A Work Project, presented as part of the requirements for the Award of a Master Degree in Finance from the NOVA – School of Business and Economics

The Impact of Quantitative Easing on Commercial Banks

Evidence from the Euro Area

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Abstract

Most of the studies tend to analyze the impact of quantitative easing (QE) on financial markets and at a macroeconomic level, not giving enough attention to the impact of this unconventional monetary policy on commercial banks. The impact of QE on 24 commercial banks based on the Euro Area will be investigated in this study, using publicly available panel data. This work project suggests that the European Central Bank's (ECB) QE purchases, since the start of the program in January 2015, had a statistically significant increase but small effect in the growth of bank's loans. Moreover, through a robustness check, it is observed that QE's impact is bigger in small banks.

Keywords: Commercial bank, Quantitative Easing, Panel Data, Euro Area

JEL classifications: C23, E52, E58, G21

1 Introdution

In order to stimulate the financial economy after the global financial crisis in 2008, the ECB, the Federal Reserve (FED) and other major Central Banks took the initiative to look for unconventional measures. Most studies concerning unconventional monetary policies focus on the United States of America (USA), the United Kingdom (UK) and Japanese.

The ECB QE program started in January 2015. On January 22th, a massive program of asset acquisitions was launched by the ECB – The Public Sector Purchase Program (PSPP) -, in order to complement previous programs, such as ECB's Asset Backed Securities and Covered Bonds Purchase Programs (ABSPP and CBPP3). Under PSPP, sovereign bonds held by Euro Area governments and securities held by institutions and other national agencies will acquired by the ECB. According to the ECB, the purchases will be continued until *"a sustained adjustment in the path of inflation which is consistent with the aim of achieving inflation rates below, but close to, 2 percent over the medium term"* (Draghi, 2015a).

In contrast with other studies, this work project takes into account publicly available data, from sources, such as Bloomberg, ECB and Worldbank database, to study how much these unconventional monetary policies took impact on Commercial Banks in the Euro Area, by influencing the growth of its lending. A panel data set was created for 24 commercial banks of the Euro Area during a period of 68 quarters (from March 1999 to December 2016).

In the following section a literature review concerning the main features related with unconventional monetary policies and QE in the USA, the UK and Japan will be presented. In the section 3, the methodology, data source and the main characteristics of the data will be displayed. The results' analysis will be explained in Section 4. Section 5, will summarize the work done and final conclusions.

2 Literature Review

The bankruptcy of the Lehman Brothers resulted in the break of confidence in financial markets, in banks, leading to a decrease in lending. According to 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."*

2.1 Quantitative Easing: What is it?

Quantitative Easing, the unconventional monetary policy, consists in a massive asset purchase program (APP) which means that the left side of Central Banks' balance sheet (BS) is expanded through the purchase of public sector debt and private assets with longer maturities, holding the assets' composition constant (Driffill, 2016). The described unconventional measure is the most common and leads to *"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 large-scale asset purchase tend to affect the interest rate through many channels, as for example, increasing companies' investment and the consumption of households, and the capacity of banks to grant credit (lend). Moreover, inflation and economic growth are affected by all of these effects. QE increases bank's liquidity by reducing the liquidity price premium and increasing the government bond yields. Nevertheless, these effects persist if central banks continue to purchase assets (Krishnamurthy and Vissing-Jorgensen, 2011).

According to Demertzis and Wolff (2016a), QE affects bank's profitability through three channels **(1)** by driving bond prices up, rewarding banks which hold these kind of assets; **(2)** decrease of term spread due to the decline of long-term yields leading to a reduction in loans to deposit ratio, so when banks grant a new credit it is difficult to earn a margin income through

interest gain; last, but not the least **(3)** QE allows banks to grant more credit, this will improve the involving economy and it will allow banks to reduce its non-performing loans (bad loans). So, bank's profitability can be both positively and negatively affected by QE, but in the beginning the impact should be positive. In conclusion, Demertzis and Wolff (2016a), is not concerned with a substantial negative impact on bank's profitability due to the ECB's QE program. This can be explain due to Bank's risk aversion created since the latest financial crisis, which lead to the failure of the mechanism and shrinking the credit available to the private sector (Olmo and Sanso-Navarro, 2014).

Bank lending is the main transmission mechanism of monetary strategy and the real economy. QE contributes to investment and spending through many channels as it can be shown in figure bellow.

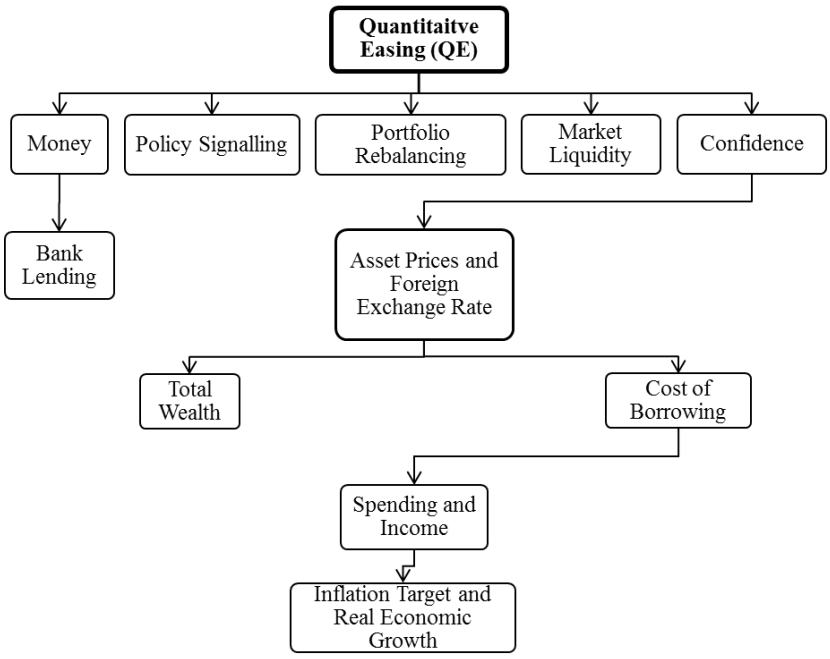

Figure 1 – Transmission channels of QE (Source: Hausken and Ncube, 2013)

The objective of unconventional monetary policies, according to Olmo and Sanso-Navarro (2014), relies on restoring the bank lending channel and, at the same time, reestablishing the other transmission mechanisms.

2.2 Quantitative Easing around the world

2.2.1 Quantitative Easing: Evidence from Japan

The implementation of QE in Japan, occurred before the 2008 financial crisis and most analysts reached the conclusion that the goal of stimulating inflation through the increase in the aggregate demand was not reached. Nevertheless, there is a possibility that QE little or positive effects were mitigated by the negative effects of Japan's economy bubble. The economist Richard Werner was the one who introduced QE in Japan, proposing it in 1994 (Visconti and Quirici, 2015), although Japan only introduced it in March 2001, it was the first country in the world applying such policy. The first program lasted for 5 years and other QE programs followed (Bowman et al., 2011). The goal of implementing QE in Japan was to introduce liquidity in the banking system, maintain the overnight interest rate near zero, encouraging bank lending. Bowman et al. (2011) used data for 137 banks on a semester basis (since March 2000 to March 2009) and estimated panel data regressions. This paper aimed to study how effective was the monetary policy implemented by the Bank of Japan in boosting bank lending, following Kashyap and Stein (2000) and Hosono (2006). The baseline equation is:

$$\Delta Loans_{i,t} = \alpha + \beta LR_{i,t-1} + \delta' \chi_{i,t-1} + \varepsilon_{i,t} \qquad (1)$$

where $Loans_{i,t}$ is the natural log of loans made by bank i at time t, $LR_{i,t}$ is the liquidity ratio for bank i at time t, and $\chi_{i,t}$ is a vector of control variables. The authors found a robust, positive and statistically significant effect of QE on bank's lending. Nevertheless, the boost in credit lending was quite small. Another paper concerning the program of QE in Japan, was the one by Ugai (2007) that studied the effect of Japanese Government Bonds purchases under QE on portfolio balance. The impact on longer-term interest rates was rather small, according to the author, since the maximum of Japanese Government Bonds (JGB) held by the Bank (4% of GDP) were lower than the FED holdings (12% of GDP) under APP.

2.2.2 Quantitative Easing: Evidence from the UK

Most of Bank of England's studies concerning QE tended to focus more on its impacts at a macroeconomic level and in the financial markets. Joyce and Spaltro (2014) focused on 30 UK banks, using non-public data in order to study the impact of a substantial acquisition of public and private assets in bank's BS and lending. The Bank of England's Monetary Policy Committee (MPC) declared in March 2009 the implementation of the unconventional monetary policy. Bank of England aimed to purchase £200 billion of assets, in the first phase, exclusively Government Bonds (Gilts). Later, the Bank of England purchased £175 billion more, bringing the total amount of the program to £375 billion.

This paper focused on the first round of the Bank of England's purchases during May 2009 and May 2010. Joyce and Spaltro (2014) investigated the relationship among the growth of bank lending and the evolution in deposits over assets. The baseline equation is:

$$\Delta l_{it} = \alpha + \beta(L)\Delta l_{it} + \gamma(L)\Delta D_{it} + \delta(L)\Delta C_{it} + \mu' I_{it} + \theta' A_t + u_{it} \quad (2)$$

where Δl_{it} is quarterly lending growth for bank i in period t, $\Delta D_{it}$is changes in the deposits over assets ratio, ΔC_{it} is changes in published regulatory capital (capital over risk-weighted assets), I_{it} is a vector of micro controls and A_t is a vector of macro controls.

The authors found that during May 2009 and May 2010 Bank of England's QE acquisitions headed to a statistically significant but minor increase in the growth of bank lending. Moreover, the impact was more significant in small rather than in larger banks.

2.2.3 Quantitative easing: Evidence from the USA

The FED announced the implementation of QE after the bankruptcy of Lehman Brothers. The first round started in 2008 and lasted until 2009, resulting in $600 billion mortgage-backed securities purchases and by the end of the program FED held $1.75 trillion of securities among

other types of assets. After a brief break from the program, the FED decided to take a second round of QE in November 2010, buying $600 billion in long-term Treasury Securities (Driffill, 2016). This policy leaded to an excess reserves resulting in the development of the economy, contributing to generate better lending and investment conditions for the banks (Thornton, 2012). The third round of the QE program started in September 2012 and consisted in $40 billion monthly purchases of agency mortgage-backed securities in an open-ended program, three months later, the monthly purchases increased from $40 to $85 billion (Driffill, 2016).

Most of studies concerning the impacts of QE in the USA focus on macroeconomic effects rather than on banks' BS. Choulet (2015) studied QE and bank BS based on the USA experience. According to this author, in the USA, quantitative easing was accompanied at the aggregate level by an unprecedented increase in banks' reserves with the central bank and in customer deposits. In Figure 2, one can see in the first example that at the end of the transaction the BS of the central bank remains unchanged, only the composition of debt changes. From the commercial bank side, the effect is similar but only the composition of assets change. On the other hand, when the counterparty is a non-bank, the commercial bank debits its client's account, everything else remains equal, at the end of the transaction, the size of the bank's BS is reduced in this case. So, if customer's deposits increases, bank's liquidity will also increase since the costumer will deposit his money in his bank account.

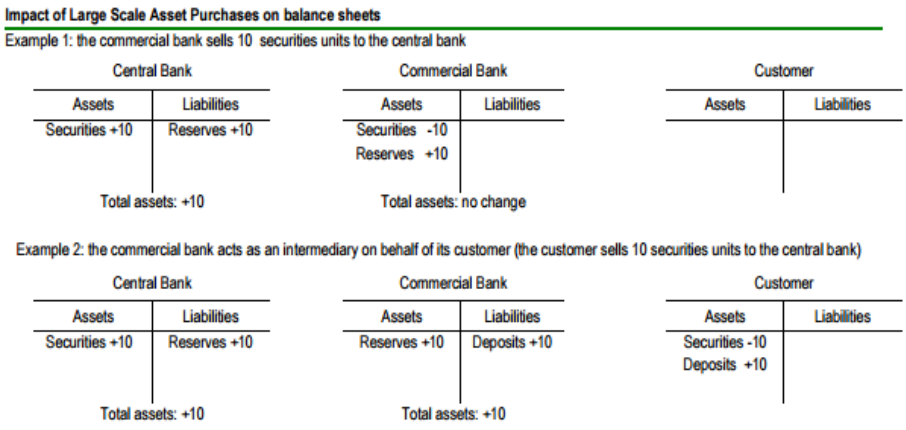

Figure 2 - Impact of QE on Commercial Banks and Customers (Source: Choulet, 2015)

2.2.4 Quantitative Easing: Evidence from the Euro Area

Promoting price stability is the main goal of the ECB, as well as to achieve a low and stable inflation rate, bellow but close to 2%. In order to achieve this, the ECB used to rely on conventional monetary policy instruments, through target interest rates, bank reserve limits and changes in money supply through open market operations (European Central Bank, 2011). However, the financial crisis of 2008 has brought some challenges for traditional monetary policy instruments and central banks (Joyce et al., 2012) which forced the ECB to adopt unconventional monetary policy.

The programs implemented were **(1)** Long-Term Refinancing Operations (LTROs) in October 2008 which are a three-month liquidity-providing operation and consist in one of the two regular open market operations. Through this program, the ECB provides financing to Euro Area banks; **(2)** Covered Bond Purchase Program (CBPP) that was launched in May 2009 and the 2nd CBPP Program was launched in October 2011 in order to improve the transmission channel of the monetary policy and support lending conditions; **(3)** Securities Market Program (SMP) that was launched in May 2010, which consisted basically of public and private debt securities purchases by ECB's aiming to restore efficiency in the monetary policy transmission channel.

However, none of these programs seemed to provide enough liquidity and confidence to the market, mainly due to the default risk on government debt of some countries like Portugal, Spain, Italy, and Greece (Driffill, 2016). Following the evidence from Japan, USA and UK, the ECB turned to announce the Expanded Asset Purchase Program (EAPP), the unconventional monetary policy formally designated by QE, in September 2014. On 22 January 2015, the first Public Sector Purchase Program (PSPP) was announced, 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, as we can see in Table 1. It is possible to verify that the ABSPP is the smallest of the three programs and the PSPP is the largest of all instruments, where APP represents the total size of all programs.

Table 1 - Eurosystem holdings under the expanded asset purchase program (Source: ECB)

Changes of holdings (last two months)	ABSPP	CBPP3	CSPP	PSPP	APP
Holdings* February 2017	23,471	212,579	67,337	1,394,205	1,697,592
Monthly net purchases	724	2,434	8,314	68,814	80,286
Quarter-end amortisation adjustment	-5	-567	-195	-5,367	-6,134
Holdings* March 2017	24,190	214,446	75,455	1,457,652	1,771,743

*At amortized cost, in euro million, at month end.

At the beginning, January 2015, the ECB's program aimed to purchase, on a monthly basis, €60 billion of assets. In the figure bellow it can be seen how that monthly purchase will be divided by each type of asset.

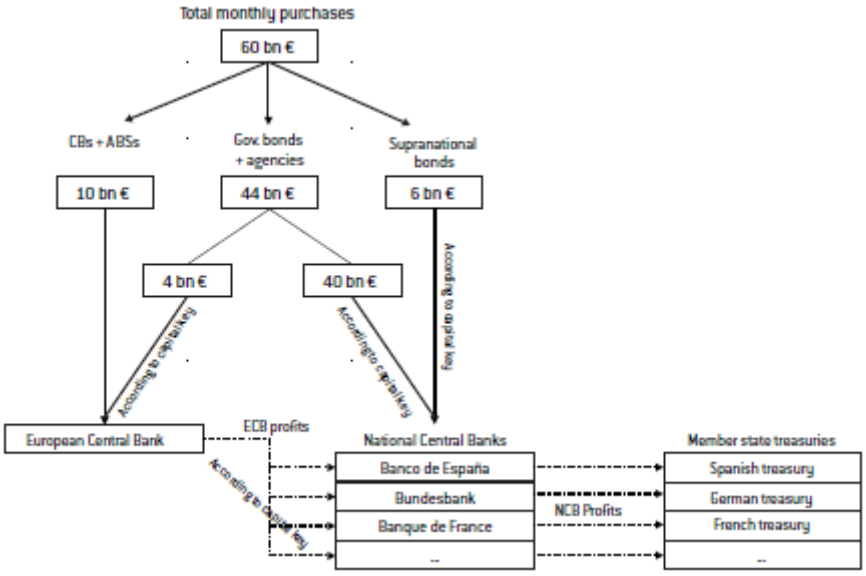

Figure 3 - Division of ECB monthly asset purchases (Source: Clays et al, 2015)

Summing up of the total €60 billion monthly purchase (1) €10 billion on covered bonds and asset-backed securities; (2) €50 billion will focus on PSPP where €6 billion correspond to debt purchase of supranational institutions placed in the Euro Area (see Table 2 and 3 for the list of eligible European institutions) and €44 billion consists on the acquisition of sovereign debt

securities, of which €4 billion held by the ECB (8% of €50 billion) and €40 billion held by the national central banks as for instance Bank of Portugal.

Table 2 - Eligible national agencies in the Euro Area (Clays et al, 2015)

Recognised issuers and outstanding euro-denominated debt in face value, € billion, 2015		
	Total	2-30 year maturity
Instituto de Credito Oficial (Spain)	34.79	14.4
KfW** (Germany)	153.5	105.5
Landeskreditbank Baden-Württemberg Foerderbank (Germany)	13.28	7.43
Landwirtschaftliche Rentenbank (Germany)	12.5	9.5
NRW.Bank (Germany)	20.15	10.45
CADES*** (France)	97.89	79.88*
UNEDIC**** (France)	17.85	13.65

Table 3 - Eligible supranational issuers in the Euro Area (Clays et al, 2015)

Recognised issuers and outstanding euro-denominated debt in face value, € billion, 2015		
	Total	2-30 year maturity
European Financial Stability Facility	226.0	204.0
European Investment Bank	228.5	206.5
European Stability Mechanism	50.2	20.0
European Union	56.2	44.9
European Atomic Energy Community*	-	-
Council of Europe Devt. Bank**	5.0	-
Nordic Investment Bank**	1.4	-

However, there were a 25% issue limit and 33% issuer limit imposed by the ECB that could constrain the length and size of the program. The 25% issue limit, prevents the ECB from having a "*blocking minority in a debt restructuring involving collective action clauses*", in other words, the ECB does not want to have control in case of a possible restructuration of government debt, in order to avoid interpretation that the ECB is funding a member country. The second limit (33%) is implemented "*with the aim of preserving market functioning and allowing the formation of a market price on a given security*" (ECB, 2015), which will affect qualified outstanding debt with 30 years maturity. As expected, these limits were constraining the length and size of the program, so in order to continue, the 25% limit was changed to 33% when on the 3rd of December 2015 Mario Draghi announced an extension of the program. According Clays and Leandro (2016), several changes were made to the initial guidelines of QE. The program was set just to last at least until September 2016, now it is expected to sustain throughout 2017. The changes were beyond the limit, the monthly asset purchases changed from €44 billion to €64 billion and regional and local government bonds were considered fit for acquisition, and deposit rate was dropped from - 0.2% to - 0.3%. According to President Mario Draghi, the APP will last "*until we see a sustained convergence towards our objective*

of a rate of inflation which is below but close to 2 percent" (Draghi 2015b), which is not near to be achieved.

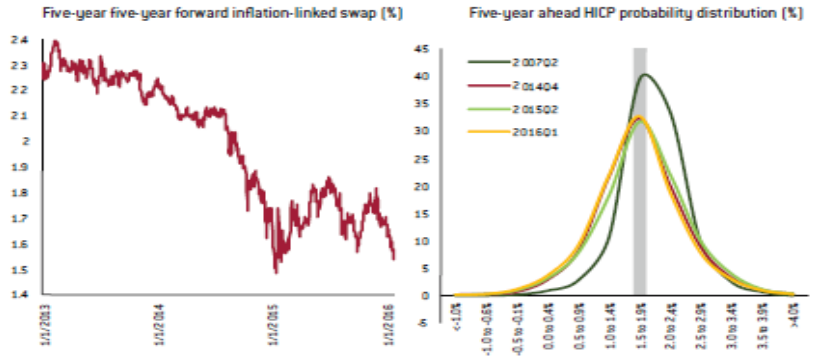

Figure 4 - Inflation outlooks in the euro area (Clays and Leandro, 2016)

When confronted with the possibility of QE creating price bubbles, Draghi (2015) responded that at this moment the ECB did not see any sign of bubbles' creation. Another risk related to this unconventional monetary policy is the decrease in profitability of financial institutions, for example, liabilities of life insurance companies have longer maturity than its assets, so the company is unprotected if there is a interest rates decrease taking into account the returns assured to customers. In Claeys and Darvas (2015)'s opinion, the benefits of QE outweigh their potential risks to financial stability.

Demertzis and Wolff (2016) research ECB's QE impact on bank profitability, and reached the conclusion that QE has not effected yet in a negative perspective bank operations, which were expected due to the decrease of interest rates, making it hard for banks to obtain net interest margin. Overall, according to this study QE impact at a macroeconomic level has been positive lowering long-term yields and increasing the government securities' price. Bank's BS is strengthened by these positive effects on the financial market.

However, there is not enough focus on the evolution of credit (as loans). Calza et al. (2003), study the relationship between the private sector and loan's demand in the Euro Area between 1980 and 1999 with quarterly data and argue that loans' demand can only be explained by a

small set of explanatory variables representing general economic activity (Gross Domestic Product - GDP) and the cost of loans. The coefficient associated with GDP is positive (1.457) while for real short and long-term interest rates is negative (-0.416 and -3.084, respectively). The second coefficient, associated with the real long-term interest rate, is much higher, in absolute terms, meaning that interest rates with higher maturities have more impact on loans.

In conclusion, the EAPP was introduced to improve lending conditions to the private sector (firms and households), and it is possible to claim, from literature, that there is little sign of the impact of this policy on lending conditions. Blattner et al., (2016) study the effects of the EAPP through a new comprehensive loan-level data from Portugal, and found some positive evidence of its impact at banks exposed to QE both via lower prices and larger quantities.

2.3 Quantitative Easing and Bank's Liquidity

Some authors as Bernanke and Blinder (1992) and Kashyap and Stein (2000) see QE as a possible lending canal of monetary policy through a positive impact on bank's liquidity converted completely in a growth of lending supply, allowing the other participants of the market to finance themselves. If QE goal was to focus on the increase of banking system liquidity, it can be anticipated an increase of bank's liquid assets, as for instance, deposits. Additionally, Gambacorta and Marques-Ibanez (2011) found that low-capitalizes banks rely more on the access to the market, so in the financial crisis, those banks were affect with the restrictive access to financial market and had decrease its lending supply.

Joyce and Spaltro (2014) adapted a version defined by Kashyap and Stein (1994) of a partial equilibrium two period model of the bank lending channel. This model takes into account bank's BS has on its asset side illiquid loans (L) and liquid securities (S), as for instance, government bonds and on its liability side equity (E), non-deposit liabilities (ND) and deposits (D). At the end, the authors reached to a lending supply equation:

$$L = \frac{3}{\alpha_2} r + \frac{r}{\alpha_1} + \rho D_1 + (1-\rho)D + E_1 - \frac{\gamma}{2} \qquad (3)$$

where r is the return, α is the cost of non-deposit liabilities, ρ defines the dimension of the impact and γ expresses deposit impact' variance. This equation suggests that a raise in deposits will lead to a growth in lending supply, so if QE boosts deposits up it will also impact in the same direction bank lending.

Moreover, as mentioned before it is expected that the impact of QE is different in small and big banks, given their difference in accessing capital markets. So, in order to analyze the different effects, the authors differentiate equation (3) with respect to D_1:

$$\frac{\partial L}{\partial D_1} = \left(\frac{1}{\alpha_1} + \frac{3}{\alpha_2}\right)\frac{\partial r}{\partial D_1} + \rho \qquad (4)$$

Assuming a simple linear loan demand function:

$$L_D = Y - kr \qquad (5)$$

where economic growth (Y) is positive related to loans and loan return, r, has a negative relation with loans, and the equilibrium condition when there are n banks is:

$$L_D = nL \qquad (6)$$

By solving it we obtain:

$$r = \frac{1}{n\left(\frac{1}{\alpha_1}+\frac{3}{\alpha_2}\right)}\left(Y - n(\rho D_1 + (1-\rho)D + E_1 - \frac{\gamma}{2}\right) \qquad (7)$$

By differentiating (7) with respect to D_1:

$$\frac{\partial r}{\partial D_1} = \frac{1}{n\left(\frac{1}{\alpha_1}+\frac{3}{\alpha_2}\right)}\left(\frac{\partial Y}{\partial D_1} - n\rho\right) \qquad (8)$$

$\frac{\partial r}{\partial D_1}$ is negative when $\frac{\partial Y}{\partial D_1}$ is small, meaning that if there is a shock in deposits, markets will not be affected much, confirming the existence of a bank lending channel. From equation (4) and

(8), for a given change in deposits, banks with higher costs in issuance of non-deposit liabilities (e.g. small banks with a high α_1 and α_2) will act more to a change in deposits. On the contrary, a change in deposits will not impact as much in the case of large banks. Additionally, in a financial crisis, if there is an increase on the non-deposit liabilities' prices, and QE is implemented, there will be a positive relation between QE and bank lending, because banks will appeal to this policy.

The main conclusions focus on (1) positive impact of deposits in bank´s lending supply, so one can infer there is a chance that QE will arise bank lending; (2) banks with high levels of capital, have a superior bank lending channel; (3) small banks have limitations in accessing capital markets, so in a stress situation where deposits are affected, small banks will not have other source of funding solutions; and last (4) in a financial crisis, banks will become more exposed, since deposits may face a reduction leading to a decrease on the liquidity available to fund lending, increasing bank's cost of raising non-deposits liabilities.

3 Econometric Methodology

In this section, the dataset and data sources will be described, and the variables and time period used in this research will be defined. This panel dataset is based on publicly available quarterly BS data on 24 banks[1] since March 1999 until December 2016 (68 time-series across 24 cross-sections). Since this paper purposes to investigate the impact of QE on commercial banks in the Euro Area, all banks are operating only in this area, since ECB's policies impact directly on member countries, even though there is little evidence that other countries can also be affect by them.

[1] The 24 banks are: Deustche Bank (Germany), Santander (Spain), Unicredit (Italy), ING Group (Netherlands), BBVA (Spain), Intesa Sanpaolo Group (Italy), Commerzbank (Germany), Banco de Sabadell (Spain), Erste Bank (Austria), Dexia (Belgium), Banca MPS (Italy), Banco Popular Espanhol (Spain), Mediobanca SpA (Italy),Banco Comercial Português (Portugal), Bankinter (Spain), BPER Emilia Romagna (Italy), Banca Popolare di Milano (Italy), Credito Emiliano (Italy), BPI (Portugal), Banca Carige (Italy), HSBC Trinkaus & Burkhardt (Germany), Oberbank AG (Austria), Comdirect bank (Germany) and Bank fur tirol und vorarlberg (Austria). See Annex 1.

3.1 Description of main variables

The variable ECB Purchases captures the effect of the QE program that started in 2015 with asset monthly purchases by country[2]. Since each bank is located in an Euro Area country, a country/bank allocation was made. Additionally, in this work project the data used is based on a quarterly basis, so the ECB Purchase monthly data was summed into quarters.

Table 4 – Description of the main variables (1999Q1-2016Q4)

Type	*Variable*	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
ALL BANKS	ΔLoans	1704	0,0084	0,1290	-1,9468	0,6590
	ΔDoA	1704	-0,0154	0,2747	-5,3780	1,1819
	ΔCapital	1704	-0,0084	0,2443	-4,8264	1,3670
	ΔPoA	1704	-1,5960	36,448	-1050,727	193,283
	ΔTA	1704	0,0196	0,107	-0,745	1,812
	ΔGDP	1728	0,0113	0,0235	-0,0711	0,0564
	ΔECBPurchases	1704	1,2162	80,9921	-964,858	1676,728
	Inflation	1728	0,0187	0,0119	-0,0151	0,0559
	ΔEuribor6m	1728	0,0220	0,0160	-0,0021	0,0518
BIG BANKS	ΔLoans	852	0,0076	0,1485	-1,8465	0,6530
	ΔDoA	852	-0,0352	0,3690	-5,3780	0,8428
	ΔCapital	852	-0,0114	0,2680	-4,1705	1,3670
	ΔPoA	852	-1,4677	33,8003	-982,673	9,9935
	ΔTA	852	0,0226	0,1410	-0,745	1,8121
	ΔGDP	864	0,0135	0,0239	-0,0711	0,0564
	ΔECBPurchases	852	0,3718	2,4505	-8,6430	24,1920
	Inflation	864	0,0190	0,0124	-0,0122	0,0559
	ΔEuribor6m	864	0,0220	0,0160	-0,0021	0,0518
SMALL BANKS	ΔLoans	852	0,0092	0,1061	-1,9468	0,6590
	ΔDoA	852	0,0044	0,1189	-0,7386	1,1819
	ΔCapital	852	-0,0055	0,2183	-4,8264	0,8727
	ΔPoA	852	-1,7243	38,936	-1050,727	193,283
	ΔTA	852	0,0166	0,054	-0,184	0,317
	ΔGDP	864	0,0091	0,0229	-0,0711	0,0559
	ΔECBPurchases	852	2,0607	114,541	-964,858	1676,728
	Inflation	864	0,0184	0,0114	-0,0151	0,0491
	ΔEuribor6m	864	0,0220	0,0160	-0,0021	0,0518

Table 4 describes the main statistics of the main variables used in this paper[3]. Loans were obtained from the Bloomberg database, as well as the variable of Deposits and Total Assets which contributed to compute the ratio of Deposits over Assets (DoA). Capital consists on the quarterly change of the Capital indicator extracted from Bloomberg and the change in the

[2] See Annex 2.
[3] See Annex 3.

Provisions ratio corresponds to the change of Provisions over Assets (PoA). This table summarized those variables for both small and large banks. The sample is divided equally in 12 large and small banks, depending on its total assets[4]. As one can conclude, both types of banks have similar descriptive statistics concerning the average of $\Delta Loans$, ΔPoA and ΔDoA. However, capital levels of small banks tend to be larger than the ones of big banks. As stated by Ueda and Weder di Mauro (2012) and Noss and Sowerbutts (2012), a small capital buffer is expected for big banks due to its lower costs in funding and the easiness to access capital markets, taking advantage in the implicit government guarantee. When comparing the standard deviation, small banks present greater dispersions than big banks, perhaps due its heterogeneity, because it can be included in the sample medium to very small banks.

Regarding the variable ECBPurchases, one may see that, in average, the volume of asset acquisitions under the QE program is higher in small banks which may lead to the conclusion that the effect of QE can be more important for small rather than big banks.

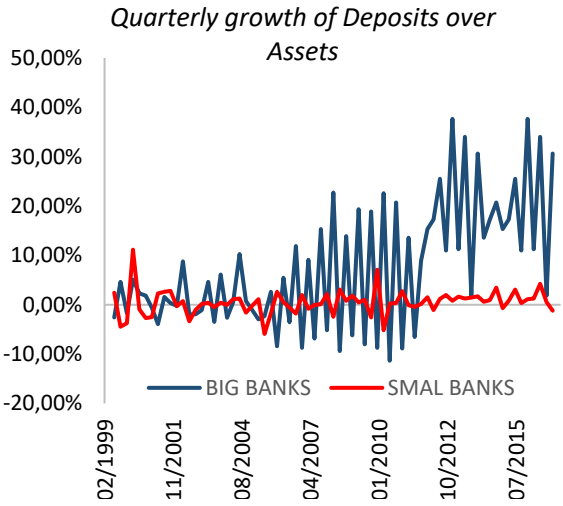

Figure 6 - Quarterly growth of Deposits over Assets

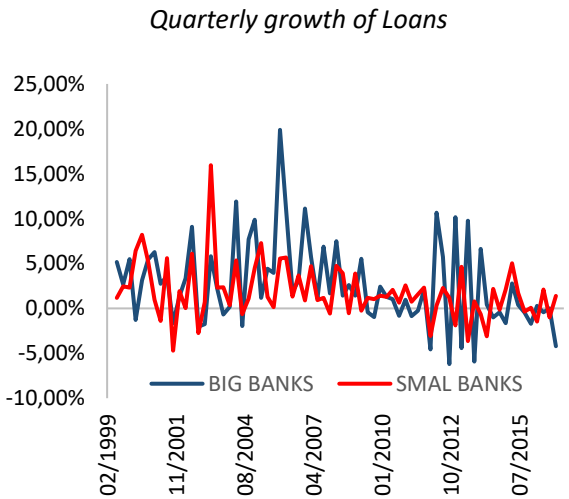

Figure 5 - Quarterly growth of Loans

One can take a closer look at the evolution of the deposit ratio, meaning to the DoA ratio, in Figure 6. Since 1999 a stable evolution of the ratio can be observed, which can be explained by

[4] See Annex 4.

banks that had been financing their activity through non-deposits liabilities, and Deposits over Asset became lower for Big Banks. This happened due to the fact that financial market became more accessible and the appearance of complex funding instruments (as for example, securitizations). One can witness that since 2011, a particular growth in loans and in the deposit ratio which matches the beginning of ECB's liquidity programs (LTROs, CBPP and SMP)[5]. Nevertheless, one should not over interpret this evidence, because there are other increases in the series that are not explain by ECB's policies.

In Figure 5, it can be show that either small or big banks faced a decrease in lending after the financial crisis and after the beginning of ECB's program small banks' lending became negative while big banks' lending increased. Lending in both types of banks got better in 2015, after the announcement of QE.

3.2 Econometric Strategy

As mentioned on Section 2, changes in deposits due to QE can influence bank's lending. In order to analyze the impact of QE on commercial banks, Joyce and Spaltro (2014) econometric strategy is followed.

This study will focus on understanding the reaction of the growth of loans to the growth in the deposit ratio (ΔDoA). Loans' growth will work as an endogenous variable following Kashyap and Stein's (2000) investigation which focused on the mechanism of bank lending taking into account bank variables and macroeconomic factors. Moreover, at a capital level through the ratio $\frac{Capital}{Assets}$, Bernanke and Lown (1991) studied the effects of lending growth. The general model can be written as follows:

[5] Long-term refinancing operations (LTROs) were announced on October 2008, Covered Bond Purchase Program (CBBP) in May 2009 and Securities Program (SMP) in May 2010.

$$\Delta Loans_{it} = \alpha + \beta(L)\Delta Loans_{it} + \gamma(L)\Delta DoA_{it} + \delta(L)\Delta Capital_{it} + \rho(L)\Delta PoA_{it} + \varphi\Delta ECBPurchases_{it} + \mu' I_{it} + \theta' A_t + u_{it} \quad (9)$$

where $\Delta Loans_{it}$ corresponds the growth of loans (lending) on a quarterly basis for bank i in period t, ΔDoA_{it} is the quarterly deposits over assets ratio growth, $\Delta Capital_{it}$ is the quarterly capital growth, ΔPoA_{it} is the quarterly provisions over assets growth, $\Delta ECBPurchases_{it}$ is change in ECB's purchases[6], the I_{it} is a vector of micro controls and A_t is a vector of macro controls. L is a lag operator and $\beta(L)$, $\gamma(L)$, $\delta(L)$ and $\rho(L)$ are lag polynomials. Additionally u_{it} corresponds to the error term and it is assumed to be normally distributed $N\sim(0, \sigma^2)$, assuming that the error terms are independent both in the time and cross-section dimensions: $E(u_{it}, u_{js}) = 0 \; for \; i \neq j, s \neq t.$

This corresponds to a dynamic model (Auto Regressive Distributed Lag) where the short-run effects are captured by the coefficients of the individual time lags and the long-run effects are capture by $\frac{\sum \text{lagged coefficients}}{1-\sum \text{lagged lending coefficients}}$.

The general model can be seen as a relationship between the demand and supply factors of lending, through macro and microeconomic variables, as bank's individualities[7]. The macroeconomic controls are: GDP growth, Inflation and Interest Rate (Euribor 6m). The microeconomic variables, or bank's individualities, are the bank's size (Total Assets), the provision ratio (as an indicator of credit quality), Capital because it is a costly source of funding that can impact bank's capacity to lend.

[6] In order to correspond EBC's Purchases to each bank, it was made a country-bank allocation.

[7] Kashyap and Stein (2000), Hoson (2006) and Kobayashi, Spiegel, and Yamori (2006) studies suggest that among banks the QE's impact is different because it depends on bank's features. Futhermore, Kashyap and Stein (2000) suggest that big banks face less credit constrains found because big banks are less sensitive to shocks in liquidity. Hosono (2006) suggests that the effect of QE is stronger for smaller banks, less liquid and more abundant with capital.

The variable ECBPurchases represents directly the asset purchase program, translating in quarter purchases by country, so we expect a positive and significant value, meaning that an increase in the ECB's asset purchase will lead to a boost in lending growth. Moreover, as stated in Section 2, QE effects can be measure through Deposits, if bank lending is affect by QE through deposits, an increase in DoA leads to increase in bank's lending capacity as long as the associated coefficients are positive and statistically significant.

3.3 Unit-roots tests

This panel dataset will be treated both as a cross-sectional and time-series dimension, so it can be regarded as a macro-panel since the number of time periods dominates over the number of banks. The panel data set is balanced with no missing values, so with all observations valid over the entire time-series period.

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, stationary of the series must be tested so that one can justify using (logs of) levels or first-differences of the observed data and, furthermore, in a cointegration context or not. This is also important to avoid spurious relationships. To that extend, we apply the panel unit root tests proposed by Im, Pesaran and Shin (2003). The null hypothesis is non-stationarity, with common or not, unit root processes across cross-sections.

Table 2 – Unit roots tests (1st level)

	ΔLoans	ΔDtA	ΔCapital	ΔPoA	ΔTA	ΔGDP	ECBPurchases	Inflation	Euribor6m
p-value	0,000	0,000	0,000	0,000	0,000	0,010	1,000	0,037	1,000
Z-t-tilde-bar	-28,964	-30,024	-29,898	-28,099	-34,026	-2,322	12,504	-1,788	5,873

As one can see, the variables ECBPurchases and Euribor6m are both non-stationary, so we must take their first differences:

Table 3 – Unit roots tests (2nd level)

	ΔECBPurchases	ΔEuribor6m
p-value	0,000	0,000
Z-t-tilde-bar	-26,420	-14,925

4 Results

The results presented were estimated using the Arellano-Bond approach in Stata software. One can see from Table 7 that not all coefficients are significant, but all will be interpreted with their respective signs.

4.1 All Banks

Table 4 - Arellano-Bond estimation for all banks

ΔLoans	*Coef.*	*Std. Err.*	*z*	*P>|z|*	*[95% Conf. Interval]*
L1.ΔLoans	-0,2693	0,0214	-12,5600	0,0000	[-0,3113809 ; -0,2273111]
ΔDoA	0,2008	0,0100	20,0100	0,0000	[0,1811031 ; 0,2204358]
ΔCapital	0,0836	0,0113	7,4000	0,0000	[0,061477 ; 0,1057683]
ΔPoA	-0,0310	0,0075	-4,1100	0,0000	[-0,0457959 ; -0,0162124]
ΔTA	0,3403	0,0241	14,1400	0,0000	[0,2930875 ; 0,3874428]
ΔGDP	0,1341	0,1426	0,9400	0,3470	[-0,1453275 ; 0,413475]
ΔECBPurchases	0,0000	0,0000	0,9700	0,3340	[-0,0000286 ; 0,0000842]
Inflation	0,1098	0,2682	0,4100	0,6820	[-0,4158892 ; 0,6354993]
ΔEuribor6m	0,7246	0,2129	3,4000	0,0010	[0,3072025 ; 1,141941]
L1.ΔDtA	-0,0116	0,0114	-1,0200	0,0030	[-0,0338376 ; 0,0106538]
L1.ΔCapital	-0,0129	0,0074	-1,7300	0,0830	[-0,0274744 ; 0,0016756]
L1.ΔPoA	0,0175	0,0112	1,5600	0,1190	[-0,0044952 ; 0,0395135]
_cons	-0,0040	0,0049	-0,8200	0,4150	[-0,0134731 ; 0,0055579]

A statistically significant effect was found for the first lag of the growth of Loans, indicating a robustness of the variable $\Delta Loans$. The first lag of growth of Capital has negative and statistically significant impact $\Delta Loans$ in the first lag, this can be justified by the high cost that this source of funding has (Capital) compared to other sources. According to Mayers and Majluf (1984) a bank capital increase is expensive so it must adjust lending taking into consideration the negative impact on P&L. In the long run, the variable growth in Capital is positive, which does not contradict what was indicated previously because the level of capital, as mentioned in Section 2, relies with the bank capital channel. As one expected, there is a negative and statically

significant impact of the provisions ratio, as banks decline the concession of loans when the quality of those begins to be bad and predicted future losses are higher. Total Assets which measures the size of the bank has statistically significant and positive effect in lending growth, so in theory, big banks concede more loans than small banks. The variable that states the ECB's purchases is not statistically significant, this can be explained by the fact that the QE program only started in 2015.

Focusing on the macroeconomic variables, both GDP and Inflation are not statistically significant for the model, but changes in Euribor 6m are, this can be explained by the fact that this rate influences positively the demand in lending.

As a robustness check, the sample was divided in big and small banks based on their Total Assets at the end of 2016.

4.2 Big Banks

Similar to the evidence stated before, the growth in assets and the changes in the Euribor 6m are the ones that contributed most to the model, all with a statistically significant effect.

Tabel 8 - Arellano-Bond estimation for big banks

ΔLoans	*Coef.*	*Std. Err.*	*z*	*P>|z|*	*[95% Conf. Interval]*
L1.ΔLoans	-0,3747	0,0313	-11,9700	0,0000	[-0,4360293 ; -0,3133529]
ΔDoA	0,0036	0,0256	0,1400	0,0470	[-0,0465228 ; 0,0538041]
ΔCapital	0,0515	0,0230	2,2400	0,0250	[0,0064048 ; 0,0965823]
ΔPoA	-0,1636	0,0187	-8,7600	0,0000	[-0,2002751 ; -0,1270191]
ΔTA	0,3584	0,0330	10,8700	0,0000	[0,2937769 ; 0,4230758]
ΔGDP	0,0694	0,1950	0,3600	0,7220	[-0,3127262 ; 0,4515038]
ΔECBPurchases	0,0009	0,0014	0,6500	0,5140	[-0,0018603 ; 0,0037168]
Inflation	0,2765	0,3690	0,7500	0,4540	[-0,4466388 ; 0,9997322]
Euribor6m	0,7313	0,2953	2,4800	0,0130	[0,1525368 ; 1,309997]
L1.ΔDtA	-0,0062	0,0267	-0,2300	0,8160	[-0,0586355 ; 0,0461749]
L1.ΔCapital	0,0017	0,0139	0,1200	0,0405	[-0,0289219 ; 0,0255861]
L1.ΔPoA	-0,0355	0,0191	-1,8600	0,0630	[-0,0728469 ; 0,0018976]
_cons	-0,0049	0,0071	-0,6900	0,4890	[-0,0189472 ; 0,0090523]

There is not much change in the results compared to the analysis done before, nevertheless, ECB purchases, even though is not statistically significant, has an impact, yet small, in the

growth of Loans. Additionally, the contribution of the growth of DoA, both in long and short run, continues to be positive and statistically significant for the model, but the coefficient compared with the sample of all banks is much lower.

4.3 Small Banks

In small banks, the variables which contribute most to the model are, in line of what was stated before, Total Assets, Euribor 6m and DoA.

Tabel 9 - Arellano-Bond estimation for small banks

ΔLoans	*Coef.*	*Std. Err.*	*z*	*P>|z|*	*[95% Conf. Interval]*
L1.ΔLoans	-0,1384	0,0278	-4,9700	0,0000	[-0,1930025 ; -0,0838749]
ΔDoA	0,2340	0,0110	21,2100	0,0000	[0,2123827 : 0,2556237]
ΔCapital	0,0690	0,0138	5,0000	0,0000	[0,0419756 ; 0,0960121]
ΔPoA	0,0009	0,0079	0,1100	0,9130	[-0,0145617 ; 0,0162774]
ΔGDP	0,0014	0,1788	0,0100	0,9940	[-0,349008 ; 0,351768]
ΔTA	0,2925	0,0624	4,6900	0,0000	[0,1701945 ; 0,4147838]
ΔECBPurchases	0,0000	0,0000	1,2200	0,2230	[-0,0000185 ; 0,0000792]
Inflation	-0,1581	0,3361	-0,4700	0,6380	[-0,8169582 ; 0,500691]
Euribor6m	0,4443	0,2536	1,7500	0,0800	[-0,0527754 ; 0,9414245]
L1.ΔDtA	0,0653	0,0138	4,7400	0,0000	[0,0382826 ; 0,0923585]
L1.ΔCapital	0,0235	0,0229	1,0300	0,3050	[-0,0214025 ; 0,0683837]
L1.ΔPoA	-0,0089	0,0077	-1,1500	0,2500	[-0,0240521 ; 0,0062578]
_cons	0,0063	0,0059	1,0600	0,2880	[-0,0053278 ; 0,0179374]

In comparison with the big banks' case, the contribution of Deposits over Assets is higher statistically significant and positive to the lending growth, both in the short and long run. For small banks, there are more statistically significant on variables such as Provisions over Assets and Deposits over Assets. The impact of Capital, both positive and statistically significant in both type of banks, is slightly higher in small banks when comparing to big banks case, it is quite interesting to realize the importance of capital to small banks rather for big banks, as stated by Hosono (2006) "*the effect of QE is stronger for smaller banks, less liquid and more abundant with capital.".*

Kashyap and Stein (1994, 2000) found that this type of heterogeneity these type of banks is quite normal in the literature because there is a bank lending channel. Small banks face

difficulties in accessing capital markets in order to increase its non-deposit liabilities, so a stress situation in deposits will lead to a deeper reduction in lending than in big banks (higher impact).

Unfortunately, the variable ECB purchases remains not statistically significant, not contributing to the model, but for both cases if we focus on the effect through deposits it can be verified the positive impact of QE on bank's lending.

5 Conclusion and Limitations

In this paper the goal was to investigate the impact of QE on commercial banks in the Euro Area since most studies focus on the economy impact. This research takes into consideration publicly available information on 24 European commercial banks during a period of 68 quarters (1Q1999 to 4Q2016).

Over the years, less attention was given to the impact of QE on commercial banks, because policy makers expected QE to impact financial markets mainly aiming to get close to a 2% inflation rate. Nevertheless, there are studies that focused on the impact of QE in commercial banks such as Bowman et al (2011) in the Japan's case and Joyce and Spaltro (2014) in the UK's case. These studies pointed out statistical significant but small increase in the growth of bank lending.

In this study, we find some evidence that QE had a bigger impact on small banks rather than on big banks, reaching to the conclusion that the effects were heterogeneous. Additionally, evidence was found regarding the positive impact of banks with higher levels of capital on QE, this can explain the little effect found because during the financial crisis bank's capital had a massive decrease. Overall, the effect of QE on commercial banks was measured to be small, the variable ECB Purchases turned out to be not statistically significant to the model, and nevertheless the QE's effect was captured by the ratio DoA. So, taking that into account, there is a statically significant, but small effect in launching this unconventional monetary policy in

commercial banks, affecting its lending channel, allowing banks to increase lending and boost their profits.

One may infer that, this small effect of QE on commercial banks can be explained by the lack of confidence in the banking system that is recovering at a slow rate since the financial crisis. The negative impact of the financial crisis could have overwhelmed the positive impact of QE, leading to a small effect of this unconventional monetary policy. Moreover, the effects can be limited because the marginal effects that were estimated using deposits are minor and because it was supposed that the total effect of QE was capture in its whole by deposits, overstating the impact.

Even though this work project reached its goal, there were some limitations. The lack of time in order to observe an impact of QE on commercial banks, through the variable ECB Purchases, because that policy was only implemented in 2015. Furthermore, also due to this last fact, there is lack of available data which constrains the scope of the analysis and lack of previous research on this topic in the Euro Area. The available data concerning the bank's BS was also a limitation, since the impact of ECB Purchases was not capture entirely since not all banks placed in the Euro Area were considered in this study because there was no publicly available data for. These limitations are an opportunity to describe the need for future research and identify new gaps in the literature.

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7 Annex

Annex 1

	Bank	*Country*
Big Banks	Deustche Bank	Germany
	Santander	Spain
	Unicredit	Italy
	ING Group	Netherlands
	BBVA	Spain
	Intesa Sanpaolo Group	Italy
	Commerzbank	Germany
	Banco de Sabadell	Spain
	Erste Bank	Austria
	Dexia	Belgium
	Banca MPS	Italy
	Banco Popular Espanhol	Spain
Small Banks	Mediobanca SpA	Italy
	Banco Comercial Português	Portugal
	Bankinter	Spain
	BPER Emilia Romagna	Italy
	Banca Popolare di Milano	Italy
	Credito Emiliano	Italy
	BPI	Portugal
	Banca Carige	Italy
	HSBC Trinkaus & Burkhardt	Germany
	Oberbank AG	Austria
	Comdirect bank	Germany
	Bank fur tirol und vorarlberg	Austria

Annex 2

Monthly net purchases (M€)	31-03-2015	30-06-2015	30-09-2015	31-12-2015	31-03-2016	30-06-2016	30-09-2016	30-12-2016
Austria	1,22	3,83	3,71	3,89	4,06	6,05	5,12	5,33
Belgium	1,53	4,84	4,64	4,89	5,13	7,65	6,45	6,72
Cyprus	-	-	98,00	187,00	- 16,00	-	- 21,00	-
Germany	11,07	35,26	33,75	35,54	37,20	55,45	46,80	48,87
Estonia	-	5,00	33,00	10,00	13,00	5,00	-	-
Spain	5,45	17,30	16,56	17,51	18,34	28,18	23,05	23,94
Finland	774,00	2.463,00	2.362,00	2.487,00	2.615,00	3,91	873,40	941,46
France	8,76	27,54	27,04	28,44	29,81	44,01	36,95	38,33
Ireland	722,00	2.294,00	2.234,00	2.333,00	2.393,00	3,28	2.665,00	1.628,02
Italy	7,61	23,98	23,20	24,42	25,59	39,21	32,15	33,45
Lithuania	39,00	339,00	394,00	335,00	343,00	322,00	193,00	299,00
Luxembourg	183,00	550,00	304,00	78,00	423,00	77,00	16,00	112,00
Latvia	75,00	428,00	64,00	117,00	115,00	224,00	144,00	145,00
Malta	5,00	204,00	53,00	20,00	141,00	163,00	30,00	191,00
the Netherlands	2,49	7,86	7,47	7,80	8,39	12,36	10,59	10,87
Portugal	1,07	3,42	968,31	3,45	3,62	4,29	1.681,02	728,04
Slovenia	209,00	678,00	651,00	690,00	769,00	732,00	595,00	609,00
Slovakia	506,00	1.597,00	1.332,00	1.187,00	1.562,00	885,00	477,00	610,00
Supranationals	5,68	18,19	18,03	18,21	18,87	23,45	18,95	19,85
Total	47,38	150,77	145,19	151,59	159,37	230,24	190,14	198,15

Annex 3

Variable	*Source*	*Formula*
ΔLoans	Bloomberg - Balance Sheet Total Loans	
ΔDtA	Bloomberg - Balance Sheet Total Assets and Deposits	$\frac{Total\ Deposits}{Total\ Assets}$
ΔCapital	Bloomberg - Balance Sheet Total Capital	
ΔPoA	Bloomberg - Provisions for Loan Loss and Balance Sheet Total Assets	
ΔTA	Bloomberg - Balance Sheet Total Assets	$\frac{Provisions}{Total\ Assets}$
ΔGDP	OECD Database	
ΔECBPurchases	European Central Bank website	
Inflation	OECD Database	
ΔEuribor6m	European Central Bank - Statistical Data Warehouse	

Annex 4

	Bank	*Total Assets*
Big Banks	Deustche Bank	1 692 872,68 €
	Santander	1 339 125,00 €
	Unicredit	859 533,00 €
	ING Group	845 081,00 €
	BBVA	731 854,00 €
	Intesa Sanpaolo Group	725 100,00 €
	Commerzbank	480 450,00 €
	Banco de Sabadell	212 507,72 €
	Erste Bank	208 227,07 €
	Dexia	203 987,91 €
	Banca MPS	153 132,00 €
	Banco Popular Espanhol	147 925,73 €
Small Banks	Mediobanca SpA	93 439,85 €
	Banco Comercial Português	71 264,80 €
	Bankinter	67 182,47 €
	BPER Emilia Romagna	64 957,03 €
	Banca Popolare di Milano	50 829,22 €
	Credito Emiliano	39 569,03 €
	BPI	38 284,70 €
	Banca Carige	26 119,30 €
	HSBC Trinkaus & Burkhardt	22 386,21 €
	Oberbank AG	20 086,81 €
	Comdirect bank	19 273,46 €
	Bank fur tirol und vorarlberg	9 655,14 €