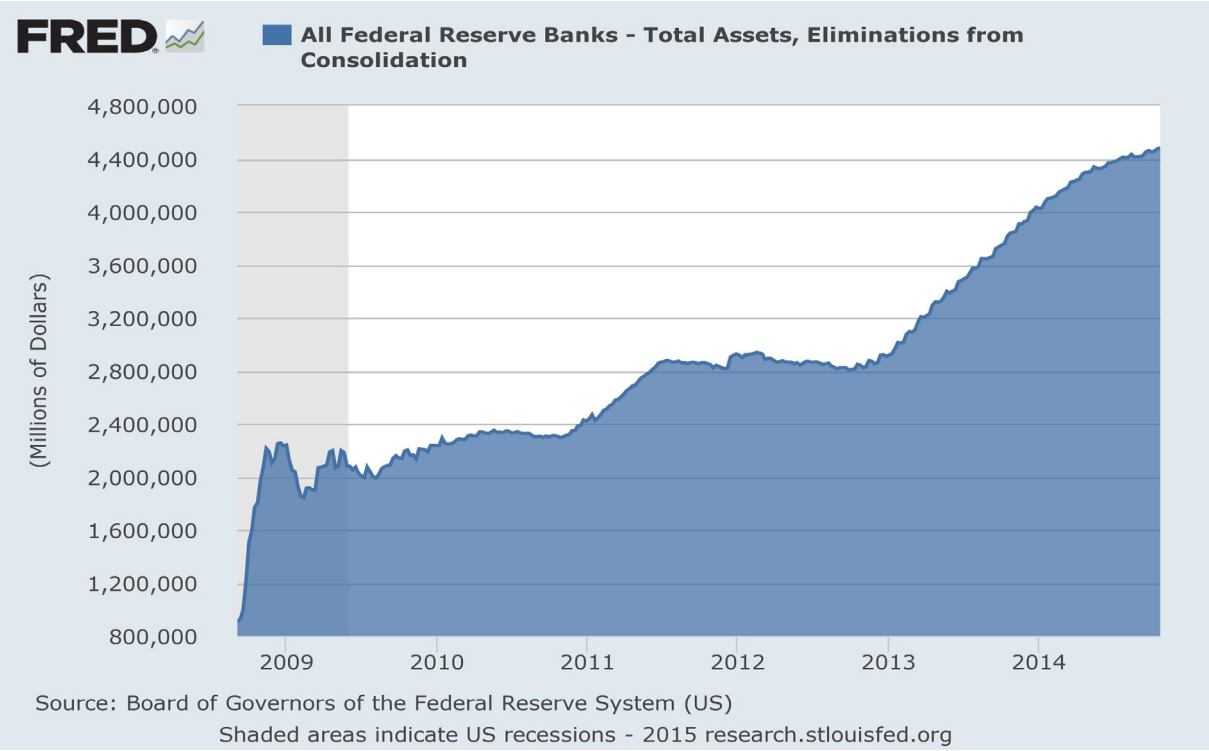

Chart 2. The Federal Reserve total assets from the onset of the crisis in September 2008 until the end of quantitative easing in October 2014

On November 25, 2008 the Fed announced that it would purchase "*up to $100 billion in direct obligations of housing-related government-sponsored enterprises and up to $500 billion in mortgage-backed securities (MBS) backed by Fannie Mae, Freddie Mac, and Ginnie Mae.*"[45] The purchase of these securities was not the first step in confronting the financial turmoil. The Fed conducted the bailing out of several major financial institutions

[45] Monetary Policy Report to the Congress, February 2009, p. 35

through most of 2008, including Bear Sterns, AIG and Citigroup.[46] These actions were accompanied by a lot of criticism from the American public, given the fact that the bailing out used tax payers' money. In the light of these reactions, the Government refused to help out the 4th largest investment bank at the time, the infamous Lehman Brothers. As a consequence, the bank was declared bankrupt on September 15, 2008. The reaction of the market was extremely negative, reflecting in capital losses, confidence issues among investors and the failing of short-term funding.

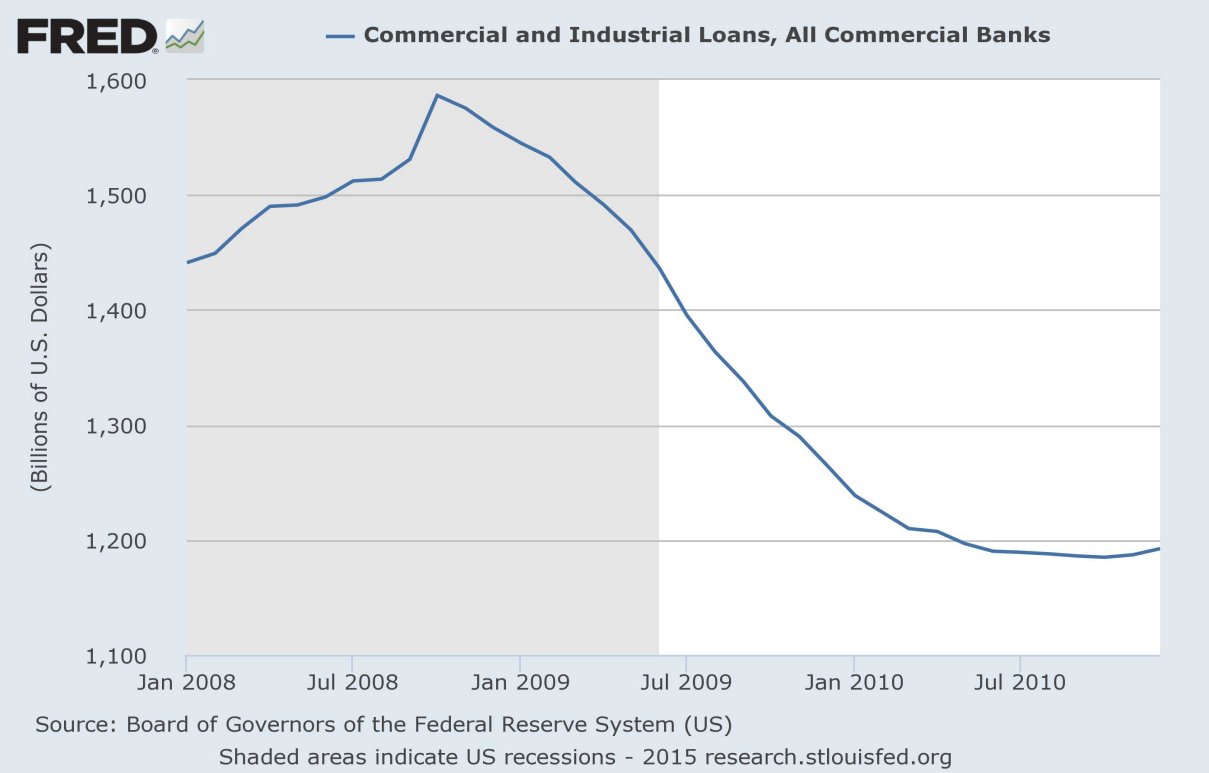

Chart 3. Decrease in bank lending after the bankruptcy of Lehman Brothers

The housing market suffered especially under these circumstances and the house prices kept on falling. In order to help the struggling market, the Fed lowered the federal funds rate, bringing it eventually to 0.25% in December 2008, while establishing facilities to support short-term loans and ease overall credit conditions.[47] Still, the QE1 was not credit easing, which is characterized by injecting money into specific parts of the market which are in need of money. The QE1 was conducted in a way that it increased overall money supply, which was supposed to reach the real economy through portfolio rebalancing channels. Buying

[46] Monetary Policy Report to the Congress , February 2009, p. 50-51
[47] Fawley and Neely (2013), p. 61

securities from state agencies simply meant that the rebalancing effect would take little longer to reach the real economy, than pure borrowing would. Although the Chairman Bernanke tried to pass the program as credit easing[48], this title did not stick long enough to be remembered.[49]

The first round of QE1 did not trigger the reaction the Fed was hoping for, i.e. there was no improvement in economic conditions in the months that followed. Instead, the markets deteriorated further, especially job and housing markets. House prices kept on falling during the last quarter of 2008 and the first quarter of 2009.[50] Under such circumstances, the Fed decided to expand the program further. On March 9, 2009 the Federal Open Market Committee (FOMC) announced that the size of Fed's balance sheet will be increased by additional $750 billion of MBS and $100 billion of agency debt. A novelty in the second phase of QE1 was the purchase of longer-term Treasury securities worth $300 billion.[51]

The overall increase in Fed's balance sheet after QE1 was $1.725 trillion, which makes it the biggest part of the program. QE1 brought some relief to the American economy, since it helped stabilizing consumer spending and housing demand. However, the outlook was far from optimistic. The unemployment rates were still high and the housing prices continued to fall. The falling house prices were one of the major reasons for pronounced reluctance among potential buyers, because they expected the prices to fall further and did not want to enter the market too early.[52]

The announcement made in March was followed by an intermission during which the FOMC proposed no new purchases. Instead, the focus was on the timing of those which have been already announced, with respect to current market conditions.[53]

[48] Speech B. Bernanke, January 2009
[49] Cf. Blinder (2010), p. 465
[50] Cf. Monetary Policy Report to the Congress , February 2009, p. 15
[51] http://www.federalreserve.gov/newsevents/press/monetary/20090318a.htm, 23.07.2015
[52] Cf. Monetary Policy Report to the Congress, July 2009, p. 6-7
[53] http://www.federalreserve.gov/newsevents/press/monetary/20090429a.htm, 23.07.2015

4.2. QE2

Even though economic conditions have improved during the second quarter of 2009, the outlook was still dissatisfying. Despite low interest rates, banks were still unwilling to give out loans, keeping the credit activity at low levels. Taught by bad experiences during the housing bubble aftermath, banks were more careful when assessing the eligibility of potential borrowers. Therefore, the increase in monetary base did not lead to an increase of money available for the real economy. This has caused further disinflationary pressures on the market, thus leading to a decrease in overall productivity. As a direct consequence, the labor market deteriorated, resulting in high unemployment rates. When the unemployment is high, people tend to spend less and save more. So even with all the money being pumped into the economy, the transmission channels did not work as expected and the real stabilizing of the economy did not occur.

As for the house prices, they have been going upwards during the second half of 2009 and the market showed signs of recovery. However, in the light of low wages, the mortgage delinquency rates have risen. Foreclosures were also on the high road, with nearly 1.4 million homes entering the foreclosure during the second half of 2009.[54] Despite favorable financial conditions, there has not been much improvement during the first half of 2010. Economic indicators, such are the GDP, employment rate and business investments remained sluggish and weak.

The announcements coming from the Fed during the second half of 2010 were somewhat inconsistent with each other. In the July issue of Monetary Policy Report to the Congress, there were certain considerations on what tools to use to withdraw the money inserted into the economy during the first phase of quantitative easing. These considerations were made out of fear of hyperinflation. Then on August 10, 2010 the FOMC stated that it will "*keep constant the Federal Reserve's holdings of securities at their current level by reinvesting principal payments from agency debt and agency mortgage-backed securities in longer-term Treasury securities.*" This meant that there would be no further expansions of the Federal Reserve's balance sheet any time soon, nor would it be downsized. However, only half a month later, Bernanke announced in a speech a possibility of further monetary

[54] Cf. Monetary Policy Report to the Congress, February 2010, p. 7

accommodation by the Committee.[55] Speeches and statements released in the weeks that followed only confirmed this possibility and it was a matter of time when a new round of QE would start.

On November 3, 2010 the FOMC announced a further expansion of the Federal Reserve's balance sheet. Subject to the purchase were longer-term Treasury securities. FOMC planned on purchasing $600 billion, at a pace of $75 billion per month. Furthermore, all principal payments from securities holdings would be reinvested in Treasuries as well.[56] The main idea behind the second round of quantitative easing was depressing longer-term interest rates through a portfolio balance channel.[57]

The QE2 differed from QE1 in two main aspects: the size and the purchase structure. The QE1, with its $1.725 trillion, was almost three times as large as the $600 billion worth QE2. While the QE1 was characterized by large-scale purchases of private sector securities – MBS, accompanied by just a fraction invested in Treasuries, the QE2 was all about longer-term Treasury bonds. None of these approaches can be found in a conventional monetary policy, since central banks usually control the money supply by buying or selling short-term securities and thus control short-term interest rates. Long-term rates are commonly viewed as a reflection of investors' expectations. The QE, however, was an attempt of influencing these rates directly. As such, it was subject to a lot of skepticism coming from intellectual as well as from public circles. Lowered bond yields made investors look for investment opportunities elsewhere, i.e. the stock market. This has brought the stock prices almost to the pre-crisis level.[58] Because the trend of rising stock prices has continued during further stages of QE, one could argue that a new stock market bubble is building up.

The QE2 ended in June 2011. It was not a complete bust, but it was far away from something to be content with. The economy showed certain progress, induced by the financial relief, but many indicators still stayed weak. By the end of QE2, it was clear that a new round of monetary action would be needed in order to achieve desired economic projections.

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[55] Cf. http://www.federalreserve.gov/newsevents/speech/bernanke20100827a.htm, 30.07.2015
[56] Cf. http://www.federalreserve.gov/newsevents/press/monetary/20101103a.htm, 30.07.2015
[57] Cf. https://www.creditwritedowns.com/2011/02/unconventional-monetary-policy-and-central-bank-communications.html, 30.07.2015
[58] Cf. http://www.nytimes.com/2014/10/30/upshot/quantitative-easing-is-about-to-end-heres-what-it-did-in-seven-charts.html?_r=1&abt=0002&abg=0, 31.07.2015

4.3. Operation Twist

The Maturity Extension Program and Reinvestment Policy, more often referred to as Operation Twist, was announced on September 21, 2011. The name Operation Twist originated from the fact that this program "twisted" the yield curve. The FOMC decided to start this program to foster quicker economic growth and support inflation, which is consistent with the Committee's mandate. However, this phase of quantitative easing was completely different from the previous two, since no new money was created. Instead, the FOMC decided to sell short-term securities, which were already part of the Fed's balance sheet and use the money to buy longer-term securities. The idea behind this program was to extend the average maturity of securities held by the Fed. This would lead to further downward pressures on long-term interest rates. In order to do so, a decision was made to purchase $400 billion Treasury securities with a maturity ranging from 6 to 30 years, while selling securities with maturities of 3 years and less.[59]

Even though the goal of depressing interest rates was achieved, the effects were not as strong as expected. The economic output was still quite weak. In June 2012 the FOMC decided to extend the program, by purchasing additional $267 billion of securities with remaining maturities between 6 and 30 years, while simultaneously selling securities maturing in 3 years and less. The average maturity of securities held by the Fed was about 120 months by the end of 2012. For comparison, the average maturity of the Fed's Treasuries portfolio was 75 months in September 2011. Even though Operation Twist largely affected interest rates on various instruments, such are home mortgages, corporate bonds and loans[60], it did not help easing conditions on the labor or housing market. The growth was still extremely slow and the Fed was once more faced with the challenge of a new round of quantitative easing.

4.4. QE3

QE3 was the last phase in the quantitative easing saga conducted by the Federal Reserve. While most economic indicators improved, the unemployment rate remained high. In January 2012 the unemployment rate was 8.25%, which represented an important improvement

[59] Cf. http://www.federalreserve.gov/newsevents/press/monetary/20110921a.htm, 01.08.2015
[60] Cf. http://www.federalreserve.gov/monetarypolicy/maturityextensionprogram-faqs.htm. 01.08.2015

compared to the rate of 9% in December the previous year.[61] However, this improvement did not continue through the rest of the year and the labor market showed little to no progress. High unemployment rates also meant lower wages in general. This directly affected the housing sector, keeping the credit conditions tight for most borrowers. As a consequence, there was a decreased number of new mortgage applications.[62]

Therefore, the QE3 was mostly aimed at elevating the sluggish employment rates, thus bringing the economy back on its track. Unlike the previous three phases of the program, QE3 was focused on the real sector of the economy.

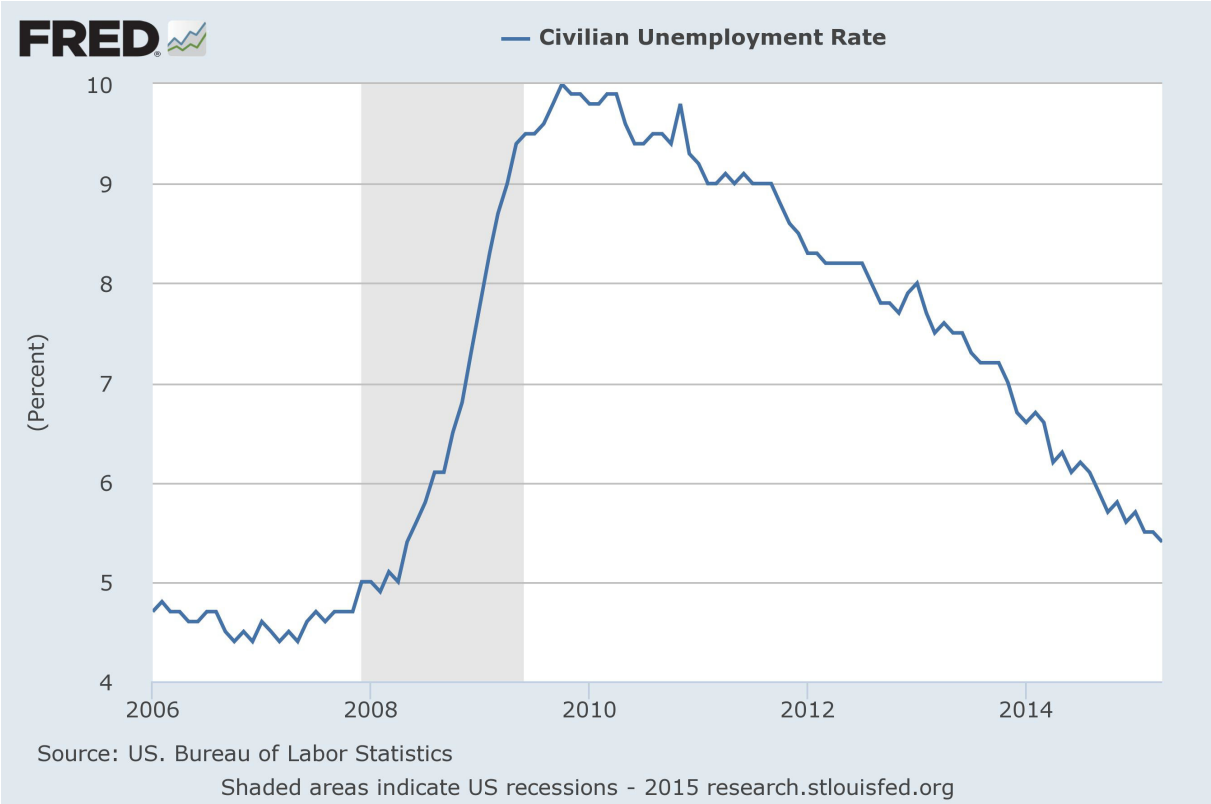

Chart 4. U.S. unemployment rate in the years before the crisis through the end of QE in October 2014

The FOMC announced on September 22, 2012 a new round of financial accommodation through monetary policy. It was decided that the FOMC will purchase $40 billion worth MBS securities per month. Rather than determining a fixed amount that should be achieved within a certain timeframe (as it was the case in previous three rounds), the QE3 was

[61] Cf. Monetary Policy Report to the Congress, February 2012, p. 17
[62] Cf. Monetary Policy Report to the Congress, July 2012, p. 2

designed for the purchases to be conducted as long as the labor market shows no signs of improvement.[63] Three months later, on December 12, 2012, the FOMC announced that it would continue buying longer-term Treasury securities after the Maturity Extension Program has ended. However, unlike the purchases under the Maturity Extension Program, the announced purchases would not be neutralized by selling short-term securities. This meant that the monetary base would be expanded further.[64] Fed decided to purchase $45 billion Treasuries per month.

In the months that followed, market conditions improved. Far from being able to say that the economy returned to its pre-crisis state, it was still possible to observe major improvements. The unemployment rate declined, inflation was moving towards its longer-term objective and business investments together with consumer spending rose.

Chart 5. 5-year inflation expectation in the years before the crisis through the end of QE in October 2014

In the light of these positive developments, the Fed decided that it was time to start cutting back on monetary expansion. The so called "tapering process" was announced on December 18, 2013. The FOMC decided that it would be purchasing $35 billion MBS securities per

[63] Cf. http://www.federalreserve.gov/newsevents/press/monetary/20120913a.htm, 03.08.2015
[64] Cf. Fawley and Neely (2012), p. 75-76

month instead of $40 billion and $40 billion Treasuries instead of $45 billion.[65] The tapering lasted from January until October 2014, when the quantitative easing in the USA officially ended.

There is no consensus on the effect of QE to American economy. While Fed representatives are certain that the program was a success, the criticism coming from markets, the government and the public shows that this opinion is not shared by everyone.

[65]Cf. http://www.federalreserve.gov/newsevents/press/monetary/20131218a.htm, 03.08.2015

5. Case-Shiller Home Price Indices

The Standard & Poor's Case-Shiller Home Price Indices serve as a measurement of change of home prices in the United States. They are updated on a monthly basis, covering 20 major metropolitan areas. There are multiple Case-Shiller indices (CSIs), with the national home price index, 10-city composite index and 20-city composite index being the most important ones.[66]

Index	Index Description	Metropolitan Statistical Area
BOXR	Greater Boston	Boston-Cambridge-Quincy, MA-NH
CHXR	Chicago Metropolitan Area	Chicago-Naperville-Joliet, IL
DNXR	Denver-Aurora Metropolitan Area	Denver-Aurora, CO
LVXR	Las Vegas Metropolitan Area	Las Vegas-Paradise, NV
LXXR	Greater Los Angeles	Los Angeles-Long Beach-Santa-Ana, CA
MIXR	South Florida Metropolitan Area	Miami-Fort Lauderdale - Pompano Beach, FL
NYXR	New York Metropolitan Area	New York City Area
SDXR	San Diego County, California	San Diego-Carlsbad-San Marcos, CA
SFXR	San Francisco	San Francisco-Oakland-Fremont, CA
WDXR	Washington Metropolitan Area	Washington-Arlington-Alexandria, DC-VA-MD-WV

Table 2. 10-city composite index CSXR (Source: Standard & Poor's and Yahoo Finance)

[66] Cf. S&P/Case-Shiller Home Price Indices Methodology (2015), p. 3

Index	Index Description	Metropolitan Statistical Area
ATXR	Atlanta Metropolitan Area	Atlanta-Sandy Springs-Marietta, GA
CRXR	Charlotte Metropolitan Area	Charlotte-Gastonia-Concord, NC-SC
CEXR	Greater Cleveland	Cleveland-Elyria-Mentor, OH
DAXR	Dallas-Fort Worth Metroplex	Dallas-Fort Worth-Arlington, TX
DEXR	Metro Detroit	Detroit-Warren-Livonia, MI
MNXR	Minneapolis-Saint Paul	Minneapolis-St. Paul-Bloomington, MN-WI
PHXR	Phoenix Metropolitan Area	Phoenix-Mesa-Scottsdale, AZ
POXR	Portland Metropolitan Area	Portland-Vancouver-Beaverton, OR-WA
SEXR	Seattle Metropolitan Area	Seattle-Tacoma-Bellevue, WA
TPXR	Tampa Bay Area	Tampa-St. Petersburg-Clearwater, FL

Table 3. 10 Additional Metro Areas, together with the areas in Table 2 creating the 20-city composite index SPCS20R (Source: Standard & Poor's and Yahoo Finance)

While the composites (10-city and 20-city composite index) measure the value of single-family homes within a constituent metro area, the national index tracks the value of single-family homes within the United States.[67] The calculation of the CSIs relies on the "repeat-sales method", which captures data on single-family homes that have been sold at least twice. This method was developed by Karl E. Case and Robert Shiller in the 1980s.[68] Since the CSIs consider only price changes of single-family homes caused by normal price dynamics, many factors that affect the prices, such are new construction, refurbishing etc. are excluded from

[67] Cf. S&P/Case-Shiller Home Price Indices Methodology (2015), p. 10 and p. 29
[68] Cf. S&P/Case-Shiller Home Price Indices Methodology (2015), p. 3-4

the calculation.[69] The CSIs trace the home prices back to 1890 and as such, these indices represent one of the longest series on asset prices.[70] When calculating the indices, it is necessary to set reference periods and to calculate aggregate values for these periods. The reference periods for the 10-city composite index are January 1990, January 2000 and March 2014. The reference periods for 20-city composite index are January 2000 and March 2014. For the national index, the reference periods are set at January 1990, January 2000 and January 2010.[71]

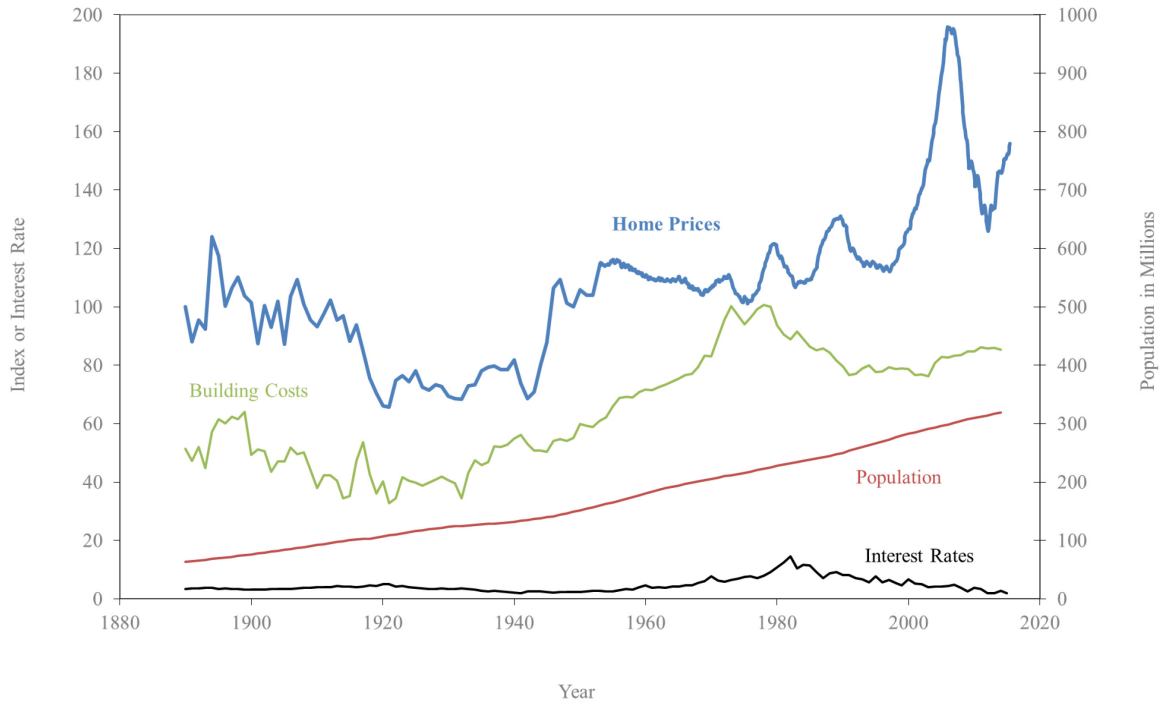

Chart 6. US Home Prices 1890-present[72] (Source: Online Data Robert Shiller)

The CSIs calculations are based on price changes between two arms-length sales of the same single family home.[73] An arm's length transaction is characterized by a consensus of the buyer and seller "*to act in their best economic interest when agreeing upon a price*".[74] Transaction data are collected from deed records. Then a previous sale of the same single-family home is identified and the two transactions are paired into a "sales pair".[75]

[69] Cf. S&P/Case-Shiller Home Price Indices Methodology (2015), p. 5
[70] http://www.econ.yale.edu/~shiller/data.htm, 20.08.2015
[71] Cf. S&P/Case-Shiller Home Price Indices Methodology (2015), p. 10 and p. 29
[72] The data on Robert Shiller online-site are updated on a monthly basis. The chart was downloaded from the site on September 1, 2015.
[73] Cf. Moody's Analytics, Case-Shiller House Price Index FAQs (2013), p. 1
[74] S&P/Case-Shiller Home Price Indices Methodology (2015), p. 19
[75] Cf. Moody's Analytics, Case-Shiller House Price Index FAQs (2013), p. 1

In order for the transactions to be representative of the market, following transactions are excluded from the sales pairs:

1. Non-arms-length transactions (for example, property transfers between family members),
2. Transactions where the property type designation is changed,
3. Suspected data errors that indicate unrealistic values and ominous transactions.[76]

The CSIs also include foreclosures, which must be filtered by the same rules as any other sales transaction.[77] They are constructed in a way that they reflect all home price changes in a particular geographic area. When price changes of individual homes differ from changes in the market as a whole, due to factors that affect only particular homes (increase or decrease of quality, new installments, etc.), the index methodology applies weighting to sales pairs. Each change is weighted differently, according to its statistical distribution in a certain geographic region. Weighting schemes include: price anomalies (due to rebuilding, neglect or recording errors), high turnover frequency (homes that sell more than once within six months), time interval adjustments (it is assumed that in sale pairs of longer intervals a house undergoes more physical changes) and initial home value.[78] Excluded from the index are newly constructed homes, until they are sold at least twice.[79]

All the sales pairs used in the indices construction are divided into price tiers. There are three tiers: low-tier, middle-tier and upper tier. In order to get to the same number of sales in each tier, price breakpoints between the tiers are computed using all sales in each period. When allocating homes into tiers, only the first sale is relevant and the second one is ignored.[80]

[76] Cf. S&P/Case-Shiller Home Price Indices Methodology (2015), p. 6
[77] Cf. Moody's Analytics, Case-Shiller House Price Index FAQs (2013), p. 1
[78] Cf. S&P/Case-Shiller Home Price Indices Methodology (2015), p. 7
[79] Cf. S&P/Case-Shiller Home Price Indices Methodology (2015), p. 19
[80] Cf. S&P/Case-Shiller Home Price Indices Methodology (2015), p. 20

6. Data analysis

In order to determine what impact the quantitative easing had on major U.S. economic indicators, I applied the regression analysis on selected data. The regression analysis is a statistical tool which investigates if there is a causal relationship between variables and how strong this relationship is.[81] In the case of simple linear regression, which was used in this thesis, there are only two variables: one independent or explanatory variable and one dependent variable. The regression analysis shows how the dependent variable changes if the independent variable is changed. In other words, it shows how much of the variation of the dependent variable around the mean is explained by the independent variable. All the data are taken from the Federal Reserve's website.

I analyzed the effects of the QE, i.e. the increase of the monetary base, on four economic indicators: the house prices, interest rates, the rate of unemployment and the inflation. The independent variable in the regression analysis is the monetary base. The goal of the QE was easing financial conditions through raising the money supply. This was primarily achieved by increasing the monetary base. "*The monetary base is defined as the sum of currency in circulation and reserve balances (deposits held by banks and other depository institutions in their accounts at the Federal Reserve).*"[82] The overall U.S. money supply is much larger, but other monetary aggregates are not relevant in terms of the conducted regression analysis. In the early stages of the QE the Fed was purchasing agency securities and gradually introducing Treasuries. As it can be seen in the following table, which represents a simplified version of the Fed's balance sheet[83], any increase on the assets side has to be offset by either increasing the monetary base or the capital. In the case of the QE, this change in the Fed's balance sheet was primarily reflected in an increase of bank reserves and Treasury deposits.

Assets	Liabilities and Net Worth
Treasury securities	Currency
Less-liquid assets	Bank reserves
Loans	Treasury deposits
	Capital

Table 4. Simplified balance sheet of the Federal Reserve

[81] Cf. Sykes (1993), p. 1
[82] http://www.federalreserve.gov/faqs/money_12845.htm, 10.09.2015
[83] Blinder (2010), p. 467

In the early stages of QE, the Fed was changing its assets portfolio by purchasing high-risk MBS. This change was therefore occurring on the assets side. By taking these securities from the market, the Fed tried to lower the risk premium. However, in the later stages of QE the focus was on the liabilities side, when the Treasury started selling its securities, i.e. borrowing ahead of its needs.[84]

For the graphical analysis of the house price developments, I observed data from May 2006 until April 2015. I chose this time frame because it shows prices before, during and after the financial crisis. This way it is possible to see how they changed due to the distress on the financial markets as well as due to the different stages in QE. However, in the case of the regression analysis I used data from November 2008 until October 2014 for the explanatory variable, i.e. the period during which the QE took place. The Fed's objectives before the financial crisis were an overall price stability and moderate long-term interest rates. The monetary policy was not used to affect specific markets, as the QE did. Before the QE started, the changes in the monetary base were minimal, since the Fed did not engage in any unconventional monetary interventions. I considered the fact that the observed economic indicators do not adjust automatically to the changes in the explanatory variable. Thus, I took into account three possible time lag scenarios: a time lag of one, three and six months. I used the monthly-average data.[85]

6.1. The effects of QE on house prices

First, I analyzed the effects of QE on house prices. I used data on futures based on the S&P / Case-Shiller Indices. Futures are financial contracts that obligate the holder to buy or sell a certain commodity or financial asset at a predetermined price and a predetermined date.[86] Since they are derivative financial instruments, their value is directly affected by the value of the underlying. Whenever the price of the underlying is rising or expected to rise, the value of the futures also increases, and vice versa. Futures are therefore a good estimate of the price movements of the underlying. Futures serve as a good protection against negative market

[84] Cf. Blinder (2010), p. 467-468
[85] The complete data sets and regression analyses are available under the following links:
https://dl.dropboxusercontent.com/u/61027229/CSI%20futures.xlsx
https://dl.dropboxusercontent.com/u/61027229/USD%203m%20LIBOR.xls
https://dl.dropboxusercontent.com/u/61027229/USD%2012m%20LIBOR.xls
https://dl.dropboxusercontent.com/u/61027229/Unemployment.xls
https://dl.dropboxusercontent.com/u/61027229/Inflation.xls
[86] Cf. http://www.nasdaq.com/investing/glossary/f/futures-contract, 12.09.2015

developments. The S&P / CSI futures are traded on the Chicago Mercantile Exchange, which is a financial and commodity derivative exchange. Unlike direct ownership, these futures represent a low cost alternative to exposure to real estate. The exchange code for these futures is XCME.

6.1.1. Graphical analysis

I conducted a graphical analysis on the data, which enables a direct comparison of the developments in the monetary base and S&P / CSI futures prices. The red lines represent the beginning of the QE.

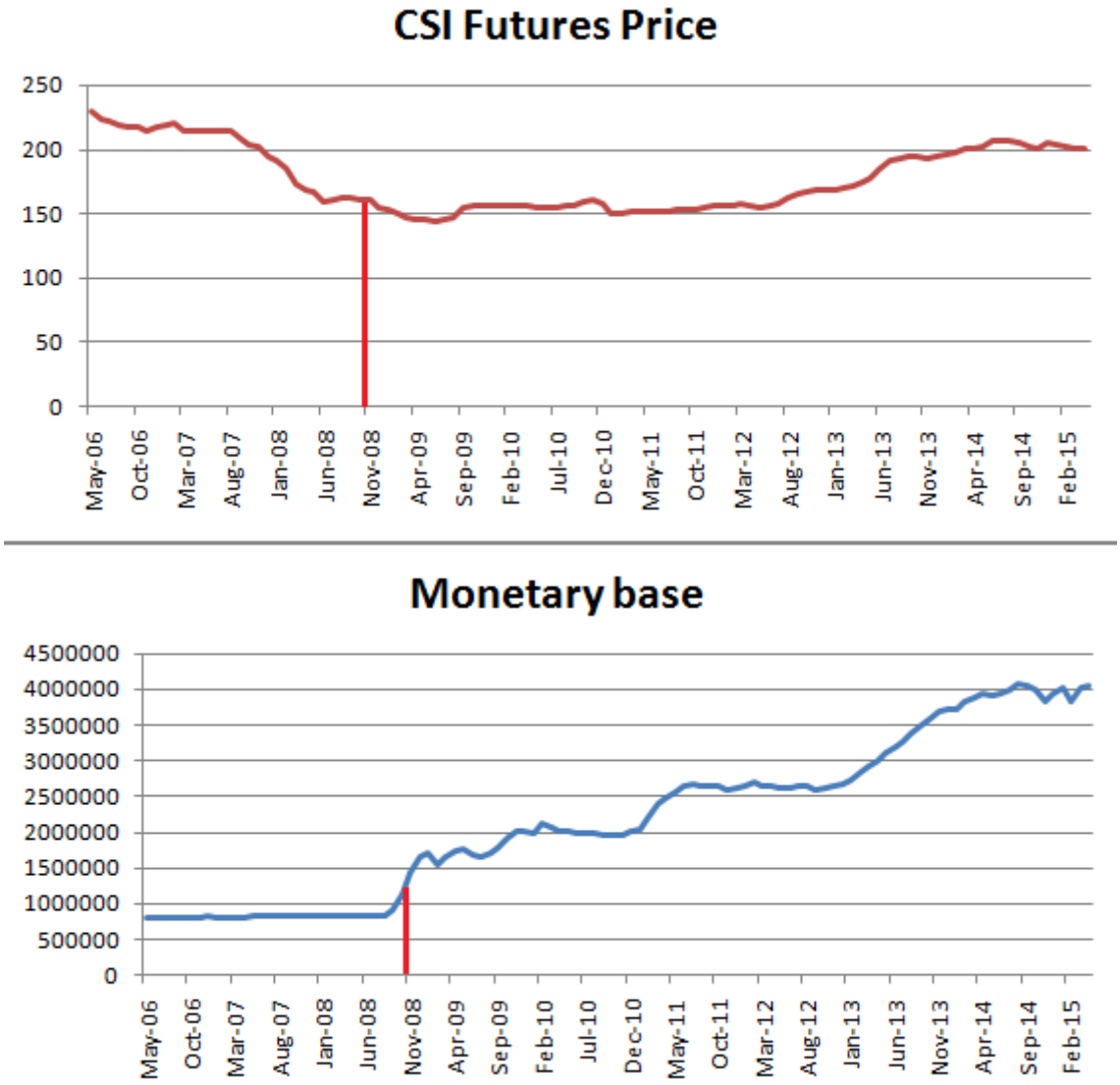

Chart 7. Comparison in changes of the S&P / CSI futures prices and the monetary base form May 2006 until April 2015(Source: CME Group and Federal Reserve)

As it can be seen in the charts, the futures prices did not respond immediately to the increase in the monetary base. Moreover, they stopped falling almost a year later. Only in later stages of the QE did the prices show a similar movement pattern as the monetary base. This can be explained by the aforementioned adjustment time lag. By the end of QE the prices almost reached the pre-crisis levels. However, the exact relationship between these variables has to be examined via the regression analysis.[87]

6.1.2. One-month time lag

The first scenario in the regression analysis takes into account a time lag of one month. Therefore, I observed the explanatory variable from November 2008 until October 2014 and the dependent variable from December 2008 until November 2014. The number of observations is 72. I analyzed the data at a confidence level of 95%.

Regression Statistics	
Multiple R	**0.920888083**
R Square	**0.848034862**
Adjusted R Square	0.845863932
Standard Error	7.600619805
Observations	**72**

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	22566.58259	22566.58259	390.632	2.36373E-30
Residual	70	4043.8595	57.76942142		
Total	71	26610.44209			

	Coefficients	*Standard Error*	*t Stat*	***P-value***	*Lower 95%*	*Upper 95%*
Intercept	**104.2643275**	3.293350957	31.65903934	**3.23E-43**	97.69594625	110.832709
X Variable 1	**2.38856E-05**	1.20852E-06	19.76441157	**2.36E-30**	2.14753E-05	2.6296E-05

Table 5. Summary output for the regression analysis in the one-month time lag scenario (S&P / CSI futures prices)

[87]The complete data sets and regression analysis are available under the following link: https://www.dropbox.com/s/v9aseip7cck94f0/CSI%20futures.xlsx?dl=0

Since I conducted a simple linear regression analysis, the second part of the summary output (ANOVA) is not relevant for the interpretation. The correlation coefficient Multiple R shows how strong the linear relationship between the variables is. Since it is the absolute value of the correlation coefficient, it can take values between 0 and 1. With a value of more than 0.92, the correlation coefficient implies strong linear dependence. The variables are almost perfectly positively correlated, which is implied by the regression line. This means that an increase in monetary base leads to an increase in futures prices. The R Square (R^2) is the coefficient of determination. It shows how many points percentage-wise fall on the regression line. In this case, more than 84% of the data points are on the regression line. This means that the regression model explains more than 84% of the variability of futures prices around the mean. Small P-values (3.23E-43 for the intercept and 2.36E-30 for the explanatory variable) imply statistical significance of the results. In other words, the null hypothesis that there is no relationship between the variables can be fully rejected.

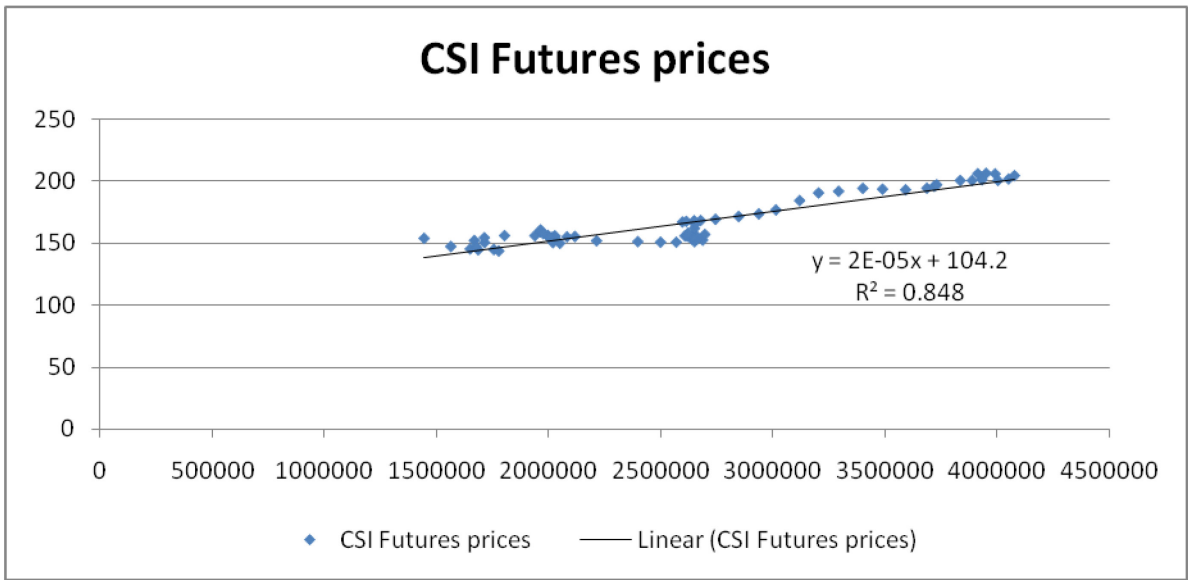

Chart 8. Scatter plot of the regression analysis in the case of one-month time lag scenario (S&P / CSI futures prices)

The regression line is: y=2.38E-05x+104.26, which means that for each unit increase in the monetary base the futures price increases with 104.2 units. As it can be seen in the scatter plot, the futures prices are more scattered around the regression line in the early stages of QE. In the later stages the prices tend to lie on the line.

6.1.3. Three-month time lag

In the case of the three-month time lag I observed the dependent variable from February 2009 until January 2015. The time-frame for the explanatory variable remains fixed from November 2008 until October 2014. The number of observations is 72. The confidence level is at 95%.

Regression Statistics	
Multiple R	**0.92411899**
R Square	**0.85399592**
Adjusted R Square	0.85191014
Standard Error	7.75653122
Observations	**72**

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	24633.37502	24633.38	409.4386	5.8058E-31
Residual	70	4211.464361	60.16378		
Total	71	28844.83939			

	Coefficients	*Standard Error*	*t Stat*	***P-value***	*Lower 95%*
Intercept	**102.862991**	3.360907423	30.60572	**2.95E-42**	96.1598721
X Variable 1	**2.4955E-05**	1.23331E-06	20.23459	**5.81E-31**	2.2496E-05

Table 6. Summary output for the regression analysis in the three-month time lag scenario(S&P / CSI futures prices)

The Multiple R is 0.924. It is slightly larger than in the previous case, implying an even stronger linear relationship. The R^2 is approximately 0.853, meaning that around 85.3% of the data lies on the regression line. The three-month time lag model explains the dependent variable better than the one-month time lag model. The P-values are in this case too well below the 0.05 limit, above which there is no statistical significance.[88] Even though they are slightly larger than in the one-month time lag model, this increase is negligible. The

[88] Typically, small P-values, i.e. below 0.05 indicate strong statistical significance of the results. This leads to rejection of the null hypothesis. P-values that are above 0,05 indicate weak evidence against the null hypothesis, leading to rejection of the alternative hypothesis.

regression line is: y=2.49E-05x+102.86. As it can be seen in the scatter plot, the data are closer to and more concentrated on the regression line.

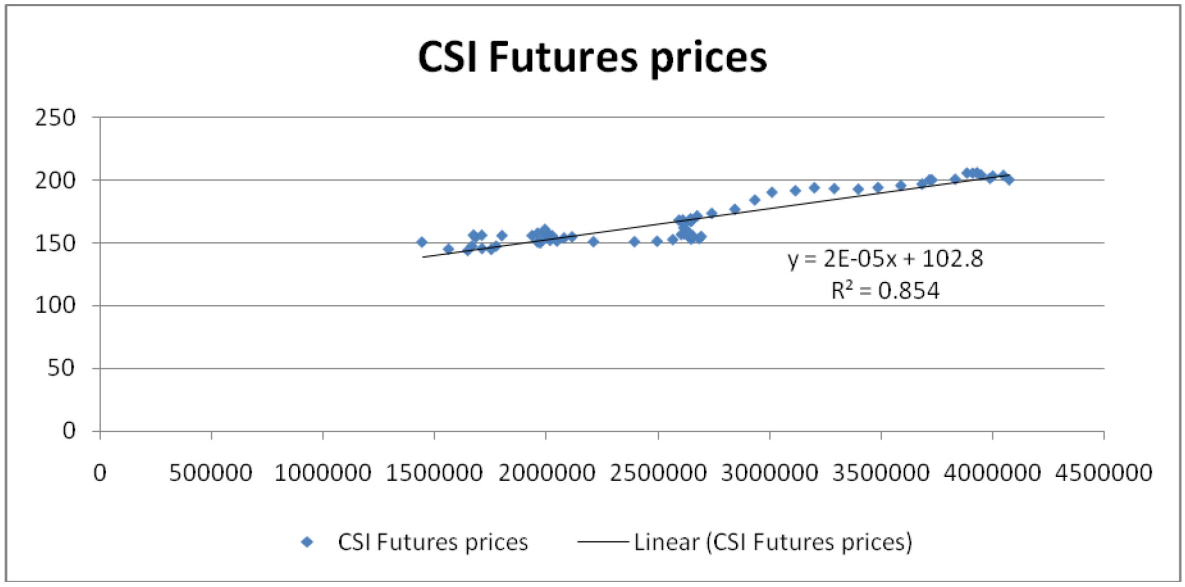

Chart 9. Scatter plot of the regression analysis in the case of three-month time lag scenario (S&P / CSI futures prices)

6.1.4. Six-month time lag

For the third scenario I assumed a time lag of six months for the dependent variable. Therefore, I made the observation from May 2009 until April 2015. The independent variable is observed in the period from November 2008 until October 2014. The number of observations remains 72 and the confidence level is at 95%.

Regression Statistics	
Multiple R	**0.91440695**
R Square	**0.83614008**
Adjusted R Square	0.83379922
Standard Error	8.43895298
Observations	**72**

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	25437.91218	25437.91	357.1941	3.327E-29
Residual	70	4985.114921	71.21593		
Total	71	30423.0271			

	Coefficients	*Standard Error*	*t Stat*	***P-value***	*Lower 95%*	*Upper 95%*
Intercept	**103.997912**	3.656600987	28.44114	**3.43E-40**	96.705051	111.29077
X Variable 1	**2.536E-05**	1.34181E-06	18.89958	**3.33E-29**	2.268E-05	2.804E-05

Table 7. Summary output for the regression analysis in the six-month time lag scenario (S&P / CSI futures prices)

In the case of a six-month time lag, the correlation coefficient (Multiple R) is 0.914. Even though the positive linear relationship is evidently still strong, its strength actually *decreased* compared to previous two scenarios. The R^2 is 0.836 and it also decreased, meaning that in a six-month time lag model "only" 83.6% of the data points lie on the regression line. This change can be seen in the scatter plot as well, since the data points are more dispersed around the regression line. The regression line is: y=2.53E-05x+103.99. The P-values are below the 0.05 limit, implying statistical significance of the model.

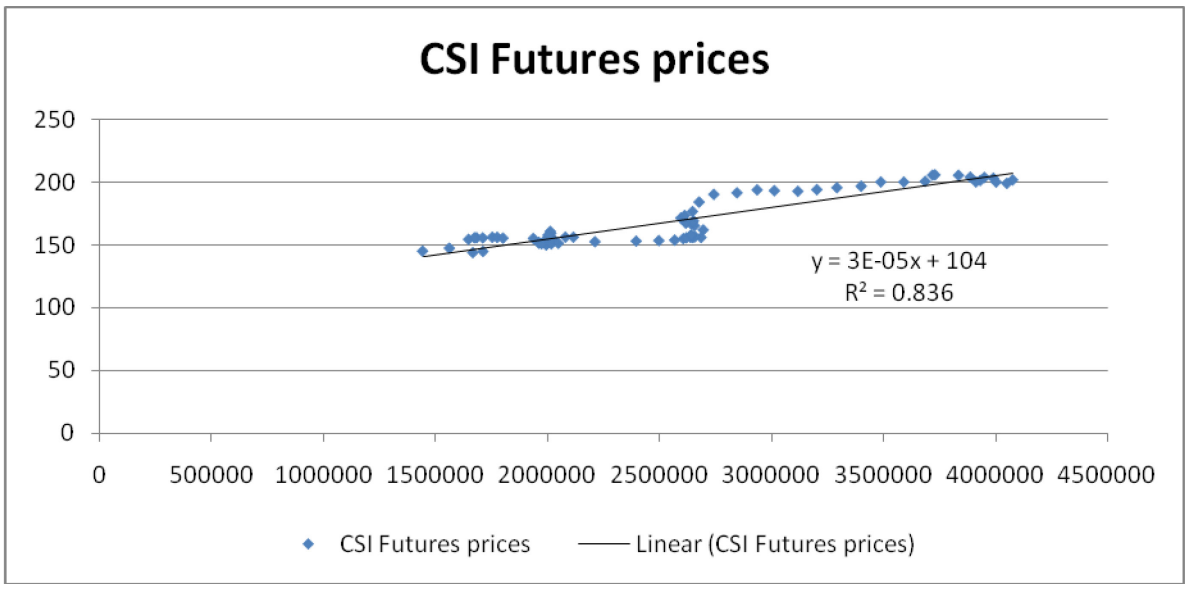

Chart 10. Scatter plot of the regression analysis in the case of six-month time lag scenario (S&P / CSI futures prices)

6.2. The effects of QE on interest rates

One of the main goals of quantitative easing was lowering interest rates and thus making credit more affordable for potential borrowers. Since the short-term interest rates were already brought down to their historic low by the Fed in the last months of 2008, the goal was lowering longer-term interest rates. Longer-term interest rates do not only incorporate monetary policy effects on these rates, but also investors' future expectations. In this thesis I investigated the effects of QE on the 3-month and 12-month USD LIBOR rates.

LIBOR is the acronym for London Interbank Offered Rate. It is a benchmark interest rate at which banks lend money to each other. The loans can have different maturities: overnight, one week, one month, two months, three months, six months and one year. The LIBOR is based on five of the most important world currencies: U.S. dollar (USD), Euro (EUR), pound sterling (GBP), Japanese yen (JPY) and Swiss franc (CHF).[89] LIBOR represents the average rate at which banks are ready to lend money. It is calculated and published on a daily basis. As a benchmark interest rate, LIBOR is used by banks in setting rates for debt intsruments, mortgages, student loans and derivative instruments, such are the credit default swaps.[90] The USD LIBOR is the average interest rate at which selected banks are willing to lend to each other in American dollars.

The 2008 financial crisis brought great distress to the credit markets. Banks were unwilling to lend to each other and the LIBOR rates rose significantly. Although the federal funds rate was cut to 0.25% in December 2008, this did not reflect on the interbank lending. The LIBOR is usually slighlty higher than the federal funds rate, but in December 2008 the LIBOR was 1.82% as in contrast to the extremely low federal funds rate. The subprime-mortgage crisis made the banks more cautious, since they did not want to accept "poisonous" MBS securities as collateral. Instead, they started hoarding cash. The Federal Reserve tried to change this trend by providing the banks with even more free money, buying off their portfolios.[91] It is important to note that the LIBOR is more than an American national issue, since it is affected by developments in economies outside the USA.

[89] Cf. http://www.investopedia.com/terms/l/libor.asp, 14.09.2015
[90] Cf. http://useconomy.about.com/od/glossary/g/LIBOR.htm, 14.09.2015
[91] Cf. http://useconomy.about.com/od/glossary/g/LIBOR.htm, 15.09.2015

For the purpose of investigating the relationship between the increased monetary base and the USD LIBOR rate, I conducted a regression analysis for these variables. As in the case of house prices, I assumed three different time lag scenarios of one, three and six months.

6.2.1. 3-month USD LIBOR rate

6.2.1.1. One-month time lag

In the first scenario with a time lag of one month, I observed the data on the explanatory variable (the monetary base) from November 2008 until October 2014, while the dependent variable, the USD 3-month LIBOR, has been observed in the period from December 2008 until November 2014. The number of observations is 72. The confidence level is at 95%. I observed monthly-average data for both variables. Both data sets were taken from the Federal Reserve database.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	**0.515953**
R Square	**0.266207**
Adjusted R Square	0.255725
Standard Error	0.24789
Observations	**72**

ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.560502	1.560502	25.3948	3.51E-06
Residual	70	4.301476	0.06145		
Total	71	5.861977			

	Coefficients	*Standard Error*	*t Stat*	***P-value***	*Lower 95%*	*Upper 95%*
Intercept	**0.926825**	0.107411	8.628776	**1.27E-12**	0.712601	1.14105
X Variable 1	**-2E-07**	3.94E-08	-5.03933	**3.51E-06**	-2.8E-07	-1.2E-07

Table 8. Summary output for the regression analysis in the one-month time lag scenario (USD 3-month LIBOR)

The results of the regression analysis suggest weak correlation between the variables. The Multiple R is only 0.515, which implies a rather weak linear relationship. The coefficient of determination suggests that only 26.62% of the data points lie on the regression line. Even though the P-values are sufficiently low, indicating statistical significance, the model fails to fully explain the variability of the dependent variable around the mean. This means that other factors outside the model have influenced the LIBOR rate. Since LIBOR is a matter in international banking, these factors are often not controlled by the Fed.[92]

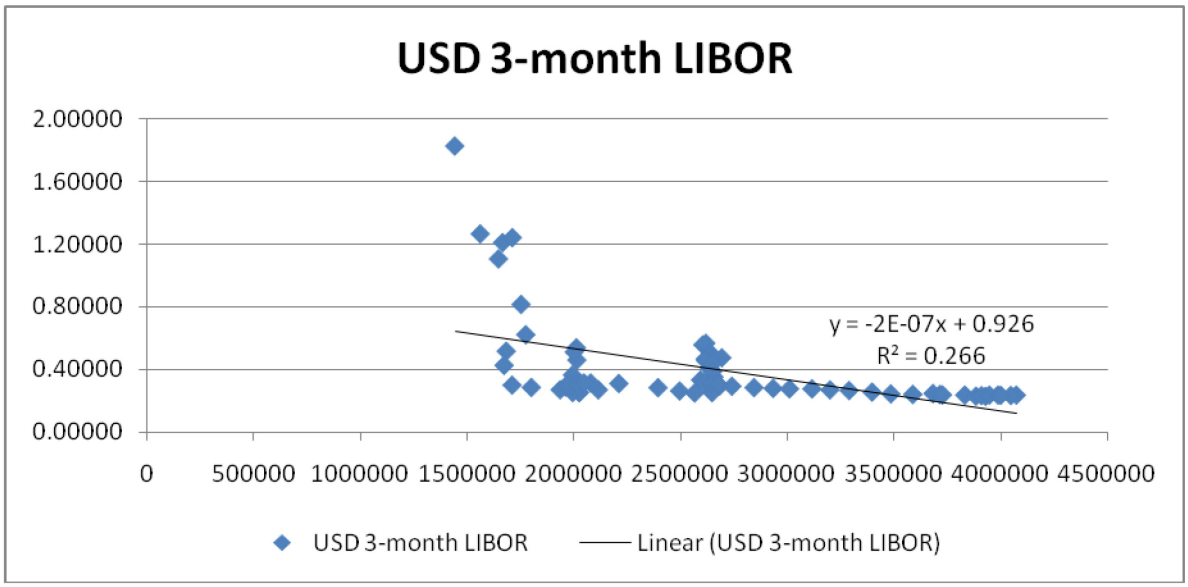

Chart 11. Scatter plot of the regression analysis in the case of one-month time lag scenario (USD 3-month LIBOR)

The regression line is described by: y=-2E-07x+0.926. The negative slope suggests a negative correlation between the variables, i.e. an increase in the explanatory variable leads to a decrease in the dependent variable. This is consistent with the notion than an increase in the money supply depresses the interest rates.

6.2.1.2. Three-month time lag

In the three-month time lag model, I observed that data on USD 3-month LIBOR from February 2009 until January 2015 et ceteris paribus.

[92] E.g. the 2012 LIBOR scandal cause by English banks.

Regression Statistics	
Multiple R	**0.475574**
R Square	**0.22617**
Adjusted R Square	0.215115
Standard Error	0.186532
Observations	**72**

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.711859	0.711859	20.45917	2.42E-05
Residual	70	2.43559	0.034794		
Total	71	3.147449			

	Coefficients	*Standard Error*	*t Stat*	***P-value***	*Lower 95%*	*Upper 95%*
Intercept	**0.722458**	0.080824	8.938622	**3.43E-13**	0.561259	0.883657
X Variable 1	**-1.3E-07**	2.97E-08	-4.52318	**2.42E-05**	-1.9E-07	-7.5E-08

Table 9. Summary output for the regression analysis in the three-month time lag scenario (USD 3-month LIBOR)

The Multiple R (0.475) is smaller than in the previous case, meaning that the correlation between the variables is even weaker. Furthermore, the R^2 of only 0.226 suggests that no more that 22.6% of the data points lie on the regression line. The regression line is: y=-1.3E-07x+0.722.

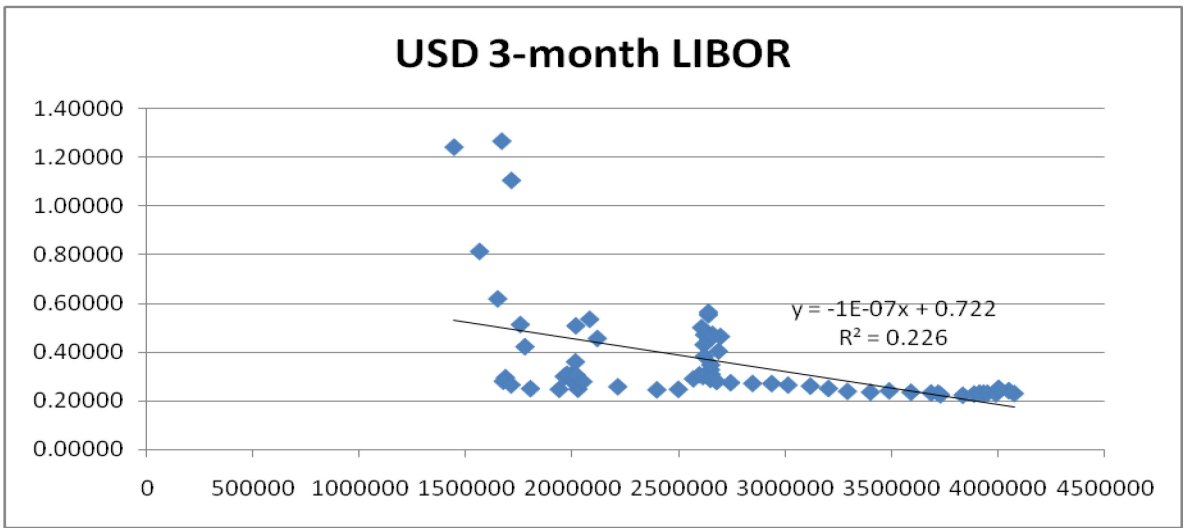

Chart 12. Scatter plot of the regression analysis in the case of three-month time lag scenario (USD 3-month LIBOR)

6.2.1.3. Six-month time lag

In the third case scenario with a time lag of six months, the data on the dependent variable were observed from May 2009 until April 2015. Other variables are held constant. The regression is conducted at a confidence level of 95%.

Regression Statistics	
Multiple R	**0.404616**
R Square	**0.163714**
Adjusted R Square	0.151767
Standard Error	0.107386
Observations	**72**

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.158023	0.158023	13.7034	0.000423
Residual	70	0.807218	0.011532		
Total	71	0.965241			

	Coefficients	*Standard Error*	*t Stat*	***P-value***	*Lower 95%*	*Upper 95%*
Intercept	**0.497341**	0.04653	10.68856	**2.33E-16**	0.40454	0.590143
X Variable 1	**-6.3E-08**	1.71E-08	-3.70181	**0.000423**	-9.7E-08	-2.9E-08

Table 10. Summary output for the regression analysis in the six-month time lag scenario (USD 3-month LIBOR)

In this case, the Multiple R is 0.404, suggesting that after a time lag of six months the correlation between the variables has weakened further. Moreover, only 16.37% of the data points lie on the regression line. The P-values imply a statistical significance of the results, since they are below the 0.05 limit. The regression line is described by: y=-6.3E-08x+0.497. This model is a bad estimate of the developments of the dependent variable.[93]

[93] In the interpretation part of this thesis, the results will be linked to other economical factors outside this model. However, those relationships will only be discussed theoretically, without designing new models.

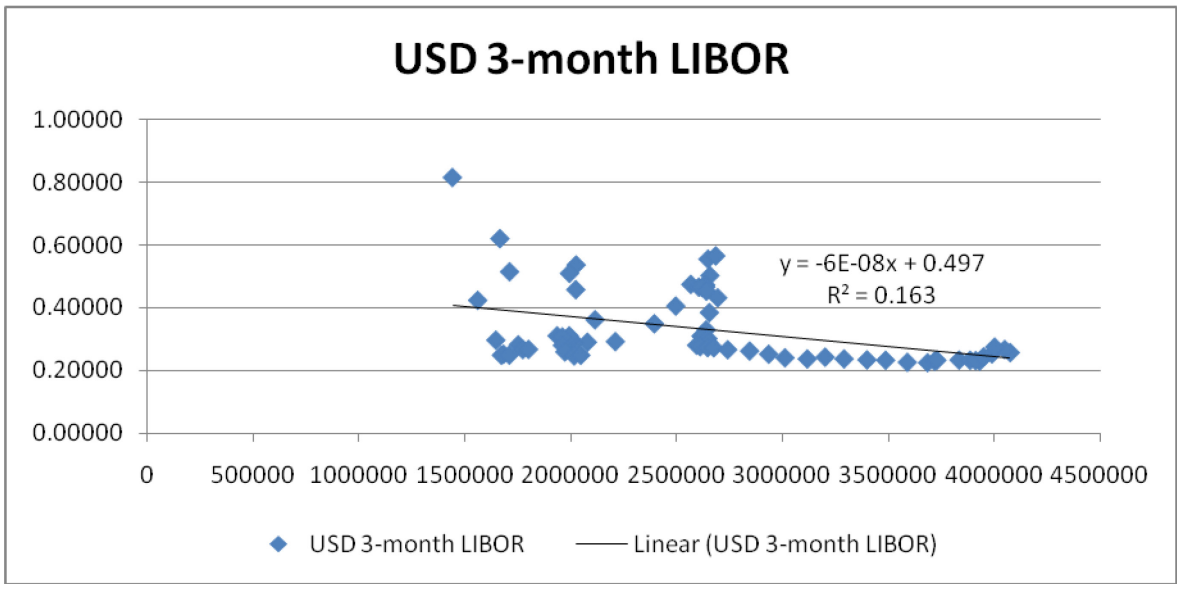

Chart 13. Scatter plot of the regression analysis in the case of six-month time lag scenario (USD 3-month LIBOR)

6.2.2. 12-month USD LIBOR rate

6.2.2.1. One-month time lag

The 12-month USD LIBOR rate is a rate at which banks lend to each other at a maturity of twelve months. The longer maturity implies a higher rate compared to the maturity of three months. In the first scenario with a time lag of one month, I observed the independent variable in the interval from November 2008 until October 2014, while the dependent variable was set between December 2008 and November 2014.

Regression Statistics	
Multiple R	**0.731994**
R Square	**0.535815**
Adjusted R Square	0.529184
Standard Error	0.277808
Observations	**72**

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	6.236094	6.236094	80.80201	2.77E-13
Residual	70	5.402422	0.077177		
Total	71	11.63852			

	Coefficients	*Standard Error*	*t Stat*	***P-value***	*Lower 95%*	*Upper 95%*
Intercept	**1.996482**	0.120374	16.5856	**5.98E-26**	1.756402	2.236561
X Variable 1	**-4E-07**	4.42E-08	-8.98899	**2.77E-13**	-4.9E-07	-3.1E-07

Table 11. Summary output for the regression analysis in the one-month time lag scenario (USD 12-month LIBOR)

The Multiple R has a value of approximately 0.73, implying a relatively strong linear relationship between the changes in the monetary base and the LIBOR rate. However, the R^2 is 0.535, i.e. only 53.5% of the data points lie on the regression line. The results are statistically significant, as implied by the low P-values. The regression line is described by: y=-4E-07x+1.996482.

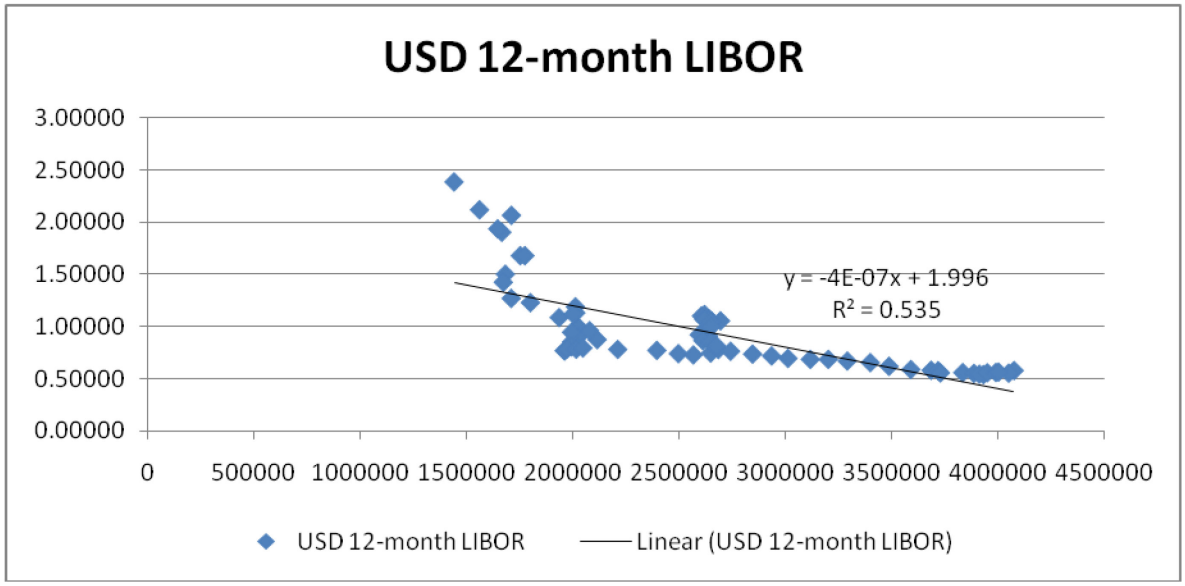

Chart 14. Scatter plot of the regression analysis in the case of one-month time lag scenario (USD 12-month LIBOR)

6.2.2.2. Three-month time lag

In the case of the three-month time lag, I observed the LIBOR rate from February 2009 until January 2015. The observations for the monetary base remain fixed for the interval between November 2008 and October 2014.

Regression Statistics	
Multiple R	**0.708701**
R Square	**0.502257**
Adjusted R Square	0.495146
Standard Error	0.250204
Observations	**72**

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	4.421869	4.421869	70.63476	3.29E-12
Residual	70	4.382132	0.062602		
Total	71	8.804001			

	Coefficients	*Standard Error*	*t Stat*	***P-value***	*Lower 95%*	*Upper 95%*
Intercept	**1.789497**	0.108413	16.50625	**7.82E-26**	1.573274	2.005721
X Variable 1	**-3.3E-07**	3.98E-08	-8.40445	**3.29E-12**	-4.1E-07	-2.6E-07

Table 12. Summary output for the regression analysis in the three-month time lag scenario (USD 12-month LIBOR)

The increase in the time lag leads to a decrease in the strength of the linear relationship. The Multiple R is in this case 0.708. The R^2 is also lower at approximately 0.5, meaning that half of the data points do not lie on the regression line.

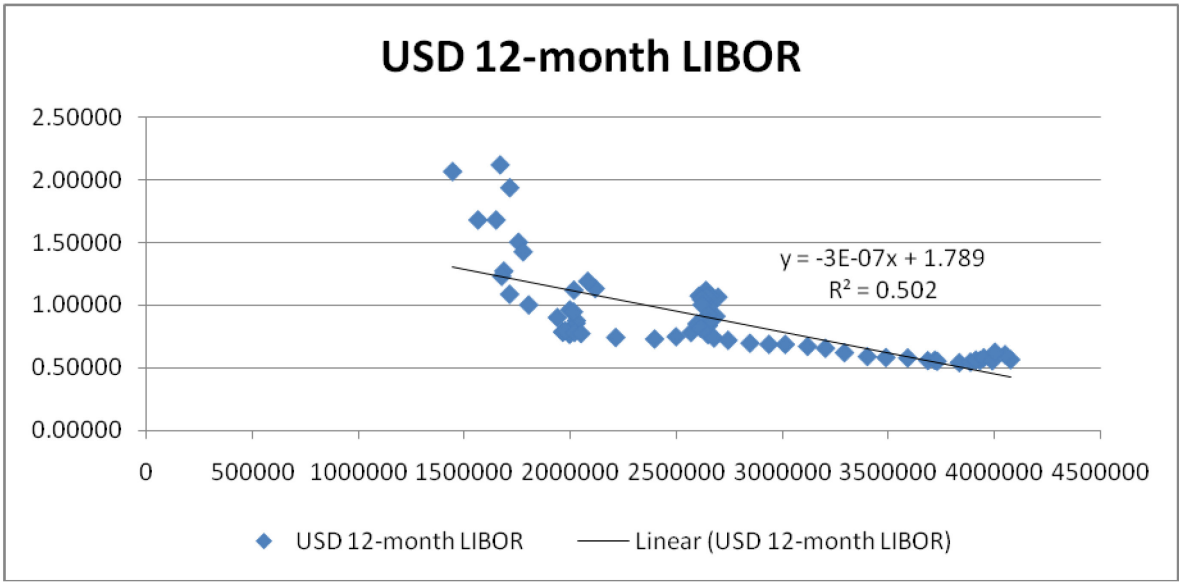

Chart 15. Scatter plot of the regression analysis in the case of three-month time lag scenario (USD 12-month LIBOR)

The statistical significance of the results is persistent in this case as well., since the P-values are well below 0.05. The regression line is given by: y=-3.3E-07x+1.789497.

6.2.2.3. Six-month time lag

For the six-month time lag scenario, I observed the 12-month USD LIBOR rate data from May 2009 until April 2015. The independent variable, i.e. the monetary base is fixed to the same interval as in the previous cases, from November 2008 until October 2014.

Regression Statistics	
Multiple R	**0.6749**
R Square	**0.45549**
Adjusted R Square	0.447712
Standard Error	0.195393
Observations	**72**

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	2.235579	2.235579	58.55605	7.98E-11
Residual	70	2.672491	0.038178		
Total	71	4.90807			

	Coefficients	*Standard Error*	*t Stat*	***P-value***	*Lower 95%*	*Upper 95%*
Intercept	**1.47975**	0.084664	17.47794	**3.08E-27**	1.310893	1.648607
X Variable 1	**-2.4E-07**	3.11E-08	-7.65219	**7.98E-11**	-3E-07	-1.8E-07

Table 13. Summary output for the regression analysis in the six-month time lag scenario (USD 12-month LIBOR)

The Multiple R of 0.6749 implies a further decrease in the linear dependence of the variables. Also, the percent of data points lying on the regression line has decreased to only 45.5%. Thus, it can be concluded that the effects of the monetary policy wane the bigger the time lag gets. The USD LIBOR rate seems to respond moderately to the QE measures and only in the short-term, while for longer periods most of the variability cannot be explained by the change in the monetary base. The regression line is given by: y=-2.4E-07x+1.47975.

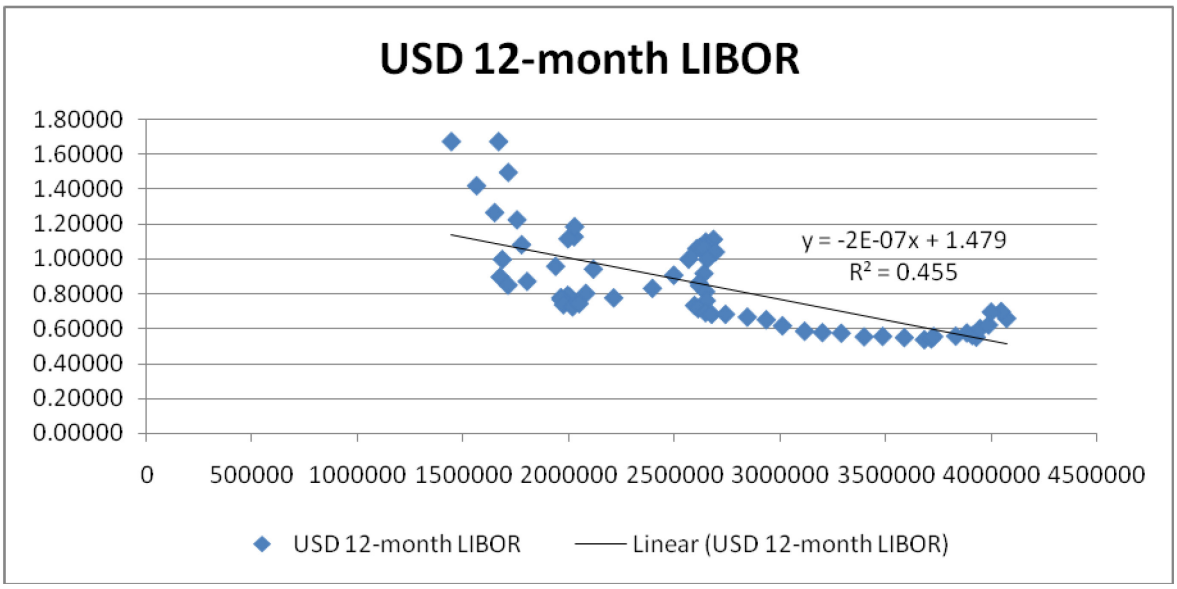

Chart 16. Scatter plot of the regression analysis in the case of six-month time lag scenario (USD 12-month LIBOR)

6.3. The effects of QE on the unemployment rate

A high unemployment rate during the financial crisis aftermath was one of the major issues the Fed was concerned with. While most economic indicators, including house prices and longer-term interest rates, reacted to as expected to the first two rounds of QE, the unemployment rate was still high and did not quite seem to respond to the monetary policy measures. It peaked during the second half of 2009, reaching 10%. High unemployment has major repercussions on the real sector of the economy. It slows down productivity, decreases aggregate demand and creates financial problems from the fiscal point of view. In an environment of low inflation, the high unemployment rate posed a threat to the stability of the U.S. economical system. The Fed decided to dedicate the third round of QE exclusively to boosting employment. This was done by further lowering of longer-term interest rates and increasing of the money supply. The surplus in money was supposed to help the labour market through encouraging business investment and consumer spending. Indeed, the unemployment rate fell during the QE implementation. How and if the increase in the monetary base affected the employment is investigated via regression analysis. As in previous two cases, I considered three possible time lag scenarios of one, three and six months. The monthly-average data were taken from the Federal Reserve database .

6.3.1. One-month time lag

In the first case scenario, I observed data on the civilian unemployment rate from December 2009 until November 2014. As in previous cases, the monetary base is being observed in the period from November 2008 until October 2014.

Regression Statistics	
Multiple R	**0.87861**
R Square	**0.771955**
Adjusted R Square	0.768697
Standard Error	0.589894
Observations	**72**

ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	1	82.45496	82.45496	236.9567	3.66E-24
Residual	70	24.35824	0.347975		
Total	71	106.8132			

	Coefficients	*Standard Error*	*t Stat*	***P-value***	*Lower 95%*	*Upper 95%*
Intercept	**12.04597**	0.255601	47.12797	**9.15E-55**	11.53619	12.55575
X Variable 1	**-1.4E-06**	9.38E-08	-15.3934	**3.66E-24**	-1.6E-06	-1.3E-06

Table 14. Summary output for the regression analysis in the one-month time lag scenario (civilian unemployment rate)

With a time lag of only one month, the unemployment rate seems to have responded to the measures taken by the Fed. The Multiple R suggests a strong linear relationship between the increase in the monetary base and the unemployment rate. The regression line, described by y=-1E-06x+12.04, has a negative slope. As implied by the coefficient of determination, 77.19% of the data points are on the line. P-values of 9.15E-55 for the intercept and 3.66E-24 for the independent variable imply statistical significance of the results. However, the decrease in unemployment was not strong, but had a rather moderate pace. The slow improvement was the main reason the Fed dedicated an entire round of QE to helping the job market.

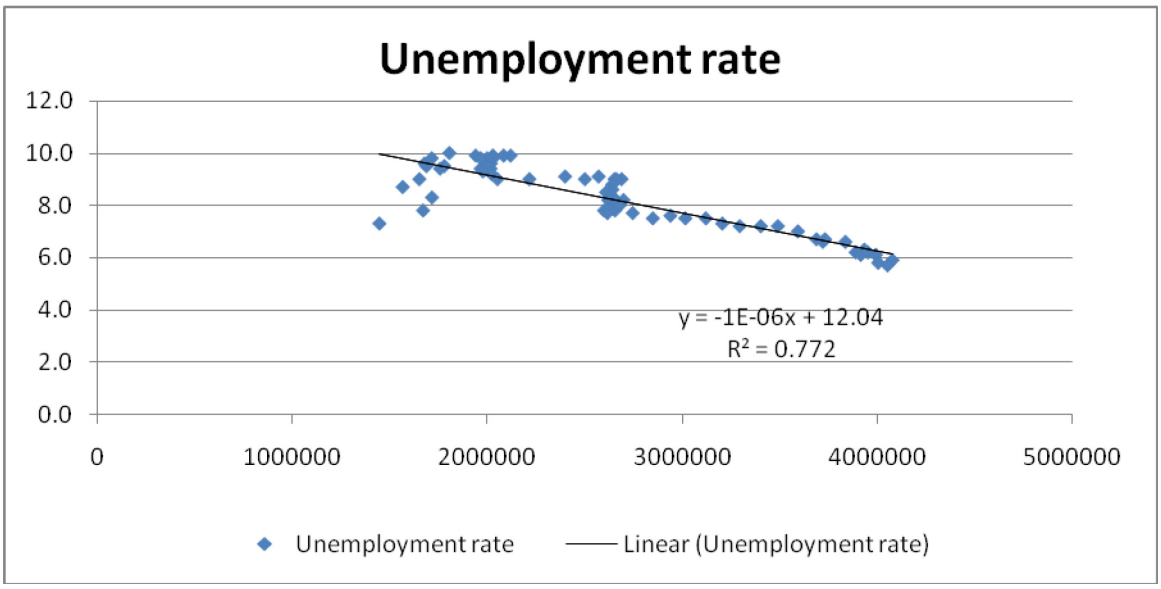

Chart 17. Scatter plot of the regression analysis in the case of one-month time lag scenario (civilian unemployment rate)

6.3.2. Three-month time lag

For the case of three-month time lag in the reaction of the unemployment rate, I considered data from February 2009 until January 2015. The results are consistent with the assumption that a longer time lag after the action implemented by the Fed, i.e. the increase in the monetary base, leads to a stronger reaction of the labour market. The assumption was made because it takes time until monetary policy decisions reflect in changes in the real sector.

Regression Statistics	
Multiple R	**0.943391**
R Square	**0.889987**
Adjusted R Square	0.888415
Standard Error	0.432654
Observations	**72**

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	106.0032	106.0032	566.2877	2.84E-35
Residual	70	13.10328	0.18719		
Total	71	119.1065			

	Coefficients	*Standard Error*	*t Stat*	***P-value***	*Lower 95%*	*Upper 95%*
Intercept	**12.49993**	0.187469	66.67725	**4.4E-65**	12.12604	12.87383
X Variable 1	**-1.6E-06**	6.88E-08	-23.7968	**2.84E-35**	-1.8E-06	-1.5E-06

Table 15. Summary output for the regression analysis in the three-month time lag scenario (civilian unemployment rate)

The correlation increased, with the Multiple R being 0.94 and the R^2 0.88. The linearity of the data can be seen in the scatter plot as well. The regression line is defined by: y=-2E-06x+12.5.

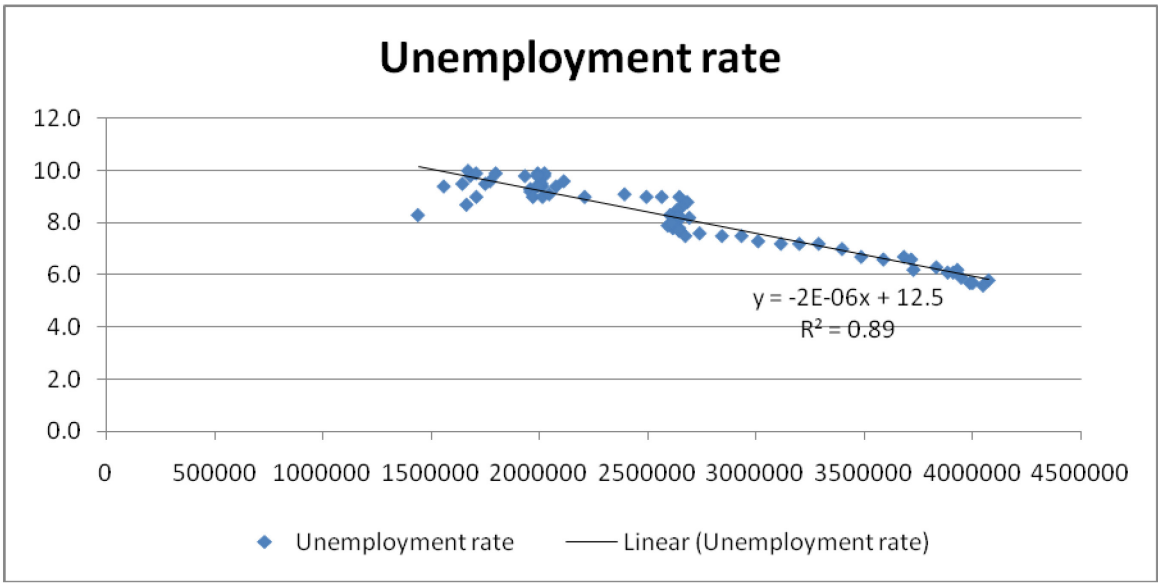

Chart 18. Scatter plot of the regression analysis in the case of three-month time lag scenario (civilian unemployment rate)

6.3.3. Six-month time lag

Finally, I conducted a regression analysis with respect to a time lag of six months. By the end of the QE the conditions on the labour market improved substantially. It is of great importance to understand that the QE has only a limited reach, despite the amount of money created during its implementation. The QE serves as a fuel for the economy and it is up to market participants, especially banks and companies to make proper use of it. The results of this analysis are summarized in the table below.

Regression Statistics	
Multiple R	**0.97505**
R Square	**0.950722**
Adjusted R Square	0.950018
Standard Error	0.313351
Observations	**72**

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	132.6066	132.6066	1350.524	1.7E-47
Residual	70	6.873229	0.098189		
Total	71	139.4799			

	Coefficients	*Standard Error*	*t Stat*	***P-value***	*Lower 95%*	*Upper 95%*
Intercept	**12.87518**	0.135775	94.82717	**1.13E-75**	12.60438	13.14597
X Variable 1	**-1.8E-06**	4.98E-08	-36.7495	**1.7E-47**	-1.9E-06	-1.7E-06

Table 16. Summary output for the regression analysis in the six-month time lag scenario (civilian unemployment rate)

The Multiple R in this model is 0.975, which indicates an almost perfect correlation. The R^2 has a value of 0.95, meaning that 95% of the data points are on the regression line, i.e. they are linearly distributed around the mean. This model succeeds in almost fully explaining variability of the dependent variable. The regression line is given by: y=-1.8E-06x+12.87.

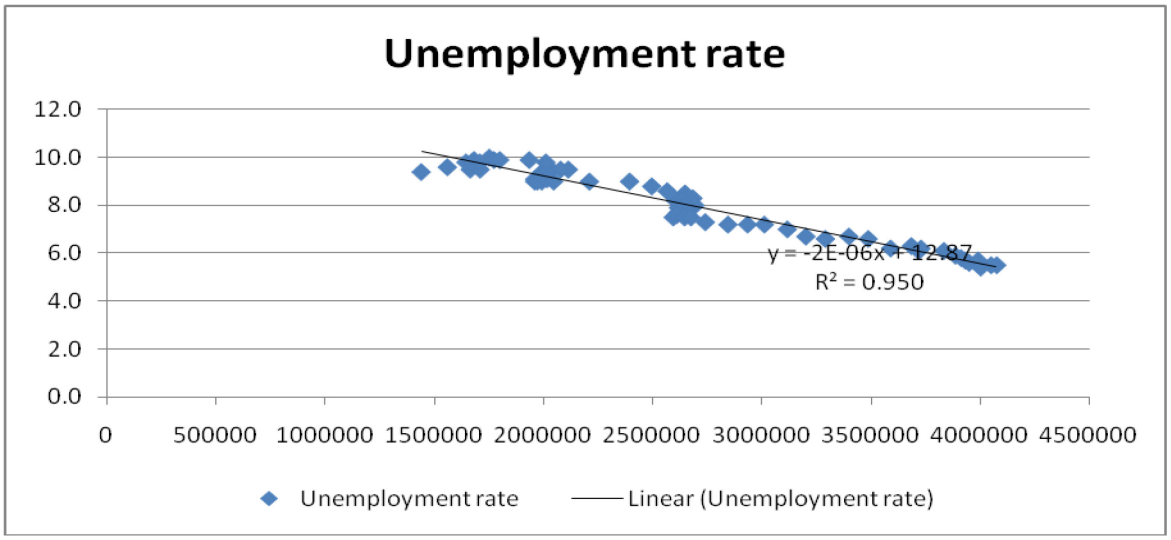

Chart 19. Scatter plot of the regression analysis in the case of six-month time lag scenario (civilian unemployment rate)

6.4. The effects of QE on inflation

In the financial crisis aftermath, the U.S. economy was facing a serious threat of deflation. Since bank lending almost ceased completely, the business investments decreased. This in turn resulted in a decreased productivity. As a consequence, the employment went down, which then lead to lowered consumption. The prices started falling as well and not only on the housing market. The Federal Reserve feared that the American economy would end up in a deep recession if no effective measures got introduced. One of the major goals of QE was anchoring the inflation towards levels that guarantee economic prosperity. This is consistent with the Fed's objectives, which are maximum employment, stable prices and moderate long-term interest rates. The FOMC noted that an inflation rate of 2% was within these objectives.[94] After the Fed announced QE, fears of hyperinflation formed on the markets. However, until now these fears have not been justified. The fears emerged as a consequence of a preconceived notion that an increase in money supply automatically causes inflation. Since the Fed almost quadrupled its balance sheet, many voices were raised in the expectation of a too high increase in prices. However, in an economy threatened by or already in recession, the surplus in money stock cannot lead to large inflationary movements – it merely provides the economy with necessary liquidity. Therefore, it is reasonable to expect that the relationship between the increase in monetary base and inflation rate cannot be strong. In order to examine the influence of the QE on the inflation rate, I conducted a regression analysis for the Consumer Price Index (CPI) as the dependent variable and the monetary base as the explanatory variable. The CPI is an economic indicator that represents changes in prices for a representative basket of goods paid by consumer. It is calculated monthly.[95] The CPI is commonly used to measure inflation.

6.4.1. One-month time lag

In a one-month time lag scenario, the interval for the dependent variable, the CPI, is set between December 2008 and November 2014. The independent variable, i.e. the monetary base is observed in the same interval as in previous cases, between November 2008 and October 2014.

[94] Cf. http://www.federalreserve.gov/faqs/money_12848.htm, 19.10.2015
[95] Cf. http://www.bls.gov/cpi/, 19.10.2015

Regression Statistics	
Multiple R	**0.335758**
R Square	**0.112733**
Adjusted R Square	0.100058
Standard Error	1.197262
Observations	**72**

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	12.74894	12.74894	8.893973	0.003935
Residual	70	100.3405	1.433436		
Total	71	113.0895			

	Coefficients	*Standard Error*	*t Stat*	***P-value***	*Lower 95%*	*Upper 95%*
Intercept	**0.106728**	0.518774	0.205731	**0.837598**	-0.92793	1.14139
X Variable 1	**5.68E-07**	1.9E-07	2.982276	**0.003935**	1.88E-07	9.47E-07

Table 17. Summary output for the regression analysis in the one-month time lag scenario (CPI/inflation rate)

The results indicate a very weak linear relationship between the variables. The Multiple R is only 0.335. The percent of data points lying on the regression line, i.e. the R^2 is just 11%. Around 89% of the CPI variability of around the mean is not explained by the model.

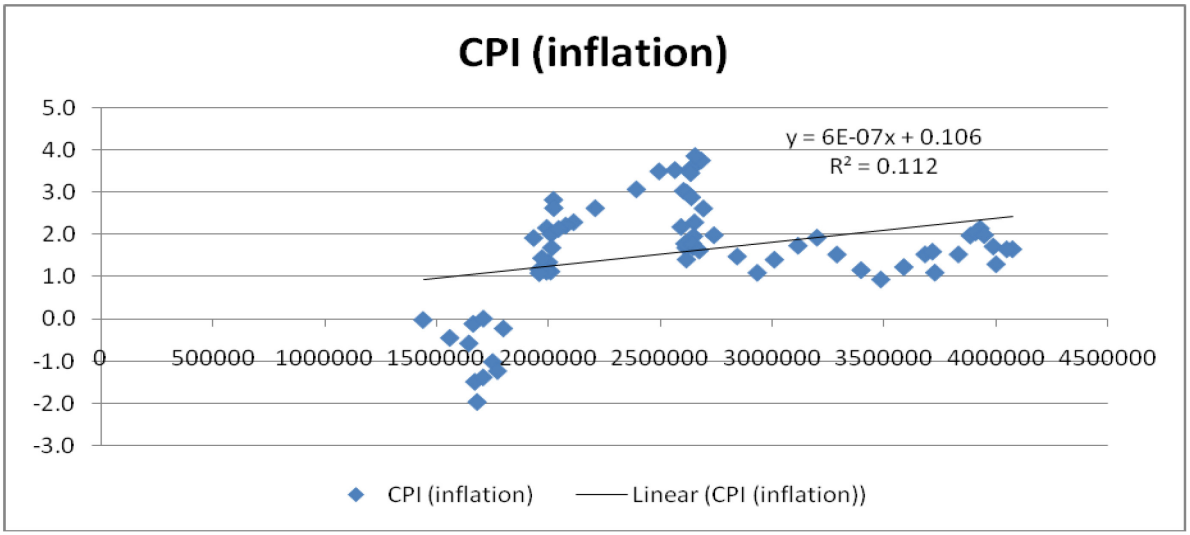

Chart 19. Scatter plot of the regression analysis in the case of one-month time lag scenario (CPI/inflation rate)

The intercept tells us that when the explanatory variable is zero, the dependent variable changes by 0.10678. This result, however, is not statistically significant, since the P-value of 0.8375 is well above the 0.05 limit. The regression line is described by: y=5.68E-07x+0.106728. The P-value for the X-variable is 0.0039, indicating statistical significance. The slope of the regression line is positive, meaning that an increase in the monetary base leads to a weak increase in inflation.

6.4.2. Three-month time lag

In this case, I observed the dependent variable from February 2009 until January 2015. Other model assumptions are equal to those in previous cases.

Regression Statistics	
Multiple R	**0.200879**
R Square	**0.040352**
Adjusted R Square	0.026643
Standard Error	1.236833
Observations	**72**

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	4.502734	4.502734	2.943433	0.090651
Residual	70	107.0829	1.529756		
Total	71	111.5857			

	Coefficients	*Standard Error*	*t Stat*	***P-value***	*Lower 95%*	*Upper 95%*
Intercept	**0.719359**	0.53592	1.342287	**0.18384**	-0.3495	1.788218
X Variable 1	**3.37E-07**	1.97E-07	1.715644	**0.090651**	-5.5E-08	7.3E-07

Table 18. Summary output for the regression analysis in the three-month time lag scenario (CPI/inflation rate)

The Multiple R suggests an even weaker linear relationship than in the previous example. Furthermore, the R^2, i.e. the percent of data points lying on the regression line is only 4%. The positively-sloped regression line is described by: y=3.37E-07x+0.719359. However, the high P-values suggest that the results are not statistically significant.

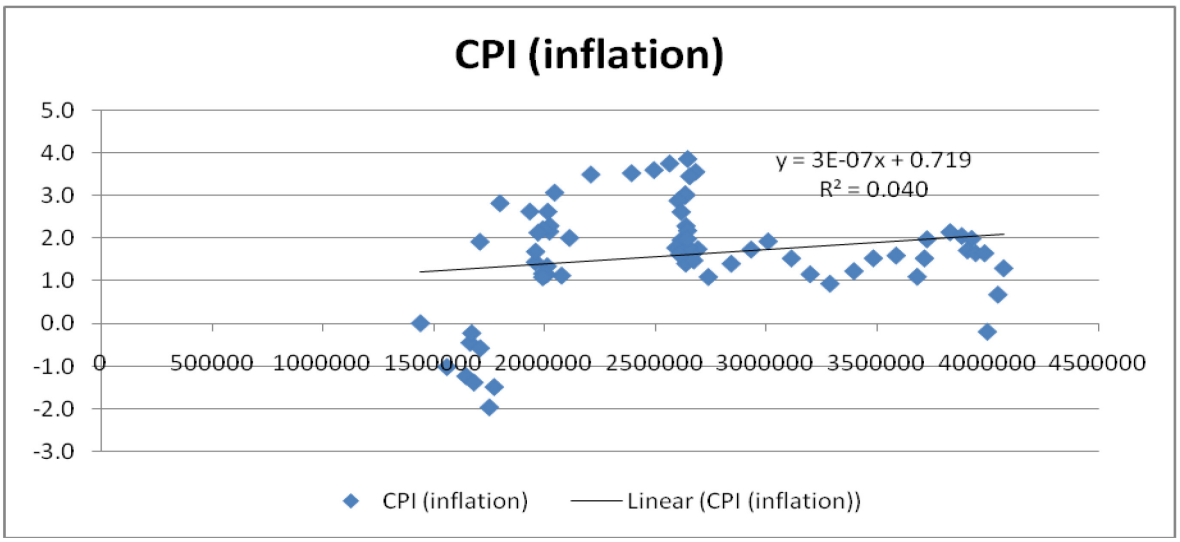

Chart 20. Scatter plot of the regression analysis in the case of three-month time lag scenario (CPI/inflation rate)

6.4.3. Six-month time lag

Finally, I conducted the regression analysis for the six-month time lag scenario. This means that I observed the inflation rate from May 2009 until April 2015 et ceteris paribus.

Regression Statistics	
Multiple R	**0.043923**
R Square	**0.001929**
Adjusted R Square	-0.01233
Standard Error	1.24355
Observations	**72**

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.209241	0.209241	0.135307	0.714102
Residual	70	108.2492	1.546417		
Total	71	108.4584			

	Coefficients	*Standard Error*	*t Stat*	***P-value***	*Lower 95%*	*Upper 95%*
Intercept	**1.80615**	0.538831	3.351981	**0.001297**	0.731486	2.880814
X Variable 1	**-7.3E-08**	1.98E-07	-0.36784	**0.714102**	-4.7E-07	3.22E-07

Table 19. Summary output for the regression analysis in the six-month time lag scenario (CPI/inflation rate)

In this case the strength of the linear relationship is almost negligible, with the Multiple R being only 0.0439. The R^2 is extremely small as well, indicating that only 1.9% of the data points actually lie on the regression line, while the rest is scattered around it. The regression line is described by: y=-7.3E-08x+1.80615. The slope is negative, meaning that after six months, the increase in the monetary base actually leads to a decrease of the inflation rate. However, the high P-value for the independent variable indicates that there is no statistical significance of the result.

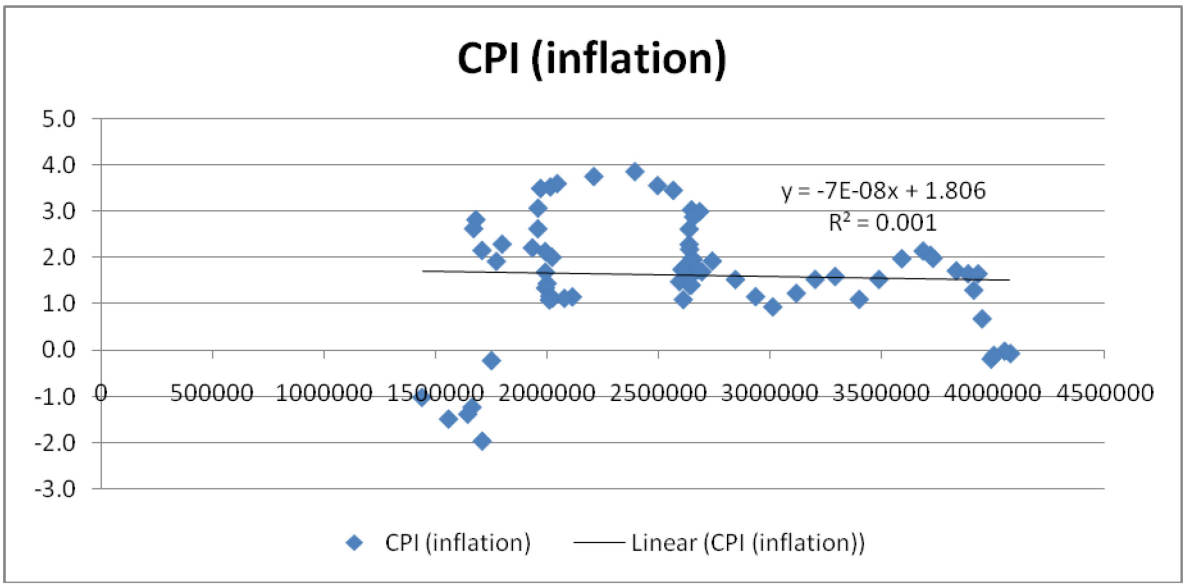

Chart 21. Scatter plot of the regression analysis in the case of six-month time lag scenario (CPI/inflation rate)

7. Results intepretation

After the financial crisis erupted, the Fed decided to fight it where it originated – on the housing market. The falling house prices led to a strong decrease in value of the MBS held by banks and other financial institutions. The Fed decided to purchase these securities from them, changing the risk structure of its own assets portfolio. The money banks were getting from these purchases was supposed to make them more willing to lend it to potential borrowers, i.e. home owners. However, the lost confidence made it difficult for these measures to work right away. House prices kept on falling for most part of 2009. Then they started recovering. Low interest rates made borrowing relatively cheap, which pushed the demand upwards. In the starting phases of QE, the market reaction was rather sluggish. Later on, the house prices started responding to the increase of the monetary base.

The regression analysis shows that there is a strong linear relationship between the increase in the monetary base and the house prices. This means that the Fed succeeded in its intentions of boosting the housing market activity via QE. The scenario with the three-month time lag shows an increase in the correlation, as compared to the one-month time lag model. This correlation was especially pronounced from the second half of 2012. That is when the housing market started its recovery. Favorable credit conditions lead to increased business investments. A big part of these investments found ground in residential construction. Improved conditions on the labour market served as an additional stimulus to the housing market, since an increase in wages meant that borrowers were more able to meet their obligations. As it can be seen in the Chart 7., the house prices already started slowing down by the end of 2014. This explains the decreased correlation in the third case scenario with a time lag of six months. The slowdown happened for two reasons. First, the Fed announced that it would be bringing the QE towards an end and raising the interest rates. This direct communication with the market, which is a part od the Fed's forward guidance, helps market participants forming expectations about the future. Banks then gradually started raising their interest rates, making mortgages more expensive. This put some pressure on the demand for houses. Second, the supply of new homes was increased during the recovery phase, effectively covering the demand.

The positive effects of the QE were not evident only due to an increased money supply banks could work with. It was also the decreased risk of their portfolios that made them ready to take up new borrowers. While many critics of the QE feared that it would lead to a new housing bubble, the analysis showed that such fears were unjustified. The house prices increased, which was the ultimate goal of the QE, but their slowdown is a sign that the market is, at least for now, relatively calm and that no great price shocks can be expected any time soon.

The regression analysis of the data on increase of the monetary base and USD LIBOR rates showed that the correlation is rather weak. With the increase of the time lag, the strength of this relationship deteriorated further, for both the USD 3-month LIBOR and USD 12-month LIBOR rate. Because the changes in the USD LIBOR rates cannot be properly explained by the variable used in the model, it is reasonable to assume that other factors had a larger impact. In normal times the USD LIBOR follows the federal funds rate, being a few points above it. It represents the major interest rate for short-term funding for banks. The 2008 subprime-mortage crisis affected this relationship heavily. The Fed lowered the federal funds rate, meaning to encourage bank lending. The banks, on the other hand, were extremely unwilling to lend to each other as a result of the shaken confidence. Instead of lending and borrowing among each other, banks started accumulating the money on their own accounts, thus pushing the interest rates upwards. Only after the government bailout of AIG did the LIBOR start going back to its normal levels. It was also the reassurance coming from the Fed that the federal funds rate would be kept low for a prolonged period of time that helped guiding the LIBOR to its pre-crisis levels. Although the singnificance of the LIBOR is larger on international markets, the adjustment was also important for American banks, since many of them finance themselves internationally. The period from the end of 2008 until 2011 was relatively calm in terms of the LIBOR rate. However, the European sovereign debt crisis lead to another increase in this rate, once again reflecting the fears of international investors. In fact, any event on the markets that affects or is in any way tied to one of the five LIBOR currencies, increases or decreases the LIBOR rate. Another important example is the 2012 LIBOR crisis, which was caused by the manipulation of the LIBOR rate conducted by English banks. With all these factors that influence the LIBOR, it is easy to understand why the monetary policy of one country cannot have a larger impact. In order to understand how the LIBOR changes, a much richer model with several explanatory variables would be

necessary. While the U.S. quantitative easing changed the interest rate structure on domestic markets, it did not have prevailing effects on international interest rates.

The unemployment has been a large issue since the beginning of the financial crisis. The "adjustment" of the labour market to the new circumstances was quick. For most of 2008, the unemployment rate has been below 6%. In the light of the AIG and Bear Stearns bailouts, market activity started contracting. Soon this contraction reflected on the employment situation. By the time Lehman Brothers announced bankruptcy, the unemployment rate rose to 6,1%. The American economy then entered almost a two-year-long recession. The Fed has been using all available measures since then to bring the economy back on track.

Even though the Fed focused in the beginning of the QE on the housing market, the improvement in house prices was not the sole goal of its actions. Moreover, the final stages of QE were devoted exclusively to improvement on the labour market. The regression analysis shows that the relationship between the increase in the monetary base and the unemployment rate is undoubtedly strong. The two variables are negatively correlated. With the increase in the time lag between the raise in the monetary base and the reaction of the labour market, the strength of the relationship increases as well. The results in the six-month time lag scenario imply that almost 100% of the decrease in unemployment happened due to the QE. This also means that the money injected into the economy during the QE actually reached the real sector and supported business investments.

One of the goals of the QE was raising the inflation rate. Because of the economic contraction due to the financial crisis, the prices in the USA started falling. The decrease in prices manifested itself first on the housing market. As the crisis progressed, the consumer spending declined. This lead to an overall drop in prices. The results of the regression analysis show that there is no strong relationshop between the increase in the monetary base and the inflation rate. The three-month time lag scenario suggests a weakening of this relationship as compared to the one-month time lag case. In the case of a six-month time lag, the direction of the relationship is reversed – the increase of the monetary base leads to a falling inflation rate. The relationship between the money supply and the inflation rate is not as straightforward as one might think. There is no reason for the prices to rise just because the central bank has decided to increase the monetary base. First of all, the money supply is a much broader category than the monetary base. The total money supply might not even be

significantly affected by the increase in central bank money.[96] Second, even if the increase was big enough to affect the money supply, it does not mean that the money will reach real economy. Banks might keep the money on their reserve accounts and hoard the cash. Finally, it is the demand for goods and assets that bids up the prices, not the amount of money available to the public. When economic conditions are unfavorable, people tend to save their money rather than spend it. Also, economic distress is usually accompanied by high unemployment rates, which again means that the demand for goods stays low. The inflation is far more than just an indicator of the central bank's monetary policy – it actually shows how the underlying economy is performing.

The results of the conducted analyses show that the QE worked for the most part. An increase and stability of house prices was achieved, the unemployment rate fell and even the USD LIBOR rate somewhat reacted to the measures taken. The inflation rate is a more complex indicator that depends on a large number of variables. It should always be put in a context, since it does not have enough informative value on its own. It should be noted that unconventional monetary policies such is the QE are the last resort for central banks. They are able to cause huge instabilities of not only the monetary system, but of an economy as a whole. Furthermore, such artificial boosters of economic activity offer market paricipants a sense of false reassurance, which makes them engage in risky behaviour that was the trigger for the financial crisis in the first place. These results show only one side of the QE experience. While it surely helped the American economy stepping out of the recession zone, it also caused a lot of controversy. The legality of QE has often been questioned, as well as its long-term effectiveness. Fed should increase the interest rates, because cheap money will find its way on the market and lead to a new bubble.

[96] The monetary base is often referred to as to "central bank money".

8. Possible effects of quantitative easing in the EU

The quantitative easing in the EU can be seen as a last desperate measure of the ECB to uplift the European economy. The last seven years have been turbulent. The 2008 financial crisis spread quickly from the USA to the rest of world and brought recession to the EU area as well. A short period of relief during 2010 was followed by the sovereign debt crisis in several EU countries. The ECB tried different measures in order to prevent a total collapse of the EU economy, but embarked on the QE only after every other measure had failed. It seems that the QE was started too late, having in mind that other leading world economies have already come out of the recession zone and gained stabilty.

Immediate effects of the QE in EU were visible even before the program officially started. Market participannts formed their expectations in the anticipation of the new monetary policy. The euro strongly devalued against the U.S. dollar. By the time the QE started, it reached its historical low of 1.05 dollars per euro.

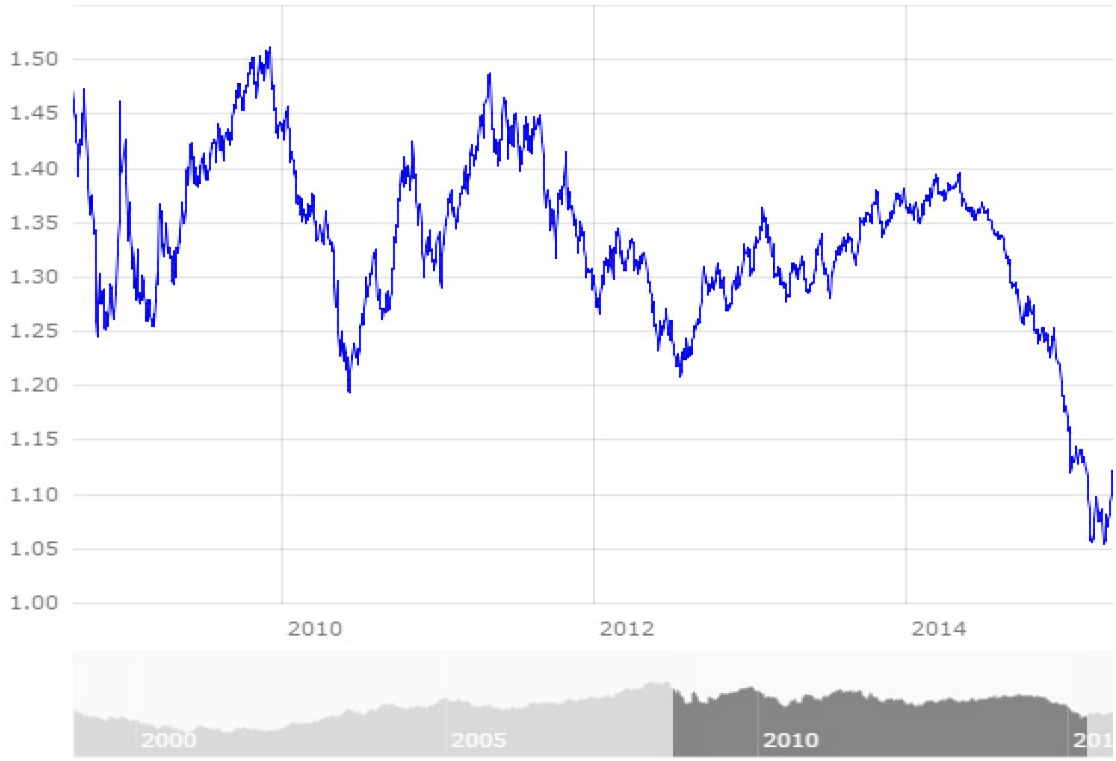

Chart 14. EUR/USD exchange rate from September 2008 until the beginning of the European QE in March 2015 (Source: ECB)

A weaker currency is supposed to boost exports, since it makes the goods cheaper. However, in a situation of decreased production due to weakened business investments, such a scenario may not be beneficial for the EU economy and could lead to further involuntary currency devaluation.

The main issue with the european QE is the legal and fiscal framework. Unlike USA, which is essentially one country constituted of fifty different states, the EU is an economic-political union of different countries. Although these countries obey by supranational laws and regulations in EU relevant matters, they still show significant differences embedded into their own legal systems. The European Union consists of 28 member countries, but only 19 are part of the monetary union. The QE is therefore being conducted only in these countries.[97] The purchases of the securities are being conducted according to a capital key explained earlier in the thesis. Due to the capital key, some countries have a much larger share in the QE than others (Germany, France, Italy). This means that most of the money created within the QE flows into these countries, thus leading to potential bubble building on their markets. Furthermore, the current political instabilities in the EU due to the refugee crisis, sovereign debt crisis and the overall strenghtening of right-winged political parties, lead to an increased investment activity in those countries that are still percieved as stable. This perception coincides with the capital key.

There is no unique fiscal authority in the EU. There are several institutional arrangements for fiscal policies on the EU level, but the actual authority on fiscal questions is on national levels. During the U.S. quantitative easing, the Treasury played a crucial role. In the European case, the Treasuries must be left out. The strict distinction of the QE from fiscal operations comes from the regulations determined in the Treaty on the Functioning of the European Union. The most important aspects of these regulations include the prohibition of monetary financing, the prohibition of privileged access to financial institutions, the no-bail-out clause and the fiscal provisions to avoid excessive governement deficits.[98] Even though quantitative easing is a monetary policy, fiscal measures as in the example of the USA would help the newly created money reach the economy in a more effective manner.

[97] The Bank of England also conducted quantitative easing in the UK, which is a member country but does not use euro as its currency.
[98] Cf. https://www.ecb.europa.eu/mopo/eaec/fiscal/html/index.en.html, 25.09.2015

The European economy is mostly bank-based. This means that most of the financing happens via bank institutions, and not directly on the financial markets as it is the case in the USA. As a result, European financial markets showcase a much weaker transmission potential. Therefore the time lag between the implementation of monetary measures and actual market response could be longer than in the USA. Furthermore, banks could hoard cash despite negative deposit rates or invest the money on markets outside Europe, thus leading to capital outflow.

The house prices will increase due to the QE, i.e. the changes are already visible. There are several reasons for this. The ECB is buying government bonds on the secondary markets. Many of these bonds are held by pension and investment funds. They usually prefer safe investments over risky company shares and bonds. Since the QE has lowered yields on sovereign bonds, there are no longer attractive to these investors. Therefore, their interests are switching to other safe alternatives, i.e. the real estate. The housing market is an important part of the real estate market and is directly influenced by this shift in investors' behaviour. This shift is visible across most investor classes. As a consequence, the house prices are being pushed upwards.

Stocks have also been influenced by the QE, especially at the beginning. The demand for stocks rose and many of leading European indices reached new record highs. However, the QE represents only a small fraction of the factors that have impact on stock prices. They are subject to much larger fluctuations caused by market movements rather than by the monetary policy. Changes in leading world indices also affect European stocks in a way that the impact of QE is almost negligible.[99] The stock prices usually adjust to important changes in monetary policy within days after the announcement of such a policy. The impact, however, does not last long and market forces take over after the initial uproar. Therefore, the change in stock prices only has a temporary effects on house prices.

Another important factor that determines the trend of rising house prices are the low interest rates. Since they are currently at their historic low, it is relatively cheap to finance a house

[99] The China market crash that started as a price correction in June 2015 and ended 2 months later in the biggest stock crash on Asian markets since 2009, has heavily affected stock markets worldwide. The European stock markets have recorded the biggest fall since the start of sovereign debt crisis in 2011. (Source: http://www.theguardian.com/business/live/2015/aug/24/global-stocks-sell-off-deepens-as-panic-grips-markets-live, 26.09.2015)

purchase. However, due to decreased economic activity, the construction of new homes is lagging behind. This puts pressure on the supply, which in combination with the demand levels pushes the prices upwards, thus leading to a potential house bubble. It is reasonable to assume that this trend will not be represented in all EU countries, but only in those that are considered economically secure (e.g. Germany, Austria, Netherlands). The surplus in money is more likely to flow into actual credit markets in these countries, than in other, "peripheral" members. This will create disbalances in the already shaky EU economy. The increase in house price is therefore more of a side-effect of QE than the actual goal. The QE is supposed to fight deflaton by increasing all asset prices. However, the simple switch from bond and stock markets to real estate markets does not have the same effect, since the only possible scenario is a housing bubble in selected countries. Local bubbles are also possible, since there is no guarantee that the distribution of the new money will be even.

The QE in Europe will increase the money supply only for big investors. An average consumer will not have much use of the program. It is also unlikely that the QE will lead to an inflation level of 2% on its own. The increase in aggregate demand will probably not be large enough to completely offset deflationary pressures. Furthermore, the money created within the QE will not reach the economy as intended, because of the weak transmission potential of European markets. If the money stays locked inside the big banks' accounts, there cannot be any positive effects on the markets. It is necessary that the monetary stimulus finds ground in investments, to help companies elevate their production capacities and thus employ more people. The key for the QE to work is to aim towards full employment. And while the U.S. quantitative easing might have been a success in this sense, the European counterpart is more likely to create new threats in form of bubbles. What the ECB will do after the QE has ended remains subject to speculation.

9. Conclusion

Quantitative easing is no longer considered “the brave new world” of monetary policy. It has already been conducted in Japan, UK and USA. The European QE is the newest example of this unconventional approach. In QE the central bank expands its balance sheet by purchasing securities from the private and public sector. The central bank uses newly created money to finance these purchases, which is then supposed to reach the economy through the portfolio rebalancing channel. By doing so, the central bank tries fulfilling several predefined goals. These goals usually include reaching certain inflation levels, boosting credit and economic activity, lowering long-term interest rates, etc.

The world financial markets suffered a major crash back in 2008. The crash resulted in frozen money markets, lost confidence among market participants and a collapse of the bank systems worldwide. The financial crisis spread quckly to the real economy, throwing both the American and European economy into recession. The crisis started as a housing bubble that has been growing for years preceeding one of the hardest price corrections world markets have ever witnessed. Even before the official start of the crisis, i.e. the bankruptcy of the Lehman Brothers, the Fed intervened. It started lowering interest rates and assisted the American government in bailing out large banks and financial companies, including AIG and Bear Sterns. Soon after the bankruptcy was announced, the Fed started considering an expansionary monetary policy in order to resurrect financial markets. The federal funds rate was cut to between 0% and 0.25%.

The U.S. QE itself started in November 2008 and ended in October 2014. In the beginning, the program was not well structured and there was no real certainty on what the next step will be. As the time passed, the QE evolved into a complex, well-organized monetary intervention that had clear goals ahead of it. The Fed intended bringing up house prices, since the housing market has been especially hard hit once the prices started to fall. It also focused on lowering long-term interest rates and thus making borrowing easy in the long run. In the final stage of QE, the focus was exclusively on fighting unemployment. The ultimate goal was raising the inflation rate. The regression analysis in this thesis showed that there is a strong correlation between the increase in monetary base and changes in house prices and the unemployment rate. Somewhat weaker correlation exists between the changes in monetary base and the USD LIBOR rates. The change in the inflation rate, however, was not explained by the increase of

the monetary base. One of the question this thesis tried to give an answer to was if the QE actually worked for the USA. The data suggest that it provided relief for the American economy, i.e. it was effective. However, it is necessary to look at the other side of the medal as well. The Fed quadrupled its balance sheet. It embarked on the program under the premise of relieving the financial systems and boosting the economy, but it was essentially a large bailout project for banks that engaged in risky affairs on the housing market. It was the banks that caused the financial crisis and it was the banks that were saved from the resulting chaos. An average American citizen did not have much use of the vast amounts of money being pumped into the economy, since the raise in money supply did not reach consumers directly. Sure, the unemployment sank by the end of QE, but only after the big banks got themselves out of the mess they created. The "too big to fail" issue has never been so strongly pronounced as in the last 7 years. Instead of sanctioning the behaviour that was the reason for the whole turmoil in the first place, the Fed and the American government implicitely approved of it. The main argument that is used to justify such government interventions is that the banks involved are too deeply embedded into the economy and that their downfall would mean the crash of the whole system. While this might be true, it is no solution to create a safety net every time some of these banks cause market disbalances. The problem of the American economy is much larger than the financial crisis or the unstable prices. American banks and corporations have gained too much power over the last decades and as such they have a huge impact not only on the markets, but also on the government and legislation. The QE treats only simptoms of a flawed system, while the underlying problems are being pushed aside.

The European quantitative easing is quite specific, since it is being conducted in a monetary union consisting of 19 countries, each of which has its own fiscal system. It started in March 2015 and will probably end in September 2016. Unlike the U.S. counterpart, which, in the beginning, was specifically targeted at elevating house prices, the QE in Europe is being conducted under the premise of reaching the inflation level of "close, but below 2%". The contraction in economic activity due to sovereign debt crisis and a decreased lending activity, has caused deflationary pressures on the markets. The ECB decided to adress this issue by purchasing government bonds, which in turn should result in an increased money supply availabe for the economy. Most of these bonds are bought from banks. The cash they receive is supossed to make them more liquid and, in that sense, more willing to lend money. The ECB also lowered key interest rates as part of the expansionary monetary policy.

The reaction of the ECB in form of QE is somewhat belated. As much as monetary easing is a helpful tool when an economy is struggling, proper timing is almost as equally important. EU markets have lost a great deal of their former power and it will not be easy regaining it. Quantitative easing in a deeply troubled economy can only stress what is wrong with it. In the EU it is the weak financial markets, serious political situation and complex legal structure of the Union. It is improbable that an increase in money supply will be able to overcome all these obstacles in the quest of boosting the European economy. It is more likely that bubbles will start building up. Also, it is reasonable to expect that the whole program will deepen the disagreements between EU countries. Mario Draghi once said that he would "do anything to save the euro". Is quantitative easing going to be the solution? This question is to be answered in the years to follow.

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