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The impacts of ECB monetary policy on Euro-area bank's performance

(Versão final após defesa)

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Resumo

Devido à gravidade da crise financeira, vários bancos centrais mudaram suas políticas e adotaram uma intervenção mais ativa. Recorrendo à compra de ativos em grande escala e programas de *quantitative easing* para diminuir os efeitos da crise financeira. O objetivo do estudo é analisar os impactos da política monetária do Banco Central Europeu sobre o desempenho dos bancos europeus. Como a pesquisa analisa bancos de diferentes países da área do euro, permite estudar os impactos e como eles variam de país para país, devido à heterogeneidade da economia europeia. O painel é composto por 1183 bancos comerciais de 18 países (Áustria, Bélgica, Chipre, Estónia, Finlândia, França, Alemanha, Grécia, Irlanda, Itália, Letónia, Luxemburgo, Malta, Países Baixos, Portugal, Eslováquia, Eslovénia e Espanha) com um tempo período de 2011 a 2016. Para alcançar o objetivo da pesquisa, os impactos do Produto Interno Bruto (dos diferentes estados da zona do euro como medida da riqueza da nação), o valor dos ativos do Banco Central Europeu e os principais a taxa de juros (como *proxies* da política monetária) sobre as variáveis de desempenho bancário será analisada. Este estudo fornece aos decisores públicos novas informações empíricas e teóricas.

Palavras-chave

ECB, QE-Quantitative Easing, Política Monetária, Zona Euro.

Resumo Alargado

A fim de abordar a gravidade da crise financeira de 2008, vários bancos centrais em todo o mundo iniciaram uma série de estímulos financeiros para controlar o impacto da crise e diminuir seus efeitos. Além disso, as taxas de juros atingiram mínimos históricos, os bancos centrais generalizaram o uso de políticas monetárias não convencionais (Gagnon et al., 2011). Como o foco desta tese é a zona do euro, o banco de referência é, obviamente, o Banco Central Europeu (BCE), que age de acordo com os princípios que o guiam, protege o valor do euro, além de procurar proporcionar estabilidade e segurança aos países que pertencem ao sistema (European Central Bank, 2018).

A política monetária não convencional combina medidas como Compras de Ativos em Grande Escala, *quantitative* e *credit easing* estas políticas têm em comum o provocarem um grande aumento dos balanços dos bancos centrais, assim como introduzem liquidez nos mercados (Falagiarda & Reitz, 2015; Woodford, 2012).

É bem conhecida a importância dos bancos num sistema financeiro, desde facilitar o crédito a empresas, agir como elo de ligação entre credores e devedores ao fornecer informações sobre serviços financeiros, facilitando o processo de conexão, permitindo assim as rápidas trocas nas quais os mercados financeiros modernos assentam. O papel dos bancos comerciais em uma economia pode quase ser descrito como uma "máquina do tempo" devido ao facto de que o seu papel é acelerar um processo que, de outra forma, levaria muito mais tempo a se concretizar. Permitem que as indústrias invistam e se renovem o que tem um efeito de fortalecimento do tecido industrial de um país, facilitando o consumo e as trocas na economia. No final de 2016 havia um total de 3167 bancos sediados na União Europeia e os bancos com sede na zona do euro detinham um total de 24183 mil milhões de euros de ativos (European Central Bank, 2017).

O principal objectivo do BCE durante este período era estabilizar os *spreads* da área do euro e reduzir os rendimentos (Haitsma et al., 2016). Este objetivo do BCE de estabilizar o mercado europeu de dívida e ajudar a reduzir os *spreads* é corroborado por outros estudos, nos quais se afirma que este objectivo foi cumprido pela injeção de liquidez no sistema, embora a diminuição tenha sido modesta (Gibson et al., 2016)

O objetivo do estudo é analisar os impactos da política monetária do Banco Central Europeu sobre o desempenho dos bancos europeus. Como a pesquisa analisa bancos de diferentes países da área do euro, permite estudar os impactos e como eles variam de país para país, devido à heterogeneidade da economia europeia. O painel é composto por 1183 bancos comerciais de 18 países (Áustria, Bélgica, Chipre, Estónia, Finlândia, França, Alemanha, Grécia, Irlanda, Itália, Letónia, Luxemburgo, Malta, Países Baixos, Portugal, Eslováquia, Eslovénia e Espanha) com um período de tempo de 2011 a 2016. Para alcançar o objetivo da pesquisa, os impactos do Produto Interno Bruto (dos diferentes estados da

zona do euro como medida da riqueza da nação), o valor dos ativos do Banco Central Europeu e os principais a taxa de juros (como *proxies* da política monetária) sobre as variáveis de desempenho bancário será analisada. Este estudo fornece aos decisores públicos novas informações empíricas e teóricas.

A fim de verificar as dúvidas relativas aos dados, a abordagem foi a seguinte: i) primeiro, foi estudada a natureza dos dados; ii) a presença de heteroscedasticidade, a correlação contemporânea é testada. Se estas hipótesess fossem confirmadas e também devido ao fato de que o T<N, significando que o número das variáveis é maior que o número de períodos de tempo, a metodologia mais apropriada e que deve ser aplicada é o *panel corrected standard errors* (PCSE) (Marques & Fuinhas, 2012; Reed & Ye, 2011).

As suspeitas foram confirmadas, assim a metodologia utilizada para estimar os modelos foi o PCSE. Esta metodologia foi desenvolvida por Beck & Katz (1995) com base em uma transformação do *ordinary least squares (*OLS).

Os resultados mostraram que as políticas introduzidas pelo BCE tiveram pequenos impactos no desempenho bancário, que se suspeitou devido às informações coletadas durante a revisão da literatura. O excesso de reservas revelou ter um impacto negativo sobre a rentabilidade dos bancos, contrariamente à expansão dos ativos dos bancos centrais que foi calculada para impactar positivamente os bancos da área do euro. A principal taxa de juros e a redução que sofreu nos últimos anos parecem ajudar os bancos a melhorar seu desempenho. A situação na Europa era mais complexa do que a que os EUA tiveram que enfrentar, devido à crise da dívida soberana e isso pode ter influenciado a decisão do banco central. O BCE foi mais focado em resolver a crise da dívida que estava afetando severamente vários países da união monetária, tentando equilibrar entre a manutenção da estabilidade do valor do euro, a solidez do sistema bancário e ajudar os países debilitados, pode ter permitido uma ambiente menos favorável para os bancos da área do euro.

Abstract

Due to the severity of the financial crisis several central banks changed their policies and adopted a more active intervention. Recurring to Large Scale Asset Purchase and quantitative easing programs in order to lessen the effects of the financial crisis. The objective of the study is to analyze the impacts of the European Central Bank monetary policy on the performance of the European banks. As the research analyses banks from the different countries of the Euro area, it enables to study the impacts and how they vary from country to country, due to the heterogeneity of the European economy. The panel consists of 1183 commercial banks from 18 Countries (Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia and Spain) with a time period from 2011 to 2016. To achieve the goal of the research the impacts of the Gross Domestic Product (of the different Euro-area states as measure of the wealth of the nation), the value of the European Central Bank assets as well the key interest rate (as proxies of the monetary policy) on the banking performance variables will be analyzed. This study provides public deciders with new empirical and theoretical information.

Keywords

ECB, QE-Quantitative Easing, Monetary Policy, Euro area.

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Acronyms

PCSE	Panel Corrected Standard Errors
OLS	Ordinary Least Squares
ECB	European Central Bank
QE	Quantitative Easing
LSAP	Large-Scale Asset Purchase
KIR	Key Interest Rate
US	United States
VIF	Variance inflation factors
GDP	Gross Domestic Product
MRO	Main Refinancing Operation
LTRO	Longer-term Refinancing Operation
TLTRO	Targeted Longer-term Refinancing Operation
APP	Asset Purchase Programs
BoJ	Bank of Japan
AT	Austria
BE	Belgium
CY	Cyprus
EE	Estonia
FI	Finland
FR	France
DE	Germany
GR	Greece
IE	Ireland
IT	Italy
LV	Latvia
LU	Luxembourg
MT	Malta
NL	Netherlands
PT	Portugal
SK	Slovakia
SL	Slovenia
ES	Spain

1. Introduction

In order to address the severity of the 2008 financial crisis, several central banks around the world initiated a series of financial stimulus to control the crisis impact and to lessen its effects. As well, as reducing interest rates to historical minimums central banks generalized the use of unconventional monetary policy (Gagnon et al., 2011). As the focus of this paper is the Euro-area the bank of reference is of course the European Central Bank (ECB), which acts according to the principles that guide it, protect the value of the euro as well as providing stability and security to the Eurosystem (European Central Bank, 2018).

Unconventional monetary policy combines measures such as Large-scale Asset purchases (LSAPs), quantitative and credit easing what these policies have in common is that all of them resulted in large increases of the central banks' balance sheets, introducing liquidity in the markets (Falagiarda & Reitz, 2015; Woodford, 2012).

Below in figure 1 to better portray the expansion of the balance sheet is presented the ECB assets and the key interest rate (KIR).

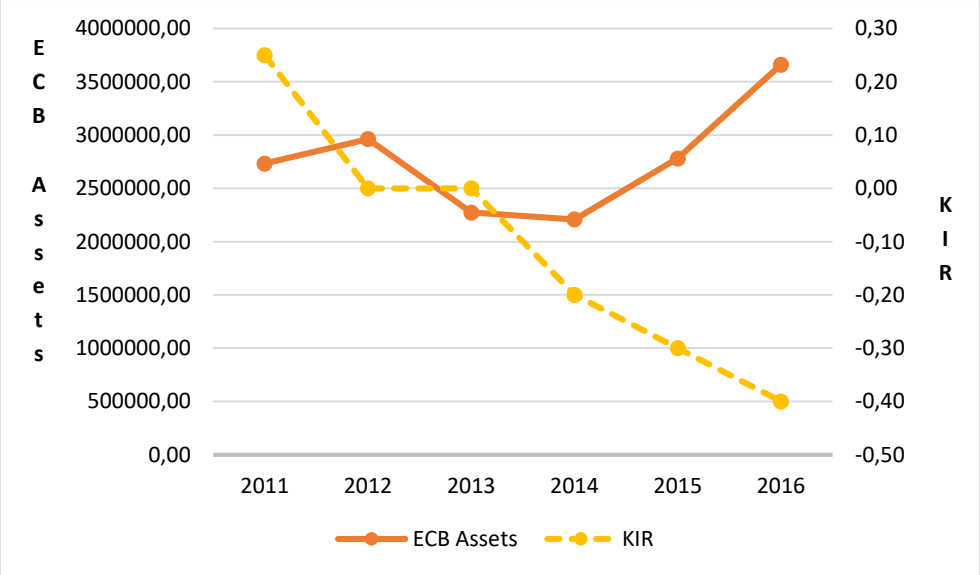

Figure 1: Effects of the ECB monetary policy

Given the harshness of the crisis the global financial system was left extremely crippled and it was required a more active intervention from the central banks, however the novelty of these measures introduces new possibilities for studies to be conducted. As well has the fact that the ECB will be ending its stimulus package at the end of the current year, making this a prime period for analyzing the effect of the programs.

It is well known the importance of banks in a financial system, from facilitating credit to companies, linking borrowers and lenders and providing information in financial services they ease the connection making process thus allowing the rapid exchanges in

which modern markets are based upon. The role of commercial banks in an economy can almost be described as a 'time-machine' due to the fact that what they do is to speed a process that otherwise would take far more time. Enabling industries to invest and to renew themselves has a strengthening effect on the industrial tissue of a country, by enabling customers to consume they introduce life and facilitate the exchanges in the economy. At the end of 2016 there were a total of 3167 banks headquartered in the European Union and the banks headquartered in the Euro-area held a total of 24183 billion euros of assets (European Central Bank, 2017).

All of the above justify studying if the recent policies by ECB effectively aided the banks or if otherwise had a negative impact on them. Since the financial crisis in Europe mutated into a sovereign debt crisis the ECB had to focus on two problems, as such this research has to take into consideration the higher complexity of the European problem.

Taking into account what was said, this research will focus on measuring the effects of these policies in the performance of European banks. The main objective is studying the ECB monetary policies and its effects on the banks performance thus contributing to the literature and giving policy makers new insights over the impacts of their decisions.

The main hypothesis of the study is whether these unconventional monetary policies positively affected the banking performance, negatively affected or did not have any significant impact. This study focused on three banking variables to measure banking performance (return on average equity, return on average assets and net interest margin). The existence of a live debate over the impacts of these measures as well, as various papers finding conflicting results was a factor of motivation for this research to occur.

This research was inspired by the work of Mamatzakis and Bermpei (2016) which focused on the impacts of unconventional monetary policy by the Federal Reserve on the American banks. As the same policies were used by the ECB it becomes relevant to study if the same results were found in the European context or if the differences between the Euro-area and USA produce different consequences.

This paper is organized in the following way: section 2 comprises the literature review in which is focuses on the tools of monetary policy both conventional and unconventional, are discussed the role of banks in the financial system as well as the risks their collapse pose to the economy of a country or group of countries (as is the case of the Euro-area and the challenges faced during the financial and sovereign debt crisis). Section 4 the data and methodology used in the paper is presented. Section 5 the results are showed and discussed and the finally on section 6 the conclusions of the research are revealed.

2. Literature review

The literature in this field is plentiful, however the debate regarding the use of unconventional monetary policies and their impacts on the economy is active and exist conflicting results. Given the relative newness of the introduction of these measures the discussion is open and research in the topic is relevant and required.

Chen et al. (2017) in their paper refer the inexistence of studies on the euro-area economy despite that changes that the euro area as suffered in recent times. Further enhancing the necessity of more research on the subject (Sarte, 2000).

2.1 Monetary policy

The main goal of the central banks trough their policies is to stabilize the economy and promoting prosperity (Suhaibu et al., 2017). Which is in line with the ECB mission statement that the drive of the bank that governs European monetary policy is to create stability and safeguarding the value of the euro (European Central Bank, 2018).

Due to the European monetary policy decisions being centralized in the form of the European Central Bank and the fiscal decisions relegated to the individual countries of the European union, articulation between the two is more difficult as a result the effects of the policies are less effective, several authors state that a stronger coordination by the central bank and the governments would achieve better results (Wang, 2018; Woodford, 2012).

Berger & Bouwman (2017) state that monetary policy does not have an economically insignificant effects in introducing liquidity by small banks during normal periods and this effect would be even smaller during periods of crisis. There are two trains of thought: one believes that if monetary policy may be able to lower interest rates it is unlikely to have a significant effect on price levels, investment and consumption in a timely manner. While the other believe monetary policy has a significant effect on the economy.

According to Vithessonthi et al. (2017) found that the fact that Switzerland is an small and open economy rendered the central bank policies ineffective, due to foreign policies effectively affect the Switzerland economy. Europe is part of a global that is exposed to effects of international shocks and changes, being the US economy one that exerts pressure on the European economy. The European monetary policy suffered from responded to US shocks (Chen et al., 2017).

2.2 European situation

As stated previously in this thesis the euro-area had to face not only the financial crisis but also to tackle the sovereign debt crisis, which led to several European countries

to be assisted due to the increasing yields putting these countries in financial strain. The ECB main objective during this period as to stabilize the euro-area spreads and reducing the yields (Haitsma et al., 2016). This objective of the ECB of stabilizing the European debt market and aiding the reduce of spreads is corroborated by other studies, in which is stated that this objective was fulfilled by injecting liquidity in the system, although the decrease was modest (Gibson et al., 2016).

While the main focus of the ECB was the sovereign debt crisis, European banks were suffering from difficulties during and after the financial crisis. Compared to US banks the European ones had lower profitability this was due to higher funding costs, decreases in earning assets and in efficiency, higher percentages of non-performing loans and the necessity to meet Basel III requirements all caused the lower profitability (Feng & Wang, 2018). Increases of the interest rates were found to lead to stock market decreases (Kholodilin et al., 2009). The securities market programme (SMP) implemented by the ECB was found to redistribute risk from crisis countries to non-crisis countries, due to the accumulation of risk in the central bank balance sheet posing a risk to all of the countries in the euro-zone even those not in crisis (Jäger & Grigoriadis, 2017).

The lower capitalization of the European banks created difficulties in the post-crisis period concerning to the decision over the decision of which policies to pursue. ECB wanted to introduce liquidity in the system by activating the banks' lending channel however this went against their objective of maintaining stability and ensuring the security of the banking system (Gambacorta & Shin, 2016).

The fact that some of the countries that requiring assistance during the sovereign debt crisis used funds to bailout banks also contributed to less soundness of the banking system. Gerhardt & Vennet (2017) found that the banks aided by the government do not show relevant performance increases, and the bailout would contribute for structural changes not being pursued and therefore would result in lower effectiveness of the bailout. Governments should entice banks to redesign their business model in other to become more competitive in the future instead of trying to salvage poorly managed operations(Gerhardt & Vennet, 2017; Kobayashi et al., 2006).

2.3 Effects of monetary policy on banks

Banks are affected by the market interest rates, these rates are positively affected by the monetary policy decisions by the central banks. Changes in the interest rates therefore affect the banks' lending channel and their loans to firms (Vithessonthi et al., 2017). Gibson et al. (2016) state in their study that central bank can effectively intervene in markets especially in markets where it is found signals of overshooting or market malfunctioning.

However, bank lending has been found to not being able to support economic activity (Gambacorta & Shin, 2016). According to Fuinhas (2003) the bank lending channel

depends on the ability of the central bank in controlling the volume of credit that the banking system grants and on the number of economic agents dependent of banking credit.

Bank liquidity creation should be closely monitored in order to predict and lessen the likelihood of crisis, by assessing capital and liquidity requirements (Berger & Bouwman, 2017). As well as the size of banks, due to larger banks posing a systemic risk to the economy, tightening capital requirements could ensure the soundness of this entities (Laeven et al., 2016).

D'Avino (2018) suggested that an international bank lending channel was activated due to unconventional monetary policies being put into action. Banks transferred the excess of money in the domestic markets to their overseas charters. In this way stimulating the transference of effects of the unconventional monetary policies into countries that did not use them.

Ricci (2015) studied the impact of these policies on the stock price of large European banks, and found that non-ordinary measures affected the banks more profoundly than simple changes in interest rates. The timing of action by the central bank was as a key aspect on the level of impact that the actions had on the banks. The intervention of central banks was more important to banks with low liquidity and located in countries which were more affected by the financial crisis.

A lot of studies focus on the role that central banks should take in the economy and how they should act. Guerello (2014) in an article over the cost of deviating from optimal monetary policy stated that a monetary policy that was not optimal would not hurt the economy, however it would be risky to deviate from what was required.

Mamatzakis & Bermpei (2016) studied the effects of unconventional monetary policy on the performance of American banks. Their conclusions were that monetary policy affected banks differently, when regarding the nature of the banks, commercial and saving banks were affected negatively. They suggested that banking performance should be taken into account by the Federal Reserve when deciding how to intervene.

2.4 Unconventional vs conventional monetary policy

Sheedy (2017) states in his article that unconventional monetary policy instruments are less effective than the conventional at stabilizing the economy. He defines the unconventional monetary policy instruments as any instrument of the central bank that does not depend on its operation on changing risk-free nominal interest rate in the present or in the future. This includes several type o balance sheet expanding policies, quantitative easing (QE), and credit easing (CE), subsidized lending, and emergency lending. As well as referring that the effects of unconventional monetary tools are not equivalent to the effects of conventional monetary tools.

McMahon et al. (2018) in their article reveal that unconventional balance sheet policies would cause the central bank to not be able to implement a steady path of

inflation in a situation where they would otherwise be able to. A less restraining monetary policy decision can announce a period of worsening economic conditions and this leads to stock market decreases, the opposite is also true, unexpected tightening of the monetary policy is positively related with higher stock prices (Haitsma et al., 2016).

Table 1:Conventional monetary operations

Conventional operations
Main refinancing operations (MRO): regular liquidity providing reverse transactions (mainly 1 week maturity)
Longer-term refinancing operations (LTRO): Same sort of operation yet the maturity can span from 3 up to 48 months. Can have other monetary policy objectives.
Fine tuning operations: Smoothing effects on interest rates caused by unexpected liquidity fluctuations. Can take the form of: foreign exchange swaps, collection of fixed term deposits.
Structural operations: reverse transactions, outright transactions issuance of debt certificates
Standing facilities: aim to provide and absorb overnight liquidity signal the general monetary policy stance and bound overnight market interest rate.
Minimum reserves: Are an integral part of the operational framework for the monetary policy in the euro area. Aims of stabilizing money market interest rates of creating (or enlarging) a structural liquidity shortage. Reserve requirement of each institution is determined in relation to elements of its balance sheet.
Regular open market operations: one week liquidity providing operations (MRO's); 3 month liquidity providing operations (LTRO's) Purpose: steer short-term interest rates, manage the liquidity situation and to signal monetary policy stance in the euro area (MRO) and providing additional longer-term refinancing to the financial sector (LTRO).

The data presented in the table 1 represents all the operations that the ECB performs which they refer to as conventional operations. In table 2, the unconventional measures are described, the information from table 1 and 2 was taken directly from the ECB.

Table 2: Unconventional monetary operations

Unconventional measures
LTRO: with longer maturities up to 3 years.
TLTROs: provide financing to credit institutions for periods of up to 4 years. Longer term funding at attractive conditions to banks in order to further ease private sector credit conditions and stimulate bank lending to the economy.
APP: outright asset purchases: sustaining growth across the euro area, and in consistency of keeping/achieving inflation rates below 2%. Beginning in 2009.

Kenourgios et al. (2015) state that the expansion of the ECB balance sheet was mainly due to delivery of long-term loans in exchange for collateral. Their findings reveal that QE induced volatility in the system, as well as a negative delayed response of the euro before and after the ECB announcements, according to the them this was due to investors not having a clear signal of what future monetary policy decisions would be, mainly attributed to the price stabilization objective that the ECB was following.

Table 3: Types of monetary policy

Conventional Monetary Policy	Unconventional Monetary Policy
Open Market Operations	Forward Guidance
Discount Rate	Quantitative Easing
Reserve Requirements	Large-Scale Asset Purchases (LSAP's)

Kobayashi et al. (2006) analyzed the effects of Bank of Japan (BoJ) QE policy on the Japanese banks' equity values. They highlight the controversial idea of the ability of QE to impact the banking sector. Although credit decreased during the QE program they state that this was due to banks being under pressure to enhance their financial positions by disposing of non-performing loans, in the absence of a QE program the availability of credit could have decreased at a much higher pace. They found that the program apparently favored weaker Japanese banks. However, they conclude that the QE program may have delayed a much need restructuration by cushioning these banks.

Hanabusa (2017) reveals that the Bank of Japan pursued their objective of enticing changes in expectations by combining QE program with forward guidance. They state that the program success is measured trough the analyses of the yields, by doing this the deemed it successful. This corroborates the idea defended by other authors that the central bank can effectively intervene in the market. The expansion of narrow money lowered short-term interest rates and increased inflation, which was one of the BoJ targets, purchases of exchange traded funds (ETF) stimulated the stock and foreign exchange markets (Matsuki et al., 2015).

3. Data

The data used in this thesis is comprised of data from 1183 euro area banks the time period spans from 2011 to 2016, from the 18 countries members of the euro area at the beginning of time horizon, all the variables are in first differences.

In figure 2 is described the sample of the banks, with the number of banks per each of the Euro-area countries, it is relevant to be observed due to highlighting the heterogeneity of the sample. Austria (AT), Belgium (BE), Cyprus (CY), Estonia (EE), Finland (FI), France (FR), Germany (DE), Greece (GR), Ireland (IE), Italy (IT), Latvia (LV), Luxembourg (LU), Malta (MT), Netherlands (NL), Portugal (PT), Slovakia (SK), Slovenia (SL) and Spain (ES). Analyzing the graphic it is possible to identify the discrepancies regarding the number of banks per country, Austria being the most represented country with close to 400 banks, and countries like Latvia and Cyprus with a very small number of banks have much less relative weight in the European banking system.

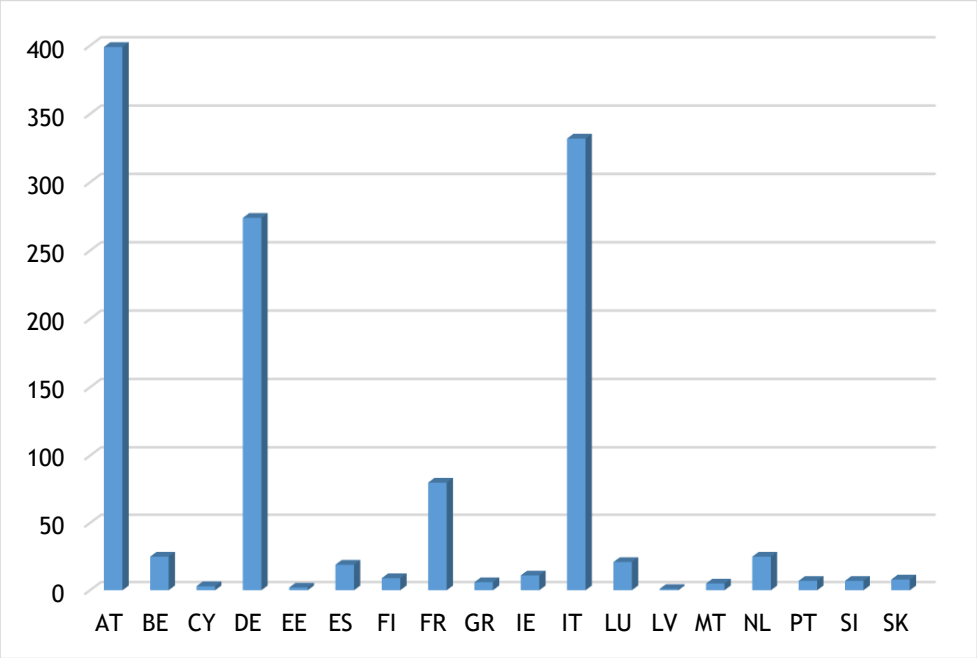

Figure 2: Banks distribution from Euro-area countries

The period was chosen with the objective of maximizing the number of countries and banks present in the study. In order to assess the effects of the unconventional monetary policies on the European banks as a whole, from big banks to smaller banks, large countries to smaller countries, while trying to reduce the heterogeneity of the euro area.

Table 4: Variable description and source

Descriptive variables			
Variables	**Acronyms**	**Databases**	**Units**
Total Assets	TA	Orbis Bank Focus	Millions of euros
Total Equity	EQT	Orbis Bank Focus	Millions of euros
Total Loans	LOANS	Orbis Bank Focus	Millions of euros
Net Interest Margin	NIM	Orbis Bank Focus	%
Operation Income	OPI	Orbis Bank Focus	Millions of euros
Return on average Assets	ROAA	Orbis Bank Focus	%
Return on average Equity	ROAE	Orbis Bank Focus	%
Unemployment	UN	WorldBank Database	%
Inflation	INF	WorldBank Database	%
Excess Reserves	EXC	ECB	Millions of euros
Central Bank Assets	CBA	ECB	Millions of euros
Gross Domestic Product (Constant LCU)	GDP	WorldBank Database	Millions of euros
Key Interest Rate	KIR	ECB	%

The dependent variables are three: return on average equity it measures the performance of a bank based on its average shareholders' equity; return on average assets measures asset efficiency during the time period; net interest margin to measure investment efficiency. It were used averaged values due to this giving a better assessment of the returns of the banks during the year. Averaging the index eliminates volatility introduced by fluctuations that occur at the end of the year.

The variables total assets and total equity, were introduced to study the effects that the size of the bank could have on their performance as well as assessing the problematic of the systemic risk that larger banks could pose to the economy (Laeven et al., 2016). Total loans is used as proxy for the bank lending channel, its introduction is relevant due to the unconventional measures used by the ECB having impact in the economic system as whole.

Several macroeconomic variables were introduced in the model as a result of during the literature research several authors suggesting combining banks micro data with macroeconomic variables in order to study the relationship between them (Burriel & Galesi, 2018; Mamatzakis & Bermpei, 2016). The Gross Domestic Product (GDP) serves as proxy for the wealth of the nation, the euro area is comprised of countries with vastly distinct economies, in terms of size, industrial fabric or composition. The largest economy in the euro area in 2016 was Germany with a GDP above 2.8trillion euros and the smallest GDP belonged to Malta with a value of roughly 6.6 billion euros these values are present in the database and were collected from the Worldbank database.

The unemployment and inflation variables were added due to the time period that was chosen, the financial and sovereign debt crisis heavily affected the economic growth of the euro area countries, this variables contributed to capturing these effects and aiding the stabilization of the models.

The variables from the ECB are the most important in this research, this are the variables than can capture the unconventional monetary policies that were introduced

in recent years. The central bank assets, captures the expansion of the balance sheet due to the QE programs and LSAP's (Gagnon et al., 2011; Woodford, 2012). The excess reserves are important since this tool highly impacts bank liquidity, loan creation which affects the operations of the banks and their profitability as well as the impact that this tool has on economic activity (Dressler & Kersting, 2015; Nguyen & Boateng, 2013). The key interest rate of the central bank is relevant due to its importance for the economy as a whole, it impacts the stock market and bank equity values (Campmas, 2018; English, Van den Heuvel, & Zakrajšek, 2018; Kholodilin et al., 2009; Vithessonthi et al., 2017).

Table 5: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
roae	7098	3.484404	17.34017	-596.314	341.169
roaa	7098	0.3902433	1.811965	-46.209	44.838
tas	7098	30499.76	146546.7	2.419	2164103
eqt	7098	1592.93	7182.09	-6055.991	103174
loans	7098	13680.34	60589.14	0	784767
kir	7098	-0.1083333	0.2168421	-0.4	0.25
cba	7098	2769827	482305.1	2208240	3661439
gdp	7098	1327579	978147.4	6693.038	2855352
nim	7098	1.823246	1.111867	-3.479	30.383
opi	7098	603.5421	3066.429	-2190.685	54939
un	7098	7.815004	3.651905	4.1	27.5

4. Methodology

This section is dedicated to the methodology used to conduct the research. The nature of the data contained in the sample of this study was imperative in the decision of the methodology to be applied. The specificities of the data, the high number of banks and the detail of being all from the same monetary system suggested *a priori* the possibility of problems concerning the presence of contemporaneous correlation (or cross-sectional dependence). The time period chosen as well as the heterogeneity of the banks in the sample also suggested the possibility of presence of heteroscedasticity.

In order to check the reservations concerning the data the approach was the following: i) first the nature of the data was studied; ii) the presence of heteroscedasticity, cross-sectional dependence is tested. If these situations were to be confirmed and also due to the fact that the T<N, meaning that the number of the variables is higher than the number of time periods the most appropriate methodology that should be applied is the panel-corrected standard errors (PCSE)(Marques & Fuinhas, 2012; Reed & Ye, 2011).

The data started to be tested with approach explained above which was the one used by Marques & Fuinhas (2012) on their article. Using the Stata 14 software the data was tested. Primarily the correlation coefficient matrix was computed which revealed correlation between the coefficients. The Variance Inflation Factor (VIF) was also calculated and certain variables revealed problems of collinearity. To address this issue the variables were differentiated, which eliminated the problem of correlation. The table A.1 (in the appendix) shows the correlation between the coefficients of the variables. The VIF was recalculated which showed that the problem of collinearity had been eliminated due to the mean VIF revealing a value of 3.29, being well below 10 and the fact that none of the variables presented a value of 10, this issue was considered eliminated. The following test that was performed was to check the existence of heteroscedasticity that was tested using the Breusch-Pagan/Cook-Weisberg test these revealed the presence of heteroscedasticity. Afterwards, cross-sectional dependence was tested recurring to the method developed by Pesaran (2004), which confirmed the suspicion.

As stated before, if the presence of heteroscedasticity and cross-sectional dependence were to be confirmed and also due to T<N the PCSE estimator would be appropriate to be used, as the suspicions were confirmed that was the methodology used to estimate the models. This methodology was developed by Beck & Katz (1995) based on a transformation of the ordinary least square estimator (OLS). The equations for the three models estimated are described below:

$$DROAE_{bt} = \alpha + \sum_{x=1}^{x} \beta_x I_{x\,bt} + \varepsilon_{bt} \quad (1)$$

$$DROAA_{bt} = \alpha + \sum_{x=1}^{x} \beta_x I_{xbt} + \varepsilon_{bt} \quad (2)$$

$$DNIM_{bt} = \alpha + \sum_{x=1}^{x} \beta_x I_{x\,bt} + \varepsilon_{bt} \quad (3)$$

The three equations for the models estimated are presented above, (1) is the estimations for the model with the dependent variable of Return on Average Equity ($DROAE_{bt}$), (2) the model with the dependent variable of Return on Average Assets ($DROAA_{bt}$) and (3) the model with the dependent variable being Net Interest Margin ($DNIM_{bt}$). In all of the models, I_{xbt} is the vector of x explanatory variables. The bt represent respectively the number of banks and the number of years. The error term is represented by ε_{bt}.

Table 6: Diagnostic tests

Dependent variables	**DROAE**	**DROAA**	**DNIM**
Mean VIF		3,29	
Breusch-Pagan/Cook-Weisberg	1566,19***	94,25***	163,07***
Pesaran CD	37,594***	66,065***	58,856***
Note: ***,**,* denotes respectively 1%, 5% and 10% significance.			

5. Results and discussion

In this section, the results are presented as well as discussed. As explained above after the specificities of the panel were analyzed and studied, it was concluded that the models should be estimated recurring to the PCSE estimator, due to it being proven to provide robust estimates if the panel is heteroscedastic and cross-sectional dependent.

Table 7: Models estimates

Variables	Model I - DROAE	Model II – DROAA	Model III - DNIM
DTA	-0.000168***	-2.75e-06**	-4.60e-07*
DEQT	0.0085044***	0.0001579***	0.0000138***
DEXC	-3.36e-06***	-3.13e-07**	-2.01e-07***
DCBA	1.09e-06***	1.50e-07***	
DKIR		-0.2904146**	-0.2607725**
DINF			0.135475***
R^2	0.1165	0.0107	0.0644
Note: ***,**,* denotes respectively 1%, 5% and 10% significance; D – stands for first differences.			

The estimates of the models were made in order to make them the most parsimonious possible. This was done toward maximizing the value of the information in the models, while reducing interferences by variables that would only introduce noise and perturb the validity of the estimations.

The models started to be estimated the first one model I (check table 7) studied the effects of the independent variables on the return on average equity of the banks. The estimation of the model lead to four of the variables being significant. The variables of total assets (DTA), total equity (DEQT), excess reserves (DEXC) and central bank assets (DCBA). Both DEQT and DCBA were revealed to have positive impacts in the return on average equity of the banks. While DTA and DEXC were demonstrated to negatively impact the dependent variable.

Model II with the dependent variable being the return on average assets (DROAA) had a higher number of significant variables five: DTA, DEQT, DEXC, DCBA and DKIR. The same variables that had a positive impact in the dependent variable in the model I also positively impacted DROAA in model II them being DEQT and DCBA. However, the number of variables having a negative impact on the ROAA were three: DTA, DEXC and DKIR.

The final model, model III also had five significant variables at the end of the estimation, with the objective of achieving the most parsimonious model possible, DCBA was not significant in this model but DINF was calculated to be statistically significant. The dependent variable in this model is the net interest margin (DNIM). As in the models described before DEQT positively impacted the dependent variable, similarly DINF had the same effect. DNIM was however found to be negatively impacted by DTA, DEXC and DKIR.

The variable DTA had a negative impact on the dependent variable in all of the models (-0.000168; -2.75e-06; -4.60e-07) meaning that the more assets a bank has the less profitable it will be. This can be attributed to the worries that were described in the literature concerning large banks and systemic risk they pose to the economy as revealed in the article of Laeven et al. (2016). Other aspect, regarding bigger banks is that they are present in more countries, as well as the fact that they have a higher levels of asset diversification together with the fact that the European economy was debilitated during this period due to the financial crisis as well as the sovereign debt crisis that ensued afterwards may justify the native impact of the total assets on the profitability of the banks.

Concerning the effects of equity (DEQT) on the banks performance, as equity is defined as the total value of a company, in this case a bank, less the value of its liabilities a higher value of the equity represents a more solid bank and therefore a more profitable one. In the literature review was assessed the fact that European banks were undercapitalized during this period as such banks with higher equity values were in better shape than banks with lower equity values and this can explain the positive impact that this variable has in all of the models (0.0085044; 0.0001579; 0.0000138).

The fact that the variable DEXC negatively impacts bank performance in all of the models (-3.36e-06; -3.13e-07; -2.01e-07) was not unexpected. As stated in the data section of this thesis the excess reserves affect bank liquidity and bank loan creation, as the banks contained in the database in study are all commercial banks and their operations are dependent of loans the fact that the reserves increase was expected to decrease their profitability. Which was what was found in the estimations.

Regarding the effects of DCBA on the profitability of banks, this variable as stated above was only significant in model I and II with an output of 1.09e-06 and 1.50e-07, respectively. The positive effect that the assets of the central banks has on the banks performance may be due to the more availability of money allowing banks to increase loan creation and therefore expanding their operations and subsequently enhancing their lucrativeness. In the literature was highlighted the fact that European banks had higher levels of non-performing loans when compared with us banks, this together with the need to meet Basel III requirements led to lower profitability, thus the higher availability of money in the system may have eased the effort of the banks to recapitalize themselves consequently aiding their performance.

The variable of the key interest rate (DKIR) according to the estimations had a negative impact in the dependent variables of models II and III (-0.2904146; -0.2607725). During the literature review it was revealed that increases of the interest rate led to decreases of the stock market which would explain the negative effect that this variable has on DROAA and DNIM. Also, the ability that the interest rate has on economic activity and equity appears to have strong impact on banking performance. The central bank with

its measures, lowered the interest rate to negative values and as the results appear to express this would aid the profitability of the banks.

At last, DINF which was only significant in the model III, with the dependent variable being DNIM. This variable had the highest output of all the independent variables estimated with a coefficient of 0.135475. Higher inflation levels would lead to increases of the net interest margin. According to the ECB and their expressed objective of wanting with the unconventional monetary tools to increase the inflation rate, means that the central banks is right when trying to increase the rate as it would lead banks to improve their performance. A higher inflation rate enables banks to profit from the increase of spreads, however it does also increase their funding costs. The speed of adjustment between funding costs and the increase of spreads, may be determinant in the performance of banks, the lag appears to have a key role in this situation. It would be interesting and relevant to study the impact of inflation as well as the way a central bank wants to achieve their inflation target goal and its subsequent impact on banking performance.

6. Conclusion

The study was performed with a sample composed of 1183 commercial banks from the Euro area countries, with the time span being from 2011 to 2016. The results showed that the policies introduced by ECB had small impacts in the banking performance, which was suspected due to the information collected during the literature review. Excess reserves were revealed to have a negative impacts on the profitability of the banks, in opposite direction the expansion of central bank assets was calculated to positively impact the euro area banks.

The key interest rate, and the reduction that it has suffered in recent years appears to aid banks improving their performance. As suggested in the beginning of this thesis the situation in Europe was more complex than the one that US had to face, due to the existence of the sovereign debt crisis, this may have influenced the decision of central bank. The ECB was more focused in solving the debt crisis that was severely affecting several member countries of the monetary union, trying to juggle between maintaining the stability of the euro, the soundness of the banking system and aiding the debilitated countries, may have enabled a less optimal environment for euro area banks. The problems faced by major European banks are a proof of this, as is the case of the German Deutsche Bank which is facing difficulties that are known to everybody.

The fact that the measures studied in this thesis are to be terminated at the end of the present year (2018) makes research on this topic even more relevant to study how the ending of these programs is going to affect banks and their overall competitiveness when compared to other banks in the global financial markets.

There are plenty of ways to continue the study on this field with focus on the euro area, studying the asset levels of the banks with a keener eye as well as testing the differences between the several countries that compose the euro area could bring important information for policy makers, bank managers and other players in the financial market. With regards to policy implications, the ECB should pay close attention to the euro area banking system and to the fact that European banks are less profitable than their US counterparts this could pose risk to the European economy if a future crisis were to occur.

7. References

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8. Appendix

Table A.1: Correlation Matrix

	droae	droaa	dta	deqt	dloans	dgdp	dun
droae	1.000						
droaa	0.5009	1.000					
dta	-0.0223	-0.0005	1.000				
deqt	0.3206	0.0936	0.2771	1.000			
dloans	0.041	0.0183	0.5663	0.3033	1.000		
dgdp	0.0017	-0.0057	0.0099	0.0352	0.0411	1.000	
dun	-0.0463	-0.0009	0.0066	-0.0284	-0.0396	-0.7463	1.000
dinf	-0.0001	0.0234	0.0323	0.0042	0.0234	0.1681	-0.2378
dexc	-0.0158	0.0074	0.0479	0.0093	0.036	0.1154	-0.1838
dkir	0.0083	-0.0181	-0.0609	-0.0299	-0.0132	0.0755	-0.0996
dcba	-0.0096	0.0155	0.0592	0.01	0.0499	0.3356	-0.3791
dnim	0.0464	0.0853	-0.0066	0.0316	-0.0038	-0.0011	-0.028
dopi	0.0316	0.0332	0.254	0.1072	0.2925	0.0069	-0.0127

	dinf	dexc	dkir	dcba	dnim	dopi
dinf	1.000					
dexc	0.5677	1.000				
dkir	-0.2632	-0.5589	1.000			
dcba	0.5827	0.8783	-0.2925	1.000		
dnim	0.1371	0.0154	-0.0644	0.0088	1.000	
dopi	-0.0205	0.0052	0.0075	0.0153	0.0374	1.000