CENTRAL BANK POLICIES

by

Nikolaos Ath. KYRIAZIS

UNIVERSITY OF
THESSALY

This thesis is submitted to the Department of Economics for the Degree of Doctor of Philosophy in Economics at the University of Thessaly

July 2018

CENTRAL BANK POLICIES

Nikolaos Kyriazis

DISSERTATION

in

Economics

Presented at the Faculties of the University of Thessaly

in

Fulfillment of the Requirements for the

Degree of Doctor of Philosophy

2018

Supervisor of Dissertation

Stephanos Papadamou

Associate Professor in Banking and Finance

Dissertation Committee:

Christos Kollias, Professor in Applied Economics

Eleftherios Spyromitros, Assistant Professor in Economic Theory and Analysis

2

To anyone who has spent minutes, hours or years of his life to learn economics.

Acknowledgements

I am deeply indebted to my supervisor Stephanos Papadamou for providing me with the intense motive, ample knowledge and useful guidance in order to complete this thesis. I sincerely would like to thank my committee members Christos Kollias and Eleftherios Spyromitros for sharing their academic expertise in their useful comments that led to the improvement of the final version of this dissertation. The quality of this work has also been ameliorated by useful discussions with my colleagues Panayiotis Tzeremes and Emmanouil-Marios Economou and I have been very pleased also for having worked with them by writing prestigious academic papers. I feel privileged to be a member of the Department of Economics at the University of Thessaly and having exchanged thoughts with a number of important academics. I also have enjoyed and benefited from every moment with undergraduate and postgraduate students that helped me understand what a good teacher should be like.

I really find too difficult to express in a few lines the loving gratitude for my parents that have unstoppably and unconditionally provided me with nothing but affection and courage since the early beginning of my life. I am most happy that this thesis renders true their biggest wish during the last three decades.

Table of Contents

6

List of Figures

List of Tables

13

Preface

This dissertation studies matters related to Unconventional Monetary Policy (UMP) that was implemented by the monetary authorities of the **United States (US), the United Kingdom (UK), Japan and the Eurozone since** the **outburst of the Global Financial Crisis** in September 2008.

Chapter 1 of this thesis poses the **questions** that are **investigated throughout subsequent chapters**. Moreover, an **analysis** takes place about the **theoretical background** on which the central banks in these advanced regions were based in order to conduct unconventional action taking. These **practices** were made **in order to lower yields**, **boost equity prices** and **devaluate local currencies**. Furthermore, **bank lending became cheaper** and **higher levels of liquidity** as well as **confidence** made their appearance in UMP-adopting countries or unions of countries. The **ultimate intention** of such policymaking was to **boost inflation and output**, thereby preventing economies from being trapped into deflation and stagnation. There is a **detailed description of the QE actions that took place** in the USA, the UK, Japan and the Eurozone as well as a **thorough analysis of the transmission channels** of unconventional monetary policies. It should be noted that the **economic underpinnings** of such extraordinary action taking are discussed and **analyzed in-depth.**

Chapter 3 provides an integrated survey of empirical findings covering all the **existing studies in highly prestigious journals** about Quantitative Easing and unconventional monetary policies in general. The number of papers examined **exceeds 250**. An investigation of non-conventional policies is conducted **under the prism of the channels** through which their impacts are transmitted to the real economy. Furthermore, we **categorize and analyze findings** according to the prices of assets that were influenced, such as **bonds, equity or currency values**. Moreover, analysis of the relevant models employed in order to **study policies at the Zero Lower Bound (ZLB)** takes place. Finally, the **macroeconomic effects** of such action taking are under scrutiny, thereby analysis is conducted of whether out of the ordinary practices have been effective for the real economies **in terms of output, inflation and unemployment**. A number of useful **policy implications** are derived as concerns effects of unconventional action taking on macroeconomic variables and asset prices in the **USA, the UK, Japan, the Eurozone** or separate European countries, as well as **advanced** countries or **emerging** countries in general.

Chapter 4 provides an integrated overview **of empirical findings** about unconventional monetary policies by employing the methodology of meta-analysis, by applying the **reporting guidelines of Stanley et al. (2013).** By using **16 primary studies with VAR specifications** and by examining the impulse responses of output and of prices, we **identify the best combination of moderators that can explain heterogeneity. Moreover, robustness tests by specifications based on different weighting schemes are conducted.** Empirical outcomes indicate that the existence of

14

a FAVAR methodology triggers a positive and statistically significant impact mainly on output responses in all horizons but also in prices responses in the short-run. Moreover, the examination of European countries affects output responses negatively. Moreover, sign restrictions in impulse response analysis as it is found to lead to lower output. The TVP-VAR methodology and the number of observations is also found to positively affect prices responses in the short-run, whereas recursive identification exerts a negative impact in all horizons on prices responses.

Chapter 5, *in its 1ˢᵗ part,* addresses whether non-conventional policies had an impact in the **UK** in terms of significantly affecting government and private yields. A **threshold cointegration (M-TART) estimation** is undertaken in order to examine the **short-run and long-run relation** between the **BoE's total assets** and **5-year as well as 10-year government bond** and **bank liability yields**. It should be emphasized that we adopt an innovative and **highly representative index for commercial bank yields**. Findings indicate the **existence of a significant threshold effect** of unconventional practices on all the four yields examined. More specifically, both the **5-year and the 10-year government bond yields** are found to **significantly adjust towards equilibrium** both **in the low and the high regime**. Furthermore, results indicate the existence of a **bi-directional impact** between total assets and the 10-year government bond yields, thereby reveal a **strong dynamic effect** between them **in the long-run** and the presence of a **feedback procedure**. Moreover, there is evidence that **commercial bank liability yields react in order to return to their long-run values, only in the low regime**. Thereby, if **they fall below the threshold**, they will have a **tendency to return to this threshold value.**

In the *2ⁿᵈ part of Chapter 5*, a **non-linear quantile causality estimation** of the **Fed's QE effects on global stock indices** takes place, by mainly focusing on the tails of stock indices distributions. This allows to capt**ure more efficiently the causality dynamics of** unconventional action taking in one of the most influential and sophisticated economies, the **USA, on capital markets in a worldwide level**. A comparison is made between US unconventional **spillover effects** on stock markets in advanced economies and stock markets in developing countries. Econometric estimations provide evidence that US non-conventional actions, apart from the US indices, have mainly affected stock indices of advanced economies. Thereby, the **Fed announcements are found to have been priced in equity quotes in advanced markets**, whereas **in a somewhat lower extent in emerging ones**. This causal link is found to be **more obvious that with classical Granger causality tests**. **There is evidence that non-linear causality is stronger in upper quantiles**, **abiding by** the **non-linear character of the crisis diffusion and** the **transmission of QE policies**.

In **Chapter 6**, a discussion takes place about the potential of higher effectiveness of more intense forms of unconventional monetary policy. The focus is made on the highly innovative concept of ''**helicopter money drops**'' as was expressed by Friedman (1969) and Buiter (2005). An in-depth analysis of the character of **overt irredeemable money financing** is conducted and emphasis is paid to the **moral hazard** inhibited in such decisions and the possibility of conflict

15

between monetary and fiscal authorities. Furthermore, the **risk of reduction of central bank credibility and** especially the European Central Bank due to such measures, is investigated.

Chapter 7 presents and **analyzes the economic implications** drawn **from all** the **previous chapters**. **Answers** are provided **to all theoretical questions** and **analysis** is made **of** the **policy implications** of each subsection presented. **Overall** findings indicate the **significance of unconventional monetary policies in affecting asset markets as well as macroeconomic variables**. This thesis offers at the best feasible extent a roadmap for further research on unconventional action taking during crises and **fuels the armory of** policymakers in order **to be more effective under adverse conditions**.

16

Chapter 1

Aims and Objectives of this thesis

1.1. Introduction

This dissertation aims to cast light on a number of matters about modern unconventional monetary policy and to broaden to the best possible extent the knowledge about the **theoretical underpinnings, the character, the forms of application, the empirical findings, the economic implications and the perspectives** of such innovative policymaking. In order to achieve this, **analytical theoretical analysis and description** are made, innovative tools of **meta-analysis and systematic reviews** are adopted, **modern econometric methodologies** are applied, and useful **economic implications** are presented based on empirical outcomes. Overall, the aim of this thesis is to be accurate both by a **theoretical and a methodological aspect**.

1.2. Questions to be answered in Chapter 3

In order to be more precise, we commence by describing the objectives and queries of this thesis inhibited in <u>Chapter 3</u>. This section is about a **systematic review**, in the form of a complete **survey**, of the **most reliable literature** concerning unconventional monetary policies. This is the reason why **over 250 academic papers** published in the **most prestigious and high-ranked economic and financial journals** are described as regards their **methodology** and their **main findings**. The intention here is to provide the full spectrum of **theoretical**, **model-based** but also **mainly empirical** literature on Quantitative Easing as well as unconventional monetary policymaking in general. Some separate but important questions are under scrutiny and their answers, when combined, are fully informative of findings about such policies.

More specifically, in the beginning, it is investigated which are the journals that have published more articles about unconventional monetary policies. Emphasis is attributed to whether these journals are high-ranked and prestigious or not, in order to make out whether the empirical results published in them are reliable enough. Furthermore, interest here is centered on what has been the **evolution regarding the bulk and the quality of publications** of academic papers relevant to QE. We distinguish when the **tendency for theoretical approaches** of non-conventional practices started fading out and when the higher **trend towards empirical studies or model approaches** was triggered. It is also of major importance that emphasis is attributed on which countries research has centered on and which was the timeline of publications studying the specific countries. This way, a **clear picture** is presented about where the **academic interest has focused intertemporally** and whether this **abides by the timeline of unconventional events** triggered by the Gl**obal Financial**

Crisis and the **European Sovereign Debt crisis**. Whether the focus has been made on emerging economies is also a point of concern as **spillover effects** have always been a primordial factor for affecting economies in a worldwide level.

When it comes to **more technical questions**, a number of findings give answer to this sequence of important matters. First, an answer is provided about which have been the methodologies most preferred by academics in order to effectively and accurately study QE impacts. Moreover, an **investigation** is made **on other innovative methodologies** employed in unconventional monetary policy studies that could be applied to further relevant research. One can see **which methodologies are deemed to be more suitable for specific countries and for specific unconventional practices during certain time periods**. For example, it is seen whether employing event-study methodologies is considered to be appropriate for studying QE announcements, or whether Global-VAR can provide reliable estimations in a worldwide level of countries.

Furthermore, **effects on specific assets** have been under scrutiny. More specifically, it is laid out how government and corporate bond yields have been affected by QE actions, that is which has been the sign and the magnitude of effects due to non-conventional shocks. This research is also cautiously **extended on** other asset prices, such as **equity prices** or **currency values**. Special emphasis is attributed to **how advanced** unconventional monetary policy-adopting **countries are differently affected** in **comparison to emerging economies** due to the former's QE action taking, regarding their exchange rates. Movements in **commodity prices** are also under examination, as there is a small but non-negligible portion of literature about these. Other innovative aspects of the economies that are examined are **housing prices**. The societal impacts of non-conventional actions, such as **effects on inequality** have also made their appearance in most recent studies and there is an examination regarding the sign and size of estimations about such innovative variables in economics.

In order to extract policy implications about the degree of efficacy of unconventional monetary policies, a detailed description and analysis of empirical findings on the **final targets**, that is the **macroeconomic variables** are undertaken. Thereby, there is a detailed description to the best feasible extent of econometric outcomes about QE effects on **output, inflation and unemployment**. This is of primordial interest as we control whether the expected sign and size of QE shocks on macro variables is achieved. The **exact size effects** presented offer valuable information to policymakers that always focus their attention on numerical values in order to readjust their policymaking, if necessary. Therefore, this systematic review in form of a survey is utilized for providing not only knowledge about policymaking during the last decade, but also **feedback regarding the efficacy of QE-like measures** on final targets intertemporally.

1.3. Questions to be answered in Chapter 4

A number of highly significant policy questions are also posed and answered in Section 4 of this dissertation, where methods of **meta-analysis** are adopted in order to provide an **integrated overview of empirical findings** about unconventional monetary policies. In terms of higher precision in our investigation, we proceed to a lot of relevant questions to which this meta-analytic framework **provides economic and econometric replies**. First, this section **casts light on which methodology is most suitable** for researchers in order to conduct a quantitative synthesis of empirical results concerning the final targets of monetary policies **in periods of the Zero Lower Bound**. In tandem with this is the answer to which macroeconomic variables are considered as appropriate to study as **to capture the final effects** of QE practices. By applying certain necessary exclusion criteria according to the **reporting guidelines of Stanley et al. (2013),** we investigate and find out how many primary studies are available and at the same time fit these criteria in order to properly conduct our meta-analysis investigation. We provide these **exclusion criteria** and justify why these precise ones are suitable for the special character of this meta-analysis. Moreover, we lay out the **number** of studies that employed in this task and the **exact list of studies** used. Special attention is paid and description is made on whether we satisfy the minimum number of primary studies and the minimum number of observations extracted from these studies that a meta-analysis requires.

Furthermore, we define the **reasons** for which this special aspect of the meta-analysis methodology has been employed, thereby we investigate and provide robust reasoning **why adopting studies with VAR specifications can bring about the best feasible results**. Specifically, we mention the **well-established meta-analysis studies** that our rationale has been based on and why such thinking also fits our analysis. The main purpose of this strenuous meta-analysis study that we have undertaken is to **explain from which moderators the heterogeneity in results among primary studies comes from** and to **provide a size effect** of such impacts. Thereby, we investigate and our analysis **reveals where differences** in estimations **come from**. To be more precise, we define some categories of variables that are shown to greatly influence QE efficacy in studies and after a lot of trials, we **identify the best combination of moderators that can explain heterogeneity** in impacts of unconventional monetary policies on macroeconomic variables. We look into and track which variables better represent the **study characteristics, the types of unconventional policies, the regional characteristics, the response variables, the VAR specifications, the identification of impulse responses and the type of variables employed** in this meta-analysis.

Furthermore, emphasis is attributed to signs and absolute values of the econometric estimations performed. Moreover, it is carefully investigated which weighting schemes should be employed in order to provide robustness tests on results and **comments are made on whether different specifications offer similar results**, thereby it is seen whether checks reinforce the original findings. Another point of extreme importance is defining **which particular point on the Impulse Response**

Functions examined do **we center our attention on** and what time-horizon each of these points represents. Thereby, we seek and accomplish to **answer to how the direction and the magnitude of the size effect alter intertemporally**. This gives a useful comparative reply to queries about the long-lasting or not character of QE policies and provides with numerical evidence and sizeable effects for policy implications. Additionally, comments are offered on **whether** this study **abides by economic theory** and how it can **fit with the underpinnings** of the relevant monetary theory. A thorough analysis of economic implications is offered and answers are given as to by what means these findings could prove useful for policymakers and practitioners and towards which direction alterations in policymaking could take place.

1.4. Questions to be answered in Chapter 5

In Section 5, econometric analysis is conducted in order to provide **size effects** about how and by which magnitude unconventional monetary policies in the United Kingdom and the United States influence financial markets. Moreover, there follows a theoretical analysis of how super modern non-conventional monetary action taking could prove decisive for impairing financial markets and the economy in the Euro area.

More specifically, in the *1st subsection* of Section 5, **threshold cointegration techniques** are employed in order to **identify** whether there is **a non-linear causal nexus** between the **Bank of England's total assets** and **government bond yields** as well as **bank liability curves**. Thereby, the primary question that is answered is in what extent have liquidity injections in the United Kingdom affected the UK economy. More concretely, we provide reply to whether the central bank assets during the unconventional monetary policy period in the UK have affected **5-year or 10-year government bond yields**. Furthermore, the same investigation is conducted as concerns **a highly representative synthetic yield of the UK interbank market which is constructed based on investors' perceptions**, also at the **5-year** and the **10-year maturities**. Other relevant questions emerge out of this highly innovative rate. We provide documentation regarding the exact manner by which this is constructed, the reasons why it is considered to be so representative of conditions in UK financial markets and we define with precision where lies its innovative character on. Moreover, there is a **definition** given on which of the two maturities of each yield can be characterized as the **short-run or long-run effect**, and how this can be justified according to economic theory.

Moreover, it should be emphasized that there is a **detailed analysis** regarding **which econometric framework is considered to be more effective** in order to capture non-linear threshold causal effects. Notably, the reasons why this framework better fits this specific investigation are deployed. **Comparison with similar non-linear specifications is performed** and econometric estimations reveal the most

21

suitable one for the purposes of our scientific investigation. An important aspect of the task we undertake is to **make out** based on results **whether there is a feedback effect between the BoE's total assets and each of the yields** under scrutiny. In other words, we provide an answer to whether there is also reverse causality, thereby we detect the existence or not of a feedback effect and **characterize causality** as **uni-directional or bi-directional.**

Referring to empirical outcomes, a number of important questions concerning policy implications arise and we work for answering them. First of all, it is clarified whether there is a higher impact of unconventional monetary policy in the UK found or not in the **short-run** in **comparison to** the **long-run. In-depth comments** are provided as to whether this is in accordance with monetary theory. Moreover, one needs to find which are the thresholds estimated in each regime and their size as well as in which direction should the adjustment of each rate take place in order to return to equilibrium. **Analytical answers** are also provided in these research questions. It should be noted that **special emphasis** should be attributed to the comparison of statistically significant or not results about the **low and the high regime**. Therefore, we investigate and provide evidence as to **whether either of the two regimes** derived by threshold cointegration has proven to be **more important** than the other for conducting monetary policy. Analyzing the economic implications of our empirical outcomes is the final task that takes place and enlightens to many questions as regards the value-added generated from this analysis.

The second econometric part of this dissertation is presented and analyzed in the *2ⁿᵈ subsection* of Section 5, where an investigation is conducted about whether **US unconventional monetary policy** measures have resulted or not in **spillover impacts in stock markets in a worldwide level.** Thereby, the econometric analysis is focused on the **non-linear causal effects** hidden **in tails of stock indices** in advanced as well as in emerging economies. The methodology adopted in order to detect non-linear causality is **quantile causality estimations** and **emphasis** is attributed **to upper quantiles** due to the non-linear and increasing character of domino effects triggered by the Lehman Brothers collapse. The first question answered by this study is which are considered to be the **most representative among stock indices** in a worldwide level. A number of highly representative stock indices in advanced countries, including regions from all over the world, are included and the same happens for stock indices of emerging markets. Moreover, a **methodological framework** is provided along with **theoretical explanations** about whether classical linear causality tests are able or not to effectively capture non-linear impacts of unconventional policies. Furthermore, an alternative solution is offered and explained in scientific language. Additionally, in the new methodology proposed the question of which quantile intervals are deemed to be more suitable for estimating non-linear causal effects is answered and **proof of robustness of this methodology** is given based on previous papers having employed such a specification. Furthermore, a detailed explanation is offered about the reasons of selecting this methodology and an

22

answer is given about the **degree of its suitability for estimating unconventional practices** that have a special diffusion character.

Emphasis is also put on **whether causality is bi-directional** or not. There is a discussion on the reasons for which such **reverse causality** could exist and an analysis is made on economic implications on such dual relationships. One question of high importance is in which quantiles is causality from the Fed's balance sheet towards stock indices found to be stronger. This questions also applies as regards reverse causality. **Investigation** about **higher statistical significance in upper quantiles** is informative about the suitability of the specific approach employed here for estimating propagation of spillover effects in a global level and can be quite indicative of practices for proper policymaking in case of future crises.

Moreover, the comparison of empirical findings between the **first group of countries (advanced)** and the **second group of countries (emerging)** offers **replies** to interrogations about how the **spillover mechanism of the highly-sophisticated US market** functions in times of extra easing policies. Comparison of effects on domestic stock indices, indices of other advanced countries and those of emerging ones, allows for useful answers as regards the propagation dynamics of the Fed's balance sheet and its stimulatory power in different regions all over the world. Thereby, the international power of US monetary policy is well defined characterized by differences according to local criteria. The differences in results generate useful thinking about whether the channels of unconventional monetary policy are more influential when affecting advanced economies and this gives the **motivation for further economic analysis** and provides policymakers with useful information. Furthermore, an investigation is conducted as to whether neighboring countries with the US, whether they are advanced or not are more affected by the Fed's policies than more distant ones.

Additionally, results before the launch of unconventional practices are compared with findings after the start of the Fed's balance sheet enlargement. Moreover, we cast light on the **question** about the **existence or not of circularity in effects denoted by reverse causality** in cases that this really makes economic sense and this also proves useful for policymaking in highly developed and influential countries as the US. Finally, we interrogate ourselves and provide an answer about the **strength of the findings** of this study and in what level the value-added from it can offer new arrows in the quiver of central bankers and market practitioners in order to render more efficient. Moreover, the same question applies to interested academics as regards the possibilities that non-linear causality in quantiles resuscitates interest for future research.

1.5. Questions to be answered in Chapter 6

In Chapter 6, a discussion takes place about whether more intense forms of unconventional monetary policy could prove more effective in the future than rounds of extraordinary measures that have already been undertaken. More specifically, we

build on the highly innovative concept of **''helicopter money drops''** as was expressed by Friedman (1969) and Buiter (2005) to analyze **whether this could be successfully adopted by modern economies** that adopt unconventional monetary policy measures and especially the Euro area. A thorough analysis of the character of **overt irredeemable money financing** is made and emphasis is attributed to the **moral hazard** inhibited in such decisions and the possibility of conflict between monetary and fiscal authorities. Furthermore, the **peril of less credibility of monetary authorities** and especially the European Central Bank is such measures were employed, are under scrutiny.

More specifically, we generate questions and provide **answers** as to **how burdensome a default spiral could become** in case of ineffectiveness of QE measures and whether and by what level could irredeemable helicopter money financing become a remedy to such a potential dead-end. These answers are mainly based on the degree by which the constantly **renewed debt in the Eurozone** could prove to be viable, thereby sustainability of debt is at the core of solving this academic puzzle. Furthermore, the **nature of fiat money is investigated** and emphasis is attributed to its **possibility of offering substantial and permanent solutions to liquidity drainage**, other than just accumulating debt that will never be repaid. The potential of a solution that can **avoid hyperinflationary pressures** and at the same time **equilibrate supply and demand forever** is under scrutiny.

Furthermore, a comparison is undertaken between forms of unconventional monetary policy that have been used so far and helicopter money drops. Thereby, an answer is provided about whether potential new rounds of extraordinary monetary practices should be in resemblance with previous rounds or more drastic measures should be preferable. Finally, the major question is investigated of how long an inflationary bubble fed by fiat money can last before it bursts. This is in tandem with the interrogation about whether debt monetization and the ''too-big-to-fail'' character can survive for long without unavoidably resulting in new crises.

Chapter 2
Analysis of Unconventional Monetary Policies and Theoretical Underpinnings

2.1. Forms of Unconventional Monetary Policies
2.1.1. Quantitative Easing

Quantitative Easing is used nowadays as a **synonymous of expansion of narrow money in the form of bank reserves or high-powered money**. The **original** Japanese **expression** for "quantitative easing" (量的緩和, ryōteki kanwa) is an abbreviation of the expression "**quantitative monetary easing**" (量的金融緩和, ryōteki kin'yū kanwa). QE was **first employed by the Japanese monetary authorities** during the period **2001-2006**. Such unconventional monetary policy measures were first adopted by the Bank of Japan during the period of the Asian financial crisis. To be more precise, the Bank of Japan decreased interest rates to zero in order to reduce the liquidity costs for businesses during the 1999-2000 period. Moreover, by purchasing Japanese government bonds during the period from March 2001 until March 2006, led the Japanese economy to **higher levels of liquidity**. This again took place during the subprime crisis in 2008, when the Japanese monetary authorities purchased a wide range of bonds in order **to fight deflation** and **provide a boost to economic growth**. These bonds included: Japanese **government bonds, corporate bonds, commercial papers as well as other fixed-rate tools**. The most recent era of Japanese unconventional monetary policy was launched in October 2010 and includes zero interest rates and asset purchase programs. It should be noted that on **January 22, 2013**, the **Bank of Japan** announced the **super QE program**, that is Super Quantitative policies taking place.

In general, **Quantitative Easing** is defined as a program where unconventional policies take place by monetary policymakers. In other words, **central banks' balance sheets enlarge by purchasing very large amounts of Treasury bonds as well as Mortgage-Backed Securities from banks that face liquidity problems**. Thereby, the aim of Quantitative Easing is to **provide a boost to nominal demand** and **infuse liquidity to markets by buying bonds**. The consequence of this is a **decrease in long-term interest rates** and **higher credit provisions** and improvement in credit conditions when it comes to insolvent banks. Moreover, they aim at **ameliorating the reserve accounts in the balance sheet of monetary authorities**. It should be emphasized that unconventional monetary policies in the USA and the United Kingdom have mainly worked through bond markets, whereas in Japan and the Euro area, non-conventional action taking has primarily functioned through bank lending.

2.1.2. Large-Scale Asset Purchases (LSAPs)

Large-Scale Asset Purchases are purchases conducted by the monetary authorities and are **about very large sums of worth of assets characterized by long-term maturities,** for example **long-term US Treasuries** and **Mortgage-Backed Securities (MBS).** The **goal** of LSAPs is **to render interest rates lower not by** employing **reductions in the Federal Funds Rate**. This additional downwards pressure on long-term yields is exercised when short-term interest rates have already decreased and reached very low levels and particularly the effective lower bound. Lowering long-term yields intends **to ameliorate economic conditions** and **provide a sufficient boost to the real economy** and at the same time **confront deflationary pressures**. Notably, when the **central bank purchases large amounts of longer-term Treasury securities or MBS,** there is a smaller amount of these securities available to the **public**. Due to this **lower supply available**, it is observed that **higher prices** for these securities emerge, **thereby yields fall**. What is interesting is that these **effects spread on other securities, too**. It should be noted that other long-term securities, such as mortgage rates and corporate bond yields also decrease because their holders no longer sell them to the central bank and prefer to invest elsewhere. Consequently, a wider array of rates of longer-term maturities tend to go downwards. Interestingly, this **urges households and firms to increase their nominal demand**, and this leads to **higher nominal spending** and a significant **spur to price levels and nominal income.**

2.1.3. Forward Guidance

Forward Guidance is primarily **based on the expectations channel** of unconventional monetary policy and its level of success crucially depends on whether the signaling channel can be effective enough. As also happens with LSAPs, forward guidance is **exercised** by monetary authorities **when interest rates** are **near the Zero Lower Bound**, thereby expansionary monetary policies cannot be conducted through conventional lowering of the federal funds rate. Forward guidance takes place by communicating the expectation that interest rates will be maintained in low levels for a non-negligible time period. This **communication** is realized **through policy statements**, the **minutes of the Monetary Policy Committees** in central banks, **forecasts conducted by the expert staff** in monetary authorities, as well as by **press conferences**. Monetary policy announcements contain a specific way of **expressing forecasts and beliefs about economic conditions** about the near and the more distant future. By employing alterations in the forward-looking language employed in its statements, the central bank can **affect investor sentiment**, **business confidence and consumer confidence** by **influencing expectations about the potential of interest rates** and monetary policy. Thereby, by having an impact on short-term perceptions, the perspectives on long-term interest rates are also managed. Therefore, it should be noted that through forward guidance long-term interest rates receive considerable

impacts by handling expectations regarding the future direction of monetary policy making.

2.1.4. Credit Easing

Credit Easing aims at **increasing the money supply not by purchasing government bonds,** but **by conducting purchases of private sector assets**, for example corporate bonds or residential Mortgage-Backed Securities. The goal of monetary authorities is **to increase the monetary base in a manner which has similarities with purchases of government securities.** Credit Easing intends to help in **stimulating bank lending by reducing funding costs**. This happens by helping in **lowering the risk perception** of the banking sector. During the crisis, high spreads on bank debt have made their appearance and this has led to upwards pressure on the rates that commercial banks have offered in order to attract retail deposits from lenders. This higher cost for acquiring funds for banking institutions has then led to borrowing rendering more expensive for households as well as businesses. It should be noted that Quantitative Easing has not proven so efficient in providing a spur to the banking sector, even though purchases of assets by monetary authorities have led to lower funding costs via rebalancing towards assets characterized by higher levels of risk. This has led **central banks** to **turn to credit easing** in order **to reduce credit spreads**. It should be emphasized that Credit Easing differs from Quantitative Easing in that the former **is introduced in order to lower certain interest rates** and **to help in repairing malfunctions in markets**, whereas the latter aims at increasing the size of the central bank's balance sheet, that is currency and bank reserves, when nominal interest rates are zero. Credit Easing can be combined with Quantitative Easing but it precisely targets specific markets and/ or rates.

2.1.5. Qualitative Easing

Qualitative Easing differs from Quantitative Easing in that it **focuses on altering the composition of the assets in the balance sheet of monetary authorities**, by indicating a **preference for less liquid assets** that **inhibit higher levels of riskiness**. Thereby, the aim of Qualitative Easing is not to enlarge the balance sheet of the central bank (this is why sterilized purchases are conducted) and of course it is not to alter the official policy rate, but to change the portions that specific assets hold in this balance sheet. It is **mainly based on rebalancing private portfolios**. The less liquid and riskier securities on which this policy focuses can be private securities but also foreign or sovereign guaranteed instruments. Purchases via Qualitative Easing can be financed in a range of manners. Firstly, **by selling or lending out assets that monetary authorities already have in their possession in their balance sheet**, such as government securities of short maturities. Secondly, **by issuing liabilities of a non-monetary form**, such as bills expressed in the domestic currency. The third way is **to agree with the government for issuing new government securities of short-term maturities and deposit this income to the balance sheet of the monetary authorities**. Because of its tight nexus to the efficacy

27

of the portfolio rebalancing channel, qualitative easing is more effective the less similar are the asset purchases and the short-term asset sold.

2.2. Financial Crisis and Unconventional Policies

2.2.1. Financial Crisis and Unconventional Policies in the USA

The **traditional monetary policy in the USA** has been for the Federal Reserve to conduct **outright open market operations (OMOs),** that is purchases and sales of assets, and to hold the assets that it has purchased in its **System Open Market Account (SOMA).** Throughout the years, the SOMA has been consisting from almost all Treasury securities but also from small amounts of agency debt sometimes. The **usual practice** of monetary authorities has been t**o affect the way that the federal funds market functions by outright OMOs**, as well as with **repurchase agreements (repos) and reverse repurchase agreements (reverse repos**) that influenced the money supply. Notably, repos and reverse repos determined reserve supply, whereas outright OMOs were **conducted periodically** in order to retain currency demand in reasonable levels.

The **securities** that were **part of the OMOs** constituted only a **small portion of the total securities**, if Treasury bills and Treasury coupon securities are also taken into consideration. This is in contrast to the very large bulk of Large-Scale Asset Purchases that the Fed has conducted, which aimed at having a significant impact on yields of the assets purchased as well as on yields of assets with similar characteristics.

During 2007 and the early 2008, just before the outburst of the Global Financial Crisis, the **Federal Reserve** realized some programs in order to **provide direct lending to financial institutions**. These measures intended to **increase the credit available to funding markets of a short-term character**, that were employed by financial institutions and other firms to **finance their short-run liquidity needs**. A number of defaults were those that led the way for the Global Financial Crisis which officially started since the Lehman Brothers collapse. Specifically, the **subprime mortgage loan crisis in the USA at the early months of 2007, the liquidity drainage of BNP Paribas in France in the middle of 2007 and the collapse of Northern Rock in the UK** just after that, had been the roots of immense malfunctions for the large financial institutions worldwide. This has led to **recession in global stock markets**, **needs for extraordinary liquidity infusion due to huge shortages of cash**, a **deterioration of macroeconomic variables** and the **trigger of massive bailout operations** and unconventional action taking by monetary authorities as well as by governments.

In the **USA**, unconventional monetary policy **mainly** took the form of **Credit Easing**, by **alterations in the size and maturities of the Federal Reserve's balance sheet**. Since the Lehman Brothers' collapse in September 2008, there has been an immediate and abrupt increase in the Fed's balance sheet. Because of the deepening

28

of the **subprime mortgage crisis in 2007**, there was a slow**down in the US economy** and particular **sectors of the capital markets** were **no longer able to function as well as before**. Thereby, the US monetary authorities introduced a number of extraordinary measures in unconventional forms in order to fight liquidity shortages by altering the composition and to a lesser extent the size of the Federal Reserve's balance sheet. Nevertheless, the **Lehman Brothers meltdown** did not leave much space to avoid the necessity for a sharp balance sheet enlargement. The principal components of this increase were facilities about providing emerg**ency liquidity infusions to troubled financial institutions.** The need for ample liquidity infusions became more than evident when **interest rates reached the Zero Lower Bound (ZLB)** but the economic recession could not yet be efficiently confronted.

It should be noted that during a **month just after the Lehman Brothers** default, the **Federal Reserve's balance sheet was almost doubled**. In November 2008, a **Large-Scale Asset Purchase Program (LSAPs)** was announced, that enabled the Fed to expand its open market operations and to enhance credit by purchasing securities of longer duration. The Fed announced that these **purchases would amount to 1.7 trillion dollars,** which represented approximately **one fifth of the combined outstanding securities, agency debt of long duration and fixed rate agency Mortgage-Backed Securities** when these purchases were launched. The **expansion of the Fed's OMOs and provision of support to credit markets through LSAPs** resulted to **security holdings by the Fed skyrocketing**. It should be emphasized that the Fed did not conduct outright purchases of US Treasuries in the form of Quantitative Easing but rather in the form of LSAPs and sometimes Credit Easing, as the primordial target of these purchases were to lead bond yields and spreads to lower levels. This means that although there has been a large increase in reserves during unconventional monetary action taking in the US, **higher reserves were not the target but just the consequence of these operations.**

The **1st round of LSAPs** took place between **November 2008 and March 2009**. Notably, later they were **extended to March 2010**. These **purchases** were at the beginning **about debt securities issued by housing-related Government Sponsored Enterprises (GSEs)** and **agency-guaranteed Mortgage-Backed Securities (MBS),** which are **securities eligible in OMOs**. The decision for these purchases aroused in an environment where the spread of these securities with yields on Treasuries was becoming larger. The **motivation** for such purchases was significantly provided by the intention **to reduce costs** and **augment the amount of available funds and credit for purchases of houses**, as an improvement in housing markets was expected to foster an **amelioration in financial markets** in general. An **additional round** of purchases was announced on **November 3rd, 2010**, as an **extra amount of 600 billion dollars** in worth **in longer-term securities** would be bought by June 2011. This was the launch of **QE2**, which led to the Fed's total assets reaching almost the **amount of 3 trillion dollars**.

In **late September 2011**, the Federal Reserve announced the launch of the **Maturity Extension Program (MEP),** which is also known as the ''**Operation Twist''**. The Fed aimed **to lead long-term interest rates to lower levels** by **purchasing 400 billion dollars in Treasuries of 6-year to 30-year maturities**, while at the same time **selling the same amount of Treasuries of 3-month to 3-year maturities**, thereby rebalancing short-term with long-term securities. Thereby, the MEP was mainly expressed by the Fed as a commitment for extending the maturities of the securities held in its balance sheet.

It should be emphasized that on **September 12th, 2012**, the US monetary authorities announced that a **new round of purchases equal to 40 billion dollars per month** would begin and would be **mainly about MBS**. No final end about this program was announced but it was intended that this could keep interest rates as low as possible at least for the next three years. This was called as ''**QE3''** and primarily **aimed at lowering borrowing costs** and **providing easier access to credit for enterprises** in order to fight the recessionary pressures and boost employment. Overall, it could be concluded that **unconventional monetary policies in the USA were effective in a medium level** as it worked beneficially regarding the repairing of markets but has increased output and the price level only moderately.

2.2.1.1. Fed's Instruments for Providing Liquidity to Credit Markets
2.2.1.1.1. Asset-Backed Commercial Paper (ABCP)

It is a form of commercial paper which is collateralized by other financial assets. It is useful for institutional investors as they prefer it in order to have diversification in their assets and to gain profits in the short-run. Thereby, ABCP is an instrument of a short-run horizon and its maturities range from 1 day to 9 months. This is issued by an ABCP program or conduit. The latter is founded by a sponsoring financial institution and aims to purchase and be the holder of financial assets from a range of sellers. By selling ABCP to outside investors, such as Money Market Funds or retirement funds, this conduit finances these assets and constitutes a structured investment vehicle (SIV). The aim of the SIV is to obtain income through credit spreads between the long-term assets that it holds and the short-term liabilities that it issues.

2.2.1.1.2. Asset-Backed Commercial Paper Money Market Fund Liquidity Facility (AMLF)

It constitutes a lending program that the Board of Governors of the Federal Reserve has decided about on September 19th, 2008. Its goal was to provide fresh liquidity to US financial institutions until the end of October 2009. The AMLF provides funds that permit the purchase of ABCP by financial institutions. This ABCP comes from Money Market Mutual Funds (MMMF) and such purchases aid banks but also bank holding companies as they have to bear no credit risk on these purchases.

30

AMLF contributes to preserving liquidity in markets and prevent alterations of holdings of ABCP and help funds that are holders of such paper to meet redemption demands by investors. AMLF were launched after a precise MMMF's net value fell significantly after having invested in Lehman Brothers.

2.2.1.1.3. Commercial Paper Funding Facility (CPFF)

This was also created by the Fed after the outburst of the Global Financial Crisis in order to enhance liquidity in markets of short-term liquidity. It was launched on October 27th, 2008, in order to fund a Special Purpose Vehicle (SPV) that bought high-quality 3-month unsecured commercial paper and ABCP from eligible issues. CPFF offers credit directly to those issues. In order for the credit risk for the Fed to be lower, the US Treasury has made a special deposit in support of CPFF. The latter had been helpful for credit towards firms. It ended in February 1st, 2010, and the final commercial paper had its maturity date on April 26, 2010. There was full repayment of all commercial paper notes.

2.2.1.1.4. Money Market Investor Funding Facility (MMIFF)

It is a facility funded by the Fed on November 24th, 2008, in order to provide further support to MMMFs and other investors in the money market. Its aim was to provide funds for purchases of certificates of deposits (CD), bank notes and commercial paper of no longer than 3-month maturities, which were issued by high-quality institutions. The MMIFF intended to fight the liquidity drainage due to institutional investors assuming overnight positions by late 2008, thereby restraining markets of short-term debt. Funding by the Fed worked through a Special Purpose Vehicle (SPV) established by the private sector. Those SPVs would finance themselves through selling ABCP and by getting access to liquidity under the MMIFF. Moreover, they would issue subordinated ABCP equal to one tenth of the asset's purchase price to sellers of the asset. This facility proved effective and expired on October 30th, 2009 and included no loan provisions.

2.2.1.1.5. Term Asset-Backed Securities Loan Facility (TALF)

This program was **created** by the US Fed on **November 25th, 2008**, in order to **provide a stimulus to consumer spending** and **credit lending** and thereby **help the economy recover**. It has worked **through issuing Asset-Backed Securities (ABS)**, which have been **collateralized by student loans, personal auto and credit card loans**, as well as **loans guaranteed by the Small Business Administration (SBA).** The Fed has provided up to 1 trillion dollars as a backing for these loans on a non-recourse basis to those that hold top-quality ABS backed by newly-created consumer and small business loans.

31

2.2.2. Financial Crisis and Unconventional Policies in the UK

When it comes to unconventional monetary policymaking in the **United Kingdom**, the Bank of England announced on **5 March 2009** that at the same time, Quantitative Easing measures would be launched and the Bank Rate would be reduced. **Three rounds of QE** have taken place in the United Kingdom. All purchases have been conducted by a subsidiary of the BoE, that is the **Asset Purchase Facility (APF)**, by the authorization of the Chancellor of the Exchequer. In the beginning, the APF **purchased private assets** through **issuing Treasury Bills** and by the **cash management operations of the Debt Management Office (DMO).** In March 2009, there was a decision that central bank money would be used for financing asset purchases, and the Government provided an indemnity for covering any losses from such purchases.

Officially, the QE asset purchase program by the **Monetary Policy Committee** (MPC) of the Bank of England was launched on March 5th, 2009. The **first round** of purchases was about **75 billion pounds of assets of the private and the public sector**. In order for these purchases to be realized, **central bank money was used**. It was expected that approximately a three-month period would be necessary for completing these purchases. The BoE was focused on buying **nominal gilts** with a **residual maturity ranging from 5 to 25 years**. Nevertheless, this later included gilts with three or more years of residual maturity. The amount of these purchases increased over subsequent announcements by the BoE. It should be noted that **on February 2010**, purchases had attained the **level of 200 billion pounds**, that represented approximately 30% of the free float. In relation to this free float, the BoE **purchased 40% of bonds with maturity from 3 to 10 years, 50% of those with maturities from 10 to 25 years and 15% of the over-25-year maturities.**

More specifically, on **August 6th, 2009**, it was announced that QE purchases would be **extended by 50 billion to 175 billion pounds** and this extension included **over 3-year maturities**. Moreover, on **November 5th, 2009**, a **further extension by 25 billion** was announced, thereby purchases reached the **total of 200 billion pounds**. Furthermore, on **February 10th, 2010**, there was an announcement that QE purchases would **remain at 200 billion** and that decisions about further purchases would depend on the economic outlook, that is whether macroeconomic indicators would improve or not.

On **February 9th, 2012**, when the launch of **QE2** took place, the BoE made an alteration to the auction maturity sectors from which purchases were conducted. Thereby, the Bank started to **purchase equally across the 3-7 year, the 7-15 year and the over-15-year sectors.** Asset purchases would be **extended by 50 billion to 325 billion pounds**. On **May 10th, 2012,** the MPC declared that asset purchases would **remain at 325 billion**. Furthermore, on **July 5th, 2012, QE3** was initiated and the MPC announced a **further expansion** of purchases **by 50 billion**, thereby **reaching** the total amount of **375 billion pounds**.

2.2.2.1. BoE's Instruments for Providing Liquidity to Markets
2.2.2.1.1. Special Liquidity Scheme (SLS)

It was founded on **April 21st, 2008**, by the Bank of England in order **to allow banks to temporarily conduct swap between high-quality MBS and other securities for UK Treasury bills**. The SLS was created in order **to help the banking sector**, because the disruption in markets for a range of securities had led banking institutions to have an ''overhang'' of these securities in their balance sheets and so were unable to sell them for acquiring liquidity. This situation had pushed commercial banks to significantly reduce their loan provisions, which in a large extent intensified credit constraint in the economy. Thereby, the Special Liquidity Scheme has **permitted to banking institutions to conduct swaps of assets with a small level of liquidity but with good enough quality, for Treasury bills**. This aimed at providing a boost to liquidity in the banking system and **improve the business sentiment and economic confidence in markets**.

2.2.2.1.2. Funding for Lending Scheme (FLS)

The Funding for Lending Scheme (FLS), was announced by the Chancellor of the Exchequer and the Governor of the Bank of England on **June 14th, 2012**. The target of this scheme was to **provide a spur in lending to enterprises as well as households**, as there was need for a greater boost that what QE measures had brought about. Under FLS, **low-cost liquidity was offered to banks and building societies** in order to supply the economy with funds. The **first phase of FLS was terminated in January 2014** and **outstanding drawings were 41.9 billion pounds**. FLS can be regarded as complementary to Quantitative Easing action taking and aims to increase loans.

2.2.3. Financial Crisis and Unconventional Policies in Japan

Japan has been the first country having adopted unconventional monetary policy in order to escape from the liquidity trap in which it had indulged since mid-1990s. In order to provide a stimulus to its economy, Japan had adopted a Zero-Interest Rate Policy (ZIRP) from 1999 to 2000. Furthermore, from 2001 to 2006 adopted more drastic measures in the form of Quantitative Easing. On August 4th, 2011 the BOJ increased the commercial bank CABs from 40 trillion to 50 trillion yen. In October 2011, its asset purchase program (APP) got larger by 5 trillion yen, reaching the level of 55 trillion yen.

33

The new phase of Quantitative and Qualitative Easing (QQE) in Japan has started in April 2013, just after Kuroda had been appointed as the Governor of the Bank of Japan by Prim Minister Abe. The BoJ realizes money market operations in order to push up the monetary base at an annual size of 60-70 trillion yen. Furthermore, a maturity extension program has been taking place regarding the Japanese government bonds that the BoJ holds. There is also a commitment for keeping up the expansion of the monetary base until inflation in Japan remains steady at the 2% level.

To be more precise, by announcing the QQE, the BoJ declared that ´´doubling of the monetary base and of the amounts outstanding of the Japanese Government Bonds (JGBs) and of (risky assets such as) exchange-traded funds (ETFs) in the subsequent two years´´. Moreover, more than doubling of the average remaining maturity of JGB purchases would take place. The launch of QQE has triggered a strong devaluation in yen whereas equity prices were significantly increased. The Current Account Balances (CABs) at the BoJ consist of reserve balances, Treasury Bills, commercial paper and bonds. Moreover, ETFs, loans and bills at a discount, assets not expressed in yen as well as repurchase agreements. Furthermore, (risky) real estate investment funds (REITs) and stocks make part of the Bank of Japan's balance sheet.

In October 2014, it was announced that QQE would be expanded and reserve balances by financial institutions were expected to increase by 80 trillion yen annually. It was on December 14th, 2014, when the new JGB purchasing strategy was launched. The average remaining maturity of JGBs under this policy is between 7 and 10 years. The bonds are divided into coupon-bearing bonds (that have the higher total purchase value), floating-rate bonds as well as inflation-indexed bonds.

2.2.4. Financial Crisis and Unconventional Policies in the Eurozone

Unconventional monetary policies by the European Central Bank could be divided into two categories. The first category includes exceptional liquidity provisions (3-year LTROs, fixed-rate full allotment (FRFA) and zero deposit rates). The second category includes asset purchases in the form buying sovereign bonds and covered bonds.

On October 8, 2008, an announcement was made by the European monetary authorities that all the **Main Refinancing Operations (MROs) would** be conducted **via FRFA.** Furthermore, on **October 15th, 2008, an FRFA procedure** was announced for the **Long-Term Refinancing Operations (LTROs)** of the ECB. This was later switched to a variable-rate tender in the regular 3-month LTROs at the end of the first quarter of 2010. Nevertheless, due to the Greek debt crisis, a return to the FRFA character in LTROs was realized on May 10th, 2010. It should be noted that on

December 8, 2011, the ECB decided to **assign an FRFA character to 3-year LTROs** and two weeks later the first 3-year LTROs of this form were offered. This was followed by a **second 3-year LTRO** of this type, **two months later**. These measures were considered to be very large in comparison to previous action taking by the ECB and intended to **provide more than 1 trillion euros to commercial banks in order to prevent fire-sales and shrinkage of lending**. However, this resulted in **much larger credit risk in the ECB's balance sheet**. It should be emphasized that the better functioning of the interbank market and the **prevention of a credit crunch** were the ultimate targets. As the ample liquidity infused was not as effective as expected, the ECB decided to **lower its deposit rate to zero on July 5th, 2012**.

In the meantime, a significant bulk of asset purchases took place by the Eurozone monetary authorities. The outburst of the **Greek sovereign crisis** led to fire-sales of a number of government bonds in the Eurozone. This led the ECB to launch the **Securities Markets Program (SMP) on May 9, 2010,** in order to provide liquidity to market segments that proved unable to function well. These **operations** were **sterilized** through schemes **designed to sweep up the liquidity infused**. Although these purchases ended in January 2011, they were re-initiated in August 2011, due to the intense character of the sovereign crisis in the Eurozone and the risk of transmission to Spain and Italy, too. The Securities Market Program led to **purchases of 219.5 billion** euros.

Later, on **July 26th, 2012**, the famous statement by **Draghi** took place, that the ECB would do ´´**whatever it takes to save the euro**´´. A new arrow in the quiver of the European monetary authorities made its appearance. The **Outright Monetary Transactions (OMT)** replaced the SMP on **September 6th, 2012**. These were focused on 3-year maturities the longest. Furthermore, higher precision in terms for funding a country were set. This country could **participate in the OMTs only if** its **fiscal authorities' decisions** abided by the macroeconomic adjustment program in accordance with the European Stability Mechanism (**ESM**) or the European Financial Stability Facility (**EFSF**). Furthermore, the OMT was considered to be more constraint-free as regards the level of its interference with the indebted country.

Notably, the **second branch of the asset purchases** was about **covered bonds**, where credit institutions are the issuers, in order to assure liquidity further than in the short-run. In terms of higher precision, it was on **May 7th, 2009**, that an announcement was made about **buying 60 billion euros of euro-denominated Eurozone covered bonds**. Consequently, **three Covered Bond Purchase Programs (CBPP)** took place, in order to **push rates for money lending to lower levels**, to **provide motivation for larger and easier loan giving** and enhance liquidity access by the private sector. **CBPP2** was announced on **October 6th, 2011** and was about purchases of covered bonds by the amount of **40 billion euros**. This was followed by a new round (**CBPP3**) in **October 2014** and also an **Asset-Backed Securities Purchase Program (ABSPP)** was launched in **September 2014**. Both of these intended to **ease credit conditions and spur inflation** to normal levels.

2.2.4.1. ECB's Instruments for Providing Liquidity to Markets

2.2.4.1.1. Securities Markets Program (SMP)

This was announced by the **Governing Council** of the **European Central Bank on May 10th, 2010**. Its aim was to **ensure liquidity in segments of the debt securities markets that were facing malfunctioning** and to aid in restoring the well-functioning of the transmission of monetary policy. The **purchases** of debt securities conducted by the SMP were **sterilized**, **thereby no alterations in central bank liquidity** were made.

The SMP helped some financial market segments to conduct transactions without significant alterations on prices, thereby contributed to **restoring financial market liquidity**. The SMP is also about **purchasing debt by the Euro system from its counterparts** and **those purchases are settled by higher current account holdings of the MFI sector with the Euro system.** The SMP employs **fine-tuning operations** in order **to re-absorb** these deposits characterized by high-levels of liquidity, **into fixed-term deposits**.

2.2.4.1.2. Outright Monetary Transactions (OMTs)

This is a program launched by the **European Central Bank** under which **outright transactions** are conducted **in secondary sovereign bond markets** of bonds that **Eurozone member countries issue**. This program was announced on **August 2nd, 2012**, by the Governing Council of the ECB. The framework for its operation was finally prepared on September 6th, 2012, at the same time **when the SMP ended**. During the OMT, the **European Stability Mechanism (ESM)** and the **European Financial Stability Facility (EFSF)** bought bonds of 1-year to 3-year maturities issued by Eurozone governments. The goal of OMT was **to ensure convergence in short-term bond yields** and to **make sure** that the **ECB's monetary policy** was equally **transmitted to all Eurozone's members**. OMT differs from Quantitative Easing in that **full sterilization applies**. The only means for sterilizing that has been employed has been the auctioning of sufficient quantities of one-week deposits at the ECB, as has also been used for sterilization during the SMP.

2.2.4.1.3. Covered Bond Purchase Program (CBPP)

CBPP was adopted **by** the **ECB's Governing Council** in **2009**. Its aim was the **stabilizing of the securities markets** and to **provide aid in banking institutions**

in order to overcome their difficulties **regarding their access to financing**. **Purchases of covered bonds by the Euro system reached 60 billion euros** in total during one year. The second round of Covered Bond Purchase Program (**CBPP2**) was initiated in **November 2011** and the total volume of purchases was **40 billion euros**. This program **ended in October 2012**. The third round of such purchases (**CBPP3**) was **launched in October 2014,** with a time **horizon of two years**. Its target was to **provide an easing to credit conditions**, thereby to enhance the transmission of monetary policy and to **help the real economy reach the 2% inflation target**. In tandem with CBPP3, an **Asset-Backed Securities Purchase Program (ABSPP)** was conducted. This was launched in September 2014 and had **exactly the same targets** as CBPP3.

2.3. Transmission channels of Unconventional Monetary Policies
2.3.1. Portfolio Rebalancing channel

Portfolio rebalancing is believed to hold the primary role between the channels of unconventional monetary policies. It is **focused on purchasing long-term assets because they are more likely to be imperfect substitutes with money**, thereby this channel can be more effective. As revealed by Tobin (1969) and Brunner and Meltzer (1972), and the segmentation theories of Culbertson (1957) and Modigliani and Sutch (1966), holding assets that are not perfect substitutes between them can lead to portfolio rebalancing and alterations in the prices of these assets. If one takes for example **long-term bonds** which are naturally higher yielding than short-term forms of liquidity, purchasing long-term bonds would result in an increase of their prices and lowering of their yields. Thereby, **more investors would become willing to alter their preferred habitat for longer maturities if the yields on those maturities rendered lower.** This means that central bank interventions could result in changes in investors' preferences through the **preferred habitat** dynamics. Higher preference for bonds of a specific maturity in the detriment of bonds of other maturities by altering the relevant prices and yields, brings to the forefront the so-called **local supply effects**. This way, risk appetite will be satisfied by higher preference and consequently demand for long-term assets, which are also more risky assets. Lower potential rates on agency debt, agency MBS and Treasury securities should provide motivation to investors to increase their preference for corporate bonds and equities.

Central bank purchases of long-term securities reduce their available supply and increases their price, thereby leading to lower yields and this spurs **favorable preferences** towards these more profitable investments in comparison to short-dated instruments. In this sense, longer-term bonds of more indebted or of developing economies are favored by unconventional practices. Intriguingly, the prices of close substitutes are also affected positively. This means that portfolio rebalancing through preferred habitat does not only create **scarcity** and influences the demand for the securities under scrutiny, but also of relevant ones. The period during which such alterations in preferences will endure depends on whether other market participants

37

face constraints in exploiting arbitrage opportunities across different maturities, eg. whether their access to capital may be limited.

2.3.2. Signaling channel

It works when unconventional policy **commitment** is made by the monetary authorities that **future policy rates** will remain in lower levels than previously. This way, the **risk-neutral part of bond yield** declines, thereby lowering yields. This is also called as ''the **expectations channel**'' as it works through the expectations that Large-Scale Asset Purchases create in market participants as regards the short-term policy rate. The signaling effect is expressed by the alterations in the **expected path of future short-term rates** that are brought about by recent news that QE actions might affect the short-run yield curve of the economy. The way that the signaling channel works is closely connected to the **expectations hypothesis** that expresses the linkage between short-term and long-term rates, where the average expected short-rate, differently said, risk-neutral component of long-term rates (the expectations part) determines long-rates.

2.3.3. Liquidity premia channel

This is also called as the ''**market functioning** channel''. In times of economic distress, markets are characterized by poor liquidity, thereby access to funding renders more expensive. This is expressed in the form of higher liquidity premia on specific assets. The existence of **monetary authorities as an active player** in markets **drives down liquidity premia**, as economic agents believe that even in times of distress, they will be able to sell their assets to the central bank. Therefore, unconventional action taking leads to higher tendency for active participation in markets and higher investment incentives. The enlargement of the central bank's balance sheet by asset purchases increases the reserves of monetary authorities and enhances higher lending towards investors, thereby reducing financial market stress due to the lower risk inhibited in investment decisions. Notably, this works much better in markets with serious problems of liquidity shortage. Then, lower liquidity premia foster an improvement in financial conditions, encourage trading in an active manner and spur growth. Purchases of MBS are likely to have functioned at least partly through this channel by **narrowing the spreads of yields on agency debt and MBS to the respective yields on Treasury bonds** and lowering the cost of financing.

2.3.4. Bank Lending channel

This is also called as the ''**Credit channel**''. The bank lending channel functions when monetary authorities **purchase assets from non-banks**. This brings **higher** levels of customer deposits, thereby it **motivates banking institutions to increase lending**. This happens as the banking sector acquires higher amounts of

38

reserves at the central bank as well as higher levels of deposits from customers. This increase in liquidity offers a motivation to commercial banks to provide **higher** amounts of **loan funds** and to **relax** their **standards for loan provisions**. The bank lending channel is effective if there are no constraints on commercial banks that impose them not to enlarge their balance sheets.

2.3.5. Confidence channel

The confidence channel is focused on **increasing investor confidence** and thereby leading to **higher asset prices**. This is because non-conventional practices result in a more **optimistic economic outlook**, characterized by a lower level of pessimism as regards investors and consumers and a **higher propensity to spend**. This turn to optimism can be seen by higher asset prices and the lowering of risk premia. Apart from the boost in **household and business sentiment**, the interventions by monetary authorities reduce volatility as well as increase economic certainty. This mitigation of concerns results in higher risk appetite, therefore an **abandoning of the** ''**flight to safety**'' that characterizes the economies in times of a crisis.

2.3.6. Term premium channel

It is tightly connected to the **duration risk of interest rates**. When the central bank purchases long-term assets, which inhibit a higher risk than shorter-term assets, then the additional compensation that holders of long-term assets require for having to bear this **risk will get lower**. This is in close **connection to portfolio rebalancing** effects. The monetary authorities by conducting purchases of long-term bonds lead the yield of these bonds to lower levels when expectations about future short-term interest rates do not alter. This means that these purchases lower the term premium. The latter is defined as the difference between the return on long-term bonds and the anticipated series of short-term interest rates. It should be noted that the term premium of each maturity under scrutiny will fall by an amount connected to each maturity. Thereby, the shape of the yield curve will be altered appropriately. Vayanos and Vila (2009), in their well-known academic paper, study portfolio rebalancing effects through term premia.

2.3.7. Prepayment risk channel

Asset purchases focused on Mortgage-Backed Securities by monetary authorities result in reducing the amount of prepayment risk that investors have to hold in total. The existence of prepayment risk on MBS leads to lower duration during falls in interest rates and to higher duration when interest rates rise. In other words, there is a **negative convexity** on MBS, that is **their prices increase by a lesser extent** in comparison to a non-callable bond with the same coupon and maturity when rates decrease. Moreover, MBS prices fall by a higher level than that non-callable

39

bond when rates increase. Large-Scale Asset Purchases **buy** a respectable amount of such **assets with high levels of convexity risk**, thereby help towards lowering MBS yields.

2.3.8. Safety channel

Unconventional monetary policy in the form of purchases by the central bank of long-term government bonds, which are considered to be safe, leads to portfolio rebalancing in the private sector. Thereby, the demand for assets that are considered to contain higher levels of risk is increased. In terms of higher precision, **corporate stocks and real estate assets** that are considered **riskier** enjoy **higher levels of demand**. Consequently, investing in the corporate sector as well as in the constructions sector is strengthened, thereby higher income emerges.

2.3.9. Exchange rate channel

One of the most important assets through which non-conventional practices exert their influence on financial markets and the real economy is currency values. Quantitative Easing measures **fortify the demand for assets expressed in foreign currencies**. Therefore, this triggers a **decline in the value of the domestic currency**. These devaluation dynamics render domestic products more competitive and lead to higher levels of domestic output. Moreover, they improve the trade balance. The latter channel is particularly **effective if trade** is characterized by an **adequate level of price elasticity**, thereby favorable alterations in prices can trigger growth led by alterations in exchange rates.

2.3.10. Inflation channel

This is in tight **connection to the exchange rate channel**. **If** the exchange rate channel is **effective**, thereby unconventional action taking drives to lower domestic currency value and results in a boost in aggregate demand and output, then **people anticipate higher inflation to come**. In other words, the level of success in domestic devaluation is positively linked to inflation expectations. Higher levels of anticipated inflation bring about lower real interest rates and provide a boost to demand which is easily affected by changes in interest rates. This is particularly true in crisis conditions where nominal rates are near the Zero Lower Bound.

2.3.11. Fiscal channel

The sources of financing of the government are affected by unconventional monetary action taking. Quantitative Easing increases the nominal prices of long-term government bonds, thereby the **government can have access to funds by having to pay lower rates**. The fiscal authorities could decide to impose an easing taxation

policy or to increase primary expenses in the short-term. Such measures could prove beneficial in terms of capacity to repay part of the fiscal debt. Moreover, this **could** possibly **lead to lower tax burden for businesses** not only at this time, but also for future periods.

It should be emphasized that the channels aforementioned are not mutually exclusive, but most of them can work simultaneously.

Chapter 3
A Survey of Empirical Findings on Unconventional Central Bank Policies[1]

3.1. Introduction

In this chapter, a survey is conducted about the econometric results of empirical estimations about the effects of unconventional monetary policies. Although there have been previous papers providing a review of academic work on non-conventional monetary policy, no paper until now has provided a thorough descrption on each country and having adopted unconventional measures and each methodology undertaken in order for these effects to be estimated. Previous reviews have been abailable in a respectable number of academic papers, that is Ugai (2007), Martin and Milas (2012), Joyce et al. (2012a), Fawley and Neely (2013), Bundesbank (2016), Bhattarai and Neely (2016), Belke and Fahrholz (2017) and Thornton (2017).

It should be noted that the main methodologies adopted in empirical estimations are event-studies, Vector Autoregression specifications or panel estimations. A respectable bulk of bibliography focuses on unconventional effects on interest rates and asset prices in general, as well as final macroeconomic targets. Moreover, worldwide spillover effects of the US on developing countries are also detected in a non-negligible number of papers. This section of the thesis also aims to provide an overview of relevant models that study out of the ordinary monetary policies.

This survey describes empirical estimations conducted about how unconventional monetary policies implemented by the United States of America, the United Kingdom, Japan and the Eurozone as well as other developed countries in a lesser extent have affected intermediate and final policy targets. The period of interest in this survey lies after the outburst of the Global Financial Crisis in September 2008, thereby no analysis of the Japanese experience during 2001-2006 takes place. It should be noted that we examine impacts through each one the unconventional monetary transmission channels and every form of non-conventional monetary policy is under scrutiny. Although special emphasis is attributed to yields and their components, a proliferating bulk of bibliography is found to emerge concerning asset prices, such as stock prices, currency and commodity values. Furthermore, effects on bank lending rates are investigated. Although one could expect a gradual decrease in the volume of relevant bibliography as time passes, no fading out of relevant academic work has been found. On the contrary, increasing academic interest has recently aroused for societal impacts of unconventional monetary policy measures.

---

[1] A part of the results of this subsection submitted for possible publication on a paper co-authored with Assoc. Prof. Stephanos Papadamou.

The rest of this survey is structured as follows. Section 2 provides the econometric outcomes of studies about unconventional effects, according to the channels by which such policies are transmitted. Section 3 lays out the academic work based on models working through each of these channels. Section 4 provides econometric results about unconventional action taking by focusing on intermediate targets, whereas Section 5 is about studies analyzing impacts in final targets Finally, Section 6 offers the concluding remarks.

3.2. Empirical Evidence on unconventional monetary policy channels.

3.2.1. Portfolio Rebalancing channel

3.2.1.1. Studies strictly focusing on US

A significant volume of academic research has investigated the linkage between portfolio rebalancing and how effective unconventional policies have proven in the US. Among the major contributions to the field is the work of Gagnon et al. (2011), and D' Amico et al. (2012). On the one hand, Gagnon et al. (2011) provides evidence that portfolio rebalancing led to long-lasting reductions in US longer-term interest rates regarding a wide array of securities, even those that were not part of the QE program. Rebalancing is found to have acted mainly through lowering **term premiums**, and this fall ranged from 30 to 100 bp. On the other hand, D' Amico et al. (2012) center their interest on the scarcity channel and the duration channel of US LSAPs and find that the real term premium is indeed influenced by non-conventional practices, thereby also is the nominal **term premium**. There is evidence that the first LSAP program has reduced longer-term Treasury yields by 12 bp, whereas LSAP2 lowered these yields by 45 bp and the scarcity impact has been responsible for 35bp out of them. In a relevant perspective, Li and Wei (2012) argue that LSAP1, LSAP2, and the Maturity Extension Program (MEP) significantly affected the **term premium** in a negative direction. Gilchrist et al. (2015) investigate the impact that the US unconventional monetary policy exerts on **real borrowing costs**. Results indicate that both conventional but also unconventional practices influence **term premia** in a negative manner and change the bond synthesis of portfolios.

Moreover, Hancock and Passmore (2011) by adopt empirical pricing models for Mortgage-Backed Securities yields and show evidence that **anticipation of portfolio rebalancing effects** constituted a very important channel for US. D'Amico and King (2013) focus on studying the flow and stock effects in the US economy. Therefore, they center their attention to a ''local supply impact'' in yields. Their results confirm that asset prices were negatively affected by unconventional actions but not by the same extent because of the Treasuries being imperfect substitutes. By extending the investigation about asset reallocation, Carpenter et al. (2015) support that preference towards riskier assets functioned through portfolio rebalancing by primary agents in the US. This leads to conclude that **preferred habitat** has worked.

43

In a similar vein, Kandrac and Schlusche (2013) investigate flow impacts because of Large-Scale Asset Purchases because markets have been segmented and assets have been imperfect substitutes. This does not abide by earlier outcomes, as medium US **flow impacts with a downwards tendency is detected** Treasury securities yields. These impacts are found to fade out quickly.

By centering our attentions to interconnectedness between LSAP announcements and yields, Neely (2015) by employing a simple portfolio choice model argues that LSAP announcements triggered powerful portfolio balance impacts in a negative direction. These impacts are detected on yields and the price of the US dollar. Additionally, Kandrac (2013) investigates and argues for the existence of ''flow effects'' in implied financing rates and the Mortgage-Backed Securities' (MBS) market. More concretely, he looks into whether MBS purchases resulted in markets not working properly during LSAP3, according to asset categories and purchase regimes. He provides evidence of **significant but not very trustworthy** outcomes being generally applied. Furthermore, Chung et al. (2012) by using a simple model over the period 1987-2007, analyze rebalancing effects by developing simulation outcomes and support that a downwards tendency in term premiums is identified in a medium extent.

3.2.1.2. Studies including US and other economies

A non-negligible bulk of academic papers have been written about unconventional action taking that center their investigation on portfolio rebalancing impacts in the United Staes in tandem with other economies. Christensen and Rudebusch (2012) by decomposing yields address the issue of how important are market institutional structures regarding the portfolio rebalancing channel efficacy in the **US and the UK**. Evidence uncovers an important negative effect of this channel on yields of both countries. Meaning and Zhu (2011) also employ event-studies and their evidence illustrates the existence of a negative connection between the portfolio balance channel and the prices of assets in both countries. Notably, the results indicate impacts during LSAP1 and the first Asset Purchase Facility (APF1). Another relevant study is conducted by Weale and Wieladek (2016) that apply a Bayesian-VAR methodology using monthly data from 2009 to 2014 and underlines that this channel is more important in the United States economy in comparison to the United Kingdom.

Identifying the interaction between non-conventional practices and yields through portfolio rebalancing in the US and other countries has been the core of research in a significant number of studies. Rogers et al. (2014) support that asset purchases lead to declines in **term premia** through portfolio rebalancing as concerns policymaking by monetary authorities in the US, the UK, the Eurozone and Japan. Results offer support of similar effects among economies. In line with the above study, Bauer and Neely (2014) by focusing their research on **Australian and**

44

German yields reveal that the portfolio balance channel was effective. In contrast to these findings, they document that a lesser impact appears in the **US, Canada, and Japan**. Overall, these results are found to be consistent with the level of substitutability across international bonds. Mamaysky (2018) provides evidence that the portfolio rebalancing along with the signaling transmission mechanisms can only in a medium extent provide explanation for the fast reaction of medium- to long-term bonds in relation to the slow reaction of stocks and its implied volatility to unconventional events conducted by the the Fed, the ECB and the BoE.

Portfolio Rebalancing effects on Term and Risk Premia

Impacts concerning the lack of economic optimism have also been investigated in the literature about non-conventional practices. In a somewhat different vein than earlier findings, Stillwagon (2015) employs a I(2) Cointegrating VAR (CVAR) model for the Treasury bills market of Canada and the LIBOR markets in the US, the UK, and Switzerland. He provides evidence for **economic pessimism** raising the preference for shorter maturity bonds, thereby pushing **longer-term premiums upwards**.

In the stream of research about unconventional effects through portfolio rebalancing, the focus on volatility impacts owing to US actions represents a significant portion. Cúrdia and Ferrero (2013). They support that US LSAPs can have an impact via the **risk premium** which is determined by the absolute amount of privately purchased long-term assets. Notably, Cho and Rhee (2014) look at the linkages between US unconventional policy and Asian economies and provide evidence that portfolio rebalancing leads to **lower US rates** and **credit default swap premiums**, especially during QE1.

US QE effects on Emerging Markets

Intriguingly, a large number of papers have addressed the question of whether portfolio rebalancing by actions mainly performed in the US has triggered impacts on emerging economies. Duca et al. (2016) study US non-conventional global spillover effects and argue that portfolio rebalancing was the main mechanism for transmission of **stock effects** to Emerging Markets Economies (EMEs) and **flow effects** in advanced economies. Lim and Mohapatra (2016) provide evidence for a portfolio rebalancing effect of US gross financial inflows to emerging countries and argue that **Foreign Direct Investments (FDI)** do not react to unconventional shocks as intensely as portfolio flows. Bowman et al. (2015b) document a **strong responsiveness of EMEs** to portfolio rebalancing shocks. Kryzanowski et al. (2017) investigate **cross-financial market correlations** during US QE1, QE2, and QE3. Empirical evidence casts light on the effects of portfolio rebalancing in terms of spillover impacts on bonds and the respective derivatives. They document that such effects were important.

By focusing on the research on tapering talk, Eichengreen and Gupta (2015) provide evidence that **open and liquid economies** received of stronger rebalancing impacts, as more capital-inducing countries were confronted with higher downwards pressures on currency and equity values, as well as on reserves.

3.2.1.3. Non-US Studies
Studies strictly focusing on the UK

A significant part of empirical work about unconventional practices is centered on effects in the UK. One of the papers of high importance is Joyce and Tong (2012) that investigate UK QE1 and argue for both **local supply and duration risk impacts** on the intertemporal yield structure. Furthermore, Joyce et al. (2014) by employing counterfactual scenarios for the UK and the US document that portfolio rebalancing by institutional investors into riskier assets such as corporate bonds was limited, thereby most of these investors avoided holding equities during QE purchases. Furthermore, they support that portfolio rebalancing exerted larger effects during QE1. In a more recent study, Papadamou et al. (2017) by adopting a threshold cointegration specification, argue that non-linear impacts exist between unconventional action taking and gilt and corporate yields in the United Kingdom.

Steeley (2015a) analyzes the effectiveness of unconventional rounds on how **UK bonds and equity are interconnected**. He supports that due to imperfect substitutability, no large alterations in such relations are shown. Breedon (2018) supports that the transactions costs to unconventional practices reach the level of 0.5% as a percentage of the overall QE purchases. Thereby, this cost would have been lower if the operational design of transactions, that is the auction design, was better.

Studies strictly focusing on the Euro area

There is a number of studies that address the link between the portfolio rebalancing channel and the effectiveness of non-standard practices in the Euro area. More specifically, Szczerbowicz (2015) supports that the non-conventional ECB's practices in the form of Outright Monetary Transactions (OMT) and Securities Market Purchases (SMP) by the ECB finally resulted in decreasing **long-term premia** and drove **spreads** down.

Studies strictly focusing on Japan

In the stream of research about portfolio rebalancing, there are also studies strictly focusing on Japan. In an innovative work, Saiki and Frost (2014) by employing a VAR specification argue that the portfolio balance channel has a noteworthy upwards effect on **inequality**, due to larger holdings of Japanese equities by a small fraction of the population. Moreover, according to Ugai (2015), the

Quantitative and Qualitative Monetary Easing Policy (QQE) in Japan has strongly affected the value of the JPY through portfolio rebalancing.

Studies strictly focusing on Switzerland

There are also studies centering their interest on how portfolio rebalancing affected Switzerland. Kettemann and Krogstrup (2014) by examining asset purchases by the Swiss National Bank (SNB) reveal that portfolio rebalancing was indeed effective on lowering **bond spreads.** This is generally in accordance with the study of Christensen and Krogstrup (2015) that provide support that the portfolio balance effect has been based on **reserves** in Switzerland. This is verified as non-conventional actions bring about a downwards movement in **term premia.** Bernhard and Ebner (2017) argue that rebalancing impacts have appeared in **Switzerland** which have been generated by the US, the UK, Japan and the Euro area.

The following Figures 3.1.a,b,c exhibit useful statistics for the academic studies preented above. To be more precise, the largest bulk of papers center their interest on USA and UK whereas not so much Euro-area and other developed countries. Year 2015 presents a respectable number of studies and three journals deem to be particularly keen on publishing about the portfolio balance channel. What is also striking though not seen in figures is that the largest portion of studies reveal the existence of an active transmission through portfolio rebalancing.

Figure 3.1.a Portfolio Balance Channel: Number of papers per country
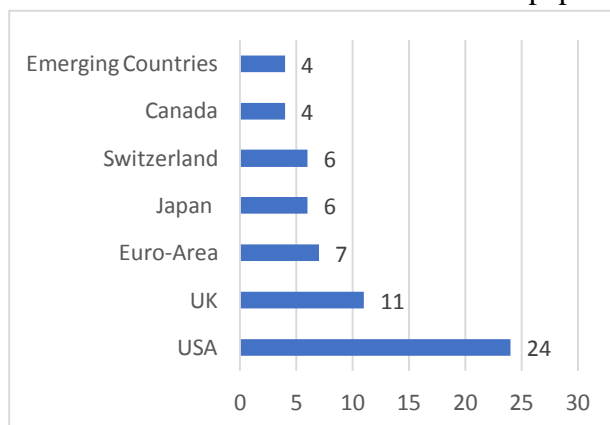
Figure 3.1.b Portfolio Balance Channel: Number of papers per year
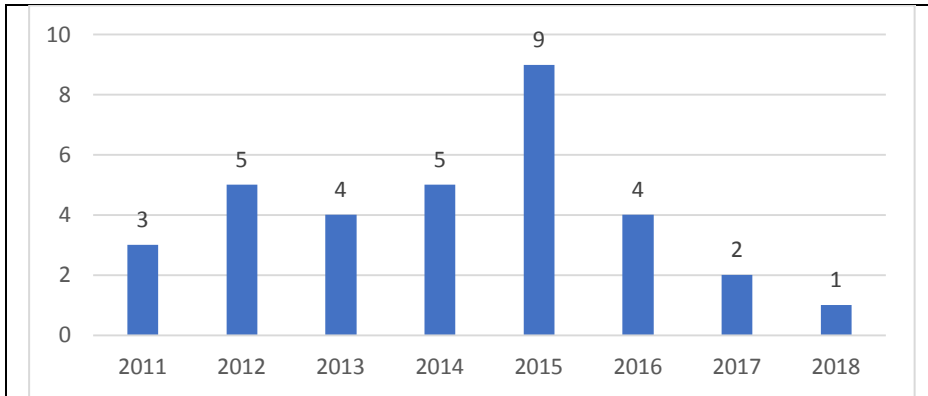
Figure 3.1.c Portfolio Balance Channel: Number of papers per Journal.
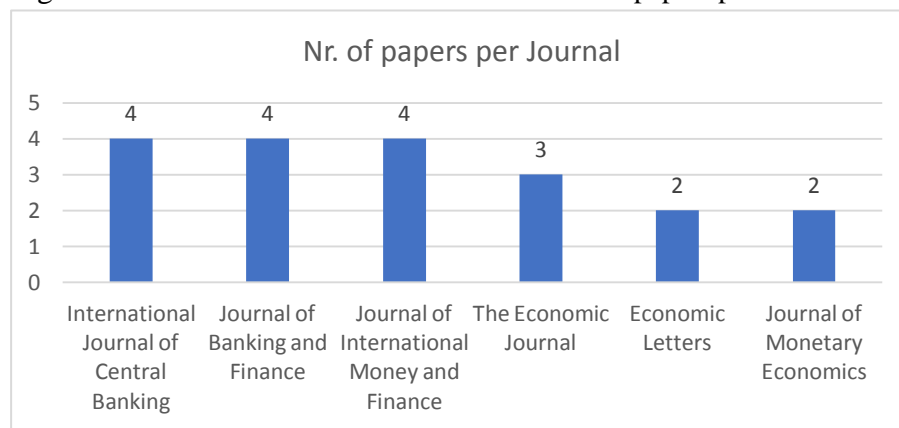
Note: Journals with more than one paper

Figure 3.1. Portfolio Balance Channel. Number of papers per country, per year and per journal

3.2.2. Signaling channel
3.2.2.1 Studies strictly focusing on US

A large number of papers have addressed the question of whether and in what extent the signaling channel has worked efficiently during non-conventional eras. Krishnamurthy and Vissing-Jorgensen (2011) argue for the existence of a signaling channel which proved influential concerning **MBS and corporate rates**, through the market's anticipation of lower Federal Funds Rates (FFRs) in the future. This impact is more evident during QE2, but rates also fell during QE1. Jones and Kulish (2013) also document that the signaling channel is effective if announcement implies lower **rates** than anticipated. This is in tandem with the **expectations hypothesis**. Similarly, Bauer and Rudebusch (2014) provide evidence that bond purchases by the Fed significantly affect future short-term rates in a negative direction through the signaling channel during LSAP1. In their study, Bhattarai et al. (2015) document that unconventional practices are efficacy through creating signs towards private investors. These signals via asset purchases indicate that low rates will be maintained. In a

48

different approach, Kiley (2014) proposes his own strategy in order to find how statements by the Fed influence the **relation of equity prices with lower rates and argues for large effects**.

Thornton (2011) supports that announcement of the Term Auction Facility (TAF) in the US is acknowledged by market participants as revealing an intensification **of the financial crisis** in the future. In the same mentality, Guidolin et al. (2014) argue that monetary expansions can be perceived as signaling an **economic slowdown** in the future, thereby revealing the level of efficacy of non-conventional policies.

3.2.2.2. Studies about US versus studies on other economies

Notably, a significant bulk of academic studies have addressed the question of whether signaling has been important for the US in combination with other countries. Interestingly, Christensen and Rudebusch (2012) base their research on **decomposing** UK and US **yields** into their effects from the signaling channel. Effects of the Fed's non-standard practices are found to be mainly driven by lowering policy expectations. Bauer and Neely (2014) also underline the importance of the signaling channel. They support that signaling was very important for the US and Canada, whereas moderate for Australia and Germany, and non-existent for Japan. Moreover, they conclude that expectations' impact is higher for countries that their yields respond more intensively to conventional US monetary policy surprises. In a somewhat similar vein, Swanson and Williams (2014) address the sensitivity of the UK's and Germany's rates on **macroeconomic news** when being near the ZLB. While results provide evidence of a weak effect on German rates, the UK's yields are recipients of aa significantly larger impact by announcements.

Another approach to measuring signaling effects in non-conventional times, is employed by Kenourgios et al. (2015a, 2015b). The authors put emphasis on the high credibility and efficacy of unconventional policies by the BoJ and the BoE. Interestingly, by the DCC-GARCH (Dynamic Conditional Coefficients Generalized Autoregressive Heteroskedasticity) methodology they apply, results point towards a **signaling effect on** markets for foreign currency that influences the stability of the EUR, the JPY and the GBP quotes. De Haan and Van den End (2018) examine the signaling impact of equity and house prices, the amounts of credit by the private sector and bond yields on inflation during non-conventional monetary times, by using signaling extraction and logit modelling. The countries under scrutiny are: US, Japan, UK, Germany, France, Italy, Netherlands, Australia, Norway, Sweden and Spain. The evidence they provide indicates that these prices serve little for signaling about inflation, thereby QE is not effective in raising inflation.

3.2.2.3. Non-US Studies

It should be emphasized that, as Figures 3.2.a,b papers present, attention on signaling channel is also focused on USA, UK, Euro area and Japan. Interestingly, two thirds of the academic studies have been published over the period 2014-15, as has happened concerning the portfolio balance channel. Attention should be paid in that studies interested in this channel are lower in number in comparison to portfolio balance channel studies.

Figure 3.2.a Signaling Channel: Number of papers per country

Figure 3.2.b Signaling Channel: Number of papers per year
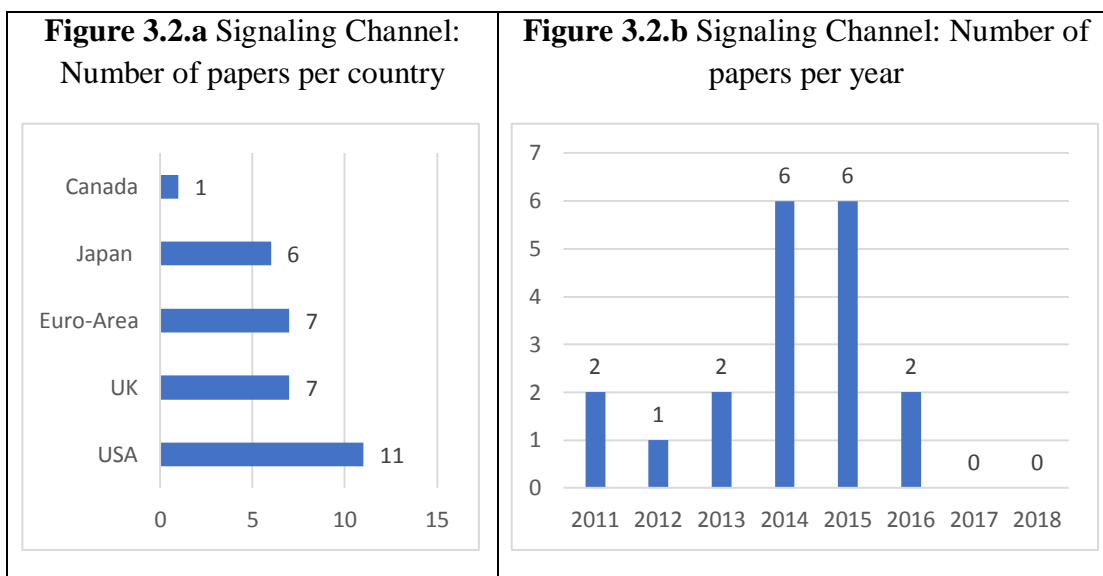
Figure 3.1. Signaling Channel: Number of papers per country and per year

Studies strictly focusing on UK

Studies where the expectations channel is important for unconventional monetary pass-through in the UK have also shown up in the literature. Among the most remarkable studies about signaling effects, is Chadha and Waters (2014). Notably, they argue that QE having lowered bond yields can be mainly explained by the signaling channel at the beginning but its effect diminishes as time passes. It is found that it can account for up to a **modest** decline in UK yields.

A focus on the nexus of volatility with signaling effects has also been detected in the non-standard practices literature. By employing a GARCH framework, Steeley and Matyushkin (2015) document an interconnectedness between the BoE's announcements and gilt yield movements. This is evident during the first two rounds of non-conventional practices in the UK. They assess that such actions have a calming down effect on markets.

Studies strictly focusing on Japan

A part of empirical work is also focused on signaling impacts in Japan. Kagraoka and Moussa (2013) identify the interaction between the **expectations channel** and the validity of the expectations hypothesis about the term structure of rates in Japan. They argue that this hypothesis is valid even in times of extraordinary policies. In the stream of research about signaling impacts, there are also studies addressing the connection of signaling effectiveness with inflation expectations. Interestingly, Ichiue and Ueno (2015) investigate the nexus between beliefs concerning duration and survey estimations of **inflation expectations** and support that a tight connection between them exists which is strengthened by the commitment of the BoJ.

51

Centering their research on impacts concerning European countries, Falagiarda and Reitz (2015) reveal a negative linkage between unconventional signaling and sovereign risk in Italy. It is worth mentioning that according to the results of Ambler and Rumler (2017), there is high importance of **inflation expectations** in transmission of the ECB's signals.

3.2.3. Liquidity premia channel
3.2.3.1 Studies strictly focusing on US

Among the well-known papers centering their research on liquidity effects in the US, Gagnon et al. (2011) support that in the first stages of US LSAPs the lower liquidity risk has led to a decrease in the spread between yields on agency debt and i) MBS on one side and ii) yields on Treasury securities on the other side. Furthermore, the cost of financing **agency-related securities** became lower. Krishnamurthy and Vissing-Jorgensen (2011) argue that during US QE1 and QE2 a liquidity channel worked inter alia. In a somewhat similar vein, Christensen and Gillan (2018) find that US QE2 lowered liquidity premium in Treasury Inflation-Protected Securities (**TIPS) yields and inflation swap rates** by 10 to 13 bp than expected, thereby implying that non-conventional practices can have a positive effect on market liquidity. Notably, Kandrac and Schlusche (2013) show evidence supporting the existence of small scale flow effects on liquidity of US Treasury securities which were not systematic.

There are some studies that have focused interest on the risk premia implications of the liquidity channel. As noted by Jones and Kulish (2013), evidence indicates that additional liquidity in the US drives down **risk premia**. Foley-Fisher et al. (2016) argue that bond market risk premia became lower during the MEP, especially for firms issuing longer-term riskier debt.

3.2.3.2. Studies about US versus studies on other economies

Liquidity impacts that the US monetary policy triggered and thereby influenced other countries, are under scrutiny by Carpenter et al. (2014), Lim and Mohapatra (2016), and Lim et al. (2014). Notably, Carpenter et al. (2014) provide evidence that unconventional action taking by the Fed and the ECB led to higher liquidity and access in credit in **money markets** and increased **business loans** from financial institutions. This is not far from the study of Lim and Mohapatra (2016) who argue that a liquidity channel works among others regarding the potential effects of US unconventional practices on the **US and other advanced economies**. Moreover, Lim et al. (2014) support that US non-conventional policymaking has affected

developing countries also through a liquidity channel in combination with other channels.

3.2.3.3. Non-US Studies
Studies strictly focusing on the European countries

A significant number of academic papers have focused their research on liquidity effects in the Euro area. Darracq-Paries and De Santis (2015) support that the 3-year Long Term Refinancing Operations (LTROs) by the ECB in December 2011 and February 2012 were mainly transmitted by mitigating **liquidity premia in the banking system** and re-boosting financing in the Euro area. In his own approach, De Santis (2016), by using macro factors to capture liquidity risk for ECB actions, employs data for the time period from 2004 to 2015 concerning ten Euro area countries and reveals that a deterioration in liquidity increases **sovereign yields.** In a similar vein, Eser and Schwaab (2016) find that SMP purchases by the ECB can also be explained in terms of lower **liquidity risk premia.** Vogel (2016) looks into banks' behavior when they bid jointly in Main Refinancing Operations (MRO) and Longer-Term Refinancing Operations (LTRO) by the ECB and argue that obtaining liquidity from these operations is seen as a substitute. Beaupain and Durré (2015) provide evidence that unconventional monetary action taking by the ECB in the form of fixed-rate full-allotment (FRFA) led to excess liquidity and this resulted in alterations in the interbank money market. Furthermore, the liquidity enabled transactions to continue and removed stress from markets.

Table 3.1 presents that the largest portion of studies centered their attention on USA and Euro area, and no more one was about the UK. Most of them support a powerful decrease in liquidity premia starting from the launch of unconventional monetary practices. Nevertheless, four studies (the majority of them in 2016) argue for modest impacts. No more that three papers revealed small impacts of such policies on liquidity premia.

Table 3.1. The effect of QE on liquidity premia

Authors	Journal	Year	Country data	Effect on liquidity premia
Krishnamurthy, A., & Vissing-Jorgensen, A.	Brookings Papers on Economic Activity	2011	USA	medium
Christensen, J., & Gillan, J. M.	Fed. Res. Bank of San Francisco	2018	USA	medium
De Santis, R.	ECB Working Paper	2016	Euro area, largest 10 Euro area countries	medium
Eser, F., & Schwaab, B.	Journal of Financial Economics	2016	Euro area	medium
Belongia, M. T., & Ireland, P. N.	Journal of Macroeconomics	2017	USA	strong
Jones, C., & Kulish, M.	Journal of Economic	2013	USA	strong

	Dynamics and Control			
Carpenter, S., Demiralp, S., & Eisenschmidt, J.	Journal of Economic Dynamics and Control	2014	USA, Euro area	strong
Lim, J. J., & Mohapatra, S.	Journal of International Money and Finance	2016	USA, 60 EMEs	strong
Darracq-Paries, M., & De Santis, R. A.	Journal of International Money and Finance	2015	Euro area	strong
Vogel, E.	Journal of International Money and Finance	2016	Euro area	strong
Beaupain, R., & Durré, A.	Journal of Macroeconomics	2016	Euro area	strong
Steeley, J. M., & Matyushkin, A.	International review of financial analysis	2015	UK	strong
Avouyi-Dovi, S., & Idier, J.	Journal of Banking & Finance	2012	Euro area, France	strong
Kandrac, J., & Schlusche, B.	Economics Letters	2013	USA	weak
Lim, J. J., Mohapatra, S., & Stocker, M.	World Bank Policy Research Working Paper	2014	USA, 60 EMEs	weak
Gagnon, J., Raskin, M., Remache, J., & Sack, B.	International Journal of Central Banking	2011	USA	weak / medium

Studies focusing on volatility effects

Steeley and Matyushkin (2015) also examine non-conventional liquidity impacts on alterations in asset prices. Interestingly, they argue that intensive unconventional actions that triggered liquidity effects in the UK led to higher stability in bond markets. In contrast to the findings of Steeley and Matyushkin (2015) about UK, a **more intense feedback between liquidity and volatility** is documented in France by Avouyi-Dovi and Idier (2012), whose research is based on a **probability Markov-switching (TVTP-MS) model** and focused on the collateral market. They argue that it is not easy to implement an optimal liquidity policy due to difficulties in detecting regimes.

3.2.4. Confidence channel

There is a respectable but not large amount of academic research on the confidence channel for transmission of out of the ordinary policymaking. Studies that are part of this literature center their research on the impact that extraordinary actions have on the confidence of economic units. By studying this type of impacts that the US action taking has brought about on **global equity prices**, Chen et al. (2016) provide evidence for an impact showing up in a **significant level.** Similar to the research of Chen et al. (2016), the work of Lim and Mohapatra (2016) considers the impact of US non-conventional policies and actions of other high-income countries on developing economies. Results abide by the view that **confidence plays an**

54

important role in **policy spillovers**. By the same token, Lim et al. (2014) argue that US non-conventional policy exerts **positive effects towards confidence in developing economies**.

In the stream of research about confidence effects, the linkage with investor/consumer sentiments holds a significant place. Lutz (2015b) presents evidence that unconventional monetary policy shocks exhibit a **strong impact of a positive sign on investor sentiment** in the United States. By employing a familiar but more granular look, Stillwagon (2015) argues that **deviations from the expectations hypothesis** grow larger as consumer pessimism increases. This reveals economic agents becoming more risk-averse regarding the great risk inhibited in long-term bonds. Hahn et al. (2017) adopt a shadow short rate as a proxy for monetary policy and argue that unconventional monetary policies trigger lower risk aversion and uncertainty. Moreover, they support that shocks to risk aversion and uncertainty lead to alterations in monetary policy.

Forecast accuracy has also been examined when studying the confidence channel. Glick and Leduc (2012) mostly center their research on the impact of LSAP announcements on **US growth forecasts**. Notably, detect a tendency for higher **pessimism** owing to signaling of further unconventional practices.

The impacts triggered on the restauration of confidence have also been under investigation. Interestingly, Roache and Rousset (2013) argue that unconventional practices give a boost to **market confidence** revival in the US in periods when uncertainty is high. In a similar vein, Hosono and Isobe (2014) provide support to the view that the US credit easing policy may have been **helpful in terms of market sentiment revival**. Stillwagon (2015) detects a negative relationship between the term premium –whose component is the liquidity premium- and consumer sentiment. Furthermore, he reveals that at least a temporary **rise in the term premium is triggered when the interest rate falls**.

Table 3.2 denotes that one quarter of the papers emphasizes the important impact of extraordinary practices on confidence, whereas only one study reveals a modest impact and two exhibit weak influences. In comparison to academic papers focusing on the other channels, a lower number of studies is found here.

Table 3.2.The effect of QE on confidence

Authors	Journal	Year	Country data	Effect on confidence
Lim, J. J., & Mohapatra, S.	Journal of International Money and Finance	2016	USA, 60 EMEs	Weak
Lim, J. J., Mohapatra, S., & Stocker, M.	World Bank Policy Research Working Paper	2014	USA, 60 EMEs	Weak

Chen, Q., Filardo, A., He, D., & Zhu, F.	Journal of International Money and Finance	2016	USA, 17 advanced and EMEs	medium
Lutz, C.	Journal of Banking & Finance	2015	USA	Strong
Stillwagon, J. R.	Journal of International Financial Markets, Institutions and Money	2015	USA, UK, Switzerland	Strong
Hahn, J., Jang, W. W., & Kim, S.	Economics Letters	2017	USA	Strong
Roache, S. K., & Rousset, M. V.	International Monetary Fund Working Paper	2013	USA	Strong
Hosono, K., & Isobe, S.	Ministry of Finance Japan Working Paper	2014	USA, UK, Euro area, Japan	Strong

3.2.5. Mixed results for the bank lending channel
3.2.5.1. Supporters of positive effects of QE on lending

Arguably, there is a number of academic studies denoting positive unconventional impacts on lending in a spectrum of economies. In USA, Wang (2016) reveals that the US credit easing and LSAP1 have **positive effects on lending** by large banks in a more significant way than in Japan. This partly abides by the findings of Hännikäinen (2015) that provides evidence of credit spreads not performing well as predicting variables in ZLB conditions and US unconventional policies. Salachas et al. (2016) argue that unconventional actions by central banks triggered higher credit growth. By focusing more on Japan, Bowman et al. (2015a) provide evidence for a **statistically significant positive impact of bank liquidity positions on lending**, that is more intense for weaker banks and only during the first years of QE. This is much similar in essence with Churm et al. (2015), where the UK Funding for Lending Scheme (FLS) is found to **reduce bank funding costs and increase incentives to lend**. In a similar vein, Hosono and Isobe (2014) identify declines in interbank loans triggered by extraordinary actions in the US, the UK, Euro area and Japan. In the same vein, Anaya et al. (2017) document a fall in lending rates of emerging countries when the US Fed policy renders unconventional.

The volatility effects of the bank lending channel are under scrutiny in Carpenter et al. (2014). They provide evidence that unconventional action taking in the US and the Euro area **reduced** bank funding **volatility** and that **increased loan supply**. Thereby, sustained lending activity is achieved.

A significant number of academic studies about impacts on European countries conform with the view that out of the ordinary policy affects the real economy. Von Borstel et al. (2016) provide evidence that the **significant drop on lending rates** is primarily attributed to large unconventional monetary policy shocks.

56

By a somewhat similar perspective, Peersman (2011) detects a **fall** on **interest rate spreads** charged by banks in the Euro area **in a persistent manner** after QE policies. Not far from this study, Darracq-Paries and De Santis (2015) reveal that the ECB's unconventional monetary policy led to a significant negative impact on lending rate spreads. Although by a different methodology, Apergis and Christou (2014) also identify a powerful lending channel effect on the European banking sector. The quantile regression methodology they employ point towards such effects, but the latter render non-conventional policy weak below a certain critical interest rate value. Additionally, Haitsma et al. (2016) find significant evidence for **a credit channel** in the transmission of ECB's unconventional shocks.

By comparing unconventional policy effects by the ECB on credit supply of Italy and Spain useful results are found. Firstly, Casiraghi et al. (2013) support that unconventional action taking by the European Central Bank resulted in supplying **larger sums of credit in Italy**. Secondly, García-Posada and Marchetti (2016) find that the Very Long-Term Refinancing Operations (VLTROs) by the ECB had a **modest positive effect on bank credit supply** to firms in **Spain**, driven by credit to Small and Medium Enterprises (SMEs). Furthermore, this impact is found to be larger for illiquid banks.

Impacts on capitalization are also under investigation in the bank lending channel literature. According to Joyce and Spaltro (2014), UK QE1 led to a small but statistically **significant upward movement in bank lending growth**, which was more effective in small banks. Low **capitalization** is found to **impede the non-conventional impact on bank lending**. Ricci (2015) employs event-study and regression methodologies and finds that large European banks reacted more intensely to out of the ordinary practices than to alterations of interest rates. D' Avino (2017) investigates how bank lending has been effective for lending by foreign branches of US banks during the Fed's QE policy. She argues for the existence of an international bank lending channel and provides evidence that global banking institutions play a significant role in transmitting abroad shocks in liquidity .

3.2.5.2. Supporters of Modest, zero, or negative effects of QE on lending

An interesting bulk of academic work supports the existence of a lower, zero, or negative linkage concerning the central banks' non-conventional practices and the effectiveness of the bank lending channel. Interestingly, Mamatzakis and Bermpei (2016) by employing a panel threshold specification address the link between US non-conventional action taking and bank performance and document for the existence of a negative nexus which is particularly emphasized above a certain threshold value. In a similar vein, Butt et al. (2014) support that during unconventional periods, ''flighty deposits'' are generated in the UK. Thereby, the bank lending channel renders ineffective. In a somewhat similar perspective, Goodhart and Ashworth (2012) argue

57

that unconventional actions lead to a weaker role for financial intermediation. Moreover, they support that improvements in the efficacy of bank lending are necessary for avoiding negative returns. The competitiveness of the banking system is also under scrutiny by Di Maggio and Kacperczyk (2017) that address the shadow character of the banking system. Specifically, they detect lower capital supply and a larger exposure to default risk during US non-conventional practices. In great resemblance to these findings are the results in Lambert and Ueda (2014) that reveal a positive nexus between unconventional surprises and bank credit risk.

Table 3.3 presents that academic papers supporting the existence of an active bank lending channel are more numerous in comparison to those with medium, weak or zero impacts. It should be noted that the Euro area countries exhibit the most powerful impacts.

Table 3.3. Mixed effect concerning an active bank lending channel via QE policies

Authors	Journal	Year	Country data	Effect on bank lending
Mamatzakis, E., & Bermpei, T.	Journal of International Money and Finance	2016	USA	negative
Goodhart, C. A., & Ashworth, J. P.	Oxford Review of Economic Policy	2012	UK	negative
Di Maggio, M., & Kacperczyk, M.	Journal of Financial Economics	2017	USA	negative
Lambert, F., & Ueda, K.	International Monetary Fund Working Paper	2014	USA, Euro area, UK	negative
Butt, N., Churm, R., McMahon, M., Morotz, A., & Schanz, J.	Bank of England	2014	UK	zero
Hännikäinen, J.	Review of Financial Economics	2015	USA	weak
Apergis, N., & Christou, C.	Economic Modelling	2015	Euro area	Medium/strong
García-Posada, M., & Marchetti, M.	Economic Modelling	2016	Spain	Medium/strong
Wang, L.	Journal of Policy Modeling	2016	Japan, USA	strong
Salachas, E. N., Laopodis, N. T., & Kouretas, G. P.	Journal of International Financial Markets, Institutions and Money	2017	USA, UK, Japan, Euro area	strong
Bowman, D., Cai, F., Davies, S., & Kamin, S.	Journal of International Money and Finance	2015	Japan	strong
Churm, R., Joyce, M., Kapetanios, G., & Theodoridis, K.	Bank of England Working Paper	2015	UK	strong
Hosono, K., & Isobe, S.	Ministry of Finance Japan	2014	USA, UK, Euro area, Japan	strong
Anaya, P., Hachula, M., & Offermanns, C.	Journal of International Money and Finance	2017	EMEs	strong

58

Carpenter, S., Demiralp, S., & Eisenschmidt, J.	Journal of Economic Dynamics and Control	2014	USA, Euro area	strong
Von Borstel, J., Eickmeier, S., & Krippner, L.	Journal of International Money and Finance	2016	Euro area	strong
Peersman, G.	CESifo Working Paper Series	2011	Euro area	strong
Szczerbowicz, U.	International Journal of Central Banking	2015	Euro area	strong
Darracq-Paries, M., & De Santis, R. A.	Journal of International Money and Finance	2015	Euro area	strong
Haitsma, R., Unalmis, D., & de Haan, J.	Journal of Macroeconomics	2016	Euro area	strong
Casiraghi, M., Gaiotti, E., Rodano, L., & Secchi, A.	Bank of Italy Working Paper	2013	Italy	strong
Joyce, M. A., & Spaltro, M.	Bank of England Working Paper	2014	UK	strong
Ricci, O.	Journal of Banking & Finance	2015	USA, UK, Japan, Switzerland, Euro area	strong
D'Avino, C.	Economic Modelling	2018	USA	strong

3.2.6. Alternative theoretical model-based perspectives of unconventional monetary policy channels

3.2.6.1. Portfolio rebalancing channel

Regarding research about the portfolio balance channel, a significant number of studies based on theoretical models can be found. In the context of a theoretical model of **preferred habitat** with clienteles, Greenwood and Vayanos (2014) document that the relative supply of **longer-term bonds has a positive nexus** with the term spread. Thereby, higher segmentation between long- and short-term rates results in larger rebalancing effects. In a relevant approach, Ellison and Tischbirek (2014) propose a **standard New Keynesian Dynamic Stochastic General Equilibrium (DSGE)** model to illustrate a **preferred habitat** framework in which asset quantities have an impact on interest rates. They address whether conventional combined with unconventional practices could be highly effective. Results provide evidence of high effectiveness under the condition of good coordination. A **DSGE** model is also employed by Falagiarda (2014). In order to isolate the portfolio rebalancing channel of non-conventional policy, he introduces imperfect asset substitutability between government bonds of different maturities. Results provide support of effectiveness of the portfolio rebalancing channel. In line with previous research, Doh (2010) analyzes a **preferred-habitat model** where alterations in the supplies of long-term assets are conducted. Evidence supports once more that the impact on long-term rates can be significant and is linked to risk-aversion. The model specification that Jones and Kulish (2013) propose in order to address the efficacy of portfolio rebalancing is a **log-linear Keynesian one**. This is characterized by a partly endogenously determined **risk premium** on long-term debt. Results document a

59

negative impact on rates through **term premia**. Moreover, Jarrow and Li (2014) by their model reveal that the Fed's unconventional policy influences **rates** without interaction of arbitrage opportunities into the Treasury security markets. Adler et al. (2018) develop a two-country model in order to study foreign exchange intervention and QE, which takes into consideration the segmentation in asset markets, imperfect substitutability between assets as well as real and nominal rigidities. McMahon et al. (2018) by their three-period model for the US reveal that under QE policies, the composition of assets does not conform to balance sheet restrictions and leads to an indeterminate inflation path. On the other hand, credit easing allows the central bank to select the maturity composition of its assets, thereby is capable of influencing the inflation path.

To illustrate the level of effectiveness of extraordinary practices in the UK, Bridges and Thomas (2012) adopt a **preferred sectoral approach**. The theoretical setting they employ is a simple **money demand and supply framework** and their estimations point towards diversified impacts of non-conventional policy on different sectors and significant effects in general.

By extending the model-based research onto the ECB's policy impacts, Eichler (2012) adopts a **regime-switching approach** and identifies a negative impact on domestic monetary value. His findings are not far from those of Priftis and Vogel (2016). Notably, the latter argue that imperfect asset substitutability affects stock prices positively and currency values negatively and renders the rebalancing effective.

3.2.6.2. Signaling Channel

Models have also been a natural starting point for understanding unconventional effectiveness through the signaling channel. As regards such specifications, a modified theoretical framework based on the Taylor rule is introduced in the analysis by Klose (2011). In this setting, shaping inflation expectations is considered as a suitable means for conducting monetary policy in the US and the Eurozone. Furthermore, it is argued that this is an appropriate way for policymaking at the ZLB. Schmidt (2016) employs a monetary business cycle model with price adjustment costs and monopolistic competition between firms and explains how to avoid liquidity traps driven by expectations. He argues that fiscal stabilization rules are the basis for the solution in order to prevent a fall in agents' confidence. Foerster (2015) employs a model of non-conventional policies with regime-switching and argues that if monetary authorities exit QE with a sell-off, the economy is led in a double-deep recession. He also emphasizes the importance of expectations about exit from QE in order for these measures to be effective from the beginning. Cole (2018) by employing a New Keynesian model, supports that forward guidance triggers more beneficial effects for the real economy in terms of output and inflation, when it is conducted under price-level targeting rather than inflation-targeting. Cook and Devereux (2016) by adopting a New Keynesian model argue that only when forward

guidance is effective in ZLB conditions, the flexible exchange rate system is preferable than the single currency area. Thereby, the credibility of the commitments by monetary authorities can prove beneficial in terms of real economy variables. Boneva et al. (2016) employ a stochastic version of a New Keynesian model and argue that ''threshold-based forward guidance'' can provide a temporary spur to the economy and enhance the time consistency of policy promises. It is found that the threshold-based version is better than the usual forward guidance in terms of preventing welfare losses.

3.2.6.3. Liquidity Channel

Model specifications have also been adopted in order to cast light on non-conventional effects through the liquidity channel. Interestingly, the framework that Güntner (2015) uses is built upon a real business cycle model and explores whether liquidity provisions by the monetary authorities could affect the real economy. Evidence indicates that injecting extra liquidity could **attenuate the impacts brought about by financial shocks' effects** on the real economy. Notably, Christensen et al. (2014) employ a model based on the assumption that a counterfactual for the 3-month LIBOR rate can be quite informative. It should be noted that a negative relationship between unconventional central bank policies and **liquidity premium in interbank rates** is observed. Arnold and Soederhuizen (2018) employ a state space model and examine whether differences in non-conventional policies between the US and the Euro area are apparent in the nexus between base money and money supply. Evidence indicates that financial market stress has allowed the higher base money to lead to higher money supply only in a very low extent. This is in contrast to findings about the US. Nevertheless, the impact is also not large in the US. Gu and Haslag (2014) construct a model with time mismatch in setting debts, where the monetary authorities buy private debts in the open market in extraordinary times, thereby redistribute liquidity among markets. The central bank removing the frictions that drive the price assets away from the par, leads to higher output. Armenter and Lester (2016) adopt a parsimonious model of the federal funds market in the US to analyze the determinants of rates and volumes under the non-conventional framework and find that overnight excess reserves and overnight reverse repurchase actions may preserve rates within targets in order for monetary policy to be conducted in a safe manner.

3.2.6.4. Bank lending Models

Model specifications are also employed by researchers in order to upgrade knowledge about unconventional policies that is derived from theoretical and empirical studies. In the context of a model with limits to arbitrage in private intermediation, Gertler and Karadi (2013) propose an innovative approach for LSAPs to become effective and argue that they should adopt the form of central bank intermediation in order for non-conventional policy to achieve its targets. Olmo and

Sanso-Navarro (2015) employ a bank-based model for the credit market and support that unconventional monetary policy measures have been effective in reducing risk aversion by improving credit conditions. Thereby, liquidity is enhanced through these measures. Herbst et al. (2014) adopt a model where QE can increase output through exchange rate depreciation and higher net exports. They emphasize the negative role of reserve traps and trade effects and argue that recovery can be achieved under certain conditions, even when money supply raises are trapped in banks and credit cannot get higher.

Moreover, Le et al. (2016) also employ their own specification and a special character for money in order to assess the effectiveness of monetary policy at the ZLB. They support the ability of money to function as a cheap collateral in the model of banking that they construct and argue that in this framework there is no need for excess credit.

An alternative view on studying unconventional practices through the model of Céspedes et al. (2017) shows that unconventional policies being beneficial when financial constraints are binding and that credit programs exert a higher impact when targeted towards banks. Wolski and van der Leur (2016) use an agent-based model of the interbank market with endogenous credit risk formation and apply unconventional monetary shocks and reveal that under forward guidance fewer bankruptcies and higher market confidence are observed.

Quint and Tristani (2018) adopt an S-VAR methodology and calibrate a closed-economy model with a banking sector in order to study how money market tensions affected the Euro area. The liquidity supplied by the ECB is found to have reduced the effect on investment and lowered the increasing impact on banking spreads that the shock would have triggered. McNelis and Yoshino (2016) use a DSGE model representing a large open economy like Japan's and introduces QE in order to estimate its effects on reducing government debt held by banks. Simulations indicate the effectiveness of QE during crisis in terms of costs of adjustment, investment and real exchange rates.

Yépez (2018) in a model with financial intermediaries finds that unconventional action taking prevents recessions and leads to faster recovery, whereas positive impacts of expansionary fiscal policy remain if credit policy already exists. Lim and McNelis (2018) employ a two-country model with financial frictions and argue that when these countries face asymmetric unconventional shocks, then optimal policy rules can be beneficial for both of them. On the other hand, when the shocks are similar, improvement of financial intermediation effects in one country leads to worsening of conditions in the other.

3.3. Asset prices and foreign exchanges rates as intermediate targets in unconventional monetary policy channels

3.3.1. Bond yields

3.3.1.1. Studies strictly focusing on US

Numerous papers have employed econometric methodologies in order to assess the level of the nexus between non-conventional action taking and bond yields. This linkage has been a primordial matter when investigating QE efficacy during balance sheet enlargement eras. In an effort to focus on US effects, D' Amico et al. (2012) adopt event study methodologies. They highlight that the effect of LSAP-style activities on longer-term Treasury yields is mainly seen in the negative response of the **real term premium**. When it comes to Gagnon et al. (2011), they provide evidence for a significant reduction that US LSAPs triggered in longer-term interest rates. In their study, Krishnamurthy and Vissing-Jorgensen (2011), examine **mortgage-backed security yields as well as corporate yields**. They identify a negative nexus between MBS purchases and corporate yields. The estimation period covers QE1. It is noteworthy though that Treasury and Agencies' yields had a significantly larger negative impact from Treasury purchases during QE2 in comparison to the effects of MBS rates and corporate rates.

Notably, the maturities under scrutiny in the study by Jarrow and Li (2014) range from **medium term to very long-term** horizons. The authors assess a significant negative impact of unconventional practices, especially about the 1-year bonds. Another interesting paper in this stream of literature is Gilchrist et al. (2015). They find that US unconventional policy leads to a full transmission of **changes in Treasury yields to private yields** of bonds enduring the same time horizons. Guidolin et al. (2017) also reveal the effectiveness of US unconventional actions. More concretely, by employing **regime swifts,** they provide evidence that unconventional monetary policies can lower **corporate yields**, while the Maturity Extension Progran, which is considered as a non-inflationary monetary policy, can lead every yield to a lower level. Arguably, the findings of Liu et al. (2017) abide by those of Gilchrist et al. (2015) and Guidolin et al. (2017). Liu et al. (2017) by employing counterfactual scenarios and a change-point VAR methodology support that US large-scale asset purchases pushed downwards the 10-year interest rate spread by approximately 0.90% during the Global Financial Crisis. In the same vein, Neely (2015) provides evidence that **strong negative impacts on domestic and non-US bond rates** have emerged due to the Fed's LSAPs. The impact is found to be more pronounced for yields of a 10-year maturity. Moreover, Bauer and Rudebusch (2014) argue that US QE1 substantially decreased yields by bringing about shifts in expectations, while subsequent unconventional phases led **expectations impacts to be much weaker**. Not far from that, as is shown by their estimations, Chung et al. (2012) provide evidence that the US Fed's asset purchases during 2009 and early 2010 resulted in an approximately 2% decrease in the short-term interest rate. Glick

and Leduc (2012) support that US LSAP announcements decreased long-term US yields by affecting people's perceptions about the future.

Meaning and Zhu (2012) support that the Maturity Extension Program may have triggered a **substantial negative effect on 10-year Treasury bond yield**. In a similar mentality, Li and Wei (2012) provide evidence that the US LSAP1 and LSAP2 and the MEP **led to a 100 bp decline in US 10-year rates.** Furthermore, Hancock and Passmore (2011) reveal that the news about US Mortgage-Backed Securities purchases during the first round of Large-Scale Asset Purchases led to a decline in **mortgage rates** equal to approximately 100 bp. Kiley (2016) adopts regressions around policy events and an instrumental-variables methodology and argues that non-conventional monetary policy announcements that have led to alterations in Treasury yields, have led to alterations in private yields.

Weak or Moderate effects of QE on yields

Moderate impacts of US extraordinary action taking has also been found in academic work about effects on bond yields. Among the most prominent papers in this category is the study of D'Amico and King (2013). Notably, D'Amico and King (2013) provide evidence that **overall, the negative preferred habitat impacts** on US Treasury yields were larger than 0.3%. Arguably, the VAR methodologies employed by Meinusch and Tillmann (2016) also provide results about a nexus of medium intensity. Meinusch and Tillmann (2016) adopt a Qual-VAR approach and estimate that US unconventional monetary shocks decrease US yields in a medium extent. Moreover, Guidolin et al. (2014) by simulating monetary policies as shocks to the US Treasury yield curve argue that on average lower corporate spreads cannot last for long. It is for this reason that they support the effectiveness of Operation Twist in such situations. In an innovative investigation, Boubaker et al. (2016) by employing counterfactual estimations, VAR and Markov Switching VAR (MS-SVAR) approaches, argue that monetary policy shocks in the US result in weaker pension funds preferring bonds.

Studies supporting the existence of zero or contrary effects on bond yields can also be traced. Thornton (2011) reveals that the news concerning the launch of the US Term Auction Facility (TAF) led to higher **risk premium** in bond yields, thereby had a contractionary effect, as it was interpreted as economic conditions worsening.

3.3.1.2. Studies about US versus studies on other economies

There are a number of academic essays investigating the nexus of the US with other countries, by putting emphasis on non-conventional impacts on yields. By employing an SVAR and event study methodologies, Wright (2012) provides evidence that US monetary policy surprises **lead to a substantial decrease in Canadian, UK, and German long-term yields. Moreover, he supports** that negative effects in the US private sector are smaller than on Treasury yields and fade

out quickly. Meaning and Zhu (2011) by adopting a methodology developed by an earlier version of D'Amico and King (2013) provide evidence that **asset purchases by the monetary authorities in the US and the UK substantially decrease bond yields** in the US and the UK, respectively. Swanson and Williams (2014) continue the investigation in this category of effects. They provide evidence that longer-term than 1-year **UK government bonds reacted very intensely** to UK unconventional news during 2010-2011. Furthermore, German bunds of the same maturities responded as expected to Eurozone unconventional actions until mid-2012. Christensen and Rudebusch (2012) provide evidence that declines in US yields mainly stemmed from lower expectations about future short-term rates, whereas term premiums led the reductions in UK yields.

Abiding by most of the other studies, in a paper employing an event-study and using ''Financial Times'' articles, Rosa (2012) argues that **unanticipated unconventional news decrease medium- and long-term US Treasury yields** by 9 bp and 30-50 bp, correspondingly. Moreover, a similar reaction is detected concerning UK yields to UK unconventional practices announcements. Lutz (2015a) addresses the linkage between US policies and German and UK yields. By using SFAVAR, he uncovers that US unconventional action taking **decreased Germany's** and **the UK's government bond yields** but these effects ended after approximately 750 days. Research on exchange effects about US and other countries is extended by Hosono and Isobe (2014). They argue that unexpected US unconventional monetary action taking influenced **short-term to long-term Treasury yields**, and **medium-term BBB-rated corporate bond yields in a larger extent** during QE1 than QE2. Effects were also significant for Japan, the UK, and the Eurozone.

Furthermore, Belke et al. (2017) by employing a cointegrated-VAR (CVAR) support that US QE1 did not harm the **nexus between interest-rates of countries over the world**, as no significant structural breaks due to QE are found.

Model-based represensations have allowed for a better examination of how non-conevntional practices have impacts on yields. By employing a Dynamic Structural General Equilibrium model, Falagiarda (2014) supports that **US and UK out of the ordinary impacts led to a decrease in long-term yield**s and the peak effect was -63 bp in the US during QE2, whereas -69 bp in the UK during QE1. In a somewhat different vein, Chung et al. (2017) reveal that by employing a specific **quadratic model** that shares the analytical tractability with unbiased expected interest rates, safe estimations of term premiums at Zero Lower Bound conditions can take place.

Global and EMEs effects

Spillover impacts are also studies in academic papers than investigate the worldwide impacts on bond yields. Intriguingly, Bauer and Neely (2014) provide evidence that non-conventional US impacts on bond yields result in substantial

covariance between domestic and non-US bond prices. Joyce et al. (2012b) support that according to the relevant literature extra easing monetary policy urges yields downwards in countries adopting it.

Rahal (2016) estimates how unconventional monetary policy has affected housing markets in eight OECD countries by employing panel vector autoregressions with zero and sign restrictions. He argues for a decrease in mortgage rates by 5-6 bp just after a 3% positive shock in total assets of the central bank happens. This effect can be observed on house prices but also on markets about mortgages.

A respectable amount of academic papers have focused on the effects that US unconventional action taking has resulted in concerning developing markets. Bowman et al. (2015b) examine the nexus between non-conventional announcements by the Fed and alterations in yields of foreign countries. They provide evidence that **sovereign yields of developing countries were very volatile** when US monetary policies provided news of further unconventional easing measures. Notably, changes in US yields, though smaller, were in tandem with changes in EMEs yields. According to Duca et al. (2016), US unconventional practices exerted flow and stock impacts in emerging markets and that greatly influenced the number of bonds issued. In a somewhat different perspective, Fratzscher et al. (2018) argue that the US QE1 measures **resulted in lower sovereign yields and increased prices of bonds** in emerging economies. Moore et al. (2013) find that when long-term US Treasury yields decline by 10 bp then **government bond yields in EMEs** decline by almost **1.7 bp**. In accordance to these findings, Tillmann (2016) by using a Qual-VAR methodology uncovers that US unconventional monetary policy shocks reduce bond spreads in EMEs. Morgan (2011) employs an event-window analysis on US non-conventional impacts and finds that only few Asian countries' yields were affected during QE1 and QE2. The effects on yields were found to be negative and mostly present in Indonesia.

There is also investigation for impacts of QE-tapering on bond yields. Rai and Sushanek (2014) by using an event study methodology find that **bond yields in EMEs fel**l due to US QE-tapering announcements.

Table 3.4. Studies indicating responses of bond yields in non-US countries to US QE

Authors	Journal	Year	US QE policy effects on bond yields of Country	Effect on bond yields
Lutz, C.	Applied Economics Letters	2015	UK and Germany	weak
Morgan, P.	East Asian Bureau of Economic Research	2011	EMEs	weak
Bowman, D., Londono, J. M., & Sapriza, H.	Journal of International Money and Finance	2015	EMEs	medium
Rai, V., & Suchanek, L.	Bank of Canada Working Paper	2014	EMEs	medium

66

Moore, J., Nam, S., Suh, M., & Tepper, A.	Federal Reserve Bank of New York	2013	EMEs	strong
Tillmann, P.	Journal of International Money and Finance	2016	EMEs	strong

Studies strictly focusing on UK

A non-negligible portion of the QE literature is centered on impacts on yields in the UK. Joyce and Tong (2012) investigate the first round of unconventional practices in the UK and reveal that it had persistent impacts on **gilt yields**. More specifically, non-conventional announcements took time to be fully priced in and impacts differed depending on maturities. The strongest negative effect was detected on 15- to 20-year gilts and its highest level was 1.2%. Abiding by the results of Joyce and Tong (2012), McLaren et al. (2014) argue that changes in expected UK unconventional purchases resulted in a noteworthy fall **in yields** after the March 2009, August 2009, and February 2012 announcements. However, the **local supply** characteristics were the main driver of effects on yields. In a similar vein, Steeley (2015b) finds **noteworthy falls in yields** due to UK QE and that near substitute bonds did not affect one another's prices significantly. Moreover, bond markets turned efficient mostly during QE3. This is in accordance with Joyce et al. (2012a) where it is argued that UK QE1 led to **lower yields by 100 bp** and that the **fall in corporate bond yields** during QE2 was smaller than during QE1. In a much similar vein, Kapetanios et al. (2012) find that UK QE1 had a **negative effect on long-term yields** as it lowered the long-term yields in the UK by approximately **1%**. In a similar line of research, Churm et al. (2015) address the linkage between UK unconventional actions and yields by employing BVAR and ARDL techniques and reveal that UK QE2 triggered a **negative impact on yields by up to 55 bp**. In the study of Papadamou et al. (2017), results from momentum-TART estimations detect a significant uni-directional long-run causality from the BoE's assets towards the government as well as the commercial bank sector.

Academic papers that focus on **macro-finance yield curves** about the UK are Breedon et al. (2012) and Chadha and Waters (2014). Specifically, Breedon et al. (2012) provide evidence of QE1 lowering government bond yields by around 50 bp. In the same line, Chadha and Waters (2014) support that UK QE lowered 10-year nominal interest rates by 46 bp on average, but no sizeable impact is found on real interest rates. There is evidence that QE1 was the most effective of rounds.

Studies strictly focusing on Japan

Moreover, studying the effects of extraordinary action taking in other countries is undertaken. Schenkelberg and Watzka (2013) by using a sign-restriction SVAR methodology show evidence that a non-conventional shock substantially decreases **Japanese interest rates of long maturities**. In a different vein, Ugai

(2015) argues for no proof that the Quantitative and Qualitative Easing effected corporate Japanese **yields.**

Studies focusing on the Euro area Countries

In the context of investigating how non-standard measures affect bond yields in the Euro area, a number of empirical studies have been developed. De Santis (2016) traces a **negative** effect on Euro area long-term sovereign yields equal to 0.63%. This is triggered by the Asset Purchase Program (APP) conducted by the ECB. The methodology he employs is a panel error-correction model. Results indicate effectiveness mostly before the realization of purchases and mainly for vulnerable countries. In a more recent paper, Von Borstel et al. (2016) model the behavior of yields in response to unconventional easing in the Euro area, in terms of a FAVAR methodology. Evidence reveals substantial negative effects mainly during powerful shocks. In a similar vein, Kinateder and Wagner (2016) investigate how spreads in European countries received an impact from extra easing policies. Despite evidence for a **negative nexus**, there is evidence that the systematic risk premium is influential. Nevertheless, unobservable common factors are traced to account for the two-thirds of the variation in yield spreads. Not far from this, Eser and Schwaab (2016) undertake estimations about 5-year maturity yields in Greece, Spain, Ireland, Italy, and Portugal. According to their findings, purchases of worth 0.1% of the respective outstanding debt reduce such yields by 0.03%. Moreover, Gros et al. (2015) supports that global trends have a large influence on rates in European countries. Thereby, unconventional effects could not prove lower if isolated from global tendencies.

Studies assessing the effects of the ECB's policy on yields of s**eparate European countries** have also brought to the surface some interesting findings. More concretely, Falagiarda and Reitz (2015) argue that **announcements of further unconventional practices** in the Euro area decrease **Italian long-term yields** in comparison to the German ones. In the same mentality, Casiraghi et al. (2013) provide evidence that **yields** in Italy decreased due to Securities Markets Purchases and Outright Monetary Transactions. Creel et al. (2016) by employing S-VAR methodologies to control for announcement effects by the ECB's unconventional policies support that impacts on interest rates were substantial but not equal from country to country. Nevertheless, the impacts on lending volumes or bond issuance were not noteworthy. The countries examined are: France, Germany, Italy and Spain. Jäger and Grigoriadis (2017) employ pooled OLS regressions and reveal that non-conventional practices resulted in declines in bond yield spreads of Euro area economies and led to higher sovereign debt. The OMT and SMP are found to be more effective for the crisis countries. Gibson et al. (2015) provide evidence that the SMP and the two Covered Bond Purchase Programs (CBPPs) by the ECB led to a reduction of sovereign spreads and raised covered bond prices in the five most indebted European countries. However, these impacts were modest.

Studies strictly focusing on Switzerland

68

A number of studies look into the nature of the impact that non-conventional practices have on Swiss bond yields. Christensen and Krogstrup (2015) abide by their earlier paper, that is Christensen and Krogstrup (2014). Notably, Christensen and Krogstrup (2014) argue that Swiss yields declined due to non-conventional announcements. Their estimations document a **0.28% decrease** as the three Swiss unconventional policy phases took place. Furthermore, Bernhard and Ebner (2017), argue that out of the ordinary actions by the four major economies that adopt unconventional measures resulted in a fall in corporate yields in Switzerland. Moreover, the Swiss franc is found to appreciate, whereas Swiss equity prices fall. Thereby, significant spillovers on Swiss assets are identified.

Studies focusing on volatility effects

Econometric papers that focus on volatility dynamics during unconventional periods include Unalmis and Unalmis (2015) that detect a nexus of a negative sign between US liquidity provisions and implied volatility in markets of bonds.

Focusing on comparing volatility effects on short-term bonds, Steeley and Matyushkin (2015) and Steeley (2015a) support that **lower maturities were more affected** by UK non-conventional actions. Moreover, Steeley and Matyushkin (2015) argue that QE1 reduced fluctuations as if the crisis had not taken place.

Empirical evidence employing Interest Rate Term Structure models

Interest rate term structure models have also been employed for a better understanding of out of the ordinary action taking. The model-based analysis conducted by Greenwood and Vayanos (2014) adopts a framework of preferred habitat and preferences for specific maturities. The authors document that longer maturities are more influenced by the supply of bonds.

Many of the papers studying unconventional practices by being based on models, concern the US economy. Vayanos and Vila (2009) in their well-known study, focus on the term structure of interest rates and examine in which ways investors that prefer specific maturities are linked with risk-averse arbitrageurs. It is shown that the preferred-habitat theory concerning the term structure of rates significantly affects bond risk premia, the impacts of shocks on demand and on expectations, the carry trade impact and the efficiency of monetary policy. Jarrow and Li (2014) employ an arbitrage-free term structure model. They argue that the first rounds of US QE exert a negative effect on forward rates of short-run and medium-run durations. This is in contrast to findings about long-term maturities, as they were very weakly influenced. An arbitrage-free term structure specification is also employed by Li and Wei (2012). It should be emphasized that observable yield factors are present in this model. Results reveal effectiveness in lowering long-term Treasury yields during LSAP1, LSAP2, and the MEP. Wu and Xia (2016) also address the question about effectiveness of US non-conventional policy. The framework they prefer is a non-linear term structure model that is suitable for ZLB conditions.

69

Evidence points towards effectiveness of such policies. The adoption of a dynamic term structure model also enables Christensen et al. (2015) to attach probabilities to different interest rate scenarios. This is made in order to address the Fed's losses. They document that there is only a very small opportunity that large losses will emerge. A significant amount of model specifications are employed for studying expectations about inflation. Notably, Christensen and Rudebusch (2012) support that policy expectations were the main driver of unconventional effects in the US. This abides by the findings about the UK, where term premia hold the primary role. Inflation expectations is also the main axis in the study of Aruoba (2016). Their horizon ranges from 3 months to 10 years. Evidence is found that a monetary stimulus has been triggered when inflation expectations do not alter in the long-term.

The term structure has also been the main focus in the study of Hamilton and Wu (2012). In the model of risk-averse arbitrageurs they employ, the level, slope, and curvature factors of the term structure risk have been under scrutiny. They reveal that these factors have contributed in making better forecasts about yields and excess returns.

Chung et al. (2017) adopt an innovative quadratic Gaussian term structure specification that is appropriate for ZLB conditions. Notably, they reveal that a bias upwards regarding the forward premium could be realized abiding by the affine model. They argue that this is in contrast to the quadratic model that leads to plausible estimates under zero interest rates. Jarrow (2013) by his model for the US is opposed to the notion that interest rates are constrained by the Zero Lower Bound and supports that negative interest rates are not incompatible with an economy with no arbitrage, even though with a low probability of appearance. He argues that an economy model with firms, non-bank financial institutions and banks is closer to reality.

Models investigating what affects the BoE's efficacy have also shown up. Interestingly, Joyce et al. (2011) focus their research on yield decomposition into expected future short-term rates and a term premium. There is evidence that longer durations are moderately influenced. About half the size of this effect in basis points is detected in the study of Breedon et al. (2012) thereby providing model-based evidence of weaker impacts.

Other models in this stream of research that are based on different countries, also present interesting findings. In a Vasicek-type form representing Japan, Ichiue and Ueno (2015), based on a modification of the Black's model of interest rates with options, investigate market expectations. They support that such expectations about duration of zero interest have significantly connected with expectations about price growth. In connection with Ichiue and Ueno (2015), Krippner (2013) employs a CAB-Vasicek model of interest rates with one factor. He argues that this being in tight relevance with the Black-Vasicek model at the level of zero interest rates provides a good representation of the Japanese monetary policy. Kagraoka and Moussa (2013) also focus on a factor-based analysis. Their preferred framework is a dynamic term

70

structure model with time-varying parameters. Interestingly, evidence supports a decrease in the level factor and the validity of the expectations hypothesis during extra easing eras.

Unconventional impacts in the US, Canada, Germany, Australia, and Japan have been the focus of research that Bauer and Neely (2014) have conducted. The dynamic term structure model specification they use reveals the existence of strong impacts on average. Model research about Switzerland focuses on dynamic term structure models and term premia. Notably, Christensen and Krogstrup (2015) reveal a substantial impact of a negative sign of unconventional action taking on term premia that leads to a decrease in Swiss yields.

Tables 3.5a,b,c offer a representative picture of the academic studies that reveal weak, medium and powerful impacts of QE practices on bond yields. Papers revealing weak influences of bond yields are primarily centered on non-US regions and are less than the rest.

Table 3.5a. Studies indicating weak responses of bond yields to QE policies

Authors	Journal	Year	Country
Gilchrist, S., López-Salido, D., & Zakrajšek, E.	American Economic Journal: Macroeconomics	2015	USA
Glick, R., & Leduc, S.	Journal of International Money and Finance	2012	USA, UK
Wright, J. H.	The Economic Journal	2012	USA
Ugai, H.	University of Tokyo	2015	Japan
Eser, F., & Schwaab, B.	Journal of Financial Economics	2016	PIGS and Italy
Christensen, J. H., & Krogstrup, S.	Swiss National Bank	2015	Switzerland
Christensen, J. H., & Krogstrup, S.	Federal Reserve Bank of San Francisco	2014	Switzerland
Bernhard, S., & Ebner, T	Journal of International Money and Finance	2017	Switzerland

Table 3.5b. Studies indicating medium responses of QE yields to QE policies

Authors	Journal	Year	Country
D'Amico, S., & King, T. B.	Journal of Financial Economics	2013	USA
d'Amico, S., English, W., López-Salido, D., & Nelson, E.	The Economic Journal	2012	USA
Krishnamurthy, A., & Vissing-Jorgensen, A.	Brookings Papers on Economic Activity	2011	USA
Chung, H., Laforte, J. P., Reifschneider, D., & Williams, J. C.	Journal of Money, Credit and Banking	2012	USA
Meaning, J., & Zhu, F.	BIS Quarterly Review	2012	USA
Hancock, D., & Passmore, W.	Journal of Monetary Economics	2011	USA
Kiley, M. T.	Finance Research Letters	2016	USA
Meinusch, A., & Tillmann, P.	Journal of Macroeconomics	2016	USA

Authors	Journal	Year	Country
Guidolin, M., Orlov, A. G., & Pedio, M.	Finance Research Letters	2014	USA
Bauer, M. D., & Neely, C. J.	Journal of International Money and Finance	2014	USA, Canada, Japan, Australia, Germany
Swanson, E. T., & Williams, J. C.	Journal of International Economics	2014	USA, UK, Germany
Meaning, J., & Zhu, F.	BIS Quarterly Review	2011	USA, UK
Papadamou, S., Spyromitros, E., & Kyriazis, N. A.	International Economics and Economic Policy	2017	UK
McLaren, N., Banerjee, R. N., & Latto, D.	The Economic Journal	2014	UK
Steeley, J. M.	Journal of International Money and Finance	2015	UK
Breedon, F., Chadha, J. S., & Waters, A.	Oxford Review of Economic Policy	2012	UK
Churm, R., Joyce, M., Kapetanios, G., & Theodoridis, K.	Bank of England Working Paper	2015	UK
Kinateder, H., & Wagner, N.	The Quarterly Review of Economics and Finance	2017	Greece, Ireland, Italy, Portugal, Spain, Austria, Belgium, Finland, France, Netherlands
Gibson, H. D., Hall, S. G., & Tavlas, G. S.	Journal of Macroeconomics	2016	Greece, Ireland, Italy, Portugal, Spain
De Santis, R.	ECB Working Paper	2016	Austria, Belgium, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal, Spain

Table 3.5c. Studies indicating strong responses of bond yields to QE policies

Authors	Journal	Year	Country
Gagnon, J., Raskin, M., Remache, J., & Sack, B.	International Journal of Central Banking	2011	USA
Jarrow, R., & Li, H.	Review of Derivatives Research	2014	USA
Guidolin, M., Orlov, A. G., & Pedio, M.	Journal of Banking & Finance	2017	USA
Liu, P., Mumtaz, H., Theodoridis, K., & Zanetti, F.	Bank of England	2017	USA
Neely, C. J.	Journal of Banking & Finance	2015	USA
Bauer, M. D., & Rudebusch, G. D.	International Journal of Central Banking	2014	USA
Li, C., & Wei, M.	Board of Governors of the Federal Reserve System (US)	2012	USA
Thornton, D.	Federal Reserve Bank of St. Louis Review	2011	USA
Christensen, J. H., & Rudebusch, G. D.	The Economic Journal	2012	USA, UK
Joyce, M. A., & Tong, M.	The Economic Journal	2012	UK
Kapetanios, G., Mumtaz, H., Stevens, I., & Theodoridis, K.	The Economic Journal	2012	UK
Schenkelberg, H., & Watzka, S.	Journal of International Money and Finance	2013	Japan
Von Borstel, J., Eickmeier, S., & Krippner, L.	Journal of International Money and Finance	2016	Euro area

Falagiarda, M., & Reitz, S.	Journal of International Money and Finance	2015	Italy
Casiraghi, M., Gaiotti, E., Rodano, L., & Secchi, A.	Bank of Italy	2013	Italy
Creel, J., Hubert, P., & Viennot, M.	Applied Economics	2016	Germany, Spain, France, Italy
Jäger, J., & Grigoriadis, T.	Journal of International Money and Finance	2017	Greece, Ireland, Italy, Portugal, Spain

3.3.2. Stock prices
3.3.2.1. Studies strictly focusing on US

Studying the impact of non-conventional action taking on equity quotes has aroused high interest in academic work about QE effects. Swanson (2015) argues that forward guidance and LSAPs had significant negative and positive impacts on US stock prices, respectively. In an innovative approach, Bhar et al. (2015) support that US non-standard policies **have helped to the recovery of the US stock market**. Moreover, Anaya et al. (2017), in accordance with earlier findings, provide evidence that a US unconventional shock leads to **higher returns of stocks**. In a somewhat similar vein, Liu et al. (2017) document that without the spread shock prior to announcement of the US non-conventional program, the st**ock prices growth would have been lower** by 15% in 2008. Hattori et al. (2016) support that US unconventional monetary policies have brought about weaker equity market risk in tails and a fall in risks associated with interest rates. Furthermore, forward guidance measures are found to be highly more influential than announcements about asset purchases.

Furthermore, studies providing evidence of medium impacts can be found. Notably, both Kiley (2014) and Meinusch and Tillmann (2016) reveal that extraordinary policy shocks bring about modest impacts in a positive direction on equity prices in the US. Interestingly, Kiley (2014) finds that this effect functions through forward guidance and consequently by lower long-term rates. In a different vein, Lambert and Ueda (2014) support that unconventional shocks do not reveal changes in the prices of bank equity. Eksi and Tas (2017) argue that unconventional monetary policies by the Fed had an impact six times larger on equity quotes than before the Zero Lower Bound. This happens by investors rebalancing towards equity after selling Treasury securities to the Fed.

Non-conventional impacts in the US can also be analyzed through the prism of **deviations from stability**. Williams (2014) provides evidence that comovements characterize US asset quotes that totally dissipate after extraordinary policies are terminated. Interestingly, Unalmis and Unalmis (2015) document that the impact on equity returns and their implied volatilities during out of the ordinary times is weaker than in conventional conditions.

Moreover, Boubaker et al. (2016) assess the impact that US policymaking has on the pension funds devoting to equity assets. Evidence indicates the existence of a significant positive impact. Furthermore, by adopting a quantile regression methodology, Roache and Rousset (2013) consider tail risk on equity indices after the termination of extraordinary practices. Evidence reveals that the diminuation of the Fed's total assets leads to weaker risk in tails. Marfatia et al. (2017) investigate the time-varying impact of US unconventional news on International Real Estate equity returns and provide evidence for differentiation as time passes and among different countries. These effects are driven by signaling effects and the portfolio rebalancing channel. The efficacy of such announcements is found to be tightly connected to the ratio of stock market capitalization to GDP of the country.

3.3.2.2. Studies about US versus studies on other economies

Studies have also investigated equity impacts that unconventional action taking has brought about on US but also in other countries. Rosa (2012) documents that unanticipated announcements in the US led to a 3% increase in US equity prices. Not very different are results about unconventional UK news and equity quotes in the UK is identified. Lima et al. (2016) apply an ARDL methodology and provide evidence that extra easing practices by monetary authorities in the US, Japan, and the UK have provided a spur to equity markets in these regions. Shogbuyi and Steeley (2017) use a multivariate GARCH methodology in order to study variance and covariance in US and UK equity markets, triggered by non-conventional actions. Results reveal a decrease in volatility in the economies having adopted them non-conventional practices, as well as in non-UMP countries. Moreover, it is found that the BoE's actions led to higher covariance between the UK and US equity markets. In a different approach, Wang et al. (2015) test for the existence of an asymmetric tail risk of equity return distribution in the **US, Japan, and other 74 countries**. They conclude by revealing that they are found to exhibit different kinds of linkage with QE policymaking. Moreover, Japanese unconventional actions are found to be more effective than British rounds.

Furthermore, an examination of the effects on developing economies are investigated. Powerful impacts on EMEs are found by Bowman et al. (2015b) and Tillmann (2016). These abide by the outcomes in Brana and Prat (2016). The latter employ a panel threshold approach and argue that excess funding in a worldwide scale triggers positive impacts on stock quotes in developing economies. Similarly to Brana and Prat (2016), Gagnon et al. (2017) provide evidence of a raise in equity quotes but loss of value concerning foreign currencies in QE periods. Miyakashi and Shimada (2017) by Vector Autoregressine specifications argue that non-conventional practices by the Fed, the ECB and the BoJ positively affected equity prices of developing markets in Asia. The US QE policies are found to have been the main driver of the stock prices inflation. The countries examined are: Bangladesh, India, Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand. Chen et al. (2016)

investigate the nexus of US QE actions and worldwide stock quotes and support that a positive impact exists. Nevertheless, Berge and Cao (2014) that reveal that no significant impacts take place.

Notably, an alternative approach to impacts on capital markets is provided by MacDonald (2017). More specifically, MacDonald (2017) focuses on different impacts on stock quotes of developing economies. She reveals that frictions between markets of stocks in different countries are responsible for such differences.

Rai and Sushanek (2014) investigate the effects that the tapering of US non-conventional actions has brought about in stock markets. They find evidence of such news exerting a negative impact on equity prices and exchange rates in developing countries.

3.3.2.3. Non-US Studies (UK, Japan, Euro-area)

Among academic work studying UK QE impacts is Joyce et al. (2012a). This study detects a higher upcoming shift in the FTSE index during the first phase of unconventional monetary policies than in the second phase. Furthermore, the study of Steeley (2015a) provides evidence that UK QE triggered **weaker alterations in stock prices**. The intensity of such actions was not found to be a strong determinant for these impacts.

Matsuki et al. (2015) look at the effects of purchases of Exchange-Traded Funds (ETFs) in Japan. Evidence uncovers a boost **on the equity market in Japan.** Hanisch (2017) bases his research on a structural dynamic factor model with sign restrictions for Japan and supports that a substantial impact on goods and equity quotes takes place.

Effects on stock prices in the Euro area have also been under investigation. Haitsma et al. (2016) provide evidence for more powerful impacts of monetary shocks on the **Eurostoxx 50** during the ECB's unconventional policies. Furthermore, they document that the impact on value stocks is greater than on growth stocks. Ruiz (2015) adopts a S-VAR methodology and finds that the ECB's unconventional monetary policy has not exercised a noteworthy long-run impact on equity markets in Spain, contrary to effects before the crisis outburst. Foley-Fisher et al. (2016) provide evidence that the Maturity Extension Program has loosened financial constraints in companies and lead to higher output for these firms. Their stock prices are found to have been higher, as well as employment and investment. Fausch and Sigonius (2018) by adopting event-study and VAR methodologies identify a signaling effect of the ECB's unconventional shocks on the German stock market. Revisions in beliefs about future dividends render excess equity returns in Germany to be volatile.

A review of implications about how equity market react to unconventional monetary policies is provided on table 3.6 that follows. Overall, a powerful impact of

unconventional actions in a positive direction for equity quotes is detected as well a substantial decline in risk in tails, particularly in the US.

Table 3.6. Studies indication responses of stock markets to QE policies

Authors	Journal	Year	Country	Effect of QE on stock market
Matsuki, T., Sugimoto, K., & Satoma, K.	Economics Letters	2015	Japan	weak
Ruiz, J.	The Spanish Review of Financial Economics	2015	Spain	weak
Meinusch, A., & Tillmann, P.	Journal of Macroeconomics	2016	USA	medium
Haitsma, R., Unalmis, D., & de Haan, J.	Journal of Macroeconomics	2016	Euro area	medium
Foley-Fisher, N., Ramcharan, R., & Yu, E.	Journal of Financial Economics	2016	USA	medium
Bhar, R., Malliaris, A. G., & Malliaris, M.	Review of Economic Analysis	2015	USA	strong
Kiley, M. T.	Journal of Money, Credit and Banking	2014	USA	strong
Eksi, O., & Tas, B.K.O.	The North American Journal of Economics and Finance	2017	USA	strong
Unalmis, D., & Unalmis, I.	University Library of Munich	2015	USA	strong
Boubaker, S., Gounopoulos, D., Nguyen, D. K., & Paltalidis, N.	Journal of Banking & Finance	2016	USA	strong
Hanisch, M.	Journal of International Money and Finance	2017	Japan	strong
Fausch, J., & Sigonius, M.	Journal of Macroeconomics	2018	Euro area on Germany	strong
Hattori, M., Schrimpf, A., & Sushko, V.	American Economic Journal: Macroeconomics	2016	USA	Lower stock tail risk
Roache, S. K., & Rousset, M. V.	International Monetary Fund Working Paper	2013	USA	Lower stock tail risk
Steeley, J. M.	The European Journal of Finance	2015	UK	Lower stock market volatility

3.3.3. Commodity prices

A bulk of papers can be found that looks into effects of non-conventional policymaking on commodities prices(see table 3.7). In their own perspective, Glick and Leduc (2012) focus on the behaviour of commodity prices during US unconventional times. Notably, findings do not support that commodity quotes were influenced positively and in a remarkable extent by such actions. Hammoudeh et al. (2015) by adopting a Structural-Vector Autoregressive specification, present evidence that the US unconventional monetary policy has influenced commodity prices in a positive way and by a medium level.

76

Furthermore, fluctuations in commodities' quotes have been found by non-linear methodologies in Papadamou and Sogiakas (2018). This is more evident when the BoJ's unconventional effects are taken into consideration. They reveal that the BoJ's unconventional monetary news have fortified gold and silver prices. Moreover, the practices of the BoE are found to increase silver returns. Nevertheless, unconventional practices by the European Central Bank lead to lower stability in precious metals markets.

Table 3.7. Studies indicating responses of commodity markets to QE policies

Authors	Journal	Year	Country	Effect of QE on commodity markets
Glick, R., & Leduc, S.	Journal of International Money and Finance	2012	USA	Medium and negative on commodities
Hammoudeh, S., Nguyen, D. K., & Sousa, R. M.	Journal of International Money and Finance	2015	USA	Medium and positive on commodities
Papadamou, S., & Sogiakas, V.	Journal of Forecasting	2018	UK, Japan, Euro area	Strong and positive on commodities

3.3.4. Exchange rates
3.3.4.1. Studies strictly focusing on US

These is also a noteworthy amount of papers detecting alterations in values of home or foreign currency when QE practices are undertaken (presented in tables 3.8 and 3.9). Glick and Leduc (2013) argue that US QE **devaluates the US dollar by 0.06% per shock**. Interestingly, Swanson (2015) provides evidence that forward guidance in the US triggered substantial USD appreciation, while Large-Scale Asset Purchases provided an even more powerful boost. In a similar vein, Rosa (2012) also addresses the linkage between non-conventional US action taking and the value of the USD. He supports that non-expected QE news decreased the exchange rate of the US dollar **by about 3%.** These results abide by Neely (2015).

There are also studies concerning the effects of US unconventional policies on exchange rates that reveal no impact or a negative influence. Swanson and Williams (2014) dispute earlier findings and argue that the relations between the US dollar and the British pound as well as between the US dollar and the euro were not recipients of significant QE impacts. Céspedes et al. (2017) also offer an analysis of non-conventional impacts on exchange rates. They provide evidence that certain circumstances allow non-conventional action taking to increase **real currency values**.

Table 3.8. Studies indicating USD responses to US QE policies

Authors	Journal	Year	Exchange rate studied	Depreciation/ appreciation

Swanson, E. T.	National Bureau of Economic Research	2015	USD/EUR USD/JPY	weak depreciation of USD
Glick, R., & Leduc, S.	Journal of International Money and Finance	2013	USD/EUR USD/JPY USD/GBP USD/CAD	weak depreciation of USD
Glick, R., & Leduc, S.	Federal Reserve Bank of San Francisco	2013	USD/JPY	medium depreciation of USD
Lutz, C.	Applied Economics Letters	2015	USD/EUR USD/GBP	medium depreciation of USD
Neely, C. J.	Journal of Banking & Finance	2015	AUD/USD CAD/USD EUR/USD JPY/USD GBP/USD	strong depreciation of USD
Swanson, E. T., & Williams, J. C.	Journal of International Economics	2014	USD/GBP USD/EUR	Very weak GBP appreciation Very weak EUR appreciation
Céspedes, L. F., Chang, R., & Velasco, A.	Journal of International Economics	2017	USD to other currences	medium appreciation of the USD real exchange rate

3.3.4.2. Studies about US versus studies on other advanced economies

Centering interest in currency values in the US in tandem with non-US regions is also presented in relevant QE academic work. Glick and Leduc (2012) support that US and UK unconventional news result in far from strong decreased in the **USD and GBP**, correspondingly. Furthermore, Lutz (2015a) documents a modest fall **in the USD/EUR and USD/GBP exchange rates**. This is found to happen during extraordinary measures and especially when a 25 bp decline in the 10-year government bond yield is the economic driver.

Lombardi et al. (2017) support that certain US unconventional monetary policy announcements **significantly affect currency values** at the ZLB. Currency values of reserve currencies such as the GBP and the EUR present a more powerful reaction to QE by increasing, when interest rate is near zero.

When studying impacts on the United Kingdom, the study of Goodhart and Ashworth (2012) is traced. Interestingly, they support that GBP **could have appreciated** by up to 500 bp if the first round of unconventional practices in the UK did not happen. QE2 effects are found to be more modest.

Empirical papers about Japanese exchange rates include Fasano-Filho et al. (2012) that provide evidence of no effect of Japanese easing policies on the yen value. Thornton and di Tommaso (2018) argue that the effective currency values of UMP-adopting economies present larger fluctuations and their bilateral, nominal and real

effective currency values tend to decline more than conventional economies. The regions examined are the US, the UK, Japan, the Euro area and Sweden.

The European Central Bank's unconventional action taking and effects on exchange rates are also investigated. Eichler (2012) by employing a regime-switching methodology supports that **a EUR** depreciation is probable due to the ECB's non-conventional actions. Kenourgios et al. (2015a) detect a **slow reaction of the EUR and in a negative direction as well as significant deviations from stability** no matter whether unconventional policies had been launched or not. In a similar research methodology and initiative, Kenourgios et al. (2015b) support the existence that the **EUR was the source of instability regarding GBP and JPY**, and the same was valid from the yen to euro and the British pound. Furthermore, Ciarlone and Colabella (2016). support that news of such actions **leads to more fluctuations in the exchange rates of Central, Eastern and South Eastern European currencies to euro.**

Alterations on the Swiss franc have also been under scrutiny. As regards the work of Bernhard and Ebner (2017), a focus on the **CHF** denotes that **an increase in value** emerges. The value of the Swiss currency is found to be recipient of positive spillover impacts from unconventional practices in other major economies.

Being based on tables 3.8 and 3.9, it can be observed that UMP-economies watch a deterioration in their currencies values. Notably, in case of out of the ordinary policymaking by the ECB influences fluctuations in exchange rates.

Table 3.9. Studies indicating USD and other currencies' responses to US QE policies

Authors	Journal	Year	Exchange rate studied	Depreciation/ appreciation
Lombardi, D., Siklos, P. L., & St. Amand, S.	Applied Economics Letters	2017	GBP/USD EUR/USD CAD/USD SEK/USD	Medium to high responsiveness to QE news
Thornton, J., & di Tommaso, C.	Finance Research Letters	2018	UMP-adopting countries (Euro area, Japan, Sweden, UK, USA)	Medium depreciation of their currencies
Goodhart, C. A., & Ashworth, J. P.	Oxford Review of Economic Policy	2012	USD/GBP EUR/GBP JPY/GBP	strong devaluation of GBP
Fasano-Filho, M. U., Wang, M. Q., & Berkmen, P.	International Monetary Fund	2012	JPY/USD	No effect
Eichler, S.	The Quarterly Review of Economics and Finance	2012	EUR/USD	medium to high depreciation of EUR
Kenourgios, D., Papadamou, S., & Dimitriou, D.	Research in International Business and Finance	2015	GBP/USD JPY/USD EUR/USD	medium depreciation of GBP, JPY, EUR.

Bernhard, S., & Ebner, T.	Journal of International Money and Finance	2017	CHF/EUR	medium appreciation of CHF
			GHF/USD	high apppreciation of CHF
Kenourgios, D., Papadamou, S., & Dimitriou, D.	Finance Research Letters	2015	GBP/USD JPY/USD	QE announcements by ECB increase EUR volatility. Volatility transmission
			EUR/USD	

3.3.4.3. Studies about US versus studies on other emerging economies

An increasing tendency has made its appearance since 2015 to investigate US impacts on exchange rates of developing countries. MacDonald (2017) supports that substantial alterations of US QE impacts lead to higher exchange rates on developing markets.

Despite that, a non-negligible bulk of papers has emerged that reveal declines in values of currencies in emerging markets. Bouraoui (2015) argues by an event-study methodology for **substantial decreases in values** of these currencies. Notably, these declines are not equal for all countries. The economies on which he focuses are: Brazil, India, Turkey, Tunisia, and South Africa. Anaya et al. (2017) argue that US non-conventional shocks result in **higher real currency values** in **developing economies**. By reaching contrasting results, Fratzscher et al. (2018) support that the first round of US unconventional practices increased the USD value but the second round led to a decline of this currency. Moreover, the procyclicality of US QE policies had led to appreciation of EMEs exchange rates.

Tapering talk effects

Empirical studies about impacts of QE-tapering news also exist as part academic work about unconventional influences on currencies. Park et al. (2014) provide evidence that higher domestic credit due to US capital flows during the first US unconventional rounds resulted in higher currency values in developing economies, while the third round and **tapering talk decreased** exchange rates of India, Indonesia, Korea, Malaysia, Philippines, and Thailand.

Furthermore, Berge and Cao (2014) address the nexus of target and path factors with exchange rates. They support that currency values respond strongly to both types of factors of asset prices in US unconventional times. Notably, the target factor effect is stronger and it is found that if the monetary shock gets higher by 0.25%, then the **value of US dollar gets higher by 0.20%.**

Table 3.10 indicates that the majority of studies reveal a noteworthy decrease in exchange rates of developing countries' currencies in relation to US dollar. Findings support that effectiveness on EMEs currencies depends on whether QE news were released at the launch or the termination of US unconventional practices.

Table 3.10. Studies indication responses of EMEs currencies versus USD to QE policies

Authors	Journal	Year	Exchange rate studied	Depreciation/ appreciation
MacDonald, M.	Journal of International Money and Finance	2017	USD/EMEs currencies	Medium to high depreciation of USD
Anaya, P., Hachula, M., & Offermanns, C.	Journal of International Money and Finance	2017	USD/EMEs currencies	Medium appreciation of EMEs currencies
Ciarlone, A., & Colabella, A.	Ensayos sobre Política Económica	2016	EUR to 11 European non-euro EMEs	Appreciation of EMEs currencies
Bouraoui, T.	Applied Economics	2015	USD/EMEs currencies	Depreciation of EMEs currencies
Rai, V., & Suchanek, L.	Bank of Canada Working paper	2014	USD/EMEs currencies	Strong depreciation of EMEs currencies
Park, D., Ramayandi, A., & Shin, K.	Asian Development Bank Working Paper	2014	USD/EMEs currencies	Strong depreciation of EMEs currencies (during tapering talk). The opposite during US QE1 QE2
Berge, T. J., & Cao, G.	Economic Review-Federal Reserve Bank of Kansas City	2014	USD/currencies of advanced and EMEs	Weak appreciation of USD
Fratzscher, M., Lo Duca, M., & Straub, R.	The Economic Journal	2018	USD/EMEs currencies	Strong appreciation of USD

3.4. GDP, inflation, and unemployment as final targets in unconventional monetary policy channels

3.4.1. Unconventional effects on GDP, inflation, and unemployment in New-Keynesian models

Model specifications have proved convenient for enabling research concerning impacts on output, inflation and employment. Lim and McNelis (2016) by being based on the Gertler and Karadi (2013) model support that unconventional practices spur a positive effect **on consumption** and that a fiscal regime could be as effective. Engen et al. (2015) argue that US unconventional practices made the **recovery faster regarding the real economy**. Moreover, Cúrdia and Woodford (2011) by extending a New Keynesian model reveal that purchases concerning specific assets can be effective if financial markets are sufficiently disrupted, so they **may lead to higher income**. In a somewhat different approach, Karras (2013) employs a model identifying sign and size asymmetries on the positive effects of positive monetary **shocks on US real GDP, and industrial production**. Evidence is provided of powerful asymmetries in signs primarily attributable to negative shocks no matter whether QE takes place or not. Furthermore, size asymmetries especially during negative shocks are detected. Chung et al. (2012) provide evidence that although QE practices by the Federal Reserve **enhanced employment and helped in**

81

confronting deflation, the Zero Lower Bound imposed first-order impediments on real activity and inflation.

In their model-based study, Ellison and Tischbirek (2014) document that coordination between conventional and unconventional policies can bring about greater stabilization of output and inflation. Gavin et al. (2015), in the New Keynesian model they employ, address the link between a positive technology shock and macroeconomic variables and argue when the central bank wishes to achieve output at the steady state, then declines, employment, and output come up. A New Keynesian-model-based methodology is also applied by Damjanovic and Girdenas (2014) and argue that lax monetary policymaking be preventive for a deterioration of the loan to value ratio.

Sheedy (2017) supports by his model that non-conventional monetary tools cannot stabilize the economy as effectively as conventional ones. He argues that unconventional aims could urge monetary policy to rely on conventional policies once more. Araújo et al. (2015) by an asset pricing model argue that when the monetary authorities purchase a risky asset, its price can get higher, as intended. Thereby, QE can fight financial obstacles and spur aggregate demand and lead to a more efficient situation. Nevertheless, negative results could also occur.

3.4.2. Supporters of empirical significant effects in US GDP
Effects of non-conventional actions on real economies have been of major interest in QE academic bibliography. An important portion of relevant authors have investigated domestic GDP impacts of US extra-easing action taking. Prominent studies such as Cúrdia and Ferrero (2013), Meinusch and Tillmann (2016), Bhattarai et al. (2015), and Chen et al. (2012), focus their research on the impact of US actions on GDP and inflation. To be more precise, Cúrdia and Ferrero (2013) argue that the second round of unconventional policies has resulted in a medium spur to US growth in prices and in general. Furthermore, also examining LSAP2 effects, Chen et al. (2012) provide evidence of a medium 50 bp upwards impact on GDP. Evidence also reveals a much smaller positive impact on inflation. Results provide evidence that commitment about keeping interest rates low renders unconventional actions twice as effective. Hanisch (2017) argues that an expansionary monetary policy shock that brings about a larger monetary base triggers higher output, though not in a powerful and permanent manner.

In a similar vein, Meinusch and Tillmann (2016) document that unexpected non-conventional shocks exhibit medium impacts of a positive direction on US real output and prices. They support that effectiveness of monetary policy is greatly helped by a ZLB commitment. Similar to the work from Meinusch and Tillmann (2016) is the study of Bhattarai et al. (2015). Their evidence enables them to support that non-conventional practices can prove influential against deflation and in favor of

82

higher output. Thereby, they attribute emphasis to the preventive role of such practices.

Arguably, the issue of how effective unconventional policies are on GDP and employment is addressed by Fuhrer and Olivei (2011). Interestingly, they detect a relation of a negative sign between rates in the United States and these macroeconomic variables. Intriguingly, Chung et al. (2012) extend research by examining how macro variables react to US unconventional actions. This study casts light on the US economy by providing evidence in favour of a positive effect on output, prices and the labor market.

Among the macroeconomic variables affected by unconventional policies is the unemployment, as is seen in the studies of Wu and Xia (2016) and Liu et al. (2017). Wu and Xia (2016) provide evidence that US non-standard practices since mid-2009 **improved employment dynamics** after four years by 100 bp. Liu et al. (2017) also identify the impact of lower rates that extraordinary practices led to. The argue that not only higher prices rhythm by 100bp but also a decline in unemployment by 0.70% is the result of Large-Scale Asset Purchases.

Krishnamurthy and Vissing-Jorgensen (2011) reveal that that the first round of US non-conventional practices triggered higher uncertainty about prices rising. Moreover, Hännikäinen (2015) supports that during unconventional times in the US the term spread could be used for forecasting industrial output, whereas the mortgage spread can do the same even during conventional policy periods.

Belongia and Ireland (2017) present rules for keeping output or inflation by handling the monetary base. They document that the Fed could conduct monetary policy more safely through focusing its policymaking on high-powered money.

3.4.3. Studies about US versus studies on other economies

Academic interest has aroused in QE effects on US output and prices in tandem to relevant impacts on other economies. The highest impacts on output and prices in the US and the UK are examined by Falagiarda (2014). He finds that impacts on output **were equal to 92 bp and 125 bp**, while on the US and UK inflation were 37 bp and 49 bp, correspondingly. Moreover, Dahlhaus et al. (2018) estimate the impact of unconventional US policy on **US and Canadian output**. There is evidence of higher US output by **230 bp and higher Canadian outout by 220 bp.** Weale and Wieladek (2016) support that QE announcements in the United States and the United Kingdom spurred output **by 62 bp and 25 bp, correspondingly.** Moreover**, the Consumer Price Index got higher by 58 bp and 32 bp.** By their perspective, Belke and Klose (2013) support that when unconventional policies in those regions are terminated, the US and UK output and prices would stop increasing substantially. Dreger and Wolters (2015) reveal that, in the US and the Euro area, long-run money demand may not present fluctuations despite interest rates being near zero.The

83

estimations are based on standard monetary aggregates. Baumeister et al. (2013) adopt a TVP-SVAR specification for the US, the Euro area, Japan and the UK and support that decreases in yield spread in the long-run provides a boost to macroeconomic variables. Furthermore, counterfactual simulations indicate that non-conventional actions in the US and the UK have prevented sharp declines in output as well as deflation.

Rogers et al. (2014) support that out of the ordinary policymaking in major UMP-countries had a negative effect on the **output gap and prohibited low price growth.** Furthermore, Van den End (2016) reveals an increase in asset quotes in US, UK, Japan, and European countries in QE periods trigger **adverse impacts on prices**.

Advanced vs. Emerging economies

A bulk of academic papers has focused on macroeconomic effects in developed markets. More specifically, Chen et al. (2016) show evidence that US unconventional policies have been effective in fighting recession and deflation **in developed markets**. Not far from that, Gambacorta et al. (2014) by employing a panel VAR methodology concerning eight developed markets find that a non-conventional shock leads to **higher output and inflation**. Moreover, no differences in impacts across countries are detected.

Moreover, papers about impacts on developing economies have emerged. Morgan (2011) supports that the **effect of US QE on macroeconomic variables** in developing economies in Asia has not been as large as believed. In a somewhat different vein, Barroso et al. (2016) argue that US out of the ordinary actions led to higher consumption-pushed output in Brazil.

Interestingly. Cho and Rhee (2013) track an impact **on asset prices** of Asian economies due to US QE actions. They provide evidence for a **positive** relationship.

3.4.4. Non-US Studies
Studies strictly focusing on UK

Investigation about the nexus between QE practices in the United Kingdom and the way that this impacts the domestic economy, has also been performed. According to the three VAR model specifications that Kapetanios et al. (2012) employ, UK non-conventional actions may have affected output and **inflation by 150 bp and 125 bp, correspondingly**. Bridges and Thomas (2012) reveal that higher money holdings would bring about a much smaller impact **on output and prices**. Moreover, Cobham and Kang (2012) support that nominal money during QE had a substantial positive influence on nominal spending in the United Kingdom. Notably, this is in accordance with Goodhart and Ashworth (2012) argue that there was a larger

spur to domestic growth by the early phases of QE that was not revealed by previous academic work. Furthermore, Joyce et al. (2012b) attribute amelioration in economic conditions to lower yields owing to large liquidity infusions, yet recovery remains fragile. Churm et al. (2015) support that the second unconventional round in the UK **resulted in higher output by 50 to 80 bp and higher inflation by 60 bp**. This positive effect is roughly in accordance with Butt et al. (2014). In a similar vein, Nelson (2013) argues that UK non-conventional practices have boosted **nominal spending** and promoted output. Whatsoever, Lyonnet and Werner (2012) by adopting a ''Hendry'' specification provide evidence that asset purchases by the BoE did not lead to improving economic performance.

Academic interest has also emerged on QE impacts on wage and inflation expectations in the United Kingdom. Boneva et al. (2016) support that **inflation beliefs of domestic companies increase by 0.22% by higher purchases equal to** 50 billion British pounds. While non-conventional actions are found to have a **modest effect on stabilizing inflation expectations**, forward guidance has an upwards but weak influence **on prices and salary expectations**. Mumtaz and Theiphilopoulou (2017) by constructing inequality measures and employing three different Vector Autoregressive specifications, provide evidence that UK QE might have strengthened inequality.

Studies strictly focusing on Japan

A number of papers have addressed the linkage between unconventional practices in Japan and impacts on the Japanese output and inflation. Schenkelberg and Watzka (2013) argue that a non-conventional shock in Japan **raises output and prices** in a certain extent. Their results offer support that this can be done without creating an ever-increasing inflation. In a similar vein, Fasano-Filho et al. (2012) reveal that the beginning of the recent but also the former Japanese unconventional measures in Japan had an **impact on economic activity but a smaller effect on inflation**. In accordance to these findings, Matsuki et al. (2015) show evidence that quantitative easing in Japan **increases inflation rates**, while qualitative easing **spurs economic activity**.

Papers about special aspects of output and prices during QE periods have also appeared. Voutsinas and Werner (2011) support that if original unconventional practices via banks were adopted in Japan, they **would boost nominal GDP growth** more than non-standard BoJ purchases did during 2000-2006. Hayo and Ono (2015) support that inflation in Japan can be explained by the monetary environment and is mainly demand-driven. In accordance with the effectiveness of Japanese non-standard policies are also Girardin and Moussa (2009). They argue that non-conventional policies in Japan have proven efficient in reviving output growth and price inflation during the ''lost decade'', thereby new rounds of such policies could prove effective.

Moreover, Michaelis and Watzka (2017) by employing a Time Varying Parameter (TVP) VAR framework with sign restrictions argue for substantial **differences in timing concerning Japanese output and inflation.** Nakajima (2011) also employs a similar approach and supports the existence of a **dynamic linkage between central bank actions and macroeconomic variables** in Japan during approximately the last 40 years. Fujiki and Tamura (2017) by conducting simulations provide evidence that when the Quantitative and Qualitative Easing policy in Japan is terminated, the Japanese central bank will be in a bad financial condition. The amount of these losses increases when the duration of the QQE program as well as the interest rate elasticity of banknote demand increase.

Studies strictly focusing on Euro Area countries

A respectable interest has also aroused in estimating the influence of of ECB's policies on output and prices. Results obtained from Darracq-Paries and De Santis (2015) indicate that such practices increased output and prices. Moreover, Priftis and Vogel (2016) by their model find that lower term premiums due to ECB's unconventional practices exert modest upwards impacts positive effects on macroeconomic variables. Nevertheless, non-conventional actions are not as effective if the assets purchased were from foreign counterparties. To examine the response of inflation to the ECB's unconventional policies, Kucharčuková et al. (2016) employ a VAR methodology and findings indicate that prices react more quickly and intensely in comparison to output. The countries under scrutiny are: the Czech Republic, Denmark, Hungary, Poland, Sweden, and the UK. It should be emphasized though that results under a B-VAR specification reveal weaker effects.

Horvath and Voslarova (2017) adopt panel-VAR estimations to illustrate the impact of the ECB's action on central European countries and argue for a non-permanent **boost in output growth while the spur in inflation is substantially lower**. This is partly in accordance with Casiraghi et al. (2013) who support that higher output in Italy by 207 bp was fed by non-conventional practices in the Euro area. Moreover, Gros et al. (2015) detect a more robust linkage between unconventional action taking and inflation in the Eurozone than in other unconventional-policy-adopting economies. Guerello (2018) utilizes a Vector Autoregressive specification and investigates how out of the ordinary monetary policy affects inequalities in income distribution within the Euro area. Moreover, non-conventional practices may lead to higher consumption even when mild or high income inequalities are present. Djigbenou-Kre and Park (2016) estimate a panel-VARX model by employing data from the US, the UK, the Euro area, Japan, Canada and 20 emerging countries and provide evidence that global liquidity affects global imbalances in a positive and significant manner. More specifically, an increase in liquidity of developed markets influences upwards the financial situation of emerging markets, whereas higher foreign exchange reserves in EMEs have a negative impact on the economic situation of advanced countries.

Valiante (2015) reveals that the ECB's QE substantially influenced interest rates of longer maturities while its effect on prices is not so strong. Furthermore, he supports that the ECB's unconventional policy mainly works through forward guidance. Burriel and Galessi (2018) employ a global-VAR model with restrictions in order to estimate the impacts of the ECB's unconventional practices by taking into consideration cross-country interdependencies between the 19 Euro area countries. Unconventional policy is found not to be strongly effective. Economies where financial intermediation does not function adequately do not enjoy higher output despite QE. Hajek and Horvath (2018) use a global-VAR specification containing measures of the shadow monetary policy rate and provide evidence that unconventional monetary shocks by the ECB and the Fed have affected Central European countries more than southeastern economies of the European Union. More specifically, a higher ECB's shadow rate suppresses output and inflation for European countries with national currencies. Overall, results indicate that non-conventional monetary policy is less effective than conventional.

3.4.5. Synopsis of QE effects on GDP, inflation, and unemployment

Table 3.11 reveals that twenty academic papers support a weak impact on prices, and much less numerous ones argue for revealing a weak to medium or no impact on prices. Furthermore, only a few academic papers identify a weak upwards effect on output. These results concern a range of advanced as well as developing economies.

On the contrary, Table 3.12 presents a powerful positive effect on prices on a respectable number of studies. Most of them also show positive efefcts also on output. They also center their interest on a wide range of economies, that is developed as well as emerging markets. Emphasis should be paid that not strong, not even modest impacts are revealed in most studies examined.

Academic papers concerning unconventional monetary effects on output and/ or employment without prices examination are denoted in Table 3.13. Low effects studies prove to be more numerous than those that provide evidence for strong effects. Furthermore, innovative evidence towards boosting higher inequality is found in papers about unconventional monetary impacts.

By looking into unemployment impacts throughout these tables, it can be observed that the majority concerns the US. Moreover, an overall powerful positive effect of easing practices in employment is detected. It should be noted that almost half of relevant papers exhibit far from strong negative effects in the US.

Table 3.11. Studies indicating weak responses of inflation to QE policies

Authors	Journal	Year	Country data	Effect on inflation	Effect on GDP	Effect on Unemployment

Kucharčuková, O. B., Claeys, P., & Vašíček, B.	Journal of Policy Modeling	2016	UK, Czech Republic, Denmark, Hungary, Poland, Sweden	No effect	Weak positive	
Valiante, D.	International Economics and Economic Policy	2017	Euro area	Very weak positive		
Darracq-Paries, M., & De Santis, R. A.	Journal of International Money and Finance	2015	Euro area	Weak positive	Strong positive	
Burriel, P., & Galesi, A.	European Economic Review	2018	Euro area	Weak positive	Weak positive	
Horvath, R., & Voslarova, K.	Applied Economics	2017	Czech Republic, Hungary, Poland	Weak positive	Weak positive	
Hajek, J., & Horvath, R.	Economic Systems	2017	Bulgaria, Czech Republic, Denmark, Euro area, Croatia, Hungary, Poland, Romania, Sweden, UK, US	Weak positive	Weak positive	
Chen, H., Cúrdia, V., & Ferrero, A.	The Economic Journal	2012	Canada	Weak positive	Strong positive	
Chen, H., Cúrdia, V., & Ferrero, A.	The Economic Journal	2012	UK	Weak positive	Weak positive	
Boneva, L., Cloyne, J., Weale, M., & Wieladek, T.	International Journal of Central Banking	2016	UK	Weak positive		
Rogers, J. H., Scotti, C., & Wright, J. H.	Economic Policy	2014	USA, UK, Euro area, Japan	Weak positive	Weak positive	
Schenkelberg, H., & Watzka, S.	Journal of International Money and Finance	2013	Japan	Weak positive	Weak positive	
Hayo, B., & Ono, H.	Journal of Asian Economics	2015	Japan	Weak positive		
Girardin, E., & Moussa, Z.	mimeo	2009	Japan	Weak positive	Weak positive	
Michaelis, H., & Watzka, S.	Journal of International Money and Finance	2017	Japan	Weak positive	Weak positive	
Nakajima, J.	The BE Journal of Macroeconomics	2011	Japan	Weak positive	Weak positive	
Morgan, P.	East Asian Bureau of Economic Research	2011	China, Hong Kong, India, Korea, Singapore	Weak positive	Weak positive	
Nakajima, J.	The BE Journal of Macroeconomics	2011	20 EMEs	Weak positive	Weak positive	
Cúrdia, V., & Ferrero, A.	FRBSF Economic Letter	2013	USA	Weak positive	Weak positive	
Meinusch, A., & Tillmann, P.	Journal of Macroeconomics	2016	USA	Weak positive	Weak positive	
Chen, H., Cúrdia, V., & Ferrero, A.	The Economic Journal	2012	USA	Weak positive	Weak positive	

Authors	Journal	Year	Country data	Effect on inflation	Effect on GDP	Effect on Unemployment
Chung, H., Laforte, J. P., Reifschneider, D., & Williams, J. C.	Journal of Money, Credit and Banking	2012	USA	Weak positive	Strong positive	Strong negative
Priftis, R., & Vogel, L.	The Manchester School	2016	Euro area	Weak to medium positive	Weak positive	
Goodhart, C. A., & Ashworth, J. P.	Oxford Review of Economic Policy	2012	UK	Weak to medium positive	Strong positive	
Falagiarda, M.	International Journal of Monetary Economics and Finance	2014	USA, UK	Weak to medium positive	Strong positive	
Weale, M., & Wieladek, T.	Journal of Monetary Economics	2016	USA	Medium to strong positive	Medium to strong positive	

Table 3.12. Studies indicating strong responses of inflation to QE policies

Authors	Journal	Year	Country data	Effect on inflation	Effect on GDP	Effect on Unemployment
Bhattarai, S., Eggertsson, G. B., & Gafarov, B.	National Bureau of Economic Research	2015	USA	Strong positive	Strong positive	
Dahlhaus, T., Hess, K., & Reza, A.	Bank of Canada	2018	USA	Strong positive	Strong positive	
Djigbenou-Kre, M. L., & Park, H.	International Review of Economics & Finance	2016	USA, UK, Euro area, Japan, Canada	Strong positive	Weak positive	
Baumeister, C., Benati, L., Hamilton, J., Kilian, L., Trab, M., Williams, J., & Giannone, D.	International Journal of Central Banking	2013	USA, UK, Euro area, Japan	Strong positive	Strong positive	
Belke, A., & Klose, J.	Economic Modelling	2013	USA, Euro area	Strong positive	Strong positive	
Gros, D., Alcidi, C., & De Groen, W. P.	CEPS Policy Brief	2015	Euro area	Strong positive		
Chen, Q., Filardo, A., He, D., & Zhu, F.	Journal of International Money and Finance	2016	USA, UK, Japan, Euro area, China, Hong Kong SAR, India, Indonesia, South Korea, Malaysia, Philippines, Singapore, Thailand, Argentina, Brazil, Chile, Mexico	Strong positive	Strong positive	

Fasano-Filho, M. U., Wang, M. Q., & Berkmen, P.	International Monetary Fund	2012	Japan	Strong positive	Strong positive	
Matsuki, T., Sugimoto, K., & Satoma, K.	Economics Letters	2015	Japan	Strong positive	Weak positive	
Kapetanios, G., Mumtaz, H., Stevens, I., & Theodoridis, K.	The Economic Journal	2012	UK	Strong positive	Strong positive	
Bridges, J., & Thomas, R.	Bank of England	2012	UK	Strong positive	Strong positive	
Churm, R., Joyce, M., Kapetanios, G., & Theodoridis, K.	Bank of England	2015	UK	Strong positive	Strong positive	
Liu, P., Mumtaz, H., Theodoridis, K., & Zanetti, F.	Bank of England	2017	UK	Strong positive	Strong positive	Strong negative

Table 3.13. Studies on macroeconomic variables but with no focus on inflation

Authors	Journal	Year	Country data	Effect on GDP	Effect on Unemployment
Voutsinas, K., & Werner, R. A.	Center for Financial Studies (CFS)	2011	Japan	No effect	
Barroso, J. B. R., da Silva, L. A. P., & Sales, A. S.	Journal of International Money and Finance	2016	Brazil	Weak positive	
Joyce, M., Miles, D., Scott, A., & Vayanos, D.	The Economic Journal	2012	UK	Weak positive	
Nelson, E.	Oxford Economic Papers	2013	UK	Weak positive	
Lyonnet, V., & Werner, R.	International Review of Financial Analysis	2012	UK	No effect	
Mumtaz, H., & Theophilopoulou, A.	European Economic Review	2017	UK	Possibly Higher income inequality	
Cobham, D., & Kang, Y.	The Manchester School	2012	UK	Strong positive	
Casiraghi, M., Gaiotti, E., Rodano, L., & Secchi, A.	Bank of Italy	2013	Italy	Strong positive	Strong negative
Guerello, C.	Journal of International Money and Finance	2018	Euro area	Weak positive on consumption	
Fuhrer, J. C., & Olivei, G. P.	Public Policy Briefs	2011	USA	Strong positive	Weak negative
Wu, J. C., & Xia, F. D.	Journal of Money, Credit and Banking	2016	USA		Weak negative

3.5. Financial Inflows- International Effects
3.5.1. Studies about US combined with effects on other countries
Effects on EMEs

Academic work related to unconventional policies has also examined spillover impacts to developing markets. The impact that non-conventional practices have on capital inflows is studied by Tillmann (2016), Kiendrebeogo (2016), Lim et al. (2014), and Anaya et al. (2017). Notably, Tillmann (2016) argues that out of the ordinary measures in the US generate an increase in capital flows and on asset quotes in EMEs. Higher portfolio flows on emerging economies are also detected by the study of Kiendrebeogo (2016). Moreover, he provides evidence that such flows in emerging markets are more than on advanced markets with standard action taking. Abiding by the results of Tillmann (2016) and Kiendrebeogo (2016), Lim et al. (2014) document the significance of gross financial inflows for the transmission of non-conventional impacts. Furthermore, they support that these flows were more useful than Foreign Direct Investments for the achievement of unconventional purposes. In line with earlier findings, Anaya et al. (2017) also find higher portfolio flows directed to emerging markets when the US practiced unconventional monetary policies. It should be noted that duration of such impacts is found to last for about half a year. Moreover, they support that EMEs also conduct easing policies in response to US lax policies. Brana et al. (2012) by employing panel-VAR methodologies argue that excess liquidity exerts spillover impacts on output and inflation in Latin American and Asian countries. Nevertheless, the effects on real estate, commodity and stock prices are unclear.

There is also a significant bulk of papers about unconventional spillover impacts that finds noteworthy effects through capital market frictions (MacDonald, 2017) or by affecting bonds (Moore et al., 2013; Duca et al., 2016). Chen et al. (2015) arue for the existence of US spillovers that result in different effects among the emerging economies. They also note that such effects trigger economic and financial instability in some of these countries. This is partly in accordance to Brana and Prat (2016) that trace a positive nexus between excess liquidity in a worldwide level and prices of assets. It should be noted that risk aversion is found to influence their relation. The outcome of the investigation that Moore et al. (2013) conduct provides evidence the US out of the ordinary practices being more effective results in a weaker negative linkage to bond yields in developing economies. Furthermore, the findings of Duca et al. (2016) abide by the important linkage between US practices and bonds in developing countries. They argue that such policies lead to alterations in corporate bond issuance.

Global Spillover Effects

91

There have also been studies about worldwide impacts of unconventional action taking. Lin et al. (2018) use fixed-effects panel regressions and argue that US out of the ordinary policies exerted very strong effects on foreign exchange and equity markets in developing economies, especially during the beginning of non-conventional practices. Significant appreciations in the domestic currencies of China, Indonesia, Singapore, Hong Kong, Taiwan, Russia and Brazil are detected during the first stages of QE, whereas much lower effects on real economies are revealed in consequent rounds. Moreover, Rogers et al. (2015) by employing SVAR methodologies focus their research on **impacts on premia and exchange rates** in 24 countries and detect a significant negative linkage of these variables with the US action taking.

Georgiadis (2015) by employing a global-VAR methodology supports that the channels by which global spillovers from ordinary and out of the ordianry monetary policy are diffused do not differ in a large extent. Meegan et al. (2018) employ a market model framework along with an Exponential GARCH (E-GARCH) methodology in order to estimate spillovers and volatility contagion of unconventional action taking by the Fed, the ECB and the BoE and argue for idiosyncratic contagion spillover effects to Western Europe by the Federal Reserve's balance sheet enlargement. The UK's non-conventional practices led to such spillovers to Western Europe and Asia, whereas the ECB's measures had internal but also worldwide impacts. Furthermore, Dahlhaus et al. (2018) identify the interaction of US non-standard policy to the Canadian economy by working with a FAVAR methodology and trace a **positive linkage**. Another contribution to the academic literature about US spillovers is made by Barroso et al. (2016). They argue that US non-standard policies trigger raises in the value of the currency, the stocks values, and generally in the Brazilian economy. Georgiadis and Gräb (2016) examine how the ECB's unconventional announcements about Asset Purchase Programs were spelt over to the global financial market. Empirical evidence indicates lower EUR value though raises in European and worldwide stock prices emerge. Differences in impacts are attributed to different global integration, the exchange rate regime and connection with carry trade.

Morgan (2011) and Cho and Rhee (2013) focus their research on effects of US monetary policy during non-conventional times in emerging Asian economies. Results point towards Asian countries having received **spillover impacts of a positive sign** in the early stages of US QE. Ganelli and Tawk (2017) examine how spillovers from the unconventional monetary policy of Japan have affected emerging Asian economies. More specifically, Indonesia, Malaysia, the Philippines, Singapore, Thailand, China and Korea are under examination. The global-VAR analysis indicates that unconventional action taking has been influential via the expectations and the confidence channels.

Further econometric outcomes have emerged in studies about spillover effects. Beckmann and Crudaj (2017) argue that effects of unconventional monetary policies

conducted by four banks of great importance on expectations are different as time passes and international spillovers exist during non-conventional eras in monetary policy. In a similar vein, Bowman et al. (2015b) argue that prices of assets in developing economies largely fluctuated due to US unconventional news and **declined in tandem with alterations in prices of US sovereign bonds**. This impact is more pronounced the worse is the economic environment in such an emerging economy. In a similar mentality, Lim and Mohapatra (2016) support that unconventional practices by advanced economies **could increase risk in emerging economies** due to heterogeneous non-absorbed financial flows transmitted through a range of channels. Whatsoever, Gagnon et al. (2017) provide evidence that **US non-conventional spillovers cause unimportant impacts on current accounts for regions characterized by large intensity in capital movements**, but when lower capital mobility exisis, there are modest and positive effects.

QE-Tapering Effects On Capital Flows

A non-negligible bulk of bibliography investigates effects of the ''tapering'' of liquidity injections. The effect that QE-tapering exerts on capital flows is scrutinized by Park et al. (2014), Rai and Sushanek (2014), and Bouraoui (2015). Park et al. (2014) reveal a negative linkage between tapering news and lack of fluctuations in financial markets in Asia. They detect that the determinant of this negative nexus was the impact of such news on capital flows, especially during US QE1. Furthermore, Rai and Sushanek (2014) provide evidence that US QE-tapering led to withdrawal of foreign funds to emerging countries. They note that countries with higher economic sanity presented a better reaction to these announcements. In the context of an event study methodology, Bouraoui (2015) also documents that capital leakages from developing economies towards the US were the consequences of QE-tapering. Furthermore, in an innovative view, Eichengreen and Gupta (2015) detect a negative effect by tapering of non-standard practices in the financial sectors of developing economies, such as currency markets. Reductions in value were found to be more intense in countries that currency appreciation had taken place before non-conventional eras. Interestingly, evidence uncovers an even larger effect on more liquid markets.

Covariance and Volatility Effects on Global Markets

Chinn (2013) supports that non-standard action taking is the source of more intense fluctuations in worldwide markets. Nevertheless, they could prove beneficial by contributing to global rebalancing by revaluating currencies in EMEs. Beetsma et al. (2017) argue that bond purchases by the European Central Bank through the Securities Market Purchases result in lower negative effects moving towards indebted economies. Consequently, not so many investors abandon the countries in order to invest in Germany. This happens because the covariance between Germany and these countries increases, whereas the positive co-movements of the yields among

93

distressed countries become lower. The distressed countries examined are: Greece, Ireland, Italy, Portugal and Spain.

Kryzanowski et al. (2017) estimate differing correlations between developed and emerging countries when the US exercised its unconventional policies. There is also differentiation in the outcomes as regards earlier or later phases of non-standard policies.

Spillover Effects on Euro area

Bibliography also exists about the nexus of non-standard policymaking by the European Central Bank and impacts on separate economies in Europe. Ciarlone and Colabella (2016) support that news about non-conventional actions substantially boosted **exchange rates and equity prices but also capital injections** in Central, Eastern and South Eastern markets. In a similar vein, Horvath and Voslarova (2017) provide evidence that the Czech Republic, Hungary, and Poland receive positive spillovers on macroeconomic variables from the ECB's unconventional action taking. Galariotis et al. (2018) employ panel-VAR, Qual-VAR and FAVAR methodologies to estimate the effect of unconventional monetary action taking in the Euro area on policy expectations in nine European countries. It is found that the Fed's as well as the ECB's unconventional practices triggered sentiment spillovers to Core Eurozone countries and Peripheral (European) countries, respectively. Particularly, the ECB's actions had a negative effect on investors' expectations. Potjagailo (2017) by employing a FAVAR methodology with two blocks provides evidence for spillover effects from the Euro area's monetary policies on European countries. He argues that such spillovers on production are larger in non-Euro area economies with high trade openness. In general, higher industrial production, lower interest rates and higher financial uncertainty are found due to non-conventional practices.

3.6. Conclusions

This survey has provided a complete review of the main empirical findings concerning how unconventional monetary policies, through event-studies. Vector Autoregressions and panel procedures as well as by more modern methods, have affected intermediate and final economic targets.

The main findings that have been brought to the surface by surveying models and empirical studies are the following. First of all, the effect of unconventional policies on final macroeconomic variables has not been strong. Specifically, it renders weaker with subsequent QE rounds. Moreover, it is found that the portfolio rebalancing mechanism has been stronger in transmitting unconventional monetary impacts than the signaling and the market functioning channels. It should also be noted that decreasing long-term yields and lending rates as well as increasing stock values and depreciating the local currency have been the usual outcomes of QE

94

practices. Additionally, results provide evidence that large capital outflows towards developing economies have taken place. Furthermore, unconventional practices are found to trigger larger income inequalities in a worldwide level.

This survey casts light on the efficacy of the transmission channels of unconventional monetary policies and provides a comparison of effectiveness of unconventional monetary measures between advanced and developing national or union markets. Moreover, size effects of QE action taking on intermediate and final economic variables are provided. Thereby, this systematical review on the form of a survey enables policymakers and investors to better understand the dynamics of QE efficacy and provides a compass for maximizing their utility during future crises episodes.

References

Adler, G., Lama, R., & Medina, J. P. (2018). Coordination Gains under Unconventional Policies. Journal of International Money and Finance, doi: https://doi.org/10.1016/j.jimonfin.2018.03.014

Ambler, S., & Rumler, F. (2017). The Effectiveness of Unconventional Monetary Policy Announcements in the Euro Area: An Event and Econometric Study. Oesterreichische Nationalbank (Austrian Central Bank).

Anaya, P., Hachula, M., & Offermanns, C. J. (2017). Spillovers of US unconventional monetary policy to emerging markets: The role of capital flows. Journal of International Money and Finance, 73, 275-295.

Apergis, N., & Christou, C. (2015). The behaviour of the bank lending channel when interest rates approach the zero lower bound: Evidence from quantile regressions. Economic Modelling, 49, 296-307.

Araújo, A., Schommer, S., & Woodford, M. (2015). Conventional and unconventional monetary policy with endogenous collateral constraints. American Economic Journal: Macroeconomics, 7(1), 1-43.

Armenter, R., & Lester, B. (2017). Excess reserves and monetary policy implementation. Review of Economic Dynamics, 23, 212-235.

Arnold, I. J., & Soederhuizen, B. (2018). The missing spillover of base expansion into monetary aggregates: Is there a puzzle?. Journal of Macroeconomics, 55, 64-76.

Aruoba, S. B. (2016). Term structures of inflation expectations and real interest rates (No. 16-9). Federal Reserve Bank of Philadelphia.

Avouyi-Dovi, S., & Idier, J. (2012). The impact of unconventional monetary policy on the market for collateral: The case of the French bond market. Journal of Banking & Finance, 36(2), 428-438.

Barroso, J. B. R., Da Silva, L. A. P., & Sales, A. S. (2016). Quantitative Easing and Related Capital Flows into Brazil: measuring its effects and transmission channels through a rigorous counterfactual evaluation. Journal of International Money and Finance, 67, 102-122.

Bauer, M. D., & Neely, C. J. (2014). International channels of the Fed's unconventional monetary policy. Journal of International Money and Finance, 44, 24-46.

Bauer, M., & Rudebusch, G. (2014). The Signaling Channel for Federal Reserve Bond Purchases. International Journal of Central Banking, 10(3), 233-289.

Baumeister, C., & Benati, L. (2013). Unconventional Monetary Policy and the Great Recession: Estimating the Macroeconomic Effects of a Spread Compression at the Zero Lower Bound. International Journal of Central Banking, 9(2), 165-212.

Beaupain, R., & Durré, A. (2016). Excess liquidity and the money market in the euro area. Journal of Macroeconomics, 47, 33-44.

Beckmann, J., & Czudaj, R. (2017). Exchange rate expectations since the financial crisis: Performance evaluation and the role of monetary policy and safe haven. Journal of International Money and Finance, 74, 283-300.

Beetsma, R., de Jong, F., Giuliodori, M., & Widijanto, D. (2017). Realized (co) variances of eurozone sovereign yields during the crisis: The impact of news and the Securities Markets Programme. Journal of International Money and Finance, 75, 14-31.

Belke, A., & Fahrholz, C. (2017). Emerging and small open economies, unconventional monetary policy and exchange rates–a survey. International Economics and Economic Policy, 1-22.

Belke, A., & Klose, J. (2013). Modifying Taylor reaction functions in the presence of the zero- lower- bound—Evidence for the ECB and the Fed. Economic Modelling, 35, 515-527

Belke, A., Gros, D., & Osowski, T. (2017). The effectiveness of the Fed's quantitative easing policy: New evidence based on international interest rate differentials. Journal of International Money and Finance, 73, 335-349.

Belongia, M. T., & Ireland, P. N. (2017). Circumventing the zero lower bound with monetary policy rules based on money. Journal of Macroeconomics, 54, 42-58.

Berge, T. J., & Cao, G. (2014). Global effects of US monetary policy: is unconventional policy different?. Economic Review (Kansas City), 65-65.

Bernhard, S., & Ebner, T. (2017). Cross-border spillover effects of unconventional monetary policies on Swiss asset prices. Journal of International Money and Finance, 75, 109-127.

Bhar, R., Malliaris, A. G., & Malliaris, M. (2015). Quantitative Easing and the US Stock Market: A Decision Tree Analysis. Review of Economic Analysis, 7(2), 135-156.

Bhattarai, S., & Neely, C. J. (2016). A Survey of the Empirical Literature on US Unconventional Monetary Policy. Federal Reserve Bank of St. Louis Working Paper Series, (2016-021).

Bhattarai, S., Eggertsson, G. B., & Gafarov, B. (2015). Time Consistency and the Duration of Government Debt: A Signalling Theory of Quantitative Easing (No. w21336). National Bureau of Economic Research.

Boneva, L., Cloyne, J., Weale, M., & Wieladek, T. (2016). The Effect of Unconventional Monetary Policy on Inflation Expectations: Evidence from Firms in the United Kingdom. International Journal of Central Banking, 12(3), 161-195.

Boneva, L., Harrison, R., & Waldron, M. (2018). Threshold-based forward guidance. *Journal of Economic Dynamics and Control*, *90*, 138-155.

Boubaker, S., Gounopoulos, D., Nguyen, D. K., & Paltalidis, N. (2017). Assessing the effects of unconventional monetary policy and low interest rates on pension fund risk incentives. Journal of Banking & Finance, 77, 35-52.

Bouraoui, T. (2015). The effect of reducing quantitative easing on emerging markets. Applied Economics, 47(15), 1562-1573.

Bowman, D., Cai, F., Davies, S., & Kamin, S. (2015a). Quantitative easing and bank lending: Evidence from Japan. Journal of International Money and Finance, 57, 15-30.

Bowman, D., Londono, J. M., & Sapriza, H. (2015b). US unconventional monetary policy and transmission to emerging market economies. Journal of International Money and Finance, 55, 27-59.

Brana, S., & Prat, S. (2016). The effects of global excess liquidity on emerging stock market returns: Evidence from a panel threshold model. Economic Modelling, 52, 26-34.

Brana, S., Djigbenou, M. L., & Prat, S. (2012). Global excess liquidity and asset prices in emerging countries: A PVAR approach. Emerging Markets Review, 13(3), 256-267.

Breedon, F. (2018). On the transactions costs of UK quantitative easing. Journal of Banking & Finance, 88(C), 347-356.

Breedon, F., Chadha, J. S., & Waters, A. (2012). The financial market impact of UK quantitative easing. Oxford Review of Economic Policy, 28(4), 702-728.

Bridges, J., & Thomas, R. (2012). The impact of QE on the UK economy–some supportive monetarist arithmetic (No. 442). Bank of England.

Brunner, K., & Meltzer, A. H. (1973). Mr. Hicks and the" Monetarists". Economica, 40(157), 44-59.

Bundesbank, D. (2016). The macroeconomic impact of quantitative easing in the euro area. Monthly Report, 29-53.

Burriel, P., & Galesi, A. (2018). Uncovering the heterogeneous effects of ECB unconventional monetary policies across euro area countries. European Economic Review, 101, 210-229.

Butt, N., Churm, R., McMahon, M., Morotz, A., & Schanz, J. (2014). QE and the Bank Lending Channel in the UK (No. 511). Bank of England Working Paper.

Carpenter, S., Demiralp, S., & Eisenschmidt, J. (2014). The effectiveness of non-standard monetary policy in addressing liquidity risk during the financial crisis: The experiences of the Federal Reserve and the European Central Bank. Journal of Economic Dynamics and Control, 43, 107-129.

Carpenter, S., Demiralp, S., Ihrig, J., & Klee, E. (2015). Analyzing Federal Reserve asset purchases: From whom does the Fed buy?. Journal of Banking & Finance, 52, 230-244.

Casiraghi, M., Gaiotti, E., Rodano, L., & Secchi, A. (2013). The impact of unconventional monetary policy on the Italian economy during the sovereign debt crisis (No. 203). Bank of Italy, Economic Research and International Relations Area.

Céspedes, L. F., Chang, R., & Velasco, A. (2017). Financial intermediation, real exchange rates, and unconventional policies in an open economy. Journal of International Economics, 108, S76-S86.

Chadha, J. S., & Waters, A. (2014). Applying a macro-finance yield curve to UK quantitative Easing. Journal of Banking & Finance, 39, 68-86.

Chang, Y. T., Gau, Y. F., & Hsu, C. C. (2017). Liquidity Commonality in Foreign Exchange Markets During the Global Financial Crisis and the Sovereign Debt Crisis: Effects of Macroeconomic and Quantitative Easing Announcements. The North American Journal of Economics and Finance, 42, 172-192.

Chen, H., Cúrdia, V., & Ferrero, A. (2012). The macroeconomic effects of large- scale asset purchase programmes. The Economic Journal, 122(564), F289-F315.

Chen, Q., Filardo, A., He, D., & Zhu, F. (2016). Financial crisis, US unconventional monetary policy and international spillovers. Journal of International Money and Finance, 67(C), 62-81.

Chinn, M. (2013). Global spillovers and domestic monetary policy (No. 436). Bank for International Settlements.

Cho, D., & Rhee, C. (2014). Effects of quantitative easing on Asia: capital flows and financial markets. The Singapore Economic Review (SER), 59(03), 1-23.

Christensen, J. H., & Krogstrup, S. (2014, August). Swiss unconventional monetary policy: lessons for the transmission of quantitative easing. Federal Reserve Bank of San Francisco.

Christensen, J. H., & Krogstrup, S. (2015). Transmission of quantitative easing: The role of central bank reserves (No. 2015-06). Swiss National Bank.

Christensen, J. H., & Rudebusch, G. D. (2012). The response of interest rates to US and UK quantitative easing. The Economic Journal, 122(564), F385-F414.

Christensen, J. H., Lopez, J. A., & Rudebusch, G. D. (2014). Do Central Bank Liquidity Facilities Affect Interbank Lending Rates?. Journal of Business & Economic Statistics, 32(1), 136-151.

Christensen, J. H., Lopez, J. A., & Rudebusch, G. D. (2015). A probability-based stress test of Federal Reserve assets and income. Journal of Monetary Economics, 73, 26-43.

Christensen, J., & Gillan, J. M. (2018, February). Does quantitative easing affect market liquidity?. Federal Reserve Bank of San Francisco, Working Paper 2013-26

Chung, H., Laforte, J. P., Reifschneider, D., & Williams, J. C. (2012). Have we underestimated the likelihood and severity of zero lower bound events?. Journal of Money, Credit and Banking, 44(s1), 47-82.

Chung, T. K., Hui, C. H., & Li, K. F. (2017). Term-structure modelling at the zero lower bound: Implications for estimating the forward term premium. Finance Research Letters, 21, 100-106.

Churm, R., Joyce, M., Kapetanios, G., & Theodoridis, K. (2015). Unconventional monetary policies and the macroeconomy: the impact of the United Kingdom's QE2 and Funding for Lending Scheme (No. 542). Bank of England.

Ciarlone, A., & Colabella, A. (2016). Spillovers of the ECB's non-standard monetary policy into CESEE economies. Ensayos sobre Política Económica, 34(81), 175-190.

Cobham, D., & Kang, Y. (2012). Financial crisis and quantitative easing: can broad money tell us anything?. The Manchester School, 80(s1), 54-76.

Cole, S. J. (2018). The effectiveness of central bank forward guidance under inflation and price-level targeting. *Journal of Macroeconomics*, *55*, 146-161.

Cook, D., & Devereux, M. B. (2016). Exchange rate flexibility under the zero lower bound. Journal of International Economics, 101, 52-69.

Creel, J., Hubert, P., & Viennot, M. (2016). The effect of ECB monetary policies on interest rates and volumes. *Applied Economics*, *48*(47), 4477-4501.

Cúrdia, V., & Ferrero, A. (2013). How stimulatory are large-scale asset purchases?. FRBSF Economic Letter, 22, 1-5.

Cúrdia, V., & Woodford, M. (2011). The central-bank balance sheet as an instrument of monetary policy. Journal of Monetary Economics, 58(1), 54-79.

D'Amico, S., & King, T. B. (2013). Flow and stock effects of large-scale treasury purchases: Evidence on the importance of local supply. Journal of Financial Economics, 108(2), 425-448.

d'Amico, S., English, W., López- Salido, D., & Nelson, E. (2012). The Federal Reserve's Large- scale Asset Purchase Programmes: Rationale and Effects. The Economic Journal, 122(564), F415-F446.

Dahlhaus, T., Hess, K., & Reza, A. (2018). International Transmission Channels of US Quantitative Easing: Evidence from Canada. Journal of Money, Credit and Banking, 50(2-3), 545-563.

Damjanovic, T., & Girdėnas, Š. (2014). Quantitative easing and the loan to collateral value ratio. Journal of Economic Dynamics and Control, 45, 146-164.

Darracq-Paries, M., & De Santis, R. A. (2015). A non-standard monetary policy shock: The ECB's 3-year LTROs and the shift in credit supply. Journal of International Money and Finance, 54, 1-34.

D'Avino, C. (2018). Quantitative easing, global banks and the international bank lending channel. Economic Modelling, 71, 234-246.

de Haan, L., & van den End, J. W. (2018). The signalling content of asset prices for inflation: Implications for Quantitative Easing. *Economic Systems*, *42*(1), 45-63.

De Santis, R. (2016). Impact of the asset purchase programme on euro area government bond yields using market news (No. 1939). ECB Working Paper.

Deng, K., & Todd, W. (2016). Is the US quantitative easing more effective than China's? A second thought. China Economic Review, 38, 11-23.

Di Maggio, M., & Kacperczyk, M. (2017). The unintended consequences of the zero lower bound policy. Journal of Financial Economics, 123(1), 59-80.

Djigbenou-Kre, M. L., & Park, H. (2016). The effects of global liquidity on global imbalances. International Review of Economics & Finance, 42, 1-12.

Doh, T. (2010). The efficacy of large-scale asset purchases at the zero lower bound. Federal Reserve Bank of Kansas City Economic Review, 95(2), 5-34.

Dreger, C., & Wolters, J. (2015). Unconventional monetary policy and money demand. Journal of Macroeconomics, 46, 40-54.

Duca, M. L., Nicoletti, G., & Martinez, A. V. (2016). Global corporate bond issuance: what role for US quantitative easing?. Journal of International Money and Finance, 60, 114-150.

Eichengreen, B., & Gupta, P. (2015). Tapering talk: The impact of expectations of reduced Federal Reserve security purchases on emerging markets. Emerging Markets Review, 25, 1-15.

Eichler, S. (2012). Financial crisis risk, ECB "non-standard" measures, and the external value of the euro. The Quarterly Review of Economics and Finance, 52(3), 257-265.

Eksi, O., & Tas, B. K. O. (2017). Unconventional monetary policy and the stock market's reaction to Federal Reserve policy actions. The North American Journal of Economics and Finance, 40, 136-147.

Ellison, M., & Tischbirek, A. (2014). Unconventional government debt purchases as a supplement to conventional monetary policy. Journal of Economic Dynamics and Control, 43, 199-217.

Engen, E. M., Laubach, T., & Reifschneider, D. L. (2015). The Macroeconomic Effects of the Federal Reserve's Unconventional Monetary Policies (No. 2015-5). Board of Governors of the Federal Reserve System (US).

Eser, F., & Schwaab, B. (2016). Evaluating the impact of unconventional monetary policy measures: Empirical evidence from the ECB′s Securities Markets Programme. Journal of Financial Economics, 119(1), 147-167.

Falagiarda, M. (2014). Evaluating quantitative easing: a DSGE approach. International Journal of Monetary Economics and Finance, 7(4), 302-327.

Falagiarda, M., & Reitz, S. (2015). Announcements of ECB unconventional programs: Implications for the sovereign spreads of stressed euro area countries. Journal of International Money and Finance, 53, 276-295.

Fasano-Filho, M. U., Wang, M. Q., & Berkmen, P. (2012). Bank of Japan's quantitative and credit easing: Are they now more effective (No. 12). International Monetary Fund.

Fausch, J., & Sigonius, M. (2018). The impact of ECB monetary policy surprises on the German stock market. Journal of Macroeconomics, 55, 46-63.

Fawley, B. W., & Neely, C. J. (2013). Four stories of quantitative easing. Federal Reserve Bank of St. Louis Review, 95(1), 51-88.

Foerster, A. T. (2015). Financial crises, unconventional monetary policy exit strategies, and agents′ expectations. Journal of Monetary Economics, 76, 191-207.

Foley-Fisher, N., Ramcharan, R., & Yu, E. (2016). The impact of unconventional monetary policy on firm financing constraints: Evidence from the maturity extension program. Journal of Financial Economics, 122(2), 409-429.

Fratzscher, M., Lo Duca, M., & Straub, R. (2018). On the international spillovers of US quantitative easing. The Economic Journal, 128(608), 330-377.

Fuhrer, J. C., & Olivei, G. P. (2011). The Estimated Macroeconomic Effects of the Federal Reserve's Large-Scale Treasury Purchase Program. Public Policy Briefs, 2.

Fujiki, H., & Tomura, H. (2017). Fiscal cost to exit quantitative easing: the case of Japan. Japan and the World Economy, 42, 1-11.

Gagnon, J. E., Bayoumi, T., Londono, J. M., Saborowski, C., & Sapriza, H. (2017). Direct and Spillover Effects of Unconventional Monetary and Exchange Rate Policies. Open Economies Review, 28(2), 191-232.

Gagnon, J., Raskin, M., Remache, J., & Sack, B. (2011). The financial market effects of the Federal Reserve's large-scale asset purchases. International Journal of Central Banking, 7(1), 3-43.

Galariotis, E., Makrichoriti, P., & Spyrou, S. (2018). The impact of conventional and unconventional monetary policy on expectations and sentiment. Journal of Banking & Finance, 86, 1-20.

Gambacorta, L., Hofmann, B., & Peersman, G. (2014). The effectiveness of unconventional monetary policy at the zero lower bound: A cross- country analysis. Journal of Money, Credit and Banking, 46(4), 615-642.

Ganelli, G., & Tawk, N. (2017). Spillovers from Japan's Unconventional Monetary Policy: A global VAR Approach. Economic Modelling, 1-17.

Garcia-Posada, M., & Marchetti, M. (2016). The bank lending channel of unconventional monetary policy: The impact of the VLTROs on credit supply in Spain. Economic Modelling, 58, 427-441.

Gavin, W. T., Keen, B. D., Richter, A. W., & Throckmorton, N. A. (2015). The zero lower bound, the dual mandate, and unconventional dynamics. Journal of Economic Dynamics and Control, 55, 14-38.

Georgiadis, G. (2016). Determinants of global spillovers from US monetary policy. Journal of International Money and Finance, 67, 41-61.

Georgiadis, G., & Gräb, J. (2016). Global financial market impact of the announcement of the ECB's asset purchase programme. Journal of Financial Stability, 26, 257-265.

Gertler, M., & Karadi, P. (2013). QE 1 vs. 2 vs. 3...: A framework for analyzing large-scale asset purchases as a monetary policy tool. International Journal of central Banking, 9(1), 5-53.

Gibson, H. D., Hall, S. G., & Tavlas, G. S. (2016). The effectiveness of the ECB's asset purchase programs of 2009 to 2012. Journal of Macroeconomics, 47, 45-57.

Gilchrist, S., & Zakrajšek, E. (2013). The Impact of the Federal Reserve's Large- Scale Asset Purchase Programs on Corporate Credit Risk. Journal of Money, Credit and Banking, 45(s2), 29-57.

Gilchrist, S., López-Salido, D., & Zakrajšek, E. (2015). Monetary policy and real borrowing costs at the zero lower bound. American Economic Journal: Macroeconomics, 7(1), 77-109.

Girardin, E., & Moussa, Z. (2009). The effectiveness of quantitative easing in Japan: New evidence from a structural factor-augmented VAR.

Glick, R., & Leduc, S. (2011). Are large-scale asset purchases fueling the rise in commodity prices?. FRBSF Economic Letter, 10(4).

Glick, R., & Leduc, S. (2012). Central bank announcements of asset purchases and the impact on global financial and commodity markets. Journal of International Money and Finance, 31(8), 2078-2101.

Glick, R., & Leduc, S. (2013, May). The effects of unconventional and conventional US monetary policy on the dollar. Federal Reserve Bank of San Francisco, Working Paper Series 2013-11

Goodhart, C. A., & Ashworth, J. P. (2012). QE: a successful start may be running into diminishing returns. Oxford Review of Economic Policy, 28(4), 640-670.

Greenwood, R., & Vayanos, D. (2014). Bond supply and excess bond returns. Review of Financial Studies, 27(3), 663-713.

Gros, D., Alcidi, C., & De Groen, W. P. (2015). Lessons from Quantitative Easing: Much ado about so little?. CEPS Policy Brief, (330).

Gu, C., & Haslag, J. H. (2014). Unconventional optimal open market purchases. Review of Economic Dynamics, 17(3), 543-558.

Guerello, C. (2018). Conventional and unconventional monetary policy vs. households income distribution: An empirical analysis for the Euro Area. Journal of International Money and Finance, 85, 187-214.

Guidolin, M., Orlov, A. G., & Pedio, M. (2014). Unconventional monetary policies and the corporate bond market. Finance Research Letters, 11(3), 203-212.

Guidolin, M., Orlov, A. G., & Pedio, M. (2017). The impact of monetary policy on corporate bonds under regime shifts. Journal of Banking & Finance, 80, 176-202.

Güntner, J. H. (2015). The federal funds market, excess reserves, and unconventional monetary policy. Journal of Economic Dynamics and Control, 53, 225-250.

Hahn, J., Jang, W. W., & Kim, S. (2017). Risk aversion, uncertainty, and monetary policy in zero lower bound environments. Economics Letters, 156, 118-122.

Haitsma, R., Unalmis, D., & de Haan, J. (2016). The impact of the ECB's conventional and unconventional monetary policies on stock markets. Journal of Macroeconomics, 48, 101-116.

Hajek, J., & Horvath, R. (2017). International Spillovers of (Un) Conventional Monetary Policy: The Effect of the ECB and US Fed on Non-Euro EU Countries (No. 2017/05).

Hamilton, J. D., & Wu, J. C. (2012). The effectiveness of alternative monetary policy tools in a zero lower bound environment. Journal of Money, Credit and Banking, 44(s1), 3-46.

Hammoudeh, S., Nguyen, D. K., & Sousa, R. M. (2015). US monetary policy and sectoral commodity prices. Journal of International Money and Finance, 57, 61-85.

Hanabusa, K. (2017). Japan's quantitative monetary easing policy: Effect on the level and volatility of yield spreads. Journal of Asian Economics, 53, 56-66.

Hancock, D., & Passmore, W. (2011). Did the Federal Reserve's MBS purchase program lower mortgage rates?. Journal of Monetary Economics, 58(5), 498-514.

Hanisch, M. (2017). The effectiveness of conventional and unconventional monetary policy: Evidence from a structural dynamic factor model for Japan. *Journal of International Money and Finance*, *70*, 110-134.

Hännikäinen, J. (2015). Zero lower bound, unconventional monetary policy and indicator properties of interest rate spreads. Review of Financial Economics, 26, 47-54.

Hattori, M., Schrimpf, A., & Sushko, V. (2016). The response of tail risk perceptions to unconventional monetary policy. American Economic Journal: Macroeconomics, 8(2), 111-36.

Hayo, B., & Ono, H. (2015). Explaining inflation in the period of quantitative easing in Japan: Relative-price changes, aggregate demand, and monetary policy. Journal of Asian Economics, 36, 72-85.

Herbst, A. F., Wu, J. S., & Ho, C. P. (2014). Quantitative easing in an open economy—Not a liquidity but a reserve trap. *Global Finance Journal*, *25*(1), 1-16.

Horvath, R., & Voslarova, K. (2017). International spillovers of ECB's unconventional monetary policy: the effect on Central Europe. Applied Economics, 49(24), 2352-2364.

Hosono, K., & Isobe, S. (2014) The Financial Market Impact of Unconventional Monetary Policies in the US, the UK, the Eurozone, and Japan. Policy Research Institute, Ministry of Finance Japan, Discussion Paper 259.

Ichiue, H., & Ueno, Y. (2015). Monetary policy and the yield curve at zero interest. Journal of the Japanese and International Economies, 38, 1-12.

Jäger, J., & Grigoriadis, T. (2017). The effectiveness of the ECB's unconventional monetary policy: Comparative evidence from crisis and non-crisis Euro-area countries. Journal of International Money and Finance, 78, 21-43.

Jarrow, R. A. (2013). The zero-lower bound on interest rates: Myth or reality?. Finance Research Letters, 4(10), 151-156.

Jarrow, R., & Li, H. (2014). The impact of quantitative easing on the US term structure of interest rates. Review of Derivatives Research, 17(3), 287-321.

Jones, C., & Kulish, M. (2013). Long-term interest rates, risk premia and unconventional monetary policy. Journal of Economic Dynamics and Control, 37(12), 2547-2561.

Joyce, M. A., & Spaltro, M. (2014). Quantitative easing and bank lending: a panel data approach. Bank of England. Quarterly Bulletin, 54(3), 355.

Joyce, M. A., & Tong, M. (2012). QE and the gilt market: a disaggregated analysis. The Economic Journal, 122(564).

Joyce, M. A., McLaren, N., & Young, C. (2012a). Quantitative easing in the United Kingdom: evidence from financial markets on QE1 and QE2. Oxford Review of Economic Policy, 28(4), 671-701.

Joyce, M., Lasaosa, A., Stevens, I., & Tong, M. (2011). The financial market impact of quantitative easing in the United Kingdom. International Journal of Central Banking, 7(3), 113-161.

Joyce, M., Liu, Z., & Tonks, I. (2014). Institutional investor portfolio allocation, quantitative easing and the global financial crisis (No. 510). Bank of England.

Joyce, M., Miles, D., Scott, A., & Vayanos, D. (2012b). Quantitative easing and unconventional monetary policy–an introduction. The Economic Journal, 122(564)

Kagraoka, Y., & Moussa, Z. (2013). Quantitative easing, credibility and the time-varying dynamics of the term structure of interest rate in Japan. Journal of International Financial Markets, Institutions and Money, 25, 181-201.

Kandrac, J. (2013). Have Federal Reserve MBS purchases affected market functioning?. Economics Letters, 121(2), 188-191.

Kandrac, J., & Schlusche, B. (2013). Flow effects of large-scale asset purchases. Economics Letters, 121(2), 330-335.

Kapetanios, G., Mumtaz, H., Stevens, I., & Theodoridis, K. (2012). Assessing the economy- wide effects of quantitative easing. The Economic Journal, 122(564), F316-F347.

Karras, G. (2013). Asymmetric effects of monetary policy with or without Quantitative Easing: Empirical evidence for the US. The Journal of Economic Asymmetries, 10(1), 1-9

Kenourgios, D., Papadamou, S., & Dimitriou, D. (2015a). On quantitative easing and high frequency exchange rate dynamics. Research in International Business and Finance, 34, 110-125.

Kenourgios, D., Papadamou, S., & Dimitriou, D. (2015b). Intraday exchange rate volatility transmissions across QE announcements. Finance Research Letters, 14, 128-134.

Kettemann, A., & Krogstrup, S. (2014). Portfolio balance effects of the Swiss National Bank's bond purchase program. Journal of Macroeconomics, 40, 132-149.

Kick, T., Koetter, M.,Storz, M. (2018) Cross-border transmission of emergency liquidity, Journal of Banking and Finance, doi: 10.1016/j.jbankÞn.2018.02.006

Kiendrebeogo, Y. (2016). Unconventional monetary policy and capital flows. Economic Modelling, 54, 412-424.

Kiley, M. T. (2014). The Response of Equity Prices to Movements in Long- Term Interest Rates Associated with Monetary Policy Statements: Before and After the Zero Lower Bound. Journal of Money, Credit and Banking, 46(5), 1057-1071.

Kiley, M. T. (2016). Monetary policy statements, treasury yields, and private yields: before and after the zero lower bound. Finance Research Letters, 18, 285-290.

Kinateder, H., & Wagner, N. (2017). Quantitative easing and the pricing of EMU sovereign debt. The Quarterly Review of Economics and Finance, 66, 1-12.

Klose, J. (2011). A simple way to overcome the zero lower bound of interest rates for central banks: Evidence from the Fed and the ECB within the financial crisis. International Journal of Monetary Economics and Finance, 4(3), 279-296.

Krippner, L. (2013). Measuring the stance of monetary policy in zero lower bound environments. Economics Letters, 118(1), 135-138.

Krishnamurthy, A., & Vissing-Jorgensen, A. (2011). *The effects of quantitative easing on interest rates: channels and implications for policy* (No. w17555). National Bureau of Economic Research.

Kryzanowski, L., Zhang, J., & Zhong, R. (2017). Cross-financial-market correlations and quantitative easing. Finance Research Letters, 20, 13-21.

Kucharčuková, O. B., Claeys, P., & Vašíček, B. (2016). Spillover of the ECB's monetary policy outside the euro area: How different is conventional from unconventional policy?. Journal of Policy Modeling, 38(2), 199-225.

Lambert, F., & Ueda, K. (2014). The effects of unconventional monetary policies on bank soundness (No. 14-152). International Monetary Fund.

Le, V. P. M., Meenagh, D., & Minford, P. (2016). Monetarism rides again? US monetary policy in a world of Quantitative Easing. Journal of International Financial Markets, Institutions and Money, 44, 85-102.

Li, C., & Wei, M. (2012). Term structure modelling with supply factors and the Federal Reserve's Large Scale Asset Purchase programs (No. 2012-37). Board of Governors of the Federal Reserve System (US).

Lim, G. C., & McNelis, P. D. (2016). Quasi-monetary and quasi-fiscal policy rules at the zero-lower bound. Journal of International Money and Finance, 69, 135-150.

Lim, G. C., & McNelis, P. D. (2018). Unconventional monetary and fiscal policies in interconnected economies: Do policy rules matter?. Journal of Economic Dynamics and Control, https://doi.org/10.1016/j.jedc.2018.01.028

Lim, J. J., & Mohapatra, S. (2016). Quantitative easing and the post-crisis surge in financial flows to developing countries. Journal of International Money and Finance.

Lim, J. J., Mohapatra, S., & Stocker, M. (2014). Tinker, Taper, QE, Bye? The effect of quantitative easing on financial flows to developing countries. World Bank Policy Research Working Paper, (6820).

Lima, L., Vasconcelos, C. F., Simão, J., & de Mendonça, H. F. (2016). The quantitative easing effect on the stock market of the USA, the UK and Japan: An ARDL approach for the crisis period. *Journal of Economic Studies*, *43*(6), 1006-1021.

Lin, J. Y., Batmunkh, M. U. J., Moslehpour, M., Lin, C. Y., & Lei, K. M. (2018). Impact analysis of US quantitative easing policy on emerging markets. International Journal of Emerging Markets, 13(1), 185-202.

Liu, P., Mumtaz, H., Theodoridis, K., & Zanetti, F. (2017). Changing Macroeconomic Dynamics at the Zero Lower Bound. Journal of Business & Economic Statistics, http://dx.doi.org/10.1080/07350015.2017.1350186

Lombardi, D., Siklos, P. L., & St. Amand, S. (2017). Exchange rates, central bank news and the zero lower bound. Applied Economics Letters, 24(4), 269-272.

Lutz, C. (2015a). The international impact of US unconventional monetary policy. Applied Economics Letters, 22(12), 955-959.

Lutz, C. (2015b). The impact of conventional and unconventional monetary policy on investor sentiment. Journal of Banking & Finance, 61, 89-105.

Lyonnet, V., & Werner, R. (2012). Lessons from the Bank of England on 'quantitative easing'and other 'unconventional'monetary policies. International Review of Financial Analysis, 25, 94-105.

MacDonald, M. (2017). International capital market frictions and spillovers from quantitative easing. Journal of International Money and Finance, 70, 135-156.

Mamatzakis, E., & Bermpei, T. (2016). What is the effect of unconventional monetary policy on bank performance?. Journal of International Money and Finance, 67, 239-263.

Mamaysky, H. (2018). The time horizon of price responses to quantitative easing. Journal of Banking & Finance, 90, 32-49.

Mann, C. L., & Klachkin, O. (2015). Has quantitative easing affected the US Treasury auction market?. Atlantic Economic Journal, 43(1), 135-146.

Marfatia, H. A., Gupta, R., & Cakan, E. (2017). The international REIT's time-varying response to the US monetary policy and macroeconomic surprises. The North American Journal of Economics and Finance, 42, 640-653.

Martin, C., & Milas, C. (2012). Quantitative easing: a sceptical survey. Oxford Review of Economic Policy, 28(4), 750-764.

Matsuki, T., Sugimoto, K., & Satoma, K. (2015). Effects of the Bank of Japan's current quantitative and qualitative easing. Economics Letters, 133, 112-116.

McLaren, N., Banerjee, R. N., & Latto, D. (2014). Using changes in auction maturity sectors to help identify the impact of QE on gilt yields. The Economic Journal, 124(576), 453-479.

McMahon, M., Peiris, U., & Polemarchakis, H. (2018). Perils of unconventional monetary policy, Journal of Economic Dynamics & Control, https://doi.org/10.1016/j.jedc.2018.01.036

McNelis, P. D., & Yoshino, N. (2016). Finding stability in a time of prolonged crisis: Unconventional policy rules for Japan. Journal of Financial Stability, 27, 122-136.

Meaning, J., & Zhu, F. (2011). The impact of recent central bank asset purchase programmes. BIS Quarterly Review, December.

Meaning, J., & Zhu, F. (2012). The impact of Federal Reserve asset purchase programmes: another twist. BIS Quarterly Review, 23.

Meegan, A., Corbet, S., & Larkin, C. (2018). Financial Market Spillovers during the Quantitative Easing Programmes of the Global Financial Crisis (2007-2009) and the European Debt Crisis. Journal of International Financial Markets, Institutions and Money, https://doi.org/10.1016/j.intfin.2018.02.010

Meinusch, A., & Tillmann, P. (2016). The macroeconomic impact of unconventional monetary policy shocks. Journal of Macroeconomics, 47, 58-67.

Michaelis, H., & Watzka, S. (2017). Are there Differences in the Effectiveness of Quantitative Easing at the Zero-Lower-Bound in Japan over Time?.Journal of International Money and Finance, Volume 70, February 2017, Pages 204-233.

Miyakoshi, T., Shimada, J., & Li, K. W. (2017). The dynamic effects of quantitative easing on stock price: Evidence from Asian emerging markets, 2001–2016. *International Review of Economics & Finance*, *49*, 548-567.

Moore, J., Nam, S., Suh, M., & Tepper, A. (2013). Estimating the impacts of US LSAP's on emerging market economies' local currency bond markets (No. 595). Staff Report, Federal Reserve Bank of New York.

Morgan, P. (2011). Impact of US Quantitative Easing Policy on Emerging Asia. East Asian Bureau of Economic Research, Working Paper 321.

Mumtaz, H., & Theophilopoulou, A. (2017). The impact of monetary policy on inequality in the UK. An empirical analysis. European Economic Review, 98, 410-423.

Nakajima, J. (2011). Monetary policy transmission under zero interest rates: An extended time-varying parameter vector autoregression approach. The BE Journal of Macroeconomics, 11(1).

Neely, C. J. (2010). The large scale asset purchases had large international effects (pp. 1-45). Federal Reserve Bank of St. Louis, Research Division, Working Paper 2010-018.

Neely, C. J. (2015). Unconventional monetary policy had large international effects. Journal of Banking & Finance, 52, 101-111.

Nelson, E. (2013). Key aspects of longer-term asset purchase programs in UK and US monetary policy. Oxford Economic Papers, 65(suppl 1), i92-i114.

Olmo, J., & Sanso-Navarro, M. (2015). Changes in the transmission of monetary policy during crisis episodes: Evidence from the euro area and the US. Economic Modelling, 48, 155-166.

Papadamou, S., & Sogiakas, V. (2018). The informational content of unconventional monetary policy on precious metal markets. Journal of Forecasting, 37(1), 16-36.

Papadamou, S., Spyromitros, E., & Kyriazis, N. A. (2017). Quantitative easing effects on commercial bank liability and government yields in UK: A threshold cointegration approach. International Economics and Economic Policy, 1-19.

Park, D., Ramayandi, A., & Shin, K. (2014). Capital Flows During Quantitative Easing and Aftermath: Experiences of Asian Countries (No. 409). Asian Development Bank.

Peersman, G., 2011. Macroeconomic Effects of Unconventional Monetary Policy in the Euro Area. CESifo Working Paper Series 3589. CESifo Group, Munich

Potjagailo, G. (2017). Spillover effects from Euro area monetary policy across Europe: A factor-augmented VAR approach. Journal of International Money and Finance, 72, 127-147.

Priftis, R., & Vogel, L. (2016). The portfolio balance mechanism and QE in the euro area. The Manchester School, 84(S1), 84-105.

Quint, D., & Tristani, O. (2018). Liquidity provision as a monetary policy tool: The ECB's non-standard measures after the financial crisis. Journal of International Money and Finance, 80, 15-34.

Rahal, C. (2016). Housing markets and unconventional monetary policy. Journal of Housing Economics, 32, 67-80.

Rai, V., & Suchanek, L. (2014). The effect of the federal reserve's tapering announcements on emerging markets (No. 2014-50). Bank of Canada Working Paper.

Ricci, O. (2015). The impact of monetary policy announcements on the stock price of large European banks during the financial crisis. *Journal of Banking & Finance*, *52*, 245-255.

Roache, S. K., & Rousset, M. V. (2013). Unconventional Monetary Policy and Asset Price Risk (No. 13/190). International Monetary Fund.

Rogers, J. H., Scotti, C., & Wright, J. H. (2014). Evaluating asset-market effects of unconventional monetary policy: a multi-country review. Economic Policy, 29(80), 749-799.

Rogers, J. H., Scotti, C., & Wright, J. H. (2015). Unconventional monetary policy and international risk premia. Working Paper, Federal Reserve Board.

Rosa, C. (2012). How 'unconventional' are large-scale asset purchases? The impact of monetary policy on asset prices. The Impact of Monetary Policy on Asset Prices (May 1, 2012). FRB of New York Staff Report, (560).

Ruiz, J. (2015). Response of Spanish stock market to ECB monetary policy during financial crisis. The Spanish Review of Financial Economics, 13(2), 41-47.

Saiki, A., & Frost, J. (2014). Does unconventional monetary policy affect inequality? Evidence from Japan. Applied Economics, 46(36), 4445-4454.

Salachas, E. N., Laopodis, N. T., & Kouretas, G. P. (2017). The bank-lending channel and monetary policy during pre-and post-2007 crisis. Journal of International Financial Markets, Institutions and Money, 47, 176-187.

Schenkelberg, H., & Watzka, S. (2013). Real effects of quantitative easing at the zero lower bound: Structural VAR-based evidence from Japan. Journal of International Money and Finance, 33, 327-357.

Schmidt, S. (2016). Lack of confidence, the zero lower bound, and the virtue of fiscal rules. Journal of Economic Dynamics and Control, 70, 36-53.

Sheedy, K. D. (2017). Conventional and unconventional monetary policy rules. Journal of Macroeconomics, 54, 127-147.

Shogbuyi, A., & Steeley, J. M. (2017). The effect of quantitative easing on the variance and covariance of the UK and US equity markets. International Review of Financial Analysis, 52, 281-291.

Steeley, J. M. (2015a). The effects of quantitative easing on the integration of UK capital markets. The European Journal of Finance, 1-26.

Steeley, J. M. (2015b). The side effects of quantitative easing: Evidence from the UK bond market. Journal of International Money and Finance, 51, 303-336.

Steeley, J. M., & Matyushkin, A. (2015). The effects of quantitative easing on the volatility of the gilt-edged market. International review of financial analysis, 37, 113-128.

Stillwagon, J. R. (2015). Testing the expectations hypothesis with survey forecasts: The impacts of consumer sentiment and the zero lower bound in an I (2) CVAR. Journal of International Financial Markets, Institutions and Money, 35, 85-101.

Stroebel, J., & Taylor, J. B. (2012). Estimated Impact of the Federal Reserve's Mortgage-Backed Securities Purchase Program. International Journal of Central Banking, 8(2), 1-42.

Swanson, E. T. (2011). Let's twist again: a high-frequency event-study analysis of operation twist and its implications for QE2. Brookings Papers on Economic Activity, 2011(1), 151-188

Swanson, E. T. (2015). Measuring the Effects of Unconventional Monetary Policy on Asset Prices (No. w21816). National Bureau of Economic Research.

Swanson, E. T., & Williams, J. C. (2014). Measuring the effect of the zero lower bound on yields and exchange rates in the UK and Germany. Journal of International Economics, 92, S2-S21.

Szczerbowicz, U. (2015). The ECB unconventional monetary policies: have they lowered market borrowing costs for banks and governments?. International Journal of Central Banking, 11(4), 91-127.

Thornton, D. (2011). The effectiveness of unconventional monetary policy: the term auction facility. Federal Reserve Bank of St. Louis Review, (Nov), 439-454.

Thornton, D. L. (2017). Effectiveness of QE: An assessment of event-study evidence. Journal of Macroeconomics, 52, 56-74.

Thornton, J., & di Tommaso, C. (2018). Unconventional monetary policy and the 'currency wars'. Finance Research Letters, https://doi.org/10.1016/j.frl.2018.02.010

Tillmann, P. (2016). Unconventional monetary policy and the spillovers to emerging markets. Journal of International Money and Finance, 66, 136-156.

Tobin, J. (1961). Money, capital, and other stores of value. The American Economic Review, 51(2), 26-37.

Tobin, J. (1963). An essay on the principles of debt management. Cowles Foundation for Research in Economics at Yale University.

Tobin, J. (1969). A general equilibrium approach to monetary theory. Journal of money, credit and banking, 1(1), 15-29.

Ugai, H. (2007). Effects of the quantitative easing policy: A survey of empirical analyses. Monetary and Economic Studies-Bank of Japan, 25(1), 1.

Ugai, H. (2015). Transmission Channels and Welfare Implications of Unconventional Monetary Easing Policy in Japan (No. 060). University of Tokyo, Graduate School of Economics.

Unalmis, D., & Unalmis, I. (2015). The Effects of Conventional and Unconventional Monetary Policy Surprises on Asset Markets in the United States, MPRA Paper No. 62585

Valiante, D. (2017). The 'Visible Hand'of the ECB's first quantitative easing. International Economics and Economic Policy, 14(4), 601-624.

van den End, J. W. (2016). Quantitative easing tilts the balance between monetary and macroprudential policy. Applied Economics Letters, 23(10), 743-746.

Vayanos, D., & Vila, J. L. (2009). A preferred-habitat model of the term structure of interest rates (No. w15487). National Bureau of Economic Research.

Vogel, E. (2016). Forward looking behavior in ECB liquidity auctions: Evidence from the pre-crisis period. Journal of International Money and Finance, 61, 120-142.

Von Borstel, J., Eickmeier, S., & Krippner, L. (2016). The interest rate pass-through in the euro area during the sovereign debt crisis. Journal of International Money and Finance, 68, 386-402.

Voutsinas, K., & Werner, R. A. (2011). New evidence on the effectiveness of" Quantitative Easing" in Japan (No. 2011/30). Center for Financial Studies (CFS).

Wang, L. (2016). Unconventional monetary policy and aggregate bank lending: Does financial structure matter?. Journal of Policy Modeling, 38(6), 1060-1077.

Wang, Y. C., Wang, C. W., & Huang, C. H. (2015). The impact of unconventional monetary policy on the tail risks of stock markets between US and Japan. International Review of Financial Analysis, 41, 41-51.

Weale, M., & Wieladek, T. (2016). What are the macroeconomic effects of asset purchases?. Journal of Monetary Economics, 79, 81-93.

Williams, M. (2014). The Impact of Quantitative Easing on Asset Price Comovement. In *International Financial Markets* (pp. 139-163). Emerald Group Publishing Limited.

Wolski, M., & van de Leur, M. (2016). Interbank loans, collateral and modern monetary policy. Journal of Economic Dynamics and Control, 73, 388-416.

Wright, J. H. (2012). What does monetary policy do to long‐ term interest rates at the zero lower bound?. The Economic Journal, 122(564), F447-F466.

Wu, J. C., & Xia, F. D. (2016). Measuring the macroeconomic impact of monetary policy at the zero lower bound. Journal of Money, Credit and Banking, 48(2-3), 253-291.

Yépez, C. A. (2018). The impact of credit and fiscal policy under a liquidity trap. The North American Journal of Economics and Finance, 44, 1-11.

Chapter 4
Meta-Analysis of Unconventional Monetary Policy Effects on Output and Inflation[2]

4.1. Introduction

In this section a quantitative synthesis of empirical results takes place by selecting data from primary studies that investigate unconventional monetary effects on output and prices. The methodologies selected for this examination are Vector Autoregressive specifications that generate Impulse Response Functions (IRFs) with sixteen quarters or higher. The examination of QE effects on output and prices have been preferred, as these constitute the main and final targets of economic policy. The selection of VAR specifications in order to conduct a meta-analysis of QE impacts is based on previous work by Ridhwan (2010) and Rusnak et al. (2013). It also derives credence from Stanley and Doucouliagos (2012) that argue for the beneficial effects of studying impulse responses.

It shouldbe noted that interest is focused on the maximum impact, the short-run effect (4th quarter), medium-run effect (8th quarter) and long-run effect (16th quarter). For this purpose, 216 primary estimates are adopted for output examination and 207 primary estimates for prices examination. The aim of these two separate meta-analysis procedures is to distinguish from which moderators heterogeneity comes from. All primary estimations come from sixteen primary studies.

The usefulness of meta-analysis lies in that it can incorporate, in a simple estimation framework, a large number of primary data in medical sciences, according to Cochrane and Campbell Reviews, but also in economics, as Stanley (2001) argues. This permits large-scale econometric estimations to become widespread in a larger scale than before, thereby to render more familiar to academics, as Ioannidis et al. (2017) support. In order to detect from which factors differences in empirical results come from, seventeen moderator variables are examined. These are the ones that according to our trials better fit the specific research. In order to safely conduct ths meta-analysis, the basis have been the reporting guidelines of Stanley et al. (2013). It should be noted that there have been separate estimations regarding QE effects on responses of output and responses on prices.

The rest of this chapter is structured as follows. Section 2 describes how the meta-analysis sample is constructed and provides summary statistics. Section 3 provides a description of the moderator variables used and performs a methodological analysis. Section 4 presents and deepens into the econometric results and their economic underpinnings. Finally, Section 5 concludes.

---

[2] A part of the results of this chapter submitted for possible publication on a paper co-authored with Assoc. Prof. Stephanos Papadamou and Dr. Panayiotis Tzeremes.

4.2. Identification and selection of studies

The main aim in this part of the thesis is to look into how non-conventional monetary shocks lead to alterations in responses of ouput and responses of prices in the primary studies examined. In other words, we seek to detect which are the sources of differences between outcomes in the original academic papers. A number of steps are essential in order for the meta-analysis procedure to be correct, accrding to Stanley et al. (2013). First, some keywords are employed in order to find relevant academic work by suitable search engines. Thereby, the terms ´´unconventional monetary policy´´ and ´´quantitative easing´´ are used for conducting a thorough academic search by the Scopus and the Google Scholar webpages. We narrow down the initially very long list by focusing on papers since the outburst of the 2008 Global Financial Crisis. Thereby, previous papers that focus on the early Japanese experience are rejected. Moreover, a further short-listing takes place by focusing our nterest only on papers with Vector Autoregression specifications being the methodology employed. Another criterion is that the papers selected should include Impulse Response Functions of at least sixteen periods and to study effects on output, on prices, or on both. Moreover, in order to further exclude irrelevant studies, the following criteria are employed:

- Only the latest version of academic papers can be included in the sample.
- Each paper needs to have been published after 2008.
- Sectoral impacts are not examined in this meta-analysis.

The second step in the meta-analysis procedure, which is the most time-consuming one, is to code the characteristics from primary studies. Notably, sixteen primary studies are left as the final sample after all the exclusion criteria have been applied. When it comes to primary data about responses of output, 216 estimates are collected, whereas the somewhat lower number of 207 estimates are derived regarding responses of prices. Primary estimates at the maximum impact, the impact at the 4th quarter (short-run), the 8th quarter (medium-run) and the 16th quarter (long-run) are extracted.

The third step of this meta-analysis is about estimating where differences across primary results come from. More specifically, Ordinary Least Squares (OLS) but also Weighted Least Squares (WLS) estimations are used in order to derive such effects. For the purposes of acieving robustness of outcomes, four different weighting schemes are employed, in accordance to previous prestigious meta-analysis papers (Stanley and Doucouliagos, 2015, 2017). More specifically, the first weighting scheme is the Repec impact factor of the academic paper. Secondly, the h-index of the academic paper is employed. Thirdly, the citations for this paper that other academic studies have realized, serve as a weighting scheme. The number of these citations is derived by Google Scholar. Finally, the references of other relevant papers that each study has employed and can be seen in its last pages, are used as a weighting factor.

It should be noted that the short-listed primary studies are about the United States of America, the United Kingdom, Japan, European countries or the Eurozone as a total. The data employed are about time periods starting from 1960 and reaching 2016. It is noteworthy that in the majority of primary studies, mre than one primary observation is extracted in each of these studies.

Table 4.1. Primary studies

	Study	Journal	Country studied	Number of estimates in Output meta-analysis	Number of estimates in Inflation meta-analysis	Rep_imp	h_index	cit_schl	ref_end
1	Baumeister and Benati (2010)	CB	Euro area, Japan, UK, USA	4	4	19.21	90	194	33
2	Belongia and Ireland (2012)	SJE	USA	1	2	11.81	60	13	40
3	Bluwstein and Canova (2016)	IJCB	Bulgaria, Czech Republic, Denmark, Hungary, Norway, Poland, Romania, Sweden, Switzerland	93	93	16.956	42	26	61
4	Bridges and Thomas (2012)	CB	UK	4	5	11.194	39	96	51
5	Dahlhaus et al. (2018)	JMCB	Canada, USA	4	4	6.141	31	11	26
6	Gambacorta et al. (2014)	JMCB	Canada, Euro area, Japan, Norway, Sweden, Switzerland, UK, USA	16	16	17.729	104	296	53
7	Kapetanios et al. (2012)	EJ	UK	4	4	28.499	138	226	51
8	Kucharcukova et al. (2016)	JPM	Czech Republic, Denmark, Hungary, Poland, Sweden, UK	7	7	5.473	38	30	55
9	Le et al. (2016)	JIFMIM	USA	1	1	6.528	33	7	39
10	Matsuki et al. (2015)	EL	Japan	1	1	6.239	76	2	8
11	Meinusch and Tillmann (2016)	JM	USA	3	3	5.446	38	32	24
12	Michaelis and Watzka (2017)	JIMF	Japan	37	37	16.298	81	7	30
13	Schenkelberg and Watzka (2013)	JIMF	Japan	6	6	16.298	81	74	58
14	Tillmann (2016)	JIMF	EMEs	11	-	16.298	81	29	34

| 15 | Weale and Wieladek (2016) | JME | UK, USA | 16 | 16 | 37.453 | 158 | 63 | 32 |
| 16 | Wu and Xia (2016) | JMCB | USA | 8 | 8 | 17.729 | 104 | 434 | 40 |

<u>Notes</u>: CB = Central Bank working paper, EJ = The Economic Journal, EL = Economics Letters, JIFMIM = Journal of International Financial Markets, Institutions and Money, JIMF = Journal of International Money and Finance, JM = Journal of Macroeconomics, JMCB = Journal of Money, Credit and Banking, JME = Journal of Monetary Economics, JPM = Journal of Policy Modeling, IJCB = International Journal of Central Banking, SJE = The Scandinavian Journal of Economics

4.3. Moderators and Methodology

The variables employed in order to detect the sources of variability of responses of output and prices, are seventeen in total. These variables are analytically presented in Table 4.2. Three of these variables have to do with study characteristics of the primary papers. One moderator is about the way by which non-conventional practices are expressed. Furthermore, three dummy variables serve for examining whether variability emerges because the United States of America, the United Kingdom or European countries are under scrutiny in primary studies. Furthermore, a variable exists that identifies in which quarter the maximum effect can be traced. Moreover, three dummies express different specifications as regards the Vector Autoregression methodology applied. It should be emphasized that four further dummies are employed in order to represent different identification procedures in impulse responses.

Furthermore, a moderator is used counting how many endogenous variables take part in the Vector Autoregression estimations. Intriguingly, a dummy expressing output in the form of output gap is employed when conducting meta-analysis in responses of output. When it comes to meta-analysis on responses of prices, the dummy of the price in levels is adopted.

Table 4.2 Acronyms and Descriptions of the explanatory variables

	Study characteristics
num_pag	The number of pages of each academic study investigated
Year_publ	The year of publication (2008 as a base)
num_obs	The logarithm of the number of observations used
	Type of unconventional monetary policy
QE_forw	= 1 if forward guidance is examined
	Regional dummies
USA	= 1 if the estimations are about the USA
UK	= 1 if the estimations are about the UK
European	= 1 if the estimations are about the Euro area or a European country
	Response variable
max_resp	The quarter where the highest response is observed
	VAR specifications
favar	= 1 if estimation is made by a factor-augmented VAR
tvpvar	= 1 if estimation is made by a Time-Varying Parameter VAR
qualvar	= 1 if estimation is made by a Qual VAR
	Identification of impulse responses
ir_chol	= 1 if Impulse responses are obtained by recursive identification (choleski).

ir_svar	= 1 if Impulse responses are obtained by non-recursive identification
ir_sign	= 1 if Impulse responses are obtained by employing sign restrictions.
ir_oth	= 1 if Impulse responses are obtained by other ways.
	Type of variables
end_variab	The number of endogenous variables included in VAR.
ea_gap	= 1 if Output gap as a measure of economic activity.
p_level	= 1 if the Prices level is used as a measure of prices

The summary statistics of variables about ouput estimations and prices estimations are presented in Table 4.3. It can be seen that the maximum impact, the short-run, the medium-run and long-run impacts exhibit higher values than the corresponsing variables about responses of prices. It could also be noted that the primary studies employed are lengthy and present a large number of primary observations on average.

Table 4.3. Summary Statistics about Output and Prices Responses

	Output						Prices					
	N	Min	Max	Mean	St.Dev.	Var.	N	Min	Max	Mean	St.Dev.	Var.
	Effects as dependent variables											
max_value	216	-0.27	7.6	0.46	0.84	0.71	207	-0.12	7.4	0.29	0.69	0.47
resp_4th	216	-0.86	5.8	0.19	0.63	0.4	207	-0.9	2.27	0.09	0.32	0.11
resp_8th	216	-0.87	7.3	0.25	0.8	0.64	207	-1.2	2.8	0.14	0.48	0.23
resp_16th	216	-0.45	4.2	0.2	0.5	0.25	207	-1.8	5.2	0.12	0.56	0.31
	Study characteristics											
num_pag	216	5	52	38.5	14.01	196.38	207	5	52	39.57	13.76	189.24
Year_publ	216	2	9	7.62	1.41	1.99	207	2	9	7.57	1.48	2.2
num_obs	216	14	219	51.4	48.54	2356.42	207	14	219	53.4	49.40	2440.7
	Type of unconventional monetary policy											
QE_forw	216	0	1	0.27	0.44	0.2	207	0	1	0.13	0.34	0.11
	Regional dummies											
USA	216	0	1	0.12	0.33	0.11	207	0	1	0.13	0.34	0.11
UK	216	0	1	0.09	0.29	0.08	207	0	1	0.1	0.3	0.09
European	216	0	1	0.50	0.50	0.25	207	0	1	0.52	0.5	0.25
	Response variable											
max_resp	216	1	50	9.16	9.71	94.24	207	0	96	11.41	14.31	204.63
	VAR specifications											
favar	216	0	1	0.12	0.32	0.10	207	0	1	0.06	0.23	0.06
tvpvar	216	0	1	0.29	0.45	0.21	207	0	1	0.2	0.4	0.16
qualvar	216	0	1	0.16	0.37	0.14	207	0	1	0.01	0.12	0.01
	Identification of impulse responses											
ir_chol	216	0	1	0.40	0.49	0.24	207	0	1	0.37	0.49	0.24
ir_svar	216	0	1	0.11	0.31	0.1	207	0	1	0.02	0.15	0.02
ir_sign	216	0	1	0.88	0.32	0.10	207	0	1	0.85	0.36	0.13
ir_oth	216	0	1	0.06	0.24	0.06	207	0	1	0.01	0.1	0.01

Type of variables												
end_variab	216	3	8	5.12	1.05	1.11	207	3	8	5.2	1.06	1.13
ea_gap (p_level for prices)	216	0	1	0.11	0.32	0.1	207	0	1	0.09	0.28	0.08
Valid N (listwise)	216						207					

The Vector Autoregression methodology employed in order to study heterogeneity among primary empirical estimations consists of equations in which every variable examined depends on its past values as well as on past values of other variables. The focus in this meta-analysis is made on the imformation derived by the responses through impulses of these VAR specifications, in order to detect how output and prices react to a QE shock.

The regressions in this meta-analysis examination take place according to the methodology that Stanley and Jarrell (1989) have indicated in their seminal paper. This methodology indicates that here the maximum impact and the short-run, medium-run and long-run impacts take the role of the dependent variable, alternatively. Moreover, estimations under four different weighting specifications take place, and the form of the weighting is the inverse of the square of the weighting factor. It should be noted that the values for different weights have been extracted from the relevant sources on 12 February, 2018.

4.4. Empirical Findings
4.4.1. Size and sign effects on output responses to QE shocks

Econometric estimations by OLS and WLS have provided the following empirical estimates as indicated in Tables 4.4a, 4.4b, 4.4c and 4.4d for output. First, we analyze the results of estimations about how the positive unconventional monetary shock affects output responses.

In Table 4.4a, findings about the way that moderators influence the maximum impact on output reveal that apart from the constant term, they are the number of pages of the academic paper, the FAVAR methodology and the dummy about Cholesky impulse responses that are positive and statistically significant. On the other hand, the dummy about whether we refer to European countries as well as that about the impulse responses being based on sign restrictions are found to exert a negative and statistically significant effect.

Table 4.4a. Results on Output (Maximum Value)

	OLS	Weighted Least Squares			
	Max value Rob. S.E.	Max value Rep Imp	Max value h- index	Max value cit schl	Max value Ref end
(Intercept)	3.4667	3.0305	3.6428	3.8446	3.9105

118

	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
num_pag	0.0315	0.0265	0.0376	0.0393	0.0329
	(0.018)**	(0.092)*	(0.027)**	(0.009)***	(0.008)***
Year_publ	-0.0638	0.0355	-0.0818	-0.0629	-0.0645
	(0.293)	(0.569)	(0.313)	(0.552)	(0.304)
num_obs	-0.0007	0.0005	-0.0010	-0.0020	-0.0008
	(0.442)	(0.519)	(0.326)	(0.148)	(0.426)
QE_forw	0.2236	0.2522	0.2263	0.3455	0.2235
	(0.179)	(0.135)	(0.222)	(0.098)	(0.261)
USA	-0.1545	0.0020	-0.1921	-0.2660	-0.2282
	(0.608)	(0.995)	(0.592)	(0.591)	(0.501)
UK	-0.0502	0.3714	-0.2099	-0.3115	-0.0767
	(0.845)	(0.225)	(0.528)	(0.414)	(0.781)
European	-0.9176	-0.6270	-1.1335	-1.2588	-0.9749
	(0.000)***	(0.007)**	(0.000)***	(0.000)***	(0.000)***
max_resp	-0.0035	-0.0036	-0.0056	-0.0007	-0.0019
	(0.499)	(0.476)	(0.314)	(0.873)	(0.743)
favar	0.8404	1.3180	0.9291	1.2766	1.1122
	(0.026)**	(0.007)***	(0.017)**	(0.004)***	(0.013)**
tvpvar	0.1084	0.3254	0.1044	0.1496	0.0910
	(0.367)	(0.025)**	(0.414)	(0.309)	(0.496)
qualvar	0.0336	0.1350	0.0009	0.0141	0.0266
	(0.751)	(0.249)	(0.994)	(0.906)	(0.816)
ir_chol	-0.6017	-0.9267	-0.5666	-0.6445	-0.6942
	(0.034)**	(0.000)***	(0.091)*	(0.122)	(0.036)**
ir_svar	0.2306	0.7100	0.2933	0.6566	0.3055
	(0.568)	(0.115)	(0.582)	(0.363)	(0.519)
ir_sign	-1.2586	-1.0764	-1.4108	-1.7582	-1.3932
	(0.004)***	(0.017)**	(0.004)***	(0.001)***	(0.004)***
ir_oth	-0.6892	-0.9802	-0.8061	-0.9913	-0.8289
	(0.064)*	(0.018)**	(0.057)*	(0.014)**	(0.027)**
end_variab	-0.3886	-0.5214	-0.3836	-0.3895	-0.4502
	(0.067)*	(0.013)**	(0.128)	(0.065)*	(0.034)**
ea_gap	0.1807	0.2495	0.1969	0.3553	0.2286
	(0.222)	(0.110)	(0.224)	(0.059)*	(0.184)
R-squared	*0.3965*	*0.5042*	*0.4625*	*0.5398*	*0.4448*

Note: P-values in parentheses. Statistical significance at the 1%, 5% and 10% level is denoted by ´***´, ´**´ and ´*´ respectively.

Moreover, estimations regarding the 4th quarter impact indicate that the FAVAR methodology affects this in a positive and significant manner. Nevertheless, more variables such as the dummy for European countries, the dummy for the Qual-VAR methodology, the dummy for impulse responses with sign restrictions and the dummy for impulse responses with another specification (neither recursive, nor non-recursive nor with sign restrictions) exert a negative and statistically significant effect.

Table 4.4b. Results on Output (4th quarter)

	OLS	Weighted Least Squares			
	Resp 4th Rob. S.E.	**Resp 4th Rep Imp**	**Resp 4th h-index**	**Resp 4th cit schl**	**Resp 4th Ref end**
(Intercept)	1.0842	0.9061	1.2621	1.5387	1.4259
	(0.148)	(0.110)	(0.105)	(0.062)*	(0.084)*
num_pag	0.0125	0.0067	0.0196	0.0211	0.0129

119

	(0.246)	(0.575)	(0.160)	(0.069)*	(0.184)
Year_publ	0.0373	0.1027	0.0371	0.0663	0.0401
	(0.394)	(0.029)**	(0.542)	(0.394)	(0.375)
num_obs	0.00004	0.0008	-0.0003	-0.0012	0.00005
	(0.933)	(0.139)	(0.687)	(0.226)	(0.935)
QE_forw	0.0980	0.1392	0.1177	0.1987	0.0941
	(0.454)	(0.292)	(0.421)	(0.236)	(0.546)
USA	0.0812	0.0650	0.0309	-0.0489	0.0026
	(0.740)	(0.754)	(0.914)	(0.902)	(0.992)
UK	0.1337	0.2440	0.0274	-0.1951	0.0591
	(0.525)	(0.171)	(0.920)	(0.518)	(0.792)
European	-0.4695	-0.2890	-0.6392	-0.7578	-0.5217
	(0.006)***	(0.073)*	(0.002)***	(0.003)***	(0.004)***
max_resp	-0.0097	-0.0092	-0.0105	-0.0034	-0.0088
	(0.069)*	(0.075)*	(0.064)*	(0.379)	(0.121)
favar	0.6069	0.9495	0.6786	0.9011	0.7908
	(0.042)**	(0.009)***	(0.027)**	(0.009)***	(0.026)**
tvpvar	0.1943	0.3650	0.1968	0.2192	0.1874
	(0.023)**	(0.000)***	(0.028)**	(0.036)**	(0.049)**
qualvar	-0.1770	-0.1224	-0.1842	-0.1883	-0.1882
	(0.013)**	(0.123)	(0.018)**	(0.022)**	(0.019)**
ir_chol	-0.1425	-0.4164	-0.1693	-0.3252	-0.2417
	(0.542)	(0.051)*	(0.533)	(0.321)	(0.376)
ir_svar	0.2473	0.6170	0.3690	0.6837	0.3340
	(0.456)	(0.098)*	(0.398)	(0.257)	(0.400)
ir_sign	-0.8868	-0.8082	-1.0417	-1.3922	-0.9954
	(0.018)**	(0.031)**	(0.011)**	(0.003)***	(0.017)**
ir_oth	-0.7896	-0.9236	-0.8005	-0.8408	-0.8520
	(0.003)***	(0.003)***	(0.009)***	(0.003)***	(0.001)***
end_variab	-0.1245	-0.2011	-0,1602	-0,1859651	-0,16701
	(0.465)	(0.223)	(0.433)	(0.263)	(0.329)
ea_gap	0.1074	0.1747	0.1346	0.2017	0.1198
	(0.332)	(0.131)	(0.272)	(0.155)	(0.355)
R-squared	*0.3842*	*0.3666*	*0.4497*	*0.5169*	*0.4204*

Note: P-values in parentheses. Statistical significance at the 1%, 5% and 10% level is denoted by ´***´, ´**´ and ´*´ respectively.

When it comes to the examination of impacts at the 8th quarter of output responses, a positive and statistically significant nexus with the FAVAR dummy is traced in each specification. Interestingly, the European dummy, the dummy about other specification in impulse responses and the number of endogenous variables are negatively connected to the 8th quarter response in a significant way.

Table 4.4c. Results on Output (8th quarter)

	OLS	Weighted Least Squares			
	Resp 8th Rob. S.E.	Resp 8th Rep Imp	Resp 8th h-index	Resp 8th cit schl	Resp 8th Ref end
(Intercept)	1.6564	1.4990	2.0165	2.6664	2.1494
	(0.109)	(0.054)*	(0.058)*	(0.009)***	(0.049)**
num_pag	0.0139	0.0011	0.0244	0.0296	0.0154
	(0.321)	(0.941)	(0.170)	(0.044)**	(0.221)
Year_publ	0.0259	0.0983	0.0174	0.0405	0.0287
	(0.651)	(0.099)*	(0.827)	(0.699)	(0.629)
num_obs	-0.0007	0.0002	-0.0012	-0.0025	-0.0007

120

	(0.462)	(0.819)	(0.269)	(0.099)	(0.487)
QE_forw	0.1790	0.2515	0.2036	0.3340	0.1778
	(0.292)	(0.147)	(0.276)	(0.101)	(0.376)
USA	-0.1061	-0.1685	-0.1819	-0.2934	-0.2161
	(0.741)	(0.547)	(0.625)	(0.546)	(0.542)
UK	0.0391	-0.0359	-0.1334	-0.3648	-0.0368
	(0.883)	(0.880)	(0.699)	(0.328)	(0.897)
European	-0.6693	-0.3622	-0.9089	-1.1119	-0.7485
	(0.002)***	(0.095)*	(0.000)***	(0.000)***	(0.001)***
max_resp	-0.0075	-0.0048	-0.0069	-0.0004	-0.0066
	(0.296)	(0.493)	(0.373)	(0.934)	(0.389)
favar	0.7984	1.2504	0.8914	1.2364	1.0792
	(0.042)**	(0.009)***	(0.024)**	(0.004)***	(0.019)**
tvpvar	0.0898	0.3440	0.0848	0.1276	0.0609
	(0.399)	(0.015)**	(0.476)	(0.346)	(0.620)
qualvar	-0.1549	-0.1396	-0.1744	-0.1453	-0.1693
	(0.105)	(0.194)	(0.097)*	(0.191)	(0.128)
ir_chol	-0.1722	-0.5253	-0.2066	-0.4351	-0.2931
	(0.561)	(0.053)	(0.547)	(0.291)	(0.391)
ir_svar	0.2007	0.6937	0.3170	0.6631	0.2969
	(0.633)	(0.139)	(0.564)	(0.366)	(0.549)
ir_sign	-1.0981	-1.0366	-1.3446	-1.8513	-1.2432
	(0.024)**	(0.033)**	(0.009)***	(0.001)***	(0.019)**
ir_oth	-0.9419	-1.1249	-0.9636	-1.1050	-1.0684
	(0.008)***	(0.005)***	(0.015)**	(0.003)***	(0.002)***
end_variab	-0.1451	-0.2007	-0.2027	-0.2782	-0.2138
	(0.511)	(0.342)	(0.434)	(0.166)	(0.326)
ea_gap	0.1089	0.2106	0.1371	0.2741	0.1412
	(0.425)	(0.142)	(0.363)	(0.108)	(0.383)
R-squared	*0.347*	*0.315*	*0.4287*	*0.5332*	*0.3972*

Note: P-values in parentheses. Statistical significance at the 1%, 5% and 10% level is denoted by ´***´, ´**´ and ´*´ respectively.

Results about the impact on the 16th quarter of output impulse responses also indicate that the FAVAR methodology has a positive impact throughout all the specifications. Furthermore, the dummy about unconventional practices being expressed as forward guidance is positive and statistically significant at the WLS specification based on the Repec impact factor. The same is valid when the Google Scholar citations are used as a weighting scheme. The year of publication variable is positive and significant only under the weighting based on Repec impact factor. This is in contrast to findings about the dummies referring to European countries, impulse responses with sign restrictions, and other specification in impulse responses, as they are all found to negatively influence the 16th quarter response in a statistically significant manner.

Table 4.4d. Results on Output (16th quarter)

	OLS	Weighted Least Squares			
	Resp 16th Rob. S.E.	Resp 16th Rep Imp	Resp 16th h-index	Resp 16th cit schl	Resp 16th Ref end
(Intercept)	0.7770	0.8293	0.9028	1.1771	1.0134
	(0.186)	(0.065)*	(0.134)	(0.043)**	(0.100)
num_pag	0.0046	-0.0033	0.0105	0.0152	0.0072
	(0.577)	(0.691)	(0.299)	(0.064)*	(0.316)

Year_publ	0.0508	0.0696	0.0452	0.0672	0.0567
	(0.142)	(0.047)**	(0.315)	(0.241)	(0.104)
num_obs	-0.00004	0.0003	-0.0003	-0.0009	-0.00003
	(0.937)	(0.534)	(0.626)	(0.270)	(0.957)
QE_forw	0.1567	0.2318	0.1549	0.2240	0,1742
	(0.093)*	(0.019)**	(0.117)	(0.038)**	(0.114)
USA	-0.2084	-0.3555	-0.2658	-0.2597	-0.2383
	(0.272)	(0.011)**	(0.211)	(0.306)	(0.232)
UK	-0.0181	-0.0537	-0,0883	-01389	-0.0205
	(0.922)	(0.689)	(0.695)	(0.564)	(0.915)
European	-0.5342	-0.3302	-0.6714	-0.7721	-0.5715
	(0.000)***	(0.014)**	(0.000)***	(0.000)***	(0.000)***
max_resp	0.0006	0.0024	0.0016	0.0052	0.0016
	(0.890)	(0.583)	(0.748)	(0.098)	(0.751)
favar	0.4419	0.7003	0.4846	0.6848	0.5971
	(0.036)**	(0.005)***	(0.022)**	(0.003)***	(0.016)**
tvpvar	0.0858	0.2391	0.0675	0.0749	0.0675
	(0.258)	(0.013)**	(0.420)	(0.366)	(0.411)
qualvar	-0.1045	-0.1273	-0.1100	-0.0610	-0.1048
	(0.111)	(0.073)*	(0.104)	(0.351)	(0.151)
ir_chol	-0.2523	-0.3968	-0.2517	-0.3659	-0.3149
	(0.133)	(0.007)***	(0.187)	(0.099)*	(0.099)*
ir_svar	0.3569	0.5806	0.4223	0.6367	0.4278
	(0.134)	(0.029)**	(0.163)	(0.109)	(0.120)
ir_sign	-0.6745	-0.6704	-0.8004	-1.0152	-0.7394
	(0.015)**	(0.014)**	(0.006)***	(0.001)***	(0.013)**
ir_oth	-0.5647	-0.6485	-0.5801	-0.7541	-0.6799
	(0.010)**	(0.005)***	(0.012)**	(0.000)***	(0.001)***
end_variab	-0.0515	-0.0701	-0.0710	-0.1424	-0.1103
	(0.683)	(0.542)	(0.622)	(0.187)	(0.363)
ea_gap	0.1104	0.1743	0.1097	0.1982	0.1480
	(0.152)	(0.024)**	(0.192)	(0.041)**	(0.113)
R-squared	*0.37*	*0.4031*	*0.4557*	*0.5282*	*0.3981*

Note: P-values in parentheses. Statistical significance at the 1%, 5% and 10% level is denoted by ´***´, ´**´ and ´*´ respectively.

4.4.2. Size and sign effects on prices responses to QE shocks

When it comes to the effect of an unconventional monetary policy shock to prices, the results are shown in Tables 4.5a, 4.5b, 4.5c and 4.5d. Estimations about the impact that an unconventional monetary policy shock has on prices indicate that heterogeneity exists due to a number of statistically significant moderators.

To be more precise, apart from the intercept, the FAVAR methodology and the impulse responses with sign restrictions are positive and significant across OLS and all WLS estimations. Furthermore, four out of five specifications provide evidence of a positive link between the TVP-VAR methodology and prices as well as between the number of observations and prices. Interestingly, only three out of five specifications in the case of the non-recursive impulse responses indicate such a linkage, whereas weaker evidence exists for a positive nexus of the USA, the UK and the year of publication to prices. On the other hand, the recursive identification in impulse responses is found to exert a negative effect in all five specifications.

Table 4.5a. Results on Prices (Maximum Value)

	OLS	Weighted Least Squares			
	Max value Rob. S.E.	Max value Rep Imp	Max value h-index	Max value cit schl	Max value Ref end
(Intercept)	2.2959	2.1233	2.2218	2.0147	2.3042
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
num_pag	-0, .02	-0.0048	-0.0196	-0.0345	-0.0187
	(0.467)	(0.759)	(0.283)	(0.061)	(0.284)
Year_publ	-0.0055	-0.0072	-0.0142	-0.0455	-0.0143
	(0.841)	(0.766)	(0.587)	(0.042)**	(0.612)
num_obs	-0.0013	-0.0015	-0.0015	-0.0022	-0.0013
	(0.015)**	(0.014)**	(0.010)**	(0.000)***	(0.011)**
QE_forw	-0.4837	-0.4878	-0.7022	-0.6995	-0.5894
	(0.409)	(0.3079)	(0.256)	(0.289)	(0.330)
USA	0.5249	0.5219	0.6869	0.6792	0.5587
	(0.120)	(0.011)**	(0.075)*	(0.145)	(0.124)
UK	0.4486	0.6812	0.5170	0.5865	0.4931
	(0.058)*	(0.001)***	(0.046)**	(0.098)*	(0.075)*
European	0.2878	0.1289	0.3766	0.4896	0.3418
	(0.106)	(0.323)	(0.069)*	(0.049)**	(0.087)*
max_resp	0.0028	0.0028	0.0038	0.0006	0.0025
	(0.538)	(0.576)	(0.511)	(0.879)	(0.562)
favar	1.1217	0.9741	1.2912	1.3603	1.1965
	(0.042)**	(0.037)**	(0.015)**	(0.009)***	(0.029)**
tvpvar	0.5066	0.4719	0.6224	0.9509	0.6052
	(0.038)**	(0.058)	(0.029)**	(0.002)***	(0.022)**
qualvar	0.0628	0.0561	0.0107	-0.4481	-0.0136
	(0.822)	(0.839)	(0.970)	(0.061)*	(0.961)
ir_chol	-0.8795	-0.8047	-0.9266	-0.8948	-0.9207
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
ir_svar	2.7328	2.2344	2.5687	1.9802	2.5544
	(0.026)**	(0.07)*	(0.037)**	(0.1)	(0.038)**
ir_sign	-0.3043	-0.3979	-0.3029	-0.4403	-0.3343
	(0.010)**	(0.006)***	(0.010)**	(0.000)***	(0.008)***
ir_oth	-0.27	-0.2032	-0.5632	-0.636	-0.2343
	(0.673)	(0.751)	(0.352)	(0.27)	(0.707)
end_variab	-0.2363	-0.2230	-0.1586	0.0601	-0.1717
	(0.06)*	(0.097)*	(0.258)	(0.620)	(0.187)
p_level	-0.1030	-0.1143	-0.1082	-0.0986	-0.0994
	(0.174)	(0.174)	(0.175)	(0.042)**	(0.225)
R-squared	*0.4779*	*0.5917*	*0.4962*	*0.5596*	*0.4755*

Note: P-values in parentheses. Statistical significance at the 1%, 5% and 10% level is denoted by ´***´, ´**´ and ´*´ respectively.

Results about the effects on the 4th quarter of the price responses reveal that the USA is strongly and positively connected with prices. The FAVAR and TVP-VAR methodologies also positively affect prices at this quarter of the impulse responses. Although to a lesser extent, the recursive identifications of impulse responses impact prices in a negative manner. The same is found to be true for the number of endogenous variables.

Table 4.5b. Results on Prices (4th quarter)

	OLS	Weighted Least Squares			
	Resp 4th Rob. S.E.	Resp 4th Rep Imp	Resp 4th h-index	Resp 4th cit schl	Resp 4th Ref end
(Intercept)	1.6126	1.63	1.5649	1.5012	1.6467
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
num_pag	-0.0105	-0.0097	-0.0148	-0.0183	-0.0138
	(0.207)	(0.168)	(0.082)*	(0.026)**	(0.110)
Year_publ	0.0129	0.0013	0.0097	-0.003	0.0111
	(0.38)	(0.862)	(0.481)	(0.759)	(0.435)
num_obs	-0.0005	-0.0006	-0.0006	-0.0012	-0.0005
	(0.129)	(0.051)*	(0.062)*	(0.002)***	(0.113)
QE_forw	-0.4274	-0.4235	-0.5665	-0.5650	-0.5050
	(0.193)	(0.098)*	(0.081)*	(0.078)*	(0.124)
USA	0.493	0.5418	0.5916	0.6545	0.5258
	(0.014)**	(0.000)***	(0.004)***	(0.002)***	(0.009)***
UK	0.2456	0.1588	0.2841	0.3677	0.2733
	(0.077)*	(0.059)*	(0.048)**	(0.059)*	(0.088)*
European	0.1551	0.0743	0.1967	0.2363	0.1799
	(0.112)	(0.203)	(0.06)*	(0.028)**	(0.087)*
max_resp	-0.0002	0.00004	-0.0002	0.0007	-0.0003
	(0.881)	(0.973)	(0.893)	(0.571)	(0.844)
Favar	0.6201	0.4568	0.7282	0.7648	0.6722
	(0.034)**	(0.055)*	(0.006)***	(0.000)***	(0.018)**
Tvpvar	0.2408	0.2299	0.3097	0.4138	0.2812
	(0.049)**	(0.038)**	(0.019)**	(0.002)***	(0.029)**
Qualvar	0.0902	-0.0709	0.0717	-0.1196	0.0607
	(0.618)	(0.658)	(0.684)	(0.444)	(0.735)
ir_chol	-0.6265	-0.6028	-0.6548	-0.6423	-0.6588
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
ir_svar	0.5043	0.3345	0.4235	0.1351	0.4308
	(0.027)**	(0.074)*	(0.061)*	(0.517)	(0.066)*
ir_sign	-0.0915	-0.1629	-0.0811	-0.1598	-0.1098
	(0.296)	(0.052)*	(0.33)	(0.038)**	(0.229)
ir_oth	-0.617	-0.7191	-0.7495	-0.8306	-0.6576
	(0.045)*	(0.009)***	(0.009)***	(0.003)***	(0.031)**
end_variab	-0.2021	-0.1703	-0.1597	-0.0903	-0.1777
	(0.000)***	(0.001)***	(0.009)***	(0.069)*	(0.003)***
p_level	0.0026	0.0029	0.0071	0.0049	0.0028
	(0.933)	(0.934)	(0.817)	(0.865)	(0.932)
R-squared	*0.3873*	*0.5928*	*0.4014*	*0.493*	*0.4075*

Note: P-values in parentheses. Statistical significance at the 1%, 5% and 10% level is denoted by ´***´, ´**´ and ´*´ respectively.

Empirical findings about the 8th quarter indicate that the non-recursive identification in impulse responses exerts positive effects. The same does the number of observations but is statistically significant in fewer specifications. These findings are in contrast to the negative outcomes found about the recursive as well as other identifications in general in impulse responses.

Table 4.5c. Results on Prices (8th quarter)

	OLS	Weighted Least Squares			
	Resp 8th Rob. S.E.	Resp 8th Rep Imp	Resp 8th h-index	Resp 8th cit schl	Resp 8th Ref end
(Intercept)	1.4953	1.5238	1.4445	1.3098	1.5553
	(0.000)***	(0.000)***	(0.000)***	(0.002)**	(0.000)***
num_pag	-0.0267	-0.0307	-0.0333	-0.0405	-0.0323
	(0.06)*	(0.011)**	(0.031)**	(0.011)**	(0.032)**
Year_publ	0.0452	0.0173	0.0382	0.0072	0.0383
	(0.073)*	(0.246)	(0.104)	(0.68)	(0.125)
num_obs	-0.0009	-0.0011	-0.0011	-0.002	-0.0009
	(0.092)*	(0.039)**	(0.045)**	(0.002)***	(0.074)*
QE_forw	-0.6999	-0.7523	-0.9063	-0.8253	-0.7995
	(0.190)	(0.068)*	(0.103)	(0.158)	(0.144)
USA	0.5303	0.7371	0.6685	0.6549	0.5576
	(0.088)*	(0.000)***	(0.053)*	(0.113)	(0.090)*
UK	0.2972	0.1516	0.3446	0.4179	0.3283
	(0.161)	(0.315)	(0.131)	(0.194)	(0.185)
European	0.2164	0.2321	0.2737	0.3132	0.261
	(0.185)	(0.027)**	(0.144)	(0.157)	(0.152)
max_resp	0.0007	0.0014	0.0009	0.0016	0.0008
	(0.746)	(0.558)	(0.702)	(0.353)	(0.749)
favar	0.8409	0.6060	1.0071	1.0362	0.9191
	(0.104)	(0.133)	(0.040)**	(0.023)**	(0.072)*
tvpvar	0.2443	0.3286	0.3444	0.5462	0.3163
	(0.232)	(0.088)*	(0.139)	(0.031)**	(0.156)
qualvar	-0.2956	-0.6646	-0.3391	-0.6722	-0.3599
	(0.317)	(0.007)***	(0.249)	(0.004)***	(0.222)
ir_chol	-0.703	-0.6723	-0.7453	-0.7075	-0.7482
	(0.001)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
ir_svar	1.7927	1.5685	1.6537	1.0962	1.6532
	(0.001)***	(0.003)***	(0.003)***	(0.038)**	(0.004)***
ir_sign	-0.1849	-0.3015	-0.1835	-0.3047	-0.224
	(0.174)	(0.028)**	(0.158)	(0.008)***	(0.12)
ir_oth	-1.4843	-1.7443	-1.7343	-1.7679	-1.4927
	(0.008)***	(0.000)***	(0.001)***	(0.000)***	(0.006)***
end_variab	-0.0704	0.0159	-0.0024	0.1459	-0.023
	(0.528)	(0.875)	(0.984)	(0.162)	(0.842)
p_level	-0.1092	-0.1214	-0.117	-0.0731	-0.1131
	(0.125)	(0.121)	(0.125)	(0.102)	(0.138)
R-squared	*0.4684*	*0.503*	*0.5213*	*0.525*	*0.4552*

Note: P-values in parentheses. Statistical significance at the 1%, 5% and 10% level is denoted by ´***´, ´**´ and ´*´ respectively.

When estimating effects at the 16th quarter, the non-recursive identification in impulse responses is found to be a positive factor, whereas the recursive a negative one. A robust negative nexus with prices is also detected for the dummy of other impulse response identifications. The same is valid but a lower level of statistical significance for the number of pages.

125

Table 4.5d. Results on Prices (16th quarter)

	OLS	Weighted Least Squares			
	Resp 16th Rob. S.E.	Resp 16th Rep Imp	Resp 16th h-index	Resp 16th cit schl	Resp 16th Ref end
(Intercept)	0.7891	0.8844	0.70041	0.4844	0.8015
	(0.191)	(0.118)	(0.266)	(0.494)	(0.213)
num_pag	-0.0341	-0.0335	-0.0427	-0.0583	-0.0422
	(0.052)*	(0.036)**	(0.030)**	(0.003)***	(0.024)**
Year_publ	0.0164	-0.0065	0.007	-0.0338	0.0012
	(0.621)	(0.771)	(0.823)	(0.148)	(0.973)
num_obs	-0.0008	-0.0009	-0.0011	-0.0019	-0.0009
	(0.223)	(0.17)	(0.132)	(0.017)**	(0.185)
QE_forw	-0.4853	-0.4941	-0.7249	-0.6752	-0.5740
	(0.448)	(0.328)	(0.28)	(0.339)	(0.385)
USA	0.2965	0.3419	0.4672	0.415	0.3082
	(0.418)	(0.117)	(0.278)	(0.453)	(0.445)
UK	0.203	0.1261	0.2794	0.3453	0.2254
	(0.407)	(0.379)	(0.309)	(0.393)	(0.441)
European	0.277	0.1854	0.3673	0.4965	0.3442
	(0.157)	(0.202)	(0.122)	(0.106)	(0.125)
max_resp	0.0036	0.0039	0.0047	0.0043	0.0035
	(0.312)	(0.309)	(0.283)	(0.094)*	(0.335)
favar	0.5258	0.3842	0.701	0.7887	0.6011
	(0.413)	(0.471)	(0.263)	(0.182)	(0.347)
tvpvar	0.367	0.4037	0.4918	0.8126	0.4908
	(0.168)	(0.125)	(0.114)	(0.015)**	(0.094)*
qualvar	-0.3868	-0.5228	-0.4515	-0.9357	-0.4887
	(0.297)	(0.051)*	(0.249)	(0.000)***	(0.185)
ir_chol	-0.5322	-0.5387	-0.5835	-0.5511	-0.5738
	(0.047)**	(0.012)**	(0.027)**	(0.027)**	(0.037)**
ir_svar	1.9676	1.705	1.7666	1.0726	1.7544
	(0.024)**	(0.044)**	(0.045)**	(0.191)	(0.045)**
ir_sign	-0.0514	-0.1347	-0.0546	-0.2237	-0.0863
	(0.681)	(0.338)	(0.668)	(0.153)	(0.52)
ir_oth	-1.7868	-1.9077	-2.1448	-2.2152	-1.6941
	(0.019)**	(0.008)***	(0.002)***	(0.000)***	(0.017)**
end_variab	0.109	0.1479	0.1985	0.4414	0.1924
	(0.522)	(0.333)	(0.29)	(0.004)***	(0.278)
p_level	0.0052	0.0088	-0.0008	-0.0048	0.0141
	(0.92)	(0.873)	(0.988)	(0.883)	(0.807)
R-squared	*0.4596*	*0.4835*	*0.4971*	*0.5413*	*0.4388*

Note: P-values in parentheses. Statistical significance at the 1%, 5% and 10% level is denoted by ´***´, ´**´ and ´*´ respectively.

4.4.3. Synopsis of our Findings

Overall, econometric estimations offer a reply about the intensity of the impact of shocks of non-conventional monetary policy on output and prices. This means that this meta-analysis has focused interest on how out of the ordinary QE practices influence the real economy. Estimation results denote that the factor-augmented specification (FAVAR) in Vector Autoregression methodologies spur an effect of positive sign and of high statistical significance in the short-, medium- and long-run as well as on the maximum value of output responses. Nevertheless, this impact is evident only in the short-run when the responses of prices are under scrutiny.

126

Furthermore, studying about European countries decreases the output response. The same holds for including sign-restrictions.

By strictly focusing on impacts on responses of prices, econometric estimations reveal that the FAVAR but also the Time-Varying Parameter VAR specification exerts an impact of a positive sign in the short-term period. Positive effects on responses of prices are also estimated concerning the number of observations included in our academic paper. Whatsoever, the recursive identification in impulse responses is found to exert a negative influence no matter whether the short-run, the medium-run, the long-run or the maximum effect are examined.

Econometric evidence supports that diverse VAR methodologies are crucial when investigating how non-conventional monetary action taking influences output and prices. Notably, a stronger impact of this characteristic is detected on output responses. It should also be noted that dummy variables representing whether practices in the USA, the UK or the Eurozone are examined, provide evidence of being important for investigating differences among studies. Interestingly, the European dummy variable is found to be more influential for responses of output, rather than those of prices. Moreover, the method of identifying impulse responses is revealed to negatively influence responses of both macroeconomic variables. Sign-restrictions decrease responses of output, whereas recursive identifications trigger impacts of a similar sign to responses of prices. Such findings prove useful for policymakers, academics and market practitioners as they cast light to the sources of heterogeneity among diverse results concerning the effectiveness of unconventionally easing monetary policies.

4.5. Conclusions

There has been an upcoming focus of academic attention on the effects that QE policies by major economies trigger on macroeconomic variables. This has led to an increasing number of econometric estimations in primary studies that reveal different empirical results. Intriguingly, this has resulted in a more vivid interest for examining sources of heterogeneity among outcomes.

This section of this thesis employed primary data from sixteen econometric academic papers and investigates which moderators are responsible for heterogeneity in outcomes when studying unconventional monetary policy effects on output responses. Separate estimations but with the same methodologies take place in order to study such effects on prices responses. The main advantage of undertaking a meta-regression analysis is that it provides a synthesis of all econometric results by being able to capture a wide array of observations and provide explanations about where differences in results come from.

The main findings of this meta-analysis as regards effects on output responses is that FAVAR methodology employed in primaty studies constitutes a positive factor, as it allows the inclusion of a large number of important factors when estimating effects in primary studies. Furthermore, the meta-analysis undertaken here

reveals that the dummy for European countries as well as identifications with sign-restrictions influence responses of output in a negative and statistically significant way. This could be attributed to the fact that European banks have not proven to be as efficient as expected regarding the transmission of unconventional monetary effects to the real economy.

When examining where differences in QE effects to prices responses come from, a positive short-run impact of FAVAR and Time-Varying Parameter VAR specifications are found. The significance of TVP-VAR methodologies could be attributed to the fast pace of alterations in economic environment during the crisis. Furthermore, Cholesky identification in impulse responses is found to be a negative determinant of responses of prices. It should be noted that the US, the UK and the European countries dummies are found to negatively affect the responses of prices but not in a lage extent.

Overall, it can be deduced that approximately a half or less of the moderators employed prove to be statistically significant. Thereby, not a large number of sources are found to be able to explain differences among primary empirical outcomes. The medium-run, when it comes to examination of responses of output, and the long-run, when investigating responses of prices, are found to present the lowest number of reliable moderators.

The outcome is that meta-analysis regarding QE effects on responses of output or prices is based on no more than seven explanatory variables. This can prove useful for policymakers, academics and market practitioners when examining the factors by which unconventional monetary policy can render effective for the real economy. Moreover, this provides feedback and a compass for useful future research.

References

Baumeister, C., & Benati, L. (2010). Unconventional monetary policy and the great recession - Estimating the impact of a compression in the yield spread at the zero lower bound (No. 1258). ECB Working Paper.

Belongia, M. T., & Ireland, P. N. (2012). Quantitative easing: Interest rates and money in the measurement of monetary policy. *The Scandinavian Journal of Economics, i*, *16*, 635-668.

Bhattarai, S., Eggertsson, G. B., & Gafarov, B. (2015). *Time Consistency and the Duration of Government Debt: A Signalling Theory of Quantitative Easing* (No. w21336). National Bureau of Economic Research.

Bluwstein, K., & Canova, F. (2016). Beggar-thy-neighbor? The international effects of ECB unconventional monetary policy measures. *International Journal of Central Banking*, *12*(3), 69-120.

Bridges, J., & Thomas, R. (2012). The impact of QE on the UK economy–some supportive monetarist arithmetic (No. 442). Bank of England.

Casiraghi, M., Gaiotti, E., Rodano, L., & Secchi, A. (2013). *The impact of unconventional monetary policy on the Italian economy during the sovereign debt crisis* (No. 203). Bank of Italy, Economic Research and International Relations Area.

Chen, H., Cúrdia, V., & Ferrero, A. (2012). The macroeconomic effects of large- scale asset purchase programmes. *The Economic Journal*, *122*(564).

Christensen, J. H., & Rudebusch, G. D. (2012). The response of interest rates to US and UK quantitative easing. *The Economic Journal*, 122(564), F385-F414.

Christensen, J., & Gillan, J. M. (2018, February). Does quantitative easing affect market liquidity?. Federal Reserve Bank of San Francisco, Working Paper 2013-26

Churm, R., Joyce, M., Kapetanios, G., & Theodoridis, K. (2015). Unconventional monetary policies and the macroeconomy: the impact of the United Kingdom's QE2 and Funding for Lending Scheme (No. 542). Bank of England.

d'Amico, S., English, W., López- Salido, D., & Nelson, E. (2012). The Federal Reserve's Large- scale Asset Purchase Programmes: Rationale and Effects. *The Economic Journal*, 122(564), F415-F446.

Dahlhaus, T., Hess, K., & Reza, A. (2018). International Transmission Channels of US Quantitative Easing: Evidence from Canada. *Journal of Money, Credit and Banking*, *50*(2-3), 545-563.

Darracq-Paries, M., & De Santis, R. A. (2015). A non-standard monetary policy shock: The ECB's 3-year LTROs and the shift in credit supply. *Journal of International Money and Finance*, 54, 1-34.

Gagnon, J., Raskin, M., Remache, J., & Sack, B. (2011). The financial market effects of the Federal Reserve's large-scale asset purchases. *International Journal of Central Banking*, 7(1), 3-43.

Gambacorta, L., Hofmann, B., & Peersman, G. (2014). The effectiveness of unconventional monetary policy at the zero lower bound: A cross- country analysis. *Journal of Money, Credit and Banking*, 46(4), 615-642.

Ioannidis, J., Stanley, T. D., & Doucouliagos, H. (2017). The power of bias in economics research. *The Economic Journal*, *127*(605).

Joyce, M. A., & Spaltro, M. (2014). Quantitative easing and bank lending: a panel data approach. Bank of England. Quarterly Bulletin, 54(3), 355.

Kagraoka, Y., & Moussa, Z. (2013). Quantitative easing, credibility and the time-varying dynamics of the term structure of interest rate in Japan. *Journal of International Financial Markets, Institutions and Money*, 25, 181-201.

Kapetanios, G., Mumtaz, H., Stevens, I., & Theodoridis, K. (2012). Assessing the economy- wide effects of quantitative easing. *The Economic Journal*, 122(564), F316-F347.

Kucharčuková, O. B., Claeys, P., & Vašíček, B. (2016). Spillover of the ECB's monetary policy outside the euro area: How different is conventional from unconventional policy? *Journal of Policy Modeling*, 38(2), 199-225.

Le, V. P. M., Meenagh, D., & Minford, P. (2016). Monetarism rides again? US monetary policy in a world of Quantitative Easing. *Journal of International Financial Markets, Institutions and Money*, 44, 85-102.

Lim, J. J., Mohapatra, S., & Stocker, M. (2014). Tinker, Taper, QE, Bye? The effect of quantitative easing on financial flows to developing countries. World Bank Policy Research Working Paper, (6820).

Lutz, C. (2015). The impact of conventional and unconventional monetary policy on investor sentiment. *Journal of Banking & Finance*, 61, 89-105.

Matsuki, T., Sugimoto, K., & Satoma, K. (2015). Effects of the Bank of Japan's current quantitative and qualitative easing. *Economics Letters*, 133, 112-116.

Meinusch, A., & Tillmann, P. (2016). The macroeconomic impact of unconventional monetary policy shocks. *Journal of Macroeconomics*, 47, 58-67.

Michaelis, H., & Watzka, S. (2017). Are there Differences in the Effectiveness of Quantitative Easing at the Zero-Lower-Bound in Japan over Time? *Journal of International Money and Finance*, Volume 70, February 2017, Pages 204-233.

Ridhwan, M. H. A. (2010). Meta-analysis on the asymmetric effects of output in a monetary union. *Bulletin of Monetary Economics and Banking*, *12*(2), 193-226.

Rogers, J. H., Scotti, C., & Wright, J. H. (2014). Evaluating asset-market effects of unconventional monetary policy: a multi-country review. *Economic Policy*, 29(80), 749-799.

Rusnák, M., Havranek, T., & Horváth, R. (2013). How to solve the price puzzle? A meta- analysis. *Journal of Money, Credit and Banking*, *45*(1), 37-70.

Stanley, T. D. (2001). Wheat from chaff: Meta-analysis as quantitative literature review. *Journal of Economic Perspectives*, *15*(3), 131-150.

Stanley, T. D., & Doucouliagos, H. (2012). *Meta-regression analysis in economics and business* (Vol. 5). Routledge, (Section 2.4.2.).

Stanley, T. D., & Doucouliagos, H. (2015). Neither fixed nor random: weighted least squares meta- analysis. *Statistics in medicine*, *34*(13), 2116-2127.

Stanley, T. D., & Doucouliagos, H. (2017). Neither fixed nor random: Weighted least squares meta- regression. *Research synthesis methods*, *8*(1), 19-42.

Stanley, T. D., & Jarrell, S. B. (1989). Meta- Regression analysis: A quantitative method of literature surveys. *Journal of Economic Surveys*, *3*(2), 161-170.

Stanley, T. D., Doucouliagos, H., Giles, M., Heckemeyer, J. H., Johnston, R. J., Laroche, P., & Rosenberger, R. S. (2013). Meta- analysis of economics research reporting guidelines. *Journal of Economic Surveys*, *27*(2), 390-394.

Swanson, E. T., & Williams, J. C. (2014). Measuring the effect of the zero lower bound on yields and exchange rates in the UK and Germany. *Journal of International Economics*, 92, S2-S21.

Tillmann, P. (2016). Unconventional monetary policy and the spillovers to emerging markets. *Journal of International Money and Finance*, *66*, 136-156.

Wang, L. (2016). Unconventional monetary policy and aggregate bank lending: Does financial structure matter?. Journal of Policy Modeling, 38(6), 1060-1077.

Weale, M., & Wieladek, T. (2016). What are the macroeconomic effects of asset purchases? *Journal of Monetary Economics*, 79, 81-93.

Wu, J. C., & Xia, F. D. (2016). Measuring the macroeconomic impact of monetary policy at the zero lower bound. *Journal of Money, Credit and Banking*, 48(2-3), 253-291.

Chapter 5

Empirical estimations about Effects of Unconventional Monetary Policy

5.1. Quantitative easing effects on commercial bank liability and government yields in UK: A threshold cointegration approach[3]

5.1.1. Introduction

There has been a proliferating bulk of academic papers about unconventional monetary policies since the 2008 Lehman Brothers collapse (a survey can be found at Joyce et al. 2012a,b). This has brought to the forefront the need of monetary authorities to get easier access to liquidity by ample provisions by central banks. This is also what renders interesting to study the linkage between the total assets that monetary authorities hold and government as well as commercial banks' liability yields. Such an investigation would probably prove beneficial for understanding the interconnectedness between the central bank, the government and financial markets by a non-linear estimation methodology that would help to better capture the fast evolution of the economic system.

When the monetary authorities in the United Kingdom purchase government bonds (gilts) their prices increase, thereby their yields decrease and lower term-premia and long-term rates in risky assets emerge. This boosts aggregate demand and so leads to higher income levels. The lowering of government bond yields improves conditions of assessing cheap credit in financial markets, thereby reduces risk premia. This provides a further spur to domestic demand. Nevertheless, such a fall in rates could come at the cost of higher leverage and risk-taking in the medium-term due to unconventional monetary easing policies (Borio and Zhu, 2012; Lambert and Ueda, 2014). As interest rates approach the Zero Lower Bound (ZLB), the banking institutions could keep on providing loans to unreliable customers and collateral requirements could loosen in order to facilitate the rolling-over of debt.

The strong nexus between the size and composition of the central bank's balance sheet and the interbank market rate is a characteristic of unconventional monetary policies (Brooke et al., 2000). More specifically, expectations about interbank rates are affected by government bonds as they are employed in the form of collateral.

There has been a significant volume of econometric academic papers that have employed a range of estimation specifications in order to measure the impacts of enlargement of the monetary authorities' balance sheet on government bond yields, such as Belke (2013). It should be noted that the larger is the central bank's balance

---

[3] A part of the results of this subsection has been published on a paper co-authored with Assoc. Prof. Stephanos Papadamou and Assist. Prof. Eleftherios Spyromitros, in the journal ´´International Economics and Economic Policy´´.

sheet, the more ample are liquidity provisions on the real economy, thereby the more positively influencing is the impact on output. Liquidity injections are found to have been effective through having an impact on bond yields (Joyce et al. 2015a,b), Christensen and Rudebusch, 2012; Breedon et al., 2012; Kapetanios et al., 2012). Furthermore, as Joyce et al. (2012a,b) argue, unconventional monetary policies in the form of Quantitative Easing (QE) prove to be effective via the portfolio rebalancing channel, by influencing the prices of assets and investment incentives. Moreover, QE is found to internationally affect yields, according to Belke et al. (2016).

Although it is evident that QE intends to decrease government and corporate bond yields and this is the reason why most relevant academic papers have focused on studying this, no study has employed non-linear estimation procedures up to now. The innovative character of this section is that it adopts a non-linear framework in order to better represent the linkage between a bond's intrinsic value and its yield, as well as the side-impacts of QE policy on financial variables. If one likes to adequately capture how yields behave as time passes during unconventional monetary policies, he should take into consideration possible tendencies for deviation from certain thresholds. Intriguingly, a large amount of hidden information could be revealed by assessing this threshold, also known as the Heaviside Indicator and by estimating the size effect of the extent of deviation and for how long this endures. Moreover, the statistical significance of such estimations should be taken into consideration. By adopting this methodology of Balke and Fomby (1997) and combining non-linear regression with cointegration procedures, we fill the gap in relevant bibliography. Adjustment towards long-run equilibrium in a non-linear way has been adopted for the first time from Enders and Granger (1998) and Enders and Siklos (2001).

The aim of estimations undertaken in this section is to take a quantum leap forward concerning the existing bibliography. This takes place by two manners. First, emphasis is attributed to the implicit nexus between Total Assets of the Bank of England and innovative yields of commercial banks in the interbank market in a medium-term and a long-term horizon. This serves in estimating how Quantitative Easing has an impact on liquidity drainage in the United Kingdom. Furthermore, examination of causality and reverse causality between Total Assets and each of the yields is realized, in order to test for feedback effects. Our empirical findings indicate the existence of a uni-directional causal nexus between Total Assets and the yields examined and evidence reveals non-linearities in every case.

The remainder of this chapter is as follows: a literature review is provided in Section 2, whereas the data employed are described in Section 3. Furthermore, Section 4 presents the methodology adopted and the econometric outcomes derived. Moreover, Section 5 concludes.

133

5.1.2. Literature Review

The nexus between QE and gilt yields can be attributed to four channels for transmission of monetary policy, according to McLaren et al. (2014). The first channel is based on preferred habitat and is called the local supply channel, where investors have preferences for specific bond maturities. A prerequisite in order for this channel to work is the assets to be substitutable between them. Thereby, the bond that the central bank purchases presents a higher price and a lower yield. This enables longer-term assets to enjoy a higher demand. This also affects bonds of similar maturities. The second channel by which unconventional monetary policies are transmitted is through the term premium. That means QE lowers the compensation required by investors in order to hold risky longer-term assets, meaning with higher duration risk which is often the case with corporate bonds. The Asset Purchase Facility leads to a lower amount required in order to bear this risk. This effect is stronger the longer is the maturity of bonds, thereby increasing the preference for such bonds. The third route by which non-conventional practices can be effective is the expectations channel, alternatively called as the ''signaling channel''. This is based on the short-term interest rate structure, as announcement of further easing policies by monetary authorities leads to altering investors' expectations. This lowers short-term yields, which are a component of long-term yields. Finally, QE efficacy is also supported by the liquidity channel. According to the latter, large liquidity infusions by the central bank result in decreases in liquidity premia. Arguable, this fuels the better functioning of markets.

A large breed of relevant bibliography has analyzed the effects of unconventional monetary policies in the UK. Joyce et al. (2011a, 2012a,b) and Chadha and Waters (2014) by employing event-study methodologies, support that the Bank of England's QE measures medium-term to long-term yields negatively[4]. Moreover, McLaren et al. (2014) argue that the local supply channel is what renders Quantitative Easing effective, as can be seen by altering the auction maturity sectors.

By adopting a non-complex term structure model, Breedon et al. (2012) use a Kalman filter in order to find estimations about yields of different maturities during unconventional periods in the UK. Alterations from the actual values of yields are attributed to substitution via portfolio rebalancing. By their own perspective, Christensen and Rudebusch (2012) separate unconventional impacts into shifts in expectations and changes in term premiums. They provide evidence that lower-term

---

[4] For the Eurozone's unconventional monetary practices, see Cihak*et al.* (2009), Lenza *et al.* (2010), Fahr *et al.* (2011), Peersman (2011), Giannone et al. (2011), Abbassi and Linzert (2012), Darracq-Paries and De Santis (2015) among others.For the QE effects in Japan see Honda *et al.* (2013), Lam (2011), Berkmen (2012), Ueda (2012) and Shibamoto and Tachibama (2013). For QE implementation in US and other countries see Chen *et al.* (2012), Gagnon *et al.* (2011), Krishnamurthy and Vissing-Jorgensen (2011), Carpenter *et al.* (2013), D' Amico and King (2013) among others.

yields drive down also long-term yields, which are strongly affected. It should also be noted that Joyce and Tong (2012) provide evidence that the time length required for Quantitative Easing to have an impact on UK government bond yields was not stable.

Notably, there also exists academic literature on how unconventional monetary measures have affected macroeconomic variables in the UK. Cecioni et al. (2011) and Joyce et al. (2011b) argue that non-conventional action taking indeed influences the real economy. This happens through higher loan provisions that ample liquidity infusion leads to. These higher levels of credit boost spending and nominal income and create an upwards tendency for asset prices and the general price level, according to Lyonnet and Werner (2012). Furthermore, Kenourgios et al. (2015b) identify alterations in currency values due to unconventional practices through the signaling channel.

By employing three alternative Vector Autoregressive specifications, Kapetanios et al. (2012) argue for a powerful preventive effect of Quantitative Easing. Furthermore, it is found that through portfolio rebalancing, QE has managed to spur GDP and inflation by levels higher than 1%.

An alternative approach to measuring efficacy of unconventional monetary practices is the investigation of effects in volatility. More specifically, Steeley and Matyushkin (2015) adopted a Generalized Autoregressive Conditional Heteroskedasticity model and provide evidence that the expectations channel has led to higher volatility on gilt yields. Moreover, transmission of volatility in currency values during QE events is detected by Kenourgios et al. (2015a).

5.1.3. Data and Descriptive Statistics

The estimations in this chapter are conducted by high-frequency (weekly) data, that is the highest frequency available for purchases by monetary authorities. It is believed that they fit better with the purposes of our estimations, as the highly-sophisticated economy of the UK can be highly volatile concerning asset prices due to QE announcements[5]. It should be noted that the first round of Quantitative Easing (which was initiated on March 2009) has focused interest on the 5-10 year and the 10-25 year maturities, whereas even 3-year maturities were later also included (Joyce and Tong, 2012; Joyce et al. (2012a,b)). Notably, in subsequent rounds (QE2 and QE3), the time horizons of 3-7 years, 7-15 years or 15 years and longer prevailed. In this chapter, we select to study the 5-year yields which represent the medium-run horizon and the 10-year yields, representing the long-run. Intriguingly, government bond yields (GB5Y, GB10Y) as well as commercial bank liability yields (BLC5, BLC10) are examined in order to investigate QE impacts on the government but also at the private interbank sector. It should be emphasized that the bank lending yield is highly innovative, as sterling instruments of the money market are employed that settle on

---

[5] Data are extracted from the official website of the Bank of England.

LIBOR and make ''synthetic interbank bonds''. Notably, these constitute a benchmark index that takes into consideration expectations as regards fund provisions between banking institutions in the interbank market. This index is constructed based on Brooks et al. (2000).

The selection of the 5-year and 10-year maturities in order for estimations to be conducted, has been based on these being the principal maturities on which unconventional asset purchases have been based. This happened due to their high levels of liquidity and thereby easiness in altering the volumes of the respective bonds. The main transmission channels through which QE is expected to be effective are the portfolio rebalancing as well as the bank lending channel.

The data employed for econometric estimations here start from May 22nd, 2006, and reach September 26th, 2014. This serves the purpose of assessing QE impacts in all the three stages and derive safer results and conclusions.

It should be noted that QE was triggered on March 5th, 2009, when QE1 was launched by 75 billion sterlings purchased (Fawley and Neely, 2013) but the amount had become 200 billion sterlings when QE1 ended. Furthermore, QE2, which started on October 6th, 2011, injected a further amount of 75 billion sterlings in the UK economy. It should be noted that QE3, which was launched on July 5th, 2012, terminated with a total amount of 375 billion sterlings as the value of total QE purchases.

Table 5.1.1. Descriptive Statistics

Country	Total_Assets	BLC5	BLC10	GB5Y	GB10Y
Mean	245681.9	3.1305	3.6791	2.7381	3.5273
Maximum	415099.0	6.1551	5.8198	5.5854	5.3872
Minimum	76991.00	0.9300	1.8722	0.5438	1.6001
Std. Dev.	119717.0	1.5867	1.1353	1.4812	1.0338
Skewness	-0.019374	0.4227	0.0984	0.3982	-0.1564
Kurtosis	1.693434	1.7792	1.7584	1.8359	1.8225
Jarque-Bera	31.04	40.06	28.71	36.15	26.96
Probability	0.00	0.00	0.00	0.00	0.00
Observations	436	436	436	436	436

In Table 5.1.1., summary statistics concerning returns of Total Assets and the GB5Y, GB10Y, BLC5 and BLC10 are presented. The values of skewness and kyrtosis as well as the Jarque-Bera statistic provide credence to non-normality, due to rejection of the relevant hypothesis. This indicates that a non-linear framework is more suitable. The statistics reveal that BLC5 and GB5Y are the more volatile yields, thereby long-term yields are seen to inhibit higher certainty levels than short-term ones.
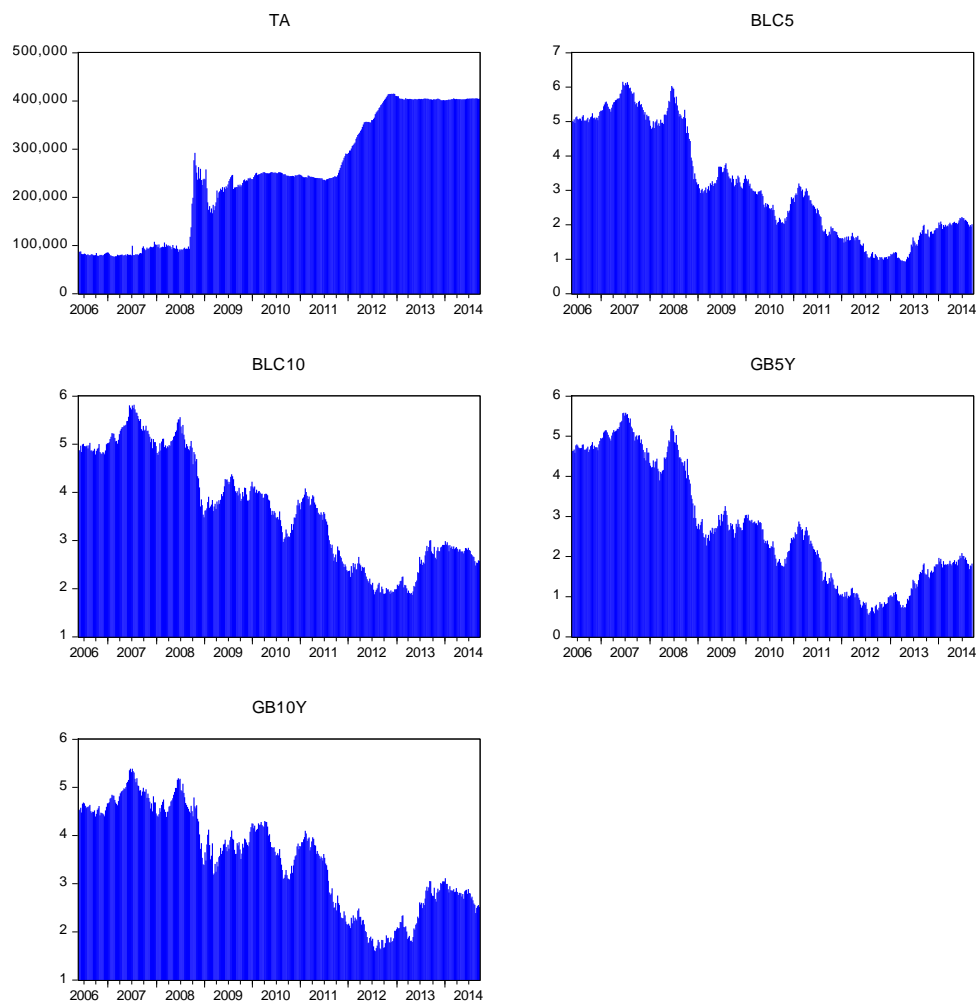
Figure 5.1.1. Plot with Spikes. Total Assets, BLC5, BLC10, GB5Y, GB10Y

It can be easily observed in Figure 5.1.1., that Total Assets follow an increasing route during Quantitative Easing, whereas all yields under scrutiny are found to decrease.

5.1.4. Empirical Analysis

First of all, in order to proceed to threshold cointegration estimations, the stationarity of the variables adopted has to be tested. This is the reason why the Augmented Dickey Fuller, ADF (Dickey and Fuller, 1981), the KPSS (Kwiatkowski et al., 1992) and NP (Ng and Perron, 2001) unit root tests are conducted. It should be emphasized that the appropriate time length is determined by the modified-Akaike information criterion for the ADF and NP, according to Ng and Perron (2001), whereas the Bartlett kernel is employed for estimating the optimal bandwidth in the KPSS criterion. In Table 5.1.2 it is revealed that the Total Assets but also each of the four yields investigated exhibit non-stationarity in levels, due to rejection of the null stationarity hypothesis. On the contrary, stationarity is achieved for every variable by first differencing.

137

Table 5.1.2. Unit Root tests

		Total_Assets		BLC5		BLC10		GB5Y		GB10Y	
		Level	Differences	Level	Differences	Level	Differences	Level	Differences	Level	Differences
ADF test	Exogenous[a]:	Constant, Linear Trend	None	Constant Linear trend	None	Constant Linear trend	None	Constant, Linear trend	None	Constant, Linear Trend	None
	Lag Length[b]:	15	17	16	15	8	3	8	1	1	0
	T-Stat.:	-2.48	-6.05	-2.24	-4.20	-2.60	-8.98	-1.94	-14.46	-2.11	-22.62
	Test critical values[c]: 5% level	-3.42	-1.94	-3.42	-1.94	-3.42	-1.94	-3.42	-1.94	-3.42	-1.94
KPSS test	Exogenous[a]:	Constant, Linear Trend	Constant	Constant, Linear Trend	Constant	Constant, Linear Trend	Constant	Constant, Linear Trend	Constant	Constant, Linear Trend	Constant
	Bandwidth[d]:	16	5	16	5	16	5	16	5	16	1
	LM-Stat.	0.09	0.05	0.35	0.17	0.20	0.09	0.35	0.17	0.17	0.07
	symptotic critical values[e]: 5% lev	0.15	0.46	0.15	0.46	0.15	0.46	0.15	0.46	0.15	0.46
Ng-Perron test	Exogenous[a]:	Constant	Constant	Constant	Constant	Constant	Constant	Constant	Constant	Constant	Constant
	Bandwidth[d]:	6	4	10	10	5	7	5	7	2	3
	MZt	0.84	-11.68	-0.01	-13.29	0.06	-11.63	0.09	-11.65	-0.28	-10.33
	symptotic critical values[f]: 5% lev	-1.98	-1.98	-1.98	-1.98	-1.98	-1.98	-1.98	-1.98	-1.98	-1.98

The I(1) character of the variables lets us examine whether a long-run equilibrium nexus between Total Assets and yields exists, by performing cointegration testing.

$$(rate)_t = a + b \cdot \log(\text{Total\_Assets})_t + \varepsilon_t \quad (1)$$

Where α and b denote cointegration parameters and ε_t stand for the possibly serially correlated residuals, which will be used for explaining the deviations from equilibrium between Total Assets and each of the rates. By conducting pair estimations, empirical results indicate the existence of cointegration and asymmetry in residuals, therefore non-linear threshold cointegration should be applied. An Ordinary Least Squares (OLS) procedure concerning the residuals takes place, to test for cointegration. More specifically, the null hypothesis Ho: ρ=0, is estimated in the relation:

$$\Delta\hat{\varepsilon}_t = \rho\hat{\varepsilon}_{t-1} + \sum_{i=1}^{p} c_i \Delta\hat{\varepsilon}_{t-i} + u_t \quad (2)$$

It should be noted that the residuals from the estimation of equation (2), are u_t and are IID(0, σ^2), and the lagged values of $\hat{\varepsilon}_{t-1}$ result in residuals with no correlation. According to Tables 5.1.3a, 5.1.3b, the Engle-Granger (1987) cointegration test reveals that the hypothesis of no cointegration is rejected. Furthermore, the existence of an asymmetric character is confirmed, then a threshold cointegration methodology can be applied, as proposed by Enders and Granger (1998) and Enders and Siklos (2001). This procedure is completed in two stages and focuses on residual examination in order to detect deviations from a certain threshold. The estimation of the threshold point is conducted by assessing the impacts that the two different regimes of residuals with lags might lead to. Furthermore, the first difference residual impact in lags on lag first differences is estimated for these purposes. Consequently, in order to assess the coefficients of ρ_1 and ρ_2 on the second stage of unit-root teats, equation (3) is employed.

138

$$\Delta \hat{\varepsilon}_t = I_t \rho_1 \hat{\varepsilon}_{t-1} + (1 - I_t) \rho_2 \hat{\varepsilon}_{t-1} + \sum_{i=1}^{p} c_i \Delta \hat{\varepsilon}_{t-i} + u_t \quad (3)$$

Where u_t stands for the residuals generated by (3). Values of ρ_1 and ρ_2 are divided into two regimes by the Indicator function I_t. Notably, this indicator being equal to 1 denotes $\hat{\varepsilon}_{t-1}$ in the high regime, while 0 represents the low regime. By this way, the Threshold Autoregressive (TAR) model takes its form. It is judged as preferable to procced to estimation of momentum alterations, that is volatility in lagged stationary residuals so as residual reactions of yields to QE action taking could be better captured. Intriguingly, the Momentum Threshold Autoregressive (M-TAR) specification is employed in order to provide an assessment of unconventional dynamics qualitatively as well as quantitatively. By combining Equations (3) and (4), the TAR estimation can be performed, whereas Equations (3) and (5) when combined, allow estimating the M-TAR scheme.

$$I_t = \begin{cases} 1, & \text{if } \hat{\varepsilon}_{t-1} \geq \tau \\ 0, & \text{if } \hat{\varepsilon}_{t-1} < \tau \end{cases} \quad (4)$$

$$I_t = \begin{cases} 1, & \text{if } \Delta \hat{\varepsilon}_{t-1} \geq \tau \\ 0, & \text{if } \Delta \hat{\varepsilon}_{t-1} < \tau \end{cases} \quad (5)$$

It should also be noted that the first option when assessing the value of threshold τ, along with values of ρ_1 and ρ_2, is the zero-threshold as employed by Enders and Granger (1998). The second option is to employ Chan's (1993) methodology of investigating which is the τ value that minimizes the Residual Sum of Squares (RSS) from the fitted model. The latter option is selected here in order to assess the threshold level that optimally fits our investigation purposes. Moreover, when conducting estimations, the dilemma between adopting simple threshold autoregressive specifications or momentum threshold autoregressive techniques for estimating QE effects, comes to the forefront. Notably, Threshold Autoregression is separated into TAR or TART estimations. In a similar vein, Momentum Threshold Autoregression can take the M-TAR or the M-TART form. In order to identify which of the four forms better corresponds to the needs of the specific estimation purposes in this chapter, the AIC as well as the Schwartz Bayesian Criterion (SBC/BIC) are applied. The null hypotheses examined under each model investigate whether H_0: no cointegration, thereby $H_0: \rho_1 = \rho_2 = 0$ is valid, as well as whether H_0: symmetry, so $H_0: \rho_1 = \rho_2$, is valid. Tables 5.1.3a and 5.1.3b present the estimation outcomes.

Table 5.1.3a. Tests for Cointegration and Symmetry TA, and MTAR models for commercial bank liability yields and central bank's total assets[1]

Model	Engle-Granger		TAR		TART		M-TAR		M-TART	
	BLC5	BLC10	BLC5	BLC10	BLC5	BLC10	BLC5	BLC10	BLC5	BLC10
Lags			1	1	1	1	1	1	1	1
Threshold			0.000	0.000	0.476	0.342	0.000	0.000	-0.049	0.050
Ho: No cointegration			3.969	3.760	5.166	4.781	3.791	4.075	4.766	5.015
$F(\rho_1=\rho_2=0)$			(0.02)**	(0.02)**	(0.00)***	(0.00)***	(0.02)**	(0.02)**	(0.00)***	(0.00)***
Ho: symmetry			0.575	0.484	2.930	2.493	0.226	1.104	2.142	2.954
$F(\rho_1=\rho_2)$			(0.45)	(0.49)	(0.09)*	(0.12)	(0.63)	(0.29)	(0.14)	(0.09)*
ρ	-0.037	-0.035								
	[-2.71]	[-2.65]								
	(0.00)***	(0.00)***								
Above			-0.046	-0.043	-0.061	-0.057	-0.029	-0.021	-0.021	-0.001
			[-2.54]	[-2.39]	[-3.11]	[-2.95]	[-1.45]	[-1.15]	[-1.23]	[-0.00]
			(0.00)***	(0.02)**	(0.00)***	(0.00)***	(0.15)	(0.25)	(0.22)	(0.99)
Below			-0.025	-0.025	-0.015	-0.016	-0.043	-0.049	-0.063	-0.049
			[-1.24]	[-1.37]	[-0.83]	[-0.95]	[-2.31]	[-2.61]	[-2.80]	[-3.17]
			(0.22)	(0.17)	(0.41)	(0.34)	(0.02)**	(0.00)***	(0.00)***	(0.00)***
DU{1}	-0.045	-0.085	-0.043	-0.083	-0.039	-0.080	-0.051	-0.093	-0.062	-0.104
	[-0.93]	[-1.77]	[-0.89]	[-1.72]	[-0.817]	[-1.68]	[-1.02]	[-1.91]	[-1.25]	[-2.12]
	(0.35)	(0.08)*	(0.38)	(0.09)*	(0.41)	(0.09)*	(0.31)	(0.06)*	(0.21)	(0.03)**
AIC=	951.641	794.172	953.062	795.685	950.701	793.669	953.413	795.061	951.489	793.208
BIC=	959.787	802.318	965.281	807.904	962.920	805.888	965.632	807.281	963.708	805.427
$Q_{LB}(4)$ p-value	(0.00)***	(0.02)**	(0.00)***	(0.02)**	(0.00)***	(0.11)	(0.00)***	(0.02)**	(0.00)***	(0.02)**
ARCH(1) p-value	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***

Table 5.1.3b. Tests for Cointegration and symmetry TAR, and MTAR models for government bond yields and central bank's total assets.

Model	Engle-Granger		TAR		TART		M-TAR		M-TART	
	GB5Y	GB10Y	GB5Y	GB10Y	GB5Y	GB10Y	GB5Y	GB10Y	GB5Y	GB10Y
Lags			3	1	3	1	3	1	3	1
Threshold			0.000	0.000	0.552	0.393	0.000	0.000	-0.109	-0.026
Ho: No cointegration			6.322	3.505	7.177	3.956	6.260	3.725	9.173	4.793
$F(\rho_1=\rho_2=0)$			(0.00)***	(0.03)**	(0.00)***	(0.02)**	(0.00)***	(0.02)**	(0.00)***	(0.00)***
Ho: symmetry			1.206	0.207	2.872	1.096	1.086	0.641	6.759	2.744
$F(\rho_1=\rho_2)$			(0.27)	(0.65)	(0.09)*	(0.30)	(0.30)	(0.42)	(0.00)***	(0.09)*
ρ	-0.047	-0.032								
	[-3.38]	[-2.61]								
	(0.00)***	(0.00)***								
Above			-0.061	-0.037	-0.076	-0.047	-0.061	-0.021	-0.029	-0.016
			[-3.20]	[-2.16]	[-3.44]	[-2.49]	[-3.11]	[-1.18]	[-1.90]	[-0.99]
			(0.00)***	(0.03)**	(0.00)***	(0.01)**	(0.00)***	(0.24)	(0.06)*	(0.32)
Below			-0.032	-0.026	-0.029	-0.021	-0.033	-0.041	-0.117	-0.057
			[-1.64]	[-1.55]	[-1.70]	[-1.32]	[-1.72]	[-2.47]	[-3.86]	[-2.94]
			(0.10)	(0.12)	(0.09)*	(0.19)	(0.09)*	(0.01)**	(0.00)***	(0.00)***
DU{1}	-0.037	-0.026	-0.034		-0.031	-0.023	-0.027	-0.031	-0.057	-0.031
	[-0.77]	[-0.54]	[-0.71]		[-0.64]	[-0.48]	[-0.56]	[-0.61]	[-1.18]	[-0.65]
	(0.44)	(0.59)	(0.48)		(0.52)	(0.63)	(0.58)	(0.54)	(0.24)	(0.52)
DU{2}	0.172		0.175		0.175		0.169		0.183	
	[3.61]		[3.67]		[3.67]		[3.54]		[3.84]	
	(0.00)***		(0.00)***		(0.00)***		(0.00)***		(0.00)***	
DU{3}	0.062		0.065		0.071		0.063		0.069	
	[1.29]		[1.35]		[1.46]		[1.31]		[1.44]	
	(0.20)		(0.18)		(0.14)		(0.19)		(0.15)	
AIC=	949.759	857.801	950.540	859.592	948.863	858.698	950.662	859.156	944.974	857.047
BIC=	966.033	865.947	970.883	871.812	969.205	870.917	971.004	871.376	965.316	869.266
$Q_{LB}(4)$ p-value	(0.99)	(0.28)	(0.99)	(0.28)	(0.99)	(0.25)	(0.99)	(0.30)	(0.99)	(0.34)
ARCH(1) p-value	(0.13)	(0.51)	(0.20)	(0.52)	(0.27)	(0.52)	(0.14)	(0.50)	(0.09)*	(0.44)

Empirical results in Tables 5.1.3a and 5.1.3b provide evidence that the hypothesis of no cointegration for the M-TART specification cannot be accepted, when each of the four pairs between Total Assets and yields are estimated. Notably, the AIC criterion indicates the M-TART to be the most appropriate estimation methodology. It should be underlined that both the medium-term and the long-term gilt yields present an asymmetry concerning the adjustment of their errors into the long-run equilibrium adjustment. The M-TART results exhibit that the medium-term gilt yield is cointegrated and not symmetric from its longer-run level. Arguably, it is also found that the adjustment threshold for positive deviations is not as fast as for negative deviations from the threshold. Thereby, when short-term gilt yields decline below the M-TART estimated indicator, there is a rapid return towards the certain threshold. Therefore, the non-linear unconventional monetary impact is stronger when yields are not as high as expected and their decline cannot continue forever. This means that gilts, which constitute the largest portion of QE purchases by British monetary authorities, tend to reach back the non-linearly estimated threshold. It should be underlined that this renders predictions about gilt yields and impacts on the real economy safer, when non-linear methodologies are adopted for unconventional monetary impacts examination.

Table 5.1.4. Estimates of M-TART-ECM model for government bond and commercial bank liability yields

	Δlog(TA)		Δ(rate)		Δlog(TA)		Δ(rate)	
	BLC5	BLC10	BLC5	BLC10	GB5Y	GB10Y	GB5Y	GB10Y
Constant	0.004	0.003	-0.007	-0.007	0.002	0.004	-0.007	-0.006
	[1.97]	[1.86]	[-1.41]	[-1.39]	[1.39]	[1.95]	[-1.37]	[-0.99]
	(0.04)**	(0.06)*	(0.16)	(0.17)	(0.16)	(0.05)*	(0.17)	(0.32)
Δlog[TA]$_{t-1}$	-0.020	-0.022	-0.023	-0.033	-0.031	-0.022	0.041	0.114
	[-0.16]	[-0.17]	[-0.11]	[-0.19]	[-0.24]	[-0.18]	[0.21]	[0.66]
	(0.87)	(0.86)	(0.91)	(0.85)	(0.81)	(0.86)	(0.84)	(0.51)
Δlog(TA)$_{t-2}$					0.318	0.066		
					[2.18]	[0.25]		
					(0.03)**	(0.80)		
Δlog(TA)$_{t-3}$					0.035	0.210		
					[0.39]	[0.97]		
					(0.68)	(0.33)		
Δ(rate)$_{t-1}$	-0.012	-0.018	-0.061	-0.103	0.003	0.012	-0.121	-0.072
	[-0.36]	[-0.523]	[-1.12]	[-1.87]	[0.16]	[0.53]	[-1.99]	[-1.256]
	(0.72)	(0.60)	(0.26)	(0.06)	(0.87)	(0.60)	(0.04)**	(0.21)
Δ(rate)$_{t-2}$					-0.009	0.089		
					[-0.46]	[1.67]		
					(0.65)	(0.09)*		
Δ(rate)$_{t-3}$					-0.011	0.045		
					[-0.67]	[0.80]		
					(0.50)	(0.42)		
Z_PLUS$_{t-1}$	0.002	0.002	-0.026	-0.009	-0.001	0.001	-0.027	-0.019
	[0.29]	[0.29]	[-2.13]	[-0.43]	[-0.27]	[0.28]	[-2.07]	[-1.37]
	(0.77)	(0.77)	(0.03)**	(0.67)	(0.79)	(0.78)	(0.04)**	(0.17)
Z_MINUS$_{t-1}$	-0.000	-0.004	-0.063	-0.041	-0.032	-0.014	-0.058	-0.034
	[-0.03]	[-0.59]	[-2.69]	[-2.95]	[-1.98]	[-2.24]	[-1.80]	[-2.03]
	(0.97)	(0.58)	(0.00)***	(0.00)***	(0.04)**	(0.03)**	(0.07)*	(0.04)**
H$_0$: λ$_{j1}$=...=λ$_{jp}$=0	0.026	0.030	0.013	0.035	5.369	0.031	0.981	0.432
	(0.87)	[0.86]	(0.91)	(0.85)	(0.15)	(0.86)	(0.81)	(0.51)
H$_0$: δ$_{j1}$=...=δ$_{jp}$=0	0.128	0.273	1.258	3.493	0.674	0.282	7.545	1.579
	(0.72)	(0.60)	(0.26)	(0.06)*	(0.88)	(0.60)	(0.06)*	[0.21]
H$_0$: λ$_{j1}$=...=λ$_{jp}$=β$_{j1}$=0			4.627	0.228			7.297	2.241
			(0.09)*	(0.89)			(0.12)	(0.33)
H$_0$: λ$_{j1}$=...=λ$_{jp}$=β$_{j2}$=0			7.416	8.765			3.811	4.681
			(0.02)**	(0.01)**			(0.43)	(0.09)*
H$_0$: δ$_{j1}$=...=δ$_{jp}$=β$_{j1}$=0	0.263	0.434			0.855	0.375		
	(0.88)	(0.80)			(0.93)	(0.83)		
H$_0$: δ$_{j1}$=...=δ$_{jp}$=β$_{j2}$=0	0.214	1.632			5.279	5.048		
	(0.90)	(0.44)			(0.26)	(0.08)*		
H$_0$: β$_{j1}$=β$_{j2}$=0	0.084	0.419	11.244	8.769	4.072	5.239	8.454	5.938
	(0.96)	(0.81)	(0.00)***	(0.01)**	(0.13)	(0.07)*	(0.01)**	(0.05)*
H$_0$: β$_{j1}$=β$_{j2}$	0.019	0.356	2.044	1.831	3.280	4.141	0.778	0.510
	(0.89)	(0.55)	(0.15)	(0.18)	[0.07]*	(0.04)**	(0.38)	(0.48)
Durbin-Watson	(1.99)	(1.99)	(2.00)	(1.99)	(2.01)	(1.99)	(1.99)	(2.00)
ARCH(4) p-value	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***

Results of the Granger causality test already described, are presented in Table 5.1.4. By adopting the asymmetric threshold error-correction model (ECM) by Enders and Granger (1998) and Enders and Siklos (2001), the following M-TART-ECM methodology can be applied for everyone of the four rates examined:

$$\Delta \log(\text{Total\_Assets})_t = \alpha_{11} + \beta_{11}Z_{\tau-1}^{+} + \beta_{12}Z_{\tau-1}^{-} + \sum_{i=1}^{p}\delta_{1i}\Delta(rate)_{t-i} + \sum_{i=1}^{p}\lambda_{1i}\Delta\log(\text{Total\_Assets})_{t-i} + w_{1,t} \quad (6)$$

$$\Delta(\text{rate})_t = \alpha_{21} + \beta_{21}Z_{\tau-1}^{+} + \beta_{22}Z_{\tau-1}^{-} + \sum_{i=1}^{p}\delta_{2i}\Delta(rate)_{t-i} + \sum_{i=1}^{p}\lambda_{2i}\Delta\log(\text{Total\_Assets})_{t-i} + w_{2,t} \quad (7)$$

Where $Z_{\tau-1}^{+} = I_t\hat{\varepsilon}_{t-1}$, $Z_{\tau-1}^{-} = (1-I_t)\hat{\varepsilon}_{t-1}$, and $\hat{\varepsilon}_{t-1}$ is estimated by (1). I_t is derived from Equation 5. The $w_{j,t}$ disturbances constitute white noise.

142

Interestingly, the M-TART-ECM results provide no evidence of a short-run linkage between Total Assets and every single rate examined in a 5% confidence interval. One should note that values below the threshold indicator estimation is considered to represent the low regime, while higher values than this indicator form the high-regime. Empirical findings indicate the existence of a uni-directional causal nexus from Total Assets to the short-run interbank lending rate in both regimes in the long-run. This is derived by rejection of both the H_0: $\lambda_{j1}= \lambda_{jp}= \beta_{j1}\ldots = 0$ and H_0: $\lambda_{j1}= \lambda_{jp}= \beta_{j2}\ldots = 0$ hypotheses. Furthermore, a bi-directional causal nexus between Total Assets and the long-run gilt yields in the low is traced, which means not only that QE is effective towards this kind of yields, but also the latter reinforce unconventional practices due to proof of their efficacy. Another interesting finding is that an attractor is detected in each of the four rates under scrutiny, thereby residuals do not tend to decline far from the estimated threshold value. This is revealed by rejection of the H_0: $\beta_{j1}=\beta_{j2}=0$ hypothesis. Moreover, rejection of the null hypothesis H_0: $\beta_{j1}=\beta_{j2}$ concerning medium-term and long-term gilt yields provides evidence for asymmetry in the causal nexus between the size of the BoE's balance sheet and these yields.

Results indicate that gilts of medium-maturity (GB5Y) make an adjustment for rliminating -2.7% (that is the Z^{+}_{t+1} coefficient) of a unit negative alteration in the deviation. Furthermore, an adjustment by -5.8% (that is the Z^{-}_{t+1} coefficient) of a unit negative shift in the low regime takes place, so as to get back to the equilibrium long-run value. Moreover, Total Assets make an adjustment equal to -3.2% in the low regime, that is statistically significant. The asset purchases converging to the threshold estimated after regression with every yield, reveals that asymmetries exist in QE impacts concerning their re-emerging in the economy. As regards the long-term gilt yields, which are of primary importance for QE to be successful, empirical outcomes indicate that a -3.4% shift in the low regime is required for returning to equilibrium. Furthermore, by investigating the impacts of momentum threshold autoregression error correction (M-TART-ECM) form the Total Assets side, an alteration by -1.4% for values below Z^{-}_{t+1} is required for returning to this threshold. It should be noted that the medium-term interbank lending rate needs a 2.6% adjustment in the high regime and a -6.3% adjustment in the low regime to return to equilibrium, while the long-term interbank lending rate has to move by -4.1% in the low regime to achieve this convergence. Notably, total assets are not found to exhibit significant coefficients when studying their nexus with medium-term and long-term interbank lending rates.

The estimation results derived in this chapter are of primary importance for the developed market of UK where unconventional monetary practices through portfolio rebalancing have to be successful. The non-linear estimation procedures of yield fluctuations can direct the incentives of monetary authorities about injecting fresh liquidity to the UK economy, in order to boost aggregate demand. Not taking into consideration non-linearity in impacts of unconventional monetary policies, would impede the Bank of England from conducting the optimal policymaking.

143

5.1.5. Concluding remarks

This chapter investigates the linkage between Total Assets purchased by the Bank of England and the medium-term as well as the long-term government bond and commercial bank liability yields. Threshold cointegration estimations are adopted so as to capture how yields are adjusted towards long-run equilibrium values by examining movements in the error term. This is what differentiates this study from other relevant academic work that employs linear estimations. The tests undertaken here provide evidence of a non-linear nexus between variables, that is why the M-TART-ECM has been found as most suitable, at the detriment of traditional specifications. Empirical outcomes reveal that a significant threshold impact of Total Assets on all yields examined exists. Notably, the medium-term and long-term gilt yields are significantly adjusted towards equilibrium in the high regime, that is above the estimated Threshold Indicator, but also in the low regime. Nevertheless, the synthetic interbank lending rates react only in the low regime, in order to fully converge back to their long-run values. Intriguingly, this allows central banks to estimate in a safer manner how unconventional monetary policy affects the real economy, as the non-linear character of such impacts is taken into consideration. Such asymmetric causal linkage urges us to conclude that Quantitative Easing presents high levels of efficacy, as it decreases gilt yields and commercial bank liability yields.

The Granger causality estimations undertaken, reveal a highly statistically significant bi-directional impact between the size of the BoE's balance sheet and long-term gilt yields. Thereby, evidence is provided of a powerful dynamic impact between this pair of variables in the long-run, that is also characterized by a feedback effect. This is very important in order to explain how effective Quantitative Easing measures have been, as they are primarily based on long-term government bond yields. The BoE's balance sheet also has a non-linear impact on medium-term gilt yields, but no reverse causality is detected in this case. Moreover, the existence of QE effects on commercial bank liability yields provides evidence of effectiveness in QE transmission to the interbank markets. Thereby, these results indicate that further academic investigation should be conducted regarding interbank funding effects on output, by employing non-linear methodologies.

References

Abbassi, P., & Linzert, T. (2012). The effectiveness of monetary policy in steering money market rates during the financial crisis. *Journal of Macroeconomics*, 34(4), 945-954.

Balke, N.S., & Fomby, T.B. (1997). Threshold cointegration., *International Economic Review*, 38, 627–645.

Belke, A. (2013). Non-Standard Monetary Policy Measures–Magic Wand or Tiger by the Tail?. *Review of Economics/Jahrbuch für Wirtschaftswissenschaften*, 341-364.

Belke, A., & Gros, D. (2016). Did quantitative easing affect interest rates outside the US? New evidence based on interest rate differentials. CEPS Working Document No. 416/January 2016.

Berkmen, P. (2012). Bank of Japan's Quantitative and Credit Easing: Are They Now More Effective? IMF Working Paper No. 12/2.

Borio, C., & Zhu, H. (2012). Capital regulation, risk-taking and monetary policy: a missing link in the transmission mechanism?. *Journal of Financial stability*, *8*(4), 236-251.

Breedon, F., Chadha, J. S., & Waters, A. (2012).The financial market impact of UK quantitative easing.*Oxford Review of Economic Policy*, 28(4), 702-728.

Brooke, M., Cooper, N., & Scholtes, C. (2000). Inferring market interest rate expectations from money market rates. Bank of England. Quarterly Bulletin, 40(4), 392-392.

Carpenter, S. B., Demiralp, S., &Eisenschmidt, J. (2014). The effectiveness of the non-standard policy measures during the financial crises: the experiences of the Federal Reserve and the European Central Bank. Journal of Economic Dynamics and Control, 43, 107-129.

Cecioni, M., Ferrero, G., & Secchi, A. (2011). Unconventional Monetary Policy in Theory and in Practice (No. 102). Bank of Italy, Economic Research and International Relations Area.

Chadha, J. S., & Waters, A. (2014).Applying a macro-finance yield curve to UK Quantitative Easing.*Journal of Banking & Finance*, 39, 68-86.

Chan, K.S. (1993). Consistency and limiting distribution of the least squares estimator of a threshold autoregressive model. *The Annals of Statistics*, 21, 520–533.

Chen, H., Cúrdia, V., & Ferrero, A. (2012).The Macroeconomic Effects of Large-scale Asset Purchase Programmes.*The Economic Journal*, 122(564), F289-F315.

Christensen, J. H., & Rudebusch, G. D. (2012). The response of government yields to central bank purchases of long-term bonds. *Economic Journal,* 122(564), F385-414.

Cihák, M., Stavrev, E., &Harjes, T. (2009).Euro area monetary policy in uncharted waters.IMF Working Paper No. 2185.

D'Amico, S., & King, T. B. (2013). Flow and stock effects of large-scale treasury purchases: Evidence on the importance of local supply. *Journal of Financial Economics*, 108(2), 425-448.

Darracq-Paries, M., & De Santis, R. A. (2015). A non-standard monetary policy shock: The ECB's 3-year LTROs and the shift in credit supply. *Journal of International Money and Finance*, *54*, 1-34.

145

Dickey, D.A., & Fuller, W.A. (1981). Likelihood ratio statistics for autoregressive time series with unit root. *Econometrica*, 49, 1057–1072.

Enders, W., &Granger.C.(1998). Unit-root tests and asymmetric adjustment with an example using the term structure of interest rates.*Journal of Business Economics and Statistics*, 16, 304–311.

Enders, W., &Siklos, P. L. (2001).Cointegration and threshold adjustment.*Journal of Business & Economic Statistics*, 19(2), 166-176.

Engle, R., & Granger, C. (1987).Co-Integration and Error Correction Representation, Estimation and Testing.*Econometrica,* 55, 251–267.

Fahr, S., Motto, R., Rostagno, M., Smets, F., &Tristani, O. (2013). A monetary policy strategy in good and bad times: Lessons from the recent past. *Economic Policy*, *28*(74), 243-288.

Fawley, B. W., & Neely, C. J. (2013). Four stories of quantitative easing. Federal Reserve Bank of St. Louis Review, 95(1), 51-88.

Gagnon, J., Raskin, M., Remache, J., & Sack, B. (2011). The financial market effects of the Federal Reserve's large-scale asset purchases. *International Journal of Central Banking*, *7*(1), 3-43.

Giannone, D., Lenza, M., Pill, H., &Reichlin, L. (2011). Non-standard monetary policy measures and monetary developments. ECB Working Paper Series No 1290.

Goodhart, C. A., & Ashworth, J. P. (2012). QE: a successful start may be running into diminishing returns. *Oxford Review of Economic Policy*, *28*(4), 640-670.

Honda, Y., Kuroki, Y., & Tachibana, M. (2013).An injection of base money at zero interest rates: empirical evidence from the Japanese experience 2001-2006. *Japanese Journal of Monetary and Financial Economics*, *1*(1), 1-24.

Joyce, M. A., & Tong, M. (2012). QE and the Gilt Market: a Disaggregated Analysis*. *The Economic Journal*, *122*(564), F348-F384.

Joyce, M. A., McLaren, N., & Young, C. (2012). Quantitative easing in the United Kingdom: evidence from financial markets on QE1 and QE2. *Oxford Review of Economic Policy*, *28*(4), 671-701.

Joyce, M., Lasaosa, A., Stevens, I., & Tong, M. (2011a). The financial market impact of quantitative easing in the United Kingdom. *International Journal of Central Banking*, 7(3), 113-161.

Joyce, M., Miles, D., Scott, A., &Vayanos, D. (2012).Quantitative Easing and Unconventional Monetary Policy–an Introduction. *The Economic Journal*, 122(564), F271-F288.

Joyce, M., Tong, M., & Woods, R. (2011b). The United Kingdom's quantitative easing policy: design, operation and impact. *Bank of England Quarterly Bulletin*, *51*(3), 200-212.

Kapetanios, G., Mumtaz, H., Stevens, I., & Theodoridis, K. (2012).Assessing the Economy-wide Effects of Quantitative Easing. *The Economic Journal*, 122(564), F316-F347.

Kenourgios, D., Papadamou, S., &Dimitriou, D. (2015a).Intraday exchange rate volatility transmissions across QE announcements. *Finance Research Letters*,14, 128-134.

Kenourgios, D., Papadamou, S., &Dimitriou, D. (2015b).On quantitative easing and high frequency exchange rate dynamics. *Research in International Business and Finance*, 34, 110-125.

Kollias, C., Papadamou, S., & Siriopoulos, C. (2016). Stock markets and effective exchange rates in European countries: threshold cointegration findings. *Eurasian Economic Review*, *6*(2), 215-274.

 Krishnamurthy, A., &Vissing-Jorgensen, A. (2011).The effects of quantitative easing on interest rates: channels and implications for policy. NBER Working Paper No. 17555.

Kwiatkowski, D., Phillips, P.C.B., Schmidt, P., & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root.*Journal of Econometrics*.54, 159–178.

Lam, W. R. (2011). Bank of Japan's Monetary Easing Measures: Are They Powerful and Comprehensive? IMF Working Papers, 1-18.

Lambert, F., & Ueda, K. (2014). The Effects of Unconventional Monetary Policies on Bank Soundness (No. 14-152). International Monetary Fund.

Lenza, M., Pill, H., &Reichlin, L. (2010).Monetary policy in exceptional times.*Economic Policy*, 25(62), 295-339.

Lyonnet, V., & Werner, R. (2012).Lessons from the Bank of England on 'quantitative easing'and other 'unconventional'monetary policies. *International Review of Financial Analysis*, 25, 94-105.

McLaren, N., Banerjee, R. N., & Latto, D. (2014). Using changes in auction maturity sectors to help identify the impact of QE on gilt yields. *The Economic Journal*, *124*(576), 453-479.

Newey, W., & West, K. (1994).Automatic lag selection in covariance matrix estimation.*Review of Economic Studies,* 61, 631–653.

Ng, S., &Perron, P. (2001). Lag length selection and the construction of unit root tests with good size and power. *Econometrica*, 69, 1519–1554.

Peersman, G. (2011). Macroeconomic effects of unconventional monetary policy in the euro area.ECB Working Paper Series No 1397.

Shibamoto, M., & Tachibana, M. (2013).The Effect of Unconventional Monetary Policy on the Macro Economy: Evidence from Japan's Quantitative Easing Policy Period. Kobe University Discussion Paper Series, No.12.

Steeley, J. M., &Matyushkin, A. (2015). The effects of quantitative easing on the volatility of the gilt-edged market. *International Review of Financial Analysis*, *37*, 113-128.

Ueda, K. (2012). The Effectiveness of Non-Traditional Monetary Policy Measures: The Case of The Bank of Japan. *Japanese Economic Review*, 63(1), 1-22.

Yau, H. Y., &Nieh, C. C. (2009).Testing for cointegration with threshold effect between stock prices and exchange rates in Japan and Taiwan. *Japan and the World Economy*, 21(3), 292-300.

5.2. US non-linear causal impacts on global stock indices in unconventional eras[6]

5.2.1. Introduction

An increasing volume of literature has been studying the spillover impacts of Large-Scale Asset Purchases (LSAPs) by the US Federal Reserve (Fed) on the real economies and the capital markets of a respectable number of countries. Since the outburst of the global financial crisis that was triggered by the Lehman Brothers collapse in September 2008 (Neuhauser, 2015) ample liquidity provisions were brought to the forefront as a necessary form of monetary action taking.

The previous literature has documented that in economies with more or less developed capital markets and credit systems, any fluctuation in the volume of total assets held by central banks leads to alterations in credibility of financial markets and volatility in asset prices. A non-negligible number of studies have looked into spillover effects of QE policies on bond yields (Lutz, 2015b; Hännikäinen, 2015; Tillmann, 2016), on exchange rates (Kenourgios et al. (2015a, b); Bouraoui, 2015), and on commodities (Papadamou and Sogiakas, 2018). This is in a large extent due to the interconnectedness of global financial markets with the US capital. The aim of this research is to investigate whether money provisions by the Fed trigger alterations in stock indices' quotes in the US as well as in other countries with advanced or less developed capital markets. This research is in connection to the study of Roache and Rousset (2013) who examine US stock market tail characteristics and effects through the confidence channel. Moreover, it is in connection to Wang et al. (2015) that investigate how effective is the US QE via the tail risks of stock markets in an international context and Apergis and Christou (2015) that employ quantile regressions for examining the dynamic behavior of the bank lending channel concerning European banks. The novelty of our paper is that we study the portfolio rebalancing channel of US non-conventional practices on capital markets via a non-linear quantile approach. Thereby, this method is applied for the first time in order to focus on a principal sector of the global economy and study the worldwide impacts of QE on financial markets, that a significant number of high-ranked academic papers such as Bowman et al. (2015), Brana and Prat (2016), and Fratzscher et al. (2018) have studied so far by other methodologies.

Portfolio rebalancing has been indicated as the main driver of US unconventional policy impacts (Gagnon et al., 2011; D' Amico et al., 2012) and UK non-conventional policies (Joyce and Tong, 2012; Chadha and Waters, 2014) and of primordial importance in Japanese (Saiki and Frost, 2014) and Euro area (Eser and Schwaab, 2016) policies. Notably, US QE action taking can be effective also through

---

[6] A part of the results of this subsection submitted for possible publication on a paper co-authored with Assoc. Prof. Stephanos Papadamou and Dr. Panayiotis Tzeremes.

other unconventional transmission channels, such as the signalling one, where economic conditions and policy rates in the future are examined (Bauer and Rudebusch, 2014) and the liquidity premium channel where alterations in risk and compensation for illiquidity are incorporated (Christensen and Gillan, 2018). Moreover, the bank lending channel that highly emphasizes the importance of bank margins and higher credit (Apergis and Christou, 2015) and the confidence channel/ expectations channel (Lutz, 2015a) are main ways of transmission of impacts due to balance sheet enlargement of monetary authorities.

The contribution of our paper to the existing literature is twofold. Firstly, we employ a non-linear quantile regression approach. Secondly, a wider array of stock indices than previous studies is taken into consideration. Notably, the majority of related studies investigate stock indices' responsiveness through conventional econometric methods and focus on the non-tail values of the stock indices distributions. Nevertheless, we innovate by adopting not only classic Granger causality estimations, but also a non-linear estimation of causality between QE and stock indices, which is based on the tail characteristics via quantile regressions. The principal advantage of quantile causality is the evaluation of causality in tails (and in the mean) that can be quite different from Granger causality considered in the conditional mean (Jeong et al., 2012). Thus, non-linear dynamics not easily discernible can be detected and provide new perspectives in the examination of non-conventional effects. Moreover, in the larger spectrum of stock markets we use, all US major indices are examined and advanced and developing countries from all over the world are represented in our estimations. The sample we employ is long and has to do with indices of major importance concerning countries such as: the US (Dow 30, Nasdaq, NYSE AMEX Composite, NYSE Composite DJ, Russell 2000, SP 500), the overall European Union (Eurostoxx 50, Euronext 100), Belgium (BEL 20), France (CAC 40), Germany (DAX), Japan (Nikkei 225), Australia (All Ordinaries, SP ASX 200), New Zealand (SP NZX 50 Gross) and Canada (SP TSX Composite). Furthermore, indices of developing countries are included, such as: Hong Kong (Hang Seng), Argentina (Merval), Brazil ((I)Bovespa), Mexico (IPC), Chile (IPSA), Indonesia (Jakarta Composite), Korea (KOSPI Composite), India (SP BSE Sensex), China (SSE Composite) and Taiwan (TSec Weighted).

Interestingly, the classical Granger causality estimations in our study indicate that indices of advanced as well as emerging economies have been exerting significant causal effects towards the Fed's balance sheet before the implementation of US non-conventional practices. Moreover, the US monetary authorities' action taking on these indices has been found as more influential in a much larger extent, during the same period. When it comes to the non-linear Granger quantile causality examination though, the Fed's assets are found to be influenced mainly by US, Latin American, Australian, and some Asian indices before October 2008, though effects are found to be in a small extent and only near the tails of distributions. Nevertheless, US QE impacts on stock indices are much more powerful regarding almost every quantile under scrutiny. Concerning the period of US unconventional action taking,

150

almost all indices are found to exert non-linear causality and evidence of feedback impacts is also found, where the latter are significantly stronger than in the pre-QE period. It should be emphasized though that effects of US QE mainly on advanced as well as on emerging countries' stock indices are mainly found in upper quantiles, in a much more significant degree than before unconventional policies were adopted. This leads to the conclusion that US balance sheet enlargement has impacts mainly on tail characteristics of stock markets' quotes and that this paper could cast light on an aspect of analyzing US QE international effects that has not been investigated enough. Interestingly, the US Fed is found to present a tighter link with foreign stock markets, especially advanced ones, during extraordinary eras, and this is more obvious with non-linear quantile rather than classical Granger causality tests.

The remainder of this paper is structured as follows. Section 2 provides an analytical literature review of US unconventional action taking effects on stock markets and a presentation of the main spillover impacts on advanced and emerging countries. Section 3 presents a detailed analysis of the data and methodology adopted for econometric estimations. Section 4 contains the empirical findings and implications on their economic importance. Finally, Section 5 concludes.

5.2.2. Literature review

One of the main topics of interest when examining the US unconventional monetary policies is the impact that the Fed balance sheet enlargement has brought about on stock prices in the US but also in other advanced as well as in developing markets. A significant bulk of academic literature has emerged concerning such effects on capital markets and is spread over a wide spectrum of countries under scrutiny.

There are a number of papers providing evidence that unconventional practices led to higher equity prices. Swanson (2015) argues that forward guidance and large-scale asset purchases significantly affect US stock prices. Moreover, according to Rosa (2012), unanticipated news of QE in the US spurs a rise in US stock prices of about 300 basis points (bp). Interestingly, Anaya et al. (2017) argue that US QE shocks lead to higher equity returns in a number of countries. Studies with modest effects are also found in relevant bibliography. Meinusch and Tillmann (2016) provide evidence that a US QE shock stimulated modest effects on US stock prices. Furthermore, by the perspective of Kiley (2014), lower US long-term rates due to forward guidance and QE result in positive effects on equity prices in a modest level. Among studies indicating negligible or no effects of US QE action taking, Unalmis and Unalmis (2015) show evidence that monetary policy shocks in the US affected stock returns and their volatilities in a lesser extent than before QE periods. Lambert and Ueda (2014) support that US stocks concerning the banking sector are not affected by US non-conventional policies. Moreover, in an innovative approach,

Roache and Rousset (2013) by examining equity indices among others present evidence of lower tail risk after the end of QE policies.

Notably, a significant portion of recent US QE bibliography has been devoted on investigating worldwide effects of US unconventional practices on international stock markets. Among supporters of US non-conventional policy effectiveness in a worldwide level are Fratzscher et al. (2018) who provide evidence that the second round of US QE has triggered a global boost to stock prices. In a much similar vein, Chen et al. (2016) argue that global equity prices received a significant upwards push due to Fed's balance sheet enlargement policies. Moreover, Eichengreen and Gupta (2015) find evidence that US QE-tapering talk led to lower equity prices in countries that significantly depend on cash flows from the US, thereby indicating the importance of US QE for keeping stock quotes high. Nevertheless, in a more or less surprising perspective, by supporting neither positive nor negative QE impacts, Berge and Cao (2014) argue for the non-existence of US unconventional impacts on equity markets of other countries.

On the contrary view regarding effects, are the findings of Rai and Sushanek (2014) concerning the emerging markets countries and their decline in equity prices. In an interesting perspective, Bernhard and Ebner (2017) support that US QE actions have negative spillover effects on Swiss equity prices. Intriguingly, Gagnon et al. (2017) support that US bond yields have notable positive impacts on other countries' stock market valuation during US QE, lending support to low yields not positively affecting equity prices.

5.2.3. Data and Methodology

The sample period is divided into two sub periods. The first one spans time from January 2003 until September 2008 so is characterized as ''pre-QE period''. The second period starts from October 2008 just after the Lehman Brothers collapse took place and QE measures were first adopted by the Fed. This covers the three phases of LSAPs, the Maturity Extension Program (MEP), and the QE-tapering period. Thereby, it ends on July 2017. To be more precise, the Fed's first phase of Quantitative Easing (QE1) was launched by announcements during October 2008. It mainly focused on government-sponsored enterprises (GSEs) debt and Mortgage-Backed Securities (MBS) that these GSEs issued. US QE2 was announced in August 2010, in order to promote a stronger pace for economic recovery and to stabilize inflation, according to the Fed's mandate. The Maturity Extension Program (MEP) started in September 2010, aiming to reduce long-term interest rates, thereby purchases of $400 billion in long-term assets took place. This led to QE3, which started in September 2012 and ended November 2014. It was a continuation of the MEP program, but in a lower extent, in order for US QE-tapering to eventually take place, which lasts until nowadays.

In our study, initially we investigate the level of the integration among our variables by utilizing several unit root tests, such as Elliott et al., 1996 - generalized

least-squares, Dickey–Fuller (DF-GLS), 1979 and Phillips and Perron- PP, 1988; Kwiatkowski et al., - KPSS, 1992. Furthermore, the AIC statistic has been applied to indicate the proper time length whereas the tests have been applied both on the trend and the drift of the data (Table 5.2.1). As a result the tests endorsed that the covariates are integrated of order one I(1).

Table 5.2.1. Unit Root tests

	DF-GLS test		Pperron test		KPSS test	
	Level	1st diff.	Level	1st diff.	Level	1st diff.
Total Assets	-1.78[2]	-6.84[4]***	-6.42[6]	-701.93[6]***	10.54[6]***	0.12[6]*
Advanced Economies						
ALL ORDINARIES	-1.61[1]	-11.09[5]***	-7.81[6]	-783.75[6]***	3.67[6]***	0.12[6]*
BEL 20	-1.36[1]	-7.53[4]***	-5.35[6]	-826.38[6]***	1.10[6]***	0.13[6]*
CAC 40	-1.54[1]	-3.95[3]***	-8.17[6]	-830.51[6]***	0.98[6]***	0.08[6]*
DAX	-1.88[2]	-3.40[3]**	-12.67[6]	-847.83[6]***	8.42[6]***	0.06[6]*
DOW 30	-2.26[2]	-13.10[5]***	-260.92[6]***	-911.29[6]***	7.64[6]***	0.01[6]*
ESTX50 EUR P	-1.61[1]	-3.40[3]**	-9.00[6]	-835.55[6]***	0.83[6]***	0.07[6]*
EURONEXT	-1.61[1]	-3.75[3]***	-7.46[6]	-830.28[6]***	2.08[6]***	0.08[6]*
NASDAQ	-1.94[2]	-3.47[3]***	-8.14[6]	-782.31[6]***	8.90[6]***	0.08[6]*
NIKKEI	-1.50[2]	-5.84[4]***	-5.35[6]	-779.13[6]***	2.51[6]***	0.11[6]*
NYSE AMEX COMP.	-1.17[1]	-11.58[5]***	-9.58[6]	-790.26[6]***	6.65[6]***	0.27[6]*
NYSE COMPOSITE	-1.85[2]	-5.29[4]***	-9.84[6]	-809.21[6]***	5.66[6]***	0.07[6]*
RUSSELL 2000	-2.29[2]	-13.31[5]***	-168.66[6]***	-912.79[6]***	7.62[6]***	0.01[6]*
SP 500	-1.60[2]	-3.68[3]***	-6.20[6]	-806.09[6]***	7.13[6]***	0.10[6]*
SP ASX 200	-1.56[1]	-11.16[5]***	-7.61[6]	-783.61[6]***	3.54[6]***	0.12[6]*
SP NZX 50 GROSS	-1.15[1]	-5.29[3]***	-3.41[6]	-764.61[6]***	7.73[6]***	0.19[6]*
SP TSX COMP.	-1.80[2]	-8.94[4]***	-10.94[6]	-857.46[6]***	6.22[6]***	0.13[6]*
Emerging Economies						
HANG SENG	-1.87[2]	-8.47[4]***	-13.09[6]	-783.25[6]***	6.38[6]***	0.09[6]*
IBOVESPA	-0.85[1]	-3.41[3]**	-7.60[6]	-868.57[6]***	6.11[6]***	0.33[6]*
IPC	-0.58[1]	-4.89[3]***	-5.99[6]	-874.71[6]***	8.93[6]***	0.48[6]**
IPSA	-0.94[1]	-7.19[4]***	-6.92[6]	-753.7[6]***	8.41[6]***	0.38[6]*
JAKARTA COMP.	-0.99[1]	-10.35[4]***	-8.38[6]	-888.34[6]***	9.78[6]***	0.36[6]*
KOSPI COMP.	-1.34[1]	-9.19[4]***	-10.01[6]	-812.27[6]***	8.05[6]***	0.16[6]*
MERVAL	-1.65[1]	-10.93[4]***	-5.77[6]	-810.51[6]***	9.18[6]***	0.12[6]*
SP BSE SENSEX	-3.21[3]**	-20.06[5]***	-125.45[6]***	-608.72[6]***	7.56[6]***	0.01[6]*
SSE COMP.	-2.15[2]	-3.89[3]***	-6.38[6]	-785.95[6]***	3.77[6]***	0.08[6]*
TSEC WEIGHTED	-2.88[2]**	-8.14[4]***	-17.62[6]	-862.5[6]***	5.95[6]***	0.04[6]*

Notes: *** , ** and * denote significant at 1%, 5% and 10% level. Numbers in square brackets are selected lags.

153

The dependent variable is the stock index examined each time and the independent one is the total assets of the US Federal Reserve. When reverse causality is under scrutiny these variables switch roles. Data about the US total assets and stock indices are derived from Datastream. All quotes are expressed in a weekly frequency.

Figures 5.2.1, 5.2.2, 5.2.3 and 5.2.4 present how worldwide stock indices move with the US Fed's total assets in the pre-crisis and the post Lehman Brothers collapse period, respectively. The great majority of stock indices have moved upwards during the pre-crisis period. Interestingly, during the period after the launch of unconventional monetary action taking larger upwards movements have taken place. In both subperiods, it is revealed that the representative stock indices of advanced economies move more steeply upwards. Specifically, the SP 500, Dow 30, and Nasdaq US indices and the DAX index have significantly increased before unconventional practices as well as the SSE Composite as concerns emerging markets. Intriguingly, the Nasdaq, SP 500, Russell 2000 in the US and the DAX and SP NZX 50 Gross are the indices with the highest upwards movements among the developed countries. Moreover, the Merval index among those representing the emerging markets has risen in a remarkable extent during QE rounds and QE-tapering.
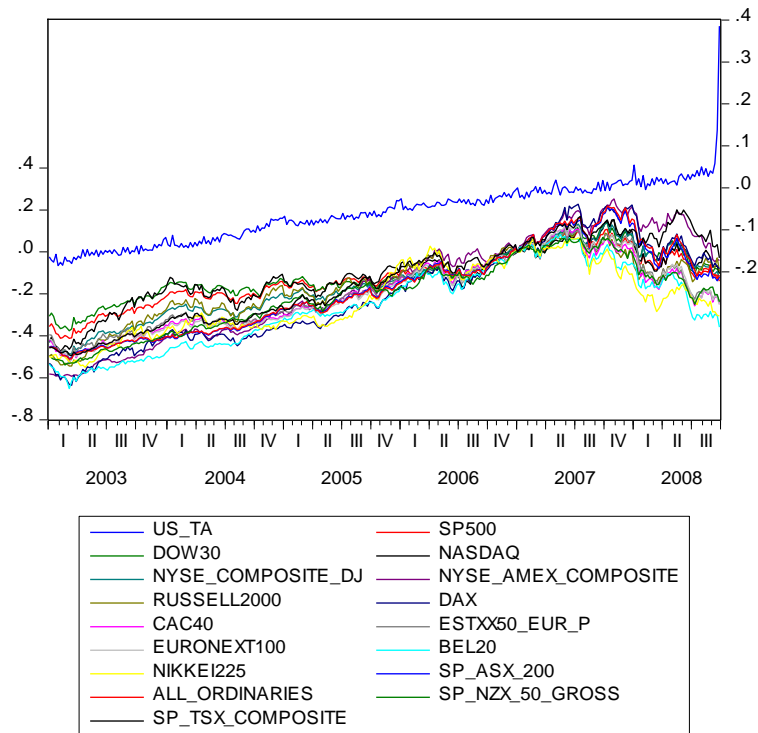
Figure 5.2.1. Stock indices of advanced countries and the Fed's total assets in the pre-crisis period
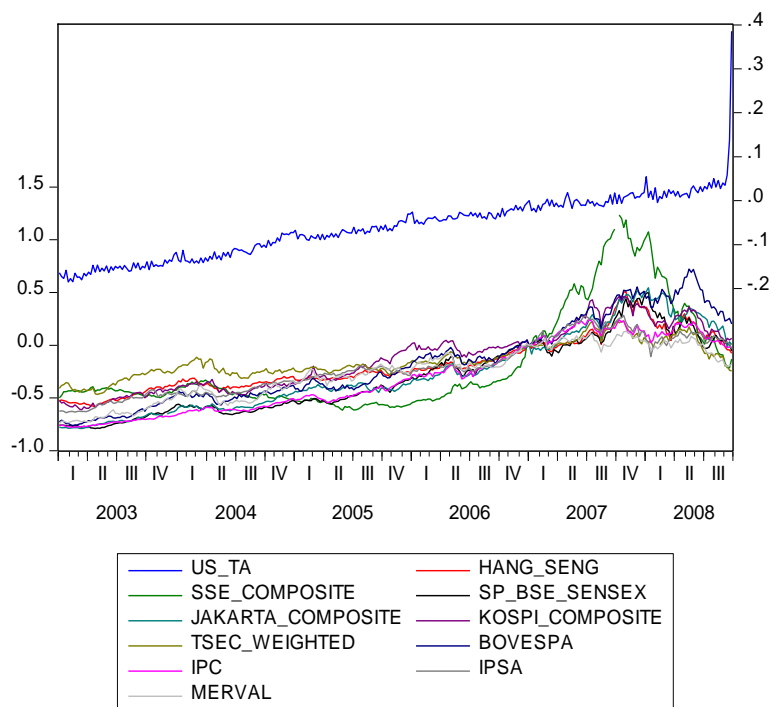
Figure 2.2.2. Stock indices of emerging economies and the Fed's total assets in the pre-crisis period

155
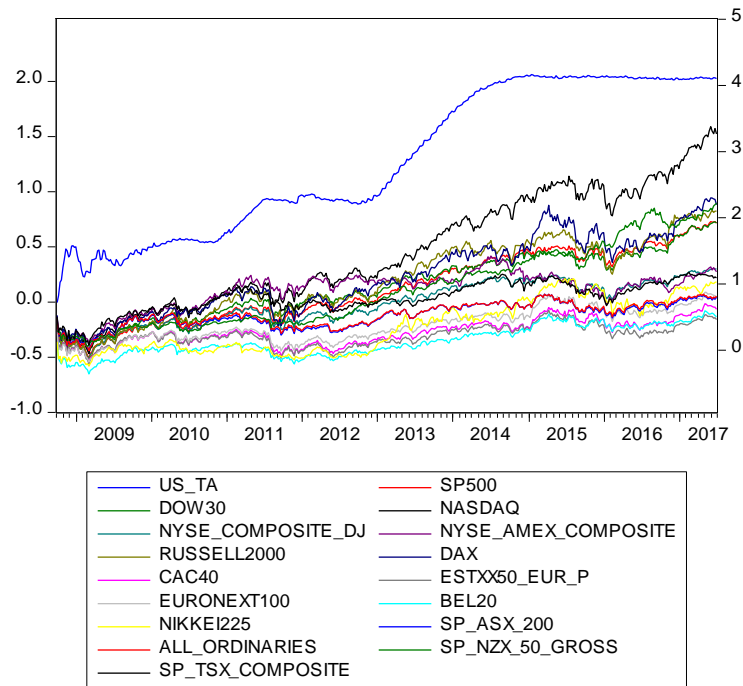
Figure 5.2.3. Stock indices of advanced countries and the Fed's total assets in the period after the launch of unconventional monetary measures due to the Lehman Brothers collapse
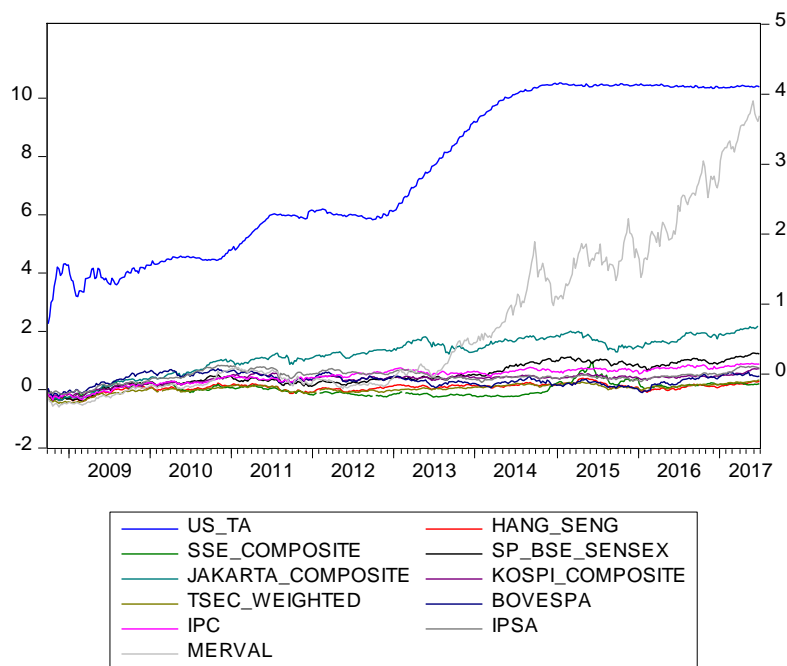
Figure 5.2.4. Stock indices of emerging economies and the Fed's total assets in the period after the launch of unconventional monetary measures due to the Lehman Brothers collapse

For the purposes of our estimations apart from classical Granger causality tests, we select to apply the Granger non-causality test in quantiles, which is proposed by Chuang et al. (2009). Interestingly, Chuang et al. (2009) extend the test of Koenker

156

and Machado (1999) in order to evaluate causality in multiple quantile ranges and to identify the quantile range for which causality is relevant. More specifically, they employ the sup-Wald test of Koenker and Machado (1999) in order to examine the hypothesis of Granger causality. It should be highlighted that there are three advantages in applying the quantile causality test compared to the classical causality tests. Firstly, the traditional Granger non-causality test based on the OLS framework is designed to investigate the average causal relationship of the time-series variables. The existence of heterogeneity could be an ordinary feature of covariates, which the traditional patterns cannot omit. Notably, the second advantage of the quantile causality approach is that it can deal with "asymmetric effects" by employing the quantile regression model. Another crucial perspective of this methodology is that it renders researchers capable of deducing the states of an economy from each quantile level (Ding et al., 2016). It should be emphasized that non-linear quantile Granger causality tests enable the researcher to study effects in tails of distributions, which are normally very difficult to make out and to isolate by conventional causality investigation methodology. Thereby, hidden impacts in tails can be traced and non-linear causal effects otherwise ignored can provide a much more representative estimation of US QE impacts on global financial markets. This estimation procedure fits better due to the non-linear character that spillovers effects use to take.

Remarkably, there is a respectable number of authors who employed this method in a wide spectrum of other than QE examination applications. Interestingly, Gebka and Wohar (2013) evaluated the relationship between volume and returns. In a somewhat different vein, Ding et al. (2016) examined the causal relationships between West Texas Intermediate (WTI) and Dubai crude oil returns and five stock index returns. Moreover, Yang et al. (2014) assessed the dynamic linkages between Asian stock prices and exchange rates. In a similar perspective, Lou (2017) estimated the relationship between stock and real-estate returns in Portugal, Italy, Greece and Spain. Lastly, in close connection to the latter study were Ding et al. (2014) that examined the causality between the real estate and stock markets in China.

In order to test about causality between the US Fed's total assets and various worldwide stock indices of high value in terms of financial markets representation in a global context, classical causality and non-linear quantile causality tests are performed.

3.1. Granger causality test

The set-off is from the principal paper of Granger (1969), who proposes a novel idea in order to test the causal relationship between two time series variables. Hence we can stipulate that the random variable x_t does not Granger − cause the random variable y_t if

$$F_{y_\tau}\left(z/(y,x)_{t-1}\right) = F_{y_\tau}(z/y_{t-1}), \quad \forall z \in R \tag{3.1}$$

holds where $F_{y_\tau}(\cdot\,|F)$ is the conditional distribution of y_t indicating F by the information set available at time $t-1$ and $(y,x)_{t-1}$ signifies the information set created by x_t and y_t up to time $t-1$. Moreover, we can specify a simplistic and essential condition for Eq. (3.1) by employing the conditional expectation

$$E\left(y_t/(y,x)_{t-1}\right) = E(y_t/y_{t-1}), \quad a.s., \tag{3.2}$$

where $E(y_t|F)$ is the mean of $F_{y_\tau}(\cdot\,|\,\cdot)$. However, we can conclude that x_t does not Granger-cause y_t in mean if only Eq. (3.2) holds.

The majority of empirical researches have checked Eq. (3.2), instead of addressing Eq. (3.1), to test the hypothesis that x_t does not Granger-cause y_t. This in turn, can be done empirically by deeming a bivariate autoregressive model for two stationary time series, namely total assets (Δta_{t-i}) and stock indices (Δsm_{t-i}):

$$\Delta sm_t = \lambda_0 + \sum_{i=1}^{p} \lambda_i \Delta sm_{t-i} + \sum_{i=1}^{p} \xi_i \Delta ta_{t-i} + \varepsilon_{sm_t}, \tag{3.3}$$

and

$$\Delta ta_t = \gamma_0 + \sum_{i=1}^{p} \gamma_i \Delta ta_{t-i} + \sum_{i=1}^{p} \delta_i \Delta sm_{t-i} + \varepsilon_{ta_t}, \tag{3.4}$$

where $\varepsilon_t = \left(\varepsilon_{eg_t}, \varepsilon_{ec_t}\right)'$ indicates a vector of i.i.d. random disturbance. The null hypothesis of Granger non-causality in mean from Δta_t to Δsm_t is rejected if the coefficients of lagged Δta_t in Eq. (3.3), that is, $\delta_1, \delta_2, \ldots, \delta_{p1}$, are jointly and significantly different from zero. Likewise, if the coefficients of $\Delta sm_{t-1}, \ldots, \Delta sm_{t-p1}$ in Eq. (3.4) are significantly different from zero, then we can strongly infer that Δsm_t Granger causes Δta_t in mean.

As stressed out above, we employ the Wald test to conduct the Granger non-causality test in mean. The selection of the optimal lag truncation order was taken from the Akaike Information Criterion (AIC). Additionally, the results of Granger non-causality are adapted from two regression models (3.3) and (3.4), in which unknown parameters are evaluated utilizing the least squares approach. Even though the empirical findings are helpful to comprehend the causal relationship between two variables, it cannot yield the full understanding of the causal relationship since the results are based on the conditional mean represented by Eq. (3.2).

3.3. Quantile causality test

Consider the following non-causality test in quantiles:

$$Q_{y_\tau}(\tau/(y,x)_{t-1}) = Q_{y_\tau}(\tau/(y)_{t-1}),$$
$$\forall \tau \in [a,b] \quad a.s., \tag{3.5}$$

In the expressions (3.5) $Q_{y_\tau}(\tau/F)$ denotes the τth quantile of the distribution and (3.5) holds, then x_t does not Granger-cause y_t over the quantile interval $[a,b]$. By following Koenker and Basset (1978), employing the quantile regression

158

framework we can stipulate the Granger non-causality test. In order to test the nonlinear causal relationship from total assets to stock markets and the reverse, we consider the computational representation of the function is as follows:

$$Q_{ta_t}(\tau \backslash x_{t-1}) = a(\tau) + \sum_{i=1}^{p} u_i(\tau) ta_{t-i} + \sum_{i=1}^{p} w_i(\tau) sm_{t-i}. \tag{3.6}$$

and

$$Q_{sm_t}(\tau \backslash x_{t-1}) = b(\tau) + \sum_{i=1}^{p} \theta_i(\tau) sm_{t-i} + \sum_{i=1}^{p} \varphi_i(\tau) ta_{t-i}. \tag{3.7}$$

where ta_{t-i} and sm_{t-i} are the total assets and stock indices at time t respectively.

Notably, the null hypothesis of non-causality in quantiles is

$$H_0: w(\tau) = 0, \quad and \quad H_0: \varphi(\tau) = 0, \quad \forall \tau \in [a, b],$$

where $w(\tau) = [w_1(\tau), w_2(\tau), \dots w_p(\tau)]'$ and $\varphi(\tau) = [\varphi_1(\tau), \varphi_2(\tau), \dots \varphi_p(\tau)]'$. A Wald test is stipulated. According to Koenker and Machado (1999) and Chuang et al. (2009), who revealed the sampling distribution of the Wald test statistic following the sum of squares of p independent Bessel process, we employ:

$$\sup_{\tau \in T} W_T(\tau) \to \left\| \frac{\mathbf{B}_p(\tau)}{\sqrt{\tau(\tau - 1)}} \right\|^2 \tag{3.8}$$

In the expressions (3.8) $W_T(\tau)$ denotes the Wald test statistic for quantile $\tau \in [a, b]$ and $\mathbf{B}_p(\tau)$ is a vector of p independent Brownian bridges, $\mathbf{B}_p(\tau) = [\tau(1 - \tau)]^{1/2} N(0, \mathrm{I}_p)$. Empirically, we may measure the sup-Wald test statistic by the following function:

$$\sup W_T = \sup_{i=1,2,\dots,n} W_T(\tau_i).$$

Additionally, we can obtain the critical values from De Long (1981) and Andrews (1993) or we can simulate the sup-Wald test with the standard Brownian motion using a Gaussian random walk with 3000 i.i.d. $N(0,1)$ innovations.

Abiding by practical stipulates of quantile causality tests, we first select a lag order p^* for each quantile interval. Following the literature (Chuang et al., 2009; Ding et al., 2016) we deem eight quantile intervals:
$[0.05, 0.95], [0.05, 0.5], [0.5, 0.95], [0.05, 0.2], [0.2, 0.4], [0.4, 0.6], [0.6, 0.8],$ and $[0.8, 0.95]$. For instance, if the null of $w_p(\tau) = 0$ for $\tau \in [0.2, 0.4]$ is not rejected under the lag $- p$ model, but the null $w_{p-1}(\tau) = 0$ for $\tau \in [0.2, 0.4]$ is rejected for lag $- p - 1$ model, albeit we deduce that ta_{t-i} does not Granger-cause sm_t in quantiles but ta_{t-i+1} does.[7] This in turn means that, we set the desired lag order as $p^* = p - 1$. We conduct the sup-Wald test in order to assess the joint significance of all coefficients of lagged

---

[7] If no value is significant in that interval at all, lag-1 order will be selected.

stock markets for eight quantile intervals (for more details see: Chuang et al., 2009; Ding et al., 2016)

5.2.4. Empirical findings and economic implications

The Wald test is employed for conducting the Granger non-causality test in mean, and Table 5.2.2 tabulates the results. As aforementioned, the selection of the optimal lag truncation order was taken from the Akaike Information Criterion (AIC). The estimation results in Table 5.2.2 reflect that Total Assets Granger-cause stock markets indices for both subperiods. Starting from the 1st subperiod, the outcomes probe thirteen bidirectional causalities, four cases disclosed that stock market cause total assets and nine for the opposite side. Notably, the neutrality hypothesis exists solely for one pair (SSE-Total assets). When it comes to the 2nd subperiod, the results are almost the same, albeit not tantamount. Precisely, Table 5.2.2 reveals eleven two-way causalities, two one-way causalities running from stock market to total assets and thirteen for the opposite side. Intriguingly, the neutrality hypothesis holds again for the pair SSE-Total assets. There is a large number of papers employing Granger causality, such as Stillwagon (2015) and Wang (2016).

Table 5.2.2 Granger causality tests in means.

	1st sub period			2nd sub period	
	(a) Stock Markets to Total Assets	(b) Total Assets to Stock Markets		(a) Stock Markets to Total Assets	(b) Total Assets to Stock Markets
Advanced Economies			*Advanced Economies*		
ALL ORDINARIES	0.08[5]*	0.00[5]***	ALL ORDINARIES	0.71[5]	0.00[5]***
BEL 20	0.13[5]	0.01[5]***	BEL 20	0.00[9]***	0.00[9]***
CAC 40	0.24[5]	0.01[5]***	CAC 40	0.13[5]	0.00[5]***
DAX	0.08[5]*	0.03[5]**	DAX	0.22[5]	0.00[5]***
DOW 30	0.00[5]***	0.45[5]	DOW 30	0.00[5]***	0.00[5]***
ESTX50 EUR P	0.39[5]	0.01[5]***	ESTX50	0.17[5]	0.00[5]***
EURONEXT 100	0.11[5]	0.01[5]***	EURONEXT	0.09[5]*	0.01[5]***
NASDAQ	0.00[5]***	0.05[5]**	NASDAQ	0.30[5]	0.00[5]***
NIKKEI	0.00[5]***	0.10[5]*	NIKKEI	0.10[5]*	0.06[5]*
NYSE AMEX COMP.	0.00[8]***	0.00[8]***	NYSE AMEX	0.19[5]	0.00[5]***
NYSE COMPOSITE DJ	0.00[5]***	0.00[5]***	NYSE COMPOSITE	0.00[9]***	0.00[9]***
RUSSELL 2000	0.00[5]***	0.24[5]	RUSSELL 2000	0.00[5]***	0.25[5]
SP 500	0.00[5]***	0.01[5]***	SP 500	0.00[9]***	0.00[9]***
SP ASX 200	0.16[5]	0.00[5]***	SP ASX	0.70[5]	0.00[5]***
SP NZX 50 GROSS	0.07[9]*	0.00[9]***	SP NZX 50	0.00[5]***	0.16[5]
SP TSX COMP.	0.00[5]***	0.00[5]***	SP TSX	0.00[9]***	0.00[9]***
Emerging Economies			*Emerging Economies*		
HANG SENG	0.03[5]**	0.08[5]*	HANG SENG	0.68[5]	0.00[5]***
IBOVESPA	0.00[5]***	0.09[5]8	IBOVESPA	0.45[5]	0.00[5]***
IPC	0.00[5]***	0.02[5]**	IPC	0.00[8]***	0.00[8]***
IPSA	0.00[5]***	0.14[5]	IPSA	0.02[5]**	0.00[5]***
JAKARTA COMP.	0.87[5]	0.00[5]***	JAKARTA	0.07[5]*	0.00[5]***
KOSPI COMP.	0.17[5]	0.01[5]***	KOPSI	0.82[5]	0.00[5]***
MERVAL	0.01[5]***	0.00[5]***	MERVAL	0.11[5]	0.00[5]***
SP BSE SENSEX	0.27[5]	0.03[5]**	SP BSE SENSEX	0.00[10]***	0.00[10]***
SSE COMP.	0.31[5]	0.34[5]	SSE	0.14[5]	0.12[5]
TSEC WEIGHTED	0.43[5]	0.00[5]***	TSEC	0.14[5]	0.00[5]***

Notes: *** , ** and * denote significant at 1%, 5% and 10% level. Numbers in square brackets are selected lags.

160

Classical Granger causality evidence indicates that mainly Brazil and Chile of emerging countries are highly more influenced by US non-conventional practices in comparison to normal times. It is noteworthy that the Dow 30 is more affected during QE, whereas the SP NZX 50 receives a lower impact than before US ample liquidity provisions. All US indices are found to be highly Granger-caused by the US Fed's actions both before and after the US practices. Interestingly, the Russell 2000 is found not to be affected, also in accordance with non-linear results. As regards reverse classical Granger causality, Belgian, European and Indian indices have a larger impact on US monetary authorities after QE implementation, whereas the Nasdaq, NYSE AMEX and Asian indices such as Hang Seng, IBovespa and IPSA are found to be less influential regarding the US monetary policy after US non-conventional practices were launched.

Table 5.2.3. Test results for quantile causality between Total Assets and Stock indices (1st sub period)

	[0.05,0.95]	[0.05,0.5]	[0.5,0.95]	[0.05,0.2]	[0.2,0.4]	[0.4,0.6]	[0.6,0.8]	[0.8,0.95]
(a) Stock indices to Total Assets before US QE								
Advanced Economies								
ALL ORDINARIES	24.04***[4]	17.60***[2]	28.37***[4]	3.86[1]	3.93[1]	2.99[1]	10.98[5]	29.12***[4]
BEL 20	5.51[2]	5.09[3]	5.51[2]	22.81**[8]	7.90[5]	2.57[5]	2.82[4]	11.40[4]
CAC 40	5.54[2]	5.64[3]	9.51**[3]	5.65[3]	2.68[1]	4.50[5]	4.64[5]	9.64*[3]
DAX	9.08[2]	9.08[2]	8.85[2]	9.13[2]	2.26[1]	2.63[2]	4.00[4]	9.96*[2]
DOW 30	29.94***[2]	29.91***[2]	25.34***[3]	29.94***[2]	4.61[2]	4.57[4]	8.36[4]	25.34***[3]
ESTX50 EUR P	8.33[2]	6.70[3]	11.26**[3]	6.70[3]	2.84[1]	1.90[1]	0.60[1]	8.41*[2]
EURONEXT 100	2.96[1]	2.96[1]	8.19[3]	2.62[1]	2.96[1]	1.94[1]	0.74[1]	9.59*[3]
NASDAQ	6.18[2]	2.10[1]	10.59**[3]	2.13[1]	1.90[1]	1.88[1]	7.45[5]	16.27[5]
NIKKEI	17.94*[5]	8.23[4]	17.94**[5]	5.31[3]	6.70[4]	1.56[1]	8.25[6]	18.27**[5]
NYSE AMEX COMP.	5.92[2]	4.58[1]	12.92*[5]	11.05[3]	2.49[1]	10.67[7]	11.58[7]	4.88[2]
NYSE COMPOSITE DJ	5.29[2]	19.60[8]	4.53[2]	4.79[1]	3.83[1]	4.06[1]	4.47[3]	4.61[2]
RUSSELL 2000	6.36[3]	3.75[1]	6.56[3]	3.66[1]	3.13[1]	3.55[1]	5.91[5]	6.36[3]
SP 500	5.94[2]	3.20[1]	18.51***[5]	3.33[1]	3.20[1]	2.28[1]	5.83[4]	6.15[3]
SP ASX 200	14.41**[2]	3.73[1]	10.19***[2]	9.79[6]	3.77[1]	6.13[6]	4.53[3]	26.35***[4]
SP NZX 50 GROSS	10.30[2]	15.11[7]	4.49[1]	10.30[2]	5.16[3]	1.50[2]	4.50[4]	4.49[1]
SP TSX COMP.	15.02[7]	15.02[7]	16.27***[5]	11.35[7]	1.67[1]	0.43[1]	0.63[1]	4.25[2]
Emerging Economies								
HANG SENG	7.43[2]	2.96[1]	4.06[1]	2.96[1]	3.60[4]	1.02[1]	3.88[2]	7.71[2]
IBOVESPA	20.30**[5]	10.91[5]	20.61**[5]	11.02[5]	2.73[1]	2.79[1]	7.18[5]	21.05**[5]
IPC	4.48[2]	4.66[2]	4.56[2]	4.73[2]	1.50[1]	7.61[8]	1.47[1]	4.61[2]
IPSA	19.26**[4]	19.26**[4]	14.71[8]	20.52**[4]	2.83[2]	2.93[2]	6.34[6]	14.84[8]
JAKARTA COMP.	15.71*[4]	15.71***[4]	5.11[2]	16.23**[4]	7.53[4]	6.47[5]	5.65[3]	5.79[1]
KOSPI COMP.	19.45*[4]	19.73**[4]	5.08[1]	19.86**[4]	11.62[5]	3.59[1]	4.97[1]	9.35[4]
MERVAL	12.08[3]	4.12[1]	11.74[5]	4.47[1]	4.13[1]	3.74[1]	3.00[1]	12.63*[3]
SP BSE SENSEX	10.55[2]	10.16[2]	7.23[2]	10.80[3]	2.48[1]	3.05[1]	4.57[2]	7.23[2]
SSE COMP.	15.59[5]	15.59[5]	1.76[1]	10.84[2]	2.66[4]	0.52[1]	0.84[1]	16.02[9]
TSEC WEIGHTED	9.89[4]	9.78[4]	7.02[2]	9.99[4]	9.17[4]	0.80[1]	0.62[1]	19.04**[2]

(b) Total Assets to Stock indices before US QE							
	[0.05,0.95]	[0.05,0.5]	[0.5,0.95]	[0.05,0.2]	[0.2,0.4]	[0.4,0.6]	[0.6,0.8]	[0.8,0.95]
Advanced Economies								
ALL ORDINARIES	21.14***[1]	21.14***[1]	23.83***[2]	21.54***[1]	20.51***[1]	21.19***[2]	23.81***[2]	6.94[5]
BEL 20	9.06*[1]	6.30[1]	9.06*[1]	6.35[1]	2.74[1]	2.88[1]	8.49**[1]	9.11***[1]
CAC 40	58.32***[2]	4.01[1]	58.32***[2]	13.71[7]	4.02[1]	3.55[1]	12.81**[2]	58.32***[2]
DAX	40.57***[1]	11.42**[1]	41.89***[1]	9.22**[1]	12.25***[1]	8.15[1]	22.78***[2]	42.35***[1]
DOW 30	27.98***[1]	27.98***[1]	3.24[1]	27.98***[1]	13.80***[1]	4.04[1]	2.33[1]	10.52[5]
ESTX50 EUR P	13.19***[1]	3.66[1]	13.19***[1]	2.05[1]	3.68[1]	7.78[3]	8.83*[2]	13.19***[1]
EURONEXT 100	59.04***[2]	5.50[1]	59.04***[2]	3.68[1]	5.52[1]	4.21[1]	15.92***[2]	59.04***[2]
NASDAQ	53.86***[1]	53.86***[1]	34.17***[3]	54.77***[1]	4.65[1]	31.15***[2]	5.32[3]	8.58[5]
NIKKEI	22.15***[1]	27.85***[1]	189.04***[2]	27.85***[1]	14.19***[1]	16.35***[2]	35.31***[2]	189.04***[2]
NYSE AMEX COMP.	73.62***[1]	74.61***[1]	3.19[1]	74.61***[1]	31.29***[1]	4.78[3]	3.18[1]	4.38[3]
NYSE COMPOSITE DJ	102.51***[1]	105.67***[1]	50.23***[3]	106.77***[1]	87.70***[1]	48.56***[1]	1.33[1]	7.52[3]
RUSSELL 2000	74.58***[1]	74.58***[1]	6.09[3]	74.66***[1]	5.01[1]	36.83***[2]	4.95[3]	6.12[3]
SP 500	83.06***[1]	85.59***[1]	36.92***[3]	85.59***[1]	81.93***[2]	3.05[1]	1.52[1]	6.04[3]
SP ASX 200	14.29***[1]	14.29***[1]	27.64***[2]	14.31***[1]	14.52***[1]	17.56***[2]	27.73***[2]	6.52[5]
SP NZX 50 GROSS	35.35***[1]	4.88[2]	36.56***[1]	14.92[7]	3.60[1]	6.18[1]	14.23***[1]	37.41***[1]
SP TSX COMP.	109.68***[1]	112.64***[1]	3.04[1]	113.36***[1]	45.54***[1]	3.04[1]	2.56[1]	2.08[1]
Emerging Economies								
HANG SENG	80.05***[1]	12.29***[1]	80.05***[1]	10.29[5]	12.33***[1]	8.37**[1]	14.41***[1]	80.05***[1]
IBOVESPA	27.54***[1]	28.01***[1]	43.61***[2]	28.01***[1]	26.46***[1]	26.63***[2]	26.75***[2]	43.74***[2]
IPC	42.27***[1]	42.27***[1]	11.08[5]	42.28***[1]	0.70[1]	2.74[1]	3.49[1]	8.12[3]
IPSA	194.65***[2]	13.54***[1]	196.70***[2]	10.89**[1]	12.13***[1]	13.54***[1]	38.08***[2]	196.70***[2]
JAKARTA COMP.	9.68*[1]	9.68**[1]	5.38[3]	9.78**[1]	1.88[1]	1.69[1]	1.74[1]	5.39[3]
KOSPI COMP.	45.45***[2]	8.54[3]	45.45***[2]	16.96*[6]	8.70[5]	2.21[1]	9.54**[2]	45.45***[2]
MERVAL	19.78***[1]	19.78***[1]	20.37***[2]	19.97***[1]	12.40***[1]	20.09***[2]	20.48***[2]	20.68[9]
SP BSE SENSEX	11.00**[1]	7.50[3]	11.01**[1]	5.75[3]	4.27[1]	4.52[1]	11.02***[1]	14.27**[2]
SSE COMP.	12.09[4]	22.39**[6]	3.14[1]	9.98[3]	12.76[9]	0.83[1]	9.38[4]	4.41[2]
TSEC WEIGHTED	15.67***[1]	6.76[2]	15.94***[1]	6.94[2]	2.65[1]	4.53[1]	7.70**[1]	16.03***[1]

Notes: *** , ** and * denote significant at 1%, 5% and 10% level. Sup-Wald test statistics and the selected lag order (in square brackets) are reported.

Concerning non-linear quantile causality results, Panel (a) of Table 5.2.3 reports the sup-Wald test statistics and the selected lag[8] truncation order for the case of stock indices to total assets for the 1st sub period, earlier defined as the pre-US QE period. It is easily observable that the largest group of stock indices cause total assets at lower or/and upper levels of quantiles. More specifically, for the quantile $[0.05, 0.95]$, $[0.05, 0.5]$, $[0.5, 0.95]$, $[0.05, 0.2]$ *and* $[0.8, 0.95]$, the All Ordinaries, Dow 30, IBovespa, IPSA, Jakarta Composite, KOSPI Composite, Nasdaq, Nikkei 225, NYSE AMEX Composite, SP 500, SP ASX 200, SP TSX Composite and TSec Weighted Granger cause the total assets. This means that the majority of indices in the advanced economies examined are shown to influence the US Fed's assets in the pre-QE period, whereas only two Latin American and three Asian indices exert such effects. Notably, the rest of the stock indices Granger cause the balance sheet enlargement for none quantile interval. Likewise, there is non-causal relationship for the middle levels of quantiles $[0.2, 0.4]$, $[0.4, 0.6]$ *and* $[0.6, 0.8]$. Nonetheless, the results correspond to quantile sub-intervals that indicate the significant causality from

---

[8] Due to length limitations and the quantity of the results, the results for lag order selection of the quantile causality tests cannot be presented. However, all the results are available upon request.

162

stock indices to total assets, which is derived from lower and upper levels of quantiles.

Panel (b) of Table 5.2.3 reports the test results for non-causality from total assets to stock indices before the US non-standard policies era. Notably, total assets exert causality on stock indices for all variables at least at one level of quantile. Interestingly, the US Fed's balance sheet size is found to Granger cause the All Ordinaries, Hang Seng, IBovespa, IPSA, Merval, Nikkei 225 and SP ASX 200 indices in almost every quantile estimation undertaken. It should be emphasized that these along with KOSPI, Euronext 100, BEL 20, CAC 40, BP BSE Sensex, and TSec Weighted are found to significantly receiving causality on the tails of their distributions. Thereby, statistically significant causal effects of the US Fed's action taking indicate that some of the US, as well as the Netherlandish and the Australian indices were not affected by the US policy before the Lehman Brothers collapse, as concerns advanced markets. When it comes to countries with emerging economies, the Mexican, Brazilian, Indonesian, and Chinese indices are not found to be receiving impacts from the Fed's actions. The phenomenon of high causality could be attributed to large volumes of funds in major foreign stock exchanges being invested in US securities, thereby foreign stock indices get affected by alterations in US monetary policy that influence premia.

Table 5.2.4. Test results for quantile causality between Total Assets and Stock indices (2nd sub period)

	[0.05,0.95]	[0.05,0.5]	[0.5,0.95]	[0.05,0.2]	[0.2,0.4]	[0.4,0.6]	[0.6,0.8]	[0.8,0.95]
(a) Stock indices to Total Assets after launch of US QE								
Advanced Economies								
ALL ORDINARIES	659.35***[8]	807.48***[8]	25.79***[4]	124.30***[4]	681.77***[5]	0.90[1]	56.79***[9]	24.37***[1]
BEL 20	210.49***[3]	197.08***[8]	49.48***[8]	210.05***[8]	1.30[1]	0.05[1]	6.52[3]	266.26***[5]
CAC 40	44.29***[2]	43.74***[7]	139.40***[5]	366.48***[8]	0.84[1]	0.04[1]	4.10[2]	143.03***[5]
DAX	47.12***[2]	26.57***[4]	50.12***[2]	14.36***[1]	3.28[2]	0.14[1]	11.39***[2]	50.12***[2]
DOW 30	110.75***[2]	100.98***[5]	236.55***[2]	19.09***[1]	21.52**[5]	3.34[1]	4.78[1]	236.55***[2]
ESTX50 EUR P	77.97***[8]	116.53***[8]	34.17***[2]	154.73***[7]	0.39[1]	0.11[1]	5.83[2]	240.36***[5]
EURONEXT 100	56.54***[3]	9.31*[1]	37.56***[2]	9.31**[1]	9.10[5]	0.04[1]	3.45[2]	90.25***[5]
NASDAQ	96.64***[6]	33.78***[3]	96.64***[6]	7.09*[1]	1.22[1]	0.11[1]	2.94[2]	96.64***[6]
NIKKEI	66.87***[6]	3.68[2]	398.91***[3]	4.24[2]	4.08[5]	0.06[1]	7.38[3]	276.80***[6]
NYSE AMEX COMP.	667.75***[8]	122.23***[5]	102.58***[4]	217.10***[4]	2.74[1]	0.41[1]	5.07[4]	89.62***[2]
NYSE COMPOSITE DJ	234.04***[5]	20.16***[1]	570.08***[8]	20.16***[1]	4.23[1]	2.35[1]	3.55[1]	42.76***[3]
RUSSELL 2000	597.69***[7]	93.48***[1]	264.54***[4]	93.48***[1]	4.77[1]	0.50[1]	0.34[1]	0.27[2]
SP 500	139.81***[5]	18.62***[1]	108.31***[2]	428.20***[8]	4.65[1]	1.93[1]	63.39***[9]	108.31***[2]
SP ASX 200	31.23***[4]	94.72***[4]	54.28***[7]	131.73***[4]	5.40[1]	0.94[1]	3.16[1]	31.23***[4]
SP NZX 50 GROSS	5.48[1]	5.48[1]	11.03**[3]	2.63[1]	4.45[1]	1.28[1]	1.08[1]	15.20*[4]
SP TSX COMP.	16.83***[1]	20.57**[5]	17.40***[1]	0.85[1]	0.45[1]	0.26[1]	1.39[1]	17.61***[1]
Emerging Economies								
HANG SENG	88.13***[4]	8.42[3]	62.69***[4]	276.78***[6]	1.74[1]	1.37[1]	3.82[1]	62.69***[4]
IBOVESPA	38.46***[1]	16.48**[3]	38.46***[1]	16.69**[3]	0.70[1]	0.07[1]	10.08[3]	38.46***[1]
IPC	31.33***[1]	2.71[1]	32.03***[1]	2.74[1]	1.02[1]	0.60[1]	6.31[3]	33.69***[1]
IPSA	31.39***[2]	24.67***[3]	31.39***[2]	9.44**[1]	0.37[1]	0.05[1]	1.11[1]	31.39***[2]
JAKARTA COMP.	29.28***[1]	17.42***[3]	39.70***[1]	17.58***[3]	2.38[1]	2.30[1]	5.41[1]	39.70***[1]
KOSPI COMP.	87.50***[3]	13.86[3]	87.50***[3]	13.86[3]	1.23[2]	0.38[1]	1.49[1]	87.50***[3]
MERVAL	19.87***[1]	12.75[3]	20.12***[1]	12.75[3]	0.93[1]	0.13[1]	1.15[1]	20.12***[1]
SP BSE SENSEX	8.98*[1]	0.15[1]	338.81***[3]	1.54[1]	5.48[1]	5.32[1]	301.92***[3]	113.19***[1]
SSE COMP.	107.64***[6]	12.32**[1]	25.67***[2]	12.65**[1]	3.06[1]	0.85[1]	6.81[5]	111.69***[6]
TSEC WEIGHTED	29.70***[2]	3.62[1]	29.70***[2]	10.83[4]	3.63[1]	1.11[1]	3.96[1]	29.97***[2]

163

(b) Total Assets to Stock indices after launch of US QE							
	[0.05,0.95]	[0.05,0.5]	[0.5,0.95]	[0.05,0.2]	[0.2,0.4]	[0.4,0.6]	[0.6,0.8]	[0.8,0.95]
Advanced Economies								
ALL ORDINARIES	83.61***[5]	83.15***[5]	26.90***[3]	84.90***[5]	17.35*[5]	7.14[4]	20.65***[4]	27.40***[3]
BEL 20	21.20**[4]	15.52[4]	8.92[3]	18.35**[4]	8.48[4]	1.66[2]	6.60[2]	21.20***[4]
CAC 40	146.49***[5]	178.11***[5]	10.70[2]	178.11***[5]	5.42[2]	0.05[1]	0.45[1]	10.70[2]
DAX	27.11***[2]	29.58***[4]	27.11***[2]	29.58***[4]	1.2[1]	0.09[1]	16.01**[4]	29.01***[2]
DOW 30	72.34***[3]	22.57***[4]	43.63***[2]	10.55**[1]	2.44[1]	7.39[2]	14.02***[2]	43.63***[2]
ESTX50 EUR P	77.82***[10]	80.17***[10]	30.52***[3]	57.55***[5]	30.21***[5]	0.54[1]	0.02[1]	30.56***[4]
EURONEXT 100	30.81***[2]	30.81***[2]	27.97***[2]	30.81***[2]	0.23[1]	0.24[1]	23.23***[4]	28.55***[2]
NASDAQ	70.20***[3]	29.36***[1]	70.20***[3]	29.36***[1]	2.06[1]	5.87[2]	12.07*[2]	71.06***[3]
NIKKEI	65.68***[3]	46.99***[9]	65.68***[3]	52.96***[9]	2.34[2]	17.30**[5]	5.76[2]	65.68***[3]
NYSE AMEX COMP.	80.91***[2]	129.67***[4]	236.90***[4]	44.51***[1]	12.61[5]	3.12[2]	42.57***[7]	80.91***[2]
NYSE COMPOSITE DJ	147.84***[3]	573.25***[4]	39.26***[2]	588.30***[4]	1.31[1]	0.58[1]	7.66[2]	163.86***[3]
RUSSELL 2000	162.38***[4]	20.42**[2]	0.16[1]	2.46[1]	47.91***[7]	0.99[1]	20.65***[2]	3.21[2]
SP 500	78.01***[3]	23.83***[1]	50.79***[2]	23.83***[1]	3.38[1]	5.00[2]	16.31***[3]	51.14***[2]
SP ASX	101.37***[4]	77.24***[5]	29.10***[5]	79.01***[5]	15.02[5]	15.35[6]	21.59***[5]	15.68*[3]
SP NZX 50	20.03***[2]	21.15***[2]	18.46***[2]	20.15***[2]	6.26[1]	2.10[1]	3.50[2]	18.68***[2]
SP TSX COMP.	125.32***[5]	75.43***[5]	18.60***[2]	77.36***[5]	4.95[2]	0.91[1]	11.25**[2]	18.60***[2]
Emerging Economies								
HANG SENG	22.60***[1]	22.60***[1]	18.29***[2]	22.60***[1]	3.14[1]	0.27[1]	0.29[1]	18.29***[2]
IBOVESPA	38.07***[2]	14.78[5]	39.42***[2]	15.00[5]	0.19[1]	0.42[1]	1.31[1]	39.42***[2]
IPC	63.26***[4]	28.21***[5]	5.30[2]	1.14[1]	0.16[1]	0.04[1]	5.09[2]	63.26***[4]
IPSA	31.08***[1]	33.42***[1]	16.58***[1]	38.85***[1]	6.05[1]	2.00[1]	4.18[1]	16.58***[1]
JAKARTA	42.58***[1]	43.37***[1]	28.55***[1]	43.96***[1]	4.29[1]	0.97[1]	17.04**[4]	83.35***[2]
KOSPI COMP.	18.92***[2]	2.29[1]	19.46***[2]	2.29[1]	0.72[1]	1.09[1]	4.80[3]	19.65***[2]
MERVAL	16.31***[1]	16.31***[1]	11.93[4]	16.51***[1]	2.12[2]	5.89[3]	8.78[4]	11.04[3]
SP BSE SENSEX	1.54[8]	1.89[5]	16.05*[5]	6.93[1]	147.36***[7]	18.73***[6]	373.13***[6]	16.13[5]
SSE COMP.	15.92***[1]	7.99*[1]	16.05***[1]	8.83[3]	8.02*[1]	6.29[1]	16.12***[1]	13.23**[1]
TSEC WEIGHTED	23.87***[1]	23.87***[1]	11.12*[2]	23.92***[2]	18.31**[4]	11.12*[2]	10.39**[2]	10.25**[2]

Notes: *** , ** and * denote significant at 1%, 5% and 10% level. Sup-Wald test statistics and the selected lag order (in square brackets) are reported.

Furthermore, panel (a) of Table 5.2.4 illustrates the sup-Wald test statistics and the selected lag truncation order for the case of stock indices effects on total assets for the US QE policies sub period. As in the 1st sub period, stock indices cause total assets at lower or/ and upper levels of quantiles, but it is strikingly interesting that this is true for almost all stock indices when the tails of distributions are taken into consideration. Notably, only the SP BSE Sensex and SP NZX 50 indices are the exceptions in lower tails, whereas the Russell 2000 in higher ones. However, there is causality at the middle levels of quantiles for four variables (All Ordinaries, DAX, SP 500 and SP BSE Sensex). All in all, as we can clearly see, the causal relationship between the total assets and stock markets is not significant for the majority of indices over the middle level of quantiles, whereas significant causal relationships exist in tails. It can easily be derived that the causal relationships are highly likely present when one variable shows very high or very low efficiency. For instance, while there is no significant causal relationship from the stock indices to the Fed's assets over the middle level ($\tau \in [0.2, 0.4]$) of quantiles, there is evidence of causality in the lower or higher levels of quantiles. This insinuates asymmetric effects of the index on the assets.

164

Panel (b) of Table 5.2.4 depicts the test results for non-causality from total assets to stock indices for the 2nd sub period. Interestingly, total assets are found to exert causality towards stock indices for all indices under scrutiny at least at one level of quantile. In this case only one variable (TSec) is significant for all quantiles intervals. It should be highly emphasized that the US Fed's balance sheet is found to have stronger and more robust impacts on stock indices than in the pre-QE period, when the focus is made on the upper quantile level. Thereby, there is evidence that US unconventional monetary practices trigger significant tail-characteristics effects on global stock indices. Interestingly, the inverse causal relationship in tails also holds. Specifically, only two indices in developed markets (CAC 40, Russell 2000) do not receive impacts from the Fed's policy in the upper quantile as well as two indices from emerging markets (Merval, BP BSE Sensex). In general, advanced economies are found to have been more influenced by the US non-conventional practices than emerging ones. It should be emphasized though that reverse causality as shown in Table 5.2.4a, that is non-linear effects from indices to Fed's assets, are statistically significant for more countries. This gives credence to advanced and mainly emerging markets being more influential towards US unconventional monetary action taking. This provides evidence of circularity in effects, which is less pronounced regarding emerging markets when the Fed acts out of the ordinary, probably because capital flows from US towards these economies are not large as the other way around. Notably, this could indicate a US preference for allocating more fresh liquidity to developed markets rather than developing ones.

It is highly likely that the high level of non-linear causality towards stock indices stems from the non-linear character by which domino effects by the Lehman Brothers collapse as well as consequent measures were spread over capital markets. This spurred the necessity for measuring stock price volatility outside of the ordinary confidence intervals in order to capture the crisis impacts more accurately. It should be highly stressed that during the US QE and QE-tapering periods, the Fed's balance sheet alterations significantly exert spillover effects to the great majority of global indices when lower and upper tails are examined. This is in accordance with earlier studies such as Chen et al. (2016), Tillmann (2016), and Fratzscher et al. (2018). The US non-conventional practices have created excessive global liquidity and findings until now indicate that this leads to massive acceleration of capital flows to advanced but mainly emerging markets. These flows have been found to create fiscal imbalances and asset price bubbles according to existing bibliography. Moreover, higher credit growth has led to overheating of the domestic as well as foreign economies. Portfolio rebalancing is found not to be always directing to more risky US assets, but also towards foreign assets. An increasing number of studies on the US unconventional impacts on other countries (Bowman et al., 2015; Kiendrebeogo, 2016) and US QE-tapering effects (Eichengreen and Gupta, 2015) show evidence of positive impact of QE on stock markets. Our results verify these earlier findings.

Our results indicate that the Fed announcements were in a large extent priced in equity quotes, especially in advanced financial markets, whereas in a somewhat lower degree in emerging ones. Intriguingly, non-linear causality being found towards

the Fed's balance sheet and reversely, towards stock indices, even in the pre-QE period, shows towards procyclicality in the effect of interventions. This concerns mainly advanced but also emerging economies, in a causal as well as a reversely causal manner.

Interestingly, our econometric estimations provide evidence that modern monetary policymaking has been important in defining the route of stock price volatility and returns in extraordinary circumstances. Notably, this leads to the conclusion that monetary action taking near the ZLB and away from the Taylor rule could indeed prove effective and render global capital markets profitable again for investors by also giving a boost to the global economy.

5.2.5. Conclusions

This study adopts not only Classical Granger causality but also non-linear causality in quantiles. This takes the form of appropriate specification so as to assess the level by which unconventional monetary practices by US monetary authorities have resulted in a causal nexus to stock markets worldwide. Despite both the pre-crisis and the post-crisis periods being examined, the attention is mainly focused on effects after the outburst of the Global Financial Crisis. This study is differentiated from relevant academic literature in that it centers attention on tail estimations. Moreover, it applies an innovative non-linear specification in order to extract the dynamics of central bank balance sheet enlargement.

Econometric results by non-linear quantile methodologies reveal that the non-conventional QE practices by the Federal Reserve have resulted in higher impacts of the Fed's assets on worldwide stock markets in comparison to the era before the Lehman Brothers default. Estimations in tails exhibit that the higher tails of their quotes' distribution receive a much more significant impact during QE action taking. To be more precise, US unconventional monetary practices not only affect domestic but also foreign stock indices. Intriguingly, the impact on advanced countries is found to be larger, whereas the vast majority of developing markets also receive an impact but this is not so intense. Notably, our results fortify previous empirical findings about a substantial level of spillover impacts worldwide, triggered by US QE actions.

Emphasis should be paid to significant ad strong reverse non-linear causal impacts from stock indices towards the Fed's assets. Notably, the Fed's balance sheet receives effects by domestic, Latin American, Australian as well as Asian stock markets in upper and lower tails, regarding the period before the global financial meltdown. It should be emphasized that the vast majority of upper tail results are statistically significant at the 1% level. All in all, US non-conventional actions have intensified the linkage of the Federal Reserve with domestic indices and neighboring advanced countries, such as Canada, but also with emerging ones like Mexico. Other emerging economies, such as China or other Asian ones are also found to have fortified such linkage. Moreover, the connection between the Federal Reserve's total

166

assets with developing countries and particularly Brazil and Chile are intensified during QE periods.

Overall, the monetary authorities in the US have been found to enjoy a stronger nexus with non-US stock indices, particularly advanced indices when unconventional measures are undertaken. This is more evident when non-linear causality methodologies focusing on upper quantiles are applied.

This study is differentiated from previous ones due to centering its interest on tail characteristics. Intriguingly, we contribute to relevant academic work by employing an innovative aspect in econometric methodologies in order to study how the Fed's balance sheet enlargement can be effective in Zero Lower Bound (ZLB) environments. This extra insight in tail estimations of equity returns could supply policymakers and investors with more complete knowledge about the stimulatory interconnectedness between monetary action taking and capital markets during out of the ordinary periods.

References

Anaya, P., Hachula, M., & Offermanns, C. J. (2017). Spillovers of US unconventional monetary policy to emerging markets: The role of capital flows. Journal of International Money and Finance, 73, 275-295.

Andrews, D., 1993. Tests for parameter instability and structural change with unknown change point. Econometrica 61 (4), 821–856.

Apergis, N., & Christou, C. (2015). The behaviour of the bank lending channel when interest rates approach the zero lower bound: Evidence from quantile regressions. Economic Modelling, 49, 296-307.

Bauer, M., & Rudebusch, G. (2014). The Signaling Channel for Federal Reserve Bond Purchases. International Journal of Central Banking, 10(3), 233-289.

Berge, T. J., & Cao, G. (2014). Global Effects of US Monetary Policy: Is Unconventional Policy Different?. Economic Review-Federal Reserve Bank of Kansas City, 5.

Bernhard, S., & Ebner, T. (2017). Cross-border spillover effects of unconventional monetary policies on Swiss asset prices. Journal of International Money and Finance, 75, 109-127.

Bouraoui, T. (2015). The effect of reducing quantitative easing on emerging markets. Applied Economics, 47(15), 1562-1573.

Bowman, D., Londono, J. M., & Sapriza, H. (2015). US unconventional monetary policy and transmission to emerging market economies. Journal of International Money and Finance, 55, 27-59.

Brana, S., & Prat, S. (2016). The effects of global excess liquidity on emerging stock market returns: Evidence from a panel threshold model. Economic Modelling, 52, 26-34.

Chadha, J. S., & Waters, A. (2014). Applying a macro-finance yield curve to UK quantitative Easing. Journal of Banking & Finance, 39, 68-86.

Chen, Q., Filardo, A., He, D., & Zhu, F. (2016). Financial crisis, US unconventional monetary policy and international spillovers. Journal of International Money and Finance, 67, 62-81.

Christensen, J., & Gillan, J. M. (2018, February). Does quantitative easing affect market liquidity?. Federal Reserve Bank of San Francisco, Working Paper 2013-26

Chuang, C. C., Kuan, C. M., Lin, H. Y. (2009). Causality in quantiles and dynamic stock return–volume relations. Journal of Banking & Finance, 33(7), 1351-1360.

d'Amico, S., English, W., López- Salido, D., & Nelson, E. (2012). The Federal Reserve's Large- scale Asset Purchase Programmes: Rationale and Effects. The Economic Journal, 122(564).

De Long, D.M., 1981. Crossing probabilities for a square root boundary by a Bessel process. Comm. Statist. Theory Methods 10 (21), 2197–2213.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. Journal of the American statistical association, 74(366a), 427-431.

Ding, H., Chong, T. T. L., Park, S. Y. (2014). Nonlinear dependence between stock and real estate markets in China. Economics Letters, 124(3), 526-529.

Ding, H., Kim, H. G., Park, S. Y. (2016). Crude oil and stock markets: Causal relationships in tails?. Energy Economics, 59, 58-69.

Eichengreen, B., & Gupta, P. (2015). Tapering talk: The impact of expectations of reduced Federal Reserve security purchases on emerging markets. Emerging Markets Review, 25, 1-15.

Elliott, G., Rothenberg, T.J.,Stock, J.H., 1996. Efficient Tests for an autoregressive unit root. Econometrica 64, 813–836.

Eser, F., & Schwaab, B. (2016). Evaluating the impact of unconventional monetary policy measures: Empirical evidence from the ECB′s Securities Markets Programme. Journal of Financial Economics, 119(1), 147-167.

Fratzscher, M., Lo Duca, M., & Straub, R. (2018). On the international spillovers of US quantitative easing. The Economic Journal, 128(608), 330-377.

Gagnon, J. E., Bayoumi, T., Londono, J. M., Saborowski, C., & Sapriza, H. (2017). Direct and Spillover Effects of Unconventional Monetary and Exchange Rate Policies. Open Economies Review, 28(2), 191-232.

Gagnon, J., Raskin, M., Remache, J., & Sack, B. (2011). The financial market effects of the Federal Reserve's large-scale asset purchases. International Journal of Central Banking, 7(1), 3-43.

Gebka, B., Wohar, M. E. (2013). Causality between trading volume and returns: Evidence from quantile regressions. International Review of Economics & Finance, 27, 144-159.

Granger, C., (1969). "Investigating causal relations by econometric models and cross-spectral methods". Econometrica 37 (3), 424–438.

Hännikäinen, J. (2015). Zero lower bound, unconventional monetary policy and indicator properties of interest rate spreads. Review of Financial Economics, 26, 47-54.

Jeong, K., Härdle, W. K., Song, S. (2012). A consistent nonparametric test for causality in quantile. Econometric Theory, 28(04), 861-887.

Joyce, M. A., & Tong, M. (2012). QE and the gilt market: a disaggregated analysis. The Economic Journal, 122(564).

Kenourgios, D., Papadamou, S., & Dimitriou, D. (2015a). On quantitative easing and high frequency exchange rate dynamics. Research in International Business and Finance, 34, 110-125.

Kenourgios, D., Papadamou, S., & Dimitriou, D. (2015b). Intraday exchange rate volatility transmissions across QE announcements. Finance Research Letters, 14, 128-134.

Kiendrebeogo, Y. (2016). Unconventional monetary policy and capital flows. Economic Modelling, 54, 412-424.

Kiley, M. T. (2014). The Response of Equity Prices to Movements in Long- Term Interest Rates Associated with Monetary Policy Statements: Before and After the Zero Lower Bound. Journal of Money, Credit and Banking, 46(5), 1057-1071.

Koenker, R., Bassett, G., 1978. Regression quantiles. Econometrica 46 (1), 33–50.

Koenker, R., Machado, J., 1999. Goodness of fit and related inference processes for quantile regression. J. Amer. Statist. Assoc. 94 (448), 1296–1310.

Kwiatkowski, D., Phillips, P.C.B., Schmidt, P., Shin, Y., 1992. Testing the null hypothesis of stationary against the alternative of a unit root. Journal of Econometrics 54, 159–178.

Lambert, F., & Ueda, K. (2014). The effects of unconventional monetary policies on bank soundness (No. 14-152). International Monetary Fund.

Lou, T. (2017). Nonlinear causality relationship between stock and real-estate returns in PIGS countries: wealth effect or credit-price effect. Applied Economics Letters, 24(11), 736-741.

Lutz, C. (2015a). The impact of conventional and unconventional monetary policy on investor sentiment. Journal of Banking & Finance, 61, 89-105.

Lutz, C. (2015b). The international impact of US unconventional monetary policy. Applied Economics Letters, 22(12), 955-959.

Meinusch, A., & Tillmann, P. (2016). The macroeconomic impact of unconventional monetary policy shocks. Journal of Macroeconomics, 47, 58-67

Neuhauser, K. L. (2015). The Global Financial Crisis: what have we learned so far?. International Journal of Managerial Finance, 11(2), 134-161.

Papadamou, S., & Sogiakas, V. (2018). The informational content of unconventional monetary policy on precious metal markets. Journal of Forecasting, 37(1), 16-36.

Phillips, P.C.B., and Perron, P., 1988. Testing for a unit root in time series regressions. Biometrica 75, 335–346.

Rai, V., & Suchanek, L. (2014). The effect of the federal reserve's tapering announcements on emerging markets (No. 2014-50). Bank of Canada Working Paper.

 Roache, S. K., & Rousset, M. V. (2013). Unconventional Monetary Policy and Asset Price Risk (No. 13/190). International Monetary Fund.

Rosa, C. (2012). How 'unconventional' are large-scale asset purchases? The impact of monetary policy on asset prices. The Impact of Monetary Policy on Asset Prices (May 1, 2012). FRB of New York Staff Report, (560).

Saiki, A., & Frost, J. (2014). Does unconventional monetary policy affect inequality? Evidence from Japan. Applied Economics, 46(36), 4445-4454.

Stillwagon, J. R. (2015). Testing the expectations hypothesis with survey forecasts: the impacts of consumer sentiment and the zero lower bound in an I (2) CVAR. Journal of International Financial Markets, Institutions and Money, 35, 85-101.

Swanson, E. T. (2015). Measuring the Effects of Unconventional Monetary Policy on Asset Prices (No. w21816). National Bureau of Economic Research.

Tillmann, P. (2016). Unconventional monetary policy and the spillovers to emerging markets. Journal of International Money and Finance, 66, 136-156.

Unalmis, D., & Unalmis, I. (2015). The Effects of Conventional and Unconventional Monetary Policy Surprises on Asset Markets in the United States, MPRA Paper No. 62585

Wang, L. (2016). Unconventional monetary policy and aggregate bank lending: Does financial structure matter?. Journal of Policy Modeling, 38(6), 1060-1077.

Wang, Y. C., Wang, C. W., & Huang, C. H. (2015). The impact of unconventional monetary policy on the tail risks of stock markets between US and Japan. International Review of Financial Analysis, 41.

Yang, Z., Tu, A. H., Zeng, Y. (2014). Dynamic linkages between Asian stock prices and exchange rates: new evidence from causality in quantiles. Applied Economics, 46(11), 1184-1201.

Chapter 6

Forms of extra-unconventional monetary policy. The case of potential effects of helicopter money drops in the Eurozone[9].

6.1. Introduction

Monetary policy easing in the major developed countries such as the US, the UK, Japan, as well as in the Eurozone, has been at the **center of academic debate** since the onset of the 2008 global financial crisis. Theoretical economists but market practitioners as well have been willing to better discern the impact of liquidity injections on the real economy and financial markets. This has led to a voluminous relevant academic literature and has **evoked conflicts** between supporters of easing policies and proponents of monetary stability.

By taking into consideration expectations about further monetary easing by the ECB, and having in mind that a new QE round or a helicopter money drop could be about to emerge, much questioning has risen about suitability of further easing. This paper tries to **provide some insights into** whether **helicopter money drops** –that is providing **irredeemable fiat money** to the economy- **could provide a suitable measure for keeping the Eurozone's financial engine warmed up.** This is examined by being **counterbalanced with a potential loss of central bank credibility** and a **decline in further easing efficacy** that such a new **modern money theory** implies for radical monetary actions like helicopter monetary drops, the analysis being based on Minsky and Kaufman (2008). While the intention of **this paper** is not to suggest that this is the best approach to be adopted when looking into the nowadays situation in monetary economics, we believe that it **could constitute the basis for a new though historically-originated way of thinking.** This could be **helpful for economists to formulate an opinion and tender advice** about whether the view at issue here could prove useful or not.

One of the main questions that have to be answered **regarding new unconventional policies** is **what is required to counterbalance their costs and benefits** regardless of the extent to which they affect the viability of the Eurozone and could irredeemably damage the European monetary authorities' credibility. In other words, **could the ECB preserve the rumor of being independent and credible after successive rounds of QE and, eventually, helicopter money drops?** In order to give a firm theoretically-based reply, one should clearly make up their mind about what modern money theory implies concerning debt monetization and how high would be the risk of financial collapse if most economic agents refused to pay their debts on time. By taking into consideration the **bank-centric character of the**

---

[9] The results of this subsection were published in the ´´International Journal of Central Banking Theory and Practice´´ in 2017. Kyriazis, N. A. (2017). Eurozone Debt Monetization and Helicopter Money Drops: How Viable can this be?. Journal of Central Banking Theory and Practice, 6(3), 5-15.

172

Eurozone that attributes to banking institutions` role of the primary moving force for economic development, one could justifiably ask himself if banks –as the biggest debtors in the world- could always avoid paying their debt with no consequences whatsoever. By bearing in mind **how heavily indebted are large banking institutions nowadays**, one should always wonder how endangering this excessive borrowing could prove. **Through accumulating large amounts of debt, banks are able to make profits but at the same time increase the risk of confronting a bankruptcy**, as the more they keep on capitalizing on other people's debt, the more difficult it becomes for them to liquidate their debts.

Modern money theory indicates that **money's existence would be impossible without the simultaneous existence of a debt that will never be discharged** (Sgambati, 2016). This is to a large extent due to monetary scarcity of precious metals to be connected with money printing and thereby liquidity creation. It could therefore be characterized as **much more than a random common thinking that bank intermediation is nothing more than creating money out of nothing**, having its origins in the **chartalism theory** supporting that using tokens economizes in real resources and is especially useful during crises and generally in periods of liquidity drainage. Abiding by the **redistributional character of financial intermediation** as its primary objective, it could easily be derived that **bank profit maximization has real economy profit-making origins** as banks are only an intermediate in the credit infusion process to economic units.

The remainder of this sub section of this thesis is structured as follows: Section 2 provides a theoretical background for money creating and liquidity dynamics. In Section 3 the positive effects of debt monetization and the benefits of helicopter money drops are examined, while Section 4 furnishes the counterarguments based on credibility risks and discusses the impact on EZ perspectives. Section 5 provides the conclusion.

6.2. Theoretical background of money creating and liquidity

If one employs the **fractional reserve mechanism** in an effort to understand how the time structure of a bank's balance sheet works, they will inevitably observe **great asymmetries between time horizons in the liabilities and the assets sides, which is much more long-term oriented**. It could thus be deduced that due to this apparent maturity mismatch, **a banking institution** abiding by the fractional reserve mechanism **is constantly inherently bankrupt**, with the burden of a nonnegligible debt. **Problems** like this though are easily **solved due to the interbank market for reserves and a clearing facility**, which should be working smoothly in any condition.

This character of **interdependence in the banking system is highly likely to turn the other way around** in times of **financial crises**, where the banking system's credibility becomes lower, and the need of borrowing in the interbank market becomes greater, whereas at the same time, **other banks become risk-averse and**

173

reduce fund supply among banks. This urges banking institutions to be **susceptible to fire-sales** in order to satisfy increased fund demand by their depositors and consequently leads to a deflationary bulge. How burdensome could this default spiral become? **Could irredeemable helicopter money become a remedy to this apparent dead-end?** The sustainability of debt seems to be in the core of this answer. **How powerful could fiduciary money that does nothing more than enhance debt accumulation prove to be? Is debt sustainability able to equilibrate supply and demand dynamics forever? For how much longer would the unconventional nature of fiat money survive and pertain in more unconventional forms without the risk of a bubble-economy bursting?** Is ''too-big-to-fail'' just a phenomenon of an impermanent and fading-out character?

One could hardly disagree that **liquidity** is **tightly connected to new money making**. Nevertheless, the two meanings are not exactly the same, in contrast to what many people would think at first blush. The ability to use money for trades, as a market instrument, is what renders money useful. Thereby the liquid or not condition of money could be claimed to be more important than money itself. This is that constitutes the **main difference between QE-injected money and helicopter money**. In the **first case, money** is provided by asset purchases but does **not affect households' willingness to consume or firms' eagerness to invest** to the extent that monetary and fiscal authorities would probably desire, owing to taking into consideration the ephemeral character of freshly provided liquidity. **On the other hand, irredeemability of helicopter-dropped money that will never have to be paid back is probably much more influential** to the public's expectations. This would affect their actions in favor of the outcome intended in the first place (Shiller, 2015). One could with no hesitation characterize helicopter money as the most unconventional of policies, at least according to our knowledge until now.

The **main drawbacks of unconventional policies** in general are: the **diminishing efficacy of new rounds** of non-conventional measures, the **increasing difficulty of swapping up the extra liquidity** injected when return to normality becomes essential, and the **weakening of monetary authorities' credibility** and trustworthiness as new unconventional policy rounds arise. The increasing uncertainty due to the financial crisis, the non-linear costs for the economy due to domino effects and the high level of leverage and inter-connectedness in the financial sector, as well as the irrational exuberance and moral hazard that ample liquidity provisions can evoke, make this **calculation of loss a Herculean task**. **Modern money theory** openly supports that **money creation is entirely a financial phenomenon**, thereby **attributable to the banking sector**. Although debt monetization used to be a very old practice exercised by kings and considered as immoral regarding the distribution of tax burden, indebtedness has intertemporally been accepted as a means of perpetuating and maintaining purchasing power and providing fresh income that keeps the engine of the real economy still working.

The main function of the central bank has always been to remain a benchmark of credibility, the one that furnishes the legal tender to money circulating in the economy and is used to finance public expenses. This irreplaceable concept is that

174

credibility forms a sine qua non for indebtedness to be preserved by the mutual will of both counterparties in order for the credit character of money to be efficient through its high elasticity dynamics. One could easily wonder about how ethical new ample liquidity is providing that lessens the real value of already existing money. This could probably be explained by **considering bank functioning** not as a **procedure** where debt is exchanged for credit, but preferably as one where **debt is exchanged for debt.** That is the debtor and the creditor should no longer form a creditor-debtor **relationship**, but a **debtor-debtor** one, shaping a **mutual indebtedness** where a debt bearing interest could be exchanged with another debt redeemable on demand (Kim, 2011). This would be in full accordance with the notion that **every economic agent owes money but never owns them**, he just owns a debt due to his capacity to convince the counterparty that he is trustworthy enough to owe and transfer his payment obligations into future periods.

In other words, **money is so dynamic that it cannot be framed** and it emancipates people from time and fund constrains that hold back economic growth due to maturity mismatching. **Unconventional monetary policies** tend to **assist** economic units, **primarily through the developed banking system in the Eurozone**, to better allocate their assets in time and capitalize other people's debts in order to be liquid in their formation. The question posed is **for how long this interaction could keep up without one of the debtor-debtor counterparties deciding to ask the other to repay his debt by not issuing further debt**. In other words, how many rounds of economic interacting will have to go by until people's expectations unavoidably become pessimistic? Modern money theory supports that debt renewal could be perpetuated forever and it is the sentiment of safety that the credibility of counterparties exerts that allows for this non-stopping character. **New unconventional** monetary policy **rounds** could easily **boost economic agents' confidence** that **yields will remain low** and investment will not become costlier because of new money printed and provided by the ECB.

As Mehrling (2000) argues, there is always a **hierarchy in monetary systems**, with **debts of higher quality circulating as money to lower quality debts**. The interest paid for the renewal of debt represents the uncertainty emanating from transferring debt into the future. **Debt monetization by the ECB via helicopter money** drops could fairly well surpass the institutional limits of cash, **enhance confidence**, and **diminish the importance of collateral and hard currency** in financial trades based on debt.

6.3. Positive effects of debt monetization and helicopter money

A voluminous extent of concern is therefore raised by the self-perpetuating character that unconventional policymaking has shown up to present, if the necessity of new rounds of QE in US, UK, Japan, and the Eurozone is considered. Simply put, **flight from money scarcity and the increasing elasticity of money supply makes**

175

the marginal impact of extra liquidity decreasing. Fiat money with continuously larger deviations between its intrinsic and its nominal value, make money substitutes more and more weak, thereby lessening their credibility and fueling new inflationary bubbles, raising fears that helicopter-dropped money will be so light and thereby in need to become too numerous to counterbalance the crisis. Moreover**, moral hazard incentives leading to excess risk-taking make the efficiency of debt monetization dubious**, thereby rendering the last arrow in the quiver of the ECB less sharp than desired. The possibility of a new liquidity crisis after helicopter drops have been implemented would leave monetary authorities with an economy stuck at the Zero Lower Bound (ZLB) and in need of much new creativity to get over such a situation.

One of the **most promising characteristics of helicopter money** is that it increases economic units' net wealth, thereby provo**king a pure wealth effect of monetary policy on consumption demand** (Buiter, 2005). In other words, the present discounted value of the final stock of money is a component of the private wealth after having taken the government and the household's budget constraints into consideration. Thus, **irredeemable fiat money** is believed to be an efficient means of affecting real consideration by **managing to exercise an impact on the present value of future endowments.** According to Buiter (2005), **monetizing the debt has the advantage of overcoming debt neutrality and not be subject to the Ricardian Equivalence theorem** that supports government non-monetary debt not being net wealth. Moreover, Buiter and Sibert (2007) prove that **irredeemability of debt leads to exclusion of deflationary bubbles,** even when both money and bonds are issued. Furthermore, according to Friedman's optimum quantity of money (OQM) equilibrium, **all liquidity trap equilibria as well as deflation equilibria are ruled out due to the weak real balance effect that the monetized non-redeemable character of debt** brings about.

A prominent feature of high importance of monetary policy in the authorities' effort to maintain a low possibility of liquidity drainage due to sudden deposit withdrawal increases is managing to preserve optimistic sentiments among investors. Differently said, a salient matter is the **ability of perpetuating public's expectations that the long-run money stock increases will not be reversed and that liquidity traps could be avoided**. Shiller (2015) argues that investor's positive sentiment is able to keep on leveraging economic activity and promoting inflation, thereby **maintaining** the **financial system alive** and vivid. It could be **difficult** for someone not to make out that **in a bank-centric financial construction such as the Eurozone**, the importance of economic concepts such as optimistic expectations get particularly large, especially in times when breakthrough discretionary actions are required. One could logically wonder if debt monetization and the perpetual character of debt renewal and fresh liquidity pumped could be applicable in real economy.

Though not having to take off one's mind from that a non-negligible amount of conditions has to be valid, it could be claimed that **currency is highly negotiable and very elastic regarding its maximum extent of nominal to intrinsic value difference**, as well as its money multiplying dynamics. In simpler terms, currency is a bearer bond that can be freely negotiated. This happens due to broad money being

176

made up of two forms of IOUs, that is: i) bank deposits being headed from commercial banks to households and companies, and ii) currency, primarily meaning IOUs from the central bank, though the latter is much less voluminous than the former (McLeay et al., 2014). The vast network of banking intermediaries in the euro area enhances new money creation not by producing large streams of new banknotes, but simply by crediting economic agents' bank accounts with bank deposits that have the same value as the assets traded. The commercial banks loading their balance sheets with new loans and new deposits lubricates the financial system's machine and spurs economic growth if these new balance sheet components are not required to be redeemed. Bank deposits are nothing more than a liability of a bank, not an asset that could be given to a borrower. One could easily claim that **deposit withdrawals constitute money destruction.** Banks buy and sell government bonds, but also do monetary authorities, thereby creating and destroying amounts of money.

Unconventional monetary practices include buying long-term bonds, thereby injecting money into the economic system through QE balance sheet enlargement operations. It should not be neglected though that **sweeping up the extra liquidity by re-selling bonds could lead to a new crisis if leaving QE is not made gradually**. This is because QE-exit-provoked liquidity shrinkage by short-term money returned for long-term debt could be considered as money destruction.

Even with money injections during non-conventional practicing, it **could not be assured that money balances will be higher, as debt repaying could absorb a large portion or even the entire newly-injected liquidity**. It would be not easily doubted that debt accumulation is a serious economic problem, debt servicing is a desired task, while debt monetization is a way of postponing a financial breakdown and fighting deflation by a double-edged sword. This happens as debt monetization is beneficial against the "reflux theory" (Kaldor and Trevithick, 1981) of fast money destroying by repaying outstanding loans applying, but also increases uncertainty about viability of the "hot potato effect" of spending continuation.

6.4. Arguments against debt monetization and money drops

Inspected from a different angle, it is highly likely that **debt monetization as a drastic discretionary action would lead to a significant loss of credibility regarding the monetary authorities**. Apparently, this **would render the financial system even more fragile in adverse shocks** due to becoming increasingly addicted to and in need of unconventional action-taking. **Issuing domestic fiat money to cover budget deficits and to confront deflationary pressures would be in danger of becoming a normality**, thereby constantly demanding for even more drastic measures because of the marginally suffocating utility of new money-injecting rounds. The **interbank market would either render more strictly regulated in order to counterbalance the high volatility of the ECB's decisions,** or would go in tandem with ample liquidity provisions, pumping even more the already enlarged

inflationary bubbles. **Helicopter money drops would at least temporarily bring efficiency in trades and the overall economic system by also helping in monetizing debts**. Nevertheless, the most important matter would be whether this far-fetched money-thriving inspiration could be **perpetuated** and if it could, **for how long**. Would inflationary pressures and the moral hazard effects due to free money available for risky-of-leading-to-zero-outcomes investments always remain counterbalanced by temporary financial sanity due to helicopter-arriving paramedics?

Cukierman (1994) supports that **inflationary bias provoked by fueling the economy with high-powered money persists long after the desirable impact of expansionary monetary policy has gone away**. Despite inflation increasing employment due to the money illusion (Fisher, 2014) that brings lower labor costs to employers, this sequential game could not last for long before the appearance of a response by the side of employees that would eventually lead to the same unemployment but higher CPI equilibrium. As Cukierman (1994) argues, inflation is negatively related to central bank independence, implying namely discretionary policy acting could not go towards a combination other than government interfering in monetary affairs. **Buiter (2005)** supports that non-independent monetary authorities exist and, specifically, that **central bank plays a secondary role in relation to the government.** He also argues that non-performing debt could be combined with fiscal policies in order to rationalize the initial stock of nominal government debt in accordance with rational expectations. Paralleling this state of affairs is conducive to the increasingly large significance of the government sector as a principal using an unwilling agent –the independent central bank- to pursue its objectives.

Therefore, the **responsibility is at least implicitly located in fiscal authorities**, thereby **enhancing opacity dynamics inside monetary committees**. In line with the literature about central bank transparency and the closely related issue of monetary independence, there is mounting evidence that opacity due to lack of political transparency inducing to lower central bank independence (Geraats, 2002) took a quantum upward leap in cases of monetary expansions. Interestingly, the **Eurozone forms a special case within the broader context of the principal-agent problem**, as it **is made up of different national treasuries**. Consequently, contentious issues about member debt-sharing could easily be brought about, providing an additional reason why the ECB independence should not be underemphasized. Although lending from the ECB and the ECSB is not allowed for national fiscal authorities, the same effect could be invoked by the government borrowing in a market and monetary authorities purchasing the same amount of fiscal debt in a secondary market. **Disagreements among members of the EZ about having to share the fiscal burden of the weaker of them by unconventionally monetizing their debts**, has helped cement a consensus that **helicopter discretionary policy include a probability of leading to socially harmful inflation**. Despite unconventional policy models providing evidence of a possible boost to the EZ economy due to LSAPs or overt money financing, no academic credence could be given for the claim that this could not turn to a negative outcome.

Communication and cooperation noise among EZ members, as well as the differences in the intertemporal budget constraints of their governments, lead to the **necessity of a stable banking and fiscal union in order to pertain the union sustainability and thereby their common targeting**. In an effort to model helicopter money transfers to the private sector after having monetized national debts, a fortified government unanimity-led arsenal of EZ risk-sharing instruments should come to the forefront. Moreover, **the ECB's reaction functions should for an indefinite time period stop being casted in terms of Taylor rules**. Interestingly, debt monetizing could be given enough latitude to be maintained as a strong policy focus in the future as is much preferable than deflation evoking.

As **Blinder (1999)** supports, **monetary authorities are subject to much more pressure during contractionary policy phases**, rather than during expansionary ones. Therefore, **debt monetization permitting helicopter money dropping could enjoy a fair amount of consent**. Nevertheless, it being far from a guardian of stability in the long-run, leads to diametrically opposed conclusions about its real effects to come. A large fraction of the debt monetization efficacy dynamics could be attributed to a trade-off between national accountability and monetary independence. Another, and a relevant one, fraction of this efficacy could intriguingly be based on the conceptualization of political transparency as openness about policy objectives in the form of modern money theory-based policymaking, which gives room for delicate helicopter piloting. Supportive evidence on a first round of unconventional debt monetization would be helpful in deciding about the cogency of such a policy perpetuation.

6.5. Conclusions

This paper is an attempt to **discuss whether debt monetization in the Eurozone in the form of continuously renewed debtor-debtor interactions that perpetuate optimistic expectations could be viable**. **Modern money theory** suggests that **debt renewal could be carried on forever in order to ensure liquidity, thereby economic growth.** This could happen via lowering the pessimism-evoking uncertainty embedded in interest rates.

A serious matter discussed is whether the loss of central bank credibility that ample helicopter money provisions could provoke could be counterbalanced by the accompanying inflationary growth-nourishing bulge. **Irredeemability of debt is expected to bring better outcomes than QE measures have led to but could also be less influential due to the higher moral hazard incentives and the diminishing marginal efficiency** due to former unconventional rounds having taken place. Bearing in mind the special "multiple principal–one agent" character of the relation between the EZ members and the ECB, **the taking over by governments of the leader place in their nexus with the ECB should take place in order for helicopter money dropping to be efficient**. This would highly likely mutate the

179

opacity-fighting role of the ECB and render future credible commitment more difficult.

A lack of past experience about debt monetizing in tandem with exceptionally unconventional monetary acting forms an impediment to expressing firm opinions about policy endurance. Despite difficulties, it is hoped that this work has succeeded in making even the slightest contribution towards the understanding of challenges that European monetary and fiscal authorities nowadays face in regard to debt monetization and overt money financing.

References

Blinder, A. S. (1999). Central Banking in Theory and Practice. MIT Press.

Buiter, W. H. (2005). New developments in monetary economics: two ghosts, two eccentricities, a fallacy, a mirage and a mythos. The Economic Journal, 115(502), C1-C31.

Buiter, W. H., & Sibert, A. C. (2007). Deflationary bubbles. Macroeconomic Dynamics, 11(04), 431-454.

Cukierman, A. (1994). Central bank independence and monetary control. The Economic Journal, 104(427), 1437-1448.

Fisher, I. (2014). The money illusion. Start Publishing LLC.

Geraats, P. (2002). Central Bank Transparency. Economic Journal, 112(483), 532-565.

Kaldor, N., & Trevithick, J. (1981). A Keynesian perspective on money. Lloyds Bank Review, 139(1), 1-19.

Kim, J. (2011). How modern banking originated: The London goldsmith bankers' institutionalisation of trust. Business History, 53(6), 939-959.

Kyriazis, N. A. (2017). Eurozone Debt Monetization and Helicopter Money Drops: How Viable can this be?. Journal of Central Banking Theory and Practice, 6(3), 5-15.

McLeay, M., Radia, A., & Thomas, R. (2014). Money creation in the modern economy. Bank of England Quarterly Bulletin, Q1.

Mehrling, P. (2000). Modern money: fiat or credit? Journal of Post Keynesian Economics, 22(3), 397-406.

Minsky, H. P., & Kaufman, H. (2008). Stabilizing an unstable economy (Vol. 1). New York: McGraw-Hill.

Sgambati, S. (2016). Rethinking banking. Debt discounting and the making of modern money as liquidity. New Political Economy, 21(3), 274-290.

Shiller, R. J. (2015). Irrational exuberance. Princeton University Press.

Chapter 7
Policy Implications and Conclusions

Unconventional monetary policy has become a tool of primary importance for policymaking by monetary authorities during periods of zero interest rates. In times of liquidity drainage, where nominal interest rates are not able to provide an expansionary boost in financial markets and the real economy, Quantitative Easing, Credit Easing and Forward Guidance prove to be the final but effective weapon in central banks' arsenal to promote growth.

The first aim of this thesis is to provide interested readers with an in-depth understanding of non-conventional monetary practices as regards the theoretical background, the monetary transmission channels, the intermediate and the final targets of out of the ordinary liquidity injections. Secondly, an academic survey has been written that includes over 250 studies focusing on research about unconventional policies by central banks. This research is about empirical estimations by the most up-to-date methodologies, as well as analysis based on models.

Furthermore, a meta-analysis has been conducted in order to provide in a synthesized manner all econometric findings that have been extracted from primary studies having employed VAR specifications. The focus is made on impacts of the main macroeconomic variables, that is output and inflation.

Moreover, this thesis offers econometric estimations on the impacts of unconventional monetary policy on government bond yields and corporate lending rates in the United Kingdom by employing threshold cointegration techniques.

A separate analysis has been conducted about the spillover effects of US unconventional practices on global stock markets by employing non-linear causality estimations.

Furthermore, there is a study of the perspectives of extra-unconventional monetary policy measures, such as helicopter money drops, in the Eurozone, where non-conventional action taking has been adopted more recently than in the UK and the US.

Detailed Policy Implications

Chapter 1 is devoted to describing the **academic research questions** that have urged us to undertake the strenuous tasks of proceeding to and completing this thesis. Since the outburst of the Global Financial Crisis that was triggered by the Lehman Brothers' collapse at September 15th, 2008, an increasing bulk of academic interest has aroused about the efficacy of extraordinary unconventional action taking. This has brought to the surface a la**rge amount of mainly theoretical papers until 2011**, and an **overwhelmingly large number of empirical studies since 2011** up to the present. This is in tandem with a **respectable bulk** of relevant papers employing

182

models, which are primarily centered on investigating effects on or through yields. Perhaps not surprisingly, the rhythm of circulation of new literature concerning Quantitative Easing and unconventional monetary practices in general has been far from fading out lately, as **renewed interest** in unconventional impacts on **asset prices** and particularly on **housing markets**, as well as on **social phenomena such as inequality**, have given a new spur in relevant bibliography.

The *first question* that this thesis answers to is **about identifying the theoretical background of unconventional monetary policies and indicate under which economic conditions it is possible for such practices to become appropriate**. Furthermore, we investiga**te whether there are other solutions available under such extraordinary circumstances** and whe**ther and which unconventional monetary practices should deem to be more suitable for fighting recessionary pressures**. The measures under scrutiny could take the form of Quantitative Easing, Credit Easing, Forward Guidance or Helicopter Money Drops. **Moreover**, we **cast light on the relevant transmission mechanisms** and analyze the complexity of transmission through different channels and description and comments on **intermediate as well as final targets** of these policies that take place. Additionally, this thesis undertakes the tasks of **describing every single aspect of unconventional monetary effects** not only through theoretical papers, but also via a large bulk of empirical studies that have been published in high-ranked academic journals. Moreover, work by employing **Dynamic Stochastic General Equilibrium and New Keynesian model** specifications are examined. All these answer to the **question of how broad has been up to now the relevant academic literature and informs about the perspectives of academic work on unconventional monetary policies**. Moreover, it **enlightens about worries on how much this literature contributes to monetary economics,** which is a field of primary importance for monetary policymakers, market practitioners and economic agents in general.

Moreover, in ***Chapter 2***, we provide a **detailed description of events** of unconventional monetary policy that have taken place in the four regions that have mainly adopted such measures. Thereby, an **exhaustive timeline of unconventional policy actions in the United States of America, the United Kingdom, Japan and the Eurozone** are offered. At the same time, each of these actions is categorized in one or more of the existing types of unconventional monetary policy, such as Securities Markets Program or Outright Monetary Transactions. An in-depth analysis of these types of non-conventional policies is offered as well a thorough analysis of transmission channels in separate sub sections.

Furthermore, there is a detailed analysis of the assets purchased or rebalanced and the amounts of purchases under consideration in each of the phases of unconventional monetary policies in each separate region.

183

Furthermore, in ***Chapter 3***, we cast **light regarding the level by which academic interest has been centered in studying the effects by event-study methodologies, VAR specifications, panel estimations or different and even more modern estimation techniques**. It should be noted that the interested researcher can learn a lot about the variables employed and the relations of primary importance which are investigated by econometric estimations. Thereby, useful information and insight, as well as a compass for exploring relevant but uncharted scientific areas are provided for future work. Moreover, the important **question of whether the focus of research is on intermediate or final targets is made**. Intriguingly, we seek and obtain **answers regarding the level by which bond yields, stock prices, currency values, commodity prices, housing prices, bank lending rates and inequality measures are affected by non-conventional actions** in **every separate UMP-adopting region**. Therefore, there is a significantly safe **reply offered to the question of whether unconventional monetary policies indeed have an impact on financial markets and the real economy as well as a societal impact**, in a wide spectrum of advanced and emerging economies. Moreover, a distinction is provided about effects in advanced compared to impacts in developing economies. This offers an **answer to whether spillover impacts from out of the ordinary monetary policies lead to higher global imbalances and to whether contagion effects in times of crises can prove strong enough to manipulate national economies in a worldwide level**.

Chapter 4 provides answers regarding the suitable methodologies for conducting a meta-analysis on effects of unconventional monetary policies on the real economy. The **output and prices responses in Impulse Response Functions in VAR specifications** are employed as better able to capture QE effects on macroeconomic variables. This is in accordance with the highly-prestigious studies of Ridhwan (2013), Rusnak et al. (2013), Havranek and Rusnak (2013). Moreover, the **reporting guidelines of Stanley et al. (2013)** are adopted in order to set the **exclusion criteria** for conducting this meta-analysis. Notably, it is shown in this study that sixteen primary studies are suitable for conducting this **quantitative synthesis of empirical results**. Furthermore, the exact list of studies is given. Moreover, analysis is conducted concerning why the **minimum number of studies and observations for acquiring trustworthy results** are satisfied.

It is made clear that the **main purpose** of this innovative econometric analysis procedure is **to detect the moderators where heterogeneity in primary empirical studies comes from.** The **seventeen** moderators that are found to be more suitable are well described and analyzed. Moreover, it is crucial that the **size effect**, which translates into **the size and the magnitude of the impact of each of these factors** is assessed and commented on. Additionally, a **comparative analysis of outcomes** is performed **based on robustness checks**. We also reply to which are the appropriate weighting schemes for conducting tests of consistency in outcomes among different estimation specifications. It should be noted that answers are provided as to **whether size effects alter intertemporally.**

184

Overall, findings indicate that the **FAVAR** methodology in primary studies denotes a **positive and statistically significant impact mainly on output responses** at the maximum effect, in the short-run, the medium-run as well as the long-run. Nevertheless, the FAVAR effect is similar but **only present in the short-run** as regards **prices responses**. Moreover, studying European countries or adopting sign restrictions in impulse responses results in lower output responses. When the focus is made on prices responses, the **TVP-VAR methodology** as well as the **number of observations** in a study are found to exert a **positive impact in the short-run**. On the other hand, **recursive identification** in impulse responses is estimated to trigger a **negative impact in prices responses in all horizons**. It should be emphasized that an **analysis** takes place regarding wh**ether such underpinnings abide by** the well-established **monetary theory**.

Two questions of utmost importance are what we seek to answer to by econometric estimations in Chapter 5. Empirical findings in this section **investigate how the UK and the US unconventional policies have affected the relevant domestic economies**, as well as the **global capital markets in the case of the US**. Notably, the UK and the US have been the workhorse of non-conventional monetary policymaking and are considered to be economies with highly sophisticated markets.

Chapter 5 is strictly oriented towards **econometric estimations** for revealing the efficacy of unconventional monetary policies on bond yields, interbank markets and stock markets. This chapter is **comprised by two empirical studies** about QE policies and **one theoretical study** about alternative measures to such policies, in the form of even stronger measures. To be more precise, the potential measure of helicopter money drops is under consideration.

1st Empirical Study

The first study of Chapter 5 is about the **non-linear character of non-conventional monetary action taking** impacts **on government bond yields** and **commercial bank liability yields** in the **United Kingdom**, in the **short-term** as well as in the **long-term**. To be more precise, the short-term is defined as the **5-year** horizon, whereas the long-term is considered to be the **10-year** maturity. The focus of examination is the **dynamic relationship between** non-conventional practices -as revealed by alterations in the **Bank of England's balance sheet**- and **government liability curves** as well as **commercial bank liability curves**. The methodology employed is the **non-linear threshold cointegration approach** in order for effects to be detected in relation to whether they surpass or not a certain threshold level that is estimated. In other words, estimations provide critical points as benchmarks to indicate the **tendencies of rates to return to their threshold values**, in case the errors decline from their **short-run or long-run equilibrium**. The dynamics of returning to their benchmark provide useful evidence for whether deviations in government bond yields or yields expressing the **interbank lending facilities in the UK market** can be attributed to QE actions. Moreover, results cast light on whether there is a **significant feedback effect between total assets of the BoE and these**

185

government or interbank rates. Special emphasis should be attributed to interbank rates, as they are **highly representative of the interbank funding market due to their special synthesis.** Intriguingly, these bank liability curves employ money sterling instruments that reach settlements **based on Libor in order for construction of synthetic ´´interbank bonds´´** to take place. It should be noted that such yields serve as a benchmark index regarding the term of providing liquidity towards banks in the interbank market by taking into consideration expectations for constructing this index.

In order to be more precise, **tests about dual causality** are performed and estimations **reveal a uni-directional causality effect** between assets comprising the balance sheet of the central bank in the UK and yields. Results provide evidence for the existence of a significant threshold impact of the Bank's balance sheet on each of the four yields under examination. More specifically, the **5-year and the 10-year government bond yields** are found to **adjust towards equilibrium in the low regime but also in the high regime.** A somewhat **weaker effect** is detected as concerns the **commercial bank liability curve**. The latter indicates a tendency to return to the threshold value only in the low regime, that is the long-run values will be attained and no larger deviation of the estimate will take place if yields fall below the threshold estimated.

By the Granger-causality methodology employed, there is a robust **bi-directional causal link between total assets and long-term government bond yields**. This provides useful evidence regarding the existence of a strong, dynamic linkage between them in the long-run. Interestingly, the QE impact is found to have a **feedback character.** Thereby, alterations in the **BoE's balance sheet** lead to **lower long-term government bond yields whether** they are **above or below a certain threshold** level. Emphasis should be paid though to lower yields also triggering further unconventional policy measures. One should note that the **feedback procedure** is **not** found to be valid when **5-year government bond yields** are under scrutiny. This strongly abides by the theory characterizing unconventional monetary practices, indicating that through the portfolio rebalancing transmission mechanism, such actions aim at mainly lowering longer-term bond yields and not short- or medium-term yields.

Moreover, it is highly important for the efficacy of non-conventional policies as regards financial markets as well as the overall economy, that the BoE's balance sheet spurs **significant effects on the interbank instruments in the highly-sophisticated market** of the UK. This urges interested researchers to focus their interest in examining the link between monetary authorities' action taking and the liquidity-infusing instruments in the interbank market by a non-linear threshold framework.

2nd Empirical Study

186

The second empirical study in Chapter 5 is about the **non-linear causal impacts** that the **US unconventional monetary policy** causes on global stock indices. By focusing on tail characteristics and adopting innovative non-linear quantile causality methodologies, estimations take place. The latter inve**stigate whether alterations in the Federal Reserve's balance sheet** are the **source of causality impacts on stock markets in a wide array of countries**, covering the majority of important economies all over the world. Estimations are conducted about the pre-crisis outburst era, as well as for the period after the Lehman Brothers collapse in 2008. This allows for a fruitful **comparison of the Fed's influence on global stock indices between non-QE eras and periods of US unconventional** monetary policymaking.

Evidence by **examination on tail characteristics** reveals that alterations in the Federal Reserve's assets have triggered significant causal effects on US stock indices, as anticipated. It should be emphasized that non-linear analysis documents for **substantial causal effects of US policies on advanced economies.** Moreover, the majority of developing economies' markets have been recipients of such non-linear causal impacts. Nevertheless, emphasis should be attributed to these **influences being found more modest in emerging countries** than in advanced ones. This provides academics with new evidence about **significant spillover effects** in a worldwide level as ample liquidity provisions in the US can lead to substantial cash outflows towards foreign countries.

The closer nexus of the Fed's balance sheet with domestic indices but also developed foreign stock markets such as in Canada is found. Additionally, a **close linkage but in a lesser extent** is detected **with indices in developing countries**, like Mexico and Asian economies as China. This provides researchers with important policy implications. In a similar line of importance are the significant feedback effects revealed by **reverse non-linear causality** by domestic and foreign indices, despite them **not being very strong**. The **weaker level of circularity in** impacts concerning **emerging markets** during US QE, provides with useful knowledge about the dynamics of out of the ordinary measures in this important UMP-adopting country. This **enlightens** academics and economic agents about **whether spillover impacts are more easily transmitted through advanced or developing economies**.

The closer interconnectedness of sophisticated stock markets with the decisions of the US monetary authorities is perhaps not surprising. Notably though, this comes into contrast with the majority of the existing relevant studies that indicate an easier transmission of US unconventional measures by **influencing capital flows** and currency values in emerging markets. The **Fed announcements being priced in the US and advanced global financial markets** constitute an important empirical finding that interests US policymakers as well as international investors. The **feedback effects** detected among US and advanced countries, **even non-neighboring ones**, provides with significant knowledge about contagion effects in times of crisis and **strengthens the arsenal of economists** when confronting extraordinary

situations. It should by no means be neglected that causality is mai**nly identified in upper quantiles intervals (tails).** Evidence on non-linear causality impacts that are mainly focused on tails and particularly in upper quantiles, is in tandem with the non-linear domino effect character of the Global Financial Crisis outburst. **This estimation methodology** is proven to **better capture causality** when classical causality estimations cannot, **due to the idiosyncratic character of shocks in financial sanity, credit provisioning and confidence**. Thereby, evidence is provided that academic interest should focus on examining upper quantiles in order to discriminate the real causal linkages of unconventional monetary practices with global financial markets.

Chapter 6 in this thesis is about the **potential of super-unconventional monetary policies,** such as **overt money financing** in the form of **helicopter money drops**. This is especially examined for the case of the **Eurozone** and the feasibility of its applying in such a union with h**igh level of complexity in decision-making.** A thorough discussion takes place as to whether debt monetization in the Eurozone in the form of **continuously renewed debtor-debtor interactions** could be viable, by **perpetuating optimistic expectations**. According to modern money theory, there could be an **infinite debt renewal** so as liquidity could be ensured and this could trigger economic growth. The confidence channel through which **lowering of uncertainty**, thereby lowering of **lending rates** could be achieved would constitute the transmission mechanism.

One of the primary questions to be answered when undertaking this discussion is **whether this would lead to a loss in the credibility** of the **European Central Bank**. The reply is positive, but this could be smoothened if the special ´´**multiple principal – one agent´´ problem** between the Eurozone members and the ECB could be amplified. We have argued that if the Eurozone rendered into a fiscal and banking union apart from a monetary one, less **conflict** about **debt-sharing and risk-sharing** would emerge. Thereby, the Eurozone monetary authorities would still be able to **fight opacity** and **remain credible**. That would allow for extraordinarily easing measures, such as helicopter money drops, in the form of **irredeemable fiat money**, that would lead to **debt monetization and perpetuation**. This would **boost growth**, but also **inflationary pressures**. Common targeting could only be efficient in the case of a synchronization of policies and targets among Eurozone members.

Overall Conclusions

This dissertation is useful for policymakers, market practitioners as well as economic agents in general. This is because it provides with a solid theoretical analysis of the main forms and the principal transmission channels of unconventional monetary policies. Furthermore, it presents a detailed description of the main non-conventional actions in the countries that have adopted such extraordinary measures. This thesis provides a systematic survey of all empirical findings about QE effects on all intermediatr targets such as yields and lending rates, stock prices, commodity prices and currency values, as well as on final targets, such as output, inflation and

employment. Moreover, this dissertation provides a quantitative synthesis of empirical findings on the short-run, medium-run, long-run and maximum impacts of unconventional measures on impulse responses of output and prices in VAR specifications. This enables policymakesrs to distinguish at which point of time specific moderators prove to be more useful for explaining differentiation in results. Moreover, the exact sixe effect of each moderator is estimated, thereby specific measures and signs indicate the appropriate monetary policy according to circumstances.

It should be emphasized that even more advanced econometric estimations take place in order to test two different aspects of unconventional policies and in two of the most influential QE-adopting regions. First, the impacts of unconventional monetary policy measures measures on short-term and long-term government bond yields and innovative interbank liability curves are examined. The threshold cointegration analysis employed permits to policymakers to study the dynamics by which returning to short-run and long-run equilibrium can be achieved for yields of the governmemt as well as for the private sector in the United Kingdom. Secondly, the spillover effect of US unconventional policies in global capital markets is investigated by focusing on non-linear upper quantile causality on stock indices in domestic, other advanced and developing markets. This reveals whether non-conventional monetary policies by very large and highly sophisticated economies can be spelt over and provide a boost in a worldwide level. This is very useful for policymakers in a global context as well as for interested investors of every scale. The potential of further monetary easing is examined by more extreme unconventional monetary policies such as ´´helicopter money drops´´, thereby providing answers about moral hazard dilemmas that risk- and debt-sharing in cuurency unions such as the Eurozone could bring about.

Appendix. 1

Timetable of unconventional monetary policy and other relevant central bank events in major countries

ECB	9/8/2007	Special fine-tuning operations
ECB	22/8/2007	Introduction of long-term refinancing operations (LTROs) with a 3-month maturity for an amount of €40 billion.
ECB	23/8/2007	Supplementary LTRO (allotment)
FED	12/12/2007	Introduction of the Term Auction Facility (TAF). Auctioning term funds to depository institutions against a wide array of eligible collateral for securing loans at the discount window. Thereby, liquidity injections to depository institutions.
FED	2007	Term funding for depository institutions. Setting up central bank liquidity swap lines (in terms of dollars and foreign currency) with foreign monetary authorities for ameliorating liquidity supply in dollar funding markets in the US and abroad and supply non-dollar funds to U.S. financial institutions
ECB	10/1/2008	Decision by the Governing Council (GC) for US dollar liquidity-providing operations.
ECB	7/2/2008	Decision by the GC for renewing two outstanding supplementary longer-term refinancing operations.
FED	11/3/2008	Introduction of the Term Securities Lending Facility (TSLF). Lending up to $200 billion of Treasury securities to primary dealers secured for 4 weeks (rather than overnight) by a pledge of other securities. The latter consist of federal agency debt, federal agency residential-mortgage-backed securities (MBS), and non-agency AAA/Aaa-rated private-label residential MBS.
ECB	11/3/2008	Decision by the GC for US dollar liquidity-providing operations
FED	16/3/2008	Introduction of the Primary Dealer Credit Facility (PDCF). Functioning as a means for overnight lending at the services of primary dealers, similar to the way the Federal Reserve's discount window supplies depository institutions with funds.
ECB	28/3/2008	Expansion of LTRO by introducing 6-month LTROs.
ECB	2/5/2008	Decision by the GC for enhancement of US dollar liquidity-providing operations
ECB	3/7/2008	Main Refinancing Operations (MRO) rate goes higher, to 4.25%.
ECB	30/7/2008	Decision by the GC for enhancement of US dollar liquidity-providing operations
ECB	31/7/2008	Decision by the GC for renewal of two outstanding supplementary longer-term refinancing operations
ECB	4/9/2008	Decision by the GC for renewal of three outstanding supplementary longer-term refinancing operations
FED	15/9/2008	Lehman Brothers Inc declares that it has gone bankrupt and the Global Financial Crisis breaks out.
ECB	18/9/2008	Decision by the GC for enhancement of US dollar liquidity-providing operations
FED	19/9/2008	Introduction of the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF). This serves for

		supplying with nonrecourse loans US institutions. These funds were used for purchasing eligible ABCP from MMMFs in order to provide with funds financial institutions, the ABCP market as well as MMMFs.
ECB	26/9/2008	Decision by the GC for increasing by 100% the temporary swap lines with the US monetary authorities
ECB	29/9/2008	Introduction of the special term refinancing operation (STRO).
FED	7/10/2008	Introduction of the Commercial Paper Funding Facility (CPFF) for supporting by liquidity the U.S. issuers of commercial paper. A special purpose vehicle (SPV) is employed for buying 3-month unsecured and ABCP directly from eligible issuers. The aim is to render the Commercial Paper (CP) market more liquid and boost issuing CP.
ECB	7/10/2008	Decision by the GC for enhancement of a LTRO and growing of US dollar liquidity-providing operations
FED	8/10/2008	Reduction of the Federal Funds Rate (FFR) by 0.5 pp to 1.50%, working in tandem with monetary authorities in Canada, the UK, Sweden, Switzerland and Japan.
BOE	8/10/2008	Lowering of the Bank rate to 4.5%
ECB	8/10/2008	Decision by the GC of adopting a fixed rate tender procedure (FRFA) with full allotment. The MRO rate falls to 3.75%
FED, ECB	13/10/2008	Announcement of Foreign Exchange swap arrangements along with monetary authorities in Canada, the UK, Sweden, Switzerland and Japan. {tenders of U.S. dollar funding at 1-week, 4-week and 12-week maturities at specific interest rates for full allotment
ECB	15/10/2008	Expansion of refinancing operations. All of them will be conducted with FRFA on MRO. Lower-rated (with the exception of asset-backed securities) and non-euro-denominated assets will be accepted as collateral in credit operations with the Bank.
FED	20/10/2008	$150 billion by the Fed in 4-week credit through its Term Auction Facility (TAF)
FED	21/10/2008	The Money Market Investor Funding Facility (MMIFF) is introduced for enhancing industry-supported private-sector motivation to finance the purchase of eligible assets from eligible investors. This happens via SPV.
FED	29/10/2008	Decline in FFR by 0.5 pp to 1.00%.
BOJ	31/10/2008	Call rate is decreased to 0.3%
BOE	6/11/2008	Fall in Bank rate to 3%
ECB	6/11/2008	MRO rate is lowered to 3.25%
BOJ	2/12/2008	The BOJ will provide an unlimited amount to banks at the uncollateralized overnight call rate and collateralized by corporate debt. Expansion of corporate debt eligible as collateral.
BOE, ECB	4/12/2008	Bank rate decreased to 2% and MRO rate fell to 2.50%
FED	16/12/2008	Anticipation of extremely low levels of the FFR.
ECB	18/12/2008	Decision by the GC for continuation of FRFA for as long as it

		takes.
BOJ	19/12/2008	Expansion of Outright purchases. Monthly JGB from 1.2 trillion yen reach 1.4 trillion yen. Moreover, attempts for buying CP. Launch and growth of special funds supplying operations for providing liquidity to firms. Wider array of corporate debt accepted as collateral, that is 30-year bonds, floating-rate bonds, and inflation-indexed bonds. Call rate declines to 0.1% level.
ECB	19/12/2008	Decision by the GC of continuation of US dollar liquidity-providing operations
FED	25/11/2008	Launch of QE1 by announcement of LSAPs. The Federal Reserve will buy $100 billion in GSE debt - Fannie Mae, Freddie Mac, and the Federal Home Loan Banks--and $500 billion in MBS backed by Fannie Mae, Freddie Mac, and Ginnie Mae. Creation of the Term Asset-Backed Security Loan Facility (TALF) which was terminated in March 2010, with total purchase of $1.25 trillion of agency MBS, about $170 billion of agency debt, and $300 billion of Treasury securities. Fed announces results of auction of $150 billion in 13-day credit. Lending up to $200 billion on a non-recourse basis to holders of certain AAA-rated ABS backed by newly and recently originated consumer and small business loans (From August 2009, TALF was extended to holders of AAA-rated CMBS.) FFR-1%.
FED	1/12/2008	First suggestion of extending QE to Treasuries by Bernanke Official declaring of a recession by the National Bureau of Economic Research (NBER).
FED	16/12/2008	The Federal Reserve ''stands ready to expand its purchases of agency debt and mortgage-backed securities...[and] is also evaluating the potential benefits of purchasing longer-term Treasury securities''. FFR target rate declines to 0-0.25%.
BOJ	22/1/2009	Announcement of Outright purchases The Japanese monetary authorities will buy up to 3 trillion yen in CP and ABCP and is examines about outright purchases of corporate bonds.
FED	December 2008	FOMC statement indicated that the FOMC was considering expanding purchases of agency securities and initiating purchases of longer-term Treasury securities
FED	2008	Discount window facility for primary dealers. Auctions for Treasury bills in exchange for illiquid securities. Purchased 90-day commercial paper. Term funding to increase liquidity for MMFs. Supported issuance of asset-backed securities. Purchased $300 billion USTs, $1,450 billion MBS and agency debt.
BOE	8/1/2009	Bank rate declines to 1.5%
ECB	15/1/2009	MRO rate falls to 2.00%
BOE	19/1/2009	Start of APF. The UK monetary authorities will buy up to £50 billion of top-ranked private sector assets, by issuing Treasury debt. Announcement by the Chancellor of the Exchequer that he

		BOE will initiate asset purchases (with funds by Treasury Bills and the DMO's cash management operations in the beginning).
FED	28/1/2009	Statement that the Federal Reserve is ready to expand agency debt and MBS purchases and buy long term Treasuries but too abstract about the size and timing.
BOE	29/1/2009	Asset Purchase Facility announcement. Exchange of letters on details of APF
BOE	30/1/2009	Setting up the Asset Purchase Facility (APF) Fund after communication between the Chancellor of the Exchequer and the Governor on 29 January 2009.
BOJ	3/2/2009	Resumes the purchase of stocks held by financial institutions
ECB	3/2/2009	The GC decided to extend the liquidity swap arrangements with the Fed
BOE	5/2/2009	MPC meeting, Bank rate reduced from 1.5% to 1%.
BOE	11/2/2009	APF. The BOE views a slight downside risk to meeting the inflation target, reiterates APF as a potential policy instrument.
BOE	13/2/2009	Launch of buying commercial paper.
BOJ	19/2/2009	Expansion of Outright purchases. The Japanese monetary authorities will extent buying CP and the SFSOs through the end of September, instead of March, and are going to buy up to ¥1 trillion in corporate bonds. This aims to facilitate fund provisions to firms.
BOE	5/3/2009	APF. Announcement of QE1 in the form of £75 billion of assets over 3 months. Lowering of Bank Rate from 1 to 0.5%. Purchases divided according to maturities between two auction (a) 5–10 years (b) 10–25 years.
ECB	5/3/2009	Decision by the GC for continuation of FRFA for all MROs, special-term refinancing operations (STROs) and supplementary and regular longer-term refinancing operations for as long as required. MRO rate declines to 1.50%.
ECB	10/3/2009	LTRO – Liquidity providing – Standard Tender, Fixed Rate
BOE	11/3/2009	Launch of UK government bonds (gilts) purchases of gilts begin.
FED	18/3/2009	Expansion of LSAPs. The Federal Reserve will buy $300 billion in long-term Treasuries. Expectations of low rates for a further 750 and 100 billion in MBS and GSE debt, respectively, so as to ameliorate conditions in markets. market conditions. They reach 1.25 trillion and 200 billion dollars, respectively. Expectations of a very low FFR during a long period.
BOJ	18/3/2009	Expansion of Outright purchases by the Bank of Japan. JGB purchases from 1.4 trillion reach 1.8 trillion yen each month.
BOE	19/3/2009	Market notice for corporate bond and Credit Guarantee Scheme facilities
ECB	19/3/2009	Decision by the GC for continuation of US dollar liquidity-providing operations
BOE	25/3/2009	Launch of buying corporate bonds by APF.
ECB	2/4/2009	MRO rate declines to 1.25%.
ECB	6/4/2009	Decision by the GC for setting up a temporary reciprocal currency arrangement (swap line) with the US monetary

		authorities.
ECB	7/4/2009	LTRO – Liquidity providing – Standard Tender, Fixed Rate
BOE	7/5/2009	APF. Expansion of QE as the Bank will up to £125 billion in assets, thereby increase purchases by £50 billion in the next 3 months.
ECB	7/5/2009	Announcement of CBPP, expansion of LTRO. The European Central Bank will buy €60 billion in euro-denominated covered bonds and conduct 12-month LTROs. Decline of the main refinancing rate by 0.25% to 1%. The rate on the marginal lending facility falls by 0.50% to 1.75%.
ECB	12/5/2009	LTRO – Liquidity providing – Standard Tender, Fixed Rate
ECB	24/9/2009	Decision by the GC for continuation of US dollar liquidity-providing operations.
ECB	4/6/2009	Announcement of the first Covered Bond Purchase Programme (CBPP1) consisting of an intended purchase of 60 billion EUR of euro-denominated covered bonds. It is launched in July 2009.
ECB	24/6/2009	LTRO – Liquidity providing – Standard Tender, Fixed Rate
ECB	25/6/2009	Decision by GC for extension of the liquidity swap arrangements with the Fed
BOJ	15/7/2009	Extension of the SFSOs and outright purchases of corporate paper and bonds through the end of the year.
BOE	3/8/2009	Secured commercial paper facility launched.
BOE	6/8/2009	APF. The MPC announces that QE asset purchases will be extended by £50 billion to £175 billion. . The Bank announces a gilt lending programme, which allows counterparties to borrow gilts from the APF's portfolio via the Debt Management Office (DMO) in return for a fee and alternative gilts as collateral. Purchases divided between three auction maturity sectors: (a) 3–10 years (b) 10–25 years (c) Greater than 25 years
FED	12/8/2009	LSAPs slowed: All purchases will finish by the end of October, not mid-September. The FOMC "decided to gradually slow the pace" of Treasury purchases ("up to" language with reference to Treasury purchases is also removed).
FED	18/8/2009	FOMC statement announced that the Treasury purchases would be finished by the end of October, rather than September 18, as originally announced.
FED	23/9/2009	Reduction in pace of LSAPs as regards agency debt and MBS purchases and their termination at early 2010.
BOJ	14/10/2009	Expiration of Outright purchases of corporate finance instruments will expire at late 2009 as anticipated, but extension of SFSOs until early 2010. Thereafter, funds supplying operations against a larger spectrum of acceptable pooled collateral will provide liquidity.
FED	4/11/2009	Decrease in LSAPs. The scheduled buying of agency debt falls from 200 billion to 175 billion dollars.
BOE	5/11/2009	Asset Purchase Facility (APF). Expansion of QE1 as the MPC declares extension of QE purchases by £25 billion to £200 billion. Expectations that total purchases will be accomplished in 3 months.

BOE	22/11/2009	Announcement that the monetary authorities will sell but also purchase corporate bonds in the secondary market.
BOJ	1/12/2009	Announcement of monetary easing Facility. The BOJ is going to provide 10 trillion in 3-month loans by accepting the full spectrum of eligible collateral at the uncollateralized overnight call rate.
ECB	3/12/2009	Decision by the GC for continuation of its MROs as FRFA for the necessary time length and enhancement of offering of longer-term refinancing operations.
BOE	6/1/2010	First selling of corporate bonds.
BOE	4/2/2010	APF. The UK monetary authorities preserve the amount of asset purchases paid by issuing reserves at £200 billion; new purchases of private assets will be financed By Treasury issuing and Debt Management Office (DMO) cash management operations new private assets will be bought. Further purchases would be realized if necessary.
ECB	4/3/2010	Decision by the GC for continuation of its MRO as FRFA for the time length required, and again variable rate tender procedures in the regular 3-month longer-term refinancing operations
FED	16/3/2010	Announcement of termination of QE1, thereby end to the special liquidity facilities employed. Only the Term Asset-Backed Securities Loan Facility will end at late June for loans backed by new-issue commercial MBS and on late March for loans differently collateralized.
BOJ	17/3/2010	Enlargement of unconventional policy action taking. FROs increase by 10 trillion and reach 20 trillion yen in the form of fixed-rate funds-supplying operation against pooled collateral.
ECB	10/5/2010	Announcement by the GC of market interventions for lowering yields in particular market segments. The first stage is Securities Markets Programme (SMP1). A large bulk of Irish, Portuguese and Greek government bonds are bought by the Euro system. Full sterilization applies. Aim to help by providing liquidity to public and private securities markets.
BOJ	21/5/2010	Announcement of GSFF. The Japanese monetary authorities will provide 3 trillion yen in 1-year lending to private financial institutions in order to promote economic growth. Call rate unaltered, Fund Provisioning.
ECB	10/6/2010	Decision by the GC for adopting an FRFA in the regular 3-month LTROs.
BOJ	15/6/2010	Statement that the Call rate will not alter. Provisions of funds discussed.
ECB	30/6/2010	Termination of CBPP at the time programmed. Holding bonds bought until they mature. LTRO – Liquidity providing – Standard Tender, Fixed Rate.
ECB	28/7/2010	Tightening of collateral rules, revision of haircuts.
FED	10/8/2010	QE2, Launch of LSAP2. Maintenance of balance sheet as "principal payments from agency debt and agency MBS will be reinvested in longer-term Treasury securities." Rolling over of

		holdings of Treasury securities at their maturity.
FED	27/8/2010	Announcement by Bernanke announces of effectiveness if the Fed further bought longer-term securities.
BOJ	30/8/2010	Strengthening of unconventional policy by an extra 10 trillion yen in 6-month loans to the FROs, in the form of fixed-rate funds-supplying operation against pooled collateral.
FED	August 2010	Balance sheet maintained: The Fed would reinvest principal payments from LSAPs in Treasuries.
ECB	2/9/2010	Decision by the GC of continuation of its main refinancing operations as FRFA for as long as needed, and for 3-month longer-term refinancing operations as FRFA.
FED	21/9/2010	The FOMC is prepared to take further action if it is required. The Federal Reserve will continue to roll over its holdings of Treasury securities as they mature, thereby reinvesting principal payments from its securities holdings.
ECB	29/9/2010	LTRO – Liquidity providing – Standard Tender, Fixed Rate
BOJ	5/10/2010	Establishment of Asset Purchase Program (APP) established: The Japanese monetary authorities will buy 5 trillion yen in assets (3.5 trillion yen in JGBs and Treasury discount bills, 1 trillion in CP and corporate bonds, and 0.5 trillion in ETFs and J-REITs). Fixed-rate funds-supplying operations against pooled collateral take place. Aim to preserve the uncollateralized overnight call rate at 0 to 0.1%.
FED	12/10/2010	FOMC are worried for need of further measures in the near future.
FED	15/10/2010	The Fed is ready for further injecting liquidity to boost growth.
BOJ	28/10/2010	Launch of the Asset Purchase Program (APP).
FED	3/11/2010	Launch of QE2. Intention of buying a further $600 billion of longer-term Treasury in mid-2011, approximately 75 billion dollars per month.
BOJ	5/11/2010	Declaring no alterations in monetary policy as regards purchases of ETFs and J-REITs.
ECB	2/12/2010	Decision for continuation of MROs as FRFA for as long as is required.
ECB	17/12/2010	Announcement by the ECB of a temporary swap facility with monetary authorities in the UK.
ECB	21/12/2010	Decision by the GC for keeping up the liquidity swap arrangements with the US monetary authorities.
ECB	22/12/2010	LTRO – Liquidity providing – Standard Tender, Fixed Rate
ECB	3/3/2011	Decision by the GC for keeping up its MRO as FRFA for the time period required and to conduct 3-month LTROs as FRFA until July 2011.
BOJ	14/3/2011	Expansion of APP. The Japanese monetary authorities will buy a further 5 trillion yen in assets to 40 trillion yen (10% in JGBs, 20% in Treasury discount bills, 30% in commercial paper, 30% in corporate bonds, 9% in ETFs, and 1% in J-REITs).
ECB	30/3/2011	LTRO – Liquidity providing – Standard Tender, Fixed Rate
ECB	7/4/2011	MRO rate reaches higher levels, equal to 1.25%
BOJ	8/4/2011	Expansion of APP/6-month collateralized loans through the

196

		FROs. The BOJ is going to buy a further amount of 5 trillion yen in assets (40% in JGBs, 30% in Treasury discount bills, 2% in commercial paper, 18% in corporate bonds, 10% in ETFs, and 0.2% in J-REITs).
FED	27/4/2011	QE2 is announced to be terminated by June 2011.
ECB	9/6/2011	Decision by the GC for keeping up its MRO as FRFA for the time period required and to conduct 3-month LTROs as FRFA
BOJ	14/6/2011	Expansion of GSFF. The Japanese monetary authorities provide private financial institutions with a further 0.5 trillion yen in loans as a new line of credit, in order to invest in equity and extending asset-based loans, in order to boost growth.
FED	22/6/2011	The end of QE2 takes place. Treasury purchases will be terminated when the month finishes, as planned, whereas reinvestment of principal payments will keep up.
ECB	29/6/2011	LTRO – Liquidity providing – Standard Tender, Fixed Rate. Decision by the GC for continuation of liquidity swap arrangements with the Fed.
ECB	7/7/2011	MRO rate reaches the level of 1.50%
FED	13/7/2011	Bernanke announces that further laxing measures will be taken if macroeconomic variables indicate that it is needed.
SNB	3/8/2011	First SNB announcement. Target range for three-month CHF LIBOR lowered to 0 to 25 basis points. In addition, banks' sight deposits at the SNB will be expanded from CHF 30 billion to CHF 80 billion.
BOJ	4/8/2011	APP is enlarged by approximately 10 trillion to about 50 trillion yen.
ECB	4/8/2011	Decision by the GC for continuation of MROs as FRFA for as long as is needed and 3-month LTROs as FRFA and a further LTRO as a 6-month FRFA. Moreover, SMP will be conducted about Spain and Italy.
	4/8/2011	The Japanese monetary authorities defend the value of the yen. Decision by the ECB not to alter the main refinancing rate.
	6/8/2011	First degradation of US Treasury debt rating from AAA to AA+ by the S&P.
ECB	7/8/2011	SMP2 is announced and large values of Italian and Spanish government bonds will be bought by the Euro system.
FED	9/8/2011	MEP-Forward Guidance. First forward guidance announcement argues that the FFR will remain between 0 and 0.25% at least until the end of second quarter in 2013.
SNB	10/8/2011	Second SNB announcement. The sight deposits of banks at the SNB will increase in a fast pace from 80 billion to 120 billion CHF.
	11/8/2011	Announcement of a ban on every type of short selling of bank and other financial companies' shares by the European financial regulator, ESMA and the corresponding regulators in France, Belgium, Spain and Italy.
SNB	17/8/2011	Third SNB announcement. Banks' sight deposits at the SNB will immediately be expanded from CHF 120 billion to CHF 200 billion.

	18/8/2011	Increase in market fluctuations and selling of European bank stocks due to news of hypothetical tapering of the ECB dollar facility for the first time since 23/2/2011.
ECB	25/8/2011	Decision by the GC for continuation of the liquidity swap arrangement with monetary authorities in the UK.
FED	26/8/2011	Bernanke in Jackson Hole mentions "range of tools" and states that additional accommodation could be taken. Announcement of the Maturity Extension Program (MEP), also called as "Operation Twist". Intention of buying by the end of June 2012, 400 billion dollars of Treasury securities with 6-year to 30-year maturities and selling an equal amount of less than 3-year Treasury securities.
SNB	6/9/2011	The SNB announces a minimum exchange rate ''exchange rate floor'' for the Swiss franc to 1.20 francs per euro and is willing to purchase as much foreign currency is needed to preserve this.
ECB	15/9/2011	Decision by the GC for three US dollar liquidity-providing operations by coordination with other foreign monetary authorities.
FED	21/9/2011	Announcement of the Maturity Extension Program (MEP) that is about Treasury purchases of $400 billion with more than 6-year maturities, financed by selling Treasuries of less than 3-year maturities.
ECB	28/9/2011	LTRO – Liquidity providing – Standard Tender, Fixed Rate
FED	September 2011	MEP TIPS purchase $1,861. MEP TIPS sale $1,456.
BOE	6/10/2011	Launch of QE2 by extending QE asset purchases by £75 billion to £275 billion. Their financing will be made by reserve issuance. Private assets still cannot exceed £50 billion.
ECB	6/10/2011	Launch of CBPP2 in November (and end by October 2012) by buying €40 billion in euro-denominated covered bonds and continuation of the ECB's main refinancing operations as FRFA for as long as is needed. These are 3-month FRFA and two supplementary FRFA with a maturity of twelve and thirteen months.
BOJ	27/10/2011	Expansion of APP by purchasing further 5 trillion yen in JGBs, thereby reaching the level of approximately 55 trillion yen.
ECB	3/11/2011	Decision by the GC about the technical modalities of CBPP2. MRO rate is lowered to 1.25%.
BOE	29/11/2011	Decrease in maximum APF private asset purchases from £50 billion to £10 billion.
ECB	30/11/2011	Decision by the GC to work with other monetary authorities for setting up a temporary network of reciprocal swap lines.
ECB	8/12/2011	Announcement of 36-month LTROs, that is LTRO2, and expansion of eligible collateral. Decrease in the main refinancing rate by 0.25% to 1%, and on the rate on the marginal lending facility by 0.25% to 1.75%. Reserve ratio to 1%.
ECB	21/12/2011	The European Central Bank supplies 489 billions to 523 banks in first 3-year LTRO.

FED	5/1/2012	The second forward guidance announcement declares that the FFR will remain low until the end of 2014, in order to boost inflation and output.
FED	25/1/2012	Announcement of keeping the FFR from 0 to 0.25% until late 2014 due to predictions about inflation. MEP TIPS sale 1,407 dollars.
BOE	9/2/2012	Expansion of QE by APF by £50 billion. Purchases of up to £325 billion in assets will take place. Movement from boundaries of 10 and 25 years towards auction gilts with remaining maturities of: (a) 3–7 years (b) 7–15 years (c) Greater than 15 years.
ECB	9/2/2012	Approval by the GC of specific national eligibility criteria and risk control measures for the temporary acceptance in a number of countries of additional credit claims as collateral in Euro system credit operations regarding 7 national banks.
BOJ	14/2/2012	Expansion of APP by approximately 10 trillion, to 65 trillion yen. 10 trillion yen will be directed towards JGBs. Announcement of a 2% target for inflation.
ECB	28/2/2012	Results of second 3-year LTROs.
ECB	29/2/2012	ECB offers 530 billion euros to 800 banks in the second 3-year LTROs.
BOJ	13/3/2012	Expansion of GSFF. The Japanese monetary authorities offer 2 trillion yen in loans to private financial institutions. 1 trillion yen is for U.S.-dollar-denominated loans and 0.5 trillion yen in 1 million to 10 million-yen loans. Thereby, total enlargement of loans available through the Growth-Supporting Funding Facility by 2 trillion to 5.5 trillion yen.
BOJ	10/4/2012	Announcement of a new U.S. Dollar Lending Arrangement in order to promote growth.
BOJ	27/4/2012	Extension of APP to 70 trillion yen and decline of FROs. An extra 10 trillion yen in JGBs, 0.2 trillion yen in ETFs, and 0.01 trillion yen in J-REITs will be purchased and 6-month FRO loans will be reduced by 5 trillion yen.
BOE	10/5/2012	Announcement by the MPC of keeping QE asset purchases at £325 billion.
ECB	6/6/2012	Decision by the GC for keeping up its main refinancing operations as FRFA for as long as is needed, and for 3-month LTROs as FRFA.
FED	11/6/2012	Extension of MEP: Keeping up purchasing long-term securities and selling short-term securities by 45 billion per month, until the end of 2012
BOE	14/6/2012	Announcement that Bank and Treasury prepare the "funding for lending" scheme.
FED	15/6/2012	Decision on keeping up the easing program until the end of the year for extending the average maturity of the Fed's holdings of securities. This will lead to buying, selling and the redemption of approximately 267 billion dollars in Treasury securities by the end of 2012.
FED	20/6/2012	Announcement of continuation of the MEP through end of 2012

		by still buying $400 billion of Treasury securities with 6-year to 30-year maturities by 45 billion per month. At the same time, selling or redeeming the same amount of Treasury securities with lower than 3-year maturities.
ECB	22/6/2012	Further action by the GC for enlarging the available collateral for counterparties.
BOE	5/7/2012	Launch of QE3. The BOE by APF will extend purchases by £50 billion up to £375 billion in assets. Bank Rate stays 0.5%.
ECB	5/7/2012	MRO rate fell to 0.75% and deposit facility rate to 0%.
BOJ	12/7/2012	Expansion of APP, reduction of FROs. The BOJ will further buy 5 trillion yen in Treasury discount bills and lower FRO loans by 5 trillion yen, thereby only shift in composition.
BOE	13/7/2012	Initiation of the Funding for Lending Scheme (FLS) by the Bank and the Treasury.
ECB	26/7/2012	Whatever it takes" London speech by Draghi.
FED	1/8/2012	QE3. FOMC members "judged that additional monetary accommodation would likely be warranted fairly soon…"
BOE	1/8/2012	The Funding for Lending scheme drawdown window opens.
ECB	2/8/2012	Draghi statement that the ECB will expand sovereign debt purchases and that "the euro is irreversible.". Announcement that the GC will conduct outright OMOs as much as is needed for target fulfilment. Announcement of OMT1 with no details.
FED	9/8/2012	FOMC members "judged that additional monetary accomodation would likely be warranted fairly soon."
FED	22/8/2012	Bernanke claims readiness for action by buying long-term Treasuries. Existing US homes are sold lower than consensus expectations.
ECB	27/8/2012	Asmussen's speech in Hamburg is in favor of the new bond purchase program.
FED	31/8/2012	LSAP3. Chairman Bernanke's speech at Jackson Hole reveals willingness for further monetary easing. MEP TIPS buy 1,979 dollars. Launch of a new $40 billion a month bond purchase program of agency MBS with no clear date to end. Moreover, keeping up with really low rates policy until at least mid-2015.
ECB	6/9/2012	Announcement of OMTs focusing on sovereign bonds with a maturity of between 1 and 3 years. Countries having applied to the European Stabilization Mechanism (ESM) for help and conforming to the ESM's terms and conditions can have their debt bought -with no constraints on amounts- on the secondary market by the ECB. Collateral rules laxing.
FED	10/9/2012	Announcement of QE3. Purchases of 40 billion dollars of MBS per month will be taking place if macroeconomic variables do not improve.
ECB	12/9/2012	Decision by the GC for continuation of the liquidity swap arrangement with monetary authorities in the UK.
FED	13/9/2012	Launch of QE3. Announcement of buying 40 billion dollars of MBS each month. Third forward guidance, declaring the FFR remaining close to zero at least until mid-2015."
BOJ	19/9/2012	Extension of APP by approximately 10 trillion, to 80 trillion

		yen. The Japanese monetary authorities will buy a further 5 trillion yen in JGBs and 5 trillion yen in Treasury discount bills.
BOJ	30/10/2012	Extension of APP to 91 trillion yen and announcement of SBLF The BOJ will buy a further 5 trillion yen in JGBs, 5 trillion yen in Treasury discount bills, 0.3 trillion yen in corporate bonds, 0.5 trillion yen in ETFs, 0.1 trillion yen in commercial paper and 0.01 trillion yen in J-REITs. SBLF will serve for providing liquidity by 100% to new loans of depository institutions towards nonfinancial firms.
FED	9/11/2012	Expansion of QE. Continuation of buying $45 billion of long-term Treasuries each month but without sterilization of purchases by selling short-term Treasuries anymore.
ECB	6/12/2012	Decision by the GC for continuation of its MROs as FRFA no matter the time horizon required, and 3-month LTROs as FRFA.
FED	11/12/2012	Extension of longer-term Treasury security purchases and announcement of numerical threshold targeting.
FED	12/12/2012	Increase in LSAP3. Decision on keeping up buying agency MBS and longer-term Treasury securities after the termination of the MEP at late 2012, by 40 billion and 45 billion dollars, correspondingly. First "threshold-based" announcement in the form of forward guidance: FFR close to 0 until unemployment falls under 6.5%, inflation gets over 2.5% in the next two years, and long-term inflation expectations alter.
ECB	13/12/2012	Decision by the GC for continuation of the liquidity swap arrangements with the US monetary authorities.
BOJ	20/12/2012	Extension of APP to 101 trillion yen. Buying further 5 trillion yen JGBs and 5 trillion yen in Treasury discount bills.
BOJ	22/1/2013	Extension of APP to 13 trillion yen per month and no clear date for ending QE. Introduction of the 2% inflation target. Aggressive monetary easing for as long as it takes.
FED	20/3/2013	Amelioration in assessment of economic and labor market conditions and willingness to alter the rhythm of asset purchases according to them.
ECB	22/3/2013	Alteration in collateral rule for some uncovered -guaranteed by the government- bank bonds.
BOJ	4/4/2013	Launch of Quantitative and Qualitative Monetary Easing in order to double the monetary base and the amount of JGBs and ETFs on its balance sheet within the next two years and more than double the average remaining maturity of JGB purchases. The QQE will keep up for as long as it takes to constantly ensure the 2% inflation target.
FED	1/5/2013	Bernanke first signals that FOMC may reduce its quantitative stimulus.
ECB	2/5/2013	MRO rate to 0.5% and extension of FRFA to July 2014
FED	22/5/2013	Bernanke warns of 'premature tightening' in monetary policy (taper tantrum).
ECB	4/7/2013	Expectations about the key ECB interest rates maintaining as they are or slipping lower for a long time period.

FED	11/7/2013	"Asset purchases are not on a preset course …"
FED	17/7/2013	FOMC underlines that the buying rhythm depends on economic conditions and costs and efficacy dynamics.
FED	18/9/2013	Surprisingly, there was no slowdown in purchases. Announcement of QE3 in the form of buying 40 billion of MBS per month until labor market conditions and inflation improve.
FED	30/10/2013	Decrease in monthly purchases to 35 billion dollars in agency MBS and 40 billion dollars in long-term Treasury securities and announcement of further declines if no improvement in labor markets and expected inflation is brought about.
ECB	7/11/2013	MRO rate falls to 0.25%, Decision to conduct the three-month LTROs at FRFA until July 2015.
FED	12/12/2013	New statement that continuation or tapering of lax policies will remain linked to unemployment and predicted inflation performance.
FED	18/12/2013	Launch of QE3 tapering. Tapering of longer-term Treasuries and MBS buying to 40 billion dollars and 35 billion dollars per month, respectively, whereas only $65 billion in assets since February 2014.
ECB	25/3/2014	Draghi QE announcement of following a consistent strategy for a recovery that will endure.
ECB	3/4/2014	Commitment by the GC for also utilizing also non-conventional tools within its mandate in order to fight low inflation maintaining for too long.
ECB	24/4/2014	Draghi announces that communication will be crucial in turbulent times.
FED	30/4/2014	In determining how long to maintain the current 0 to 0.25% target spectrum for the FFR, the Committee will be based on whether maximum employment and the 2% inflation target can be reached.
FED	April 2014	Continuation of QE3 tapering. Since July 2014, only assets worth of 25 billion dollars would be bought. Reduction in MBS purchases from 15 billion a month to 10 billion and in Treasury securities from 20 billion to 15 billion dollars.
ECB	5/6/2014	Announcement by the GC of Targeted Longer-Term Refinancing Operations (TLTRO1) in the form of 4-year tenders conducted quarterly until June 2016 that would let banks to acquire funds from the Euro system up to 7% of the amount of their loans to the private sector (excluding household loans for house purchases). MRO rate falls to 0.15%.
FED	June 2014	End of asset purchases by QE3. Nevertheless, continuing to reinvest maturing securities in the Fed's balance sheet until short-term rates increased.
ECB	3/7/2014	Announcement of TLTROs - details of TLTROs a period of low inflation
FED	July 2014	Announcement by the FOMC that it will not hurry to normalize the stance of monetary policy.
ECB	4/9/2014	Announcement of Asset-Backed Securities (ABSPP) to support credit creation in the non-financial corporate sector. ABS

		purchases were intended for at least two years and started in the fourth quarter of 2014. Decision for CBPP3 launching in October 2014. MRO rate fell to 0.05%.
FED	17/9/2014	Reaffirmation by the Committee that the 0 to 0.25% FFR target range for the federal funds rate is right.
ECB	2/10/2014	Details of ABSPP CBPP3
ECB	4/12/2014	Introducing the QE-PSPP and Draghi leaves open the possibility for further lax measures.
ECB	22/1/2015	Announcement of APP1, which expands the purchases under the ABSPP and CBPP3 and also includes bonds issued by euro area central governments, agencies and European institutions, which is called as Public Sector Purchase Programme (PSPP). Start of buying on 09/03/2015 in the secondary market. monthly purchases of 60 billion EUR until September 2016.
ECB	5/3/2015	Announcement of technical details of the PSPP and decision on maintaining the key ECB interest rates unaltered.
ECB	9/3/2015	Launch of the PSPP purchases.
ECB	3/9/2015	Draghi argues for possibly extending the existing unconventional policies – Decision by the GC for increasing the issue share limit from the initial limit of 25% to 33%
ECB	22/10/2015	Statement by the GC that will use all of its powers for maintaining the appropriate monetary stance.
ECB	3/12/2015	Extension of the monthly purchases of 60 billion by the APP to at least March 2017. Principal payments of maturing bonds will be reinvested in order to prevent a decline in the size of the central bank's balance sheet (APP2). Announcement of a modification and expansion of the PSPP. Also, a decrease of the interest rate on the deposit facility from -0.20% to -0.30%.
FED	16/12/2015	FOMC increases fed funds rate by 0.25% pp to the range 0.25-0.50%
ECB	21/1/2016	Decision for keeping the key ECB interest rates unchanged and expectation to remain at present or lower levels for an extended period of time.
FED	27/1/2016	Decision by the Committee for preserving the target range for the FFR at 0.25 to 0.5%.
ECB	10/3/2016	Announcement by the ECB of APP3: increase of combined monthly purchases to 80 billion EUR and adding investment grade euro-denominated bonds issued by non-financial corporations to the purchases under a new Corporate Sector Purchase Programme (CSPP). Moreover, announcement of a second series of Targeted Longer-Term Refinancing Operations (TLTRO2) consisting of four consecutive quarterly four-year tenders starting in June 2016. Thereby, banks are allowed to borrow up to 30% of their outstanding loans to the private sector (excluding loans for house purchases). MRO rate decreased to 0.00%, the deposit facility to -0.40%.
FED	21/4/2016	No changes in key ECB interest rates. Asset purchases of 80 billion are intended to run until the end of March 2017, or beyond, if necessary, and in any case until the Governing

		Council sees a sustained adjustment in the path of inflation consistent with its inflation aim.
BOE	August 2016	Launch of the Term Funding Scheme (TFS) due to Brexit decision.
FED	21/9/2016	Decision for maintaining the target range for the FFR at 0.25 to 0.5%, even though a raise seems to become necessary, but the Committee expects for further evidence.

Appendix. 2
List of presentations to Conferences resulted by this thesis

At this point, it could be useful to list the presentations in international and Greek academic conferences that have resulted by this thesis.

1. ''Testing for Cointegration with Threshold Effects between bank of England's Assets and Interest Rates'', paper presented at the 15th Annual Conference of the European Economics and Finance Society (EEFS), Brussels, Belgium, June 14-18, 2015

2. ''Threshold Cointegration Nexus between Bank of England's Assets and Interest Rates'', paper presented at the 14th Annual Hellenic Finance and Accounting Association Conference, Panteion University, Athens, Greece, December 18-19, 2015

3. ''Portfolio Rebalancing Effects of Unconventional Monetary Policies after the 2008 Lehman Brothers Collapse'', paper presented at the 5th International Conference on Applied Economics, University of Thessaly, Volos, May 27-29, 2017

4. ''The Perspectives of Quantitative Easing in the United Kingdom'', paper presented at the International Conference on Emerging and Developing Economies- Society for the study of Emerging Markets (Euroconference 2017), University of Thessaly, Chania, Greece, June 28-30, 2017

5. ''A Critical View on Traditional and Unconventional Monetary Practices in the US'', paper presented at the 5th International PhD meeting in Economics, University of Macedonia, Thessaloniki, Greece, July 5-6, 2017

6. ''Correlations between stock indices and futures indices in US QE-tapering eras'', paper presented at the 3rd International Conference on Econophysics (ICE3), University of Thessaly, Volos, September 28-30, 2017

7. ''Spillover Effects of US QE Tapering on African and Middle Eastern Financial Markets'', paper presented at the International Conference on Business and Economics (ICBE-HOU), Hellenic Open University, Athens, Greece, May 11-12, 2018

8. ''A Survey of Empirical Findings on Unconventional Central Bank Policies'', paper presented at the Future of Money -Trends, Alternatives, Potentials-

Conference, The American School of Classical Studies (Gennadius Library), Athens, Greece, May 24, 2018

9. ''Unconventional Monetary Policy Effects on Output and Inflation: A Meta-Analysis'', paper presented at the Symposium for Meta-Analysis organized by the International Review of Financial Analysis, Poznan, Poland, June 9, 2018

10. ''Unconventional Monetary Policy Effects on Output and Inflation: A Meta-Analysis'', paper presented at the INFINITY2018 Conference, Poznan, Poland, June 11-12, 2018

11. ''US Non-linear Causal Impacts on Global Stock Indices in Unconventional Eras'', paper presented at the 18th Annual Conference of the European Economics and Finance Society (EEFS), London, United Kingdom, June 21-24, 2018

12. ''ECB's Unconventional Monetary Policies' Causality Impacts on the Italian FTSE MIB Index Components'', paper presented at the 14th Biennial Athenian Policy Forum (APF) Conference, University of Piraeus, Greece-Loyola University of Chicago, USA,- Ryerson University, Canada, Piraeus, Greece, July 6-8, 2018