Quantitative Easing Effect on Banks' Assets and Lending Volume

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Abstract

This thesis aims to research the impact of ECB's Quantitative Easing (QE) announcement on sovereign bond prices, banks' assets and their lending volume change. The two hypotheses developed are: QE increased sovereign bond prices which subsequently increased valuation of assets of banks holding such bonds and; banks which benefited this way (increased valuation of their assets), increased their lending volume. I find that they are both true. In a sample of 81 EU banks on the period 2014-2016, the findings show that the benefit of banks due to QE has a positive and significant effect on their lending volume. It is also shown that the effect is more significant for smaller banks and banks in GIIPS countries. This thesis aims to add value in the discussion about ECB's unconventional monetary policies and could be used as a starting point to a possible research on QE effect on real economy.

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1. Introduction

Since 2009, European Central Bank (ECB) has implemented several non-standard monetary policy measures to complement the regular operations of the Eurosystem. While ECB's objective is to help real economy recover in distressed periods, literature has shown that the goal is not always achieved, or it is achieved with unintentional consequences. Programs like Asset Purchase Programme (APP), that is examined in this thesis, may help banks to provide more funding to corporates but it does not always help the real economy, namely employment and investments. Various papers have shown that, in some cases, either banks use the liquidity to provide facilities to firms that cannot use them but to pay back old loans, or it is firms that do not seem to use them in growing investments and/or employment. There are some that argue that it is banks' fault; misusing the programs by providing facilities to keep distressed firms alive or exploiting them in any other way. A counterargument is that banks do whatever is necessary to keep up with the competition and to maintain a low default rate, while it is ECB's job to design the programs in such a way that cannot be misused or exploited. This thesis does not attempt to answer this debate, rather to assess one of these unconventional monetary policies, APP, which can be used as an additional research to this discussion.

In 22 January 2015, ECB implemented Quantitative Easing (QE) through an Asset Purchase Programme (APP) to address low inflation. APP extended existing programs to include sovereign bonds. On 9 March 2015, the Eurosystem started to buy public sector securities under the Public Sector Purchase Programme (PSPP). The securities covered by the PSPP include nominal and inflation-linked central government bonds and bonds issued by recognized agencies, regional and local governments, international organizations and multilateral development banks located in the euro area.[1] An indirect effect of APP, and the main concern of this research, is an increase in the valuation of banks' bonds holdings that usually is referred to as capital relief or capital injection. As ECB's assessment of APP (2016) mentions: "The capital relief channel suggests that the higher prices of sovereign bonds induced by the APP should benefit banks through the ensuing increased valuation of their bonds holdings. This mechanism is dubbed capital relief channel, because it is akin to a capital injection".

The main question of this research is *whether and how ECB's quantitative easing affected the valuation of banks' assets and lending volume*. There are two hypotheses developed:

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[1] https://www.ecb.europa.eu/mopo/implement/omt/html/index.en.html

Hypothesis 1: QE increased sovereign bond prices which subsequently increased valuation of assets of banks holding such bonds.

Hypothesis 2: Banks which benefited this way (increased valuation of their assets), increased their lending volume.

A confirmation of Hypothesis 2 would mean that QE helped indirectly, through a capital relief channel, banks to provide more facilities to corporates. Possible extension of this research could examine whether the firms that received these facilities, used them to help the real economy by increasing their investments and employment. Therefore, stakeholders of this research may be the banks that benefited but the implication and possible extension would concern a wider spectrum including firms and employees, assuming there is an impact on the whole EU economy. Findings from literature that has assessed past ECB's programs and their impact in real economy, implicate that often firms use this liquidity to pay back old loans. That means that the programs do not help the real economy, they just result to a "zombie lending" phenomenon (more in Section 2). If this is also the case with APP, the research could be a first step to a criticism towards these unconventional monetary policies and propose a change. However, this second step exceeds the purpose of this thesis.

This thesis attempts to answer the first hypothesis by examining the impact on bond prices on the announcement date, since that is when market adjusted the prices for the QE and not when the purchases actually happened. Then, the change in valuation of banks' assets can be easily measured. Regarding the second hypothesis, whether the benefited banks increased their lending volume or not is examined. I find that both hypotheses are true. QE announcement had a positive effect on the prices of sovereign bonds. Banks holding these bonds at that time experienced an increase in their assets. Then they used this benefit to increase their lending volume to corporates. These findings contribute to the existing academic research assessing ECB's programs. In the best of my knowledge, there is limited research assessing ECB's APP, but I find its contribution quite important as it can be used as a starting point for questioning and subsequently improving ECB's unconventional monetary policies.

This thesis is organized as follows: Section 2 reviews the empirical literature, section 3 provides the data used and their descriptive statistics, section 4 demonstrates the methodology, section 5 shows the results and section 6 the robustness checks. Finally, in sections 7 and 8 there are the conclusions and the references respectively.

2. Literature Review

This section first discusses the transmission channels through which ECB's policies affect asset prices, bank lending and the economy. Then, it reviews the empirical literature on the effect of unconventional monetary policies on bond prices and real economy. The section closes with a discussion on other factors that influence bank lending.

ECB uses a number of instruments to control inflation and maintain economic stability in Eurozone. Distress times require more unconventional measures and some non-standard monetary policy measures that ECB has used in the past are LTROs (Longer-Term Refinancing Operations), TLTROs and APP. LTROs, for instance, were used by ECB to lend money at very low interest rates to EU banks. LTROs provide an injection of low interest rate funding to banks with sovereign debt as collateral on the loans. The loans are offered monthly and are typically repaid in three months, six months or one year. In some cases, the ECB used longer-term LTROs, such as the three-year LTRO in December of 2011, which tend to see significantly higher demand. The LTROs are designed to have a two-fold impact: Greater bank liquidity and lower sovereign debt yields.[2] Essentially, banks borrow money from ECB with very attracting interest rates and terms and they, in turn, can use this liquidity to provide corporates with more loans. Ideally, this can be transmitted in the real economy if corporates use this funding to make investments and offer employments.

There are several different channels through which a monetary policy can pass-through the economy. The traditional monetary transmission mechanism occurs through interest rate channels, which affect interest rates, costs of borrowing, levels of physical investment, and aggregate demand. Additionally, aggregate demand can be affected through friction in the credit markets, known as the credit view. The monetary transmission mechanism can be defined as the link between monetary policy and aggregate demand. On this thesis, the transmission channel that is mainly explored is the asset valuation (or capital relief) channel. It is the monetary transmission channel that is responsible for the distribution of the effects induced by monetary policy decisions made by the central bank of a country that affect the price of assets. These effects on the prices of assets will in turn affect the economy (Mishkin F. S., 2001). The key monetarists' objection for analyzing monetary policy effects was that it traditionally focused on only one asset price, the interest rate, rather than on many asset prices. There are three other categories of asset prices besides those on debt instruments that are

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[2] https://www.thebalance.com/what-is-a-ltro-or-long-term-refinancing-operation-1979094

regarded as critical channels through which monetary policy affects the economy. These are (1) stock market prices, (2) exchange rates and (3) real estate prices. Changes in these asset prices affect investment and consumption decisions of both firms and households and therefore central banks often use it as an instrument of monetary policy. Regarding quantitative easing specifically, the following figure can summarize the channels through which central banks can use it to affects bank lending and real economy.
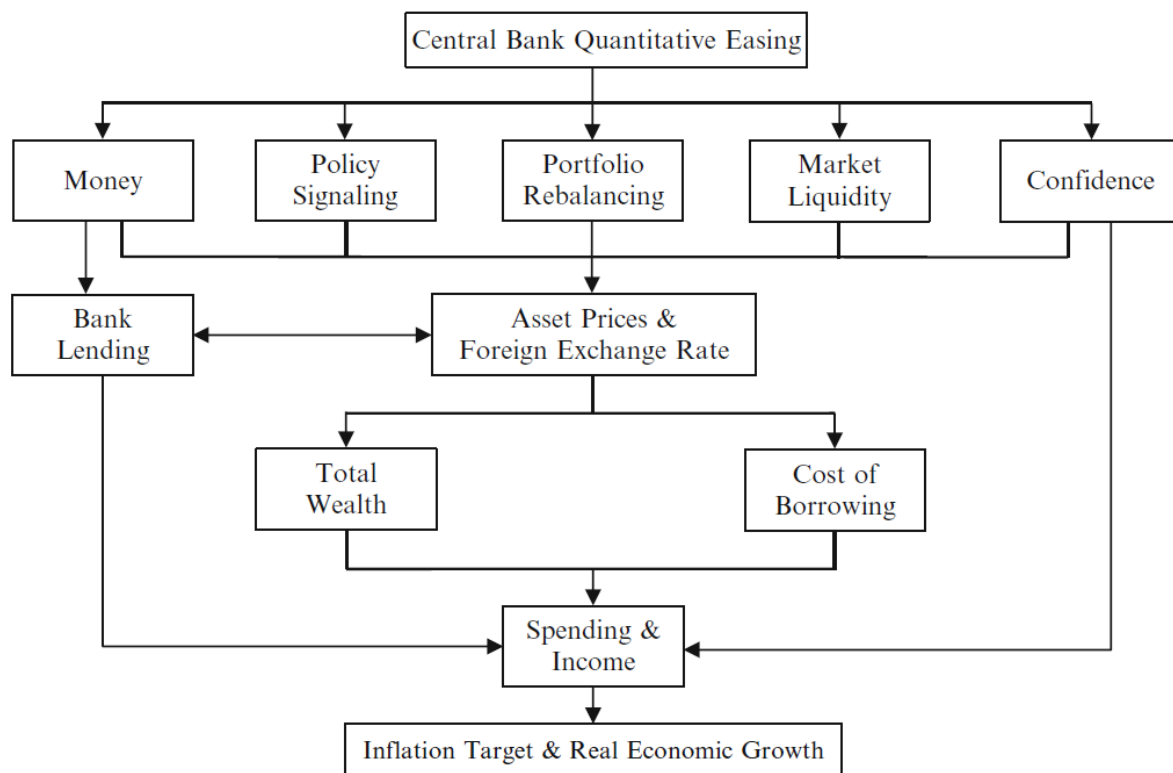

Figure 1: Transmission channels of quantitative easing (Hausken et al., 2013)[3]

Similarly, Gern et al. (2015) argued that QE programmes can affect economic activity through various channels, including the interest rate channel, the signaling channel and the exchange rate channel. They explained that the purpose of QE is to bring inflation and inflation expectations in line with the central bank's target, stimulate economic growth, and lower unemployment. QE programmes are designed to positively affect the economy by lowering interest rates and devaluing the currency, but there are various transmission channels through which they can achieve it. The two most prominent ones are the signaling and the portfolio

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[3] Adopted from Joyce et al. (2011)

rebalancing channels. Both are mainly targeted at lowering long-term interest rates. There are two primary factors that affect long-term interest rates: first, expectations about future short-term interest rates, and second, the term premium. The signaling channel affects the former, while the portfolio rebalancing channel affects the latter. Moreover, by announcing large-scale asset purchases, central banks provide information about the likely path of future monetary policies to market participants through a signaling channel. Purchasing a large quantity of long-term assets under QE serves as a credible commitment by central banks to keep interest low in the future (Hausken et al., 2013). Dermetzis M. and Wolff G. B. (2016) argued that, in theory, QE also affects banks' profitability in three main ways. First, as bond prices increase because of QE, banks holding such bonds see their balance sheets strengthened. Second, QE reduces long-term yields and therefore reduces term spreads. Last, QE makes the economic outlook better, which should help banks exposed to the economy find new lending opportunities and should decrease problems with non-performing loans. Furthermore, there is the perspective of the risk-taking channel. Apart from the traditional bank lending channel, which focuses on the amount of loans supplied, the risk-taking channel may exist when banks' incentive to bear risk related to the provision of loans is affected. The risk-taking channel operates mainly via two mechanisms: First, low interest rates boost asset and collateral values. This, combined with the belief that the increase in asset values is sustainable, leads both borrowers and banks to accept higher risks. Second, low interest rates make riskier assets more attractive, since agents search for higher yields. In the case of banks, these two effects usually translate into a softening of credit standards, which can lead to an excessive increase in loan supply.[4]

The empirical literature written about APP effect on banks' assets and lending volume is limited until now since it is a quite recent program. However, there is an assessment of it by European Central Bank and there are also assessments of previous unconventional monetary policy ECB's programs. Moreover, since this thesis is considered as a starting point for questioning this type of policies, papers that examine their impact on real economy will be also cited in this section. All papers are very recent with some of them being working papers.

Going back to the channel of our interest, the asset valuation channel, it is worth mentioning that apart from the theory provided, there is also empirical evidence for its influence. In ECB's assessment of APP (Andrade et al., 2016), the effects of the programme on yields and on the macroeconomy were analyzed. It showed that the announcement of the programme, on January

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[4] https://www.ecb.europa.eu/mopo/intro/transmission/html/index.en.html

2015, had significantly reduced sovereign yields on long-term bonds and raised the share prices of banks that held more sovereign bonds in their portfolios. The paper begins with an empirical assessment of the APP on various asset prices. Two results emerge from this analysis. First, the programme produced significant announcement effects, on 22 January 2015. Second, such effects are estimated to persist for several months and, more specifically, for approximately as long as in the case of standard monetary policy announcements. In terms of transmission channels, this evidence is consistent with two aspects of an "asset valuation" (or "portfolio rebalancing") channel: the reduction of duration risk and the bank capital relief. The capital relief channel suggests that the higher prices of sovereign bonds induced by the APP should benefit banks through the ensuing increased valuation of their bonds holdings. This mechanism is called capital relief channel, because it is similar to a capital injection. The results in ECB's assessment provide support for the capital relief channel. They show that the equity prices of banks holding a larger portfolio share of government bonds benefited more from the increase in bond prices. Their analysis towards the impact of APP on euro area banks provides three main results. First, they found that the share of sovereign bonds on a bank's balance sheet has explanatory power to account for changes in the bank's stock price after the PSPP announcement. Second, they found that banks' stock prices tend to increase more, the larger the increase in their country's overall stock price index. Third, they found evidence of adverse effects of the PSPP on banks' profitability. Lastly, additional findings, which are relevant for my research, indicated that the fall in yields after the programme announcement was larger, the longer the maturity of the bonds. However, this thesis follows a slightly different approach than this of ECB's assessment. I am examining bond prices instead of yields and direct changes in assets valuation instead of changes in stock prices. The rationale is that this approach will reflect the capital relief more directly.

Regarding bank lending and monetary transmission in the euro area, De Santis et al. (2013) made an analysis on Germany, France, Spain and Italy over the period 1999-2011. On pre-1999 studies by the Eurosystem Monetary Transmission Network, jointly by the ECB and the euro area National Central Banks (Angeloni et al., 2003), findings supported that an increase in interest rates tended to reduce loan growth in France, Germany, Italy and Spain. Moreover, they found that banks in these four countries with more liquid asset holdings showed weaker loan adjustments. On post-1999 data, when ECB was in charge of monetary policy in the euro area, De Santis et al. found that the effect of monetary policy on bank lending is significant and heterogeneous in Germany and Italy, which are characterized by a large number of banks; but

it is very weak in Spain and more homogeneous in France, where the banking industry has a higher degree of market concentration. They also found evidence that monetary policy has a larger effect on cooperative and saving banks with lower liquidity and less capital in Germany and saving banks with smaller size in Italy. Therefore, bank lending depends on monetary policy and this relationship vary with bank characteristics.

Acharya et al. (2017) performed an assessment of the OMT (Outright Monetary Transactions) official announcement on July 2012. They found that its announcement lowered spreads of sovereign bonds, especially ones issued by distressed European countries. Banks holding these bonds realized significant windfall gains, and this improved their capitalization, allowing them to regain access to market-based financing. At an aggregate level, the improvement in bank health translated into an increased loan supply to the corporate sector. I follow their methodology for calculating the benefit due to announcement. They sum the individual gains over all EU sovereign bonds in a bank's portfolio and they report it as a fraction of its total equity, while they separate for GIIPS and non-GIIPS countries as well. They found that OMT program improved the health of banks (especially in the periphery of the Eurozone) by improving their capitalization. Subsequently, at an aggregate level, this translated into an increased loan supply to the corporate sector. Acharya et al. go a step further and examine the quality of the borrowers and whether they had an established relationship with the banks. They show that the new loans were mainly provided to distressed preexisting customers leading to a zombie-lending phenomenon. Finally, they also examine how zombie and non-zombie firms used the new loans. They conclude that zombie firms used the funding to pay interest payments on outstanding loans and only a fraction to build cash reserves. Neither zombie or non-zombie firms used the facilities to increase employment or investment, helping the real economy.

In their paper "Real Effects of the Sovereign Debt Crisis in Europe", Acharya et al. (2016) study the impact of the European Sovereign Debt Crisis and the resulting credit crunch on the corporate policies of firms. They found that banks' exposures to impaired sovereign debt and risk-shifting behavior of undercapitalized banks were of high importance for explaining the negative real effects suffered by European firms. These firms increased their motives to save cash out of free cash flows and their investment, job creation and sales growth decreased.

Daetz et al. (2016) did a research on another ECB's program, LTROs, but their findings were similar. They found that firms in countries that banks received funds under the LTRO programs, ended up with more cash but they did not increase their employment or investment.

On the contrary, there is evidence that firms even decreased their investment in these countries. Daetz et al. admit that the corporates in the Eurozone were affected by the ECB liquidity injections, however the impact was different from what ECB intended. The real economy could not have benefited from the liquidity if firms just hoarded the cash that they borrowed instead of hiring or investing. Overall, their study "casts doubt on the effectiveness of certain unconventional monetary policies in improving real economic output".

Crosignani et al. (2016) wrote a paper about LTROs' consequences. They focus on the Portuguese economy and they find that while the program was targeted to stimulate the economic activity, it had two possibly unintended consequences: It expanded the demand for collateral, in the form of domestic government debt, and this effect was more noticeable at shorter maturities. Crosignani et al. argue that banks exploited an attractive trade involving the purchase of collateral assets with maturity lower than the long-term central bank loan and this allowed them to earn a positive return while mitigating funding liquidity risks. This is supporting evidence on the argument that these policies do not always work as intended and they can be exploited by the banks that struggle to keep up with the competition.

Although these unconventional monetary policies tend to have a huge impact on bank lending since they usually make it cheaper or they give banks a push, there are other factors, that affect it as well. These factors could be divided into three categories: macroeconomic variables, loan demand and loan supply. Loan demand refers to the factors that affect the demand for facilities from the corporates and loan supply refers to the ones that affect the supply from the banks side. Most central banks, including ECB, have issued several reports researching the macroeconomic factors. However, since the time span of this thesis is short (only the period after the beginning of QE), it is assumed that the macroeconomic variables do not fluctuate very much. This research focuses on the bank side and the loan supply factors, so I look more into the bank characteristics as controls for lending volume. As I mentioned above, the relationship between monetary policy and bank lending depends largely on bank characteristics (De Santis et al., 2013). Alkhazaleh (2017) divided the factors that affect bank lending into internal and external. Internal factors are banks' characteristics such as Return on Assets, bank size (total assets), credit risk, liquidity, deposits and investments. External factors refer to inflation rate, GDP and broad money supply. His findings showed that the most significant factors were the credit risk, liquidity, size and ROA among the internals and inflation rate, money supply and GDP growth among the external. More precisely, size (total assets) and ROA have a positive effect on bank lending while liquidity ratio and credit risk have a negative

effect. Bruno et al. (2017) on their paper used evidence from Europe and US and they found that size, capitalization, liquidity, ownership and to a lower extend reliance on deposits and exposures to government bonds are the main bank characteristics affecting lending. In Europe, lending is better shielded in smaller banks, more capitalized and more relying on deposits. In the US, the most significant determinant of lending seems to be the liquidity. They also distinguish between Euro-Periphery banks where capitalization, liquidity and exposure to sovereigns have a positive effect on lending and they rely more on deposits. Moussa and Chedia (2016) and Awdeh (2017) researched the determinants of bank lending in countries outside of Europe and US. Moussa and Chedia (2016) concluded that the most important factors were ROA, Net Interest Margin and inflation have a significant effect on bank loans. Awdeh (2017) found that deposits, GDP, inflation and money supply, all have a positive and significant effect. The bank characteristics that I include in my research are: ROA, liquidity, deposits (and short-term funding) and long-term funding[5]. Based on the theory and literature I predict that they should all have a positive effect on lending.

3. Data

To answer these questions, data from three databases has been used. First, prices of 1403 fixed-coupon and zero-coupon sovereign bonds are obtained by Datastream for a period around the announcement dates. The dataset consists of bonds issued only by countries included in the PSPP, since bonds issued by countries that are not included in the program are not relevant for this exercise. For example, Greece was not included in the program, therefore any change in the Greek bond prices should not affect the calculations. For each bond, the year that was issued, the issuer and the maturity are known. Therefore, the residual maturity per 12/2014 can be easily calculated. Second, I use exposures of 103 banks on 12/2014, obtained by European Banking Authority's (EBA) EU-wide transparency exercise results of 2015. The data is on exposures level and each bank's exposure is separated on issuer country and residual maturity. Hence, matching these two datasets, I have data on exposures per issuer and per residual maturity of each bank and how the prices of these amounts fluctuated. Third, I need balance sheet data for these banks to answer the second hypothesis. Annual data of 3700 EU banks over the period 2014-2016 are obtained by Orbis Bank Focus. The balance sheet data includes total assets, equity, lending volume, liquid assets, deposits and short-term funding, long-term

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[5] Size (total assets) is also included as a scale factor.

funding, return on assets and return on equity. The following table (Table 1) shows the descriptive statistics of the banks' characteristics for banks that exist in both EBA and Orbis datasets.[6] The banks' characteristics that will be used as control variables are winsorized on 1% and 99% levels to prevent for possible outliers, although this transformation did not affect the results.

Variable	Obs	Mean	Std. Dev.	Min	Max
Total Assets	78	258005.1	412724.9	4270.086	2077758
Total Equity	78	13607.71	20144.93	242.042	89714
ROA	78	0.0620128	0.7410609	-2.851	1.682
ROE	78	0.5775897	14.58946	-90.382	29.593
Sovereign Exposures	80	30808.76	39133.31	550.9844	153908.2
Loans	78	115041.4	159263.4	874.003	784767
Loans / Assets	78	0.5482317	0.1672377	0.0684	0.86686
Loan growth	77	-0.0058694	0.1395811	-0.20506	0.26049
Liquid Assets / Total Assets	78	16.34617	14.00462	1.113	69.25
Deposits and short-term Funding	78	142179	205395	3496.88	1031624
Long-term Funding	78	34831.45	45819.76	0.693	212176

Table 1: Descriptive statistics of banks' balance sheet data as per 12/2014.

For bank level balance sheet data other authors have chosen SNL, which has quarterly observations and would provide more granularity to the findings, but Orbis Bank Focus was the only one that I had access to. The source that I selected for the exposures (EBA) was the only available database to me, but it is also what Acharya et al. (2017) chose for their OMT assessment. Regarding the selection of the control variables, after research and the rationale provided on the last paragraph of literature review section, I concluded that these are of the highest importance.

I also examine the presence of multicollinearity between the variables of Table 1. Multicollinearity can affect coefficients of the variables, as well as the significance of those

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[6] 81 of the 103 banks of EBA match with Orbis dataset.

coefficients. The following table (Table 2) depicts the pairwise correlations between these variables.

	Total Assets	Total Equity	ROA	ROE	Sovereign Exposures	Loans	Loan growth	Liquid Assets / Total Assets	Deposits	Long-term Funding
Total Assets	1									
Total Equity	0.95	1								
ROA	0.08	0.12	1							
ROE	0.09	0.12	0.92	1						
Sovereign Exposures	0.91	0.91	0.07	0.07	1					
Loans	0.90	0.97	0.10	0.09	0.89	1				
Loan growth	0.11	0.13	0.30	0.33	0.11	0.14	1			
Liquid Assets / Total Assets	0.30	0.21	0.07	0.15	0.29	0.15	0.26	1		
Deposits and short-term Funding	0.98	0.97	0.10	0.11	0.91	0.95	0.12	0.27	1	
Long-term Funding	0.84	0.85	0.04	0.05	0.89	0.88	0.10	0.27	0.83	1

Table 2: Pairwise correlations

As a sign of possible multicollinearity, I find a strong correlation between total assets and sovereign exposures, loans, deposits and short-term funding and long-term funding. This proves that my dependent variable as well as my controls depend greatly on total assets and for that reason are all scaled by total assets, so they can be comparable. The above bank characteristics are reported as descriptive statistics of my sample but not all of them will be used in the regressions. The controls that will be used are ROA, liquid assets, deposits & short-term funding and long-term funding. The correlation between all of my controls is very low except for the pair deposits and short-term funding – long-term funding. However, I keep both in the regression because according to theory and bibliography they are important factors to loan supply thus they should be taken into consideration.

4. Methodology

In order to measure how much each asset's value increased because of QE announcement, the following methodology is being used and described on this section.

First, I calculate the daily bond returns (price on day t / price on day t_{-1}) and I multiply the five returns after the five announcement dates. As announcement dates, apart from the official announcement, I define dates that big news about QE released by the most well-known, international newspapers, since the market started to adjust its prices months before the 22nd of January (official announcement). ECB's "APP an early assessment" also claims that asset price effects were produced on announcement, specifically when information about the ECB programme was released. No statistically significant effects can be identified when purchases were carried out. On 20/09/2014, 27/11/2014, 03/12/2014 and 03/01/2015, Financial Times and the Economist published articles discussing about a possible upcoming QE that apparently affected the sovereign bond prices. More precisely, on September 20, F.T. published an article entitled "Weak ECB loans take-up paves the way for QE".[7] In this article, it is stated that TLTRO volume was disappointing low (banks borrowed only €212 billion of the €400 billion available) and that QE is the one of the few monetary options that Mr Draghi could use to revive eurozone. Lyn Graham-Taylor, rates strategist at Rabobank, quoted that "(TLTRO take-up) makes full blown QE more likely". On November 27, again F.T. published an article with title "US data disappoint as possibility of European QE comes into focus" and on December 3: "Draghi needs support on QE in the eurozone".[8] At that time, F.T. debated the possibility that ECB would purchase government bonds on early January since Mr Draghi was heading towards it despite some criticism. They argued that the new year would be a good time for ECB to extend the APP programme to other types of assets (government bonds through PSPP). In the beginning of 2015, a few weeks before the announcement, the Economist published the article "Euro-zone quantitative easing. Coming soon?".[9] In this article, the Economist discusses the prospect that ECB would take action on the governing council of January 22. They build their argument about an upcoming QE as following: Inflation was uncomfortably lower than the 2% target and Mr Draghi had implied of buying €1 trillion worth of assets. The only realistic way to raise €1 trillion was to buy public debt. There was a precedent too: purchasing public

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[7] https://www.ft.com/content/89b404cc-3fee-11e4-a381-00144feabdc0
[8] https://www.ft.com/content/156419fa-76f2-11e4-944f-00144feabdc0
[9] https://www.economist.com/news/finance-and-economics/21637422-ecb-might-unleash-its-long-awaited-programme-early-2015-coming-soon

debt was the main way that QE had been conducted in America, Britain and Japan. In the end, analysts were right, and ECB officially announced QE on 22/01/2015; which is the last date I include to calculate price changes.

The total percentage change of a bond price (p) because of the QE announcements is the product of these five returns minus one. For dates t, y:

$$Total\ Percentage\ Change_p = \left(\frac{Price_t}{Price_{t-1}} \times \frac{Price_y}{Price_{y-1}} \times \dots \right) - 1$$

Illustrating the above calculation with an example for two dates:

Date	Closing Price	Percentage Change
27/11/2014	100	-
28/11/2014	105	1.05
03/12/2014	210	-
04/12/2014	231	1.10

Table 3: Example of Total Percentage Change calculation.

$$Total\ Percentage\ Change = (1.05 \times 1.10) - 1 = 0.155\ or\ 15.5\%$$

Then, I categorize the bonds into seven categories based on their residual maturities. The buckets for residual maturity are [0 - 3M), [3M - 1Y), [1Y - 2Y), [2Y - 3Y), [3Y - 5Y), [5Y - 10Y), [10Y - more). Since there are multiple bonds for each category on the Datastream dataset, I calculate the average total percentage change by issuer and residual maturity category. I match each bank's exposure from EBA for issuer and residual maturity to its total percentage change. Then, I calculate the amount change of each exposure by multiplying exposure outstanding with the total percentage change matched. I call this measure benefit (per exposure):

$$Benefit_e = Exposure\ amount\ outstanding_m \times Total\ percentage\ change_m$$

Therefore, the benefit, for an exposure e with residual maturity m, is the exposure amount outstanding times the total percentage change of bonds with residual maturity m. The total benefit for each bank is the sum of the benefits for its exposures.

$$(Total)\ Benefit_b = \sum Benefit_e$$

Following Acharya et al. (2017), I scale the total benefit (amount) with equity prices. The 95% of the sample has total benefit/equity between 0% and 10%, while there are some observations

with 78%. I drop the highest 5% of the sample as I consider these observations outliers that would give misleading results.

By merging the EBA dataset with the Orbis dataset, I end up with a sample of 81 matched banks. I want to examine whether the "total benefit" from QE announcements has any explanatory power to the lending volume of 2015 and 2016. I answer that by running a regression with dependent variable the change in lending volume and independent variable the (scaled) total benefit.

$$\Delta Loans_{bt} = \beta_1 \cdot Benefit_b \quad (1)$$

For bank b on period t, change in lending volume is calculated relative to the year of the QE announcement, following Acharya et al. (2017). However, other variables may affect the lending volume, such as banks' Return-on-Assets and loan supply, so I include them on the regression (2).

$$\Delta Loans_{bt+1} = \beta_1 \cdot Benefit_b + ROA_{bt} + Loan\ Supply\ factors_{bt} \quad (2)$$

Factors that affect the loan supply and subsequently the lending volume are: liquidity (measured by liquid assets to total assets), deposits and short-term funding and long-term funding (Alkhazaleh, 2017). The dependent variable is one year ahead than the control variables, assuming that the effect of any variable is observable on the next period. The dependent variable as well as all the control variables are scaled by the total assets.

5. Results

In this section, the results of the aforementioned regressions and methodology are presented. Summarizing my hypotheses and predictions, I expect QE announcements to have a positive effect on bond prices and banks to realize an increase in the valuation of their assets (capital relief channel). Furthermore, a positive relationship between price increase and maturity is expected. Regarding banks' lending, the measure "benefit" should have a significant and positive affect on it, as well as all the bank characteristics, such as ROA, liquidity, deposits (and short-term funding) and long-term funding. Observing the above would confirm my two hypotheses and answer to my research question.

5.1. The effect on bond prices

The total percentage changes of all bonds because of the QE announcements are reported on the Figure 2 in a form of a histogram.
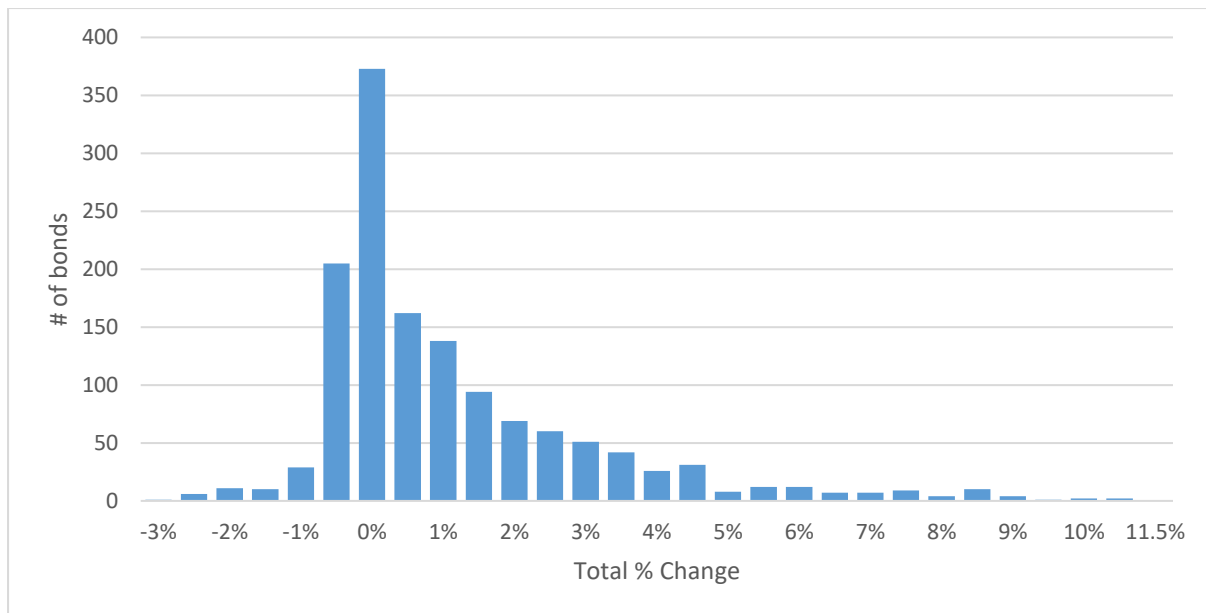

Figure 2: Percentage changes of prices of bonds after QE announcements.

It is shown that most bonds had a positive reaction to the news. In a total of 1404 bonds, 1139 (81%) had a positive percentage change, while 215 (15%) had a negative percentage change and 49 (3%) did not move significantly. The findings confirm that the dates that news released about possible QE, as well as the official announcement, were of high significance for sovereign bond prices.

Grouping these bonds in countries and maturities shows us more information about the breakdown of the ones that their prices moved. The average total percentage changes per issuer for bonds with maturities buckets [0Y – 5Y), [5Y – 10Y) and [10Y – more) are shown on Table 4.

Issuer	Average Total % Change		
	[0Y - 5Y)	[5Y - 10Y)	[10Y - more)
Austria	0.07%	0.32%	2.09%
Belgium	0.15%	0.36%	2.24%
Cyprus	0.51%	0.99%	
Finland	0.08%	0.25%	1.42%
France	0.03%	0.70%	2.59%
Germany	-0.06%	0.15%	1.11%
Ireland	-0.09%	0.05%	0.74%
Italy	0.44%	0.80%	4.22%
Latvia	0.26%	-0.10%	1.59%
Lithuania	0.07%	0.26%	1.80%
Luxembourg		0.14%	0.46%
Malta	0.01%	0.29%	0.42%
Netherlands	0.05%	0.28%	2.30%
Portugal	-0.18%	-0.10%	1.42%
Slovakia	0.27%	0.45%	1.04%
Slovenia	0.45%	0.85%	1.94%
Spain	-0.03%	-0.14%	2.52%

Table 4: Average Total Percentage change per issuer.

We observe that only the bonds of a few countries, for some maturity buckets, do not increase in price. However, the majority of the bonds do have an increase. The only pattern that seems to exist for countries that have a decrease is that Spain and Portugal low maturity bonds did not react positively to the news, as well as Irish bonds of same maturity, all GIIPS countries. What is also interesting is the fact that there seem to exist a positive relationship between maturity and average total percentage change: The longer the maturity of the bonds, the larger the percentage increase. This finding is perfectly reasonable, since quantitative easing is used for assets of longer maturity than short-term government bonds resulting to lower longer-term interest rates further out on the yield curve. It is also consistent with the empirical literature, since Andrade et al. (2016) similarly found that the fall in yields after the programme announcement was larger, the longer the maturity of the bonds and, naturally, the relationship between bond prices and yields is negative.

Hence, it is reasonable to say that in an aggregate level, the sovereign bonds issued by countries included in the PSPP increased their prices, which answers the first part of the first hypothesis. However, to answer the second part of it, I examined if banks held bonds issued by these countries and in what degree they benefited from these rises in prices.

5.2. The effect on banks' exposures

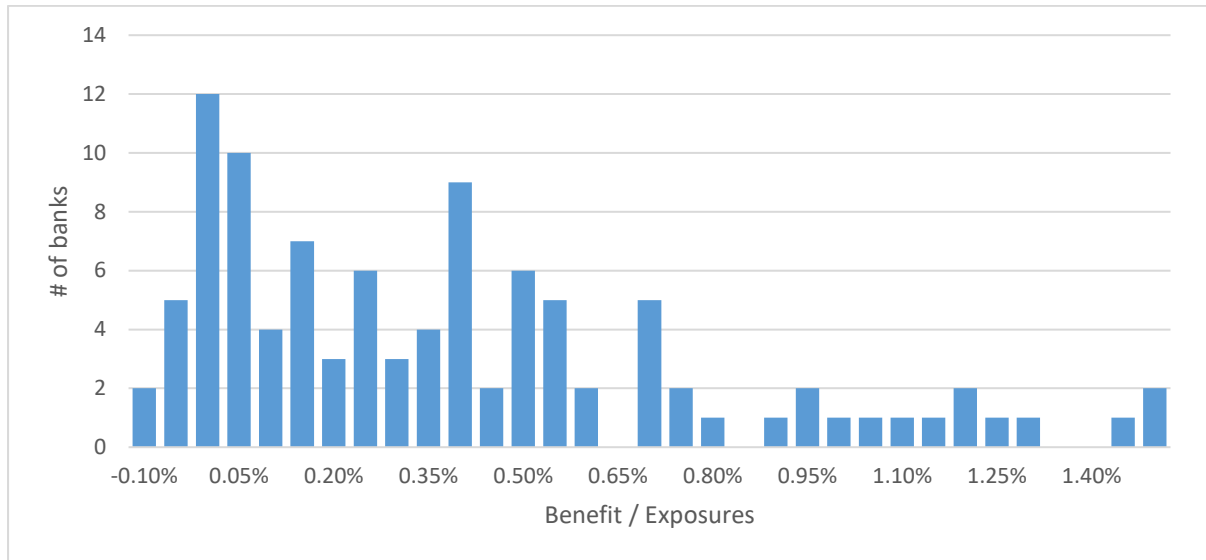Figure 3 shows the change in the value of exposures for the 103 banks in the EBA sample.

Figure 3: Total benefit of banks (as a % of total exposures).

Most of them realize an increase in the value of their exposures, therefore in their assets, while only 7 of 103 realize a decrease.

Hence, taking into account the results shown on sections 5.1 and 5.2, I conclude that hypothesis 1 is true.

5.3. The effect on banks' lending volume

In order to assess whether hypothesis 2 is confirmed, we follow the regression as described in section 4. Table 5 shows the result of the baseline regressions. Regression (1) shows the relationship between lending volume and the measure "Benefit", while regression (2) includes control variables for the loan supply. Both regressions include time fixed effects.

Table 5: Effect on banks' lending volume. OLS regression with change (delta) in lending volume as dependent variable and the measure "Benefit" as independent, among Return-on-Assets, liquid assets, deposits and short-term funding and long-term funding. All variables are scaled on total assets. 141 observations of a sample of 81 banks present in both EBA and ORBIS.

	(1)	(2)
	Δ Lending Volume	Δ Lending Volume
Benefit	0.832	0.736
	(4.04)***	(3.43)***
ROA		-0.006
		(-1.49)
Liquid Assets		0.000
		(0.20)
Deposits & Short-term Funding		-0.060
		(2.17)**
Long-term Funding		-0.048
		(1.99)**
Constant	0.004	0.053
	-1.06	(2.38)**
R^2	0.11	0.15
N	141	140
Time Fixed Effects	YES	YES

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Table 5: Effect on banks' lending volume.

As we can see, the QE benefit has a positive and significant effect on banks' lending volume change. More specifically, looking at regression (2) of Table 5, the lending volume over total assets increases by 0.736% for each additional 1% that a bank earned through the benefit of the QE announcements. Regarding the control variables, deposits & short-term funding have a significant effect consistent with literature and my predictions, although positive effect was expected. ROA and liquidity do not seem to have a significant effect on bank lending.

6. Robustness

In order to check the robustness of my baseline regression and the findings regarding my second hypothesis, the following model modifications have been made.

First, I divide the sample into two subsets according to their size. The size is measured by total assets by the end of 2014 and the cut-off point is the median of the sample. The median is approximately €100 billion, meaning that banks with total assets higher than that are considered large and banks with assets lower than €100 billion are smaller than the median. Table 6 shows the results of the baseline regression (same factors), only this time the sample is divided into two groups according to the banks' size.

Table 6: Small (3) and large (4) banks. Banks are divided into two groups according their size. Size is measured by total assets per Q4 2014. Sum of number of observations may differ from baseline regression due to missing data.

	(3)	(4)
	Δ Lending Volume	Δ Lending Volume
Benefit	1.674	0.247
	(4.29)***	(1.25)
ROA	-0.002	-0.021
	-0.39	(1.79)*
Liquid Assets	0.000	0.000
	(0.59)	(0.01)
Deposits & Short-term Funding	-0.165	0.006
	(2.17)**	(0.17)
Long-term Funding	-0.167	-0.130
	(1.96)*	(2.06)**
Constant	0.132	0.036
	(2.15)**	(1.21)
R^2	0.29	0.12
N	70	69
Time Fixed Effects	YES	YES

* p<0.1; ** p<0.05; *** p<0.01

Table 6: Small (3) and large (4) banks.

We see that the main conclusion of the baseline regression holds: the benefit from QE has a positive effect on lending volume for both subsamples, but the effect is much larger for smaller

banks. Both the economic and the statistical significance of the benefit are higher in the regression of the sample with the small banks. The rationale behind this finding could be the fact that smaller banks needed this capital relief more than the bigger ones. Hence, they exploited this benefit from QE announcement by providing more facilities in the following years. Looking again at the bank characteristics, deposits and short-term funding (only in small banks) and long-term funding have a significant effect on lending and ROA in large banks. It's interesting that the effect is negative although I predicted a positive one based on the literature.

Likewise, I divide the initial sample into two subsamples according to the banks' country. More specifically, I create two groups: banks from GIIPS countries and banks from non-GIIPS countries[10]. It is worth mentioning that 31 of the 81 banks (38%) are banks from GIIPS countries. Table 7 presents the results of the two regressions of the GIIPS and non-GIIPS samples.

Table 7: Banks from GIIPS (3) and non-GIIPS (4) countries. Banks are divided into two groups according their country of origin.

	(3)	(4)
	Δ Lending Volume	Δ Lending Volume
Benefit	0.740	0.662
	(1.94)*	(2.53)**
ROA	-0.008	-0.007
	(1.79)*	(0.58)
Liquid Assets	0.000	0.000
	(0.83)	(0.16)
Deposits & Short-term Funding	-0.004	-0.078
	(0.07)	(2.22)**
Long-term Funding	0.026	-0.058
	(0.28)	(2.35)**
Constant	0.001	0.069
	(0.01)	(2.44)**
R^2	0.18	0.15
N	60	80
Time Fixed Effects	YES	YES

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Table 7: Banks from GIIPS (3) and non-GIIPS (4) countries.

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[10] The sample from the merge of EBA and Orbis datasets does not include banks from Greece.

By examining Table 7, we observe that while the result of the baseline model is the same: the QE benefit has a positive and significant effect on lending volume change, it is of higher magnitude for GIIPS banks than the rest. This finding is not surprising, since ECB's Quantitative Easing was considered from many a relief for banks in peripheral countries. These banks were the ones that needed it most, so they could use the liquidity for providing more facilities to corporates.

Therefore, I conclude that the second hypothesis is also true: The QE benefit has a positive and significant effect on banks' lending volume change. Moreover, the findings suggest stronger effect on banks with total assets below median and GIIPS banks.

7. Conclusion

Concluding, ECB has launched several unconventional monetary programs in the past few years to address low inflation or to help the Eurozone economy in general. Some of them are the LTROs, the announcement of OMT and, more recently, APP (quantitative easing). There is quite a criticism among some academics who claim that these programs have unintentional consequences or, sometimes, do not help the real economy in a satisfying degree. Literature has shown that while these programs give a relief to banks by cheaper funding or an increase on their assets, banks provide facilities to distressed preexisting customers. They, in turn, use these facilities to pay back old loans and not for employment and investments, leading to a zombie lending phenomenon.

My research focuses on quantitative easing and, more specifically, its effect on banks assets and lending volume. The sample is formed by data of 81 European banks on the period after the announcement. My main research question is whether and how ECB's quantitative easing affected the valuation of banks' assets and lending volume. The first hypothesis formed is that QE increased sovereign bond prices which subsequently increased valuation of assets of banks holding such bonds. To answer if it is true, I examine bond returns around the announcement dates and I find that they were indeed positive. Also, the findings suggest that the higher the maturity of the bonds, the higher the percentage change. Then, I calculate the increase in banks' assets due to QE announcements. The findings indicate that most banks in my sample were benefited through this capital relief channel. Second hypothesis is that banks which benefited this way (increased valuation of their assets), increased their lending volume. The results show

that the effect on lending volume was positive and significant, confirming the second hypothesis. The regressions control for other factors that affect the loan supply and time fixed effects. Robustness checks strengthen the findings by confirming that the main finding holds when dividing the sample into groups according to banks' size and country of origin (GIIPS and non-GIIPS). They also suggest that the effect is larger on small banks and banks from GIIPS countries.

Further research could examine whether firms that were provided this funding used it to help real economy (employment and investments) or not. If findings are similar to those of the literature, then QE could be added to the list of questionable unconventional monetary policies. I consider this matter of high importance and it exceeds the interests of banks only, since it concerns a wider spectrum including firms, employees and essentially the whole EU economy. Many researchers already question these unconventional monetary policies and believe it is time for ECB to reconsider the structure, target and goals of these programs.

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