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UNCONVENTIONAL MONETARY POLICIES IN THE EUROZONE AND THE PROVISION OF CREDIT: AN EVENTS STUDY APPROACH

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Resumo

Com o objetivo de alcançar taxas de inflação baixas e estáveis, o Banco Central Europeu (BCE) normalmente utilizava instrumentos monetários convencionais. Contudo, a crise financeira provocou alguns desafios a esses instrumentos tradicionais, uma vez que o objetivo era estimular a economia num cenário de inflação extremamente baixa. Como consequência da crise financeira, as taxas de juro de referência em muitas economias desenvolvidas alcançaram o limiar do 0% (*Zero Lower Bound*) devido à baixa inflação e à ineficácia das políticas monetárias convencionais em estimular o crescimento económico. Como resultado destes efeitos, as políticas monetárias não convencionais começaram a ser implementadas nas maiores economias do Mundo, nomeadamente nos Estados Unidos da América, no Reino Unido e na Zona Euro. Usando o Método do Estudo de Acontecimentos, estudámos como o mercado europeu de crédito responde a estas políticas implementadas pelo BCE no período entre 2008 e 2016. Os resultados sugerem que tanto as compras mensais líquidas inseridas no programa do BCE de compras do sector público, como a *dummy* associada ao Método do Estudo de eventos da política monetária não convencional, têm um efeito positivo na concessão dos diferentes tipos de crédito.

Palavras-Chave: *Quantitative Easing*, Política Monetária Não-Convencional, Crédito, Abordagem por Estudo de Eventos, Zona Euro, Dados em Painel

JEL Codes: C23, C51, E51, E52, E58

Abstract

In order to achieve low and stable inflation rates, the European Central Bank (ECB) usually used conventional monetary instruments. However, the financial crisis brought some challenges to these traditional instruments since the goal was to stimulate the economy in a scenario of very low inflation. In the aftermath of the financial crisis, the policy interest rate in many developed economies reached the Zero Lower Bound due to low inflation and conventional monetary policies started to be ineffective to stimulate economic growth. As a consequence of the crisis, unconventional monetary policies started to be implemented in the World most important economies, namely in the USA, the UK and the Euro Area. Using an Events Study Method we study how the European credit market responds to these unconventional monetary policies implemented by the ECB in the period between 2008 and 2016. Our results suggest that both the monthly net purchase of Public Sector Purchase Program and the dummy associated to the events study method of unconventional monetary policy, have a positive impact in the different kind of credit concession.

***Keywords*:** Quantitative easing, Unconventional monetary policy, Credit, Events study approach, Euro Area, Panel Data

***JEL Codes*:** C23, C51, E51, E52, E58

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List of Abbreviations

ABSPP: Asset-Backed Securities Purchase Program

APP: Asset Purchase Program

CBPP: Covered Bond Purchase Program

CBPP2: Second Covered Bond Purchase Program

CBPP3: Third Covered Bond Purchase Program

CPI: Consumer Price Index

CSPP: Corporate Sector Purchase Program

CUSIP: Committee on Uniform Securities Identification Procedures

DSGE: Dynamic Stochastic General Equilibrium

EAPP: Expanded Asset Purchase Program

ECB: European Central Bank

Fed: Federal Reserve

FOMC: Federal Open Market Committee

GDP: Gross Domestic Product

HICP: Harmonized Index of Consumer Prices

IPI: Industrial Production Index

JGB: Japanese Government Bond

LSAP: Large-Scale Asset Purchase

LTRO: Long-Term Refinancing Operation

MBS: Mortgage-Backed Security

MFI: Monetary Financial Institutions

MPC: Monetary Policy Committee

PSPP: Public Sector Purchase Program

QE: Quantitative Easing

SMP: Securities Markets Program

SVAR: Structural Vector Auto-Regression

TLTRO: Targeted Longer-Term Refinancing Operation

U.K.: United Kingdom

U.S.A.: United States of America

VAR: Vector Auto-Regression

ZLB: Zero Lower Bound

Sumário Executivo

O objetivo da presente dissertação assenta na elaboração de um estudo sobre o impacto que as políticas monetárias não convencionais, que têm vindo a ser implementadas pelo Banco Central Europeu, têm sobre a concessão de crédito na Zona Euro.

Em primeiro lugar é elaborada uma revisão literária aos estudos realizados no âmbito destas políticas monetárias a nível de outras economias, com especial ênfase para os estudos de Gagnon *et al.* (2011) e Chen *et al.* (2011) que são especialmente aplicados à economia dos E.U.A., Breedon *et al.* (2012) e Bridges e Thomas (2012), que focam-se no impacto destas políticas nos mercados financeiros e na oferta de moeda no Reino Unido, e Bowman *et al.* (2011) que estudou a eficiência da liquidez injetada no mercado interbancário Japonês na promoção dos empréstimos bancários.

Além de fazer uma revisão literária aos estudos noutras economias, foi também feita uma revisão aos estudos realizados neste âmbito para a economia em estudo, a Zona Euro. Após a análise da revisão de literatura é formulada uma base para o contributo que vai ser apresentado na presente dissertação - uma interação entre a concessão de crédito e a política monetária não convencional, *Quantitative Easing*, na Zona Euro.

É utilizada uma abordagem econométrica, por via da estimação de modelos para dados em painel, de forma a obter os resultados relevantes para a pergunta inicial da presente dissertação. A base de dados tem uma periodicidade mensal para os 19 países pertencentes à Zona Euro, compreendidos entre Janeiro de 2008 e Maio de 2016. Para capturar o efeito do *Quantitative Easing* no crédito, construiu-se uma *dummy* associada ao método de estudo de eventos (neste caso da política monetária não convencional), bem como utilizou-se uma variável de nível, associada às compras mensais líquidas para cada país de ativos do Estado, inseridas no programa do Banco Central Europeu em estudo. É assim desta forma que é analisada a eventual existência de impactos da política monetária não-convencional na concessão de crédito, quer a nível global, dos governos e também a nível das famílias, depois de controlados todos os outros fatores que determinam o crédito.

Os resultados permitem concluir que a implementação destas políticas monetárias não convencionais na economia tem uma relação estatisticamente significativa na explicação da evolução da concessão do crédito, uma vez que através deste estudo verificou-se o impacto positivo que estas políticas têm sobre o crédito. Por sua vez, quando analisado separadamente por agentes económicos, o maior impacto é verificado no crédito concedido aos governos da Zona Euro, com três períodos de desfasamento.

1. Introduction

The present work aims to disclose how unconventional monetary policies implemented by the ECB affects the provision of credit in the Euro Area.

The subprime crisis, which started in the USA, quickly spread through other nations, generating a global financial crisis, affecting economies throughout the world. In the aftermath of this global crisis, the policy interest rate reached the Zero Lower Bound in several countries and financial markets, due to disruptions, generated losses, affecting liquidity. These two factors are appointed by Joyce *et al.* (2012) as reasons for the failure of conventional monetary policy.

Conventional monetary policy measures did not work anymore and Central Banks needed new tools to stimulate the economy, so the implementation of unconventional policies was crucial for economy recovery. This topic is relatively recent and there is not too much literature about it. Most studies about unconventional monetary policies are about the USA, the UK, and the Japanese economies, focusing on the impacts on financial and bond markets, and/or are usually studies made by Central Banks using data not available outside these institutions.

In contrast to the studies available in the literature, this work uses publicly available data (from Bloomberg, Thomson Reuters DataStream Database, Eurostat and the European Central Bank) to study how much unconventional monetary policies affect the provision of credit in the Euro Area, an economy that has been somehow neglected in the literature. A panel data was created with data for the 19 countries of the Euro Area, during a period of 101 months (January 2008 until May 2016).

In order to capture the effect of these policies, a *dummy* variable was created using the Events Study Approach, as well as a real-valued variable measuring the monthly net purchases under the Public Sector Purchase Program (PSPP). The results were obtained through panel linear regression analysis.

This work is organized in the following way. In Section 2 we present a literature review about the main features related with unconventional monetary policies and Quantitative Easing throughout the world (USA, UK, and Japan) and also about the main determinants of credit. On Section 3 data sources and treatment is described. On Section 4 the methodology is presented, which includes several diagnosis tests and the estimation method. On Section 5 the analysis of the results are presented. Finally, in Section 6 we conclude.

2. Literature Review

The main objective of the European Central Bank (ECB)'s monetary policy is to promote price stability. Specifically, the ECB aims to achieve low and stable inflation rates, which means, inflation rates below, but close to 2%, in the medium term. In order to achieve its goals, the ECB used to rely on conventional monetary policy instruments, such as target interest rates, bank reserve limits, and changes in money supply through open market operations (European Central Bank, 2011). However, the financial crisis of 2007-2008 has brought some challenges for traditional monetary policy instruments and central banks (Joyce *et al.*, 2012).

In September 2008, the bankruptcy of the U.S. Investment bank Lehman Brothers has brought consequences which were suffered in the world's financial markets and investors lost confidence in other banks. In the words of Paulson (2008) "we had a system-wide crisis. Credit markets froze and banks substantially reduced interbank lending. Confidence was seriously compromised throughout our financial system. Our system was on the verge of collapse, a collapse that would have significantly worsened and prolonged the economic downturn that was already underway."

In the aftermath of the global financial crisis of 2007-08, policy interest rates in several advanced economies reached the zero lower bound (ZLB) due to low inflation, the long and deep recession, and low real interest rates (Driffill, 2016). The reasons appointed for the failure of conventional monetary policy in recent years are: (1) Nominal short-term interest rates reached the ZLB, losing the capability to stimulate the economy; (2) Disruptions in the financial markets generated large losses, affecting the liquidity and solvency of both banks and borrowers. Since conventional policies were not working, Central Banks needed new tools to stimulate their sluggish economies, which means to implement unconventional policies (Joyce *et al.*, 2012).

The unconventional monetary policy, in the last years designated by Quantitative Easing (QE), consists in a large-scale asset purchase program (APP) which means that Central Banks expand the left size of the Balance Sheet through the purchase of public sector debt and private assets with longer maturities, holding constant the assets' composition (Driffill, 2016). The described unconventional measure is the most common, but there is also the Qualitative Easing, which is "a shift in the composition of the assets of the Central Bank towards less liquid and riskier assets holding constant the size of the balance sheet" (Buiter, 2008).

a. The Transmission Mechanism of Quantitative Easing

The large-scale asset purchases affect the interest rate through various transmission channels, changing the willingness of: companies to invest, households to consume, and banks to lend. These changes influence the inflation rate and economic growth.

The signaling channel affects the interest rate across the yield curve and the effects depend on bond maturities. The QE measures increase the liquidity of the banking system, leading to a reduction in the liquidity price premium and an increase on government bond yields. However, this effect only persists if central banks purchase assets (Krishnamurthy and Vissing-Jorgensen, 2011).

The asset purchases, under QE, push up asset prices by lowering expectations about the future short-term interest rate and reducing the term premium. Higher asset prices increase the net wealth of asset holdings and reduce the cost of borrowing, boosting nominal spending in the private sector, helping to achieve a higher inflation rate, stimulate economic growth, and reduce the unemployment rate. The asset price channel may have an impact through the bank lending and confidence channels: (1) in the bank lending channel, the improvement of liquidity persuades banks to finance more new loan (however, there are restrictions due to the weak financial system); (2) the confidence channel may encourage investment and spending directly or further boost asset prices by reducing the risk premium. The channels which QE may support investment and spending are summarized in Figure 1 below, taken from Hausken and Ncube (2013). The main transmission mechanism between monetary policy instruments (e.g., the official interest rate and the monetary base) and the real economy is the bank lending channel. However, during the latest financial crisis, the risk aversion by banks increased, leading to the failure of the mechanism and shrinking the credit available to the private sector (Olmo and Sanso-Navarro, 2014). As referred previously, the crisis led to a strong economic contraction worldwide and for this reason, Central Banks announced unconventional monetary policies in order to stimulate the economy (Joyce *et al.*, 2012).

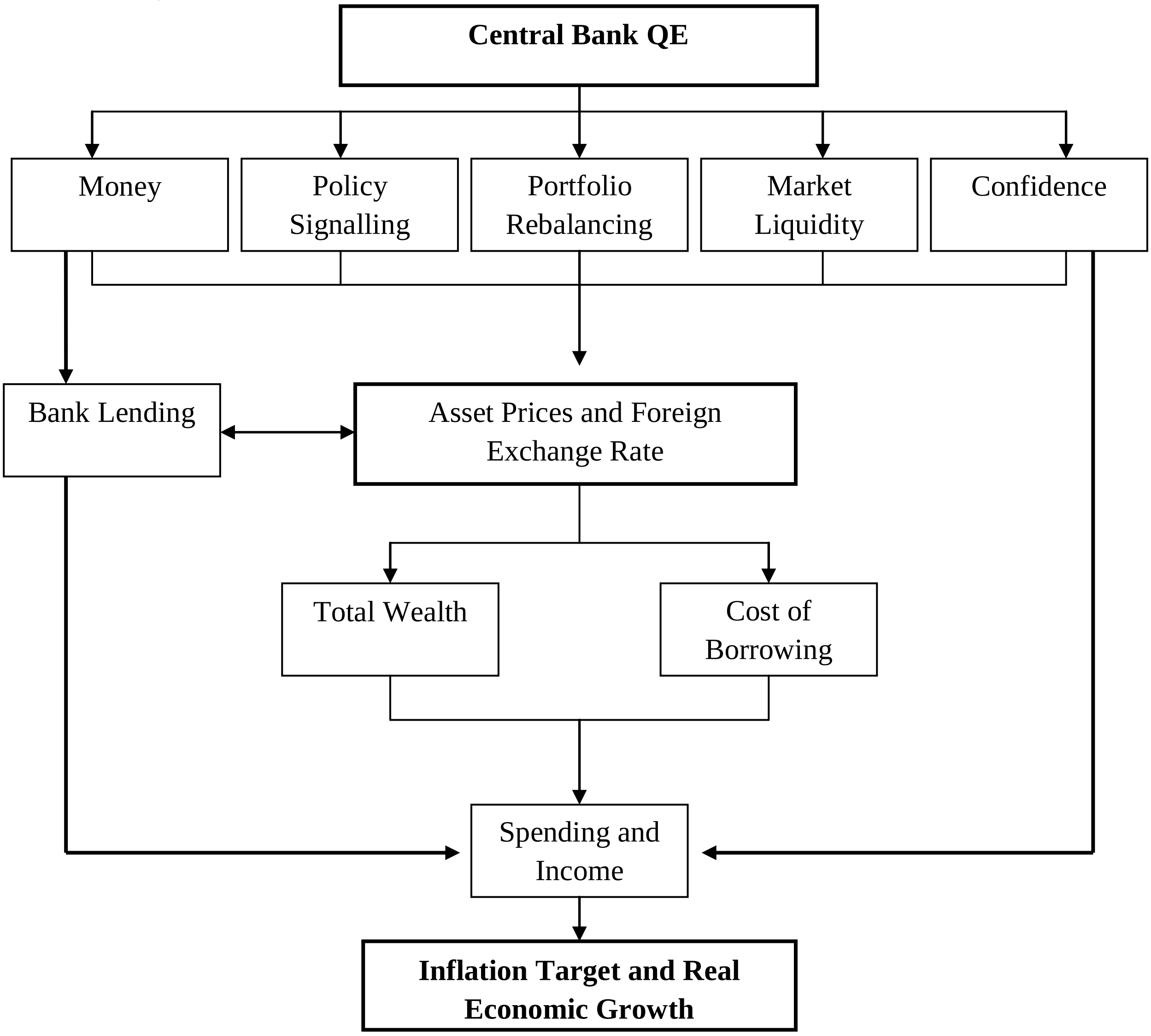

Figure 1 – Transmission Channels of QE

Olmo and Sanso-Navarro (2014) argue that the goal of unconventional monetary policies is also to restore the bank lending channel and after that, to reestablish the other transmission mechanisms. They developed a bank-based model to connect the money stock, interest rates, and real income and highlight the relevance of competition in the banking sector.

b. The Determinants of Credit to the Private Sector

The private sector is divided in households and non-financial corporation and the access to credit is important in both groups. Families, normally, acquires loans to finance consumer expenses, while firms, do it mostly, to finance investment expenditures. Economic growth has an impact on credit demand, as well as productivity expectations. These two factors are included in the four sets of variables that explain the dynamics of credit allocation:

- Borrowing capacity of households
- Financial conditions
- Financial condition of the borrower
- Structural factors that affect the banking system

Structural factors that affect the banking system are linked with the determinants of credit supply and demand, and according to the literature, the determinants of credit focus on the variables related with the demand for credit, due to the strain in measuring supply variables. Both the determinants of demand and the supply of credit are important variables in the dynamics of credit (Castro and Santos, 2010).

According to the majority of the literature that estimates a long-run relationship between the aggregated value of credit and some macroeconomic variables, the total amount of credit has a positive correlation with GDP and asset prices, while presenting a negative correlation with the interest rates (Egert *et al.*, 2007).

c. The Several Quantitative Easing Programs throughout the World

i. Quantitative Easing in Japan

The economist Richard Werner was the one introducing the term "Quantitative Easing" (QE) for the first time, also proposing the implementation of this kind of policy in Japan in 1994 (Visconti and Quirici, 2015). Therefore, Japan was the first country to implement an unconventional monetary policy in March 2001 due to the decline in consumer prices, a weak banking system and the expectation of a new recession following the collapse of the global information technology bubble. The first program lasted for 5 years and other QE programs followed (Bowman *et al.*, 2011). The QE Program aimed to introduce more liquidity in the banking system, keeping the overnight interest rate near zero, encouraging bank lending. Others objectives of the Program were the commitment to maintain interest rates at the ZLB – until the core CPI is above zero – and the purchases of Japanese Government Bonds (JGBs), in order to supply banks with liquidity (Gagnon *et al.,* 2011).

Bowman *et al. (*2011) estimate panel data regressions, using semiannual data for 137 banks over the period of March 2000 to March 2009. The authors study the effectiveness of the Bank of Japan's injections of liquidity into the interbank market in promoting bank lending. The authors find a robust, positive and statistically significant effect of QE policy on credit boost to the economy. Ugai (2007) investigates the effect of JGBs purchases under QE on portfolio balance, finding small or insignificant effects on longer-term interest rates, including on corporate bonds. According to the author, the maximum of JGBs hold by Bank of Japan was about 4% of GDP, less than the 12% of GDP increase in the Federal Reserve holdings under the Large-Scale Assets Purchases (LSAP).

After the financial crisis the policy rates in the United States and the UK decreased quickly and the ECB followed since 2009, although the interest rates were kept above 1% until 2012. Subsequently, the ECB cut all its policy interest rates gradually until late 2014. Regarding the BoJ's policy rates, these have been at the ZLB since the financial crisis, as can be seen in Figure 2 (Driffill, 2016).

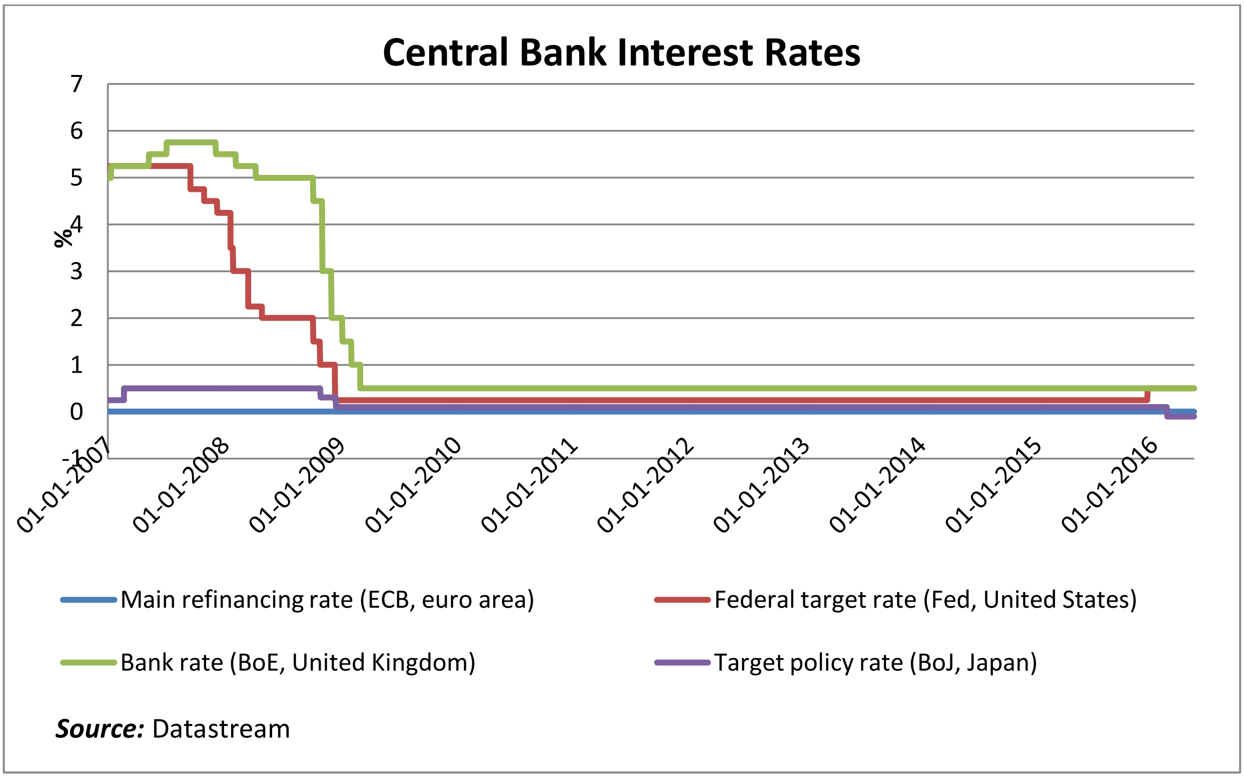

Figure 2 - Central Bank Interest Rates

ii. Quantitative Easing in the USA

The Federal Reserve started to increase the balance sheet after the Lehman Brothers bankruptcy, starting the QE1 (2008-2009) buying $600 billion in mortgage-backed securities (MBS). In March 2009 it held $1.75 trillion in bank debt, MBS and Treasury notes. The Fed halted the program after the economy started to improve, however the program resumed shortly, since the economy was not growing vigorously. In November 2010, the Fed announced the QE2 program, buying $600 billion in long-term Treasury Securities (Driffill, 2016). These kind of actions resulted in excess reserves leading to an improvement in the economy as well as in the banks’ opportunities to lend and invest (Thornton, 2012). In September 2012 was announced the QE3 program by the Federal Reserve and the Federal Open Market Committee (FOMC), with monthly purchases of $40 billion of agency mortgage-backed securities in an open-ended program. Three months later, the FOMC announced an increase in the monthly purchases from $40 to $85 billion (Driffill, 2016).

Using daily data from the Committee on Uniform Securities Identification Procedures (CUSIP)[1] on LSAP and returns, D'Amico and King (2010) analyze the effects of changes in the supply of publicly available Treasury debt on yields. The result is a reduction in longer-term Treasury yields, between 30 and 50 basis points, which is large taking into account the historical standards and represents a cut in the cost of borrowing for corporations and households. Therefore, the Treasury LSAP program "was probably successful in its stated goal of broadly reducing interest rates, at least relative to what they would otherwise have been".

Gagnon *et al.* (2011) was one of the first studies about the US Federal Reserve's LSAPs, focusing on the effects on securities' long-term interest rates. The conclusion is that QE had economically significant and long-lasting effects. The authors found a reduction, between 30 and 100 basis points, in the 10-year term premium, which they estimated to be in the lower and middle thirds of this interval. Moreover, they find a more dominant effect of the interest rates on agency debt and agency mortgage-backed securities (MBS), improving the liquidity of the financial system.

Chen *et al.* (2011) estimated the effects of LSAP2 on some macroeconomic variables using a dynamic stochastic general equilibrium (DSGE) model incorporating asset market segmentation. The results show that the impact of LSAP2 on GDP growth is not expected to go beyond 0.5%, with a minimal impact on inflation.

iii. Quantitative Easing in the UK

In March 2009 the Bank of England's Monetary Policy Committee (MPC) announced the program of large-scale purchase of public and private assets – QE - in addition to the reduction of its bank rate to the historical low rate of 0.5%. In the first round of QE, the Bank of England purchased £200 billion of assets, exclusively Government Bonds (Gilts). Later on, the Bank of England purchased more £175 billion, bringing the total amount of the program to £375 billion (Joyce and Spaltro, 2014).

The impact of the initial QE program (2009-2010) on financial markets is analysed by Breedon *et al.* (2012), taking into account two empirical approaches to measure the

[1] According to D'Amico and King (2010) the CUSIP-level data allow us to analyze the effects better. It is possible to examine "differential effects of purchases across security characteristics such as maturity and liquidity".

impact of QE, uncovering an economically significant impact on bond market. The impact of this type of monetary policy on the economy, in particular on financial markets, remains controversial. The study by Joyce *et al.* (2011), with the identical purpose, found that the medium long-term UK government bond yields fall by about 100 basis points.

Bridges and Thomas (2012) examine the impact of QE on money supply using a "Monetary Approach" and the estimates are applied to two econometric models: (1) an aggregate structural vector autoregression (SVAR) model and (2) a model linked with a set of sectoral money demand systems (a sectoral approach). The authors concluded that an increase of 8% in money holdings, in the QE period, decrease the yields, on average, about 150 basis points, and increased the asset values by 20%. These effects, based on the sectoral approach, led to a boost in the GDP around 2% and in the CPI by about 1%.

Joyce and Spaltro (2014) study the effects of QE on bank lending growth, using new non-publicly available data on UK banks and explore the heterogeneities between large and small banks. The authors found that QE may lead to an increase in bank lending, since the deposit ratio has a statistically significant effect on bank lending. Moreover, the effects on small banks are higher than in the big ones.

d. Quantitative Easing in the Euro Area

In order to respond to the financial and the sovereign debt crises, the ECB implemented some measures to provide liquidity in the economic system. The programs implemented were:

- Long-Term Refinancing Operations (LTROs) in October 2008 – LTROs is a three-month liquidity-providing operation (in euros), one of the two regular open market operations. Through this program, the ECB provides financing to Euro Area banks.
- Covered Bond Purchase Program (CBPP) in May 2009 and 2nd CBPP Program in October 2011 – The purchase of covered bonds helps to improve the functioning of the monetary policy transmission mechanism as well as support lending conditions in the Euro Area.
- Securities Market Program (SMP) in May 2010 – ECB's interventions in public and private debt securities markets in the Euro Area in order to restore monetary

policy transmission mechanism, making the monetary policy efficient-oriented towards price stability in medium term.

However, none of these programs was enough to provide liquidity and give confidence to the investors about the default risk on the sovereign debt of some countries like Portugal, Spain, Italy, and Greece (Driffill, 2016). So, after the Japan, United States and United Kingdom, it was the turn of the ECB to announce, in September 2014, the Expanded Asset Purchase Program (EAPP), the unconventional monetary policy formally designated by QE. The first announcement and implementation was the Third CBPP and the Asset-Backed Securities Purchase Program (ABSPP). On 22 January 2015, it was announced another type of QE Program, specifically the first Public Sector Purchase Program (PSPP), directed to the purchase of sovereign bonds from Euro Area governments and securities from European supranational institutions and national agencies. Therefore, PSPP was added to the CBPP3 and to the ABSPP, like we can see in Table 1.

Table 1 - QE Announcement and Implementation Dates

Program	Announcement	Implementation
CBPP3	4th September 2014	20th October 2014
ABSPP	4th September 2014	21st November 2014
PSPP	22nd January 2015	9th March 2015

Source: ECB

In Tables 2 and 3 is possible to verify that the ABSPP is the smallest of the three programs and the PSPP is the biggest of all instruments (Claeys *et al.*, 2015).

Table 2 - Eurosystem Holdings under the Expanded Asset Purchase Program

	ABSPP	CBPP3	PSPP	APP
Holdings* February 2016	18,571	158,321	597,529	774,421
Holdings* March 2016	18,994	165,638	648,022	832,655

Source: ECB. * - at amortized cost, in euro million, at the end of the month.

Table 3 - Eurosystem Outright Operations

Instrument	Reference date	Outstanding amount*
CBPP	29 April 2016	19,082
SMP	29 April 2016	114,685
CBPP 2	29 April 2016	8,442
CBPP 3	29 April 2016	172,253
ABSPP	29 April 2016	19,043
Public sector purchase program	29 April 2016	726,521

Source: ECB. * - at amortized cost, in euro million.

The original guidelines of PSPP correspond to €60 billion worth of monthly purchases until September 2016 with the following purchases allocation: (1) €10 billion *per* month of asset-backed securities and covered bonds; (2) €44 billion *per* month of government and national agency bonds (divided in holdings of the ECB and the National Central Banks); (3) €6 billion *per* month of supranational institutions located in the Euro Area. On the 3rd of December 2015, Mario Draghi announced an extension of the program, leading to changes in the initial guidelines (Claeys and Leandro, 2016). In its website, the ECB claimed that: "The initial program changed in March 2016, changing the monthly amount of purchases from 60 to €80 billion and changing its end to March 2017 or until the Governing Council sees a sustained adjustment in the inflation, which means the observation of at least a trajectory to the inflation target. According to the Governing Council, one of the reasons to announce the EAPP was the historical low rates in most indicators of actual and expected inflation in the Euro Area. This program can stimulate the economy and ease monetary and financial conditions, which makes access to finance cheaper for firms and households."

The governments of the Euro Area could not implement fiscal stimulus because most European economies are highly indebted and are reducing deficits. So, taking into account the background of "below target inflation, high unemployment, weak growth, high public debt, the unavailability of fiscal policy, and nominal interest rates at rock bottom" the Central Banks have been using unconventional policies (Driffill, 2016).

The introduction of QE by the ECB led to a new perspective about the link between monetary policy and financial stability after the ECB clarify that price stability is the main objective of this program, seconded by financial stability. The Vice-President of the ECB has named this as a new separation principle, implying that fiscal dominance and financial stability dominance of monetary policy should be avoided by the central banks (Constâncio, 2015). Taking into account this principle, Draghi (2015) says that the financial stability risk should be driven by macro-prudential policy instruments. There are some expectations that QE could increase some price bubbles on certain categories of assets, but Draghi (2015) responds that for now the ECB sees no sign of bubbles, only certain situations in specific markets, in which prices grow up fast. However, if bubbles are of a local nature, the macro-prudential instruments are the most appropriate.

The separation principle, referred above, is criticized by End (2015), concluding that the approach of tightening monetary policy for financial stability reasons at the expense of short-term inflation is not an appropriate reaction, since in some countries the inflation rate is far below the target, making this monetary policy infeasible. The author refers that the financial stability should have more weight as a driving force of asset prices. In a regression with quarterly data for the period 1978-2014, 11 advanced economies[2] are analyzed and it was found that a decrease in equity prices and an increase in corporate bond rates lower the inflation rate, meaning that asset price developments should be taken into account in monetary policy.

Albu *et al.* (2014) analyze the impact of the unconventional monetary policy – QE – issued by four major central banks[3] on credit risk, in nine countries of Central and Eastern Europe[4]. In the study is used daily data in an ARMA-GARCH Model and two variables: credit default closing prices and dates of the announcements of QE policies. The range of influence of QE on credit risk, on the analyzed countries, is similar between the ECB and the BoJ. On the other hand, the influence of QE by the Bank of England and the Federal Reserve is lower (and identical between them). Moreover, the QE policies of the ECB and the Federal Reserve, determine both surges and descents in credit risk, while for the Bank of England and the BoJ the leaning of reduction is superior to those of growth.

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[2] Advanced economies are the USA, Japan, UK, Germany, France, Italy, Netherlands, Australia, Norway, Sweden and Spain.
[3] QE issued by The ECB, the Bank of England, the Federal Reserve and the Bank of Japan.
[4] Nine countries analyzed: Turkey, Russia, Germany, Poland, Hungary, Ukraine, Austria, Bulgaria and Romania.

In order to analyze the QE' effects on prices and yields, Driffill (2016) collected the dates of announcements and actions to examine the changes around those dates. The effects are diverse, depending on the date and country in analysis, hence there are countries more sensitive to announcements than others (e.g., the fall in the 10-year Government bond yields was higher in Portugal - 57.75 basis points - than in Germany, France and Greece - 23.20; 15.00, and 5.06, respectively).

Credit to the private sector is a key source of funding for households and non-financial corporations in the Euro Area, as well as a source of valuable information to analyze and forecast economic activity, prices, and monetary developments. The developments of credit in the Euro Area have received little attention. An exception is Calza *et al.* (2003), who study the demand for loans to the private sector in the Euro Area between 1980 and 1999 with quarterly data. Relative to the empirical model, the authors argue that "the analysis of the demand for loans to the private sector in the Euro Area is limited to a relatively small set of explanatory variables representing general economic activity and the cost of loans". Consequently, the model is based in the following long-run relation:

$$LOANS = \alpha + \beta_1 . GDP + \beta_2 . ST + \beta_3 . LT + \varepsilon \qquad (1)$$

In which LOANS is the logarithm of loans to the private sector (in real terms), GDP stands for logarithm of GDP (in real terms), ST denote the real short-term interest rate, and LT represents the real long-term interest rate. The coefficient associated with the GDP is positive (1.457) while with the real short-term and real long-term interest rates are negative (-0.416 and -3.084, respectively). The second coefficient, associated with the real long-term interest rates, is much higher, meaning that interest rates with higher maturities have more impact on loans.

Hofmann (2001) studies the determinants of credit to the private non-financial sector in 16 industrialized countries[5], including 8 Euro Area countries, based on a cointegrated VAR (Vector Autoregressive) estimation, over the period 1980-1998, using quarterly data. The outcome of this study is that in the long-run credit is positively linked to real GDP and real property prices and negatively to the real interest rate. The author also

[5] 16 Industrialized countries: United States, Japan, Germany, France, Italy, United Kingdom, Canada, Australia, Spain, Netherlands, Belgium, Ireland, Switzerland, Sweden, Norway and Finland.

argues that a rise in real GDP affects lending and property prices positively and increases in both credit and property prices, promote real GDP growth.

The EAPP was introduced to improve lending conditions to the private sector (firms and households). From the related literature is possible to claim that there is little evidence on the impact of this policy on lending conditions. This may be due to lack of information about asset purchases and interest rates, while there is ample evidence on bond yields (Blattner *et al.*, 2016). The authors study the effects of the EAPP through new comprehensive loan-level data from Portugal, and find some positive evidence of its impact at banks exposed to QE both via lower prices and larger quantities. Portugal is relevant to the study because both the size of purchases are large relative to the size of the market, suggesting a significant impact of EAPP, and the dependence of the private sector for bank credit is significant, being a good example to study the transmission of QE through the bank lending channel.

3. Data

In this section we will describe our dataset, data sources, and define our variables and time period. Our work aims to analyze the impact of unconventional monetary policy on private credit in the 19 Euro Area countries.[6] The choice of this monetary union can be justified by the little evidence on the impact of QE on credit for several economic agents of the member countries, namely households, firms, and the government, when compared with others economies, namely the U.S.A. and the United Kingdom. A panel model is estimated using monthly data, covering the period between January 2008 and May 2016 (101 time-series across 19 cross-sections). With this sample period it is possible to analyze unconventional monetary policies since their beginning, i.e., after the Lehman Brother’s bankruptcy in September 2008.

The dependent variables were taken from the Thomson Reuters DataStream database and are the loans of Monetary Financial Institutions (MFIs) to Euro Area residents, both private and public (TOT) by country and four other variables related to credit, which will be used interchangeably as dependent variables, namely:

[6] The 19 Euro Area economies are: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia, and Spain.

- Loans of MFIs to Euro Area general governments (GOV);
- Loans of MFIs to households consumer credit (HCC);
- Loans of MFIs to households for house purchase (HIH).
- We have computed the variable HOUSE, which is the sum of the variables HCC and HIC.

All the referred five dependent variables (TOT, GOV, HCC, HIH, and HOUSE) have p-values for the panel unit root tests above the significance level, hence they are non-stationary (see Tables A1, A2, A3, A4 and A5, respectively, in the Appendix).

We have the following independent variables, chosen according to the literature:

- **Industrial Production Index (IPI) -** IPI is a monthly series that measures output in manufacturing, mining and electric, and gas utilities, presenting values between 0 and 100. The IPI is used as a proxy for the Gross Domestic Product (GDP), which measures the market value of goods and services produced in a country. The source of this data was the Thomson Reuters DataStream database. This variable presented evidence of seasonality in all its cross-sections (countries), which can be seen in Figure A1 in the Appendix. In order to remove the seasonal component we used the X-12-ARIMA procedure, with a multiplicative decomposition. The series after seasonality have been removed are presented on Figure A2. This series was labelled IPI_NS. IPI_NS has a p-value in unit root tests below the significance levels, so it is stationary (see Table A6 in the Appendix).

- **EURIBOR (Euro Interbank Offer Rates) –** The EURIBOR is based on average interest rates established by a group of around 50 European banks that lend and borrow from each other. We have data for EURIBOR 3 months (EUR03M) and 6 months (EUR06M). The Bloomberg was the database used to get this data. Both variables have p-values lower than significance levels, so they are stationary (see Tables A7 and A8 in the Appendix).

- **Risk-Free Rate (GOV10Y) –** To represent the risk-free rate we choose the 10-year Government Bond Yield for each country in analysis. Usually, a government bond is issued by a national government and is denominated in the country's currency. The source for this variable was the Eurostat. In contrast to the last four independent variables mentioned, GOV10Y is non-stationary (see Table A9 in the Appendix).

- **Interbank Offered Rate (INTRATE) –** The interbank rate is the rate of interest charged on short-term loans made between banks, which can borrow or lend money in the interbank market in order to control for liquidity. There is a broad range of interbank rates such as: LIBOR (London), LISBOR (Lisbon) and VIBOR (Vienna). These rates are set taking into account the average rates on loans made within that interbank market. Thomson Reuters DataStream database was the source for all these rates. The Interbank Offered Rate is a stationary variable, having low p-values (see Table A10 in the Appendix).

- **Inflation Rate (INFL) –** The annual inflation rate, in percentage, is measured by the Harmonized Index of Consumer Prices (HICP) and this rate measures the change of the HICP between a month and the same month of the previous year. The source for this variable was the Thomson Reuters DataStream database. The unit root tests for INFL have opposite results. For the Levin, Lin & Chu (2002) and Im, Pesaran & Shin (2003) tests, the variable is stationary, while for the ADF – Fisher and PP – Fisher tests is non-stationary (see Table A11 in the Appendix).

- **Quantitative Easing (PSPP)** – This variable is the monthly net purchases under the Public Sector Purchase Program (PSPP) by country and data are available since March 2015, when the program started, until May 2016. However, there are no data for Greece and Cyprus presents missing values. The explanation for the absence of data for Greece is that the ECB cannot buy Greek sovereign bonds as part of its QE program. The Greek rating was too low and the Governing Council decided that the countries that have bond yields lower than the deposit rate are excluded from the purchases. In relation to Cyprus, the reason is that it became eligible for the EAPP of the ECB only on October 2015. The negative net purchase in Cyprus in March 2016 is the result of transactions conducted to ensure continued compliance within the limit framework, reflecting buyback operations by the Cypriot Public Debt Management Office.

The source for monthly net purchases was the ECB. The PSPP variable is non-stationary (see Table A12 in the Appendix). In this kind of variables we have to take first differences.

- **UNCONV (Dummy)** - The dummy was built to capture the effect of unconventional monetary policy on the dependent variables and is the same for all countries. In order to perform an event study, we made a list with monetary policy announcement days (see Table A13 in the Appendix). The dates match announcements dates of unconventional monetary policy initiatives by the ECB. In the same table, there is a column that shows whether conventional monetary policy measures were announced on that same day, i.e., whether there were changes in short-term policy interest rate at the same day. The first announcement by the ECB concerning unconventional monetary policies is on the 28 of March 2008, year of the Lehman Brother's bankruptcy, representing the start of the financial crisis period. The dummy is defined as follows below.

$$Dummy \begin{cases} 1, if\ an\ unconventional\ monetary\ policy\ was\ announced\ on\ that\ month \\ 0, otherwise \end{cases}$$

- **CONV (Dummy)** – This dummy was built taking into account the changes in conventional monetary policy at the time of regular Governing Council meeting (see Table A14 in the Appendix). The dummy is defined as:

$$Dummy \begin{cases} 1, if\ a\ conventional\ monetary\ policy\ was\ changed\ on\ that\ month \\ 0, otherwise \end{cases}$$

- **TT (Dummy) –** This variable intends to capture the effect of the period since the ZLB started (February/2012 – May/2016). The dummy is defined as:

$$Dummy \begin{cases} 1, Zero\ Lower\ Bound\ Period \\ 0, otherwise \end{cases}$$

- **TT3 (Dummy) –** This dummy defines the period that the ECB was concerned in controlling for the inflation rate (above the target of 2%). The definition is:

$$Dummy \begin{cases} 1, between\ January\ 2008\ and\ December\ 2012 \\ 0, otherwise \end{cases}$$

Through the Correlation Matrix between the independent variables (see Table A15 in the Appendix) is possible to determine the possibility of the existence of multicollinearity. We can conclude that the two variables that cannot be simultaneously in the regressions, because the correlation between them is higher than 0.8, is the EUR03M and EUR06M.

Table 4 presents summary statistics (number of observations, mean, standard deviation, minimum, and maximum) for the dependent and independent variables. Table 5 shows the arithmetic average for the dependent variables, calculated by country (cross-section).

Table 4 - Descriptive Statistics for the Main Variables

Variable	N obs.	**Mean**	**St. Deviation**	**Min**	**Max**
TOT	1862	933618.8	1373551.0	9436.8	4937298.0
GOV	1864	57257.26	103136.6	29.00000	453093.0
HCC	1862	32190.55	50238.51	286.1000	187386.0
HIH	1862	196982.8	290574.3	2032.700	1087045.0
HOUSE	1862	229173.4	338984.1	2318.800	1264074.0
PSPP	256	2801.086	4064.030	-16.00000	19573.00
UNCONV	1919	0.257426	0.437330	0.000000	1.000000
EUR03M	1919	1.044050	1.415275	-0.257000	5.277000
EUR06M	1919	1.207842	1.408017	-0.143000	5.377000
GOV10Y	1817	4.074590	3.048654	0.060000	29.24000
INFL	1919	1.780615	2.319141	-4.300000	17.70000
INTRATE	1426	1.390419	2.098695	-0.280000	24.20000
IPI	1857	102.1955	13.69630	51.50000	159.8000
IP_NS	1859	102.2760	11.97611	68.4523	160.5184
CONV	1919	0.178218	0.382796	0.000000	1.000000
TT	1919	0.514851	0.499910	0.000000	1.000000
TT3	1919	0.504059	0.491201	0.000000	1.000000

Table 5 - Arithmetic Mean for Credit Variables by Country (Cross-Section)

Country	TOT	GOV	HCC	HIH	HOUSE	PSPP
Austria	581,525	28,120	23,403	82,035	105,438	1,393
Belgium	545,485	25,681	8,753	96,942	105,695	1,755
Cyprus	71,432	1,045	3,384	11,070	14,454	67
Estonia	16,727	427	663	6,003	6,666	7
Finland	241,019	8,918	12,859	80,272	93,131	892
France	4,208,911	293,635	152,713	796,231	948,944	10,127
Germany	4,602,594	377,981	177,845	995,206	1,173,051	12,759
Greece	270,676	9,696	29,521	71,371	100,892	---
Ireland	494,117	22,672	17,331	94,726	112,057	811
Italy	2,451,557	257,385	60,490	333,906	394,396	8,749
Latvia	18,724	114	792	5,874	6,666	62
Lithuania	18,939	795	852	5,915	6,767	111
Luxembourg	440,803	4,313	1,944	20,438	22,282	106
Malta	14,055	140	371	2,938	3,309	37
Netherlands	1,305,919	52,973	25,036	384,768	409,804	2,839
Portugal	306,501	8,626	13,958	108,078	122,036	1,180
Slovakia	40,205	942	3,114	12,759	15,873	456
Slovenia	35,264	1,285	2,557	4,708	7,265	232
Spain	2,074,302	83,735	76,034	629,434	705,468	6,273

Notes: values in Euro (millions).

4. Methodology

a. Panel Linear Regression Model

In order to analyze the relationship between the amount of credit concession and the net purchases under the PSPP and the announcements of unconventional monetary policy measures, we use an events-study approach through standard panel linear regression models.[7] As explained in the previous section, our work will focus on the 19 Euro Area economies and cover the monthly period between January 2008 and May 2016. Thus, we will develop panel data models, i.e., with both country cross-sectional and time-series dimensions. Our dataset can be regarded as a macro-panel since the number of time periods clearly dominates over the number of countries. Our panel is balanced, with all our cross-section observations valid (no missing values) during the entire time-series period. The general model can be written as follows:

$$y_{it} = \beta_0 + \boldsymbol{X_t}\beta_1 + \boldsymbol{Z_{it}}\beta_2 + \boldsymbol{A_t}\beta_3 + \boldsymbol{P_{it}}\beta_4 + \boldsymbol{C_{it}}\beta_5 + \boldsymbol{L_{it}}\beta_6 + \boldsymbol{I_{it}}\beta_7 + u_{it}$$

For cross-sections $i = 1, \dots, N$ and periods $t = 1, \dots, T$

$\boldsymbol{X_t}$ This K_X-dimensional vector represents the "external" explanatory variables, namely **EUR03M** and **EUR06M.** These variables are international, i.e., equal for all countries and cannot be controlled (exogenous).

$\boldsymbol{Z_{it}}$ This K_Z-dimensional vector represents the "internal" explanatory variables, specifically **INFL, IPI_NS, GOV10Y**, and **INTRATE.** These variables are determined at each country's level.

$\boldsymbol{A_t}$ This variable represents the announcements of non-conventional monetary policy. The announcements were transformed in a dummy variable **(UNCONV).**

$\boldsymbol{P_{it}}$ This variable **(PSPP)** represents the amount of purchases through the Public Sector Program for each country.

$\boldsymbol{C_{it}}$ This variable **(CONV)** represents the changes in conventional monetary policy at the time of the regular Governing Council meeting.

$\boldsymbol{L_{it}}$ The variable **(TT)** captures the effect of the ZLB period.

$\boldsymbol{I_{it}}$ The variable **(TT3)** captures the effect of the period that the ECB was concern in controlling the inflation rate (above the target rate of 2%)

[7] The estimations of the models were obtained using the software EVIEWS, version 7.

$\boldsymbol{\beta_0}$ Represents the intercept. The $\boldsymbol{\beta_j}$ is the partial slope associated to the j^{th} regressor, after controlling for all other terms.

$\boldsymbol{u_{it}}$ Is the error term and includes all unobserved components that also affect y_{it}.

In the general model, we may also include interactions of the announcements dummy variable with other covariates, lags and/or nonlinearities in some particular regressors, and a deterministic time trend.

In order to identify the effect of the EAPP on credit, three different kinds of credit will be considered as the dependent variable y_{it}: (1) the total loans from MFIs to euro residents; (2) the loans from MFIs to Euro Area general governments; (3) and the total loans from MFIs to households (it includes credit for consumption and for the acquisition of houses).

b. Panel Unit Root Tests and Individual Effects Tests

In macro-panels, the statistical properties of the sample regarding time are relevant for the decision on how variables in the model are to be measured. In particular, stationarity of the series must be tested for so that one can justify using (logs of) levels or first-differences of the observed data and, furthermore, in a cointegration context or not. To that extend, we consider the following panel unit root tests obtained by EViews: Levin, Lin and Chu (2002), Im, Pesaran and Shin (2003), Fisher-type tests using ADF and PP tests – Maddala and Wu (1999). The null hypothesis is of non-stationarity with common or not unit root processes across cross-sections.

In linear regression models using panel data is important to determine the statistical properties of the potential individual-specific effects (country and/or time) – unobservable - which may be correlated with the other observed explanatory variables. The individual country-specific effects α_i are assumed to be time-invariant, fixed or random, distributed independently across individuals and with variance σ_α^2 (Hausman and Taylor, 1981). The model's error is typically decomposed as:

$$u_{it} = \alpha_i + \varepsilon_{it}$$

Where $\boldsymbol{\delta_t}$ can also be added to account for time-specific effects. In this case, $\boldsymbol{X_t}$ and $\boldsymbol{A_t}$ drop out of the model due to collinearity problems. In the LM test, it is assumed that the unobserved individual effects are distributed as independent $N(0, \sigma_\alpha^2)$ and the idiosyncratic disturbances are independent $N(0, \sigma_\varepsilon^2)$. The null hypothesis is of no individual effects ($\sigma_\alpha^2 = 0$).

$$\begin{cases} H_0: \nexists\ \alpha_i\ (No\ individual\ effects) \rightarrow STOP \\ H_1: \exists\ \alpha_i\ (Individual\ effects) \rightarrow Hausman \end{cases}$$

Under the null hypothesis, the coefficients are estimated using standard least squares methods. Under the alternative hypothesis, and to know whether the individual effects are fixed or random, it is used the Hausman Test (Hausman, 1978). This test is only applicable under homoskedasticity and cannot include time fixed effects. The random effects (RE) is chosen under the null hypothesis due to its higher efficiency, while under the alternative hypothesis we pick the fixed effects (FE) estimator, the one that is consistent.

Hausman Test Statistic:

$$H = n\left(\hat{\beta}_{FE} - \hat{\beta}_{RE}\right)' [\widehat{Cov\left(\hat{\beta}_{FE}\right)} - \widehat{Cov\left(\hat{\beta}_{RE}\right)}]^{-1} \left(\hat{\beta}_{FE} - \hat{\beta}_{RE}\right) \underset{H_0}{\overset{d}{\rightarrow}} \chi_k^2$$

Where $\hat{\beta}_{FE}$ is the FE estimator for the panel data model with FE errors and $\hat{\beta}_{RE}$ is the corresponding RE estimator. The "Cov" terms are the variance-covariance matrices. The limiting law is therefore the chi-squared distribution with *k* degrees of freedom, where *k* is the number of coefficients in the model.

$$\begin{cases} H_0: Random\ Effects \\ H_1: Fixed\ Effects \end{cases}$$

Interpretation of the Hausman Test

	H_0 **is true**	H_1 **is true**
Random Effects (RE) Estimator	Consistent Efficient	Inconsistent
Fixed Effects (FE) Estimator	Consistent Inefficient	Consistent

For further details about the estimation and inference of panel data models see, for example, Wooldridge (2006) and Arellano (2003).

5. Results

This study aims to show the contributions of unconventional monetary policies to the loans of MFIs to Euro Area residents (total), as well as disaggregated by Euro Area general government and households, as we have explained above. The results presented were estimated through a regression analysis using a method of Least Squares (LS) and all coefficients are significant and apparently with the expected signs.

The existence of individual effects was tested for all models, concluding that only for GOV does not exist individual effects, since the p-value of the test is above the significance level. For all other models the p-value is close to zero, which means that there are individual effects (see Table 6 below).

Table 6 - Summary of Individual Effects' Test

Redundant Fixed Effects Test[8]

Test cross-section fixed effects

Dependent Variable	P-values	
	Cross-section F	Cross-section Chi-square
TOT	0.0001	0.0001
GOV	0.9672	0.9658
HCC	0.0000	0.0000
HIH	0.0000	0.0000
HOUSE	0.0000	0.0000

After we have tested for the existence of individual effects, we use the Hausman test to know whether the individual effects are fixed or random. The conclusion is that all models that present evidence of individual effects, have p-values below the significance level, meaning that they exhibit fixed-type effects (see Table 7 below).

Table 7 - Summary of the Hausman Test

Correlated Random Effects – Hausman Test[9]

Test cross-section random effects

Dependent Variable	P-value Cross-section random
TOT	0.0026
HCC	0.0004
HIH	0.0093
HOUSE	0.0012

As explained before, in order to capture the effect of non-conventional monetary policies on Credit, there are two particular independent variables of interest: UNCONV (dummy) and PSPP (level variable). We use these variables interchangeably in the models, but never together, in order to know the impact of each one on credit. We only

[8] See all outputs in Tables A16, A17, A18, A19, and A20.
[9] See all outputs in Tables A21, A22, A23, and A24.

use the PSPP variable in the GOV estimations, since this program will have a direct impact in the loans to governments – the biggest percentage of monthly asset purchases by the Eurosystem is allocated to the Public Sector Purchases. So GOV was studied in two ways: first with PSPP and then with UNCONV.

The estimation with PSPP of the GOV model was made with the GLS Weight Period SUR procedure and concludes that, for a 1% increase, *ceteris paribus*, PSPP and the IPI_NS have a positive impact in loans to Euro Area Governments of 0.00815% and 0.04651%, respectively. On the other hand, for the same 1% increase, *ceteris paribus*, the EURIBOR 6 months (with a lag of 3 months) has a negative impact of -13.824% (see Table 8 below).

The results presented before were estimated with PSPP as an explanatory variable for the unconventional monetary policy. The following results were estimated with the dummy variable, UNCONV.

An increase of 1% in the IPI_NS causes an increase in credit, *ceteris paribus*. This impact occurred in five dependent variables, being higher in loans to euro area general governments (0.0666%) than for TOT, HCC, HIH and HOUSE (0.03673%, 0.01148%, 0.01298%, and 0.01225%, respectively). The sign of the coefficient is as expected, since the IPI is a proxy of GDP and according to the literature review this variable has a positive relationship with credit (See Tables 9, 10, 11, 12, and 13 below).

The implementation of an unconventional monetary policy affects positively the amount of loans (credit). One month after the implementation of measures of unconventional monetary policy, there was an increase of 0.401% and 0.339% in total credit (TOT) and in credit to households' consumer credit, respectively, *ceteris paribus*. For the other credit variables, the unconventional monetary policy measures (with a delay of three months) have a smaller impact, but still positive, in credit to households' for purchase house and total households, 0.1304% and 0.185%, respectively, and higher in credit to government, 1.154%, *ceteris paribus* (See Tables 9, 10, 11, 12, and 13 below).

During the ZLB years, the variation of 1% in EURIBOR 6 months has a negative impact on loans, which varies between -0.283% and -0.586%, *ceteris paribus*; depending on the kind of loans that is affecting (See Tables 9, 11, 12, and 13). For the case of the governments the interest rate that affects negatively the loans is the

Interbank Offered Rate. The deviation of 1% in INTRATE, during the ZLB years, decreases the loans to government by 2.497%, *ceteris paribus* (See Table 10 below).

In the case of loans to the households, the inflation's impact only occurs during the TT3 period (the period that the ECB was concerned in controlling the inflation rate). For a 1% increase, *ceteris paribus,* the uppermost impact is in HCC, with 0.091%, and for HIH and HOUSE is 0.039% and 0.043%, respectively.

In the case of loans to the euro area governments, the inflation's impact only occurs during the conventional monetary policy. When the ECB changes the conventional monetary policy (with a delay of the impact in two months), for a 1% increase, *ceteris paribus,* of inflation, there is a 0.534% increase in loans.

Also during the conventional monetary policy (with a three months delay), for a 1% increase, *ceteris paribus,* the impact of GOV10Y in the total credit to euro area residents is superior in 1.019%.

Dependent Variable: D(LOG(GOV))
Method: Panel EGLS (Period SUR)
Date: 08/16/16 Time: 16:21
Sample (adjusted): 2015M04 2016M03
Periods included: 12
Cross-sections included: 18
Total panel (unbalanced) observations: 175
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.209555	0.048985	-4.277931	0.0000
D(LOG(PSPP))	0.008146	0.002847	2.861084	0.0047
LOG(IPI_NS(-1))	0.046507	0.010480	4.437552	0.0000
EUR06M(-3)	-0.138242	0.061658	-2.242072	0.0262

Weighted Statistics

R-squared	0.172939	Mean dependent var	-0.035516
Adjusted R-squared	0.158429	S.D. dependent var	0.980717
S.E. of regression	0.899884	Sum squared resid	138.4742
F-statistic	11.91874	Durbin-Watson stat	1.962549
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.034370	Mean dependent var	0.002799
Sum squared resid	1.423295	Durbin-Watson stat	2.059805

Table 8 – Final Output for Dependent Variable GOV with PSPP

Dependent Variable: D(LOG(TOT))
Method: Panel Least Squares
Date: 08/24/16 Time: 17:29
Sample (adjusted): 2008M04 2016M02
Periods included: 95
Cross-sections included: 18
Total panel (unbalanced) observations: 1697

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.169442	0.029288	-5.785360	0.0000
LOG(IPI_NS)	0.036733	0.006351	5.783652	0.0000
UNCONV(-1)	0.004009	0.001336	3.001824	0.0027
TT*EUR06M	-0.005864	0.002134	-2.747950	0.0061
CONV(-3)*D(GOV10Y)	0.010190	0.001980	5.146360	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.063201	Mean dependent var	-0.000232
Adjusted R-squared	0.051456	S.D. dependent var	0.024133
S.E. of regression	0.023504	Akaike info criterion	-4.650442
Sum squared resid	0.925306	Schwarz criterion	-4.579962
Log likelihood	3967.900	Hannan-Quinn criter.	-4.624348
F-statistic	5.381103	Durbin-Watson stat	2.244193
Prob(F-statistic)	0.000000		

Table 9 – Final Output for Dependent Variable TOT

Dependent Variable: D(LOG(GOV))
Method: Panel Least Squares
Date: 08/24/16 Time: 17:24
Sample (adjusted): 2008M04 2016M02
Periods included: 95
Cross-sections included: 15
Total panel (unbalanced) observations: 1339

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.305562	0.135291	-2.258554	0.0241
LOG(IPI_NS)	0.066631	0.029375	2.268339	0.0235
UNCONV(-3)	0.011543	0.006806	1.696075	0.0901
TT*INTRATE	-0.024972	0.010611	-2.353384	0.0187
CONV(-2)*INFL	0.005339	0.002357	2.265430	0.0236

R-squared	0.011639	Mean dependent var	0.003152
Adjusted R-squared	0.008675	S.D. dependent var	0.105316
S.E. of regression	0.104858	Akaike info criterion	-1.668693
Sum squared resid	14.66759	Schwarz criterion	-1.649276
Log likelihood	1122.190	Hannan-Quinn criter.	-1.661418
F-statistic	3.927202	Durbin-Watson stat	2.103490
Prob(F-statistic)	0.003560		

Table 10 – Final Output for Dependent Variable GOV

Dependent Variable: D(LOG(HCC))
Method: Panel Least Squares
Date: 08/24/16 Time: 17:25
Sample (adjusted): 2008M02 2016M02
Periods included: 97
Cross-sections included: 19
Total panel (unbalanced) observations: 1832

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.055086	0.027376	-2.012213	0.0443
LOG(IPI_NS)	0.011487	0.005939	1.934320	0.0532
UNCONV(-1)	0.003399	0.001341	2.535480	0.0113
TT*EUR06M	-0.005042	0.002132	-2.364571	0.0182
TT3*INFL	0.000905	0.000256	3.528752	0.0004

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.054026	Mean dependent var	-0.000584
Adjusted R-squared	0.042522	S.D. dependent var	0.024889
S.E. of regression	0.024354	Akaike info criterion	-4.579740
Sum squared resid	1.072978	Schwarz criterion	-4.510524
Log likelihood	4218.041	Hannan-Quinn criter.	-4.554212
F-statistic	4.696148	Durbin-Watson stat	2.056828
Prob(F-statistic)	0.000000		

Table 11 – Final Output for Dependent Variable HCC

Dependent Variable: D(LOG(HIH))
Method: Panel Least Squares
Date: 08/29/16 Time: 16:20
Sample (adjusted): 2008M04 2016M02
Periods included: 95
Cross-sections included: 19
Total panel (unbalanced) observations: 1794

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.057995	0.014166	-4.093888	0.0000
LOG(IPI_NS)	0.012975	0.003073	4.221972	0.0000
EUR06M*TT	-0.002833	0.001082	-2.619465	0.0089
INFL*TT3	0.000389	0.000136	2.865839	0.0042
UNCONV(-3)	0.001304	0.000690	1.888627	0.0591

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.107278	Mean dependent var	0.002337
Adjusted R-squared	0.096189	S.D. dependent var	0.012955
S.E. of regression	0.012316	Akaike info criterion	-5.943140
Sum squared resid	0.268621	Schwarz criterion	-5.872727
Log likelihood	5353.996	Hannan-Quinn criter.	-5.917143
F-statistic	9.673697	Durbin-Watson stat	1.869110
Prob(F-statistic)	0.000000		

Table 12 – Final Output for Dependent Variable HIH

Dependent Variable: D(LOG(HOUSE))
Method: Panel Least Squares
Date: 08/24/16 Time: 17:28
Sample (adjusted): 2008M04 2016M02
Periods included: 95
Cross-sections included: 19
Total panel (unbalanced) observations: 1794

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.055425	0.014131	-3.922227	0.0001
LOG(IPI_NS)	0.012252	0.003066	3.996786	0.0001
UNCONV(-3)	0.001805	0.000689	2.620827	0.0088
TT*EUR06M	-0.002897	0.001079	-2.684885	0.0073
TT3*INFL	0.000429	0.000136	3.167268	0.0016

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.106171	Mean dependent var	0.001737
Adjusted R-squared	0.095068	S.D. dependent var	0.012914
S.E. of regression	0.012285	Akaike info criterion	-5.948111
Sum squared resid	0.267289	Schwarz criterion	-5.877698
Log likelihood	5358.456	Hannan-Quinn criter.	-5.922114
F-statistic	9.561974	Durbin-Watson stat	1.899070
Prob(F-statistic)	0.000000		

Table 13 – Final Output for Dependent Variable HOUSE

6. Conclusion

This dissertation aimed to analyze the relationship between the amount of credit concession and the net purchases under the PSPP and the announcements of unconventional monetary policy measures in the Euro Area. We use an events-study approach through standard panel linear regression models. We analyzed the total amount of credit concession, and also the concession to households, divided by consumer credit and house purchase, and finally, the loans to Euro Area general governments.

Accordingly to the literature, we know that the large-scale asset purchases programs affect different financial and economic variables through the different transmission channels. However there are not many studies that analyze the impact on the credit market of unconventional monetary policy measures, contrary to the literature for the impact in the bonds and/or the financial markets that is already significant.

Japan was the first country to implement this kind of policy, in 2001. Thereafter, and due to the financial crisis, the unconventional monetary policy was implemented by the UK and the USA after 2008. The ECB responded to the financial crisis by implementing several programs to provide liquidity into the Eurozone economies; however none of these measures were enough. Taking this into consideration, the ECB announced the EAPP in September 2014 and the specific program for purchase of Euro Area sovereign bonds (PSPP) in January 2015.

The results show that all coefficients are significant, exhibiting the expected signs according to theory. Taking into account all estimations, the Industrial Production Index (with non-seasonality) has always a positive impact on credit concession. On the other hand, the two different interest rates - the EURIBOR and the Interbank Offered Rate by country -, have a negative impact. These results are in agreement with the literature. The risk-free rate - GOV10Y - impacts total credit in 1.019% when there is a conventional monetary policy.

The monthly net purchases of sovereign bonds from Euro Area governments and securities from European supranational institutions and national agencies have a positive impact of 0.815% on the Euro Area governments' loans concession.

Regarding the impact of the dummy UNCONV on credit concession, it is possible to conclude that it is always positive, despite the fact the impact is not always immediate, which means that an impact today refers to the unconventional monetary policy implementation taking place one month or three months ago.

The inflation rate presented in the models is associated to a period when the ECB was concerned in controlling the inflation rate, concluding that the inflation impact in this period is higher than in the remaining one. Economic agents are waiting that interest rates rises due to inflation rates rise, leading agents to acquire more credit at the present moment.

Although this research has reached its aims, there were some unavoidable limitations. These limitations are related mainly to the fact that the Asset Purchase Program is relatively recent, leading to a lack of available data, restraining the scope of analysis, and to a lack of prior research studies on the topic, making difficult to understand the research problem as well to develop the methodology. Note that these limitations are an opportunity to describe the need for future research and identify new gaps in the literature.

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Appendices

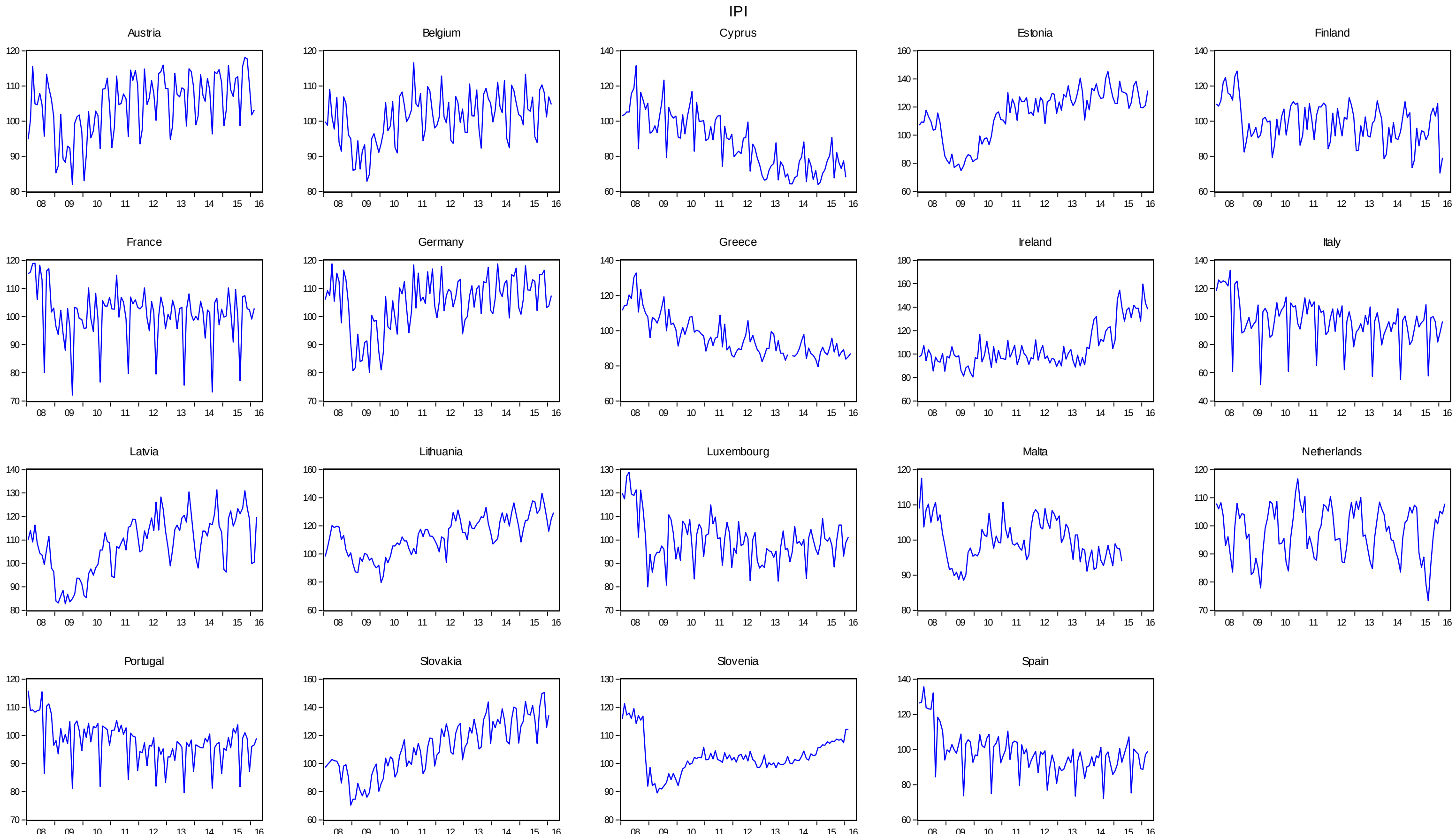

Figure A1 - Observed Seasonality in the IPI

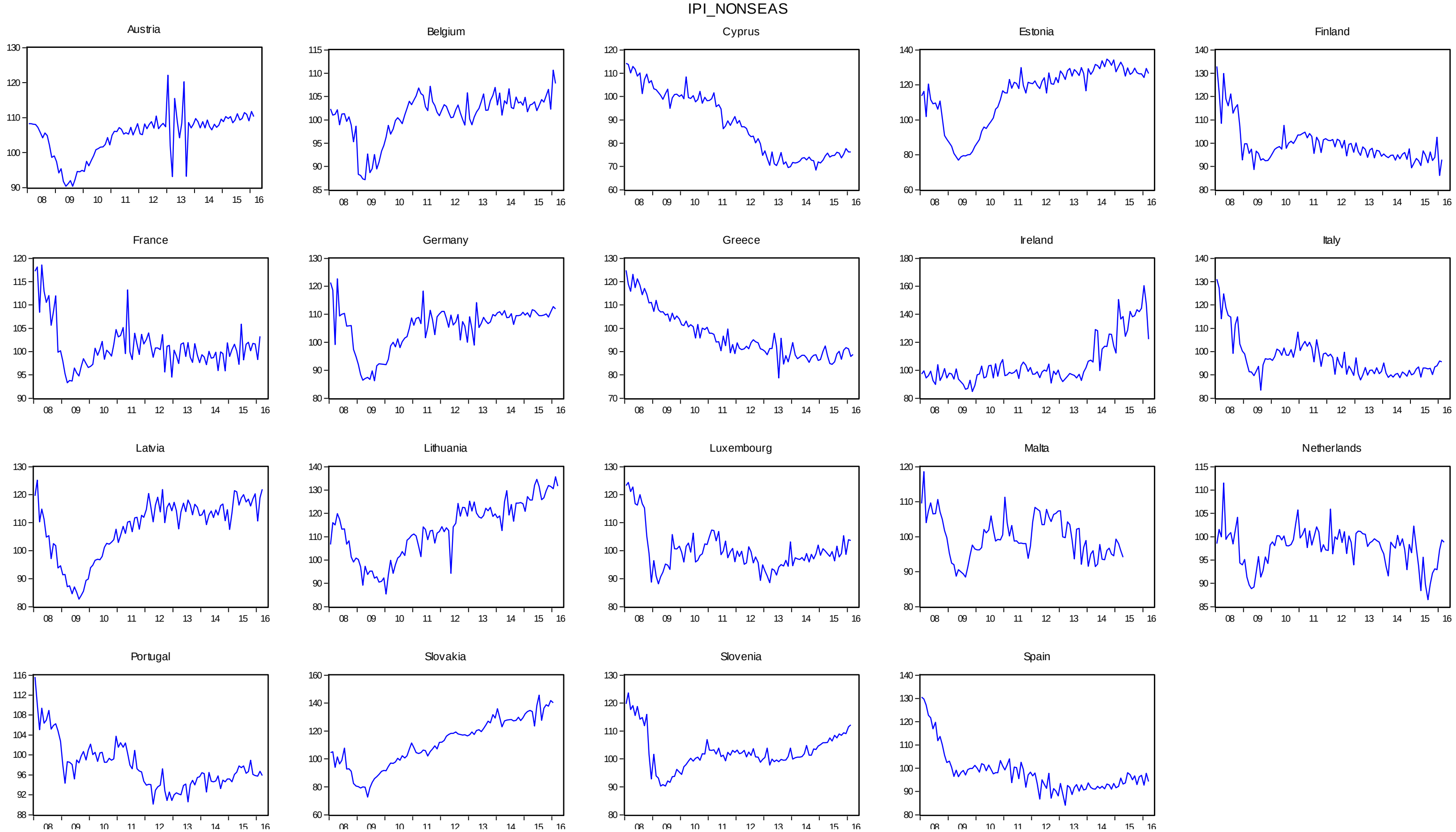

Figure A2 – Variable IPI after the X-12-ARIMA Adjustment (IPI_NS)

Panel unit root test: Summary
Series: TOT
Date: 07/25/16 Time: 17:28
Sample: 2008M01 2016M05
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 2
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	2.02418	0.9785	19	1837
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	1.85821	0.9684	19	1837
ADF - Fisher Chi-square	38.0575	0.4669	19	1837
PP - Fisher Chi-square	38.8897	0.4295	19	1843

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table A1 – Unit Root Test for Variable TOT

Panel unit root test: Summary
Series: GOV
Date: 07/25/16 Time: 17:27
Sample: 2008M01 2016M05
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-1.50508	0.0662	19	1843
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.86069	0.1947	19	1843
ADF - Fisher Chi-square	45.3197	0.1931	19	1843
PP - Fisher Chi-square	42.1892	0.2947	19	1845

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table A2 – Unit Root Test for Variable GOV

Panel unit root test: Summary
Series: HCC
Date: 07/25/16 Time: 17:27
Sample: 2008M01 2016M05
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 8
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.03136	0.4875	19	1835
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	3.06630	0.9989	19	1835
ADF - Fisher Chi-square	30.6617	0.7954	19	1835
PP - Fisher Chi-square	25.7489	0.9350	19	1843

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table A3 – Unit Root Test for Variable HCC

Panel unit root test: Summary
Series: HIH
Date: 07/25/16 Time: 17:27
Sample: 2008M01 2016M05
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 11
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	3.61464	0.9998	19	1818
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	5.21517	1.0000	19	1818
ADF - Fisher Chi-square	46.0760	0.1728	19	1818
PP - Fisher Chi-square	74.5040	0.0004	19	1843

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table A4 – Unit Root Test for Variable HIH

Panel unit root test: Summary
Series: HOUSE
Date: 07/25/16   Time: 17:50
Sample: 2008M01 2016M05
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	2.25469	0.9879	19	1833
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	5.42684	1.0000	19	1833
ADF - Fisher Chi-square	36.5427	0.5369	19	1833
PP - Fisher Chi-square	55.6581	0.0321	19	1843

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

Table A5 – Unit Root Test for Variable HOUSE

Panel unit root test: Summary
Series: IPI_NS
Date: 07/25/16   Time: 17:25
Sample: 2008M01 2016M05
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 1 to 6
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.15816	0.0155	19	1794
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.18753	0.0000	19	1794
ADF - Fisher Chi-square	102.336	0.0000	19	1794
PP - Fisher Chi-square	173.992	0.0000	19	1840

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

Table A6 - Unit Root Test for Variable IPI_NS

Panel unit root test: Summary
Series: EUR03M
Date: 07/25/16 Time: 17:20
Sample: 2008M01 2016M05
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 2
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-12.9122	0.0000	19	1862
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-10.1083	0.0000	19	1862
ADF - Fisher Chi-square	178.231	0.0000	19	1862
PP - Fisher Chi-square	58.7298	0.0170	19	1900

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table A7 - Unit Root Test for Variable EUR03M

Panel unit root test: Summary
Series: EUR06M
Date: 07/25/16 Time: 17:21
Sample: 2008M01 2016M05
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-7.53343	0.0000	19	1881
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-5.16421	0.0000	19	1881
ADF - Fisher Chi-square	85.1190	0.0000	19	1881
PP - Fisher Chi-square	50.3542	0.0866	19	1900

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table A8 - Unit Root Test for Variable EUR06M

Panel unit root test: Summary
Series: GOV10Y
Date: 07/25/16 Time: 17:21
Sample: 2008M01 2016M05
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 3
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	1.86864	0.9692	18	1779
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	4.03322	1.0000	18	1779
ADF - Fisher Chi-square	8.65197	1.0000	18	1779
PP - Fisher Chi-square	7.42089	1.0000	18	1798

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

Table A9 - Unit Root Test for Variable GOV10Y

Panel unit root test: Summary
Series: INTRATE
Date: 07/25/16 Time: 17:24
Sample: 2008M01 2016M05
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 5
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-9.48199	0.0000	15	1382
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-6.65333	0.0000	15	1382
ADF - Fisher Chi-square	109.231	0.0000	15	1382
PP - Fisher Chi-square	41.0587	0.0859	15	1411

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

Table A10 - Unit Root Test for Variable INTRATE

Panel unit root test: Summary
Series: INFL
Date: 07/25/16 Time: 17:22
Sample: 2008M01 2016M05
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 3
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.13697	0.0163	19	1888
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.35448	0.0878	19	1888
ADF - Fisher Chi-square	47.6971	0.1346	19	1888
PP - Fisher Chi-square	40.0046	0.3812	19	1900

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table A11 - Unit Root Test for Variable INFL

Panel unit root test: Summary
Series: PSPP
Date: 07/25/16 Time: 17:26
Sample: 2008M01 2016M05
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.91323	0.1806	18	234
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.08142	0.5324	17	231
ADF - Fisher Chi-square	42.0235	0.2262	18	234
PP - Fisher Chi-square	41.6326	0.2389	18	234

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Table A12 - Unit Root Test for Variable PSPP

Table A13 – Announcements of Unconventional Monetary Policy Decisions

Date	Announcement	After-Governing Council
22 August 2007	Supplementary LTRO	N (15.33)
23 August 2007	Allotment LTRO	N (11.18)
28 March 2008	Six-Month LTRO	N (15.00)
07 May 2009	One-Year LTRO and CBPP	Y
04 June 2009	Details CBPP	Y
03 December 2009	Amendments to LTRO	Y
04 March 2010	Amendments to LTRO	Y
10 May 2010	Securities Markets Program (SMP)	N
03 March 2011	Fixed Rate Full Allotment Refinancing Operations	Y
04 August 2011	Securities Markets Program	Y
06 October 2011	Second CBPP	Y
08 December 2011	New LTRO; Reduced Reserve Ratio; Increased Collateral Availability	Y
21 December 2011	LTRO Results	N (11.15)
09 February 2012	National Central Banks Credit Claims Approvals	Y

28 February 2012	Second LTRO Results	N (11.16)
26 July 2012	London 'Whatever it takes' Speech	N
02 August 2012	Outright Monetary Transactions	Y
06 September 2012	Details Outright Monetary Transactions	Y
22 March 2013	Amendments to Collateral Rules	N (15.00)
05 June 2014	TLTRO; Preparatory work on ABSP	Y
03 July 2014	Details TLTRO	Y
4 September 2014	Third CBPP3 and the ABSPP	Y
18 September 2014	Mario Draghi makes a speech to the European Parliament Economic and Monetary Affairs committee; The ECB allotted €82.6 billion to 255 counterparties in the first of eight TLTRO	N
22 January 2015	EAPP; Interest Rates Changes for LTRO; ECB announces a modification to the interest rate applicable to future TLTRO	Y
09 March 2015	The beginning of PSPP, QE	N
23 September 2015	Eurosystem adjusts purchase process in ABSPP	N
9 November 2015	Eurosystem increase the PSPP issue share limit, making the higher issue limit effective	N

3 December 2015	Eurosystem decides to extend the APP until March 2017	Y
10 March 2016	The Eurosystem decides to increase monthly purchases from €60 billion to €80 billion, starting in April	Y
10 March 2016	ECB announces a new series of four TLTRO	Y
10 March 2016	ECB adds corporate sector purchase program (CSPP) to the APP and announces changes to APP	Y
21 April 2016	Started the expand monthly purchases under the APP to €80 billion	Y
21 April 2016	ECB announces details of the CSPP	Y
3 May 2016	ECB publishes legal acts relating to the second series of TLTRO	N

Source: Rogers *et al.* **(**2014), Haistma *et al.* (2016), and ECB website**.** The table shows announcements of unconventional monetary policy decisions. The third column shows whether the decisions were taken during a regular Governing Council meeting.

Table A14 – Changes in Conventional Monetary Policy

Dates	Conventional Monetary Policy was changed
03 July 2008	Yes
06 November 2008	Yes
04 December 2008	Yes
15 January 2009	Yes
05 March 2009	Yes
02 April 2009	Yes
07 May 2009	Yes
07 April 2011	Yes
07 July 2011	Yes
03 November 2011	Yes
08 December 2011	Yes
05 July 2012	Yes
02 May 2013	Yes
07 November 2013	Yes
08 May 2014	Yes
04 September 2014	Yes

03 December 2015	Yes
10 March 2016	Yes

Source: ECB website**.** The table shows dates of regular Governing Council meeting where conventional monetary policy changed.

Table A15 – Correlation between Independent Variables

	CONV	EUR03M	EUR06M	GOV10Y	INFL	INTRATE	IPI_NS	PSPP	UNCONV	TT	TT3
CONV	1.000000	-0.471340	-0.378852	0.033246	0.001043	-0.164367	0.046142	-0.074978	0.492366	-0.117371	0.068854
EUR03M	-0.471340	1.000000	0.993078	-0.045416	0.020958	0.435584	-0.081082	0.020391	-0.134030	-0.634665	0.545802
EUR06M	-0.378852	0.993078	1.000000	-0.044093	0.011657	0.440879	-0.078878	0.009331	-0.079849	-0.665242	0.588442
GOV10Y	0.033246	-0.045416	-0.044093	1.000000	-0.039325	-0.010063	-0.142304	-0.125143	-0.035106	-0.302639	0.383273
INFL	0.001043	0.020958	0.011657	-0.039325	1.000000	-0.180392	-0.094327	-0.119739	-0.149258	-0.373416	0.428541
INTRATE	-0.164367	0.435584	0.440879	-0.010063	-0.180392	1.000000	0.362087	-0.330579	-0.038177	-0.540857	0.460695
IPI_NS	0.046142	-0.081082	-0.078878	-0.142304	-0.094327	0.362087	1.000000	-0.339218	0.023728	0.090020	-0.085718
PSPP	-0.074978	0.020391	0.009331	-0.125143	-0.119739	-0.330579	-0.339218	1.000000	-0.032124	NA	NA
UNCONV	0.492366	-0.134030	-0.079849	-0.035106	-0.149258	-0.038177	0.023728	-0.032124	1.000000	0.118437	-0.066660
TT	-0.117371	-0.634665	-0.665242	-0.302639	-0.373416	-0.540857	0.090020	NA	0.118437	1.000000	-0.802440
TT3	0.068854	0.545802	0.588442	0.383273	0.428541	0.460695	-0.085718	NA	-0.066660	-0.802440	1.000000

Redundant Fixed Effects Tests
Equation: DTOT01
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	2.837738	(17,1675)	0.0001
Cross-section Chi-square	48.184576	17	0.0001

Cross-section fixed effects test equation:
Dependent Variable: D(LOG(TOT))
Method: Panel Least Squares
Date: 08/24/16 Time: 17:28
Sample (adjusted): 2008M04 2016M02
Periods included: 95
Cross-sections included: 18
Total panel (unbalanced) observations: 1697

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.100244	0.024745	-4.051114	0.0001
LOG(IPI_NS)	0.021720	0.005365	4.048247	0.0001
UNCONV(-1)	0.004138	0.001347	3.071238	0.0022
TT*EUR06M	-0.005857	0.002153	-2.720263	0.0066
CONV(-3)*D(GOV10Y)	0.010186	0.001989	5.121780	0.0000

R-squared	0.036220	Mean dependent var	-0.000232
Adjusted R-squared	0.033942	S.D. dependent var	0.024133
S.E. of regression	0.023720	Akaike info criterion	-4.642084
Sum squared resid	0.951956	Schwarz criterion	-4.626066
Log likelihood	3943.808	Hannan-Quinn criter.	-4.636153
F-statistic	15.89688	Durbin-Watson stat	2.183023
Prob(F-statistic)	0.000000		

Table A16 – Test for individual effects for dependent variable TOT

Redundant Fixed Effects Tests
Equation: DGOV03
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	0.425461	(14,1320)	0.9672
Cross-section Chi-square	6.028598	14	0.9658

Cross-section fixed effects test equation:
Dependent Variable: D(LOG(GOV))
Method: Panel Least Squares
Date: 08/24/16 Time: 17:23
Sample (adjusted): 2008M04 2016M02
Periods included: 95
Cross-sections included: 15
Total panel (unbalanced) observations: 1339

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.305562	0.135291	-2.258554	0.0241
LOG(IPI_NS)	0.066631	0.029375	2.268339	0.0235
UNCONV(-3)	0.011543	0.006806	1.696075	0.0901
TT*INTRATE	-0.024972	0.010611	-2.353384	0.0187
CONV(-2)*INFL	0.005339	0.002357	2.265430	0.0236

R-squared	0.011639	Mean dependent var	0.003152
Adjusted R-squared	0.008675	S.D. dependent var	0.105316
S.E. of regression	0.104858	Akaike info criterion	-1.668693
Sum squared resid	14.66759	Schwarz criterion	-1.649276
Log likelihood	1122.190	Hannan-Quinn criter.	-1.661418
F-statistic	3.927202	Durbin-Watson stat	2.103490
Prob(F-statistic)	0.003560		

Table A17 – Test for individual effects for dependent variable GOV

Redundant Fixed Effects Tests
Equation: DHCC02
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	4.296959	(18,1809)	0.0000
Cross-section Chi-square	76.700393	18	0.0000

Cross-section fixed effects test equation:
Dependent Variable: D(LOG(HCC))
Method: Panel Least Squares
Date: 08/24/16 Time: 17:24
Sample (adjusted): 2008M02 2016M02
Periods included: 97
Cross-sections included: 19
Total panel (unbalanced) observations: 1832

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.029329	0.023582	-1.243699	0.2138
LOG(IPI_NS)	0.005948	0.005120	1.161717	0.2455
UNCONV(-1)	0.003419	0.001362	2.510271	0.0121
TT*EUR06M	-0.005003	0.002166	-2.309651	0.0210
TT3*INFL	0.000795	0.000253	3.146119	0.0017

R-squared	0.013580	Mean dependent var	-0.000584
Adjusted R-squared	0.011421	S.D. dependent var	0.024889
S.E. of regression	0.024747	Akaike info criterion	-4.557523
Sum squared resid	1.118854	Schwarz criterion	-4.542476
Log likelihood	4179.691	Hannan-Quinn criter.	-4.551974
F-statistic	6.288242	Durbin-Watson stat	1.971907
Prob(F-statistic)	0.000050		

Table A18 – Test for individual effects for dependent variable HCC

Redundant Fixed Effects Tests
Equation: DHIH01
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	10.076067	(18,1771)	0.0000
Cross-section Chi-square	174.913658	18	0.0000

Cross-section fixed effects test equation:
Dependent Variable: D(LOG(HIH))
Method: Panel Least Squares
Date: 08/29/16 Time: 16:17
Sample (adjusted): 2008M04 2016M02
Periods included: 95
Cross-sections included: 19
Total panel (unbalanced) observations: 1794

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.031606	0.012377	-2.553640	0.0107
LOG(IPI_NS)	0.007242	0.002687	2.695630	0.0071
EUR06M*TT	-0.002697	0.001130	-2.387283	0.0171
INFL*TT3	0.000426	0.000138	3.090294	0.0020
UNCONV(-3)	0.001303	0.000721	1.806752	0.0710

R-squared	0.015854	Mean dependent var	0.002337
Adjusted R-squared	0.013654	S.D. dependent var	0.012955
S.E. of regression	0.012866	Akaike info criterion	-5.865707
Sum squared resid	0.296130	Schwarz criterion	-5.850400
Log likelihood	5266.540	Hannan-Quinn criter.	-5.860056
F-statistic	7.205074	Durbin-Watson stat	1.695167
Prob(F-statistic)	0.000009		

Table A19 – Test for individual effects for dependent variable HIH

Redundant Fixed Effects Tests
Equation: DHOUSE01
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	9.660284	(18,1771)	0.0000
Cross-section Chi-square	168.023435	18	0.0000

Cross-section fixed effects test equation:
Dependent Variable: D(LOG(HOUSE))
Method: Panel Least Squares
Date: 08/24/16 Time: 17:27
Sample (adjusted): 2008M04 2016M02
Periods included: 95
Cross-sections included: 19
Total panel (unbalanced) observations: 1794

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.032065	0.012322	-2.602169	0.0093
LOG(IPI_NS)	0.007181	0.002675	2.684629	0.0073
UNCONV(-3)	0.001798	0.000718	2.503336	0.0124
TT*EUR06M	-0.002765	0.001125	-2.458648	0.0140
TT3*INFL	0.000452	0.000137	3.289815	0.0010

R-squared	0.018411	Mean dependent var	0.001737
Adjusted R-squared	0.016216	S.D. dependent var	0.012914
S.E. of regression	0.012809	Akaike info criterion	-5.874519
Sum squared resid	0.293532	Schwarz criterion	-5.859212
Log likelihood	5274.444	Hannan-Quinn criter.	-5.868868
F-statistic	8.388634	Durbin-Watson stat	1.728745
Prob(F-statistic)	0.000001		

Table A20 – Test for individual effects for dependent variable HOUSE

Correlated Random Effects - Hausman Test
Equation: DTOT01
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	16.306944	4	0.0026

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
LOG(IPI_NS)	0.036733	0.026862	0.000008	0.0005
UNCONV(-1)	0.004009	0.004094	0.000000	0.0006
TT*EUR06M	-0.005864	-0.005865	0.000000	0.9780
CONV(-3)*D(GOV10Y)	0.010190	0.010176	0.000000	0.9225

Cross-section random effects test equation:
Dependent Variable: D(LOG(TOT))
Method: Panel Least Squares
Date: 08/24/16 Time: 17:29
Sample (adjusted): 2008M04 2016M02
Periods included: 95
Cross-sections included: 18
Total panel (unbalanced) observations: 1697

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.169442	0.029288	-5.785360	0.0000
LOG(IPI_NS)	0.036733	0.006351	5.783652	0.0000
UNCONV(-1)	0.004009	0.001336	3.001824	0.0027
TT*EUR06M	-0.005864	0.002134	-2.747950	0.0061
CONV(-3)*D(GOV10Y)	0.010190	0.001980	5.146360	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.063201	Mean dependent var	-0.000232
Adjusted R-squared	0.051456	S.D. dependent var	0.024133
S.E. of regression	0.023504	Akaike info criterion	-4.650442
Sum squared resid	0.925306	Schwarz criterion	-4.579962
Log likelihood	3967.900	Hannan-Quinn criter.	-4.624348
F-statistic	5.381103	Durbin-Watson stat	2.244193
Prob(F-statistic)	0.000000		

Table A21 – Hausman Test for dependent variable TOT

Correlated Random Effects - Hausman Test
Equation: DHCC02
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	20.459799	4	0.0004

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
LOG(IPI_NS)	0.011487	0.008558	0.000005	0.1980
UNCONV(-1)	0.003399	0.003411	0.000000	0.5312
TT*EUR06M	-0.005042	-0.005023	0.000000	0.5964
TT3*INFL	0.000905	0.000854	0.000000	0.2297

Cross-section random effects test equation:
Dependent Variable: D(LOG(HCC))
Method: Panel Least Squares
Date: 08/24/16 Time: 17:25
Sample (adjusted): 2008M02 2016M02
Periods included: 97
Cross-sections included: 19
Total panel (unbalanced) observations: 1832

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.055086	0.027376	-2.012213	0.0443
LOG(IPI_NS)	0.011487	0.005939	1.934320	0.0532
UNCONV(-1)	0.003399	0.001341	2.535480	0.0113
TT*EUR06M	-0.005042	0.002132	-2.364571	0.0182
TT3*INFL	0.000905	0.000256	3.528752	0.0004

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.054026	Mean dependent var	-0.000584
Adjusted R-squared	0.042522	S.D. dependent var	0.024889
S.E. of regression	0.024354	Akaike info criterion	-4.579740
Sum squared resid	1.072978	Schwarz criterion	-4.510524
Log likelihood	4218.041	Hannan-Quinn criter.	-4.554212
F-statistic	4.696148	Durbin-Watson stat	2.056828
Prob(F-statistic)	0.000000		

Table A22 – Hausman Test for dependent variable HCC

Correlated Random Effects - Hausman Test
Equation: DHIH01
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	13.451010	4	0.0093

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
LOG(IPI_NS)	0.012975	0.011841	0.000001	0.1306
EUR06M*TT	-0.002833	-0.002810	0.000000	0.0288
INFL*TT3	0.000389	0.000395	0.000000	0.6724
UNCONV(-3)	0.001304	0.001305	0.000000	0.7731

Cross-section random effects test equation:
Dependent Variable: D(LOG(HIH))
Method: Panel Least Squares
Date: 08/29/16 Time: 16:18
Sample (adjusted): 2008M04 2016M02
Periods included: 95
Cross-sections included: 19
Total panel (unbalanced) observations: 1794

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.057995	0.014166	-4.093888	0.0000
LOG(IPI_NS)	0.012975	0.003073	4.221972	0.0000
EUR06M*TT	-0.002833	0.001082	-2.619465	0.0089
INFL*TT3	0.000389	0.000136	2.865839	0.0042
UNCONV(-3)	0.001304	0.000690	1.888627	0.0591

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.107278	Mean dependent var	0.002337
Adjusted R-squared	0.096189	S.D. dependent var	0.012955
S.E. of regression	0.012316	Akaike info criterion	-5.943140
Sum squared resid	0.268621	Schwarz criterion	-5.872727
Log likelihood	5353.996	Hannan-Quinn criter.	-5.917143
F-statistic	9.673697	Durbin-Watson stat	1.869110
Prob(F-statistic)	0.000000		

Table A23 – Hausman Test for dependent variable HIH

Correlated Random Effects - Hausman Test
Equation: DHOUSE01
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	18.083387	4	0.0012

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
LOG(IPI_NS)	0.012252	0.011040	0.000001	0.1401
UNCONV(-3)	0.001805	0.001805	0.000000	0.9997
TT*EUR06M	-0.002897	-0.002870	0.000000	0.0204
TT3*INFL	0.000429	0.000433	0.000000	0.7777

Cross-section random effects test equation:
Dependent Variable: D(LOG(HOUSE))
Method: Panel Least Squares
Date: 08/24/16 Time: 17:28
Sample (adjusted): 2008M04 2016M02
Periods included: 95
Cross-sections included: 19
Total panel (unbalanced) observations: 1794

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.055425	0.014131	-3.922227	0.0001
LOG(IPI_NS)	0.012252	0.003066	3.996786	0.0001
UNCONV(-3)	0.001805	0.000689	2.620827	0.0088
TT*EUR06M	-0.002897	0.001079	-2.684885	0.0073
TT3*INFL	0.000429	0.000136	3.167268	0.0016

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.106171	Mean dependent var	0.001737
Adjusted R-squared	0.095068	S.D. dependent var	0.012914
S.E. of regression	0.012285	Akaike info criterion	-5.948111
Sum squared resid	0.267289	Schwarz criterion	-5.877698
Log likelihood	5358.456	Hannan-Quinn criter.	-5.922114
F-statistic	9.561974	Durbin-Watson stat	1.899070
Prob(F-statistic)	0.000000		

Table A24 – Hausman Test for dependent variable HOUSE