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The impact of unconventional monetary policies on alternative investments

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Contents

Abstract……..…...…3

1. INTRODUCTION ……...….4

2. THE AIM OF MONETARY POLICY ……..……..5

2.1. Strategy of ECB……...…..6

2.2. Unconventional Monetary Policy ……8

2.3. Quantitative Easing……..……....11

3.Literature review…….…..13

4. Data, methodology and Empirical Tests …….……..….16

4.1. Data …….....……16

4.2. *Empirical results* ……..…….....*20*

4.3. Conclusions …….……....26

5. Literature ……**.....***27*

Abstract

The paper aims to study the impact of unconventional monetary policies implemented by the FED and ECB on sectors of alternative economy beyond stock markets such as real estate, commodity, wine market, rare coins, and crude oil futures. This will be done by examining the impact of unconventional monetary policies on these alternative assets/sectors using the OLS method and appropriate dummy variables for each QE program.

We see that there is a negative impact on the first period that FED launched the first QE program on real estate, on the contrary ECB's QE programmes did not have significant effects on real estate. The impact on commodity from the first FED's QE program is negative. On the wine LVX index, we see that that ECB's QE programmes were not significant but FED's programmes created a negative impact on this market with different coefficient for every time period of first and second program that FED launched. We see that we have differences on the impacts on these markets between the programmes that ECB and Federal Reserve launched.

1. INTRODUCTION

Since the announcement of the global crisis in 2008 many economies have been forced in different times to adopt new policy methods in order to maintain the price level and financial market stable, we have seen enchased credit support, credit easing, quantitative easing, interventions in foreign exchange and securities markets, and the provision of liquidity in foreign currency. These tools have been used to support the functioning of the financial sector, to protect the real economy from the fallout of the financial crisis. Announcements related to the Federal Reserve's three rounds of the LSAP, program Securities Market Program (SMP), Outright Monetary Transactions (OMT), Covered Bond Purchase Program (CBPP3), Public Sector Purchase Program (PSPP) also known as quantitative easing programmes, consisted of suggestions of possible future purchases, firm statements of planned purchases, including time-frames and quantities, and announcements of reductions or slowdowns of purchases. These announcements changed market expectations of future asset purchases by the Fed or ECB and, consistent with the efficient market hypothesis, immediately affected asset prices and real estate prices, purchase of goods, purchase of works of art, wine market, purchase of rare currencies. Therefore, we apply to analyse the impact of the announcements associated with the LSAP programs and ECB's programmes.

A low interest rate environment encourages households and companies to borrow, consume and invest, which boosts domestic demand and should therefore have a positive effect on GDP growth. ECB action has strengthened business sentiment, which is a necessary condition for future investments. The European System of Central Banks and the ECB have been key actors in providing added value to European citizens – monetary policy action in support of growth in employment, investment and consumption. ECB action has undoubtedly also protected the euro area from further exogenous shocks, financial system disturbances and lessened the impact of the UK referendum on EU membership.

Here we are trying to estimate the impact of various quantitative easing programs implemented by both the FED and ECB on alternative assets such as the real estate, rare coins, commodities, wine and futures on crude oil during the period 2000-20016.

On chapter two we are going to see the aim of monetary policy and the strategies of European central banks and Federal Reserve and how they took unconventional monetary policies. On chapter three we see a burgeoning literature on the effectiveness of the unconventional policy actions taken by central banks in a number of major economies. On chapter four we analyse the data, the periods of every QE and their effectiveness on the indexes we have chosen to analyse. We are going to estimate that there is no significant impact on these markets by the quantitative programmes that central banks launched.

2. THE AIM OF MONETARY POLICY

The aim of monetary policy is to achieve low and stable inflation, the policy framework is inflation targeting, the instrument is a short-term interest rate at which the central bank provides funds to banks or the interbank market and the impact of this official rate on market rates and the wider economy is reliably quantified. Within this framework, the setting of interest rates is done judgementally using a wide variety of macroeconomic signals but in a manner that could be approximated with reference to so-called Taylor rules, whereby interest rates responded more than one for one to changes in inflation and also responded to fluctuations in the output gap. This effectively summarises what constituted conventional monetary policy amongst the mature economies. Its operation led to an effective and predictable use of monetary policy and a largely successful pursuit of low inflation.

The financial crisis and its aftermath of the worst global recession since the 1930s poses a number of challenges for monetary policy and central banks. While conventional monetary policy achieved low and stable inflation, it did not prevent asset market bubbles from occurring. Pre-crisis, a significant literature examined the role of monetary policy in containing asset market bubbles. An influential line of thought suggested that the main aim of monetary policy should be to contain inflation, that ex ante it is far from clear that bubbles can be identified or dealt with by monetary policy and that it may be more effective to use monetary policy to mop up the aftermath of a burst bubble than use it to tackle its build-up.

This view has been widely challenged since the financial crisis. Central banks now have a much greater focus on financial stability in addition to targeting inflation. But by Tinbergen's Law, if an authority has N policy targets it needs at least N policy instruments, so we have seen central banks augment their arsenal of policy instruments with macroprudential tools (see for instance in the UK, the creation of a Financial Policy Committee to run macroprudential policy alongside the Monetary Policy Committee) and a strengthening of capital adequacy and liquidity rules through Basel III. The aim of these policies is to achieve financial stability and prevent or at least moderate asset market bubbles.

The other main challenge to this pre-financial crisis consensus has been the ability of conventional monetary policy to mop up in an aftermath of a financial crisis and stimulate the economy into sustainable recovery.

The result was that conventional monetary policy proved ineffective – the usual official rate could not be changed in line with the Taylor rule; it did not impact market rates in the expected way and problems with financial intermediation meant that the usual monetary

transmission mechanism was not working. While central banks hold onto the belief that when recovery occurs, conventional monetary policy and macroprudential tools will achieve price and financial stability jointly, the challenge is to aid the economy in its recovery so as to reach that point. (Joyce et al)

2.1. STRATEGY OF ECB

The primary objective of the ECB's monetary policy is to maintain price stability. The ECB aims at inflation rates of below, but close to, 2% over the medium term. Inflation refers to a general increase in consumer prices and is measured by an index which has been harmonised across all EU Member States: Harmonised Index of Consumer Prices (HICP). The HICP is the measure of inflation which the Governing Council uses to define and assess price stability in the euro area as a whole in quantitative terms.

The financial structure of the euro area differs from that of other large economies such as the US in that banks play a crucial role in the financing of the economy and in the monetary transmission mechanism. The corporate sector can to some extent find substitutes for bank lending; however, such substitution is easier for large corporations than for SMEs, which constitute almost 99% of all enterprises in the euro area. The largely bank-based structure of financing is reflected in the way that monetary policy is implemented. ECB operations consist mainly of refinancing operations. This contrasts with the US Federal Reserve System, where operations consist mainly of outright purchases and sales of assets in the open market, in line with US economy's greater reliance on capital markets.

2.1.a The first phase of the crisis (2008-10) – Banking crisis: 'Enhanced credit support'

The collapse of Lehman Brothers in September 2008 created uncertainty among financial and credit institutions concerning each other's financial health. (In academic terms, due to increasing liquidity – and even solvency – risks, the collapse increased counterparty risk that was exacerbated by asymmetric information among market participants.) This uncertainty accentuated pressures that had already existed since the summer of 2007, specifically pressures related to significant balance-sheet exposures of numerous euro-area banks to the US sub-prime housing market. This situation eventually led to a near freeze in interbank lending and to the collapse of activities in a large number of financial market segments and threatened to severely limit the financing of the real economy. If left unresolved, this state of affairs would have made the refinancing of many bank assets impossible, risking a disorderly deleveraging49 by credit institutions at heavily discounted prices. Given the particular structure of the euro-area economy, such a disorderly deleveraging would have had severe consequences for the real economy and price stability

in the euro area. Thus, the first priority of the ECB was to accommodate the funding needs of banks. To do so, it decided to drastically reduce its key interest rates within a seven-month period (October 2008 to May 2009) and to complement this measure with Enhanced Credit Support, a set of non-standard, temporary policy measures.

2.1.b The first stage of the sovereign debt crisis (2010-11) – the 'Securities markets programme'

In January 2010, markets were expecting a possible Greek sovereign default. Given Ireland, Portugal, Spain and Italy were also facing difficult economic situations (a housing crisis evolved into a financial crisis in Spain and Ireland, there was high public debt in Italy, and slow growth and increasing debt-to-GDP ratio in Portugal), certain secondary markets for government bonds began to dry up. These developments presented the risk of impairing the transmission mechanism through:

- the price channel (because of the link between government bond prices and the
- prices of assets and costs of borrowing in the economy)
- the liquidity channel (because government bonds play a crucial role in repurchase
- transactions) and
- the balance sheet channel (because the price of government bonds would have an impact on banks' balance sheets).

This sovereign debt crisis brought to the fore institutional design problems of the euro area: The Treaties include provisions that prohibit monetary financing by the ECB (Article 123 TFEU) and bailouts (Article 125 TFEU). Therefore, the ECB was more constrained in its actions than, for instance were the Federal Reserve or the Bank of England. To reduce market turbulence, it introduced the Securities Markets Programme in May 2010, under which it purchased (mainly) sovereign bonds on the secondary markets. In addition, it sterilised its interventions by offering banks, on a weekly basis, interest-bearing deposits for an amount equal to the amount of government bonds it purchased. At its peak, the programme's volume totalled around €210 billion. According to an ECB study, it led to 'stabilisation in markets as well as to an immediate and substantial decline of government bond yields'.

2.1.c. The intensification of the sovereign debt crisis (2011-12) and a new banking crisis – additional measures

The Securities Markets Programme was not enough. The downgrades of euro-area sovereign bonds, the slowing down of the European economy, and uncertainty regarding the effectiveness of the measures to tackle the euro-area crisis increased the pressure on the government debt of euro-area countries under financial assistance. In autumn 2011, the

adverse interaction between government bonds and national banking systems raised concerns about their viability, which once again rendered the interbank market dysfunctional. This situation worsened on 26 October 2011, when the Council agreed on a capital package proposed by the European Banking Authority (EBA), under which banks were required to build up additional capital buffers to reach a level of 9% Core Tier 1 capital. The objective of the exercise was to 'create an exceptional and temporary capital buffer to address (...) market concerns over sovereign risk', which would 'provide a reassurance to markets about banks' ability to withstand a range of shocks and still maintain adequate capital'. Nevertheless, the results of the exercise showed that banks needed another €115 billion in total64 to reach the desired level, which created uncertainty about their capital adequacy and added to market turbulence. In this context (December 2011), the ECB response focused on providing banks with short-term liquidity support and sufficient time to reach the desired capital level. *2.1.d The third stage of the crisis (2012-14)*

The end of 2011 and beginning of 2012 were tumultuous, with a proposed Greek referendum on the EU financing package and government crises in both Greece and Italy, as well as with Standard & Poor's downgrades of nine euro-area sovereigns69 in January and their lowering the credit rating of 16 Spanish banks70 in April. The uncertainty created – which the Greek election in spring 2012 did not lessen – resulted in government bond yields of a number of euro-area countries71 reaching new heights and starting to incorporate 'redenomination risk premiums' – that is, the risk that those countries would exit the EMU and redenominate their public and private liabilities. (Delivorias)

2.2. UNCONVENTIONAL MONETARY POLICY

This is the challenge facing central banks and why they have turned to unconventional monetary policy. Unconventional monetary policy takes many forms, as it is defined by what it is not rather than what it is. In some cases (for instance Denmark), it involves the use of negative interest rates. Some commentators advocate suspension or changes to inflation targets. The more common forms of unconventional monetary policy involve massive expansion of central banks' balance sheets and attempts at influencing interest rates other than the usual short-term official rates. For instance, the Federal Reserve implemented policies known as 'credit easing' when they purchased mortgage-backed securities. The purchase of these securities meant that the Fed now held more assets and so its balance sheet expanded. The purchase of these assets also provided liquidity to a market that had dried up in the wake of the financial crisis and helped lower mortgage interest rates directly and provided credit lines to an important part of the economy. The Federal Reserve has also implemented 'Operation Twist'. In this case the size of the balance sheet of a central bank

is not affected but the central bank tries to influence non-standard interest rates. In Operation Twist, the Fed sells short-term government bonds and uses the proceeds to buy long-term bonds.

Because its sales and purchases are of equal amount, the balance sheet of the central bank is unaffected but through its purchase of long-term bonds, it drives up their price and lowers long-term interest rates. The most high-profile form of unconventional monetary policy has been Quantitative Easing (QE). The phrase was first applied to Japan as it dealt with the bursting of a real estate bubble and the deflationary pressures that followed in the 1990s. Conventional monetary policy operates by affecting short-term interest rates through open market operations. By either buying or selling securities from the banking system, they influence the level of reserves that banks hold in the system. In normal times, these fluctuations in the volume of reserves are merely a by-product and are not a focus or target of policy itself. Instead, fluctuations in reserves are a means to achieve desired changes in interest rates. The phrase 'Quantitative Easing' was introduced to signal a shift in focus towards targeting quantity variables. With interest rates at their Zero Lower Bound, the Bank of Japan aimed at purchasing government securities from the banking sector and thereby boosting the level of cash reserves the banks held in the system. The hope was that by targeting a high enough level of reserves, eventually this would spill over into lending into the broader economy, helping drive asset prices up and remove deflationary forces. (Joyce et al)

When significant financial stresses first emerged, in August 2007, the FOMC responded by cutting the discount rate and the extending term loans to banks and afterwards lowering the target for the federal funds rate by 50 basis points. Bernanke et al (2012)

Making monetary policy with non-traditional tools is challenging. In particular, our experience with these tools remains limited. In this context, the FOMC carefully compares the expected benefits and costs of proposed policy actions. The potential benefit of policy action, of course, is the possibility of better economic outcomes--outcomes more consistent with the FOMC's dual mandate. In light of the evidence I discussed, it appears reasonable to conclude that non-traditional policy tools have been and can continue to be effective in providing financial accommodation, though we are less certain about the magnitude and persistence of these effects than we are about those of more-traditional policies. The possible benefits of an action, however, must be considered alongside its potential costs. I will focus now on the potential costs of LSAPs. One possible cost of conducting additional LSAPs is that these operations could impair the functioning of securities markets. As I noted, the Federal Reserve is limited by law mainly to the purchase of Treasury and agency securities; the supply of those securities is large but finite, and not all of the supply is actively

traded. Conceivably, if the Federal Reserve became too dominant a buyer in certain segments of these markets, trading among private agents could dry up, degrading liquidity and price discovery. As the global financial system depends on deep and liquid markets for U.S. Treasury securities, significant impairment of those markets would be costly, and, in particular, could impede the transmission of monetary policy. For example, market disruptions could lead to higher liquidity premiums on Treasury securities, which would run counter to the policy goal of reducing Treasury yields. However, although market capacity could ultimately become an issue, to this point we have seen few if any problems in the markets for Treasury or agency securities, private-sector holdings of securities remain large, and trading among private market participants remains robust. A second potential cost of additional securities purchases is that substantial further expansions of the balance sheet could reduce public confidence in the Fed's ability to exit smoothly from its accommodative policies at the appropriate time. Even if unjustified, such a reduction in confidence might increase the risk of a costly anchoring of inflation expectations, leading in turn to financial and economic instability. It is noteworthy, however, that the expansion of the balance sheet to date has not materially affected inflation expectations, likely in part because of the great emphasis the Federal Reserve has placed on developing tools to ensure that we can normalize monetary policy when appropriate, even if our securities holdings remain large.

In particular, the FOMC will be able to put upward pressure on short-term interest rates by raising the interest rate it pays banks for reserves they hold at the Fed. Upward pressure on rates can also be achieved by using reserve-draining tools or by selling securities from the Federal Reserve's portfolio, thus reversing the effects achieved by LSAPs. The FOMC has spent considerable effort planning and testing our exit strategy and will act decisively to execute it at the appropriate time. A third cost to be weighed is that of risks to financial stability. For example, some observers have raised concerns that, by driving longer-term yields lower, non-traditional policies could induce an imprudent reach for yield by some investors and thereby threaten financial stability. Of course, one objective of both traditional and non-traditional policy during recoveries is to promote a return to productive risk-taking; as always, the goal is to strike the appropriate balance. Moreover, a stronger recovery is itself clearly helpful for financial stability. In assessing this risk, it is important to note that the Federal Reserve, both on its own and in collaboration with other members of the Financial Stability Oversight Council, has substantially expanded its monitoring of the financial system and modified its supervisory approach to take a more systemic perspective. We have seen little evidence thus far of unsafe build-ups of risk or leverage, but we will continue both our careful oversight and the implementation of financial regulatory reforms aimed at reducing systemic risk.

A fourth potential cost of balance sheet policies is the possibility that the Federal Reserve could incur financial losses should interest rates rise to an unexpected extent. Extensive analyses suggest that, from a purely fiscal perspective, the odds are strong that the Fed's asset purchases will make money for the taxpayers, reducing the federal deficit and debt. And, of course, to the extent that monetary policy helps strengthen the economy and raise incomes, the benefits for the U.S. fiscal position would be substantial. In any case, this purely fiscal perspective is too narrow: Because Americans are workers and consumers as well as taxpayers, monetary policy can achieve the most for the country by focusing generally on improving economic performance rather than narrowly on possible gains or losses on the Federal Reserve's balance sheet. In sum, both the benefits and costs of non-traditional monetary policies are uncertain; in all likelihood, they will also vary over time, depending on factors such as the state of the economy and financial markets and the extent of prior Federal Reserve asset purchases. Moreover, non-traditional policies have potential costs that may be less relevant for traditional policies. For these reasons, the hurdle for using non-traditional policies should be higher than for traditional policies. At the same time, the costs of non-traditional policies, when considered carefully, appear manageable, implying that we should not rule out the further use of such policies if economic conditions warrant. (Bernanke 2012).

2.3 Quantitative Easing

Japan was the first to use QE, from 2001 to 2006 Japan's most recent QE programme began in April 2013 and worth $1.4 tn. The Bank of England launched its QE programme in March 2009 with an initial spending target of 75 bn over three months. At the same time, it cut interest rates to a record low of 0.5%. between March 2009 and January 2010, the Bank bought 200bn of assets, equivalent to 14% of GDP. Then in October 2011, faced with growing warnings of a double-dip recession and eurozone crisis, policy makers voted to resume QE and pump another 75 bn into the financial system increasing the QE to 275bn. The bank later increased the total to 37bn.

The U.S. Federal Reserve undertook the most successful QE effort. It added almost $2 trillion to the money supply. That's the largest expansion from any economic stimulus program in history. The European Central Bank adopted QE in January 2015, after seven years of austerity measures. It agreed to purchase 60 billion in euro-denominated bonds, lowering the value of the euro and increasing exports. It increased those purchases to 80 billion euros a month. In December 2016, it announced it would taper its purchases to 60 billion euros a month in April 2017.

The Federal Reserve significantly increased bank reserves and the monetary base after Lehman Brothers announced on September 15, 2008, that it had filed for chapter 11 bankruptcy protection. The Fed took additional steps toward quantitative easing (QE) on March 18, 2009, when it announced that it would purchase up to $1.725 trillion in mortgage-backed securities and government and agency debt. Recent speculation that the Federal Open Market Committee (FOMC) may purchase an additional large quantity of government debt to stimulate economic growth, increase employment, and prevent deflation has prompted considerable debate over the effectiveness of additional quantitative easing (QE2). (Thornton)

Program	Period of implementation
Securities Market Program (SMP)	10 of May 2010 - 06 of September 2012
Outright Monetary Transactions (OMT)	26 of July 2012 – 06 of September 2012
Covered Bond Purchase Program (CBPP3)	20 of October 2014 – Ongoing
Public Sector Purchase Program (PSPP)	9 of March 2015 - Ongoing

Table 1. The implementation period of QE programs from the ECB

The Asset Purchase Programme (APP) was launched in September 2014. It consisted initially of the purchase of Asset-Backed Securities[1] (ABSPP) and Covered Bonds (CBPP3) for a monthly total amount of €10 billion with the aim of facilitating credit, boosting investment, and ultimately, supporting economic growth.

In January 2015, the scope of the programme was widened to include Public Sector Purchase Programme (PSPP) in order to buy sovereign bonds[3] from euro-area countries and from supranational European institutions. The monthly total amount of purchased bonds has therefore reached €60 billion (€10 billion from ABSPP+CBPP3 plus €50 billion from the PSPP) and the expiry date of the programme was fixed at September 2016.

Since the beginning of the programme, several changes have been implemented on these criteria.

- In July 2015, national agencies were added to the list of possible purchases, since the original criteria already constrained the implementation of the programme in some

countries. In this way, the ECB has also had the possibility to buy securities other than sovereign bonds.

- In September 2015, the issue limit was raised to 33 % for non-CAC bonds.5
- In December 2015, the ECB announced 1) the length of the programme was extended to March 2017; 2) regional and local governments bonds were to be included in the eligible assets; 3) the deposit facility rate was lowered from -0.2 % to -0.3 %; 4) the issuer limit for supranational EU institutions was raised to 50 %; and 5) the principal payments deriving from the programme will be reinvested in it.
- in March 2016, corporate bonds6 of high quality would be considered as eligible assets for the programme (CSPP) and the total amount of APP purchases was increased to €80 billion

Also, in parallel with the APP programme, the ECB decided in March 2016 the following modifications: The deposit facility rate was fixed at -0.4 % and the lending rate was reduced to 0 %.

The market consensus expected an extension of the QE programme (currently running until the end of March 2017). This would lead to scarcity of assets eligible for the APP. According to recent studies, the amount of assets eligible for the purchasing programme was decreasing rapidly in some countries and the situation would be aggravated if the ECB decided to extend the APP. There was indeed a trade-off that should be taken into account between an extension in the length of the programme and the pool of assets eligible for such purchases. This posed a problem for how to extend QE. As Mario Draghi stated during the September 2016 press conference: 'the Governing Council tasked the relevant committees to evaluate the options that ensure a smooth implementation of our purchase programme'. (Nieminem 2016)

3.Literature review

The unconventional policy actions taken by central banks in a number of major economies to a burgeoning literature on their effectiveness. A number of of recent studies have centered their attention on the effects of of the U.S. unconventional monetary policy measures and the spillovers to advanced and emerging markets around the world. For instance, Moore et al (2013) investigates whether large-scale asset purchases (LSAPs) by the Federal Reserve influenced capital flows out of the United States and into emerging market economies (EMEs) and also analyzed the degree of pass-through from long-term U.S. government bond yields to long-term EME bond yields and concluded that with the further development of local currency government bond markets in EMEs in recent years, foreign investment in these markets has also grown. In this environment, changes in US

longer-term Treasury rates appear to have influenced foreign investment in EMEs' government bond markets and, in turn, longer-term government bond yields in many EMEs

Analysis of the impact of the US interest rates on foreign investment in EMEs' government bond markets and the impact of foreign ownership shares on government bond yields in the countries suggests that a 10-basis point decrease in the US 10-year Treasury yield pushes up the foreign share in government bond markets of the EM countries in our sample by an average of 0.4 percentage points, which in turn causes their government bond yields to fall by roughly 1.7 basis points. It is therefore estimated that the 100 and 13 basis point decreases in the 10-year US Treasury yield attributable to LSAP1 and LSAP2, respectively, did cause foreign capital to flow into the countries and consequently lowered their government bond yields, by approximately 17 and 2 basis points, respectively.

So, they estimated that US LSAPs increased portfolio flows into many emerging market economies. These increased investment flows may have furthered the development of local currency bond markets. On the other hand, negative effects on EMEs' government bond markets may arise from substantive outflows of foreign capital as monetary policy in developed economies normalize.

Christensen and Gillian (2016) investigated if Quantitative Easing affected market liquidity. In this paper, they argue that it is also possible for QE programs to reduce priced frictions to trading as reflected in liquidity premiums through a liquidity channel. This effect comes about because the operation of a QE program is tantamount to introducing into financial markets a large committed buyer, who is averse to large asset price declines and does not mind price increases. For example, one repeatedly stated goal of the Fed's various asset purchases programs was to put downward pressure on long-term interest rates or, equivalently, raise the prices of long-term bonds. This persistent presence and behaviour of the central bank increases the bargaining power of sellers relative to buyers in the markets for the targeted securities, which can lower their liquidity premiums as shown by Duffie et al. (2007). By the same logic, liquidity premiums of securities not targeted by the QE program are unlikely to be affected by the liquidity channel as there is no change in the bargaining power in those markets.

Bauer and Neely (2013) aimed to fill that gap by using term structure models to evaluate the relative importance of LSAP channels in mediating the impact of the Fed's asset purchases on international bond yields. In addition to U.S. yields, they studied the effects on interest rates in Canada, Germany, Australia, and Japan. They considered announcements associated with the three LSAP programs during the period from 2008 to 2012: QE1, QE2, and QE3. The empirical results show that both the signalling channel and the portfolio balance channel likely made substantial contributions to the decline in yields in most countries. For the U.S. and

Canada, the evidence for pronounced signalling effects is strongest, and the results are consistent across all three LSAP programs considered. For Germany and Australia, there is also evidence for signalling effects, however with slightly more uncertainty surrounding our estimates. For Japan, the signalling effects are negligible, in line with Japanese rates already being very depressed at short and medium maturities. Their evidence indicated that portfolio balance effects were likely relatively more important for Australia and Germany than for the U.S. and Canada and that portfolio balance effects were modest for Japan. Overall, they found that the evidence on the relative importance of the international effects of the Fed's LSAP programs on foreign yields was largely consistent with past sensitivity to conventional U.S. monetary policy surprises and with the covariance of foreign and U.S. bond returns.

Kenourgios et al. (2013) found a delayed negative response of EUR accompanied with increased variability before and after the ECB' announcements. This implies an unclear signal of future monetary policy actions for investors, which can be attributed to the price stabilization policy followed by the ECB ("strong currency" policy). On the other hand, the BoE's and BoJ's QE announcements cause a more direct and significant reduction on their currencies without producing increased volatility. These findings highlight the increased credibility and effectiveness of the BoE's and BoJ's monetary easing policies and support the existence of a signalling channel in the foreign exchange markets. Monetary authorities should take into account these differences in the transmission of QE announcements on foreign exchange markets. High frequency data may reveal the perception of markets concerning the credibility of the central banks to employ QE actions.

Chen et al. (2015) examine the domestic and cross-border effects, both real and financial, of the Federal Reserve's unconventional monetary policies using an estimated GVECM. And find that QE measures which lower the US corporate spread have had sizeable effects, which vary significantly across regions and individual economies Second, monetary policy and exchange rate responses have been diverse in the emerging economies, which may partly explain the important cross-economy differences in the responses of output, inflation and credit. Third, US QE measures have had sizeable and widespread effects on global equity prices, and the confidence channel may be important. Fourth, such measures tend to have a greater impact on many emerging economies than on the US economy.

MacDonald et al (2016) has shown that the Fed's LSAP program from 2000-2014 was associated with large and statistically significant currency appreciations, decreases in long-term local currency sovereign yields, and increases in equity markets across a large sample of EMEs. The degree to which individual EME asset prices were affected, however, displayed substantial heterogeneity. Much of the heterogeneity in currency, equity, and debt prices can be explained by the degree of capital market frictions between EMEs and the US, measured using exogenous

gravity variables. This is true even after controlling for exchange-rate regimes, capital control policies, and domestic monetary policy in EMEs.

These results have important policy implications for EME and advanced country central banks. Recently, governments and central banks in EMEs along with international policy institutes have pressed advanced countries to consider the international implications of their unconventional monetary policy actions. The results suggest that policy makers in EMEs can better anticipate and plan for the impact they will observe following action by foreign central banks, if they know in advance the types of assets advanced country central banks are purchasing and how integrated they are with these countries. Furthermore, if advanced country central banks are able to stimulate their economies with purchases of assets other than government bonds, when at the zero lower bound, then they should do so in order to limit international spillovers from their actions.

Bowman et al (2015) found that EME asset prices, especially sovereign yields in local currency, experienced large fluctuations around unconventional monetary policy announcements by the FED. In particular, asset prices in several EMEs experienced tail-event fluctuations around the dates of the first LSAP announcement, and then again around the June 2013 FOMC. We show that these large fluctuations in EME asset prices are in line with the estimated effects of U.S. monetary policy shocks. Specifically, they found that U.S. monetary policy shocks that lower U.S. sovereign yields also lower sovereign yields in most EMEs. In some cases, the effect on EME sovereign yields is larger than the effect on U.S. sovereign yields and is clearly significant and persistent. They also found that several country-specific variables drive the vulnerability of countries to changes in U.S. monetary policy, characterized by sovereign yields and high-yield bond spreads. In particular, countries with high interest rates, CDS spreads, inflation rates, or current-account deficits and those with more-vulnerable banking systems seem to become more affected by changes in U.S. financial variables.

4. Data, methodology and Empirical Tests

4.1. Data and methodology

Our data consist of returns of the values of the indexes of real estate REIT index, CRB commodity index, rare coin index and wine LVX50 index.

The Commodity indices track baskets of commodities to reflect price movements and are recognized as a major barometer of commodity prices and markets. This index is designed to provide exposure to the global commodities industry, all indices have a strong connection to the Commodity Research Bureau (CRB) name, and many are tracked by Exchange Traded

Funds and other derivatives, crude oil futures index, rare coins (source: Rare Coin Values Index -Liv-ex).

The Rare Coin Values Index follows the percent change movements of 87 carefully selected United States coins. The purpose of the Index is to assess the overall direction of the U.S. rare coin market over a period beginning in January 2000 to the current month. This Index is calculated once a month, for each coin in the Index, the current retail value is estimated and compared to the previous month's estimated value, and a percent difference is computed (it could be positive, negative, or no change). The percent difference for all 87 coins are added together and divided by 87 to come up with an average percent difference of the entire group. Thus, each coin in the Index carries equal weight. Let's call this result the Current Month Index, or CMI. The previous month's Index score is multiplied by (1+CMI) to arrive at an updated Index score. We examine the period between 2000 and 2016. And finally, the wine LVX50 index this index tracks the daily price movement of the most heavily traded commodities in the fine wine market - the ten most recent vintages (excluding En Primeur, currently 2001-2010) the Bordeaux First Growths.

As a control variable we use the volatility index VIX (which is designed as gauge to measure investors' fear of market crash and is widely used as of 30-day volatility. It is constructed using the implied volatilities of a wide range of S&P 500 options which allows for a more accurate view of investors' expectations on future market volatility. VIX values greater than 30 are generally associated with a large amount of volatility as a result of investor fear or uncertainty, while values below 20 generally correspond to less stressful, even complacent, times in the markets.

The implementation periods and the appropriate dummies for each QE program of the two Central Banks are presented in Tables 2 and 3. The first dummy refers to purchase of government's bonds, bonds of Portugal Greece and other's countries of eurozone with economic problems as Draghi has said: whatever it takes, and the second one refers to programmes more accurate to the definition of quantitative easing which launched ECB

Period	Program	Period of implementation
DTO	No QE Program	
DT1 period of first QE programme	Securities Market Program (SMP)	10 of May 2010 - 06 of September 2012
	Outright Monetary Transactions (OMT)	26 of July 2012 – 06 of September 2012
DT2 period of second QE program	Covered Bond Purchase Program (CBPP3)	20 of October 2014 – Ongoing
	Public Sector Purchase Program (PSPP)	9 of March 2015 - Ongoing

Table 2. The implementation period of QE programs from the ECB with dummies periods

period	date	Program	Event	Brief description
Dt0_fed	1/1/2000-11/25/2008	NO QE	No event	
Dt1_fed	11/25/2008	QE1	FOMC statement	LSAPs announced: Fed will purchase $100 bil. in GSE debt and $500 bil. in MBS.
	12/01/2008	QE1	Bernanke speech	First suggestion of extending QE to treasuries.
	12/16/2008	QE1	FOMC statement	First suggestion of extending QE to treasuries by FOMC.
	01/28/2009	QE1	FOMC statement	Fed stands ready to expand QE and buy Treasuries.
	03/18/2009	QE1	FOMC statement	LSAPs expanded: Fed will purchase $300 billion in long term Treasuries and an additional $750 and $100 bil. in MBS and GSE debt, respectively.
	08/12/2009	QE1	FOMC statement	LSAPs slowed: All purchases will finish by the end of October, not mid-September.
	09/23/2009	QE1	FOMC statement	LSAPs slowed: Agency debt and MBS purchases will finish at the end of the 2010:Q1.
	11/04/2009	QE1	FOMC statement	LSAPs downsized: Agency debt purchases will finish at $175 bil.
	08/10/2010	QE1	FOMC statement	Balance sheet maintained: The Fed will reinvest principal payments from LSAPs in Treasuries.
Dt2_fed	08/27/2010	QE2	Bernanke speech	Bernanke suggests role for additional QE "should further action prove necessary".
	09/21/2010	QE2	FOMC statement	FOMC emphasizes low inflation which "is likely to remain subdued for some time before rising to levels the Committee considers consistent with its mandate".
	10/12/2010	QE2	FOMC minutes released	FOMC members "sense" is that "[additional] accommodation may be appropriate before long".
	10/15/2010	QE2	Bernanke speech	Bernanke reiterates that Fed stands ready to further ease policy.
	11/03/2010	QE2	FOMC statement	QE2 announced: Fed will purchase $600 bil. in Treasuries.
	06/22/2011	QE2	FOMC statement	QE2 finishes: Treasury purchases will wrap up at the end of month, as scheduled; principal payments will continue to be reinvested.
	09/21/2011	Maturity extension Program	FOMC statement	Maturity Extension Program ("Operation Twist") announced: The Fed will purchase $400 bil. of Treasuries with remaining maturities of 6 to 30 years and sell an equal amount with remaining maturities of 3 years or less; MBS and agency debt principal payments will no longer be reinvested in Treasuries, but instead in MBS.

	06/20/2012	Maturity Extension Program	FOMC statement	Maturity Extension Program extended: The Fed will continue to purchase long-term securities through the end of 2012. Purchases/sales will continue at the current pace, about $ 45 bil./month.
Dt3_fed	08/22/2012	QE3	FOMC minutes released	FOMC members "judged that additional monetary accommodation would likely be warranted fairly soon…"
	09/13/2012	QE3	FOMC statement	QE3 announcement: The Fed will purchase $40 bil. of MBS per month as long as "the outlook for the labor market does not improve substantially…in the context of price stability.
	12/12/2012	QE3	FOMC statement	QE3 expanded: The Fed will continue to purchase $45 bil. of long-term Treasuries per month but will no longer sterilize purchases through the sale of short-term Treasuries.
Dt4_fed	06/19/2013	Tapering		Ben Bernanke announced a "tapering" of some of the Fed's QE policies contingent upon continued positive economic data. Specifically, he said that the Fed could scale back its bond purchases from $85 billion to $65 billion a month during the upcoming September 2013 policy meeting. He also suggested that the bond-buying program could wrap up by mid-2014.
	09/18/2013	Tapering		The Fed decided to hold off on scaling back its bond-buying program.
	02/2014	Tapering		Began tapering purchases.
	10/29/2014	Tapering		Purchases were halted on 29 October 2014 after accumulating $4.5 trillion in assets.
dto_ FED	10/29/2014-2016	NO QE		

Table 3 The implementation period of QE programs from the FED with dummies periods and important announcements by the Fed.

The methodology we are going to use is the OLS which is a method for estimating the unknown parameters in a linear regression model. OLS chooses the parameters of a linear function of a set of explanatory variables by minimizing the sum of the squares of the differences between the observed dependent variable (values of the variable being predicted) in the given dataset and those predicted by the linear function. The explanatory variables we use to explain our model are the dummies we created for each program of QE. We do that for each central bank separately. So, the linear regression models we are going to use are for European Central Bank:

$$Qi= \alpha*DT0_{\_ECB} + b*DT1_{\_ ECB\_SMP\_OMT} + c*DT2_{\_ECB\_cbpp3\_PSPP} + g * VIX$$

And for Federal Reserve:

$$Qi= \alpha*DT0_{\_FED} + b*DT1_{\_FED} + c*DT2_{\_FED} + e*DT3_{\_FED} + f*DT4_{\_FED} + g*VIX$$

According to the table 3 the dummy variables $DT1_{\_FED}$ refers to the time period between 25/1/2008 and 10/8/2010, $DT2_{\_FED}$ refers to the time period between 27/8/2010 and 20/6/2012, $DT3_{\_FED}$ refers to the period between 22/8/2012 and 12/12/2012, $DT4_{\_FED}$ refers to the time period between 19/06/2013 and 2/9/1014 and Dt0_fed is a dummy for the time period with no QE program (2000-2008 and 2/9/2014-2016).

On the other hand, when we are trying to estimate the impact of ECB's QE the dummy variables $DT1_{\_ECB\_SMP\_OMT}$ refers to the period between 10/5/2010 until 6/9/2012 and $DT2_{\_ECB\_cbpp3\_PSPP}$ refers to the time period between 20/10/2014 until 2016 and the dummy $Dt0_{\_ECB}$ refers to time period 2000-10/5/2010.

Then we search for serial correlation in our models. Serial correlation is a term used in statistics to describe the relationship between observations of the same variable over specific periods of time.

4.2. *Empirical results*

The dummies variables Dt0_fed, Dt1_fed, Dt2_fed, Dt3_fed, Dt4_fed are equal to one during the corresponding period of interpretation and zero otherwise with this procedure we examine all the coefficients of the dummy variables. On the other hand, when we are trying to estimate the impact of ECB's QE the dummy variables $Dt0_{\_ECB}$ $DT1_{\_ECB\_SMP\_OMT}$ and $DT2_{\_ECB\_cbpp3\_PSPP}$ are equal to one during the corresponding period of interpretation and zero otherwise

dependant variable:		REAL ESTATE _REIT		
METHOD:		LEAST SQUARES		
SAMPLE		2000M01 2016M07		
OBSERVATIONS		199		
VARIABLE	COEFFICIENT	Std. Error	t-Statistic	Prob
DT0_ECB	-1.386045	0.467586	-2.96425	0.0034
DT1_ECB_SMP_OMT	-1.389935	1.057839	-1.31394	0.1904
DT2_ECB_cbpp3_PSPP	-1.524354	1.246581	-1.22283	0.2229
VOLUME_VIX	-12.13235	1.865137	-6.5048	0

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	4.192544	Prob. F (2,193)	0.0165
Obs*R-squared	8.285779	Prob. Chi-Square (2)	0.0159

Table 4 Impact of ECB's QE on real estate REIT

According to the empirical result in table it seems that there is a negative impact on REAL ESTATE _REIT (-1.389935) from the variable $DT1_{\_ECB\_SMP\_OMT}$ which is the dummy for SMP and OMT programmes but it is not significant since probability is equal to 19,04%, and there is a negative impact (-1.524354) on REAL ESTATE _REIT from CBPP3 and PSPP programmes but it is not significant since probability is equal to 22,29%. We have no serial correlation since Prob. Chi-Square (2) (1,59%) is less than 5%.

dependant variable:		REAL ESTATE _REIT		
METHOD:		LEAST SQUARES		
SAMPLE		2000M01 2016M07		
OBSERVATIONS		199		
VARIABLE	COEFFICIENT	Std. Error	t-Statistic	Prob
DT0_FED	-1.145243	0.503624	-2.274003	0.0241
DT1_FED	-2.486959	1.245621	-1.996562	0.0473
DT2_FED	-2.113755	1.805468	-1.170751	0.2431
DT3_FED	-1.279933	1.165850	-1.097854	0.2736
DT4_FED	-1.822150	1.525464	-1.194489	0.2338
VOLUME_VIX	-12.02507	1.873293	-6.419216	0.0000

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	4.823541	Prob. F (2,192)	0.009
Obs*R-squared	9.567890	Prob. Chi-Square (2)	0.0084

Table 5 Impact of FED's QE on real estate REIT

According to the empirical result in table it seems that there is a negative impact on REAL ESTATE _REIT (-2.486959) from the variable $DT1_{\_FED}$ which is the dummy for the first FED's QE program and it is significant since probability is equal to 4,73%, and there is a negative impact (-2.1133755) on REAL ESTATE _REIT from the second FED's QE program but it is not significant since probability is equal to 24,31% and there is a negative impact (-1.2799933) on REAL ESTATE _REIT from the third's FED's QE program which is also not significant since probability is equal to 11.09% , and for the period of tapering we ha no significant result. We have no serial correlation since Prob. Chi-Square (2) (0,91%) is less than 5%.

dependant variable:		CRB_COMMODITY		
METHOD:		LEAST SQUARES		
SAMPLE		2000M01 2016M07		
OBSERVATIONS		199		
VARIABLE	COEFFICIENT	Std. Error	t-Statistic	Prob
DT0_ECB	-0.495691	0.242291	-2.04585	0.041
DT1_ECB_SMP_OMT	-0.457012	0.548144	-0.83374	0.4054
DT2_ECB_cbpp3_PSPP	0.3811	0.645946	0.589988	0.5559
VOLUME_VIX	-3.378188	0.966465	-3.49541	0.0006

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	4.560122	Prob. F (2,193)	0.0116
Obs*R-squared	8.979450	Prob. Chi-Square (2)	0.0112

Table 6 Impact of ECB's QE on commodity index

According to the empirical result in table it seems that there is a negative impact on CRB_COMMODITY (-0.495691) when there is no ECB's QE program and from the CBPP3 and PSPP programmes and according to the results there was a negative impact on CRB_COMMODITY from SMP and OMT programmes but these coefficients are not significant. The only significant variable is for period with no ECB's QE, that means that ECB 's programs did not impact the market of CRB_ Commodity. We have no serial correlation since Prob. Chi-Square (2) (1,12%) is less than 5%.

dependant variable:		CRB_COMMODITY		
METHOD:		LEAST SQUARES		
SAMPLE		2000M01 2016M07		
OBSERVATIONS		199		
VARIABLE	COEFFICIENT	Std. Error	t-Statistic	Prob
DT0_FED	-0.242418	0.255579	-0.948505	0.3441
DT1_FED	-2.117896	0.632126	-3.350431	0.0010
DT2_FED	-1.423313	0.916237	-1.553432	0.1220
DT3_FED	0.367187	0.591644	0.620622	0.5356
DT4_FED	0.157364	0.774141	0.203276	0.8391
VOLUME_VIX	-3.407316	0.950657	-3.584169	0.0004

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	3.018836	Prob. F(2,191)	0.0512
Obs*R-squared	6.097802	Prob. Chi-Square(2)	0.0474

Table 7 Impact of FED's QE on commodity index

According to the empirical result in table it seems that there is a negative impact on CRB COMMODITY (-2.117896) from the variable DT1_FED which is the dummy for the first FED's QE program and it is significant since probability is equal to 0,13%, and there is a negative impact (-1.423313) on CRB COMMODITY from the second FED's QE program but it is not significant since probability is equal to 12,20% and there is a positive impact (0.367187) on CRB COMMODITY from the third's FED's QE program which is also not significant since probability is equal to 53,56 % and for tapering period we the impact we have is not significant. We have no serial correlation since Prob. Chi-Square (2) (4,62%) is less than 5%.

dependant variable:		CRUDE OIL FUTURES		
METHOD:		LEAST SQUARES		
SAMPLE		2000M01 2016M07		
OBSERVATIONS		199		
VARIABLE	COEFFICIENT	Std. Error	t-Statistic	Prob
DT0_ECB	-1.047577	0.76376	-1.37161	0.1718
DT1_ECB_SMP_OMT	-0.844658	1.727883	-0.48884	0.6255
DT2_ECB_cbpp3_PSPP	0.788049	2.036176	0.387024	0.6992
VOLUME_VIX	-7.804534	3.04	-2.56178	0.0112

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.953849	Prob. F (2,193)	0.3871
Obs*R-squared	1.947752	Prob. Chi-Square (2)	0.3776

Table 8 Impact of ECB's QE on crude oil futures index

According to the empirical result in table it seems that this model has serial correlation problem since Prob. Chi-Square (2) (37,76%) is more than 5%

dependant variable:		CRUDE OIL FUTURES		
METHOD:		LEAST SQUARES		
SAMPLE		2000M01 2016M07		
OBSERVATIONS		199		
VARIABLE	COEFFICIENT	Std. Error	t-Statistic	Prob
DT0_FED	-0.681003	0.818055	-0.832467	0.4062
DT1_FED	-3.113490	2.023312	-1.538808	0.1255
DT2_FED	-1.141133	1.893737	-0.602583	0.5475
DT3_FED	2.808750	2.477873	1.133533	0.2584
DT4_FED	-7.748969	3.041906	-2.547406	0.0116
VOLUME_VIX	-0.681003	0.818055	-0.832467	0.4062

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.772582	Prob. F(2,191)	0.4633
Obs*R-squared	1.596964	Prob. Chi-Square(2)	0.4500

Table 9 Impact of FED's QE on CRUDE OIL FUTURES

According to the empirical result in table it seems that this model has serial correlation problem since Prob. Chi-Square (2) (37,76%) is more than 5%.

dependant variable:		RARE COINS		
METHOD:		LEAST SQUARES		
SAMPLE		2000M01 2016M07		
OBSERVATIONS		199		
VARIABLE	COEFFICIENT	Std. Error	t-Statistic	Prob
DT0_ECB	-0.864512	0.130099	-6.645011	0.0000
DT1_ECB_SMP_OMT	-0.274886	0.294329	-0.933943	0.3515
DT2_ECB_cbpp3_PSPP	-0.048017	0.346844	-0.138441	0.8900
VOLUME_VIX	0.299604	0.518948	0.577328	0.5644

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	31.18127	Prob. F(2,193)	0.0
Obs*R-squared	48.59814	Prob. Chi-Square(2)	0.0

Table 10 Impact of ECB's QE on RARE COINS

According to the empirical result in table it seems that there is a negative impact on REAR COINS (-0.274886) from the variable $DT1_{\_ECB\_SMP\_OMT}$ which is the dummy for the first ECB's QE program and it is not significant since probability is equal to 35,15%, and there is a negative impact (-0.048017) on REAR COINS from the second ECB's QE program but it is not significant since probability is equal to 89%. We have no serial correlation since Prob. Chi-Square (2) (0%) is less than 5%.

dependant variable:		RARE COINS		
METHOD:		LEAST SQUARES		
SAMPLE		2000M01 2016M07		
OBSERVATIONS		199		
VARIABLE	COEFFICIENT	Std. Error	t-Statistic	Prob
DT0_FED	-1.033511	0.136845	-7.552420	0.0000
DT1_FED	0.111496	0.338460	0.329420	0.7422
DT2_FED	-0.178414	0.490582	-0.363678	0.7165
DT3_FED	-0.205152	0.316785	-0.647608	0.5180
DT4_FED	0.018735	0.414499	0.045198	0.9640
VOLUME_VIX	0.104007	0.509012	0.204332	0.8383

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	4.823541	Prob. F (2,192)	0.009
Obs*R-squared	9.567890	Prob. Chi-Square (2)	0.0084

Table 11 Impact of FED's QE on RARE COINS

According to the empirical result in table it seems that there is a positive impact on REAR COINS (0.111554) from the variable DT1_FED which is the dummy for the first FED's QE program and it is not significant since probability is equal to 74,15%, and there is a negative impact (-0.178565) on REAR COINS from the second FED's QE program but it is not significant since probability is equal to 71,57% and there is a negative impact (-0.122592) on REAR COINS from the third's FED's QE program which is also not significant since probability is equal to 62,6 % . We have no serial correlation since Prob. Chi-Square (2) (0%) is less than 5%.

dependant variable:		WINE LVX		
METHOD:		LEAST SQUARES		
SAMPLE		2000M01 2016M07		
OBSERVATIONS		199		
VARIABLE	COEFFICIENT	Std. Error	t-Statistic	Prob
DT0_ECB	-0.885322	0.245981	-3.59915	0.0004
DT1_ECB_SMP_OMT	0.336135	0.556492	0.604026	0.5465
DT2_ECB_cbpp3_PSPP	-0.952467	0.655782	-1.45241	0.1480
VOLUME_VIX	-0.813932	0.981182	-0.82954	0.4078

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	48.43912	Prob. F(2,193)	0.0000
Obs*R-squared	66.50644	Prob. Chi-Square(2)	0.0000

Table 12 Impact of ECB's QE on WINE LVX

According to the empirical result in table it seems that there is a negative impact on WINE LVX (-0.952467) from the CBPP3 and PSPP programmes and according to the results there was a positive impact on WINE LVX (0.336135) from SMP and OMT programmes both of them are not significant variables. We have no serial correlation since Prob. Chi-Square (2) (0%) is less than 5%.

dependant variable:		WINE LVX		
METHOD:		LEAST SQUARES		
SAMPLE		2000M01 2016M07		
OBSERVATIONS		199		
VARIABLE	COEFFICIENT	Std. Error	t-Statistic	Prob
DT0_FED	-0.799164	0.252785	-3.161437	0.0018
DT1_FED	-2.619668	0.625217	-4.190016	0.0000
DT2_FED	-2.068055	0.906222	-2.282062	0.0236
DT3_FED	0.923796	0.585177	1.578661	0.1161
DT4_FED	1.077972	0.765679	1.407864	0.1608
VOLUME_VIX	-0.859417	0.940265	-0.914016	0.3618

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	38.21991	Prob. F (2,192)	0.0000
Obs*R-squared	56.87831	Prob. Chi-Square (2)	0.0000

Table 13 Impact of FED's QE on WINE LVX

According to the empirical result in table it seems that there is a negative impact on WINE LVX (-2.619628) from the variable DT1_FED which is the dummy for the first FED's QE program and it is significant since probability is equal to 0 %, and there is a negative impact (-2.068055) on WINE LVX from the second FED's QE program but it is significant since probability is equal to 2,32% and there is a positive impact (0.923796) on WINE LVX from

the third's FED's QE program which is not significant since probability is equal to 11,61 %. We have no serial correlation since Prob. Chi-Square (2) (0%) is less than 5%.

4.3. Conclusions

To provide estimations we used a model separately for every period that ECB and Federal Reserve launched QE programmes. We divided the time to periods from the moment that each central bank announced each program until the end of the program and we created dummies for the evaluation of the impact for every separate index.

We have seen that there was a negative impact on the first period that FED launched the first QE program on real estate. On the contrary ECB's QE programmes had not significant effects on this real estate index. The impact on commodity of the first FED's QE program was negative according to the model we used. There was no significant impact on the index of rare coins, from the programmes that both of the central banks launched. On the contrary on the wine LVX50 index we saw that that ECB's QE programmes were not significant but FED's programmes created a negative impact on this market with different coefficient for every time period of first and second QE. So as a conclusion we see that we had differences on the impacts on these alternative markets between the programmes that ECB and Federal Reserve launched and we investigated.

Through our investigation with the model we used we have found that there were no significant impacts generally on the indexes of real estate, commodity, wine, crude oil futures since the coefficient of the dummies who referred to the time period that the quantitative easing were launched gave us values we could not estimate them as significant coefficient. In future research it would be helpful to be analysed with more advanced methodologies in order to check the robustness of this thesis's results.

5. Literature

Bauer, M & Neely, C. 2013. International channels of the Fed's unconventional Monetary Policy, *Working Paper, International Monetary Fund.*

Bekaert, G., Hoerova, M &Lo Duca, M.,2012 Risk, Uncertainty, And Monetary Policy, *Working Paper, Columbia University.*

Bernanke, B.S., August 31 ,2012. Monetary Policy since the onset of the crisis, *Federal Reserve Bank of Kansas City Economic symposium, Jackson Hole, Wyoming(vol.31)*

Bowman, D., Londono J.M & Sapriza, H., 2014 U.S. unconventional monetary policy and transmission to emerging market economies, *Board of Governors of the Federal Reserve System, International Finance Discussion Papers (number 1109)*

Chen Q., Filardo A., He, D& Zhu, F., 2015 Financial crisis U.S. Unconventional Monetary Policy and International Spillovers, *IMF Working Paper, International Monetary Fund,22-24*

Delivorias, A., February 2015 Monetary policy of the European Central Bank, *European Parliamentary Research service.*

Jens H.E.C. & Gillan, J.M., June 2016. Does Quantititave Easing affect Market Liquidity? *Federal Reserve Bank Of San Francisco.*

Joyce, M., Miles, D., Scott, A& Vayanos, D., November 2012. Quantititave Easing And unconventional Policy- An introduction, *The Economic journal 122, F271-272*

Moore, J., Nam, S., Suh, M. &Tepper, A., 2013. Estimating the impacts of US LSAPs on Emerging market economies' local currency bond markets, *Federal Reserve Bank of New York*

Kenourgios, D., Papadamou, D. & Dimitriou, D., 2015. Intraday exchange rate volatility transmissions across QE announcements. *Finance Research Letters 14,111-123*

MacDonald, M., 2016. International capital market frictions and spillovers from quantitative easing, *Queen's Economics Department Working Paper No. 1346, 22-23*

Nieminen, R., Stansilas De Finance with Osvaldo M., Picarelli November 2016. ECB's unconventional monetary policy. Tapering or Extension? Options on the table, *European Parliamentary Research service.*

Thornton, D.L., 2010 Would QE2 have a significant effect on economic growth, employment or inflation? *Economic Synopses.*