iscte

**INSTITUTO
UNIVERSITÁRIO
DE LISBOA**

The impact of Basel III on the Return On Equity of the European banking sector

José Maria Duarte (82524)

Master in Business Economics and Competition

Supervisor: Professor Diptes Chandrakante Prabhudas Bhimjee,

Asistant Professor (Invited),

Iscte Business School, Economics Department

August, 2022

The impact of Basel III on the Return On Equity of the European banking sector

José Maria Duarte (82524)

Master in Business Economics and Competition

Supervisor: Professor Diptes Chandrakante Prabhudas Bhimjee,
Assistant Professor (Invited),
Iscte Business School, Economics Department

August, 2022

I dedicate this thesis to my parents who I believe are always watching over me, and thus I fulfil not only a dream of mine but also theirs.

Acknowledgments

First of all, I would like to thank my supervisor, Professor Diptes Bhimjee, for all his support, patience and clarifications along this path.

Additionally, I would like to thank my family for all the strength and faith they have placed in me, not only during this journey, but throughout my life.

I would also like to thank my friends who have always encouraged and helped me during my life.

Finally, I would like to thank Dr.ª Maria Anjos Canha and Dr.ª Rute Isabel Dias for allowing me to interview them during this work and thus adding content of enormous quality to this thesis.

Resumo

Nos últimos anos, a regulação sobre as instituições bancárias tem sido cada vez mais rígida e evolutiva, de forma a mitigar acontecimentos como a crise financeira de 2008. Após esta mesma crise percebeu-se que a regulação à data não era suficiente, pois as instituições financeiras apresentavam falta de liquidez e elevada alavancagem financeira. Desta forma, o Comité de Basileia sobre supervisão bancária lança o Acordo Basel III. Com a introdução deste acordo, diversos estudos apontavam que o mesmo iria afetar o Return on Equity bancário. Este estudo pretende avaliar o impacto das variáveis do Basel III no ROE bancário do sistema europeu, assim como analisar a evolução das variáveis que o compõem. Através da revisão de literatura foi possível identificar quais as variáveis que fazem mais sentido para o estudo.

De forma a produzir este trabalho, foram utilizados diferentes métodos complementares. Numa parte mais quantitativa retirou-se os dados da base de dados do Banco Central Europeu. A estes dados foi aplicado uma regressão linear múltipla com standard robust errors. De forma a complementar o estudo, foram realizadas entrevistas a especialistas na área.

Os resultados indicam que o risco de crédito tem um impacto positivo sobre o ROE, por outro lado os ativos ponderados pelo risco e o rácio de common equity tier 1 demonstram um impacto negativo sobre o ROE. Analisando as variáveis, os principais resultados indicam um decréscimo significativo dos non-performing loans, assim como um reforço de capital e o crescimento de ativos mais seguros nos balanços dos bancos.

Palavras-chave: Instituições Financeiras, Acordos Basel, Requisitos de Capital, Regulação Bancária, Risco Bancário, Rentabilidade.

JEL Classification System:

G28: Government Policy and Regulation

G20: Financial Institutions and Services: General

Abstract

In recent years, regulation on banking institutions has been increasingly strict and evolving in order to mitigate events such as the 2008 financial crisis. After the crisis, it was realised that regulation at the time was not enough, as financial institutions lacked liquidity and had high financial leverage. Thus, the Basel Committee on Banking Supervision launched the Basel III Accord. With the introduction of this accord, several studies pointed out that it would affect banking Return on Equity (ROE). This study aims to assess the impact of Basel III variables on banking ROE in the European system, as well as to analyse the evolution of the variables that compose it. Through the literature review it was possible to identify which variables make more sense for the study.

In order to produce this work, different complementary methods were used. In a more quantitative part, data was taken from the European Central Bank database. A multiple linear regression with standard robust errors was applied to these data. In order to complement the study, it was conducted interviews with experts in the field.

The results indicate that credit risk has a positive impact on ROE, on the other hand, risk-weighted assets and the common equity tier 1 ratio show a negative impact on ROE. Analysing the variables, the main results indicate an significantly decrease on non-performing loans, as well as a strengthening of capital and the growth of more secure assets on banks' balance sheets.

Keywords: Financial Institutions, Basel Accords, Capital Requirements, Banking Regulation, Banking Risk, Profitability.

JEL Classification System:

G28: Government Policy and Regulation

G20: Financial Institutions and Services: General

Index

Index of Figures

Index of Tables

Glossary of Acronyms

ASF: Available Stable Funding

BIS: Bank for International Settlements

CETier 1: Common Equity Tier 1

CVA: Credit Valuation Adjustment

EBA: European Banking Authority

ECB: European Central Bank

EU: European Union

HQLA: High Quality Liquidity Assets

IRB: Internal Rating-Based

LCR: Liquidity Coverage Ratio

NPL: Non-Performing Loan

NSFR: Net Stable Funding Ratio

OTC: Over-the-Counter

ROE: Return on Equity

RSF: Required Stable Funding

RWA: Risk Weighted Asset

SA: Standard Approach

SSM: Single Supervisory Mechanism

CHAPTER 1

Introduction

The first activities considered banking, where there was a process of lending money by a creditor to a debtor, appear in the historical period of the Babylonia Empire (World Bank, 2022), which shows that, very early on, society realized the importance of banking. Over time, banks have always provided capital to sustain economic growth. As the global banking system evolved, it became clear that these institutions needed to be regulated in order to avoid economic and financial crises.

During the second half of the 20th century, the need arose for the creation of an international regulatory and supervisory committee, the main motivation being the desire to globalise national banking sectors, which until then had been governed by domestic regulation. This process stems from World War II (WW2), where there were changes in power and banking restrictions were mostly removed. The growth of the Euro-dollar market comes to show the first step of globalization at the financial level post WW2, with Europe being a virtually unregulated place in the 1960s and a threat to economies that were already regulating at the time (Goodhart, 2011). With the growth of Euromarket the G10 leaders decided to create The Euro-currency Standing Committee in 1971 in order to passively control them.

However, the genesis of the BCBS (The Basel Committee on Banking Supervision) arose as a result of two historical events in the 1970s, the first being the Arab and Israeli war of Yom Kippur, whose confrontation led to a cut in oil production, causing the price of this commodity to quadruple. The second was the collapse of Herstatt Bank, thus creating doubt as to whether the banking system was really safe. Thus, the need arose to create a standard system of regulation related to active international banks. In July 1988, the G10 along with Spain launched the first Basel I protocol, The International Convergence of Capital Measurements and Capital Standards (Balin, 2008).

Nonetheless, being the first agreement, Basel I had notable limitations such as, for example, not considering the debtor's rating when attributing a risk weight to exposure, which meant that debtors with a B or C rating had the same weight. Also, it was not possible to distinguish between on and off-balance sheet assets, which led to financial engineering. In this way, banks were encouraged to reduce their equity and to leverage up more easily, which caused this lack of sensitivity to distort economic reality and the decisions to be taken based on this agreement (Saidenberg and Schuermann, 2003). Therefore Basel II - The New Framework was created, which was an evolution of the latter at various levels and had the purpose of greater control over second-tier banks, and come into force in 2004.

However, with the 2008 banking crisis, the need to restructure Basel II became evident, but even before the onset of this crisis, banks were already over-leveraged and the fall of Lehman Brothers was the final evidence of this event. Added to this were poor management and low levels of liquidity buffers, which led to one of the biggest financial crises in history. As this crisis unfolded, Basel III was created, which contains greater levels of regulation on liquidity risk, management and supervision. It makes Tier 2 more restrictive by creating higher quality capital, as well as forcing banks to provide more stable funding to combat the crisis years and easy-to-sell assets, i.e. more liquid assets that are easily convertible, such as government bonds (BIS, 2021).

Taking into consideration this evolution in the banking sector, with the implementation of the Capital reinforcement, the focus on banking leverage and the liquidity of the banking institutions present in Basel III, it makes perfect sense to analyse the evolution of this agreement with the Return on Equity of the banking sector, as it is in this indicator that these new requirements may also have an impact (Härle *et al.*, 2012).

The study of the impact of Basel III on bank ROE is due to the fact that several variables of Basel III raise possible changes in the return on equity of banking institutions. The increasingly tighter regulation that second-tier banks are subjected to makes banks' risk management a major growth area. The regulator's requirement for banks to hold more capital relative to their risk weighted assets means that management must better manage their assets to maintain the performance of the banking business.

According to the new Basel III Accord, banks are required to have 4.5% Common Equity Tier 1 plus a buffer of 2.5% of this same core capital, which means that Common Equity Tier 1 must be at least 7% of the total RWA (King & Tabert, 2011). According to Dr.ª Rute Dias, Director of RWA at Caixa Geral de Depósitos, equity capital is more expensive than borrowed capital[1].

On the other hand, it is important to highlight that banks are not obliged to make capital increases, as what they have to control is the Tier 1 ratio on RWA, so banks can only decrease their RWA, through assimilating more safer assets, such as Treasury bonds.

In addition, there are also new Basel III impositions on liquidity and leverage. In terms of liquidity, this new agreement includes two indicators: a short-term indicator, the LCR - Liquidity Coverage Ratio, which aims to increase the short-term resilience of banking institutions' liquidity, and a medium/long-term indicator, the NSFR - Net Stable Funding Ratio, which aims to promote longer-term liquidity stability (King & Tarbert, 2011). Taking the latter into consideration, banks will have to hold more liquid assets, i.e., easily convertible to liquidity assets to combat possible shocks.

---

[1] Dr.ª Rute Isabel Dias was one of the people interviewed for this dissertation. She is the director of RWA at Caixa Geral de Depósitos.

The Leverage Ratio emerges in this new agreement due to the fact that many banks managed their capital well against their RWA, but went into the 2008 financial crisis overleveraged in debt (Acosta-Smith *et al.* 2020). Thus, the regulator requires in this new agreement that banks have at least 3% Tier 1 Capital against their total on and off balance sheet exposure. This means that even if banks control their RWA, they also have to control their maximum exposure against capital and thus more adequately choose the type of operations of their business.

In light of the above, several authors have studied the impact of Basel III on bank ROE, starting with a McKinsey study which suggests that the average ROE of European banks could fall between 3.7 and 4.3 per cent by 2019 (Härle *et al.* , 2012). Sharing the same view, other studies point to a decrease in EU banking ROE during the Basel III implementation period (e.g. Cohen & Scatigna, 2014). Cohen and Scatigna also make a detailed analysis of the evolution of some important variables of this new Basel accord, such as RWA, capital ratio, or even assets, where it is found that there was a strengthening of capital, but there was also an increase in RWA. Shukla (2018) also studied the impact that capital, leverage ratio and liquidity indicators have on the profitability of Indian banks, leading to the view that capital has a negative impact on banking performance.

With this in mind, this dissertation addresses the impact of Basel III on bank ROE and the performance of the Basel III variables.

Thus, this research aims to answer the following academic research questions:

- What is the impact of Basel III on banking ROE in the EU?

- What is the evolution of the Basel III variables during the period under study?

Therefore, the main goals of the present Dissertation are to verify which Basel III variables have a statistically significant influence on the return on equity of banks in the EU, namely: Common Equity Tier 1, Credit Risk, NPL, Total Assets, Operational Risk and RWA. On the other hand, the Dissertation also critically analyses the trajectories of the variables during the period under study, namely between the second quarter of 2015 and the third quarter of 2021. This time window was chosen because it is the most recent and complete sample available in the European Central Bank database used at the time of the writing of this dissertation, thus coinciding with the implementation of Basel iii by banking institutions.

This Dissertation is divided into six chapters. The first chapter explains the main theme of the study, providing an overview of banking regulation and its evolution until Basel III. This chapter also includes the research problem and the objectives of this work.

The second chapter refers to the Literature Review, which identifies the important areas that are addressed in banking regulation, from its genesis to Basel III. This chapter includes several concepts of variables included in the Basel Accords, such as the RWA, the Capital Ratio, or even the Leverage Ratio.

Thus, in the Literature Review it is possible to verify the variables that are important for the intended analysis.

The third chapter is the Conceptual Model of this thesis, where the variables for this study are verified taking into consideration several authors and previous studies. This chapter also contains the hypotheses for this study.

The fourth chapter refers to the methodology used in this research, which explains how and in what way this work will be done, taking into account the data collection and the model to be used.

The fifth chapter is the follow-up of the previous chapter, where there is the analysis of the results obtained and the presentation of their interpretation, with a discussion of the results.

Finally, the sixth and last chapter aims to demonstrate the conclusions of this study, as well as the main contributions, limitations and future recommendations on the subject of this thesis.

Literature Review

2.1.   Regulation on Financial Institutions:

The term 'Macroprudential' has been used over the last decades by leading experts within Central Banks and has been at the centre of the action and thinking of the Bank for International Settlements (Cecchetti, 2012). According to Clement (2010), the term 'macroprudential' dates back to the 1970s, where in 1979 in the context of a Basel Committee on Banking Supervision, it was suggested that microeconomic problems were beginning to emerge into macroeconomic problems, which took 'microprudential' to 'macroprudential'. This term leads us to what we know today know as regulation and supervision.

Apătăchioae (2013) describes regulation and supervision as the two close concepts, banking regulation being the set of rules of banking conduct, issued by competent authorities, of which their results are achieved by imposition. On the other hand, banking supervision is defined by the act of observation, where one should meticulously witness compliance with all rules of banking regulation. These concepts become important in banking during the second half of the twentieth century, where they became quite relevant and began to be implemented.

2.2.   Reason to regulate:

There are two main sets of reasons for financial regulation. The most logical is related to the protection of bank clients' main interests. Financial institutions tend to be more 'protective' of the information related to the banking business and corresponding stakeholders (e.g. bank clients) which constrains the flow of information in order to best protect clients. The second reason is systematic risk. Since banks are intermediary institutions for payments and capital allocation, they are seen as a potential source of systemic risk (Saindenberg & Schuermann, 2003).

Saindenberg and Schuermann (2003, p.3) also add that "Capital requirements are intended to mitigate moral hazard by ensuring that the owners of a financial institution have a stake in ensuring that the firm does not engage in fraud and conforms to conduct of business rules, if only to avoid fines or loss of equity value." This statement fully describes the agent's problem, who tries to mitigate it as much as possible, namely through bank regulation compliance.

2.3.   Origins of the Banking System:

During the second half of the 20th century, the need arose for the creation of an international regulatory and supervisory committee, the main motivation being the desire to globalise national

banking sectors, which until then had been governed by domestic regulation. This process stems from World War II (WW2), where there were significant changes in the global balance of powers, and banking restrictions were mostly removed. The growth of the Euro-dollar market demonstrates the first step of globalization at the financial level post-WW2, with Europe being a virtually unregulated marketplace in the 1960s and a threat to economies that were already regulating at the time (Goodhart, 2011). With the growth of Euromarket the G10 leaders decide to create The Euro-currency Standing Committee in 1971 in order to control them passively. However, the origin of the BCBS (The Basel Committee on Banking Supervision) arose as a result of two historical events in the 1970s, the first being the Arab and Israeli war of Yom Kippur, whose confrontation led to a cut in oil production, causing the price of this commodity to quadruple. The second was the collapse of the Herstatt bank, thus creating doubt as to whether the banking system was really safe. Thus, the need arose to create a standard system of regulation over active international banks. In July 1988, the G10 along with Spain launched the first Basel I, The International Convergence of Capital Measurements and Capital Standards (Balin, 2008).

2.4. The International Convergence of Capital Measurements and Capital Standards - Basel I

According to the BIS (2022), Basel I was divided into four main pillars: the first one 'The Constituents of Capital' where capital was divided by its quality. Capital was divided into two groups, the first and highest quality group called 'Tier 1' which included assets such as reserves or shares, i.e. equity that was more liquid and easy to convert. The second group 'Tier 2' included, in addition to 'Tier 1', other types of assets such as subordinated debt, potential reserves or equity financial instruments. The second pillar is 'Risk Weighted Assets', i.e. where assets were weighted by their type. This pillar was divided into five categories where each one had a different weight: assets such as sovereign debt or demand money were given a 0% weight, i.e. assets were considered risk-free. On the other hand, bank debt from non-OECD institutions could have a risk weight of 100%.

$$RWA \; = \; RW \; x \; EAD \qquad (1)$$

Equation 1 - RWA Calculation in Standard Approach

The third pillar is the Basel I target ratio. The ratio of equity to risk-weighted assets should be higher than 8%. This capital included Tier 1 and Tier 2 capital.

$$\frac{\text{Capital}}{\text{Risk-Weighted Assets}} \geq 8\% \tag{2}$$

Equation 2 - Capital Requirement

Finally, the last pillar was the transition and implementation of the agreement, where the Central banks of each country were responsible for making the 2nd order banks adopt these standards within a period of four years (Balin 2008).

2.5. Basel III:

The implementation of Basel II and Basel III followed a continuation of the improvement of the Basel Accords in order to improve the banking system and protect the global economy. There was a need to strengthen the Basel II Accord, which showed weaknesses in view of the banking reality experienced at the beginning of the 21st century. However, the greatest motivation for the migration to Basel III was actually the beginning of the 2008 financial crisis (BIS, 2021).

2.5.1. 2008 crisis:

Lehman Brothers went bankrupt on September 15, 2008 and triggered one of the biggest financial crises ever recorded. As of May 2008, the bank held $639 billion in assets and $613 in liabilities, according to financial statements for the second quarter of that year. The bank had over 25,000 employees and was the largest US investment bank (Beccar-Varela et al., 2017).

Mcdonald (2009: 134-135) quotes a sentence from the Former Global Head, Mike Gelband, which translates the reality experienced inside the bank before the collapse: "It's all leverage, essentially false money from false housing prices and false mortgages that may never be paid".

The bank was targeting mortgage related financial products such as CDOs (collateral debt obligation), which are products that accompany an underlying loan, such as loans on cars or houses in this case. There was clear speculation that the housing sector would continue to grow, however home loans were given to people who had little collateral to support the underlying loan. So in case the housing market fell, the risk would be transferred to the investment banks holding the CDOs which tracked the underlying asset prices (Guhathakurta, 2012). This movement was one of the main reasons for the fall of Lehman Brothers in September of 2008.

Allen and Moessner (2011) reveal that this crisis has similarities to the 1931 crisis. The transfer of settlement and security is a common point in both crises. According to this study, in the last quarter of 2008, funds were transferred from the euro area in excess of $300 billion, which shows an effect of this crisis. Another characteristic was the investment in more liquid and secure assets such as bonds of the safest countries.

According to the BIS (2022), the banking industry entered the 2008 financial crisis over-leveraged and with inappropriate liquidity buffers. In addition to these indicators, weak risk management and weak structures led to a liquidity and excessive credit growth crisis.

2.6.   Basel III – Changes:

As previously mentioned, risk and governance are directly linked to banking and it is often lack of awareness in risk taking that causes financial crises of global proportions as seen in the previous crisis, originating in the leading 'too-big-to-fail Lehman Brothers. The Global Financial Crisis increased awareness that, in order to have a sustainable and innovative growth, it is necessary to have a stable financial and economic environment (Rubio & Carrasco-Gallego, 2016).

Consequently, the responsible institutions had to react to this crisis and these risk factors, so in November 2010, the new Accord called 'Basel III' with the new capital and settlement standards was approved by the G20 leaders in Seoul and later that year agreed by the Basel Committee meeting (BIS, 2021).

The main purpose of the latest Basel Accord is to improve and strengthen the regulation, supervision, and management of banks. Basel III was created to make banks more resilient and better qualified to absorb shocks, such as crises coming from the financial or economic sector, to increase transparency and also to improve management risk and governance (Walker, 2011).

Thus, Basel III is based on several changes from Basel II, among them:

1.   Strengthening the capital base;

2.   Leverage Ratio; and

3.   Bank Liquidity;

2.6.1.   Strengthening the capital base

2.6.1.1.   Quality Capital:

Among the priorities is increasing the quality of banks' capital, as well as their consistency and transparency. To this end, Basel III aims to ensure a portfolio of quality assets in banks, in order to deal with possible crises that may arise in the coming years. In the first accord known as Basel I, the first pillar describes the composition of Capital in Tier 1 and Tier 2, where the first is the core capital of the

bank and the second the capital of slightly lower quality. In this same agreement, the minimum required capital ratio is equal to 8% (Saidenberg & Schuermann, 2003), however the proportion of capital in these sub-types of capital had to be equal i.e. 4% minimum of each (Balin, 2008). In the new Basel III agreement, the minimum required of total capital is still 8% of RWAs, however this agreement requires 75% of this capital to consist of Tier 1, leaving only 25% for Tier 2 type capital. In this new agreement Tier 1 is still divided into 'Common Equity tier 1' and 'Additional Tier 1', the former contains the bank's more core capital, such as retained earnings and common stock. Banks must have a 'Common Equity Tier 1' of 4.5% of total RWAs, leaving 1.5% for 'Additional Tier 1' and 2% for Tier 2. In this way, the quality of the capital of banks increases compared to previous agreements, thus making banks more resilient (King & Tarbert, 2011).

2.6.1.2.   Additional buffers:

Even during crises, many banks continued to distribute dividends to their shareholders, which led to the bank's core capital becoming eroded. Thus, two additional buffers were created in order to sustain quality capital in banks (Walker, 2011). The main message to be retained from these requirements is the need to create sustainability bubbles during the upward stages of the economy's business cycles in order to more easily overcome times of crisis.

2.6.1.3.   Capital Conservation Buffer:

This additional capital buffer is required from banks to create pools of 2.5% of RWAs in the form of Common Equity Tier 1, up from the 4.5% required previously, which leads to Common Equity Tier 1 actually being 7% of RWAs. Banks will be exempt from this capital conservation buffer in times of crisis, but dividend or bonus payments will also be limited until the buffer is recomposed (King & Tarbert, 2011). The table below shows the percentage of dividends that can be distributed according to Basel III.

Common Equity Tier 1 (percent)	Existing Buffer (percent)	Percentage of earnings available for discretionary distributions
4.5 – 5.125	0 – 0.625	0%
5.125 – 5.75	0.625 – 1.25	20%
5.75 – 6.375	1.25 – 1.875	40%
6.375 – 7.0	1.875 – 2.5	60%
>7.0	2.5	100%

Table 1 – Table adapted from King and Tarbert (2011).

2.6.1.4. Countercyclical Buffer:

This buffer is also created as a way of placing restrictions on banks' participation in the growth of credit design and thus ensure a reduction of losses in times of crisis (BIS, 2021). Financial assets such as Collateralized Debt Obligations, which are assets that follow sets of loans created by financial institutions (pool of loans), tend to increase in times of economic growth, where there is an increase in credit, which causes bubbles to be created, as not all of these loans have a desirable level of quality. So when the bubble eventually bursts, the loans stop being paid, which causes banks to reduce loans and thus the number of loans in default increases. In this way, the countercyclical buffer is created which can have values between 0 - 2.5% depending on the financial situation experienced in each jurisdiction (King & Tarbert, 2011).
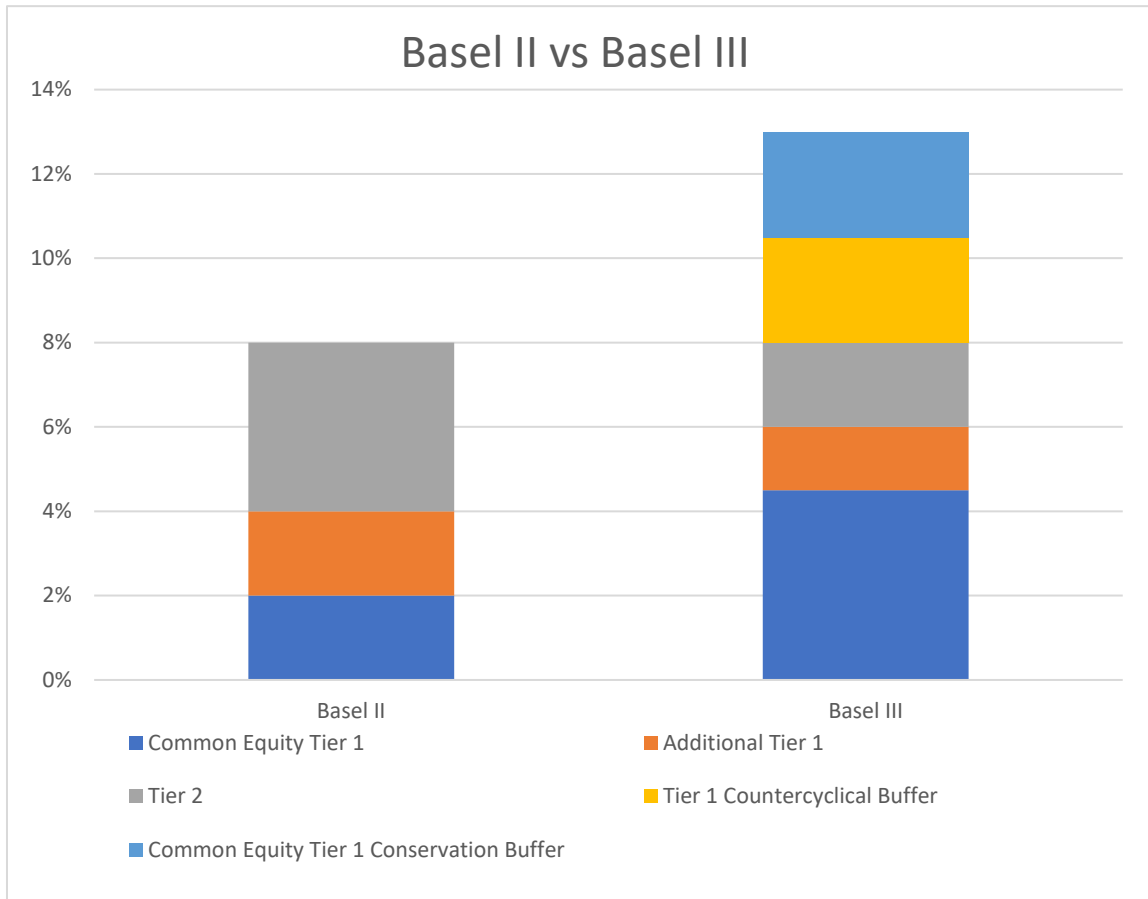
Figure 1 – Figure adapted figure from King & Tarbert (2011)

2.6.2. Leverage Ratio:

Many banks managed to keep the ratio of capital to RWAs at positive levels even though they were clearly leveraged, which showed that they were choosing assets well, but that there were many banks that entered the last crisis overleveraged in relation to debt (Acosta-Smith et al. , 2020). As a result of this finding, the Basel Committee decided to adopt a leverage ratio where Tier 1 is compared to total exposure. This ratio has to be higher than 3%, thus being able to control banks' leverage levels. By taking in total exposure rather than RWAs, the overall assets chosen are not relatively important, but rather the exposure of banking institutions, thus controlling capital in two perspectives (Capital Requirements and Leverage Ratio), leading to more effective regulation and increased resilience of banks (Walker, 2011).

$$\text{Leverage Ratio} \;=\; \frac{\text{Tier 1 Capital}}{\substack{\text{On and off balance} \\ \text{sheet exposures}}} \;\geq\; 3\% \qquad\qquad (3)$$

(including derivatives, repos and other securities financing transactions)

Equation 3 – Leverage Ratio

2.6.3. Bank Liquidity:

During the initial liquidity phase of the Global Financial Crisis, there were banks that, even though they could control their capital levels, they were having great difficulties in terms of liquidity. Thus, Basel III introduced two main control measures. The first was the Liquidity Coverage Ratio, whose main objective was to promote the robustness of the liquidity of banking institutions, in a short term perspective. This ratio is intended to ensure that the banking industry is able to combat and absorb stress shocks that could come from this sector, and thus reduce the possibility of these risks spreading to the real economy. The second was the Net Stable Funding Ratio (NSFR), whose main purpose is to complement the LCR, i.e. to promote the robustness of banks' liquidity from a long-term perspective. The aim is for banks to create more stable and sustainable liquidity structures (BIS, 2013).

2.6.3.1. Liquidity Coverage Ratio

According to BIS (2013, p.4), "The Committee has developed the LCR to promote the short-term resilience of the liquidity risk profile of banks by ensuring that they have sufficient HQLA to survive a significant stress scenario lasting 30 calendar days[2]."

$$\text{Liquidity Coverage Ratio} = \frac{\text{High Quality Liquid Assets}}{\text{Total net cash outflow over a 30 day period}} \quad (4)$$

Equation 4 – Leverage Coverage Ratio

This ratio has two components, the first being the value of HQLA stock under stress conditions. The second, the total net cash outflow, is calculated according to Basel III parameters. This ratio can never be less than 100%[3].

HQLA have particular characteristics, these are assets that can be quickly and easily converted into cash, without having a huge loss (BIS, 2013).

The fundamental characteristics, according to BIS are that they have **Low Risk**, i.e. assets that tend to be less risky tend to have greater liquidity; **Ease and certainty of valuation**, i.e., more standardized assets, with simple structures are usually assets that are easier to convert.[4]; **Low Correlation with risky assets**; and **Listed on a developed and recognised exchange**, increasing the asset's transparency.

---

[2] Bank for International Settlements (2013, p.4).
[3] Since 2019
[4] Bank for International Settlements (2013, p.7)

HQLA are divided into two main asset categories. The categories are Level 1 and Level 2. In the former assets can be admitted without any kind of limits, in the latter only up to 40% of the total HQLA can be included (BIS, 2013).

Level 1:

Below we can see the limitations of Level 1.

Level 1 assets	A) Coins and Banknotes;
	B) central bank reserves (including required reserves), to the extent that the central bank policies allow them to be drawn down in times of stress;
	C) marketable securities representing claims on or guaranteed by sovereigns, central banks, PSEs, the Bank for International Settlements, the International Monetary Fund, the European Central Bank and European Community, or multilateral development banks, and satisfying all of the following conditions: 1) assigned a 0% risk-weight under the Basel II Standardised Approach for credit risk; 2) traded in large, deep and active repo or cash markets characterised by a low level of concentration; 3) have a proven record as a reliable source of liquidity in the markets (repo or sale) even during stressed market conditions; and 4) not an obligation of a financial institution or any of its affiliated entities;
	D) where the sovereign has a non-0% risk weight, sovereign or central bank debt securities issued in domestic currencies by the sovereign or central bank in the country in which the liquidity risk is being taken or in the bank's home country;
	E) where the sovereign has a non-0% risk weight, domestic sovereign or central bank debt securities issued in foreign currencies are eligible up to the amount of the bank's stressed net cash outflows in that specific foreign currency stemming from the bank's operations in the jurisdiction where the bank's liquidity risk is being taken.

Table 2 - Adapted from Bank For International Settlements (2013: p. 12)

Level 2:

Level 2 is divided into two groups Level 2A and Level 2B permitted by the regulator. These assets cannot exceed 40% of the total stock after the haircut is applied to them. All Level 2A assets held in

the HQLA stock will suffer a haircut of 15%. Within level 2A, assets such as securities that may mirror sovereign guarantees, central banks, among others, are included. In addition, bonds issued by banks or corporate debt securities may also be included (BIS, 2013).

The assets that may be part of level 2B must have the endorsement of national authorities, where they are expected to ensure that banks have structures and ways to monetise potential risks that may come from these assets (BIS, 2013).

The Total Net Cash Outflow over 30 day period is the denominator of the LCR ratio, this being the expected difference between the cash outflow and the cash inflow in a 30-day stress period scenario. The total expected cash outflow is calculated by multiplying the exposures by weights according to the type of financial instrument. The same applies to the total expected cash inflow (BIS, 2013).

Basel III provides the tables with the factors to be multiplied by the total of each amount. Below we can see some examples of cash outflows.

Cash Outflows	
A. Retail deposits:	
Demand deposits and term deposits (less than 30 days maturity)	
• Stable deposits (deposit insurance scheme meets additional criteria)	3%
• Stable deposits	5%
• Less stable retail deposits	10%
Term deposits with residual maturity greater than 30 days	0%
B. Unsecured wholesale funding:	
Demand and term deposits (less than 30 days maturity) provided by small business customers:	
• Stable deposits	5%
• Less stable deposits	10%
Operational deposits generated by clearing, custody and cash management activities	25%
• Portion covered by deposit insurance	5%
Cooperative banks in an institutional network (qualifying deposits with the centralised institution)	25%

Table 3 - Adapted from Bank For International Settlements

As can be seen, a retail deposit with a maturity of less than 30 days can be a cash outflow, so its amount has to be multiplied by 3%, 5% or 10%, according to its typology.

Initially, this ratio did not have to be 100%, as it was introduced progressively, as can be seen in the table below[5].

	1 January 2015	1 January 2016	1 January 2017	1 January 2018	1 January 2019
Minimum LCR	60%	70%	80%	90%	100%

Table 4 - Adapted from Bank For International Settlements

2.6.3.2.   Net Stable Funding Ratio (NSFR)

In order to control liquidity, on the one hand Basel III introduced the LCR which controls this short-term risk, and on the other it introduced the NSFR which aims to promote medium and long-term funding by establishing minimum amounts of liquidity (King & Tarbert, 2011).

The NSFR is a ratio which must be equal to or greater than 100%, with the Total Available Stable Funding (ASF) in the numerator and the Total Required Stable Funding (RSF) as the denominator.

$$\frac{\textbf{Total Available Stable Funding (ASF)}}{\textbf{Total Required Stable Funding (RSF)}} \geq 100\% \qquad (5)$$

Equation 5 – Net Stable Funding Ratio (NSFR)

Available Stable Funding

According to BIS (2018, p.1), "A bank's total ASF is the portion of its capital and liabilities that will remain with the institution for more than one year. The broad characteristics of an institution's funding sources and their assumed degree of stability are the basis for determining ASF"[6].

---

[5] Bank for International Settlements (2013. p.2)
[6] Bank for International Settlements (2018, p.1)

Below we have a summary table of the categories and associated ASF factors.

| Summary of liability categories and associated ASF factors | Table 1 |

ASF factor	Components of ASF category
100%	• Total regulatory capital (excluding Tier 2 instruments with residual maturity of less than one year) • Other capital instruments and liabilities with effective residual maturity of one year or more
95%	• Stable non-maturity (demand) deposits and term deposits with residual maturity of less than one year provided by retail and small business customers
90%	• Less stable non-maturity deposits and term deposits with residual maturity of less than one year provided by retail and small business customers
50%	• Funding with residual maturity of less than one year provided by non-financial corporate customers • Operational deposits • Funding with residual maturity of less than one year from sovereigns, PSEs, and multilateral and national development banks • Other funding with residual maturity between six months and less than one year not included in the above categories, including funding provided by central banks and financial institutions
0%	• All other liabilities and equity not included in the above categories, including liabilities without a stated maturity (with a specific treatment for deferred tax liabilities and minority interests) • NSFR derivative liabilities net of NSFR derivative assets if NSFR derivative liabilities are greater than NSFR derivative assets • "Trade date" payables arising from purchases of financial instruments, foreign currencies and commodities

Table 5 - Adapted from Bank For International Settlements

Required Stable Funding

Conforming to BIS (2018, p.1) "A bank's total RSF is the amount of stable funding that it is required to hold given the liquidity characteristics and residual maturities of its assets and the contingent liquidity risk arising from its off-balance sheet exposures[7]."

Both ASF and RSF are calculated by multiplying their exposure value by the typology of ASF or RSF they belong to. These weightings, in both cases, are between 0% and 100%.

2.7.   Implementing Basel III:

Being a change with a sense of disruption to improve the regulation of the banking system and because it is somewhat complex, the BIS established the deadlines for the implementation of this agreement. These deadlines for harmonisation can be seen below.

---

[7] Bank for International Settlements (2018, p.1)

	Phases	2013	2014	2015	2016	2017	2018	2019
Capital	Leverage Ratio		Parallel run 1 Jan 2013 – 1 Jan 2017 Disclosure starts 1 Jan 2015				Migration to Pillar 1	
	Minimum Common Equity Capital Ratio	3.5%	4.0%	4.5%				4.5%
	Capital Conservation Buffer				0.625%	1.25%	1.875%	2.5%
	Minimum common equity plus capital conservation buffer	3.5%	4.0%	4.5%	5.125%	5.75%	6.375%	7.0%
	Phase-in of deductions from CET1*		20%	40%	60%	80%	100%	100%
	Minimum Tier 1 Capital	4.5%	5.5%	6.0%				6.0%
	Minimum Total Capital		8.0%					8.0%
	Minimum Total Capital plus conservation buffer		8.0%		8.625%	9.25%	9.875%	10.5%
	Capital instruments that no longer qualify as non-core Tier 1 capital or Tier 2 capital		Phased out over 10 year horizon beginning 2013					
Liquidity	Liquidity coverage ratio – minimum requirement			60%	70%	80%	90%	100%
	Net stable funding ratio						Introduce minimum standard	

* Including amounts exceeding the limit for deferred tax assets (DTAs), mortgage servicing rights (MSRs) and financials.

- - transition periods

Table 6 - Adapted from Bank for International Settlements

Empirical Model and Research Hypotheses

This chapter describes the empirical conceptual model herein used and the connection between the different variables under study, taking into account the previously described literature review.

3.1. Empirical Model

After conducting the Literature Review, and taking into account works previously carried out within the scope of banking regulation, the variables that will sustain this study are presented as follows.

The profitability of a bank is a variable used in several studies addressing the impact of banking regulation. In particular, whether the variables that are introduced or adjusted during the evolution of regulation and supervision in the banking world affect the profitability of banks, as seen in several studies such as Cohen & Scatigna (2014) or Shukla (2018). In 2012, Mckinsey presented a study on the impact of the new Basel accord on ROE, where it assumed it would fall between 3.7% and 4.4% in the EU by 2019 (Härle *et al.* , 2012).

There are several studies that address the entire implementation of Basel III and the variables under study (Mahapatra, 2010), which serves as a basis for other studies that intend to analyse profitability according to these same variables. In a wide range of studies, Capital is a variable that is studied in order to understand whether it influences banks' ROE (e.g. Shukla, 2018). Credit risk is also analysed in studies involving Basel III (e.g. Abbas *et al.* , 2019), as well as Total Assets, RWA and Operational area (e.g. Cohen & Scatigna, 2014). Non-performing Loans is a variable used in studies that relate this variable to efficiency (e.g. Karim *et al.* , 2010), so it makes sense to use this variable to measure its significance against ROE.

Thus, the independent variables that may be relevant to this study in question are: CETier 1, Credit Risk, NPL, Total Assets, Operational Risk and RWA.

Below we regress a model created in order to answer the research question underlying the present Dissertation, where we can address the relationship of the independent variables with ROE.
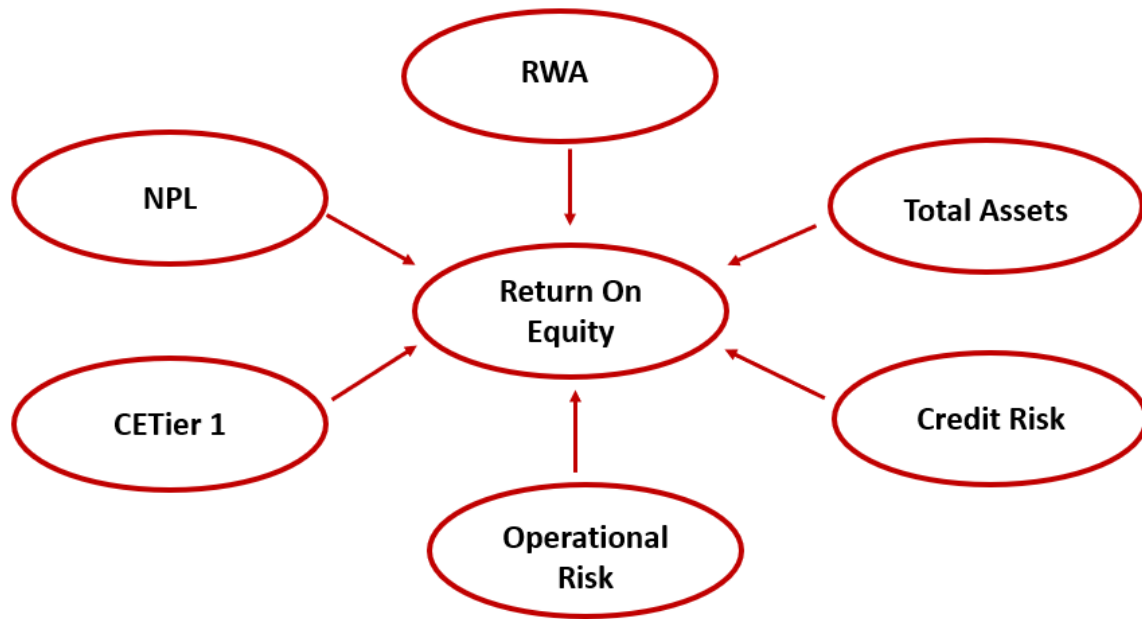
Figure 2 - Conceptual Model

3.2. Hypotheses:

Taking into account the literature review previously conducted, the articles previously analysed and the empirical model carried out, the hypotheses of this Dissertation are formulated as follows:

Capital is a variable that is studied in several papers for its influence on banking performance and is also one of the main indicators since the implementation of Basel I (Balin, 2008). That said, it makes sense to be one of the independent variables, having been studied in previous works (e.g. Shukla, 2018). Thus, hypothesis 1 studies whether CETier 1 ratio is statistically significant for the study of ROE.

H1: CETier 1 ratio has a statistically significant influence on bank ROE.

Credit Risk is the main risk component and has been addressed in different researches (e.g. Cohen & Scatigna, 2014; Abbas *et al.*, 2019), so it is included in this research. Thus, hypothesis 2 studies whether credit risk exposure is statistically significant in the variation of ROE.

H2: Credit Risk has a statistically significant influence on bank ROE.

Non-Performing Loans appear in several banking studies as they are a gauge of credit in default, besides that they are associated with bank asset quality (Bholat *et al.*, 2016) and efficiency of banking institutions (e.g. Karim *et al.*, 2010). That said, hypothesis 3 examines whether NPLs are statistically significant for the study of ROE.

H3: The NPL ratio has a statistically significant influence on bank ROE.

Assets are a variable recurrently used in studies of banking regulation (Mahapatra, 2010), not only for its own growth, but also for its comparison with RWA, because in this way it is possible to

understand the asset management policy of banks (Cohen & Scatigna, 2014). Thus, hypothesis 4 verifies the statistical significance of the influence of Assets on bank ROE.

H4: Assets have a statistically significant influence on bank ROE.

Operational Risk is a component of RWA, which validates this variable's inclusion in our estimation; in addition, it is a variable used in several previous studies (e.g. BIS, 2021). In conclusion, hypothesis 5 analyses whether Operational Risk is statistically significant for the study of bank ROE.

H5: Operational Risk has a statistically significant influence on bank ROE.

Risk Weighted Asset or Total Risk Exposure Amount is one of the most widely used variables in Basel studies (e.g. Cohen & Scatigna, 2014), having been included as the denominator of the main regulatory ratio on capital (Balin, 2008). Thus, hypothesis 6 assesses whether RWAs have a statistically significant relationship with bank ROE.

H6: RWAs have a statistically significant influence on bank ROE.

Methodology

This chapter describes the methodology to be used in order to meet the goals of this Dissertation. Firstly, the qualitative part of this research and how it is divided is explained. In a second part, the quantitative study of this thesis is explained.

4.1. Qualitative study

In this part, an empirical research technique will be used, which is the semi-structured interview. At this point, we intend to create a set of open questions taking into account the new Basel III implementations, that is, when asking the question, we do not intend a predefined answer, but rather to generate some constructive thought regarding the new measures of this Agreement. These questions will be based on work carried out by BIS in order to have a common thread with all the research. This point will serve as a complement to the analysis of the quantitative research part of this Dissertation, discussed below. These interviews are aimed at two Interviewed Professionals currently highly placed in risk management/department in a major Portuguese bank. The main Idea is to critically examine the more practical aspects of the application of Basel III, bearing in mind that the more theoretical dimension is carried out in the literature review of this Dissertation.

4.2. Quantitative study

This study aims at a more general and economic analysis of the application of Basel III. Thus, an econometric study is conducted, where a multiple linear regression is applied to the important variables for this Dissertation, as further explained below. In this research the dependent variable will be bank ROE.

4.3. Population and Sample

Population is a distinct group of individuals who have identical characteristics. In statistical studies, a population is a set of individuals from which a statistical sample is taken to conduct a study (Momoh, 2021). According to the same author, a sample is a statistically significant portion of a population, thus this sample may have a margin of error or a standard deviation, as only the whole population would not have a standard deviation.

4.3.1. Qualitative study Structure

In a more qualitative part the sample will be the responses to the people interviewed, which will support the more quantitative dimension of the Dissertation.

The questions aim at provide more open answers where more data can be extracted than just a closed answer to the question. In this way, the questions arise based on themes addressed by the BIS within the scope of the Basel III agreement and on studies previously carried out, but they may not be addressed to the same person, as the two professionals work in different risk areas. The themes of the questions being the following:

Constructs:	Items
Basel III General	SSM - Single Supervisor Mechanism
Independent Variables	Link between different variables in the scope of Basel III
Different types of risk	Average weight of each risk
Calculation methods	Variables evolution from the Standard Approach to the IRB
Performance	Banking ROE
Study	Impact of Variables

Table 7 - Interviews themes

4.3.2. Quantitative study Structure

In order to efficiently collect the best variables it is first necessary to establish a target population, which was carried out as follows:

This analysis will extract data from banks that are under the remit of The Single Supervisory Mechanism, i.e. the supervision of the banking system in Europe. This group includes the ECB and the banking authorities of each participating country. Thus, this analysis becomes more reliable and with consistent data. These data will be extracted from the SUP - Supervisory Banking Statistics database of the European Central Bank, which contains a wide range of variables useful for this study. This data is collected from a large number of banks that provide the data to their local banking authorities and ultimately the ECB has access to them.

22

The chosen variables take into account researches previously carried out in the context of Basel III and its impacts. Each variable will have 26 data points (although not reaching 30 data per variable), which is already large enough and of sufficient quality to apply a multiple linear regression, in view of the limitations related to this specific database. Finally, with this database, it is possible to have a very consistent overview of the development of the variables within the European banking system.

Taking into account the literature review previously prepared, studies already carried out and the changes that have occurred under this new agreement, the variables chosen are the following:

Theme/Variable	Study:	Adapted from:
Banking Exposure	BASEL III MONITORING EXERCISE	EBA (2020)
CETier 1 Ratio	Banks and capital requirements: channels of adjustment	Cohen & Scatigna (2014)
Non-Performing Loans	BANKING CREDIT MARKET IN ROMANIA: BASEL II IMPACT	IACOBESCU & OPRIŢESCU (2008)
Exposure to Credit Risk	Basel I to Basel III: Impact of Credit Risk and Interest Rate Risk of Banks in India	Rizvi; Kashiramka & Singh (2018)
Exposure to Operational Risk	Banks and capital requirements: channels of adjustment	Cohen & Scatigna (2014)
Total Assets	Banks and capital requirements: channels of adjustment	Cohen & Scatigna (2014)
Euro Stock	Capital requirements and banks performance under Basel-III: A comparative analysis of Australian and British banks	Lea; Nasir & Huynh (2020)
Inflation	Capital requirements and banks performance under Basel-III: A comparative analysis of Australian and British banks	Lea; Nasir & Huynh (2020)
ROE / ROA	Basel III: Now the hard part for European banks	Härle et al. (2012)

Table 8 - Dissertation themes/variables

Data Analysis and Results

5.1. Quantitative study

The data taken from the European Central Bank were analysed with IBM SPSS Statistic 26. The total number of significant institutions at the highest level of consolidation[8] within the Single Supervisory Mechanism varied as shown in the figure below:
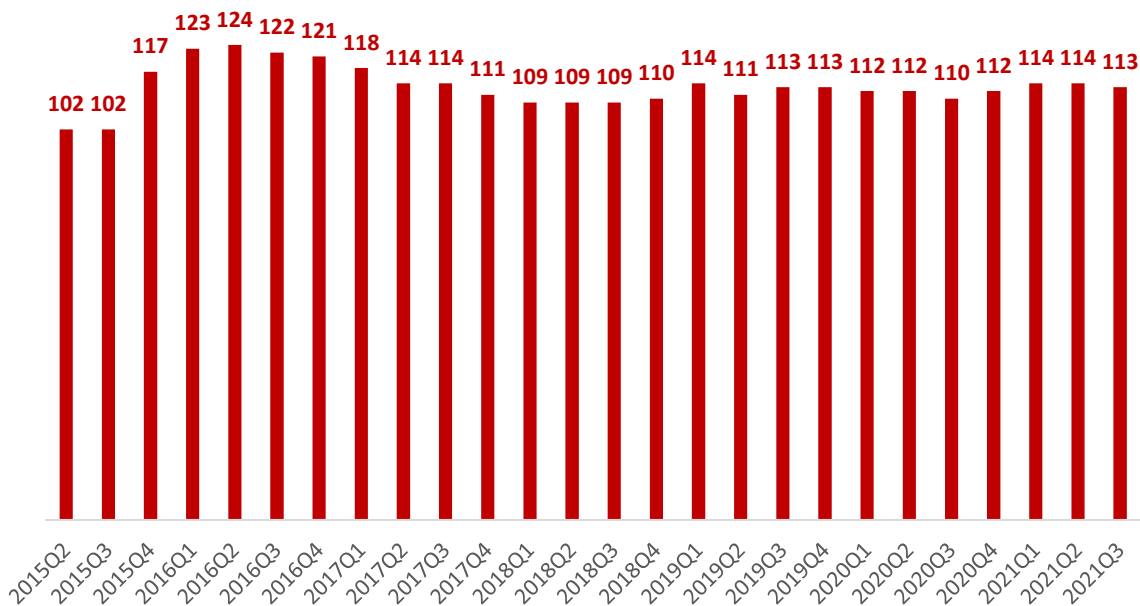

Figure 3 - Number of significant institutions at the highest level of consolidation within the Single Supervisory Mechanism - full sample

It should be noted that the Single Supervisory Mechanism (SSM) is a pillar of the EU banking system, as it is a supervisory system composed of banking institutions in the euro area and outside the euro area, but which are part of the EU, that choose to be part of this mechanism. This makes it possible to have highly transparent and reliable data. This analysis takes into account 26 quarters starting in the 2nd quarter of 2015 to the 3rd quarter of 2021. This time window was chosen because it is the most recent and complete sample available in the European Central Bank database used at the time of the writing of this dissertation, thus coinciding with the implementation of Basel iii by banking institutions.

---

[8] Significant institutions considered at the highest level of consolidation within the Single Supervisory Mechanism are those that prepare their consolidated accounts in accordance with national accounting standards, along with significant institutions that report individually.

5.1.1. Descriptive Analysis of the Variables:

5.1.1.1. Common Equity Tier 1 Ratio:

As one of the main changes in Basel III compared to the previous Accord, below we can see the changes in the quality of capital by analysing Common Equity Tier 1.
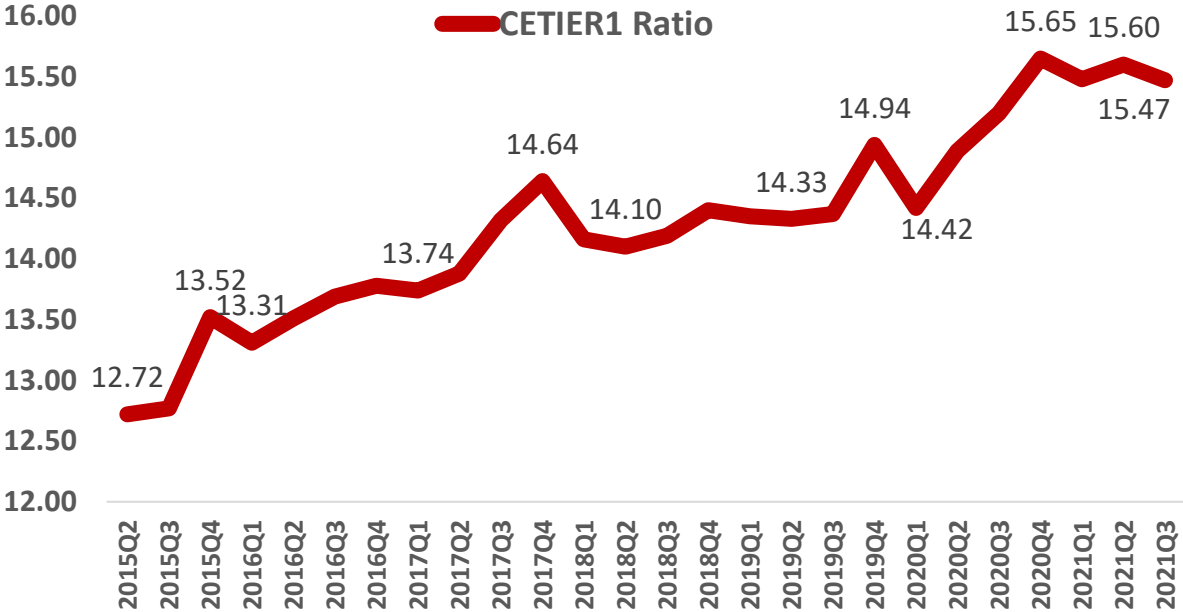

Figure 4 - Common Equity Tier 1 Ratio %

The figure above shows that banks in the EU have been increasing their Tier 1 ratio from an average of 12.72% to 15.47%, reinforcing the idea that a more robust capital structure is increasingly being adopted. It should be noted that the measures imposed by the regulator are now a minimum Common Equity Tier 1 of 7%, counting on the 2.5% buffer, against 2% under Basel II (King & Tarbert, 2011). This means that banks in the EU, on average, are presently above the minimum required.

5.1.1.2. LCR and Leverage Ratio:

The Liquidity Coverage Ratio and Leverage Ratio are two innovations in Basel III.

According to the BIS, the liquidity Coverage Ratio arises in order to make banks' short-term liquidity positions more resilient, i.e. to have sufficient HQLA to face 30-day stress test scenarios.

According to Figure 5, the Liquidity Coverage Ratio shows a positive evolution, standing at 137.64 in the third quarter of 2016 and 173.78 in the third quarter of 2021, which shows that even during the pandemic, banks were able to control their liquidity.

The need for the implementation of the leverage ratio occurred at the time of the 2008 financial crisis, after banks showed good Tier 1 ratios to their Risk Weighted Assets, and simultaneously were

clearly leveraged. This demonstrated that banks knew how to appropriately choose assets according to their interests (Acosta-Smith et al. , 2020).

According to Figure 5, it can be seen that, on average, banks are above the minimum required ratio of 3%, starting at 4.99% in the third quarter of 2016. The Leverage Ratio shows some oscillations in recent years, but always presents an upward trend, reaching its peak at the end of 2020.
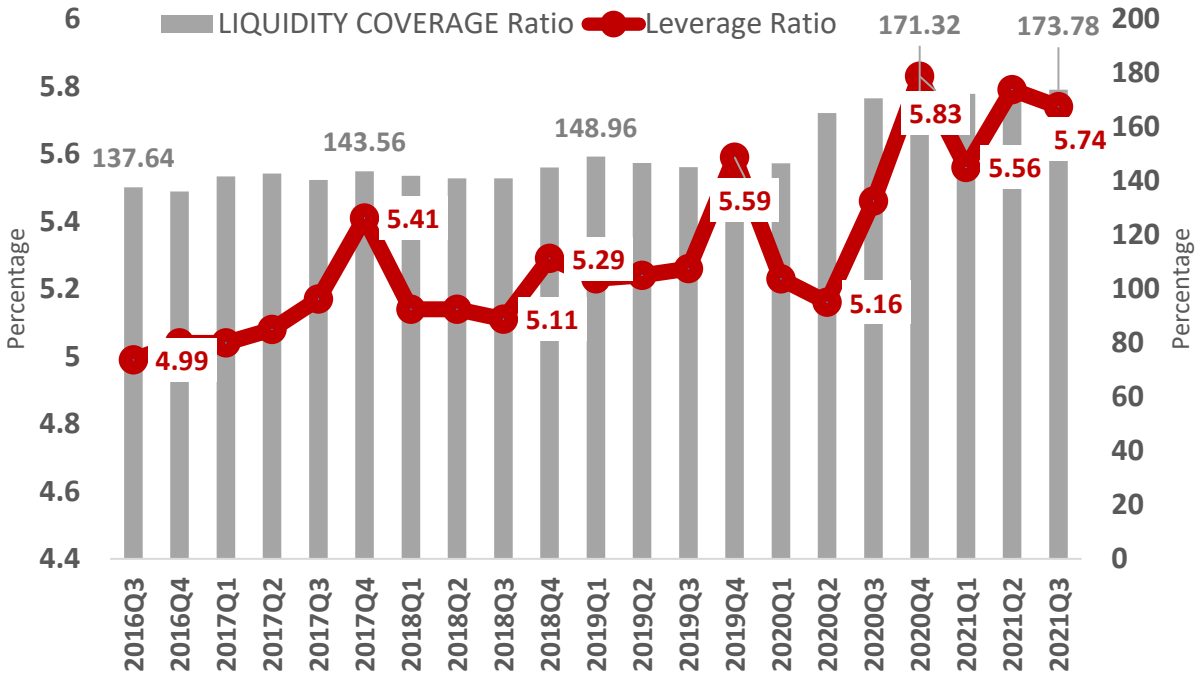

Figure 5 - LCR and Leverage Ratio

5.1.1.3. Non-Performing Loans and Total Risk Exposure Amount for Credit Risk

According to Figure 6, we now analyse the evolution of Non-performing Loans and Exposures to Credit Risk - Total[9], between the second quarter of 2015 and the third quarter of 2021. NPLs show a downward trend in this period under study, starting at 7.48% and ending at 2.17%. On the other hand, Exposures to Credit Risk - Total are not constant, from the second quarter of 2016 this indicator begins to decline from 6.9 trillion of euros until the first quarter of 2018, where it reaches 6.5 trillion of euros. This indicator then shows an increase until the third quarter of 2019, and then decreases for one year

---

[9] The RWA calculation for Credit Risk can be made through two methods, the Standard Approach or the IRB. The Standard Approach was the method first used since Basel I, The IRB is introduced in Basel II and is based on the improvement of the RWA calculation. The IRB approach is divided into two methods, the Foundation and the advanced (Basel Committee on Banking Supervision, 2019).

until the third quarter of 2020. Finally, this indicator shows an increase until the end of this period of analysis, coinciding with the Covid-19 pandemic period.
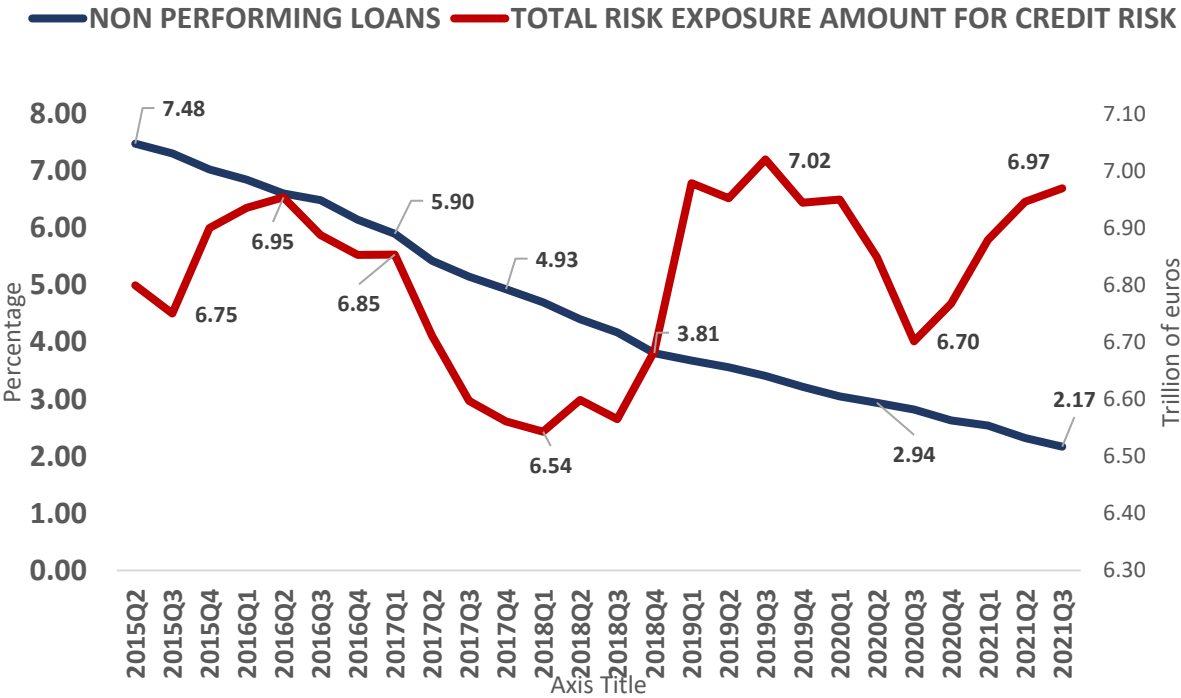

Figure 6 - Non-performing Loans (%) and Total Risk exposure Amount for Credit Risk (€ trillion)

5.1.1.4.   Total Risk Exposure Amount and Total Assets:

As seen in Figure 7, Total Risk Exposure Amount and Total Assets show identical behaviour in their evolution from the second quarter of 2015 to the third quarter of 2021.

Total Assets began at 21.55 trillion of euros in the second quarter of 2015, rising to 22.7 trillion of euros in mid-2016, but then fell until the last quarter of 2017, reaching 20.75 trillion of euros. From then until the third quarter of 2021 there is a clear growth trend, with the exception of the last quarter of 2019, which shows a decline, reaching a peak of 25.68 trillion of euros.

In the same vein, the Total Risk Exposure Amount starts at 8.1 trillion of euros in the second quarter of 2015, despite a slight drop it goes up until the second quarter of 2016 to 8.2 trillion of euros, however from that moment until the first half of 2018, the RWA[10] decreases to the lowest point of this period reaching 7.2 trillion of euros. From this point until the first quarter of 2020, RWA shows substantial growth, reaching 8.3 trillion of euros. Since then, this indicator is somewhat unstable, suffering a drop of about 240 billion of euros until the third quarter of 2020, and returning to the levels of the first quarter of 2020 in the third quarter of 2021. This analysis shows that the Total Risk Exposure Amount has never exceeded the levels of Total Assets.

---

[10] RWA - Risk Weighted Assets is the term also used for Total Risk Exposure Amount.
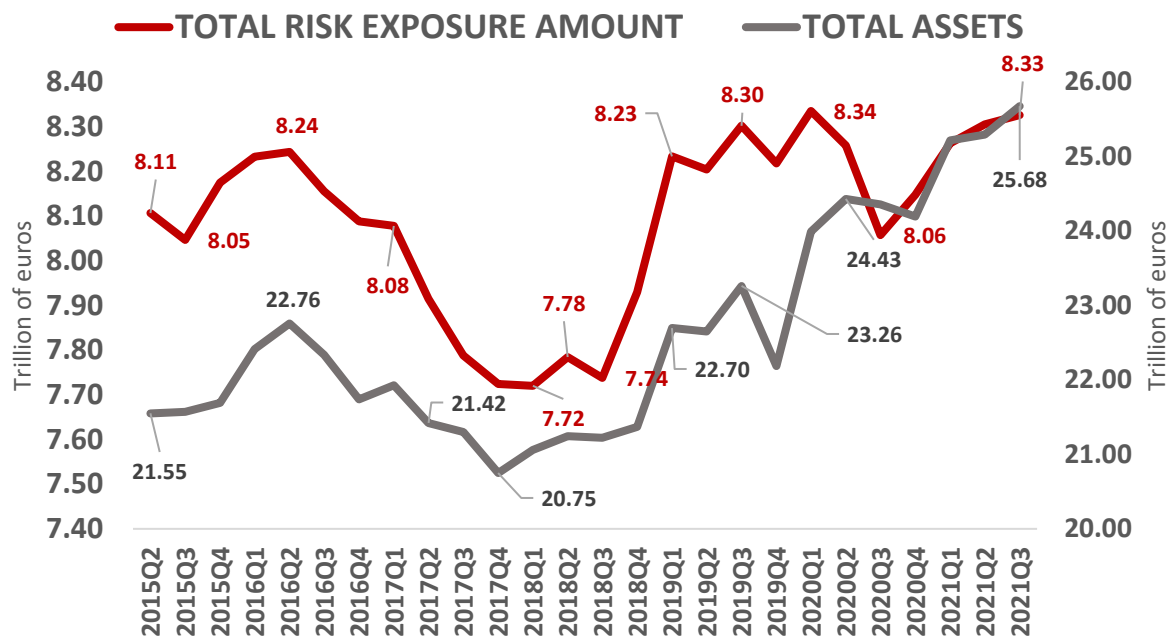
Figure 7 - Total Risk Exposure Amount and Total Assets

5.1.1.5.   Total Risk Exposure Amount:

In this analysis, the Total Risk Exposure Amount is divided into three major groups: Exposure to Credit Risk, Exposure to Operational Risk and Other Risks. As seen in Figure 8, it is possible to observe that the Exposure to credit risk has the greatest weight in the total RWA, which is around 85% on average for EU banks. Next, it is possible to see that the Exposure to Operational Risk is around 10% in the four periods analysed, the second most important type of risk.

The remaining risks occupy around 5% to 6% of the Total Risk Exposure Amount. Market Risk and CVA Risk are included within these Other Risks. According to Deutsche Bundesbank, "Market risk is the risk of losses in on- and off-balance sheet risk positions arising from movements in market prices." (Deutsche Bundesbank, 2019, p.1) Following the same source, CVA Risk appeared in order to evaluate the OTC[11] derivatives. During the 2008 financial crisis, banks suffered heavy losses on CVAs, and there is a positive correlation between the credit quality of the counterparty of the derivative and the value of the derivative, i.e. a decline in the credit quality of the counterparty has a negative effect on the value of the derivative. Therefore, it was necessary to introduce regulation on CVA risk in Basel III.

Thus, it can be seen that, on average, Credit Risk continues to be the main component when calculating the total risk exposure of European Union banks.

---

[11] OTC stands for Over-the-Counter, which are derivatives that are traded directly between interested parties, without having to be listed on an exchange market (Murphy, 2022).
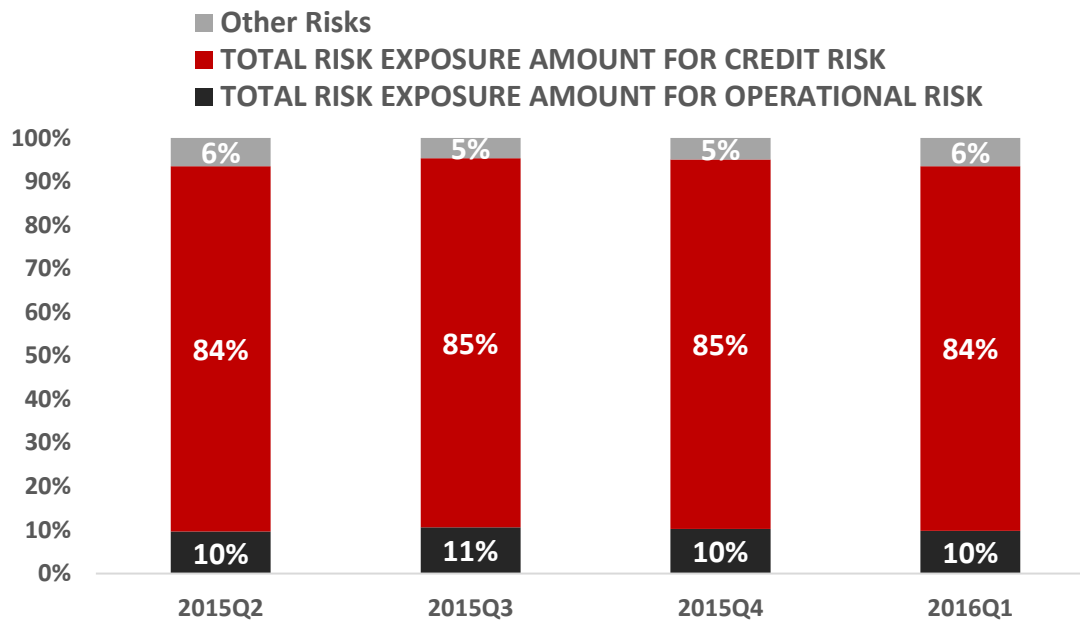
Figure 8 - The different types of risk taken in account for the Total Risk Exposure Amount

5.1.1.6.   Average Annual Growth of Variables[12] **:**

In order to evaluate the average changes in the variables, their average annual growth was calculated (Figure 9).

 According to the ECB data in Figure 9, EU bank ROE grew 2.5% on average per year. Of the positive growth, the Liquidity Coverage Ratio averaged 4.77%, which shows that banks in the EU have been strengthening their short-term liquidity, that is, increasing their High Quality Liquidity Assets in relation to their short-term liabilities (BIS, 2022).

---

[12] The growth rates are for the time interval between Q2 2015 and Q3 2021, except for the Liquidity Coverage Ratio and Leverage Ratio which the initial period starts in Q3 2016.

The Leverage Ratio shows an average annual growth of around 2.84%, which means that the European Union banks are strengthening this ratio which opposes Tier 1 Capital to Total Exposure on and off balance (King and Tarbert, 2011).

Average Annual Growth
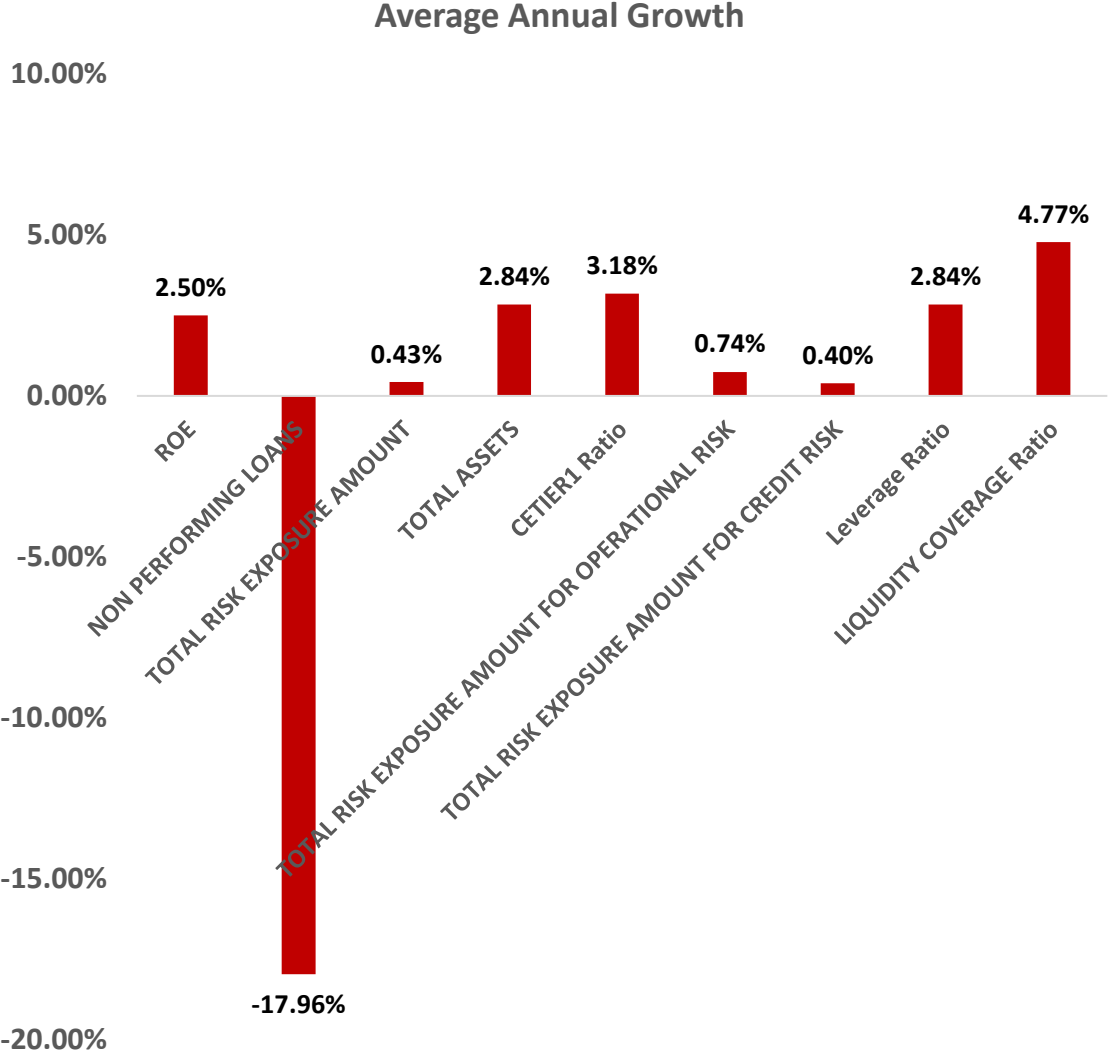
Figure 9 - Variables Average Annual Growth

The Total Credit Risk Exposure along with the Operational Risk grows, on average, below 1% per year, 0.40% and 0.74%, respectively, which represents that there is control over these variables in the EU banks' exposures. Total Exposure also grows in line with Total Credit Risk Exposure, which makes sense considering that, as seen in Figure 8, Credit Risk Exposure represents almost the entire Total Risk Exposure.

The Common Equity Tier 1 ratio shows average annual growth of around 3%, as shown in Figure 9, which demonstrates the expected strong impact of Basel III on this variable within European Union banks. With the Total Risk Exposure Amount growing on average by 0.43% per year and this ratio in

the region of 3%, it is possible to conclude that the core capital of banks has been increasing over the period under study.

Lastly, the significant annual average decrease in Non-performing Loans, which is one of the most relevant banking indicators, was around 18%. This demonstrates that banks have managed to control NPL levels, which in the second quarter of 2015 was 7.84% and in the third quarter of 2021 was 2.17%.

5.1.2. Linear Regression Model with Robust Standard Errors:

In this study, a multiple linear regression model using the Robust Standard Errors mechanism will be applied, as it is the model that best fits this type of analysis. This procedure overcomes the problems related to the accurate measurement of p-values. Note that the variables Liquidity Coverage Ratio and Leverage Ratio were not used in this regression due to the small number of observations in the sample.

Theoretical Model:

ROE = $\beta 0$ + $\beta 1$ x Common Equity Tier 1 + $\beta 2$ x Exposure to Credit Risk + $\beta 3$ x NPL + $\beta 4$ x Total Assets + $\beta 5$ x Total Risk Exposure for Operational Risk + $\beta 6$ x Total Risk Exposure Amount + $\beta 7$ x Inflation EA + $\beta 8$ x Stoxx50E

From this analysis it is intended to study whether banking performance, ROE, depend on the following independent variables:

1. H1 - Common Equity Tier 1 (CETier1)
2. H2 - Total Risk Exposure Amount for Credit Risk (IRB and Standard)
3. H3 - NPL (Non performing loans)
4. H4 - Total Assets
5. H5 - Total Risk Exposure for operational Risk
6. H6 - Total Risk Exposure Amount
7. H7 - Inflation EA
8. H8 - Stoxx50E

Bearing in mind that the aim is to verify whether there is an associative relationship between the dependent variable, ROE, and the aforementioned independent variables, it can be concluded that the technique is suitable for the overall estimation of this associative link.

Table 9 describes the estimation results. The estimation findings point to the following:

- The adjusted coefficient of determination (adjusted R^2) indicates that about 75.8% of the variance of ROE is explained by the independent variables that are in the adjusted linear regression model.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.914[a]	.835	.758	.99934	2.360

a. Predictors: (Constant), Exposures to credit risk - Total, ^STOXX50E, Inflation EA , TOTAL RISK EXPOSURE AMOUNT FOR OPERATIONAL RISK, TOTAL ASSETS, CETIER1, NPL, TOTAL RISK EXPOSURE AMOUNT

b. Dependent Variable: ROE

Table 9 - Model Summary

In order to measure the model's global significance, one must resort to the F Test (ANOVA) as it enables one to ascertain whether the independent variables influence ROE, that is, whether this model can be used to make statistical inference. Thus, the test has two hypotheses:

- H0: The linear model is not adequate ($\beta1=\beta2=\beta3=...=\beta8=0$)
- H1: The linear model is fit ($\beta1\neq\beta2\neq\beta3\neq...\neq\beta8\neq0$)

To make the decision it is necessary to resort to the Sig, if it is less than $\alpha=0.05$ then we reject H0.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	86.020	8	10.753	10.767	.000[b]
	Residual	16.978	17	.999		
	Total	102.998	25			

a. Dependent Variable: ROE

b. Predictors: (Constant), Exposures to credit risk - Total, ^STOXX50E, Inflation EA , TOTAL RISK EXPOSURE AMOUNT FOR OPERATIONAL RISK, TOTAL ASSETS, CETIER1, NPL, TOTAL RISK EXPOSURE AMOUNT

Table 10 - ANOVA Test

According to Table 10, it can be verified that sig=0.000<α=0.05, which in this way causes H0 to be rejected, thus the estimated linear model is adequate, that is, the model is statistically significant so that it can appropriately explain the relationship between the variables analysed.

Following the F test, the T test should be performed. The T test allows verification of the significance of the parameters, that is, if the coefficients of the linear regression line are significant, and this is done for all independent variables. The parameters in this test are calculated based on Robust Standard Errors. To carry out the t-test, the following hypotheses must be taken into account:

H0 - variables do not influence bank ROE ($\beta\iota = 0$, i = 1,2,3...8)

H0 – variables influence bank ROE ($\beta\iota \neq 0$, i =1,2,3,...8)

In decision making it is intended to reject H0 if sig<α=0.05 or not to reject H0 if sig>α=0.005.

Thus it is verified that the variables NPL (p=0.405), Total Risk Exposure Amount for Operational Risk (p=0.610) and Total Assets (p=0.165) are not statistically significant, i.e. these independent variables do not influence ROE, as their p-values are higher than the significance level of 0.05, as verified in the Table 12. Thus, H3, H4 and H5 are not valid.

Parameter Estimates with Robust Standard Errors

Dependent Variable: ROE

Parameter	B	Robust Std. Error[a]	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	56.165	28.870	1.945	.068	-4.744	117.075
CETIER1	-1.924	.928	-2.073	.054	-3.882	.034
TOTALRISKEXPOSUREAMOUNTFORCREDITRISK	30.962	11.019	2.810	.012	7.715	54.209
NONPERFORMINGLOANS	-.591	.691	-.854	.405	-2.049	.868
TOTALASSETS	.986	.679	1.452	.165	-.446	2.418
TOTALRISKEXPOSUREAMOUNTFOROPERATIONALRISK	-17.634	33.970	-.519	.610	-89.305	54.038
TOTALRISKEXPOSUREAMOUNT	-30.723	9.438	-3.255	.005	-50.634	-10.811
InflationEA	-.792	.560	-1.415	.175	-1.973	.389
STOXX50E	.003	.001	3.017	.008	.001	.005

a. HC3 method

Table 11 - Robust Standard Errors

On the other hand, we can verify that the variable Exposure to Total Credit Risk (b=30.962; t=2.810; p=0.012) is statistically significant in this model. The impact of this variable on ROE is positive, that is, for each trillion of euros that Exposure to Credit Risk Total increases, bank ROE will increase by 30.962 percent, H2 is verified. The variable Common Equity Tier 1 (b=-1.924; t= -2.073; p= 0.054), is statistically significant for this model at a 90 percent confidence interval, as its sig is above the validation threshold at a 95 percent confidence interval. Thus, for every unit of percentage that CETier 1 increases, bank ROE decreases by 1.924 percent, H1 is verified at a 90 percent confidence interval. The Total Risk Exposure Amount variable (b= -30.723; t= -3.255; p = 0.005) also reveals a negative relationship with the dependent variable, whereby for every unit of trillion increase in this variable, the dependent variable decreases by 30.723 percent, H6 is verified. For variables Exposures to Credit

Risk - Total and Total Risk Exposure Amount, the impacts on the dependent variable reveal a high beta, which is normal, since these are variables studied in trillion of euros.

In the two control variables used in this study, only ^Stoxx50E (b=0.003, t=3.017; p=0.008) proves to be statistically significant for this regression, but with a small impact on the dependent variable (beta=0.003).

Research Hypotheses	Conclusion of this study
H1: Common Equity Tier 1	Validated
H2: Exposure to Credit Risk - Total	Validated
H3: Non-Performing Loans	Not Validated
H4: Total Assets	Not Validated
H5: Total Risk Exposures Amount for Operational Risk	Not Validated
H6: Total Risk Exposures Amount	Validated

Table 12 - Research Hypotheses

5.1.3. Interviews:

Two interviews were conducted with management professionals from the largest Portuguese bank in Assets, Caixa Geral de Depósitos. The first interview was with Drª. Rute Isabel Dias, Risk Director in charge of Risk Weighted Assets, and the second interview was with Drª. Maria Anjos Canha, Risk Director in charge of Liquidity Risk. These interviews' goal is to get a more comprehensive view of two different areas. These interviews had different questions due to their different areas of activity, although both are related to risk areas. The interviews can be analysed in appendix A.

5.1.3.1. Questions to Dr.ª Rute Isabel Dias:

1. Does Caixa Geral de Depósitos report to the SSM - Single Supervisor Mechanism?

The answer to this question was affirmative from the interviewee, and the bank began to be supervised in 2014.

2. Is there a relationship between NPLs and Total Credit Risk Exposure Amount?

The answer was negative, the decrease in NPLs in recent years is not directly linked to the Total Credit Risk Exposure Amount, but rather to the fact that banks in Europe have followed strategies to reduce these assets. These strategies include the sale of credit portfolios, write-off's[13] and ceding of assets to funds.

3. How do you analyse the relationship between RWA and Total Assets in the EU, with the former growing by an average of 0.43% per year and the latter by 2.84%?

The answer was that with Total Assets growing at a higher rate than RWA, it represents that banks' balance sheets are composed of safer assets. Banks have been strengthening their sovereign debt, as these bonds have a risk weighting of zero, and so their RWA value is zero. However in extreme cases banks may be increasing their risk even while decreasing their RWA. The interviewee added that "This purchase of these risk free assets occurs because of excess liquidity on the part of banks and as the economy does not absorb it, then this money is applied in safer assets."

4. Can RWAs be decreased with the evolution of the Standard Approach to the IRB?

The conclusion of the response was that theoretically there is an expectation of reduction of RWA, with special focus on mortgage, as it is the last loan that people stop paying. Having said this, the PD is low and as there is collateral the LGD is also reduced. Dr.ª Rute Isabel Dias also said that there is a tendency for the calculation of RWA in IRB to be more favourable than in the Standard Approach. However, the IRB method is more exposed to the economic cycle.

5. Do you consider that banks are growing the CETier ratio by decreasing RWA or by increasing CETier?

Dr.ª Rute Isabel Dias supported that CETier 1 grows in this sample. This is because the CETier ratio has been growing more than the RWA, and the two indicators are growing. Thus it can be concluded that CETier 1 is growing in absolute value. The interviewee further states that RWA being high does not necessarily represent that the bank is doing badly, as sometimes this is due to holding assets with higher returns. Finally, she says there is a trend of capital strengthening in banks in the EU.

6. Is it normal for the credit risk weight to be around 80%?

The answer was affirmative, adding that at Caixa Geral de Depósitos it is close to 90%.

7. Analysing the Leverage Ratio we can see that it grows at the same rate as Total Assets, 2.84% average per year, does this imply that Tier 1 is growing?

The answer was in line with the question and confirmed that it is normal that Tier 1 is increasing, as there is a constant strengthening of capital in banks in the EU.

---

[13] Write-off is a write-off of the loss, deregistered of the balance sheet. It has no additional cost to the bank. The customer does not stop owing the bank, only the bank derecognises from the balance sheet by writing off the NPLs.

8. According to this study the statistically significant variables are CETier 1, Total Risk Exposure Amount and Total Risk Exposure Amount for Credit Risk, in your opinion do they make sense?

The answer was affirmative.

9. If we look at CETier 1, it has a negative impact on ROE, according to this study. Does this kind of result make sense?

The answer was affirmative. It is normal for ROE to be lower as CETier evolves, as equity capital is more costly than borrowed capital.

10. When we compare Total Risk Exposure Amount for Credit Risk with ROE, we can see that they have a positive relationship, is that normal?

The answer was yes. As you increase credit risk it is natural that you can increase your results.

11. If we analyse the impact of RWA on banking ROE we notice that there is a negative relationship between the two variables, do you agree with this effect?

The answer was affirmative, as RWA can influence in both directions. RWAs include various risks, including operational risk, which in the event of a rise could adversely affect the banking business. In RWA, CVA risk is also included, which can also be detrimental due to its nature. Finally, the interviewee states that by increasing RWA we also have to increase the Core Capital of the bank due to banking regulations. Equity being more costly than borrowed capital, it can negatively affect the results. Thus, RWA can negatively affect ROE.

5.1.3.2.   Questions to Dr.ª Maria Anjos Canha:

1. How do you think the liquidity requirements imposed by Basel III have affected banks?

The interviewee said that by securing liquidity in banks or holding assets that are easily convertible into liquidity, banks have greater liquidity and funding flexibility to face negative business cycles and change in the economic sentiment of different economic agents.

2. The LCR has been growing in recent years, do you expect it to continue in this direction or is there a slowdown?

Dr.ª Maria Canha says that there is not exactly a link. Initially, there was an increase in this ratio due to its entry into banking regulation and, at the same time, the decrease in banking leverage, but momentarily this indicator is more correlated with the economy. The interviewee also states that Caixa Geral de Depósitos has high liquidity ratios due to its characteristics of being a deposit-holding bank. Finally, she concludes by saying that in the future we may see a reduction of this ratio due to the rise in interest rates along with inflation, which will cause lower savings.

3. Apart from the NSFR and LCR, are there other measures to control liquidity? If yes, which ones?

The interviewee stated that in the short term, simultaneously with the LCR, there is also an analysis of the evolution of intraday liquidity and monitoring of the liquidity gaps.

From a long-term perspective, in parallel with the NSFR, there is also control over the HQLA and the unencumbered eligible collateral assets in a central bank, as these are assets that may not be included in the HQLA, but which allow banks to finance themselves with the central bank in the event of a liquidity shock.

4. Is there room for improvement? If so, how? Example of this in the calculation through the IRB. Dr.ª Maria Anjos Canha said that there is always room for improvement, and especially in the LCR, because its calculation involves a high complexity, and thus makes it more difficult for management to analyse them. She also stated that all liquidity indicators should be based on the other risks, because if something changes in the other risks it also changes in liquidity.

5.2. Discussion of Results:

After analysing the data, it is necessary to proceed with a discussion of the results of this Dissertation taking into account the quantitative part, but also the interviews.

Through the application of a linear regression applied, the results show that there are three statistically significant variables in the variation of ROE in EU, namely: (i) Common Equity Tier 1, (ii) Total Risk Exposure Amount for Credit Risk (Credit Risk), and (iii) Total Risk Exposure Amount (RWA). According to this research, Common Equity Tier 1 has a negative influence on Return on Equity of EU banks, which is in line with the study of Shukla (2018) and Cohen and Scatigna (2014). This dynamics is also corroborated by Drª. Rute Isabel Dias, as equity is more costly than borrowed capital and thus a capital strengthening can actually lead to a fall in bank ROE.

Credit Risk has a positive influence on ROE, that is, with the increase in credit risk, an increase in banking ROE is also associated, which makes sense, since with the growth of the banks' credit portfolio it is natural that there is an increase in returns, a relationship also defended by Drª Rute Isabel Dias.

Finally, from these three variables the research indicates that the increase of RWA's can decrease the Return on Equity of banks, and from the interview made to Drª. Rute Isabel Dias it is possible to analyse this situation in different ways. RWA's contains several risks, among which Operational Risk and CVA. With the growth of Operational Risk it makes sense that the banking business is jeopardised and consequently negatively affects their ROE. On the other hand, by increasing the RWA's, it is implicit that it is also necessary to increase the core capital of the bank in order to meet the minimum capital requirements, which is more expensive than financing from third parties. It is then natural that an increase in RWA has a negative influence on ROE.

In view of the analysis of the variables under study in this Dissertation, there are several situations, among which: NPLs showed a downward trend, with a negative annual average variation of 17.96%, which shows that banks were able to lower the type of credit that is not 'healthy' for banks. According

to Drª Rute Isabel Dias, this drop was essentially due to a generalised strategy in Europe to sell portfolios of non-performing loans, write-offs, and the ceding of these same assets to funds by the banks.

Analysing RWA and Total Assets, the results prompt the conclusion that assets grew more on average than RWA, which can also be seen in Cohen and Scatigna (2014). According to Drª. Rute Isabel Dias, this phenomenon may be due to the fact that Basel III is more advantageous in terms of risk-weights than Basel II, especially in housing loans and the small and medium-sized companies segment. Another justification is the new approach of banks when buying safer assets, such as sovereign debt, which can be calculated using the Standard method and has a RW of 0%, so, in terms of risk, these assets are accounted for as zero.

On the other hand, there was a strengthening of equity by these European banks, as shown by analysing the growth of the CETier ratio which was 2.50% and the RWA ratio of 0.40%, and thereby Common Equity Tier 1 grew above RWA. This trend is also verified in Cohen and Scatigna (2014).

By analysing the Leverage Ratio, we can see that there is a growth trend, which can also be verified in previous researches where they point out that capital has grown more than RWA. Drª Rute Isabel Dias also corroborates this trend in this variable, as it is a constant for European banks that have reinforced capital in recent years.

Analysing the LCR indicator, it grows the most in average in the analysed period, around 4.77%. According to Drª. Maria Anjos Canha, this movement is normal, because it is an early effect of the regulation. In the future it may stabilise, however within a negative economic environment, it is also possible that this indicator may suffer a negative impact due to low savings ratios.

In short, taking into account previous academic research, the quantitative study carried out and the interviews conducted suggest that Basel III had an impact on banking ROE in the EU, through its allocation variables, including common equity Tier 1, credit risk and RWA. It is also possible to verify the evolution of the main variables that make up Basel III, in this period under analysis.

CHAPTER 6

Conclusions

The purpose of this research is to answer the following questions: What is the impact of Basel III on banking ROE in the EU?; What is the Evolution of Basel III variables during the period under study? Accordingly, these research questions prompt us to analyse the influence of each variable under study on the Return on Equity. Thus, the variables analysed were based on other studies (e.g. Cohen & Scatigna, 2014; Shukla, 2018; Mahapatra, 2010)

In order to answer these questions Single Supervisory Mechanism (S.S.M.) data were taken from the ECB database. A multiple linear regression with robust standard errors is applied to the sampled dataset, using IBM SPSS 26.

The econometric estimation is then complemented by two interviews to two highly experienced professionals in management positions in the risk area of a major bank in Portugal, namely Drª. Rute Isabel Dias (Director of RWA at Caixa Geral de Depósitos) and Drª. Maria Anjos Canha (Director of Liquidity at Caixa Geral de Depósitos). These interviews allowed to complement the quantitative part of the Dissertation by providing information of enormous relevance to the academic research questions under study.

Where the quantitative section of this research is concerned, the results indicate that there are variables that have a significant impact on Return on Equity in the banking sector, these are: the CETier 1 Ratio, the Total Exposure Amount for Credit Risk and the RWA, in line with the studies conducted by Shukla (2018), Cohen and Scatigna (2014) and Härle et al. (2012) . On the other hand, there are certain variables which are not statistically significant, namely: Non-performing Loans, Total Risk Exposure Amount for Operational Risk and Total Assets. Thus, this research concludes that an increase in the CETier Ratio has a negative impact on banking ROE in the EU (most likely due to the high levels of capital required for banks to operate under BASEL III). In the same direction, an increase in RWA also leads to a negative change in the dependent variable (ROE). On the other hand, an increase in the Total Exposure Amount for Credit Risk, leads to a growth in the Return on Equity of the banking sector.

Analysing the variables, we conclude that banks had a policy of reducing NPLs , according to Drª. Rute Isabel Dias, which was achieved through the sale of asset portfolios, write-offs, and the sale of assets to funds. It can also be concluded that banks reinforced their core capital and have been choosing safer assets for their balance sheets.

In terms of liquidity, the banks also showed growth in the Liquidity Coverage Ratio, which indicates that their liquidity has evolved positively, as recommended by BASEL III.

Finally, ROE showed positive growth in the period in question.

Taking into account previous studies conducted by Shukla (2018), Cohen and Scatigna (2014), and Härle et al. (2012), this Dissertation adds the fact that it concentrates several variables of different risk typologies in a single research. Having said this, it is possible to have with this research a global view of the impact of regulation on banking performance. So, we conclude that the CETier 1 Ratio, Total Exposure Amount for Credit Risk and RWA variables have a statistically significant impact on the return on equity of the banking sector in the EU. Finally, these findings contribute positively to the area of banking sector risk and regulation, further enriching research in this field.

As to the managerial contributions of this Dissertation, this research can help banks to have a generalised view of which variables, under Basel scrutiny, most influence banks' Return on Equity, among them credit risk, RWAs, and CETier 1.

It also allows banks to take into account the evolution of the variables under study in the EU. That is, this research allows for the analysis of the behaviour of new variables such as the Liquidity Coverage Ratio and the Leverage Ratio, but also of old variables that have been adjusted with this new agreement, such as the CETier 1 Ratio.

Finally, this research will allow professionals in the field to analyse the impact of Basel III on the banking sector from a more general perspective.

Where the limitations and recommendations for future research are concerned, during the preparation of this Dissertation, some limitations were identified. Even though the sample has high credibility, the time frame could be larger and thus make the results even more reliable (data is not available for longer time frames). On the other hand, quantitative regulatory data are difficult to find and banks still do not issue all the variables with different methodologies, which makes the critical analysis difficult to implement. Finally, as Basel III is still recent, there are certain variables that cannot yet be fully included in the study, such as the LCR and NSFR.

For future studies, It is also necessary to analyse the liquidity variables that we are not yet able to draw conclusions on at the moment. Finally, try to analyse the characteristics of banking institutions in different geographical areas on a global level.

References

Abbas, F., Iqbal, S., & Aziz, B. (2019). The impact of bank capital, bank liquidity and credit risk on profitability in postcrisis period: A comparative study of US and Asia. *Cogent Economics & Finance*. https://doi.org/10.1080/23322039.2019.1605683

Acosta-Smith, J., Grill, M., & Lang, J. H. (2020). The leverage ratio, risk-taking and bank stability. *Journal of Financial Stability*, 100833.

Allen, W. A., & Moessner, R. (2012). The international propagation of the financial crisis of 2008 and a comparison with 19311. *Financial History Review*, *19*(2), 123-147.

Apătăchioae, A. (2015). The performance, banking risks and their regulation. *Procedia economics and finance*, *20*, 35-43.

Baldwin, J. (2012). *Notes of a native son*. Beacon Press.

Balin, B. J. (2008). *Basel I, Basel II, and Emerging Markets: A Nontechnical Analysis*. *Johns Hopkins University - Paul H. Nitze School of Advanced International Studies (SAIS)*. Published.

Bank for International Settlements (2014, October 9). *History of the Basel Committee* https://www.bis.org/bcbs/history.htm

Bank for International Settlements (2017). *Basel Committee on Banking Supervision reforms – Basel III*. https://www.bis.org/bcbs/basel3/b3_bank_sup_reforms.pdf

Bank for International Settlements. (2013). *Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools*. https://www.bis.org/publ/bcbs238.pdf

Bank for International Settlements. (2014, October). *Basel III: the net stable funding ratio*. https://www.bis.org/bcbs/publ/d295.pdf

Bank for International Settlements. (2017, December). *Finalising Basel III In brief.* https://www.bis.org/bcbs/publ/d424_inbrief.pdf

Bank for International Settlements. (2018, June). *Net Stable Funding Ratio (NSFR) – Executive Summary*. https://www.bis.org/fsi/fsisummaries/nsfr.pdf

Bank for International Settlements. *(2019). Calculation of RWA for credit risk.* https://www.bis.org/basel_framework/chapter/CRE/31.htm?inforce=20191215

Bank for International Settlements. (2019, December). *LCR Liquidity Coverage Ratio LCR40 Cash inflows and outflows.* https://www.bis.org/basel_framework/chapter/LCR/40.htm?inforce=20191215

Bank for International Settlements. (2021). *Revisions to the Principles for the Sound Management of Operational Risk.*

Basel Committee on Banking Supervision (2021). *Calculation of RWA for credit risk*. Bank for International Settlements. https://www.bis.org/

Basel III phase-in arrangements. (2013). Bank for International Settlements. https://www.bis.org/bcbs/basel3/basel3_phase_in_arrangements.pdf

Beccar-Varela, M. P., Mariani, M. C., Tweneboah, O. K., & Florescu, I. (2017). Analysis of the Lehman Brothers collapse and the Flash Crash event by applying wavelets methodologies. *Physica A: Statistical Mechanics and Its Applications*, *474*, 162-171.

Bholat, D., Lastra, R., Markose, S., Miglionico, A., & Sen, K. (2016). *Non-performing loans: regulatory and accounting treatments of assets.* Bank of England. https://www.bankofengland.co.uk/research/Pages/workingpapers/default.aspx

Brogi, M., & Lagasio, V. (2021). Better safe than sorry. Bank corporate governance, risk-taking, and performance. *Finance Research Letters*, 102039.

Carlson, M. A., King, T., & Lewis, K. (2011). Distress in the financial sector and economic activity. *The BE Journal of Economic Analysis & Policy*, *11*(1).

Caselli, S. (2010). Governance and strategy within the financial system: tradition and innovation. *Journal of Management & Governance*, *14*(3), 241-271.

Cecchetti, S. (2012, October). The future of financial intermediation and regulation. In *Remarks Prepared for the Second Conference of the European System of Central Banks Macro prudential Research Network, Frankfurt* (Vol. 30).

Cohen, B. H., & Scatigna, M. (2014, March). *Banks and capital requirements: channels of adjustment. Bank for International Settlements*.

Dermine, J. (2014). Basel III Leverage Ratio Requirement and the Probability of Bank Runs. *Journal of Banking and Finance.*

ECB publishes supervisory banking statistics for the third quarter of 2021. (2022). European Central Bank. https://www.bankingsupervision.europa.eu/press/pr/date/2022/html/ssm.pr220112~618de 6b7dd.en.html

Fidrmuc, J., & Lind, R. (2020). Macroeconomic impact of Basel III: Evidence from a meta-analysis. *Journal of Banking & Finance*, *112*, 105359.

Goodhart, C. (2011). *The Basel Committee on Banking Supervision: a history of the early years 1974-1997*. Cambridge University Press.

Guhathakurta, K. (2012). A Colossal Failure of Common Sense–The Incredible Inside Story of the Collapse of Lehman Brothers.

Härle, P., Pepanides, T., & Pfetsch, S. (2010). Basel III: *Now the hard part for European banks.* Mckinsey & Company. https://www.mckinsey.com/industries/financial-services/our-insights/basel-iii-now-the-hard-part-for-european-banks

Hicks, J. (1969). Automatists, hawtreyans, and keynesians. *Journal of Money, Credit and Banking*, *1*(3), 307-317.

Hicks, J. (1969). Automatists, hawtreyans, and keynesians. *Journal of Money, Credit and Banking*, *1*(3), 307-317. https://www.worldbank.org.ro/about-banks-history

Karim, M. Z. A., Chan, S. G., & Hassan, S. (2010). Bank Efficiency And Non-Performing Loans: Evidence From Malaysia And Singapore. *Prague Economic Papers*.

King, P., & Tarbert, H. (2011). Basel III: An Overview. *Banking & Financial Services Policy*.

King, P., & Tarbert, H. (2011). Basel III: an overview. *Banking & Financial Services Policy Report*, *30*(5), 1-18.

Koop, C., & Lodge, M. (2017). What is regulation? An interdisciplinary concept analysis. *Regulation & Governance*, *11*(1), 95-108.

Le, T. N. L., Nasir, M. A., & Huynh, T. L. D. (2020). Capital requirements and banks performance under Basel-III: A comparative analysis of Australian and British banks*. The Quarterly Review of Economics and Finance.*

Leão, P. R., Leão, E. R. & Bhimjee, D. C. P. (2017). The 2007-2009 subprime crisis and the global public policy response. The Journal of European Economic History. 46 (2), 51-73

Levine, R. (1997). Financial development and economic growth: views and agenda. *Journal of economic literature*, *35*(2), 688-726.

Levine, R. (2004). *The corporate governance of banks: A concise discussion of concepts and evidence* (Vol. 3404). World Bank Publications.

Lucas Jr, R. E. (1988). On the mechanics of economic development. *Journal of monetary economics*, *22*(1), 3-42.

Lundqvist, S. A. (2015). Why firms implement risk governance–Stepping beyond traditional risk management to enterprise risk management. *Journal of Accounting and Public Policy*, *34*(5), 441-466.

Mahapatra, B. (2012). *Implications of Basel III for capital, liquidity and profitability of banks*. Bank for International Settlements.

Mcdonald, L. G., & Robinson, P. (2009). *A Colossal Failure of Common Sense: The Inside Story of the Collapse of Lehman Brothers*. Crown Business.

Murphy, C. B. (2022). *Over-the-Counter (OTC).* Investopedia. https://www.investopedia.com/terms/o/otc.asp

OPRITESCU, Marin & IACOBESCU, Alina. (2008). Banking credit market in Romania: Basel II impact. *Finante - provocarile viitorului (Finance - Challenges of the Future).* 1. 21-30.

Own funds requirements. (2019). Deutsche Bundesbank. https://www.bundesbank.de/en/tasks/banking-supervision/individual-aspects/own-funds-requirements/own-funds-requirements-623136

Patrick, H. T. (1966). Financial development and economic growth in underdeveloped countries. *Economic development and Cultural change, 14*(2), 174-189.

Pessarossi, P., & Weill, L. (2013). *Do capital requirements affect bank efficiency? Evidence from China.* Bank of Finland, BOFIT Institute for Economies in Transition.

Posner, R. A. (1999). *Natural monopoly and its regulation*. Cato Institute.

Rajan, R., & Zingales, L. (1998). Financial development and growth. *American Economic Review, 88*(3), 559-586.

Rizvi, N. U., Kashiramka, S., & Singh, S. (2018). Basel I to Basel III: Impact of Credit Risk and Interest Rate Risk of Banks in India. *Journal of Emerging Market Finance*. https://doi.org/10.1177/0972652717751541

Rubio, M., & Carrasco-Gallego, J. A. (2016). The new financial regulation in Basel III and monetary policy: A macroprudential approach. *Journal of Financial Stability, 26*, 294-305.

Saidenberg, M., & Schuermann, T. (2003). *The New Basel Capital Accord and Questions for Research*. Wharton Financial Institutions Center. https://core.ac.uk/download/pdf/6649673.pdf

Selznick P (1985) Focusing Organizational Research on Regulation. In: Noll R (ed)Regulatory Policy and the Social Sciences,pp.363–367. University of California Press, Berkeley.

Settlements, B. (2018, June 5). *Basel Committee Charter*. Bank for International Settlements. https://www.bis.org/bcbs/charter.htm

Sheedy, E., & Griffin, B. (2018). Risk governance, structures, culture, and behavior: A view from the inside. *Corporate Governance: An International Review, 26*(1), 4-22.

SHUKLA, S. (2017). Basel III: Impact analysis for Indian Banks. *NMIMS JOURNAL OF ECONOMICS AND PUBLIC POLICY.*

Slovik, P. and B. Cournède (2011), *"Macroeconomic Impact of Basel III"*, OECD Economics Department Working Papers, No. 844, OECD Publishing. http://dx.doi.org/10.1787/5kghwnhkkjs8-en

Stewart, R., Chowdhury, M., & Arjoon, V. (2021). Interdependencies between regulatory capital, credit extension and economic growth. *Journal of Economics and Business*, 106010.

Stigler, G. J. (1971). The theory of economic regulation. *The Bell journal of economics and management science*, 3-21.

Supervisory banking statistics. (2022). European Central Bank. https://www.bankingsupervision.europa.eu/banking/statistics/html/index.bg.html

Taskinsoy, J. (2019). *Ever More Financial Instability notwithstanding the Basel Standards and the IMF's Financial*. Universiti Malaysia Sarawak (UNIMAS). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3328473

THE HISTORY OF BANKS. (2022). World Bank. https://www.worldbank.org.ro/about-banks-history.

Toniolo, G., & Clement, P. (2005). *Central bank cooperation at the Bank for International Settlements, 1930-1973*. Cambridge University Press.

Walker, G. A. (2011). Basel III market and regulatory compromise.

Zhang, X., Li, F., & Ortiz, J. (2021). Internal risk governance and external capital regulation affecting bank risk-taking and performance: Evidence from PR China. *International Review of Economics & Finance, 74*, 276-292.

Momoh, O. (2022). Population Definition in Statistics and How to Measure It. *Investopedia*. https://www.investopedia.com/terms/p/population.asp

Webography

Bank for International Settlements (bis.org)
CBD2 - Consolidated Banking data - ECB Statistical Data Warehouse (europa.eu)
European Banking Authority | (europa.eu)

European Central Bank (europa.eu)
Federal Reserve Board - Home
Lehman Brothers Holdings (LEH) Quarterly Balance Sheets as of May 30, 2008 - CSIMarket

Publication of supervisory data (europa.eu)

SUP - Supervisory Banking Statistics - ECB Statistical Data Warehouse (europa.eu)

Appendices

Appendix A – Interviews with experts in Banking Risk

These interviews aim to understand the point of view of qualified and practical people on the subject of this dissertation.	
Interviewee:	Dr.ª Rute Isabel Dias
1 - Does Caixa Geral de Depósitos report to the SSM - Single Supervisor Mechanism?	"Yes, GGD reports to the SSM, and they have been supervised since 2014 by the ECB."
2 - Is there a relationship between NPLs and Total Credit Risk Exposure Amount?	"It does not appear so, but there is a clear strategy by banks to reduce NPLs, including sales of credit portfolios, sale of assets to funds and write-offs, with reporting and monitoring requirements by the regulator for banks with NPL ratios above 5%. In this process, departments were created to streamline NPL recovery processes with customers."
3 - How do you analyse the relationship between RWA and Total Assets in Europe, with the former growing by an average of 0.43% per year and the latter by 2.84%?	"The fact that Total Assets are growing more than RWA means that banks' balance sheets are composed of safer assets. Following this logic, the weight of sovereign debt in banks' assets in the European Union is increasing, and as you know, sovereign debt in the EU is zero weighted. In extreme cases, even if the RWA is not increasing, the risk of the banks' portfolios could be increasing, following this thought. This purchase of risk free assets occurs because of excess liquidity by banks and as the economy

	does not absorb it, then this money is applied in safer assets. "
4 - Can RWAs be decreased with the evolution of the Standard Approach to the IRB?	"Theoretically, there is the expectation of a reduction in RWA, especially in the mortgage and small and medium enterprises segment, because mortgage is the last credit that people stop paying. Thus, the PD is low and as there is collateral the LGD is also reduced. These two factors are the driver for the RWA calculation. Having said that, in these cases there is a tendency that the RWA calculation in IRB is more favourable to banks. However, IRB is more exposed to the economic cycle than SA, so in situations that the PD is higher the RWA takes this into account. In periods of greater contraction in the economy the IRB forces you to hold more capital and vice versa. Finally, the IRB tends to be more favourable in terms of RW, compared to SA which is more stable. "
5 - Do you consider that banks are growing the CETier ratio by decreasing RWA or by increasing CETier?	"CETier 1 grows in this sample, as the CETier ratio has been growing more than the RWA, and both are growing. Thus, this shows that CETier 1 in absolute value has been increasing. Note that having higher RWA does not mean of course that it can be bad, because sometimes there are assets that give us higher returns. Finally, there is a strategy to strengthen capital in banks in the EU. "
6 - Is it normal for the credit risk weight to be around 80%?	"Yes it's normal, at Caixa Geral de Depósitos it can be close to 90%. "

7 - Analysing the Leverage Ratio we can see that it grows at the same rate as Total Assets, 2.84% average per year, does this imply that Tier 1 is growing?	"Yes, it is natural for Tier 1 to be growing, because it has been a constant for banks to reinforce their capital. Having said this, we can see that according to these figures there is a clear tendency for Tier 1 to grow."
8 - According to this study the statistically significant variables are CETier 1, Total Risk Exposure Amount and Total Risk Exposure Amount for Credit Risk, in your opinion do they make sense?	"Yes, in my opinion it makes sense the same ones."
9 - If we look at CETier 1, it has a negative impact on ROE, according to this study. Does this kind of result make sense?	"Yes, because by increasing the core capital of the bank we are decreasing the leverage activity of banks, accompanying this reasoning with the fact that equity capital is more expensive than debt capital. So, this negative relationship is natural."
10 - When we compare Total Risk Exposure Amount for Credit Risk with ROE, we can see that they have a positive relationship, is that normal?	"It makes sense, because as we increase the bank's loan portfolio, it is normal that the bank's returns can go up, so it is normal to have a positive relationship."
11 - If we analyse the impact of RWA on banking ROE we notice that there is a negative relationship between the two variables, do you agree with this effect?	"There could be numerous reasons for this as it could also affect positively. RWA also include Operational Risk, which could negatively affect ROE, because with the increase in operational risk, it is natural that the banking business is affected. CVA Risk can also negatively affect ROE, for all its characteristic. Finally, when we increase banks' RWA it is implicit that we also increase their equity. Assuming that equity is more costly than debt, then increasing it means we are incurring more costs, and thus negatively affecting bank ROE.

	Having said this, one can conclude that RWA can negatively affect ROE. "
Thank you for your collaboration.	

Interviewee:	Dr.ª Maria Anjos Canha
1 - How do you think the liquidity requirements imposed by Basel III have affected banks?	"By ensuring that banks have liquidity or assets easily convertible into liquidity, it allows them to have a flexibility that, in times of crisis or change in economic sentiment, they can have stability at this level and in terms of funding. An example of this is if you have a bank that has little liquidity and poor planning at the funding level, a certain shock (e.g. customer withdrawals) means that the bank will have to fund itself in the market, which will affect profitability and capital. "
2- The LCR has been growing in recent years, do you expect it to continue in this direction or is there a slowdown?	"It doesn't necessarily have a link to regulatory impact. Initially yes, where it was even seen in the level of leverage of banks. At the moment it has more correlation with the economy, i.e. low interest rates, increased conservatism and the low profitability of the markets led to banks having more liquidity because deposits increased. In this case, Caixa Geral de Depósitos has high liquidity ratios, as it is a bank with deposit-holding characteristics. On the other hand, some banks have taken advantage of the trend of low interest rates to borrow from the central bank and take advantage of funding at attractive rates and then channel these amounts into buying public debt and obtaining some margin of return on safe assets.

	Finally, one may see in the near future a reduction due to the growth in rates along with inflation, which will cause savings rates to reduce."
3- Apart from the NSFR and LCR, are there other measures to control liquidity? If yes, which ones?	"From a short-term perspective, there is the LCR, additionally there is the analysis of the evolution of intraday liquidity and the monitoring of monthly gaps. In the long term, there is the NSFR imposed by the regulator. There's also HQLA monitoring, which is included in the indicators. But there is also monitoring of the unencumbered eligible collateral assets in a central bank, which are assets that allow you to be financed by the central bank in the event of a liquidity shock. There are assets like financial bonds that don't enter into the HQLA, because the regulator doesn't want leverage in the banking system, but they are eligible for the central bank."
4- Is there room for improvement? If so, how? Example of this in the calculation through the IRB	"There is always room for adaptation, but there is one criticism that needs to be assessed, in particular with regard to the LCR: when an indicator is created in which its calculation involves a high degree of complexity, it makes it more difficult for management to analyse it. When the regulator introduces the same rules for all banks, it is with the intention that there should be no manoeuvring over liquidity indicators. All liquidity indicators should drink from the other risks, because if something changes in the other risks it also changes in liquidity. An example of this is when we calculate PD and LGD that affect capital, it necessarily affects liquidity

	and then there can be improvements in the calculation.
	On the other hand there is sentiment which is very important in liquidity. The sentiment is if investors sense that the economy is down and start withdrawing their deposits the indicators decline rapidly. An example of this was the 2008 financial crisis."
Thank you for your collaboration.	