



Università
Ca' Foscari
Venezia

Master's Degree

Accounting and
Finance

Final Thesis

**The impact of
Basel III
Liquidity
Requirements
on the size of
European banks**

Supervisor

Ch. Prof. M. Tolotti

Graduand

Vanessa Manfrin

Matriculation number:

851273

Academic Year

2018 / 2019

ABSTRACT

Having acknowledged that the size of the banking sector in Europe has grown significantly in the years before the crisis and that the banking sector has shown significant liquidity deficiencies in 2007, this paper aims at investigating whether the liquidity requirements introduced by Basel III in 2011 have contributed to the reduction of the size of total amount of bank financing in European countries. The author conducts a quantitative analysis on a sample of 100 European banks (ranked by total assets) to understand how European countries have complied with this regulation. In particular, the focus is placed on whether European countries have reduced the total amount of bank financing provided to the non – financial sector and on whether the total assets of banks per country have decreased as a result of the introduction of liquidity requirements.

The main findings of this paper are that liquidity requirements imposed by Basel III contributed to the reduction of the size of the banking sector and of the total amount of bank financing in Europe. On the other hand, it also demonstrates that capital requirements imposed by Basel III did not have a statistically significant effect on these two variables, suggesting to the reader that capital requirements did not affect the size of banks.

Liquidity regulation have, as expected, reduced the amount of lending for banks, which, after the crisis have reduced their reliance on complicated financial instruments and have turned their business toward more safe forms of operations as retail banking.

The structure of the paper is set up as follows. The first part is dedicated to a literature review analysis and an extensive description of liquidity regulation before and after the crisis. The author describes in the third chapter the details of Basel III requirements. In the second part of the paper the author describes the methodology and data used, as well as the econometric specifications applied in the analysis. Finally, in the last section the paper provides the empirical results obtained and an analysis of their implications and limitations.

Key Words: Liquidity Coverage ratio; Basel III; Overbanking; Banks in Europe.

RÉSUMÉ

Après avoir reconnu que la taille du secteur bancaire en Europe a considérablement augmenté au cours des années qui ont précédé la crise et que le secteur bancaire a connu d'importantes insuffisances de liquidité en 2007, le présent document vise à déterminer si les exigences de liquidité introduites par Bâle III en 2011 ont contribué à la réduction du montant total du financement bancaire dans les pays européens. L'auteur effectue une analyse quantitative sur un échantillon de 100 banques européennes (classées selon le total des actifs) pour comprendre comment les pays européens se sont conformés à cette réglementation. L'accent est plus particulièrement mis sur la question suivante : savoir si les pays européens ont réduit le montant total du financement bancaire accordé au secteur non financier et si le total des actifs des banques par pays a diminué en raison de l'introduction d'exigences de liquidité.

Ce document tire donc la conclusion que les exigences de liquidité imposées par Bâle III ont contribué à réduire la taille du secteur bancaire et le montant total du financement bancaire en Europe. D'autre part, elle démontre également que les exigences de fonds propres imposées par Bâle III n'ont pas eu d'effet statistiquement significatif sur ces deux variables, ce qui laisse à penser au lecteur que les exigences de fonds propres n'ont pas affecté la taille des banques.

La réglementation de la liquidité a, comme prévu, réduit le montant des prêts accordés aux banques, ce qui, après la crise, a réduit leur dépendance à l'égard d'instruments financiers complexes et a orienté leurs activités vers des formes plus sûres d'opérations comme les services bancaires de détail.

La structure du document est la suivante. La première partie est consacrée à une analyse documentaire et à une description détaillée de la réglementation de la liquidité avant et après la crise. L'auteur décrit dans le troisième chapitre les détails des exigences de Bâle III. Dans la deuxième partie de l'article, l'auteur décrit la méthodologie et les données utilisées, ainsi que les spécifications économétriques appliquées dans l'analyse. Enfin, dans la dernière section, l'article présente les résultats empiriques obtenus et une analyse de leurs implications et limites.

Key Words: Liquidity Coverage ratio; Basel III; Overbanking; Banks in Europe.

ACKNOWLEDGEMENTS

I would like to firstly thank my thesis supervisor, Pr. Lei Zhao, for the support he has given me in the development of this paper and for his helpfulness in helping me going through the development of the idea and of the methodology.

He has supported me whenever I had doubts trying to help me in finding the right direction.

I would like to thank the ESCP Europe and Ca' Foscari universities that through their partnerships have provided me with the opportunity to take this double degree experience, enriching my knowledge and giving me an international oriented education.

I would also like to thank my parents, who have always supported me through my university career. They have always given me their support and their advice whenever I needed it and they encouraged me in achieving my academic goals.

Finally, I would like to thank my friends, who have, directly or indirectly, contributed to the achievement of my goals and who have provided me with their support and encouragement.

Table of Contents

ABSTRACT	1
ACKNOWLEDGEMENTS	3
1. INTRODUCTION	5
2. LITERATURE REVIEW	9
2.1 Causes of the increase in European banking sector	14
2.2 Post crisis regulation	16
2.3 Recent trends in the European Sector	23
3. LIQUIDITY MEASUREMENT	27
3.1 Standard Liquidity Measures	28
3.2 Liquidity risk	29
3.3 Development of international regulation addressing liquidity issues	31
4. Basel III	35
4.1 Minimum Capital Requirements	36
4.1.1 Capital Conservation Buffer (CCoB)	38
4.1.2 Countercyclical Capital Buffer (CCyB).....	39
4.2 Leverage Requirements introduced by Basel III	40
4.3 Liquidity requirements introduced by Basel III	42
4.3.1 Liquidity Coverage Ratio	43
4.3.4 Issues	45
4.3.5 Net Stable Funding Ratio	46
4.4 Basel IV	49
5. DATA AND METHODOLOGY	50
5.1 Data Description	50
5.2 Evolution of banks' size	53
5.3 Evolution of LCR and CAR	56
5.3.1 Liquidity Coverage Ratio	56
5.3.2 Capital Adequacy Ratio	58
5.4 Comparison	60
5.5 Econometric specifications	62
6. RESULTS	63
6.1 Total Amount of Bank Financing	63
6.2 Size of the Banking Sector	65
7. CONCLUSIONS	67
7.1 Limitations and suggestions for further researches	70

1. INTRODUCTION

The Banking Sector have been subject to a fast evolution process in the last years and it is, by now, one the faster changing sector in the modern economy.

One of the most discussed questions in the recent literature has been the size of the financial sector in the European Union. In particular, recent evidences have demonstrated that the size of the banking sector has almost doubled since 1996 and that this increase has been due mainly to the increase in the size of the major 20 European Banks, rather than an increase in the size of the banking system as a whole.

This increase has differentiated significantly the European economy from the ones in Japan and US, which are instead more based on market-financing and do not rely as much on bank financing as European countries. This increase has been kept significantly under control in the past years and the literature has demonstrated that there are both significant advantages and disadvantages in having a bank based financial system. It has been argued that having a bank based financial system provides several advantages in the sense that banks are more efficient in mobilizing savings, they enable investors to easily identify good investment opportunities and they favor economic growth, in particular during the first stages of economic development. Moreover, banks are usually faster in gathering information and in processing different issues compared to other investors and this may often result in a more efficient allocation of resources. However, having a bank – based financial system involves a series of issues for a country, including the so-called hold-up problem and an excessive volatility of credit supply. On the other hands, several merits are associated with having a market-based financial system. On average market – based economies are believed to provide more information availability, investors are believed to manage risk more efficiently and these systems are also characterized by a more efficient capital allocations. In general, market – based economies are believed to be the better structure for countries at an already mature stage of economic growth. Because of these considerations and of its peculiar rapid growth, the size of the banking sector in Europe has been kept under control in the past years.

There have been controversial arguments in the literature on whether relying too much on banking may have a negative effect on growth. Researchers do not only agree on this but, on

average, it has been proved that, while under certain pre-determined thresholds having a market-based or a bank-based financial system does not significantly affect growth, relying too much on banking may have a negative effect on GDP growth after a 90% of the ratio Bank/GDP.

Finally, past evidences have also shown that this too much relying on banking in Europe has had significantly negative effect also during the crisis. In particular, European countries have demonstrated a slower capacity to recover the losses incurred between 2007 and 2009 with respect to the US economy.

For these reasons, and due to the fear that actually banking has grown too much in Europe, the European authorities has undertaken several initiatives aimed at reducing the amount of banking in Europe, at recovering the losses generated by the crisis and at grating a safer financial system. Among them we identify the Basel III international regulatory framework for banks. This was drafted by the Basel Committee on Banking Supervision in 2011 with the aim of “strengthen the regulation, supervision and risk of banks” (BIS, 2019).

The aim was to build a system more efficient that the one prior crisis that could help avoiding future collapses of the financial system. Among the main contribution of the Basel III, we identify the introduction of the liquidity requirements, in particular we refer to the introduction of the Liquidity Coverage Ratio (LCR). Furthermore, Basel III also updates some of the previously existing requirements under Basel II. The Basel Committee on Banking Supervision had required financial institutions to adapt to the new regulation by 2019, and this is way we think now it could be useful to look at the behavior of the main banks in response to these requirements.

While it has been shown that the introduction of Basel III and, in particular, of the Liquidity Coverage Ratio requirements have on average reduced the amount of financing provided by a single bank, this paper wants to contribute to the previous literature by trying to assess whether this impact has also had an effect at macroeconomic level. Moreover, in the literature there are not many researches focused on the impact of Basel III liquidity requirements and the majority of these studies have been conducted by the Basel Committee for Banking Supervision itself.

In this paper, we want to investigate whether the improvement in a bank’s liquidity structure has not only impacted the individual bank policies, but whether it has reduced the amount of bank

financing over GDP, which as we said should not exceed 90%, and whether it has reduced the total size of banks' assets in Europe.

To conduct the research, we rely on a quantitative research method, based on observations of banks behavior in the years from 2013 to 2018. We focused on the main 100 Banks in the European Union, ranked by total assets of 2018. This decision has been due to the fact that, as previously stated, the Increase in the banking size has been mainly due to a doubling in the size of the major 20 banks in Europe. We split then these banks by country and we obtain observations for 10 different European countries. For each of these banks, we analyzed the development of the main ratios introduced Basel III, i.e. the Liquidity Coverage Ratio and the Capital Adequacy Ratio since 2013. We investigate its development across countries in the past years.

As first step of this research, we analyze the impact of these two coefficients on the amount of bank financing (expressed as a percentage of GDP) in each of the observed countries. This to assess whether this has had an impact on decreasing/increasing this variable, which, as previously discussed, could be detrimental for a country's growth if it exceeds certain levels.

As second step, we analyze the impact of these two coefficients on a particular country size of the banking system, expressed as a total amount of bank assets.

As far as LCR is concerned, we discovered that, in either case, the relation is negative and statistically significant, meaning that the requirements introduced by Basel III have caused a decrease in the size of banking in Europe. This also underlines the fact that Basel III does not only safeguard the financial stability of a single bank, but is also operates from a macro- economic perspective, safeguarding the safety of an entire country's financial system.

This thesis is organized according to the following structure.

In the second chapter the paper provides an extensive definition of the literature review that concerns this field. In particular we underline the main discoveries that have contributed to the analysis of the consequences of relying significantly on bank financing from both a micro and a macroeconomic perspective. We also underline the main studies that have discussed the impact of Basel III liquidity requirements in the past years.

In the third chapter we focus on liquidity needs of banks and on the main issues related with liquidity risk. Given that this paper mainly focuses on the liquidity requirements introduced by

Basel III and that liquidity has been a very discussed topic, we explain which the main drivers of liquidity risks and how previous regulations are have addressed them.

In the fourth chapter of this thesis the author covers Basel III regulation as a whole, explaining its main introductions with respect to previous regulations.

In chapter five the paper presents the dataset and econometric specifications used to go through this research. Chapter six presents the findings of this research.

Chapter seven included a series of conclusions related to this research, the implications for the banking industry as well as the limitations to be considered in interpreting this paper.

2. LITERATURE REVIEW

The banking sector in the last years have known a significant transformation, both in Europe and abroad. After the steep growth of banks that started at the end of the 1990s, the financial crisis that took place between 2007 and 2009 significantly impacted this sector. The financial systems of the main economies were not able to absorb the shock and many institutions failed.

In considering the many differences that could be identified in this sector worldwide, it is evident that some countries rely much more on banking than others. In particular, the so-called bank-based economies, like Europe, finance the majority of their activities using bank financing, while in the so-called market – economies, like US, the major sources of funding are financial markets (Pagano, 2014).

Since in the years between 1996 and 2007, characterized by a fast growth of the banking sector, the ratio of bank financing over GDP have dramatically increased in Europe, this became an issue for researchers, who started to investigate whether having a too much bank-based financial system could have negative effect on a specific country economy.

In particular, being aware that the banking system has been significantly evolving in the past years, it has been an issue for financial literature to identify which evolutions could be positive or negative for a specific economy and what measures could potentially regulators take to prevent that possible future financial shocks or other periods of financial distress could bring down the economy as a whole. In discussing this topic, we start from the main discussions that previous researches went through in order to understand whether it is better for a modern economy to have a bank based or a market based financial system.

First, we underline what it means to have a bank based or a market-based economy. Sawyer (2014) stated that:

“...in bank based financial systems such as Germany and Japan, banks play a leading role in mobilizing savings, allocating capital, overseeing the investment decisions of corporate managers and providing risk management vehicles. In market- based financial systems such as England d US, securities market share center stage with banks in terms of getting society’s savings to firms, exerting corporate control and easing risk management...” (Sawyer, 2014)

There are strong evidences showing advantages and disadvantages of having a bank based or a market based financial system. While some literature shows that having a system based on banking or market does not affect long run growth (Levine, 2002), other economists demonstrated the relevance of this variable in determining the GDP growth of a country.

First references are found in 1999, when authors started to analyze the development of banks and market institutions and to evaluate its effect on the wealth of a country. The author demonstrated that in higher income economies, stock markets tend to prevail with respect to banks. Moreover, the author also analyzed the differences between countries, showing that countries having a Common law¹ tradition tend to be more market based than those with a Civil Law tradition, which instead tend rely more on bank financing. (Detragiache and Demirgüç-Kunt, 1999).

First references that having a market based or a bank based financial system does not affect economic growth were found in 2002, when Levine demonstrated that this variable is indeed not significant and that rather financial development appears to be a more significant indicator in explaining cross-country differences in economic growth. (Levine, 2002)

However, recent evidences seem to demonstrate the opposite. In particular, Lee in 2012 contributed to the previous literature investigating whether “a bank-based or a market-based financial system is better for promoting long run growth” (Lee, 2012). He focuses on whether there exists a causal relationship between these two variables, and he addresses “whether financial systems lead to economic growth or economic growth leads the growth in financial systems” (Lee, 2011). Moreover, he conducts an empirical analysis to assess whether, if it is true that the first variable has a causal effect on the second, which one between bank based or market based financial system has a more significant effect on economic growth. It complements this analysis making an historical analysis to analyze growth shifts. The author showed that “stock market played an important role in financing economic growth in US, UK and Japan, while in Germany, France and Korea, the banking sector played a more important role”. Furthermore, the

¹ With Common Law tradition we refer to a juridical system (whose origin is attributed to British countries) where the judgment of cases is based on judgment previously made on similar cases. US and UK are recognized as being common law jurisdictions. With Civil Law Tradition, we refer to a more European based juridical systems, where cases judgements are based on laws and juridical norms enacted by regulatory authorities.

author demonstrated that in the entire sample, composed both of developed and developing countries, the banking sector played a more significant role in the early years of development while the stock market seems to have a more positive effect on growth in already developed countries. Among the countries analyzed by the author, Korea shows the strongest evidences of this relation, together with Japan and China.

On average, literature has proved that a bank based financial system can foster economic growth in the early stages of economic development while market based is better in fostering growth of developed economies. Moreover, by measuring the amount of banking in a country as total amount of bank financing over GDP, literature has identified a threshold (on average recognized as being around 90%) according to which having too much bank finance decreases economic growth (Reinghart and Rogoff, 2010). These authors have demonstrated through an empirical analysis that, as far as already developed economies are concerned, 90% can be considered as a reliable threshold after which having too much debt becomes detrimental for growth. As far as emerging economies are concerned, they have identified a lower threshold; according to the authors, for emerging economies debt/GDP ratio should not exceed 60%. This has further been demonstrated by Caner, Grennes and Koehler- Geib (2012), which reevaluated the analysis conducted by the previous authors. While they agree on the 60% threshold for emerging economies, they suggest that the Debt over GDP threshold to be applied for developed countries should be lower than 90%.

They suggested that, on average, considering both developed and non-developed countries the estimated threshold should be of 77%. However, since we are focusing in this paper on European economy we consider the reference detrimental threshold for Europe to be set at 90% level.

Having understood the negative effect of having too much banking on the growth of a country, many researchers focused on how the recent development in the credit structure of the European Union countries may affect its long run growth.

A more detailed analysis on why relying too much on bank credit has negative effect of growth and a more detailed focus on the peculiar situation of the European Union has been provided in 2015, when the European Central Bank analyzed the credit situation of its countries before and after the financial crisis. In particular, the researches demonstrated that the “near-doubling size

of the EU banking system since 1996 is entirely attributable to the growth of the largest 20 banks” (Pagano, 2014). The author focused on three related issues.

The first finding that significantly contributed to the literature is that “financial development benefits on growth appears to come exclusively from countries where financial development is at a relatively early stage ... Beyond a certain threshold credit expansion has a negative effect on growth” (Pagano, 2014). Furthermore, the authors also demonstrated that the expansion of credit may result in a misallocation of both Financial and Human Capital. The first may result from the fact that banks may tend toward investments in easily scalable activities while the second results from the fact that this increase in the financial sector attracts a high percentage of talented human capital, which could otherwise be invested in other productive activities.

The literature does not only investigate the effect of financial structure on GDP and long run growth, but it considers other variables associated with the wealth of a country. In particular in 2016 Zeynab Sedghi Moradi, Mohammadreza Mirzaeenejad, Gholamreza Geraeenejad demonstrated that whether a system is bank based or market based also affects the income distribution of a country (Moradi, 2016). The authors constructed a variable defining income distribution by splitting the GDP among the elements that contributed in creating value added for a given enterprise and conducted an OLS regression showing that “market based financial systems lead to better income distribution in developed countries while bank based financial systems reduces inequalities in developing countries” (Moradi, 2016). Furthermore, the authors contributed to the literature by demonstrating that there are other relevant variables affecting income distribution, including Demographical structure, political system, historical and cultural factors and Economic Growth Development.

There are other factors to be considered in analyzing the consequences of having a bank-based economy. First of all, it is important to consider that having a financial system that relies mainly on banks has some significant advantages. These institutions are usually faster in gathering information and in processing problems compared to markets, which on the other hand are usually associated with a more efficient allocation of resources. While this rapidity in gathering information could be considered as a being a positive sign, it may also create particular kind of issues for bankers. The first issue that may arise is the so-called hold-up problem. It refers to the

fact that, through their operations, banks become specialized producers of specific information about a borrower credit quality. In the long term, this may generate a sort of bilateral monopoly between borrowers and lenders, in which borrowers that are classified as being high-quality borrows have prioritize access to funding. Banks will choose to lend firstly to these institutions while other potential borrowers may face issues in raising funds. This could lead to a misallocation of wealth.

Another issue that may arise in a system in which large banks dominate lending markets is the creation of a sort of large-banks monopoly. Given the high fixed costs associated with entering the banking industry, already existing giants may have an incentive in raising entry barriers that could additionally deter the entry of possible competitors. This would lead to a further centralization of banking services. Finally, having a too big banking system affects credit supply, which become more volatile. This is due to the fact that, since the credit cycle² is considered as a significant determinant of the business cycle of specific country, if a negative shock hits an economy, this would notably impact the amount of available credit supply which, in turns, may trigger the ability of institutions to access credit.

Credit cycle is one of the major factors affecting the business cycle. In particular, the growth in bank credit is much more volatile than the growth in stocks or other securities of non-banks institutions.

This is mainly due to a sort of amplification mechanism in which a change in the value of a bank's equity (or collateral) determines changes in the credit supply ability of that bank. Consequently, given the fact that the firms' ability to access credit depends on the value of their collateral, an increase in asset prices increases the value of their equity and hence their ability to borrow. An increase in the ability to borrow leads firms to invest more and this result in a further increase in assets prices, which in turns increase the values of banks collateral and boost their credit supply. This creates a sort of positive feedback loop in which, as assets prices increase, balance sheets size expands, credit supply increases further, and investments increases. This positive feedback loop takes a negative sign in the case a negative shock hit the economy. Indeed, a decrease in

² Credit cycle can be defined as the steps and evaluation that an insitutions should perform in order to be able to access bank credit.

asset prices would decrease the amount of available credit supply, reducing the firm's ability to access credit as well as their ability to invest. Due to the structure of this loop, having a too large bank system could be particularly dangerous for an economy.

Another important consideration to understand the current situation of the European banking system is the acknowledgement that most European banks can be defined as universal banks, i.e., banks which do not only perform banking activities, but which also undertake a series of other businesses including IT, HR etc. While this appears to be profitable from a bank perspective, from an economic perspective it generates social costs due to market distortions. Indeed, these institutions are likely to have specialized relationships with the government and privileged access to private funding with respect to their competitors in these sectors. These relationships could harm the correct functioning of the market.

Another negative consideration associated with having a bank based financial structure is that, according to Langfield (2016) this is likely to imply a higher systemic risk for banks. The author, through an empirical analysis, also demonstrates that this risk becomes particularly significant in the case of a decrease in the housing prices by more than 10%. This underlines the relevance for a given economy of having too high mortgages, in which houses are held as collateral.

On average what literature underlines is that, while there are several advantages associated with having a bank based financial structure, market-based systems are safer. Indeed, countries with high amounts of lending perform much better in positive economic periods, but in years of financial distress they incur in higher losses and longer recovery times.

2.1 Causes of the increase in European banking sector

Having understood that there is a bank bias in Europe and that it has negative effect for the long run growth of countries, many economists focused their attention in analyzing which are the causes of such bias, which indeed does not affect other countries like US or Japan.

The main causes identified in the literature are the followings.

First, literature blames political and supervisory institutions. Indeed, compared to other countries where the bank to market ratio is lower, economists showed that the European Government tend to support more distressed banks, especially the largest banks. Even if these contributions have

decreased after the crisis, the government still gives considerable incentives to these institutions compared to the amount issued in US. Moreover, historical analysis has shown a tendency of the European Government to favor the acquisition of distressed banks by domestic ones, instead of letting them go bankrupt. These incentives have resulted in the overbanking problem previously explained and has increased the tendency toward risk-taking activities by banks.

Pagano (2014) identified a list of reasons that in the past years have caused overbanking. These include mainly historical reasons, excessive universal banking (which indeed do not exist in the US) and politics. Indeed, the author underlines that in Europe there is a very tight relation between banks and government. This relation has been existing since World War II and, despite the initiatives taken by authorities to reduce the interdependency between banks and governments, it seems to be hard to change.

The last reason underlined by Pagano (2014) is that in order to face the very large costs incurred from technological expenses, it is necessary for a bank to exploit economies of scale, and thus take advantage from providing services to a large number of consumers. This, as a consequence, imply an increase in the size of institutions. This has had a major impact on European banks than on American because there has been a tendency after 2000 for the 20 largest European institutions to decrease the amount of assets designated to retail banking and increase those invested in the development of new financial instruments, including security trading and activities of issuance. For these banks, these strategic decisions have implied the necessity to invest significant in technological instruments and in highly skilled human capital. In order to recover the costs incurred, since once developed these products where expected to generate a high revenue, the most reasonable strategy for European banks has been to sell more and more of these instruments, resulting in an increase of their balance sheets size.

After the financial crisis that took place between 2007 and 2009, the European Government has taken significant steps aimed at reducing the bank bias in Europe. According to Pagano (2014), the government should move in two directions: Authorities should either reduce the so called “regulatory favor” that governments reserves to banks or take specific moves aimed at improving and favoring the activities of security markets.

2.2 Post crisis regulation

To reduce this regulatory favor, we see that the European Union have enacted a series of new policies in recent times. In particular, literature has been looking at 4 policies enacted between 2013 and 2014 that aim at improving the status quo. They are *The fourth capital requirement initiative package (2013)*, which empowers the authorities with the possibility to impose additional capital requirements and in this way reduce systemic risk. *SSM Regulation. (2013)*, which created a new system of financial supervision by the European Central bank. The *Bank Recovery and Resolution Directive (2014)*, which provides authorities with the power to take preventive interventions in advance on a specific institution if they reasonably believe that it is going toward bankruptcy. This with the aim of reducing the Too Big to Fail (TBTF) problem. Finally, there is the *Single Resolution Mechanism (2014)*, which provides European institutions, i.e. the Single Resolution Board, with the same power granted to national authorities by the previous directive.

Another significant initiative undertaken by the EU in this sense is the Capital Market Union (CMU) which is a plan aimed at creating a capital market more flexible and integrated among European countries. According to Teodor Boldeanu (2016), it can be considered as a powerful tool to “reduce fragmentation in financial markets, diversify financial sources, strengthen cross border capital flows and improve access to finance for business, particularly SMEs”. (Florin Teodor Boldeanu, 2016).

This project started in 2014 with the aim of integrating capital markets and reduce the costs for SMEs in raising capital and improve connectivity between investors in and across EU. CMU “involves widening the span of policy making in two senses: geopolitically from the Eurozone to the single market of all EU Member States and sartorially from banking in the narrow sense to wider financial markets and players.” (Dorn, 2016) Moreover, the project involves a tightening of the relationship between CMU and Fund for Strategic Investment (EFSI) because the two entities share the same logic of closer cooperation between regulators and markets. In 2015, the European Commissions published an action plan in order to foster the implementation of the CMU, which was revised in 2017 and it is still under implementation.

While the policies previously described were minor incentives and they took place only in Europe, we focus on the post crisis requirements imposed by the Basel Committee on Banking Supervision (BCBS). This authority was set up in 1974 by the Central Banks' representatives of ten countries and it can be defined as a committee of inter-country cooperation on banking supervision and regulation, aimed at fostering the worldwide financial stability. To recover the losses generated by the financial crisis and to reestablish the stability of banking institutions, the Basel Committee on Banking Supervision introduced in 2011 the Basel III regulation, a set of requirements aimed at strengthening banking operations at macroeconomic level. This aimed at creating a financial sector able to better respond to future financial crisis and to absorb possible economic shocks that may take place in the future. To achieve these goals, BCBS published a set of standards: Liquidity Coverage Ratio (LCR), Net Stable Funding Ratio (NSFR), Leverage Ratio and Capital Adequacy Ratio (CAR). Banks were given time from 2013 to 2019 to comply with Basel III requirements.

As far as Capital Adequacy and Leverage requirements are concerned, the contribution of Basel III was to update and improve the requirements previously mandated by Basel II in 2002. A more innovative contribution was the introduction of the Liquidity Coverage Ratio and the Net stable funding ratio, two liquidity requirements that did not exist prior to 2011. These introductions were mainly due to the significant liquidity weaknesses of the financial sector underlined by the financial crisis. In particular, what has been clear after 2009 was that the majority of banks did not have enough liquidity to absorb negative financial shocks and for this reason many of these institutions have not been able to survive to this period of financial distress.

The liquidity coverage ratio (LCR) requires banks to have a ratio of high-quality liquid assets (HQLA) over projected net cash outflows (NCO) greater than 100%, while the net stable funding ratio is calculated as total available stable funding (ASF) over total required stable funding (RSF) and it is required to be above 100%.

Because of its innovativeness and because of the liquidity weaknesses highlighted by the crisis, the liquidity coverage ratio has been kept under observations in the recent literature and its impact have been widely discussed.

Some studies have demonstrated a statistically significant relation between bank liquidity and the ownership structure of banks. (Lapteacru, 2016). The author has conducted an empirical analysis and have demonstrated that domestic and foreign private banks are less risky than state-owned, while those that appear to be the absolute least risky institutions are foreign banks. Moreover, it has been proved that the more the ownership structure of banks is concentrated the more liquidity is generated. Also the nature of shareholding may affect liquidity generations. It has been demonstrated that having an ownership structure in which controlling shareholders are other banks or financial institutions have a positive impact on liquidity generations (Yeddou, 2017).

Other relevant studies have tried to assess the impact of LCR and NSFR on banks profitability and return on assets. What literature has underlined is that, in recent years LCR has increased and has reached in almost all Europe since 2016 the mandatory requirement of a 100% level (EBA Report, 2017). Moreover, it has been proved that this has been mainly driven by an increase in HQLA, rather than by a decrease in the denominator coefficient of the ratio. The last report published by the European Banking Authority (EBA) on the analysis of the LCR evolution trends have also demonstrated that the levels of LCR across Europe are significantly above the minimum requirements mandated by the Basel Committee and that this value significantly depends on countries. In particular, in some east and north European countries this amount is close to 300%, while LCR appears to be lower in southern countries. After the financial crisis of 2007, which was mainly a liquidity crisis, the financial system has responded by significantly raising their amount of liquid assets over total assets, which now represents on average 16% of total assets. Given the fact that many banks show an LCR three times higher than the expected amount, European Authorities have also investigated this liquidity buffer. Empirical findings show that banks on average tend to have higher liquidity buffers in their domestic currencies than in foreign currencies (Fuhrer, 2016). This may create a risk for currencies in which the excess liquidity amount is lower compared to other currencies. This because, in periods of financial distress, liquid assets may become difficult to access due to Forex fluctuations (EBA, 2018). For this reason, the European union is now focusing on finding new ways of reducing currency mismatch.

Particularly relevant in the analysis of the Liquidity Coverage Ratio is the study conducted in 2017 by Giordana and Schumacher (2017), which have studied the development of LCR and CAR and

of the net stable funding ratio in a sample of Luxemburg banks. They have analyzed the impact of these ratio on the profitability of a single bank, on its return on assets and on its probability of default. Their results (based on an econometric analysis) were statistically significant and the authors have demonstrated that an improvement in this ratio increases the profitability of a bank and reduces its default risk. Thus, they provide an empirical evidence of what was expected by the BCBS, i.e. that Basel III regulation could effectively improve the soundness and safety of financial institutions.

The introduction of LCR has also impacted central banks' monetary policies. In particular, monetary policies are usually defined by central banks as a sort of target according to which central banks and other banks lend central bank reserves to each other. Since these reserves are considered as part of the HQLA of a bank, in order to meet the LCR requirements one may expect a higher demand of these assets. (Fuhrer 2016). In particular, literature has demonstrated that LCR affects monetary policies implementation in this sense and, in particular, it affects the process through which the implementation of monetary policy takes place (Bech, 2012). Indeed, banks require reserves from the central banks for two main purposes: to increase their amount of HQLA in order to achieve LCR requirements and to accumulate reserves for their operations. In the first case, a bank will tend to have a lower request for funds provision than a bank that requires reserves designated to their reserves account. In this way, LCR affects the relation between quantity of reserves demanded to the central bank and the overnight interest rate³, since reserves required may exceed the one needs to meet a bank's reserve requirement. Since the standard model of monetary policy implementation is based on the relation between the demands of reserves to the central banks and overnight interest rates, the introduction of LCR requirements could impact this relation, altering the standard model of monetary policy implementation. For this reason, central banks are likely to adapt their model of monetary policy to take into account this new requirement.

As far as the ability of banking to lend after the introduction of LCR is concerned, we see that literature has face this issue at a single bank level. In particular, it has been demonstrated that in some countries, for example in Luxembourg, small and large banks have reacted differently to

³ Overnight interest rate is the rate applied by institutions to borrow/lend one day funds between them.

monetary policies shocks after the liquidity coverage ratio introduction. In particular, meeting these requirements would require banks to adjust their balance sheet items, either to increase HQLA or to decrease expected outflows. This from a short-term perspective. From a long-term perspective, it has been argued that banks should have a safer balance sheet structure and they should be able to operate more safely (Liang, 2012).

Authors have underlined, in this sense, significant differences across the way in which small banks and big banks have changed their balance sheets. In particular, while big banks tend to decrease lending to small consumers, small banks have reduced wholesales sources of funding (Giordana, 2011). However, this particular study underlines that the different reaction of banks to LCR requirements refer to a sample of banks belonging to a single country and thus may not be representative of the entire European Sample.

Boora (2018) have proved that among the majority of countries both in Europe and abroad, those countries that complied with these regulations show better figures of ROE, ROA and risk exposure.

As fast as the readiness demonstrated by banks in complying with Basel III requirements is concerned, Diallo (2014) have shown that the majority of banks comply relative fast with what was requested by Basel III and demonstrating that they had the necessary resources to apply these new regulation (Diallo, 2014).

To sum up, we can say that, according to empirical literature, Basel III introduction have increased the profitability of banks, it has contributed in the reduction of their risk exposure and has foster the improvement of their stability factors.

While the papers previously cited have discussed mainly the positive impact of LCR introduction of financial stability, it is relevant to underline that other authors have argued that its introduction could actually have a negative effect in the financial economy. In particular, it has been discussed that, from a short-term perspective, meeting these requirements could require banks to undertake unfavorable moves. It has been argued that “the cost of increasing capital ratio may lead banks to raise the lending rates and reduce lending” (Cohen, 2013). The author has discussed that the same procedure has been applied from banks to increase their capital adequacy ratios. Many financial institutions have taken particular moves, like accumulating retained earnings and

reducing the amount of dividend payout in order to be able to meet the requirements imposed by Basel III. For the same reason, countries that have higher rates of LCR and CAR ratios at the end of the financial crisis have shown better growing patterns than those that presented lower ratios.

Some other studies have criticized the norms introduced by Basel III as unable to respond to the needs of the financial system. Some searchers, like Petitjean in 2013 have suggested that this regulation was not able to actually increase the ability of banks to respond to financial shocks. In particular, the author acknowledged that no tight regulation too much focused on avoiding default risk could actually prevent bank default and suggested that, instead of tight regulations, authorities should focus on increasing supervisions. This because, according to Petitjean (2013), having a too tight regulation could increase banks incentives to misbehave and manipulate balance sheets data and, for this reason, the current supervision mechanisms enacted by Basel III may not be sufficient in preventing this issue. Another significant finding against what was proposed by Basel III was stated by Samitas (2015), who conducted a financial simulation proving that Basel III was not so effective in preventing the risk of contagion.

Some others have demonstrated the fact that, according to their analysis, many financial institutions after the financial crisis were not ready or did not have the resources to implement Basel III regulations. These underlies that adapting with these new regulations would have signify a significant challenge for banks and, in particular, a high need of expertise and IT resources and huge adaptation costs.

Another issue that has been underlined by literature after the implementation of Basel III regarding the Liquidity Coverage Ratio was based on whether this requirement could actually decrease competition and increase financial stability given its peculiar structure. Harlage (2012) argued that the need to comply with Liquidity Coverage Ratio Requirements may increase competitions between banks in getting specific kind of resources. By creating a differentiation between retail and wholesale funding in liquidity requirements, it becomes challenging for banks to get retail funding.

Furthermore, the author has demonstrated that these concerns were not merely theoretical and suggested that Europe may follow the same example of Korea in the previous years, where particularly tight liquidity regulations has created incentives for market distortions.

Thus, while the introduction of Basel III in general seems to have increased the stability of the financial sector and it has been proved that complying with LCR and CAR requirements may have a positive impact on bank's profitability, many authors have presented several doubts regarding the effectiveness of Basel III in general and in particular with the issues associated with the introduction of LCR.

Moreover, the analysis of this last ratio has been mainly conducted by European Authorities and from a single entity perspective, while there are not many evidences on its impact on the impact of LCR on whole European economy.

It has also been argued that the introduction of the liquidity coverage ratio may reduce the amounts of funds that banks are willing to lend (Cohen, 2013) and this is why it may be useful to investigate whether, from a macroeconomic perspective, this has reduced the amounts of bank lending and thus the reliance of the European market on the banking sector which, as previously discussed, may be detrimental for growth.

Before proceeding with the analysis, this paper focuses on the recent trends that have characterized the European market after the financial crisis, to better understand the evolutions that have taken place.

The following section is based on the reports published by the European central bank on the financial system evolution in the years following 2009.

2.3 Recent trends in the European Sector

Before proceeding with the analysis, this paper underlines some of the main trends that have characterized the European banking sector after 2009.

After the financial crisis, the banking sector in the European Union has been subject to a restriction process.

In addition, other trends have played a significant role in impacting the banking system. As first, we see that the European Union has followed a deleveraging trend⁴ in the past ten years.

By looking at the European banking system after the financial crisis, we see that European countries have followed a decreasing trend in the total size of their banking system. In particular, empirical evidences have demonstrated that between the years 2003-2007 the banking system in Europe has been subject to a process of fast increase, with an average annual growth of almost 12%. This trend has totally changed direction in Europe. To note that, this applies to European banks, while financial institutions in the emerging markets have continued to growth after the financial crisis.

Another main trend that has characterized the post-crisis banking system is a change in bank concentration⁵. In particular, the number of operating banks has dramatically decreased in the past 10 years. This fall regards mainly small banks which suffered significantly the impact of the financial crisis and many of them has gone out of the market in these years.

Moreover, there has been a re-direction of financial institutions attention toward home countries businesses. In particular, after the financial crisis, the large M&A (which decreases the concentration ratio just considered) transactions increased significantly, maybe as a sign of the fact that banks moved toward a more stable business strategy. Also in this case, this consideration applies to countries most affected by the financial crisis, and to the European Union in particular, while as far as those countries not affected by the crisis are concerned, like in the case of Australia or Japan, the expansion trends of banks did not stop after 2009 and, instead, the number of financial institutions continued to increase.

⁴ As source we refer to the Report published by the European Central Bank in the past years.

⁵ With concentration we mean the share of bank assets held per each institution in a given country.

Other major trends that have affected the post crisis period and reflected how banks have reacted to these years of financial distress include some strategic considerations. In particular, in the post crisis many banks have changed their business strategy toward more safe models. These trends are not homogeneous in the sector, but still they characterized the vast majority of the banking industry. These changing of the business included in particular going toward less capital intensive and risky activities, increasing their commitment in wealth management and retail banking. By looking at the four main categories belonging to the banking industry we see, in fact, that while commercial and trading banks decreased in the past 10 years, the number of assets of retail funded banks increased.

Moreover, in some European countries, but also in abroad economies including Australia and US, evidences have shown an increase in the holding of liquid assets.

Particularly surprising, given the fact that one of the main causes of the financial crisis have been the sub-prime mortgages, has been the increasing amount of assets in banks' balance sheets held for mortgages. These have increased in the last years both in economies not affected by the crisis, but also in the European and Canadian economies. Only exception in this sense have been the United States, probably because of the many banks' failures due to subprime mortgages. Together with the assets held for mortgages, also the amount of non-performing loans (NPLs) have increased, on average in the major economies.

Moreover, by looking at the Europe countries in particular, we see that after the crisis the amount of wholesale funding in balance sheets banks have significantly decreased, as a proof that they moved toward a less risky business model. Indeed, before the financial crisis there was a significant tendency for European Banks to rely on market-funding to finance their operations. This has dramatically changed in the last years and banks have moved away from financial markets to rely on more stable sources of funding.

Always with the aim of increasing stability, both banks themselves as well as regulatory authorities have put a significant effort in increasing capitalization, which can be considered as a signal of bank stability. In particular, regulators have increased the capital buffers that financial institutions should apply in periods of financial distress and they have changed requirements

regarding the composition of common equity. Finally, also the amount of leverage in the banks' balance sheets have dramatically decreased in the last years.

While in the period pre-crisis the banking industry has been characterized by a significant increase in the amount of international banking, with financial institutions having large amount of interests in foreign economies, this trend has presented an opposite shift after the crisis. This has been particularly evident in the European union, where the size of banking dramatically shrank and many banks withdraw investments in foreign economies. Thus, what can be inferred from this is that not only the amount and type of activities of European banks were impacted by the financial crisis, but also the geographical distribution of exposures showed a significant restriction after 2009.

As far as the profitability of the banking industry in these years is concerned, we can state that, according to the analysis conducted by the European Central bank in 2018, also the average profitability of banks decreased. Both banks return of equity and return on assets decreased dramatically in these years and, while a slight increase was perceived after 2010, they still do not meet shareholder expectations.

These changes have triggered from one side and have been a consequence of, from the other side, changing in banking regulations.

In particular, with the introduction of Basel III banks have increased their capital and liquidity buffers and have thus increased the ability to meet financial stability.

By looking at the banking sector in the post crisis era, there are some improvements as far as financial stability is concerned.

Banks are now being evaluated according to new stress tests (designed after the crisis and approved by BCBS) and they are being evaluated using new indicators to assess their ability to absorb possible shocks. These tests suggest that the stability of banks has increased, mainly due to a change in the major sources of funding and as a result of improved risk management activities. Even if there is still room for further improvements, this suggests that the regulation is going in the right direction. On the other hand, there some concerns remaining about banks profitability. Indeed, even if the system seems to have reached a higher level of safety, banks still present lower profitability rates. Moreover, as we have seen banks moved the focus from an

international perspective to domestic operations, which is a change whose results may be either positive or negative.

As far as the amount of bank credit in the market is concerned, this has shown a significant increasing trend in the years before the crisis, and a decreasing trend after 2009. This has been particularly true for some of the European economies, where bank credit has decreased by more than 20 percentage points in the past 10 years. Bank credit amount in markets not affected by the crisis has not been impacted.

3. LIQUIDITY MEASUREMENT

After the financial crisis that took place in 2008, bank regulations moved a significant amount of focus on the concept of liquidity. Liquidity became a central issue in all the risk-management frameworks in all jurisdictions and new requirements were designed to ensure that banks have enough liquidity to face periods of financial distress.

To understand why liquidity is so important in defining macro-economic conditions, we have to focus on the acknowledgement that banks perform two main functions in the economy: liquidity generation and risk transformation. Banks finance risky loans through the issuing of riskless deposits and they generate liquidity by funding through short term liquid liabilities long term illiquid assets.

After the failure of the Lehman Brothers in 2008⁶, many studies have focused on the concept of liquidity, on the factors affecting liquidity generations in financial institutions and on the concept of liquidity risk.

Liquidity risk can be defined as “the current and future risk arising from a bank’s inability to meet its financial obligations when they come due” (BCBS, 2008). The main events that may cause liquidity of a bank to fall include unexpected increase in banks’ cash outflows, macroeconomic conditions that prevent other institutions from borrowing to banks and general liquidity risk in the market that also impact the liquidity risk of banks. Increasing liquidity risk is considered as dangerous both because of the consequences it triggers itself, but also because it may cause other kinds of risks, including market risk and credit risk.

In order to understand precisely what we mean with liquidity risk, we need to focus on the fact that banks operate by taking money from “savers”, who deposit money in bank accounts, and lending them to investors. There is then a “time gap” between when deposited money can be withdrawn and when money lent to investors are returned to the bank (with the formula principal + interest). With liquidity risk we mean the risk that a bank has not enough money to pay its contractual obligations in the time settled by previous contractual agreement.

⁶ Lehman Brothers was the 4th largest US investment banks, whose failure in 2008 is remembered as one of the most shocking events that ever affected the financial market. Its failure is considered as the result of the sub mortgage crisis that affected those years and, after the shutdown of Lehman Brothers (which counted more than 25 000 employees) the gravity of the financial crisis increased significantly.

This inability may arise as a result of *funding liquidity risk*, i.e. the inability of a financial institution to collect financial resources in time to pay its obligations, or from the *market liquidity risk*, i.e. the inability of a bank to convert a specific financial position previously undertaken in a liquid asset without incurring in a significant loss in the market value of the position. There are other causes to be mentioned as mainly triggering the liquidity risk: corporate factors that may affect liquidity risk and systemic factors affecting liquidity risk.

In the first case we refer to particular instruments that, if present in the balance sheet of financial institutions, may increase the liquidity risk of that institution. Moreover, there are also risk related factors that could downgrade the rating or the reputation of banks, lowering the trust of the market and of consumers on financial institutions. These factors may trigger the need of unexpected internal liquidity funding.

As far as systemic factors affecting liquidity risk are concerned, we refer to factors that are out of the single institution control but that could however affect the need of a bank to use more liquid resources than expected. These may include macroeconomic financial crisis, political restructuring effects, natural catastrophes.

These two possibilities generate respectively *corporate liquidity risk* and *systemic liquidity risk*.

3.1 Standard Liquidity Measures

There are some commonly used measures to assess the extent to which a financial institution is exposed to liquidity risk. In general, they represent a sort of standard evaluation models that assess the liquidity from an accounting perspective. These are then used by financial authorities to evaluate the liquidity risk of a specific bank.

The first indicator of liquidity that authorities and investors look at to evaluate the liquidity position of a bank is the Cash flow statement, which presents an analysis of the cash inflows and outflows in a company's financial statements.

The second main measure in this sense is the Liquidity index, which is designed to measure the ability of a company to convert non-cash items into cash to pay its obligations. In particular, it is

the ability to convert receivables and inventories. Liquidity Index is calculated using the following formula:

$$\text{Liquidity Index} = \frac{(\text{Trade Receivables} * \text{Days to convert}) + (\text{Inventory} * \text{Days to convert})}{(\text{Receivables} + \text{Inventories})}$$

Finally, liquidity positions can be assessed by looking at liquidity ratios. Among them, the most used are the quick ratio, defined as current assets minus inventories minus prepaid expenses on current liabilities, the acid ratio, defined as current assets minus inventories on current liabilities, and the current ratio, defined as current assets on current liabilities. These ratios allow the reader to assess the ability of a company to repay its short-term commitments using its short-term assets.

3.2 Liquidity risk

Before the financial crisis of 2007-2009 took place, banks were still required to maintain a minimum level of liquidity. Financial institutions were required to be able to face in any moment the payment of their commitments, but the evaluation of this ability was subject to a trade-off valuation offered by three operativity conditions: the maintenance of an adequate level of liquidity, the ability of meeting liquidity requirements in any time based on the commitments undertaken and the ability to generate an amount of profit adequate based on the kind of activity performed.

In this sense, the assessment of liquidity requirements was based on two evaluations: Liquidity management and treasury management.

As far as liquidity management was concerned, the measured entities were split into two groups: national banks (or groups of banks) and international intermediaries operating in different countries. For banks operating at national level the headquarter was in charge of the definition of the liquidity requirements to be applied and of the definition of the recovery plans to be

implemented while for international operating institutions each entity was responsible of the evaluation of their own liquidity levels.

This did not imply a significant complicated system and was an adequate procedure as long as the main function of banks was lending. However, in the past twenty years we have seen the born of more complicated financial instruments. Many banks moved from an *originate to hold* model to an *originate to distribute*. With these new instruments and new business models the traditional methods of assessing liquidity appeared as not being appropriate anymore for many financial institutions. In particular, before the financial crisis the assessment of liquidity was mainly aimed at avoiding market liquidity risk, while the other kind of possible liquidity defaults were neglected. Furthermore, the last financial crisis underlined the inappropriateness of the stress tests performed in the pre-crisis framework. With stress test, we mean the test aimed at assessing the extra outflows a bank should face in periods of financial distress and its ability to survive those periods. What the crisis underlined is that the results of these tests were not truthful and often financial institutions did not have enough liquidity to survive these periods.

Moreover, stress tests were performed individually by the single entity and they were not subject to any kind of control by the central headquarters. The same reasoning was applied in the estimation of the length of financial distress periods, which were evaluated by the subsidiaries individually and often appeared to be a too positive estimation compared to reality.

During the financial crisis the liquidity lack in the economy became particularly evident. The years before 2007 were characterized by very high liquidity availability and very low interest rates, which encouraged American citizens to make debts over their repayment ability. These led to the creation of the so-called subprime mortgages, mortgages granted to people showing relatively low guarantees.

The very high risk incurred by banks making these loans was compensated by the high interest rates charges. To collect the liquidity required to survive in this system, banks launched bonds and other obligations that have as repayment the subprime mortgages themselves. This system led to the creation to *Credit default obligations* (CDO) and *Credit Default Swaps* (CDS).

When the crisis exploded, there was a sort of liquidity disappearing from the market. Banks blocked mortgages and other debts to external institutions and, by doing so, they triggered the

collapse of the entire economy. The crisis hit both the financial system and the real economy and had its worst impact on families and individuals. The lack of trust in the market characterized the entire world. Firms and individuals reduced the risk of their activities and many institutions were not willing anymore to invest in relatively illiquid assets or activities, with the fear that their value could have dropped.

As far as the liquidity risk is concerned, we see that during the crisis the time mismatch between the time in which the money was lent and the time in which it was repaid was considerably long. In these years, the stability of the financial system was regulated mainly by Basel II, which was focused on the idea of fostering the stability and soundness of every single institution, which would have then been reflected on the financial stability of the system as a whole.

With the introduction of Basel III after the crisis, regulators aimed at addressing each one of these problems. They wanted to provide a regulatory framework aimed at improving a system that was not working properly from the beginning and that have shown all of its weaknesses during the years of the financial crisis.

3.3 Development of international regulation addressing liquidity issues

Numerous international institutions have faced the issue of liquidity risk. The most relevant in this sense took place in 1992, at the time of the first Basel Committee. This focused on fostering a better communication between the state and banks, which, according to the authorities, could foster a more efficient liquidity control. These documents included a series of *best practices* to be implemented by banks and were written with the contribution of national authorities. It included, among the other requirements, a set of mandatory frameworks to be followed for liquidity reporting.

The document was updated then on 2000, when the Basel Committee published a set of principles, i.e. 14 principles, aimed at re-assessing the methods of liquidity evaluation and liquidity risk assessment. These principles were developed with the aim of reinforcing previous requirements.

In 2003, Basel II, also known as "*The new Basel Capital Accord*" was released. This was developed with the aim of improving the stability of financial markets and it focuses on three main pillars.

The first pillar aimed at ensuring that banks have enough resources to avoid insolvencies due to credit risk, market risk and operating risk.

The second pillar focused on the control functions exercised by supervisory authority on liquidity adequacy of banks. Basel II required banks to adopt adequate and efficient measure to ensure liquidity adequacy.

The third pillar of Basel II was focused on information transparency. Banks were required, for each category of risk, to display the objectives and strategies pursued in each sense, the organizational structure and the methods used to measure that risk. However, they were not required to display detailed information on the managing of their liquidity risk.

In 2006, the Basel Committee for Bank Supervision, the international Association of Insurance Supervisors (IAIS) and the International Organization of Securities Commissions (IOSCO) published a report on *Liquidity Risk Management* for banks, insurance companies and other financial institutions. This report, focused on the managing liquidity risk, set out a set of prescriptive rules, which represented a sort of best practices but were not mandatory to be implemented at country level.

In 2006, also the European Union published a Directive on liquidity risk, i.e. *Directive 2006/48/CE* aimed at underling specific procedures to manage liquidity risk. This directive was in harmony with what prescribed by Basel II and represented a sort of additional specification for countries belonging to the European Union.

The last step in developing international rules for liquidity risk management took place just before the last financial crisis. In 2007, the Committee of European Banking Supervisors (CEBS) was put in charge of the analysis of the various and possible liquidity risks in the European countries. The entity was required to analyze the situation of banks, insurance and other financial institutions from a wide perspective, taking into account all possible issues that could arise and including a detailed analysis of funding liquidity risk, market liquidity risk, liquidity risk that could arise from an excessive time mismatch from lending and receiving back liquid assets. They were also required to analyze rating agencies requirements.

What these reports underlined is that liquidity risk discipline differed significantly across countries. These were not unique standard measures and threshold to assess liquidity

requirements in the many European countries. Some European countries used quantitative methods to assess liquidity, while other used qualitative evaluation techniques.

What the crisis showed is what European authorities started to understand with these analyses. Those measures of liquidity were totally inadequate and were not able to ensure the safety and soundness of financial systems.

In particular, while the other kinds of liquidity risks mainly affected the single entity, funding liquidity risk did not represent a threat only for the single institutions to have losses, but had the ability create a significant time delays in the expected cash inflows and outflows.

For this reason, it was not appropriate to face this kind of risk with additional liquidity provided by stakeholders, rather it should have been faced with the handling of more cash and cash equivalent or items readily convertible into cash.

The crisis that started in the second half of 2007 showed the inadequateness of the financial markets and underlined the weakness of Basel II in preserving the stability of the financial system. Indeed, while Basel II represented a good principle of framework, it let too much freedom to banks. Furthermore, the requirements developed in 2004 were put in place with a significant delay and were not universally applied. In particular, the US showed a very high resistance in complying with these rules.

As a consequence of this, two of the main episodes that represented the fall down of financial markets took place in this area: the fall of Lehman Brothers and Northern Rock.

As a result of these considerations, even if Basel II cannot be considered as totally responsible for the 2007 crisis, there were still some weaknesses in the framework that authorities wanted to face, including the requirements related to liquidity regulation.

The following figure summarizes the differences in the three regulations.

Table 1. *Summary of Basel evolution*

BASEL I	BASEL II	BASEL III
<p>Focus on:</p> <ul style="list-style-type: none"> • Credit Risk • Market Risk <p>Characteristics:</p> <ul style="list-style-type: none"> • Strong weighting coefficients • Diversification of portfolio assets recognized • CAR set at 8% level • Banks have the possibility to assign their own weight of risk to different assets 	<p>Focus on:</p> <ul style="list-style-type: none"> • Greater focus on market risk, operational risk and credit risk • No liquidity risk <p>Characteristics:</p> <ul style="list-style-type: none"> • Sophisticated evaluation methods • Efficient weighting coefficients • Few focus on SMEs 	<p>Focus on:</p> <ul style="list-style-type: none"> • Credit Risk • Market Risk • Liquidity Risk • Operational Risk <p>Characteristics:</p> <ul style="list-style-type: none"> • Introduction of tighter Liquidity regulation • Imposition of tighter requirements on total leverage • Tighter capital adequacy requirements

4. Basel III

To respond to the recent financial crisis that took place between 2007 and 2009, the Basel Committee on Banking Supervision (BCBS) met in Basel in 2010 and published, in 2011, a new document on banking regulation: the Basel III. Basel III includes a set of requirements aimed at solving the deficiencies of the banking sector revealed by the financial crisis. These include requirements aimed at strengthening regulation and at improving risk management in the banking sector. Banks were asked to comply with these new requirements in a time span between 2013 and 2019.

The main objectives of Basel III can be summarized in three main goals that the BCBS aimed to achieve.

They aimed first at achieving simplicity and transparency. Basel III aims at improving simplicity and transparency, by reducing the complexity of the framework and by granting a more agile comprehension of the new regulatory requirements as well as improving the ease of their applicability. The second main objectives that the Basel Committee on Banking Supervision fostered in developing Basel III were Consistency and Comparability. To enhance comparability of the financial positions of banks, the document tried to reduce the variability to which banks could present their financial figures and developed a framework aimed at avoiding the use of internal models to present “excessively favorable” financial statements. The third and last objective of the authorities was to improve Risk Sensitivity, which means improving the sensitivity to risk of standardized approaches applied to review internal banks’ models.

Among the main actors that contributed to the drafting of Basel III we identify the BCBS, the Financial Stability Board (FSB) which is an international organization that operated with the aim of supervising and ensuring the soundness operations of the financial system, and the G20, which is a group of financial leaders, finance ministers and central banks representatives created in 1999. This group was created as a consequence of a period of periodical financial crisis with the aim of improving the soundness and safety of the financial system. The BCBS, on the other hand, was established in 1974 with the aim of enhancing cooperation on banking supervision among the major countries in the world. The Basel Committee closely collaborates with the International

Organization of Security Commissions (IOSC) and with the International Organization of Insurance Supervisors (IOIS).

The changes enacted by Basel III are aimed at affecting the system both at micro and at macro level. In order to achieve these goals, Basel III introduces a series of updates to the current system, aimed at promoting a “set of system-wide macro prudential measures” (Banking Financial Services), which represents a significant improvement compared to the previously enacted Basel II, focused instead more on micro-prudential measures.

The regulation is designed as divided into three pillars: The first pillar is focused on the minimum capital requirements and it includes a series of mandatory thresholds that a bank should comply with. The second pillar focuses on the supervisory review process while the third pillar aims at enhancing disclosure.

4.1 Minimum Capital Requirements

The first Pillar enacted by the regulation has the goal of improving capital structure, facing risk and containing leverage.

The pillar focuses firstly on strengthening the CAR (Capital Adequacy Adjustments), a ratio already set at 8% by Basel II. The new regulation also set this ratio at the same level, but it requires that 75% of total capital is composed of Common Equity Tier 1 (CET1) and Additional Tier 1 (AT1), while the maximum amount of AT1 has to be lower than the 25% of CET1 capital. The remaining 25% can be composed of CET2 (Common Equity Tier 2).

$$\text{Capital Adequacy Ratio} = \frac{\text{Tier 1 Capital} + \text{Tier 2 Capital}}{\text{Risk weighted Assets}} \geq 8\%$$

Capital Adequacy Ratio is calculated as the sum of Tier 1 and Tier 2 capital of a bank on its risk weighted assets.

By breaking down the ratio, we can analyze each of its elements. Common Equity Tier 1 (CET1) is composed of common stock (including additional surplus related to regulatory requirements) retained earnings, other comprehensive income and minority interests in common stocks of

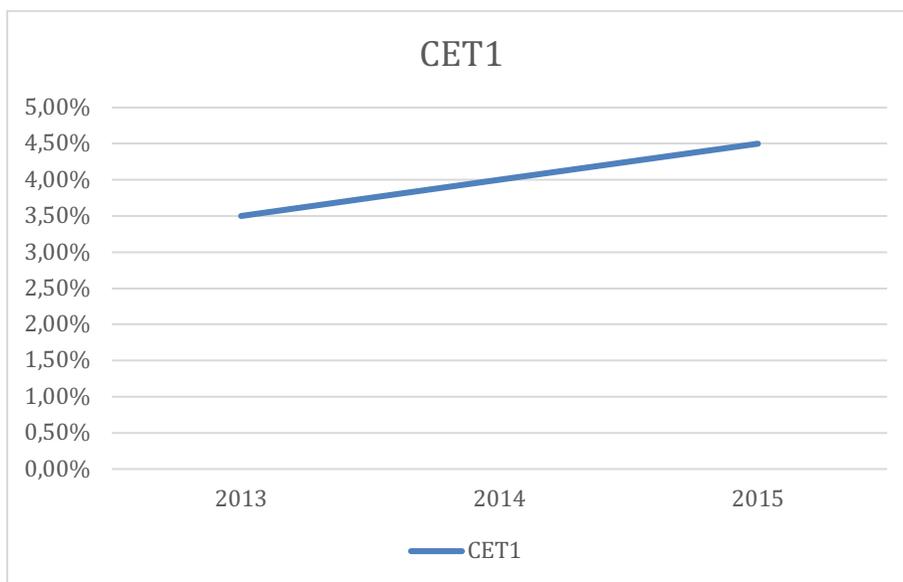
subsidiaries. Basel III also sets out the guidelines for the calculation of CET1 and for the issuing of new instruments pertaining to this category. The second element of CAR is the Additional Tier 1 (AT1), which includes additional common stock or additional paid in capital that do not present the necessary requirements to be classified as CET1. Finally, Common Equity Tier 2 is a composed of common equity that do no classify as CET1 and AT1, as well as stock with debt-like characteristics. The rationale behind the design of Tier 2 capital is to provide absorption on a “going concern” basis.

Basel III mandated that the CET1 component of the Tier 1 is increased from 2% to 4.5 % by 2015, while AT1 can amount only to the 1.5% of Tier 1 Capital. The remaining amount of the CAR denominator can be composed of Tier 2.

The amount of CET1 capital included in the calculation of the Tier 1 ratio also affected the amount of capital Buffers that banks were required to meet under Basel III requirements.

Furthermore, the regulation set out in 2010 the timeline for the achievement of these thresholds by banks, which were required to show on their balance sheet a 3,5% CET1 by 2013, 4% of CET1 by 2014 and 4.5% if CET1 by 2015.

Chart 1. CET1 Adaptation Time table



As far as the denominator of the Capital Adequacy Ratio is concerned, we see that it is composed of risk weighted assets, i.e. on- and off-balance sheet assets weighted according to their level of risk.

Moreover, given the fact that many financial institutions paid significant dividends also when facing financial distress conditions, Basel III designed two additional buffers. The rationale behind their implementation is that banks should collect capital enough during stable periods to be able to survive in periods of financial distress. The two buffers include a Capital Conservation Buffer and a Countercyclical Capital Buffer.

4.1.1 Capital Conservation Buffer (CCoB)

Capital Conservation Buffer (CCoB) is designed to permit banks to survive during periods of economic distress. Banks are required to maintain a buffer of 2.5% in addition to the amount of Tier 1 capital requirements (set at 4.5%). This brings the total amount of equity required at 7%. Financial institutions which fails to comply with the additional requirements related to the CCoB will face additional restrictions on dividend payout policies, on the ability to undertake share buyback operations and on the possibility to pay bonuses to employees or shareholders. Moreover, Basel III regulation mandates that the capital conservation buffer has to be only composed of common equity. The following table summarizes the requirement imposed by the CCoB.

Table 2. *CCoB requirements under Basel III*

Common Equity Tier 1 ratio (%)	Existing buffer (%)	Minimum Capital Conservation ratio (% of earnings banks to be held to rebuild the buffer)	Percentage of earnings available for discretionary distributions
4.5 - 5.125	0 – 0.625	100%	0%
> 5.125 – 5.75	0.625 – 1.25	80%	20%
> 5.75 – 6.375	1.25 – 1.975	60%	40%
> 6.375 – 7.0	1.875 – 2.5	40%	60%
> 7.0	2.5	0%	100%

4.1.2 Countercyclical Capital Buffer (CCyB)

The second requirement related to the CAR is the countercyclical capital buffer (CCyB). This is designed as an extension of the Capital Conservation Buffer and it is always aimed at ensuring that banks will be able to continue their operations in periods of financial distress. It ranges between 0% and 2,5% of common equity and it is implemented differently according to national circumstances. It is designed with the aim to achieve macroprudential regulation and requires financial institutions to accumulate additional buffer in periods when credit is growing faster, which have historically been associated with periods in which the systemic risk increases worldwide. Moreover, the countercyclical capital buffer is designed in a way that will prevent the reduction of credit supply available in an economy in periods of financial distress. This with the aim of preventing that a possible period a financial crisis could have a disastrous impact on the real economy.

The requirements related to the CCyB must be disclosed by the different member states periodically, at least when changes in additional capital requirements are disclosed. In case of banks active in many member states, jurisdictional reciprocity is applied. The CCyB has been under a trial phase between 2016 and 2018 and it is fully effective since 2019 for all jurisdictions, except for those that have been experiencing significant fast growth in these years. In this case, the application of the countercyclical capital buffer has been accelerated by regulators. Moreover, regulations mandate that different national jurisdiction have to announce increases in CCyB requirements at least 12 months in advance, in order to permit banks to accumulate additional capital to be able to meet additional requirements. On the other hand, reduction in the buffer requirements do not need to be pre-announced and are applied immediately when they are disclosed. In general, we see that currently jurisdictions are applying a 0% CCyB requirement, with some exceptions. These include among Basel III member jurisdictions UK (1% required CCyB), Sweden (2%) and Hong King SAR (1,875%).

As far as the rules regarding the setting of the CCyB requirements are concerned, we see that Basel III disclose specific guidelines that different member states have to follow in order to define their own requirements. In particular, according to the *Guidance for national authorities operating the countercyclical capital buffer* paper published by the Basel Committee on Banking

Supervision in 2010, we see that the underlying principles that member states have to apply in this sense are: objectivity, common reference guide, avoid misleading information, prompt release and macro prudence.

Thus, by summing up previous requirements, we see that by adding the Capital Conservation Buffer we obtain a total capital requirement of 10.5 % on risk weighted assets, subject to increases due to changes in the countercyclical capital buffer.

4.2 Leverage Requirements introduced by Basel III

Being the financial crisis of 2007 – 2009 significantly driven by an excessive leveraging of banks mainly financed through off balance sheet items, undertaking deleveraging operations during the period of the crisis worsened the already dramatic situation of the financial system in Europe at that time, by reducing the amount of credit available to the real economy. In order to avoid the incurring of deleveraging operations in the peak of financial crisis in the future, Basel III introduced a leverage ratio, aimed at reinforcing the risk-based capital requirements. It measures the degree of coverage of the Tier 1 capital on the total exposure of a bank and it is defined as:

$$\text{Leverage Ratio} = \frac{\text{Tier 1 Capital}}{\text{Total Leverage Exposure}} \geq 3\%$$

The requirement imposed by the BCBS was set at 3%, while the mandatory disclosure of the ratio was set starting from 1st January 2015. The ratio has to be revalued by banks every three months. By breaking down the ratio, regulators have defined as capital measures needed to calculate the numerator of the leverage ratio the Tier 1 capital evaluated under a risk-based framework.

The denominator of the ratio measures the exposure of a bank and it includes both on and off – balance sheet items. The first category includes all balance sheet items measured in general at their book value (except for derivatives and other financial securities subject to revaluation at fair value), reduced in general by the same items that are deducted from the calculation of the CET1.

Off balance sheet items include items such as credit and liquidity commitments, guarantees and standard letters of credit that are calculated by multiplying the notional amount of these items by a credit conversion factor. This credit conversion factor was derived from the Basel II approach for the calculation of credit risk.

Basel III is currently subject to updates on the leverage requirements introduced in 2017 by Basel IV. However, these are still under review and will not be applied until 2022.

The introduction of these two requirements, i.e. the improvement of the CAR and the leverage ratio, was mainly to face the concerns of BCBS on Counterparty risk. In particular, the focus is on two categories of counterparty risk: counterparty credit risk and external rating.

With Counterparty credit risk (CCR) we refer to the risk that one of the counterparties involved in a contractual agreement may default before the agreement is settled.

In order to face this risk Basel III introduced a series of requirements that financial institutions have to comply with, based on the periodical calculation of bank's assets and risks under the assumption of *worst-case scenario* (also called stress test). Banks are required to quarterly run a *stress test of default risk*, while the frequency of the test may increase in case of economic distress. The amount is subject to *credit valuation adjustments*, to take into account the capital that a bank would need to face the possibility that a counterparty solvency decreases. Banks are also periodically required to evaluate *wrong way risk*, which is the risk that a financial institution could suffer a loss in an exposure as a result of a decrease in the counterparty's creditworthiness. As far as external rating is concerned, Basel III requires banks to periodically assess their own rating, rather than relying on the assessment of external agencies.

In addition, Basel III introduces specific requirements regarding the minimum amount of liquidity that financial institutions should have in order to respond to future financial distress. These require banks to hold enough liquid assets to continue its operations over a period of a month in case of financial distress. The goal is achieved through the introduction of two new liquidity ratios: the liquidity coverage ratio (LCR) and the Net Stable Funding Ratio (NSFR).

To note that, following the introduction of Basel III, also the US Federal Government amended in 2013 its own liquidity requirements, by demanding banks to have enough short-term liquid assets

to cover its expected net outflows for one month (basically a slightly modified LCR). In particular, United States moved from a “qualitative” assessment of banks liquidity performed by supervisory auditors in the pre-crisis period, to the introduction of a Liquidity Coverage Ratio in 2013. This requirement still presents some differences with respect to the one enacted in the European Union but it represents a radical change, moving from a qualitative to a quantitative approach to liquidity assessment.

4.3 Liquidity requirements introduced by Basel III

As mentioned in the previous chapter, liquidity risk and new liquidity requirements after the crisis represented a significant challenge for new regulations. In particular, we start from the acknowledgement that the financial crisis of 2007-2009 was more a liquidity crisis than a credit crisis (at least in the first phase), since banks were unable to deliver short term funding. As response, Basel III published, in 2008, a set of *Principles for Sound Liquidity Risk Management*, and introduced two new standards: Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR).

Basel III aimed at strengthening the liquidity risk management practices and developed its new regulation applying the following principles.

First, Basel III aimed at regulating system-wide risk exposure, ensuring that each firm does not have more risk than what it could actually tolerate. Second, there is the aim to provide adequate measures of liquidity risk management, which did not exist before the financial crisis. The BCSB also aimed at providing measures that guaranteed that the risk undertaken by a financial institution was coherent with the amount of liquidity that it had on its balance sheet and they also aimed at developing risk test that actually reflected the ability of banks to survive in periods of financial distress. Finally, the liquidity requirements defined also aimed at guaranteeing that banks hold a sufficient quantity of high quality liquid assets in their balance sheets and that the regular mandatory disclosure of the liquid position of a firm is real and free from bias, both from a quantity and from a quality perspective.

While these were the main objectives of the introduction of liquidity requirements by Basel III, the authority states in the text that these principles should “be implemented in commensurate with the size and nature of the bank’s operations” (Basel III, 2011).

Thus, as previously anticipated the BCBS aims at achieving these goals through the introduction of the following two main liquidity requirements: the liquidity coverage ratio (LCR) and the Net Stable Funding Ratio (NSFR).

4.3.1 Liquidity Coverage Ratio

The LCR is calculated as high liquid assets divided by total cash outflows estimated for the next thirty days under the assumption of being in a period of severe financial distress and aims at granting that banks have enough HQLA to survive over a one-month period facing difficult financial conditions.

The ratio is calculated according to the following formula:

$$LCR = \frac{HQLA}{NCOF} \geq 100\%$$

In the calculation of high liquid assets banks should include central bank reserves, debt securities issued by public authorities, high – rated non-financial corporate bonds and covered bonds, while total expected cash outflows are calculated by multiplying the size of various size of liabilities and off-balance sheet commitments by the rate at which they are expected to run off or be drawn down under a stress scenario. Banks are expected to meet this requirement continuously.

4.3.2 High Quality Liquid Assets

in order to be classified as a high quality liquid asset, an asset must be considered as liquid in periods of financial distress, which means that a high quality liquid asset can be converted into cash at any time easily or immediately with (almost) no loss in value.

HQLA share some basic common characteristics. They include assets with low credit and market risk that have an enhanced degree of liquidity. They have low liquidity risk, low duration and low inflation risk. They have a high degree of certainty in their valuation and their correlation with risky assets is relatively low. In other words, if financial institutions agree on the valuation of an asset, this is more likely to be considered as highly liquid.

Being listed on developed and recognized exchange markets also enhances an asset liquidity.

As far as markets in which HQLA are traded are concerned, there are some further characteristics that these markets have to share. Indeed, these assets have to be traded on markets that are constantly active and including a relatively high number of traders and the quotations to buy or sell that specific HQLA have to be constantly available. The markets in which HQLA are traded have to be markets with a low concentration rate and operators should focus on this kind of trading in case of financial distress.

Furthermore, high quality liquid assets can further be classified in two categories: level 1 and level 2. Level 1 assets include “cash, marketable securities claims granted by sovereign, central banks, non-central government public sector entities, the bank of international settlements, the international monetary funds, and the European commission; central bank reserve; non-0% weighted sovereigns or central bank debt securities” (Liang, 2013). These types of assets can be illimitably included in the numerator of the LCR.

The second category can include assets on only up to 40% of the stock (after having applied a 15% security haircut). Assets with a lower degree of liquidity compared to the Level 1 assets belong to this category. They include marketable securities claims that are granted by sovereign authorities and that satisfy specific conditions. They have to be assigned a 20% risk weight using the Basel II approach to risk valuation, they have to be traded on large markets with low concentration and they have to be relatively liquid (Basel III mandate a maximum of 10% fluctuations in their price on a 30-days period).

4.3.3 Net Cash Outflows

“Net cash outflows are defined as cumulative expected cash outflows minus cumulative expected cash inflows arising in the specified stress scenario in the time period under consideration” (Liang, 2013)

In general, it is costly for banks to comply with these new requirements and regulators did not expect banks to exceed the 100% that the European Union has required them to comply with by 2019. This is why the trends previously underlined appear to be surprising.

Another expected trend by regulators when LCR was firstly implemented was an increase in the borrowing rate of Central Bank reserves.

By looking at how lending may affect the liquidity coverage ratio of a financial institution, we note that acquiring bank reserves can be used to make up deficiencies and get the LCR closer to 100%. On the other hand, “interbank loans of more than 30 days are not included in the NCOF and the repayment falls outside the stress scenario. It increases the numerator without affecting the denominator and can thus be used to make up deficiencies”.

This because this would increase the denominator but less with respect to the numerator, having thus a positive impact on the LCR.

4.3.4 Issues

Implementing correctly LCR calculations can include a series of challenges for banks. Here we underline the main difficulties faced by firms in this sense.

First often the accounting view of items, as reflected in the balance sheet displayed at the end of the accounting year, may not correctly reflect the financial position of a company. Thus, further adjustments have to be made in order to correctly evaluate the liquidity of assets as well as to correctly evaluate the cash outflows. Moreover, often reliable models to assess the maturity of particular kinds of debts (needed to estimate the expected cash outflows in a period of financial distress) are not available or easy to calculate.

Being the LCR a relatively recent regulatory requirement, it has been argued that its description is not very clear and banks have faced significant challenges in correctly interpreting the regulation. Moreover, LCR set up has been mainly designed for large banking groups rather than

for small banks. This creates some issues for both categories. In particular, while for large banks difficulties arise because of the size of the entities and because of their complicated structure, in the case of small banks difficulties are related to the fact that their structure could strongly differ from the one of large banking institutions.

Furthermore, more detailed studies on the issue have stressed the fact that, once banks have implemented their Liquidity Coverage Ratio requirements correctly, they should develop an operating model that enables them to insert all their liquidity calculations in a system able to evaluate a company's LCR and they also have to incorporate these new evolution methods on their balance sheets.

While the BCBS gave banks a significant amount of time to adapt their system to these new requirements, it is important to note that it represents a cost for financial institutions, which have now to adapt their whole internal system to meet the new liquidity framework requirements.

4.3.5 Net Stable Funding Ratio

The second main liquidity requirement introduced by Basel III is the Net Stable Funding Ratio (NSFR). The NSFR is established to “promote resiliency over longer – term horizons by creating additional incentives for banks to fund their activities with more stable sources of funding on an ongoing basis” (Basel Committee) and it is defined as:

$$NSFR = \frac{\textit{Total Available Stable Funding}}{\textit{Total Required Stable Funding}} \geq 100\%$$

With Available stable funding (ASF), we mean the liabilities of a bank, weighted according to their stability. Stability is defined according to the category of funding and to an evaluation of the counterparty. In particular, longer term liabilities are in general considered as having a higher degree of stability than short term liabilities. Moreover, SFR is calibrated under the assumption that short-term deposits provided by retail customers and small enterprises are more stable than wholesale types of funding with the same maturity but granted by other counterparties.

Required Stable Funding (RSF) is defined as being calculated through an evaluation of balance sheet assets (weighted inversely according to their liquidity) needed in order to meet the commitments of an institutions.

According to Basel III regulation, NSFR must be greater than 100%, i.e. $ASF > RSF$, and must guarantee that an institution can operate as a going concern for at least one year.

This requirement was mandated since 2013 (with mandatory alignment by 2019) for international active banks and national authorities were given the possibility to extend this requirement to national banks, even if not operating internationally. The practical results should be then a reduction in maturity mismatch.

It is important to note that, while both LCR and NSFR are two liquidity requirements aimed at improving the liquidity stability of a financial institution, there is a structural difference between the two. In particular, LCR directly affects the required liquidity of banks, NSFR impact the financial composition of the main balance sheet items.

Many studies have investigated the impact of NSFR introduction on banks operations and, in particular, it has been proved that banks with a NSFR below 100% at the time in which Basel III was enacted, have tried to improve the ratio by increasing the numerator (ASF). From a macroeconomic perspective, this has an impact in our analysis because, by improving ASF, financial institutions have reduced loans to real economy, reducing the credit supply financed by banks.

The following figure summarizes the main introduction of Basel III.

Table 3. Summary chart of Basel III

RATIO	CALCULATION
CAR	$CAR = \frac{CET1 + CET2}{RWA} \geq 8\%$
LEVERAGE	$Leverage\ Ratio = \frac{Tier\ 1\ Capital}{Total\ Leverage\ Exposure} \geq 3\%$
LCR	$LCR = \frac{HQLA}{NCOF} \geq 100\%$
NSFR	$NSFR = \frac{ASF}{RSF} \geq 100\%$

4.4 Basel IV

Before proceeding with the analysis of our sample, I would like to underline that Basel III is still not considered as a definitive framework. Indeed, soon after its publishing in 2011, the Basel Committee on Banking Supervision (BCBS) started planning the further meeting to develop Basel IV.

The final draft of this last framework was published in 2017, which mainly updated the CAR calculations. In particular, Basel IV updated the framework as far as the calculation of risk weighted assets was concerned. Moreover, it provided a more specific definition of how Tier 1 Capital was defined and it published further updates on the calculation of leverage ratio buffers. The main improvements of Basel IV will be to change how risk weighted assets will be calculated and will provide a series of innovative solutions for banks, which will have to update their internal model for RWA calculation.

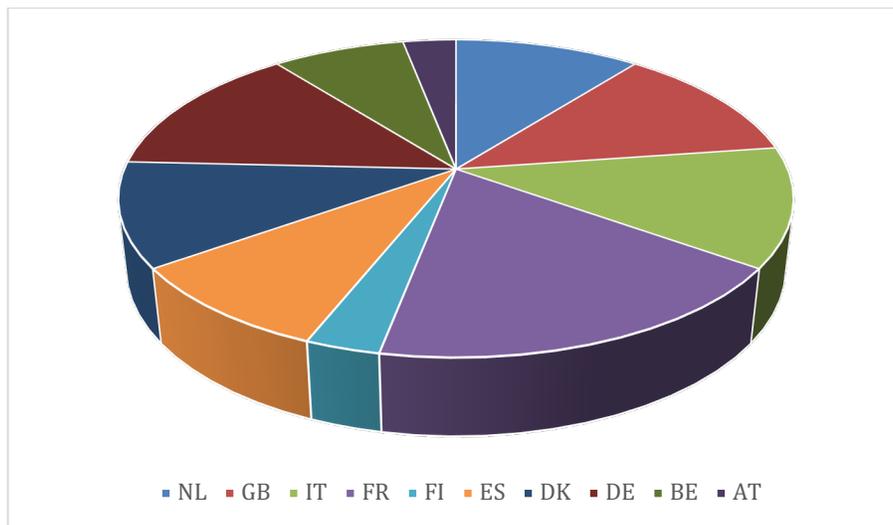
Since it has been estimated that the new approaches to risk weighted assets calculation will significantly decrease this amount for banks, creating a challenge for financial institutions to meet the requirements imposed by regulatory standards, the framework considers a nine years compliance phase in order to give enough time to banks to adapt to these new requirements. In particular, BCBS requires companies to start their process of adaptation by 2022, while they will be required to fully be aligned with Basel IV requirement by 2027.

5. DATA AND METHODOLOGY

5.1 Data Description

Our database was constructed using the following procedure. We selected the first 100 European banks ranked by total assets. Then, we deleted banks for which relevant data from 2013 to 2018 were not available or which were born after 2013. The remaining institutions were then split by country and the resulting dataset is then divided between 10 European countries: Germany, Austria, Spain, Italy, United Kingdom, France, Finland, Denmark, Belgium and Netherlands.

Chart 2. *Sample Distribution by Country*



The previous graph underlines the distribution of the sample by country. In particular, we can see that on average the distribution of the sample is quite homogeneous, which means that the observations obtained are on average equally split between the 10 countries analyzed. The countries for which we have the higher amounts of observations are United Kingdom and France, while those with the fewest number of banks belonging to our sample are Austria and Finland. Given the fact that our sample was based on the selection of the largest European banks ranked by total assets, this means that UK and France are the countries with the largest banks in Europe.

As main dependent variable we used the amount of bank financing in a specific country. This amount has been measured as Credit to Private non-financial sector from Banks, total at market value, measured as a percentage of GDP. We took this value for each of the 10 observed countries from 2013 to 2018. The same procedure was applied to the other dependent variable, i.e. total bank assets per country, used as a proxy of the evolution of the size of the banking sector.

These data were taken from the Bis (Bank for International Settlement) Statistics Warehouse and are updated at 2019, while data on individual banks were taken from the Bank Scope database.

Since our aim is to check the effect of liquidity requirements for banks on the total amount of bank financing, and given the fact that the main improvement in this sense as previously explained was the one introduced by Basel III, we select as predominant regressor in model the Liquidity Coverage Ratio (LCR).

To create this variable, we considered the value of the LCR displayed by each of the banks in the sample in the six years under observation and we averaged them in order to get a single value for each country.

Since, except for liquidity requirements, this paper has been looking at Basel III regulation as a whole, this paper also checks the impact of the other main pillar of the regulation, i.e. the capital adequacy ratio (CAR). To evaluate the average CAR by country in each year we applied the same method previously described for the LCR.

We can define these two as our predominant regressors in the model.

In order to increase the robustness of the model, we check for macroeconomic conditions by considering GDP growth rate per country (*GDP percentage change*) and inflation rates (*inflation per country*) in each of the considered countries. Inflation rates and the total absolute GDP per country were taken from the BIS statistical warehouse database. In order to evaluate the GDP percentage change per country we evaluated the percentage change in the absolute GDPs per year.

The following figure provides a summary statistic of the variables in the model.

Table 4. *Summary Statistics*

Variable	Mean	Std. Dev.	Min	Max
year	2015,50	1,72	2013,00	2018,00
LCR	146,78	43,46	49,60	323,43
CAR	19,03	3,04	13,54	24,71
GDP percentage change	0,03	0,02	0,00	0,07
Inflation per country	1,05	0,76	-0,50	2,60
Log total assets	5,33	0,46	4,30	5,86
Bank Financing	98,18	29,12	178,10	55,30

We see that on average Liquidity Coverage Ratio and Capital Adequacy Ratio in the sample are above the minimum standards required by the Basel III regulation. Moreover, the average percentage increase in GDP per country is 0.03 and the inflation rate per country is on average in the years between 2013 and 2018 1.05%.

As far as the dependent variables are concerned, we see that the average amount of bank financing (expressed as a percentage of GDP) in the period under observations amounts to 98.18. This is a significant high amount, especially if we consider that according to what has been discussed in the literature, having an amount of total bank financing on GDP above 90% has a negative effect on GDP growth. However, this amount differs significantly among countries.

To evaluate the other dependent variable, i.e. total bank assets per country, we took total assets of banks per country in the period under observation. To have a better estimation of this variable, we took the logarithm of total bank assets per country.

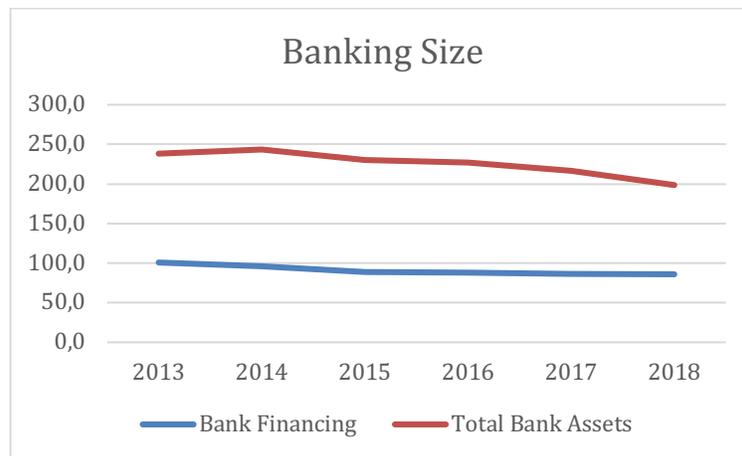
Further, we will proceed with a more detailed analysis of these indicators to understand which countries present a larger bank industry.

5.2 Evolution of banks' size

The amount of bank financing in a specific country was taken from the Bis (Bank for International Settlement) Statistics Warehouse and, to evaluate this amount, we looked at the Credit to Private non-financial sector from Banks, total at market value, measured as a percentage of GDP. The total size of the banking sector in country, on the other hand, have been valued using the total bank assets per country.

The following figure shows the average trends of the two dependent variables.

Chart 2: *Evolution of Bank financing and of Bank Total Assets*

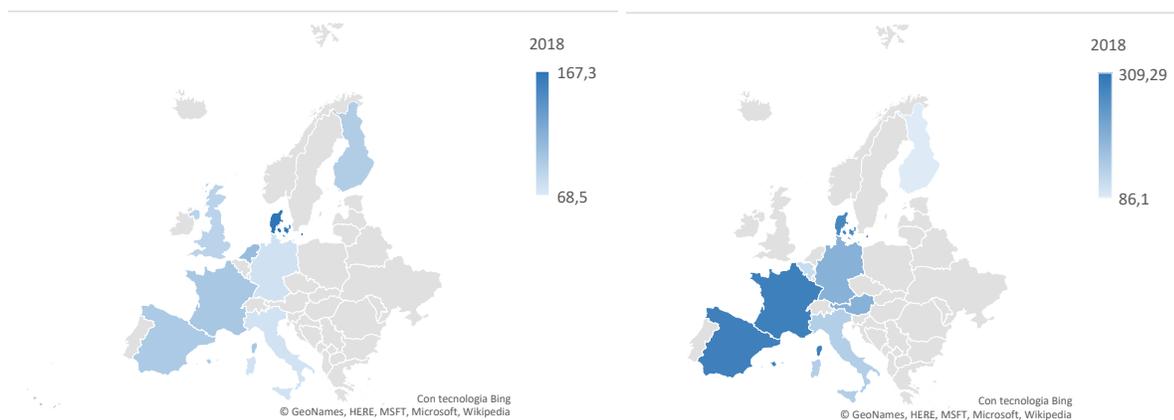


As we can see, both total bank financing and total bank assets decrease from a European perspective after 2013, which is the year in which the introduction of Basel III requirements became effective. In particular, as we can see from the graph, the banking sector in Europe started to decrease after 2014, while from 2013 to 2014 we still see a slight increase in banks' total assets and a constant amount of bank financing in Europe.

This is consistent with what was published in the European Central Bank reports in the past years, as a sign that that our sample can be considered as a good representative of European banks situation.

In particular, we start by looking the amount of bank financing in the European countries in the last period of observation.

Chart 4. *Distribution of Bank Financing (right) and Total Bank Assets (left) by European Countries*



From the two graphs we can see that there is a sort of consistency between countries with higher amount of bank financing and countries with a higher amount of bank assets.

On average, we can see that countries that show a higher amount of bank financing are countries from the north of Europe, which show an amount of about 1,5 times their GDP.

On the other hand, countries that have lower bank financing are countries from the south and eastern Europe.

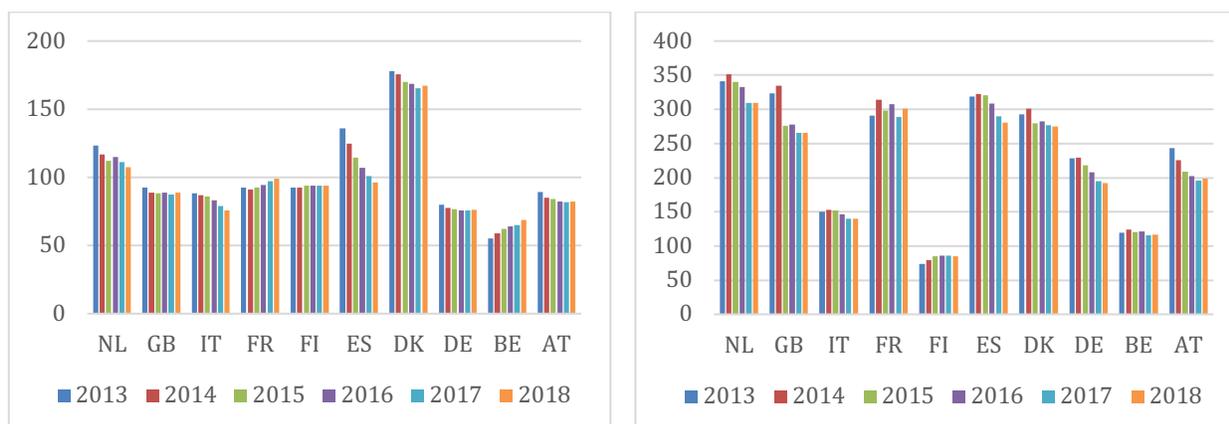
Countries with a higher total amount of bank assets are countries mainly located in western Europe, like Spain, France and UK, while countries that had a lower banking sector in 2018 were countries from the east, including Italy and Finland.

We also want to look at the evolution of the bank industry by country, to understand whether some countries strongly differentiate its banking sector from the trend of the European Union in the period under observation.

By looking at the total amount of bank assets by country, expressed as a percentage of GDP, and at the total amount of bank financing the sample periods we can infer that, on average, countries with a higher amount of bank financing and of total assets in 2013 have shown more significant decreasing patterns, with respect to countries that had a lower amount of bank assets in 2013.

Figure 4. summarizes each country's evolution pattern.

Chart 5. *Evolution of Bank Financing (right) and Total Bank Assets (left) by Country*



By looking at this graph we can see some particular characteristics among European countries. In particular, the majority of the countries in the sample show significantly decreasing trends in both variables, Like United Kingdom, Spain and Italy. Other countries, like Germany and Austria show significantly decreasing pattern in the total amount of bank assets, while the amount of bank financing remains almost stable and the decrease in the sample period is slight.

Countries that from the beginning of the sample period positioned themselves as having a lower amount of bank assets compared to the most bank-reliant countries did not significantly decrease its bank assets after the crisis and rather they kept an almost stable amount.

The only countries in our sample that significantly differentiate from the other in this sense are Finland and Belgium, which show a slightly growing trend in both the size of the banking industry and in the total amount of bank financing. However, these were two of the economies with the smallest size of banking in 2013.

What we can infer from this analysis is that, while on average the amount of bank financing in Europe decreased after the crisis, this shrink is mainly associated with countries that relied more on banks during those years. This is probably due to the fact that, due to their structure, those countries were the ones that suffered more during the crisis.

On the other hand, countries that have demonstrated not to have a large amount of bank assets in the crisis period, have not significantly decreased the size of their banking sector.

5.3 Evolution of LCR and CAR

5.3.1 Liquidity Coverage Ratio

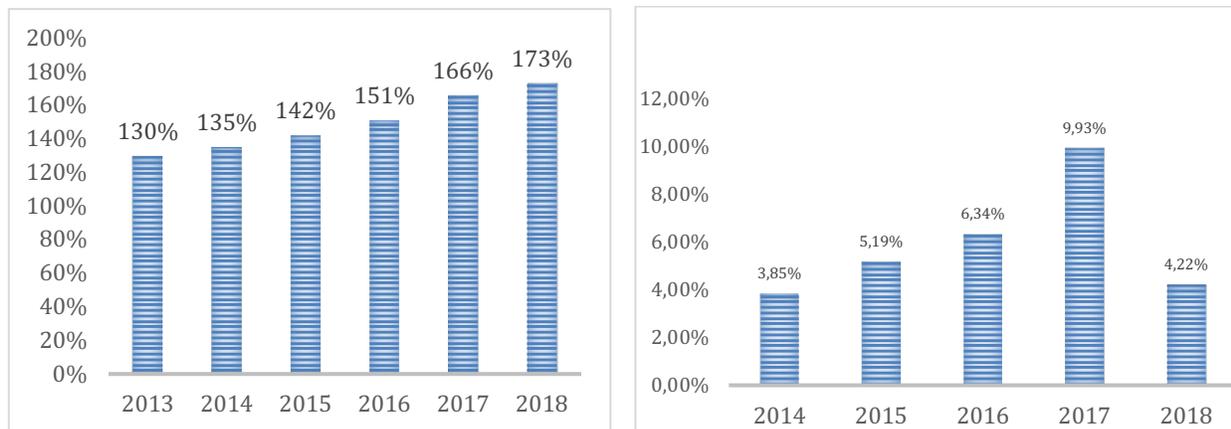
The dataset used in our research is composed of 100 European banks ranked by total assets. We eliminate banks for which data were not available for the period under observation or which were born after 2013. We then split banks by country of origins, obtaining observations for 10 different countries in Europe.

Based on our sample, we conduct an analysis of the evolution of the LCR and of the CAR ratios in the past six years. Then we proceed through a comparison between these two.

Banks have put a significant effort in complying with LCR requirements and, on average in Europe, all banks LCR was higher that 100% level since 2016. In our sample only one financial institution did not comply with liquidity requirement after 2015.

Chart 5 shows the LCR evolution in the largest European Banks since 2013.

Chart 6. Average absolute LCR evolution per year (right) and LCR percentage evolution (left)



As we can see, LCR increase in the largest European Banks follow a positive trend, underling the willingness of the financial sector to comply with liquidity requirements.

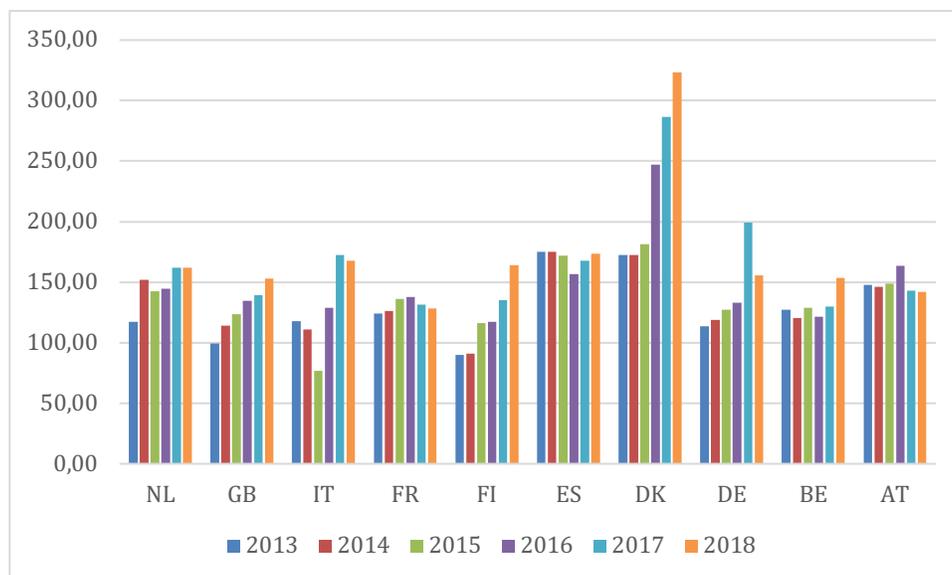
By looking at the evolvment of LCR from a percentage increase perspective, we see that this value shows a relatively constant increase from 2013 to 2016, when the percentage increase per year increases on average by 1.5 percentage points per year. The largest increase in liquidity availability by banks took place in 2017, when banks in our sample on average increased their

liquidity requirements of about 10%, while the percentage increase from 2017 to 2018 amounts only to 4%.

By looking at our observations split by countries, we can see that, while the majority of countries show average LCR between 100% and 200%, one of them, Denmark, show a value above 200% in the last three years. However, it is important to note that only 7 banks of the sample are located in Denmark and thus this number may not be a good representation of this country.

Chart 6 display the LCR trends per country.

Chart 7. LCR evolution per country

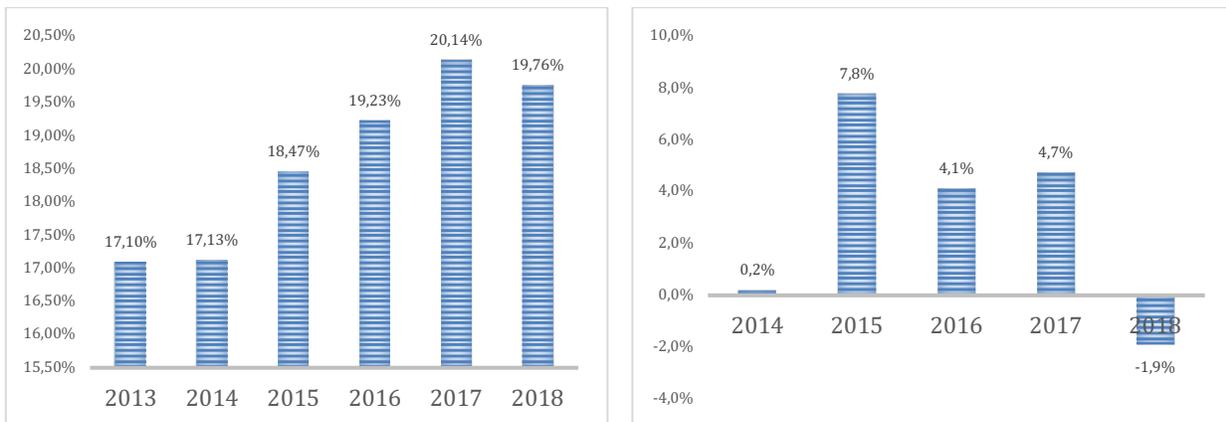


By looking at the trend for each country we can see that the growth is relatively stable and that there is a relative consistency in the average among countries. As previously anticipated, the main exception is Denmark, which shows a very high amount of liquidity retained on average by banks. Among the countries considered, we can see that in 2018 liquidity requirements were between 128,27 and 323,43 and the north European countries present on average higher liquidity ratios than southern countries. However, the distribution differs from the one conducted from the size of banking. While in the previous case higher amounts of bank assets were in France and UK, here we see that France is significantly behind other countries in complying with liquidity requirements.

5.3.2 Capital Adequacy Ratio

Our sample suggested us an in increasing trends among European banks of the Capital Adequacy Ratio.

Chart 8. Average absolute CAR evolution per year (right) and CAR percentage evolution (left)



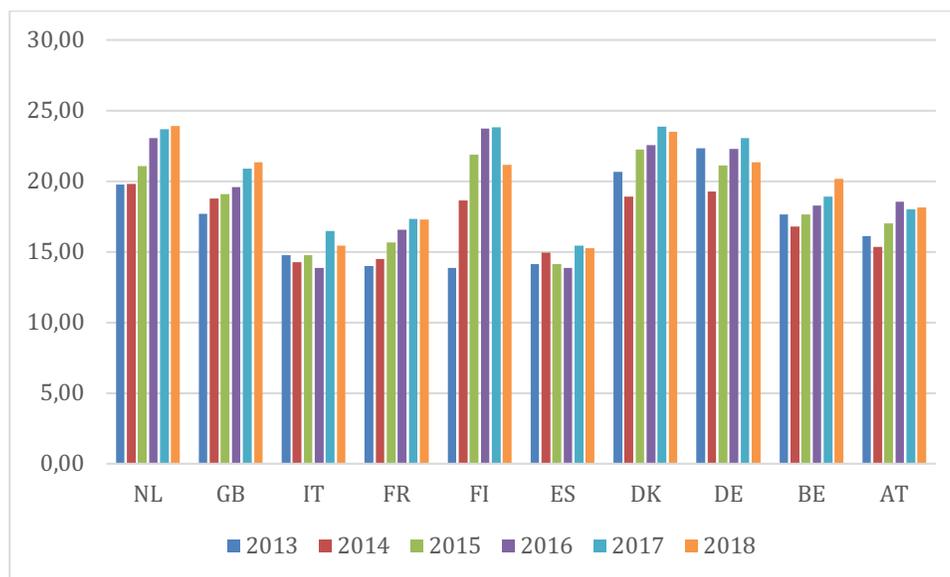
In particular, CAR has been increasing from 2013 to 2017, while it slightly decreased on average in the past year. However, given the fact that the requirement imposed by Basel III is that the Tier 1 and Tier 2 capital represent at least 10% of a company risk weighted assets, we can argue that banks still complied with the requirements imposed by the European Union.

Rather than just looking at these values in absolute terms, it may be useful to look also at the percentage increase from one year to another.

In particular, as we can see from the graph on the right, the major increase took place in 2014, while Capital adequacy ratios increases at a constant rate from 2015 to 2017 and drop dramatically in 2018, when the trend shows a decrease in the amount of CET1 and CET2 on risk weighted assets of almost 2%.

Also in this case we want to look at the ratio's value of 2018 among European countries. As in the case of LCR compliance, financial institutions located in the northern countries show on average a higher CAR ratio compared to the southern European.

Chart 9. CAR evolution per countries



By looking at the growth rate per country, we can see that it is characterized by a relatively low constant increase. Countries that showed a relatively high amount in the first years kept their level of CAR high compared to the other countries in the following years, while those countries that presented a low ratio in 2013 still have a relatively low ratio in 2018.

The main exception in this reasoning are Finland and Netherland. Those two countries showed a significant increase in their Capital Adequacy Ratio between 2013 and 2018.

5.4 Comparison

In general we can say that, while the improvement of the LCR ratio in the last five years is evident and clear at first sight, the improvement of CAR has been less significant, even if still characterized by a constant increase. Only exception in this sense has been last years, when the percentage increase in CAR showed a negative value.

This may be due to the fact that capital adequacy requirements were still existing under Basel II, which required banks to have at least 8% CAR ratio. The contribution of Basel III is related indeed to the introduction of the capital buffers to be applied by banks in periods of financial distress and, as far as the numerator is concerned, to the maximum amount of CET1, AT1 and CET2 that could be included in the ratio. For this reason, banks probably already adapted their financial structure to these requirements and did not have to significantly change their structure to comply with Basel III capital adequacy requirements.

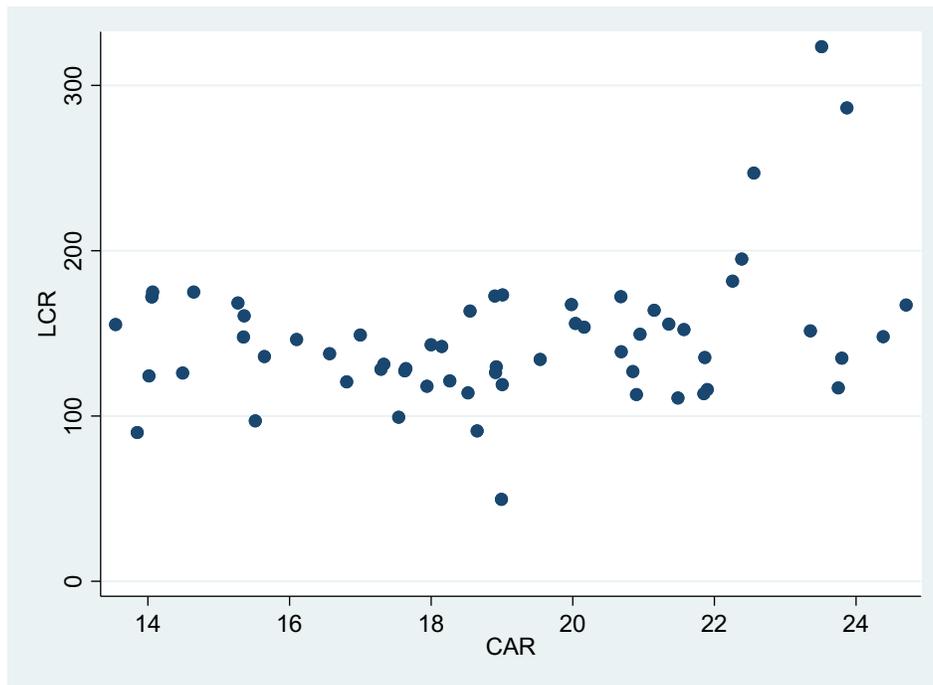
On the other hand, the liquidity coverage ratio did not exist before Basel III introduction. It represents a totally new liquidity requirement with which financial institutions did not have to comply before. Thus, financial institutions have needed to adjust their balance sheets structure to reach the amount of LCR required and, for this reason, they show a more evident increasing trend in the last six years.

Correlation between LCR and CAR in the sample appears to be relatively low and it shows a value of 0.3495. This means that countries in which banks show a relatively high liquidity coverage ratio do not necessarily show a high capital adequacy ratio.

Chart 9 displays the correlation between liquidity and capital requirements.

We checked also for the correlation between the logarithm of these values by checking the correlation between the logarithm of the LCR and CAR in one country for each year, but also in this case the correlation between these two values appear relatively low, showing an average value of 0.2274.

Chart 10. Correlation between CAR and LCR



Since we know that the minimum liquidity coverage ratio requirements imposed by Basel III is 100%, we can see from the graph that very few observations are below that value. Moreover, by looking at the previous analysis of the industry trend we can say that probably these observations belong to the first years of the observation period.

Moreover, we know that the minimum CAR requirements imposed by Basel III are 8%, which may reach a 10% threshold due to the presence of capital buffers. None of the observation in the sample appear to be below this value and this is probably due to the fact that these requirements (in a similar format) were still present under Basel II.

5.5 Econometric specifications

With these data we constructed a Panel Data composed of six periods for the 10 countries observed. We used a fixed effect model to run the regression.

The model is constructed as follow:

$$Bank_{Financing_{i,t}} = \alpha + \beta_1 LCR_{it} + \beta_2 CAR_{it} + \beta_3 GDPincrease_{it} + \beta_4 inflation_{it} + \mu_{it}$$

where i represents one of the ten countries in the sample and t each of the 6 years of the observation period.

Since our dataset does include some omitted variables, like specific countries characteristics, and since we assume that these variables will be time invariant, we use a fixed effect estimation model.

To estimate the effect of Basel III liquidity requirements on the size of the banking sector, we construct a similar model, keeping as dependent variable the logarithm of the total amount of bank assets per country in the sample period.

$$\begin{aligned} Log(Bank_Assets)_{i,t} \\ = \alpha + \beta_1 LCR_{it} + \beta_2 CAR_{it} + \beta_3 GDPincrease_{it} + \beta_4 inflation_{it} + \mu_{it} \end{aligned}$$

Also in this case, we use a fixed effect estimation model.

6. RESULTS

6.1 Total Amount of Bank Financing

In this section we present the results from the model previously described using a fixed effect estimation model.

In particular, this section will underline the possible effects that recent changes in the average LCR and CAR of the major banks across 10 European countries had on the total amount of bank financing in each country. By testing LCR as unique regressor, we see that the coefficient is negative and statistically significant at 1% significance level. By including the CAR in our regression, we can see that the coefficient of this variable is positive but not statistically significant, while LCR coefficient remains negative and statistically significant at 1% significance level.

After having analyzed the impact of the main regressor (LCR) and of the CAR individually, we check for the robustness of the model by estimating simultaneously these two factors with the control variables previously described, i. e. the percentage GDP increase from one year to another in each country and the inflation rate per country. This leads us to the analysis of the last column in chart 5. We see that the coefficient of the LCR remains negative and it is still statistically significant at 1% significance level, meaning that a one percent increase in the LCR ratio of the major banks in a given country decreases the amount of bank financing to non-financial institutions (expressed as a percentage of GDP) by 0,52 per cent.

On the other hand, after having included the control variables in our regression we see that the coefficient of CAR remains positive but not statistically significant, while the coefficient of the other two controls, i.e. the GDP annual percentage change for each country and inflation rates present a negative coefficient but not statistically significant.

Results suggest that, what seems to play a major role in reducing the dependency of the European countries on the bank sector are more bank related indicators, rather than macroeconomic indicators.

Table 5. *Estimation results: Bank Financing (% GDP)*

VARIABLES	(1) Bank financing	(2) Bank financing	(3) Bank financing
LCR	-0.0512771***	-0.0537*** (0.0139)	-0.0523** (0.0167)
CAR		0.0814 (0.422)	0.128 (0.361)
GDP (% change)			-7.265 (29.92)
Inflation (% change)			-0.636 (2.050)
Constant		104.6*** (7.543)	104.4*** (7.285)
Observations	55	55	55
R-squared	0.117	0.117	0.129
Number of country_id	10	10	10

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Both models showed a Prob > F lower than 0,05, meaning that according to the F test all the coefficients in the model are different from 0.

6.2 Size of the Banking Sector

After having analyzed the impact of Basel III liquidity requirements on the amount of bank financing in Europe and having acknowledged that the coefficient of the variable is positive and statistically significant, we want to check whether it may affect also the size of the banking sector. I took for each of the country under observations the amount of total consolidated assets of domestic groups evaluated as a percentage of GDP.⁷ In order to get a better estimation, I logged this variable and I kept as dependent variable of the regression the logarithm of total bank assets per country.

By running a fixed effect estimation using the regressors previously described as independent variables and the logarithm of total banking assets per country (expressed as percentage of GDP) as dependent we are able to estimate Basel III impact on the size of the domestic banks.

The following charts underlines the results.

Table 6. *Estimation results: Total Bank Assets (% GDP)*

VARIABLES	(1) log_assets	(2) log_assets	(3) log_assets
LCR	-0.000589* (0.000318)	0.000626** (0.000270)	0.000584** (0.000252)
CAR		0.00130 (0.0106)	0.00163 (0.00750)
Inflation (% change)			-0.0272* (0.0142)
GDP (% change)			0.128 (0.703)
Constant	5.418*** (0.0466)	5.399*** (0.191)	5.408*** (0.146)
Observations	53	53	53
R-squared	0.109	0.110	0.224
Number of country_id	10	10	10

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

⁷ Source: European Central Bank Statistical Data Warehouse

By checking for LCR and CAR alone I obtained that the first variable's coefficient is negative and statistically significant at 5% significance level, while also in this case the coefficient of the CAR is positive but not statistically significant.

In the second column of the chart I checked for the same controls as in the previous case.

Since the logarithm of total bank assets is a macro economic indicator, we check the robustness of the model using macro-economic variables.

Also in this case the coefficient of LCR is negative and statistically significant meaning that for 1% increase in the value of the LCR, there is a 0,0006 per cent decrease in the amount of total bank assets by countries. The coefficient of the CAR is not statistically significant as well as the coefficient of GDP percentage change and both coefficients present a positive sign.

In this case, the inflation rate per county presents a coefficient which is slightly significant and with a negative sign meaning that, while inflation does not impact the amount of bank financing, it does affect negatively the total amount of bank assets. In particular, for one percent increase in a country's inflation rate we have 0,027 percent decrease in a country's domestic banks total assets.

Moreover, both models showed a Prob > F lower than 0,05, meaning that according to the F test all the coefficients in my model are different from 0.

Hence, we can conclude that Liquidity requirements imposed by Basel III play a significant role in reducing dependency on bank financing in European countries and on reducing the size of the European sector.

7. CONCLUSIONS

In this paper, we want to contribute to the analysis of the effect of the liquidity and capital adequacy requirements introduced by Basel III on the status of banking in Europe from a macroeconomic perspective. In particular, since it has been argued in the recent literature that the size of the banking system in Europe has significantly increased in the years from 1996 to 2009 and that this increase is considered as dangerous from a growth perspective, we want to analyze whether recent liquidity regulations have provided a significant contribution in facing this bank bias in Europe.

Indeed, it has been proved that having a too big banking system and, in particular, relying too much on bank financing has a negative effect on growth. While there are both advantages and disadvantages of having a bank-based or a market-based financial system, it is clear that relying too much on banking increases a developed country's exposure to the detrimental effects that could be triggered by a financial crisis and that it implicates longer recovery times.

Among the initiatives of the BCBS, we place our focus on the main liquidity requirements introduced by Basel III. The Liquidity Coverage Ratio has been considered a great innovation in banking regulation and it was first introduced in 2011. While literature has investigated the impacts of LCR introduction at a single institution level and has demonstrated that LCR introduction could increase the profitability of a bank and its return on assets (Giordana, 2017), this paper contributes to the literature by analyzing whether there has been an impact on the size of banking from a macroeconomic perspective. Moreover, to understand whether the results are related mainly to liquidity requirements or if they are associated more with capital regulation, the paper also investigates capital adequacy requirements introduced by Basel III.

In order to achieve this goal, we constructed a panel dataset using data from the 100 biggest banks in the European Union, ranked by total assets of 2018. These were split by origin country and for each country we have calculated the average Liquidity Coverage Ratio per year and the average Capital Adequacy Ratio per year.

As dependent variables we used the total amount of financing provided by banks to the non-financial sector (expressed as a percentage of GDP) and the total bank assets per country (expressed as a percentage of GDP) as a proxy of the size of the banking system. Our panel is

composed of observations from 2013 to 2018, which is the time period in which banks were required to comply with Basel III requirements. An analysis of the variables included in the dataset have demonstrated that in the years under observations, the banking sector in Europe has significantly shrank. This has resulted both in a decrease of bank financing and on total bank assets. These trends, however, are not constant across countries. Countries that have demonstrated to have a higher banking sector in 2013 have significant decreased their total bank assets in the past years. On the other hand, countries that did not have a significantly big financial system in the past years, have maintained a constant amount of bank assets and bank financing and some of them (like Finland) have shown an increasing trend, meaning that the banking sector is growing in these countries. On average, we can say that countries that were more affected by the financial crisis are those whose banks' size decreased more significantly.

LCR ratios have shown an increasing trend in all the ten countries under observations, while the CAR has remained relatively constant.

After having analyzed these trends we conducted a fixed effect estimator regression to analyze the impact of the evolution of average LCR and CAR across banks on two dependent variables. In either case, for the 10 countries under observation, the coefficient of the ratio is negative and statistically significant, meaning that an increase in the amount of liquidity retained by the largest banks in a country triggered a decrease in the amount of bank's total assets and in the total financing provided to the financial sector to the non-financial sector. On the other hand, the CAR's coefficient is not statistically significant in either case, meaning that changes in the Capital ratio that took place among the major banks between 2013 and 2019 do not affect the size of the banking sector in that specific country.

In order to increase the robustness of our model, we controlled both regressions for two macro-economic factors: the inflation and GDP growth per country.

The coefficient of the Liquidity Coverage Ratio remains negative and statistically significant.

This analysis suggests the reader that the introductions made by Basel III were partially successful in decreasing the total size of the banking system. Liquidity regulation significantly contributed to the reduction of the bank sizes across Europe while capital regulations appear not to be significant in this sense. This however may be due to the fact that their introduction has been prior to the

period under observation, since CAR requirements existed under Basel II before the financial crisis and Basel III contribution in this sense was related to an “update” of these requirements. In particular, the reader has to consider that one of the factors that have contributed to a rapid expansion prior crisis of the banking sector has been the acquisition of dangerous trading instruments, that banks developed with the aim of generating revenues from economies of scale. Being required to hold more HQLA in their balance sheets, banks were probably required to reduce these exposures and increase investments in safer activities. This would also be consistent with the recent trends identified by the ECB in the banking sector. The authority, indeed, shows a trend toward redirecting banking business toward domestic markets and to rely more on the retail business than in the years prior the crisis. However, to confirm this evaluation it may be useful to analyze how these banks have increased their liquidity coverage ratios and how their balance sheets exposure has actually changed in the past years.

While this reduction in banking size has probably implications in the sense of increasing bank stability, these recent trends may also be positive from a growth perspective. What literature have demonstrated on having a too much bank based financial system is that, after a threshold identified at 90% of bank financing over GDP, this may be detrimental for growth.

Given the fact that many European countries showed a ratio significantly higher in the first years under observation, we may infer that this reduction in the bank assets may foster the growth of European countries. The same conclusion may be inferred from a comparison with the American market. As previously discussed, the US economy is more market based than the European economy, meaning that American institutions rely much more on financial markets than on bank lending to finance their operations. While both Europe and US have suffered significant losses during the crisis, United States have demonstrated in the post-crisis years a significant faster ability to recover from these losses, as a sign that having a market – based financial system is probably better for a developed economy. Thus, this might demonstrate the willingness of the European economy to reduce this bank bias and to increase its reliance on market finance. This both with the aim to foster growth, but also to foster a better economic structure that could increase the safety of the system and increase its ability to absorb negative shocks.

7.1 Limitations and suggestions for further researches

The paper provides the reader with a better understanding of the impact of liquidity regulations on the total bank size of most European countries. In particular, we focused on the major financial institutions in the European union and on a sample of 10 countries to which these institutions belong.

This may represent a limitation in the sense that the analysis focused on the major European economies. In order to have a better understanding of the European Union as a whole it could be useful to reconduct this analysis for each country perspective, to understand the trends that have characterized less developed economies in the past 10 years.

Moreover, Basel III regulations gave time to financial institutions until 2019 to comply with Basel III regulations, but the framework has been already subject to updates with the introduction of Basel IV in 2017. This last regulation amended Basel III mainly on the calculation of RWA and we expect that this may have an impact on average banks CAR. Thus, it may be useful to re-evaluate capital requirements after 2027, when Basel IV will be applied in the European union.

Finally, further researches could make a comparison between the impact of LCR on European and US economies, to understand its impact of BCBS liquidity requirements on a market-based wrt a bank-based system.

BIBLIOGRAPHY

Accenture (2019). Liquidity Coverage Ratio: Implications and a Pragmatic Approach to Implementation.

Angelini, P., Clerc, L., Cúrdia, V., Gambacorta, L., Gerali, A., Locarno, A., Motto, R., Roeger, W., Van den Heuvel, S. and Vlček, J. (2014). Basel III: Long-term Impact on Economic Performance and Fluctuations. *The Manchester School*, 83(2), pp.217-251.

Banerjee, R. and Mio, H. (2015). The Impact of Liquidity Regulation on Banks. *SSRN Electronic Journal*.

BCBS (2019). [online] Bis.org. Available at: <https://www.bis.org/publ/bcbs272.pdf> [Accessed 5 Apr. 2019].

Bech, M. and Keister, T. (2017). Liquidity regulation and the implementation of monetary policy. *Journal of Monetary Economics*, 92, pp.64-77.

Bis.org. (2019). Bank for International Settlements. [online] Available at: <https://www.bis.org/> [Accessed 7 May 2019].

Bis.org. (2019). *Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools*. [online] Available at: <https://www.bis.org/publ/bcbs238.htm> [Accessed 5 May 2019].

Bis.org. (2019). *Basel III: international regulatory framework for banks*. [online] Available at: <https://www.bis.org/bcbs/basel3.htm> [Accessed 9 May 2019].

Bis.org. (2019). *Principles for Sound Liquidity Risk Management and Supervision*. [online] Available at: <https://www.bis.org/publ/bcbs144.htm> [Accessed 14 Apr. 2019].

Boldeanu, F. and Tache, I. (2016). The Financial System of the EU and the Capital Markets Union. *European Research Studies*, XIX(1), pp.59 - 70.

Bonner, C. and Eijffinger, S. (2012). The Impact of the LCR on the Interbank Money Market. *SSRN Electronic Journal*.

Boora, K. and Jangra, K. (2019). Preparedness level of Indian public sector banks for implementation of Basel III. *Managerial Finance*, 45(2), pp.172-189.

Buch, C. and Prieto, E. (2014). Do Better Capitalized Banks Lend Less? Long-Run Panel Evidence from Germany. *International Finance*, 17(1), pp.1-23.

Byoung Hark Yoo and Jo, Kyoo-Hwan (2012). Countercyclical Capital Buffer and Monetary Policy. *KDI Journal of Economic Policy*, 34(4), pp.69-90.

Caner, M., Grennes, T. and Köhler-Geib, F. (2010). Finding the Tipping Point - When Sovereign Debt Turns Bad. *SSRN Electronic Journal*.

Caner, M., Grennes, T. and Köhler-Geib, F. (2010). Finding the Tipping Point - When Sovereign Debt Turns Bad. *SSRN Electronic Journal*.

Casu, B. and Molyneux, P. (2003). A comparative study of efficiency in European banking. *Applied Economics*, 35(17), pp.1865-1876.

Ceron, J. (2015). The Basel III Debt Overhang. The Special Case of the Net Stable Funding Ratio. *SSRN Electronic Journal*.

Chakraborty, S. and Ray, T. (2002). Bank-Based Versus Market-Based Financial Systems: A Growth-Theoretic Analysis. *SSRN Electronic Journal*.

Cohen, B. and Scatigna, M. (2016). Banks and capital requirements: Channels of adjustment. *Journal of Banking & Finance*, 69, pp.S56-S69.

Cohen, How have banks adjusted to higher capital requirements?, B. (2019). *How have banks adjusted to higher capital requirements?*. [online] Bis.org. Available at: https://www.bis.org/publ/qtrpdf/r_qt1309e.pdf [Accessed 5 May 2019].

Detragiache, E. and Demirgüç-Kunt, A. (1999). Monitoring Banking Sector Fragility: A Multivariate Logit Approach. *IMF Working Papers*, 99(147), p.1.

Dorn, N. (2016). Capital cohabitation: EU Capital Markets Union as public and private co-regulation. *Capital Markets Law Journal*.

Eba.europa.eu. (2019). Home - European Banking Authority. [online] Available at: <https://eba.europa.eu/> [Accessed 7 May 2019].

EBF. (2019). *Banking in Europe: EBF publishes 2018 Facts & Figures - EBF*. [online] Available at: <https://www.ebf.eu/ebf-media-centre/banking-in-europe-ebf-publishes-2018-facts-figures/> [Accessed 15 Apr. 2019].

Esr.europa.eu. (2019). [online] Available at: https://www.esrb.europa.eu/pub/pdf/asc/Reports_ASC_4_1406.pdf [Accessed 5 May 2019].

Fidrmuc, J. and Lind, R. (2018). Macroeconomic impact of Basel III: Evidence from a meta-analysis. *Journal of Banking & Finance*.

Florin Teodor Boldeanu, I. T. (2016). The Financial System of the EU and the Capital Markets Union. *European Research Studies*, XIX, p. 59 - 70.

Fuhrer, L., Müller, B. and Steiner, L. (2019). *The Liquidity Coverage Ratio and security prices*.

Gallizo, J., Moreno, J. and Salvador, M. (2016). Banking Efficiency in the Enlarged European Union: Financial Crisis and Convergence. *International Finance*, 19(1), pp.66-88.

Gambacorta, L. and Shin, H. (2018). Why bank capital matters for monetary policy. *Journal of Financial Intermediation*, 35, pp.17-29.

Gambacorta, L. and Shin, H. (2018). Why bank capital matters for monetary policy. *Journal of Financial Intermediation*, 35, pp.17-29.

GIORDANA, G. and SCHUMACHER, I. (2019). *The Impact Of The Basel Iii Liquidity Regulations On The Bank Lending Channel: A Luxembourg Case Study*. Banque Centrale Du Luxembourg, Luxembourg.

Greiner, A. (2015). Public Debt, Productive Public Spending and Endogenous Growth. *Japanese Economic Review*, 66(4), pp.520-535.

Handley, N. (2010). Growth in a Time of Debt. *CFA Digest*, 40(3), pp.19-20.

Harlage. (2012). The Basel III liquidity coverage ratio and financial stability, *Michigan Law Review* pp. 453

Hartlage, A. (2019). [online] Repository.law.umich.edu. Available at: <https://repository.law.umich.edu/cgi/viewcontent.cgi?article=1082&context=mlr> [Accessed 5 May 2019].

Ion Lapteacru. Income and funding structures, banking regulation and bank risk-taking: The role of ownership in Central and Eastern European banks. 2016

Jurzyk, E. and Havrylchuk, O. (2010). Inherited or Earned? Performance of Foreign Banks in Central and Eastern Europe. *IMF Working Papers*, 10(4), p.1.

Langfield, S. and Pagano, M. (2016). Bank bias in Europe: effects on systemic risk and growth. *Economic Policy*, 31(85), pp.51-106.

Lee, B. (2012). Bank-based and market-based financial systems: Time-series evidence. *Pacific-Basin Finance Journal*, 20(2), pp.173-197.

Levine, R. (2002). Bank-Based or Market-Based Financial Systems: Which is Better?. *SSRN Electronic Journal*.

Li, B. (2017). The Impact of the Basel III Liquidity Coverage Ratio on Macroeconomic Stability: An Agent-Based Approach. *SSRN Electronic Journal*.

Liang, J. (2019). The impact of the Basel III capital & liquidity requirements: Balance Sheet Optimization.

Moradi, Z., Mirzaeenejad, M. and Geraeenejad, G. (2016). Effect of Bank-Based or Market-Based Financial Systems on Income Distribution in Selected Countries. *Procedia Economics and Finance*, 36, pp.510-521.

Nouy (2018). Overbanking?: Too Much Banking Or Too Many Banks? *The Corner*

Petitjean, M. (2013). Bank failures and regulation: a critical review. *Journal of Financial Regulation and Compliance*, 21(1), pp.16-38.

Samitas, A. and Polyzos, S. (2015). To Basel or not to Basel? Banking crises and contagion. *Journal of Financial Regulation and Compliance*, 23(3), pp.298-318.

Sawyer M. (2014). Bank Based vs Market Based financial systems: a critique of the dichotomy, EU Working Paper Series No. 19.

Schoenmaker, D. and T. Peek (2014), "The State of the Banking Sector in Europe", OECD Economics Department Working Papers, No. 1102, OECD Publishing.

Swamy, V. (2018). Modeling the impact of Basel III regulations on loan demand. *Journal of Financial Economic Policy*, 10(1), pp.136-164.

Véron, N. and Wolff, G. (2019). *Capital Markets Union: a vision for the long term* | Bruegel. [online] Bruegel.org. Available at: <http://bruegel.org/2015/04/capital-markets-union-a-vision-for-the-long-term/> [Accessed 2 Mar. 2019].

YEDDOU N., POURROY M. (2017). Bank Liquidity: Does ownership structure matter?