BASEL III LEVERAGE RATIO IN THE EU BANKING SYSTEM

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ABSTRACT

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Abstract
The Basel accords stated that banks should have a leverage ratio (Tier1 capital over on and off-balance sheet exposures) of a minimum of 3 %. This master's thesis studies what drives the banks in the EU area to have leverage ratios bigger than the requirement. The empirical research was conducted with a sample of 447 banks from 2010 to 2020. The excess leverage ratio (part of the bank's regulatory leverage ratio that was in excess of 3%) is examined with two different models to enable comparison. Variables of the study are commonly used key measures of bank performance used in the existing literature. The results of the study differ between samples. The profitability variable seems to affect the excess leverage ratio negatively across the samples. The capital ratio has the most prominent effect from the variables, and its effect is positive. From the models used, the linear OLS model fits the data better than the fixed effects model.
From the results, it would seem that the main drivers behind the excess leverage the banks in the EU area hold are Capital ratio, time of negative interest rates, profit, loans, and funding costs. This would indicate that the excess leverage that banks hold is mostly driven by banks' internal figures and not the common macro variables. This could indicate that the excess leverage is somewhat protected from macro level-shocks.

Key words
Leverage ratio, Basel III, bank capital

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Tiivistelmä

Baselin sopimuksissa määritellään, että vähimmäisomavaraisuusasteen tulee olla yli 3 prosenttia (Ensisijainen pääoma jaettuna taseessa oleviin ja taseen ulkopuolisille vastuille). Tämä Pro Gradu työ tutkii mikä ajaa EU alueen pankkien vaatimuksia korkeampaa vähimmäisomavaraisuusastetta. Empiirinen tutkimus suoritettiin käyttämällä aineistoa 447 pankista vuosilta 2010-2020. Työ tutkii vähimmäisomavaraisuusaste vaatimuksen ylittävää osaa pankin kokonais-vähimmäisomavaraisuusasteesta. Tutkimuksen muuttujat ovat yleisesti aikaisemmissa tutkimuksissa käytettyjä tunnuslukuja. Tulokset tutkimuksesta vaihtelevat eri näytteiden välillä. Tutkimuksen tulokset vaihtelevat näytteiden välillä. Kannattavuusmuuttuja vaikuttaa vähimmäisomavaraisuusaste vaatimuksen ylittävää osaan suurimmassa osassa tapauksista negatiivisesti. Vakavaraisuudella on muuttujista merkittävin vaikutus vähimmäisomavaraisuusaste vaatimuksen ylittävää osaan ja tämä vaikutus on positiivinen. Käytetyistä malleista lineaarinen OLS-malli sopii dataan paremmin.
Tulosten perusteella näyttäisi siltä, että EU-alueen pankkien vaatimuksen ylittävää osaa vähimmäisomavaraisuusasteesta ajaa pääomasuhde, negatiivisten korkojen aika, voitto, lainat ja rahoituskustannukset. Tämä viittaa siihen, että pankkien ylimääräiseen vähimmäisomavaraisuusasteeseen vaikuttaa enimmäkseen pankkien sisäiset tekijät eikä yleiset makromuuttujat. Tämä saattaa viitata siihen, että vähimmäisomavaraisuusaste on jossain määrin suojattu makrotason muutoksilta.

Asiasanat
Basel III, vähimmäisomavaraisuusaste, pääomavaateet

Säilytyspaikka
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1 INTRODUCTION

Since the financial crisis of 2008, the supervision of banks has been a topic of many conversations. To improve the stability of the banking sector and the soundness of individual banks the Basel Committee of Banking Supervision (BCBS) has enhanced its guidelines for banking supervision. The Basel III framework was published in 2009 and it is composed of three pillars: minimum capital requirements, the supervisory review process, and market discipline. Some key changes in Basel III were the introduction of liquidity ratios and added supervisory requirements for globally systematically important banks (G-SIBs). In 2017 the Basel committee introduced some additions to their framework publishing Basel III: Finalizing post-crisis reforms. This new framework included revised standardized and internal-rating-based approaches to credit risk, new minimum capital requirements for credit valuation adjustments (CVA) and operational risk, and output floor and leverage ratio. One main addition was the introduction of the aggregated output floor which limits the benefits a bank can gain from using the internal-rating approach to 72,5% from the standard approach.

Another addition to the supervisory toolbox was the leverage ratio, the aim of which is to restrict the expansion of excessive leverage in the banking system. This is important as during the financial crisis of 2008, many banks that reported good capital ratios had high leverage. As the financial crisis deepened, many banks started to decrease their on- and off-balance sheet leverage, and this activity lowered the asset prices even more and ended up deepening the crisis. To prevent that from happening again, the BCBS created the leverage ratio, that in addition to preventing deleveraging is to acts as "a simple, non-risk-based backstop" for the otherwise mostly risk-based capital requirement framework (Basel Committee on Banking Supervision, 2017). The idea of a leverage ratio was not new. Already in 2008, Blum wrote that a non-risk-based leverage ratio would incentivize banks to report their risks more accurately.

According to the guidelines presented by the BCBS, the leverage ratio must be at least 3 %, and it is calculated as

$$\text{Leverage ratio} = \frac{\text{Capital measure}}{\text{Exposure measure}}$$

The capital measure is Tier 1 capital containing common equity tier 1 capital and additional tier 1 instruments. The exposure measure is composed of balance sheet exposures, derivative exposures, securities financing transactions, and off-balance sheet exposures. Exposure measure is defined in quite a detail so that the varying accounting standards across different jurisdictions do not create discrepancies between banks.

The leverage ratio is also implemented in the revised Capital Requirements Directive and Regulation (CRR2); therefore, it is legally binding in all the countries in European Union. The CRR2 leverage ratio regulation is aligned with the guidelines so that the EU-based banks and internationally operating banks have a "level playing field" (European parliament and council regulation (EU) 2019/876, 2019).

Even if the leverage ratio was created to promote long time financial stability, it can also be used to relieve times of distress. In 2020 during the COVID-19 pandemic, the European Central Bank announced that banks they supervise are allowed to exclude some of their exposures to the central bank from their leverage ratio. According to the European Central Bank (2020), this was done to ease "the implementation of monetary policy" and is valuable for the banks as they could report better leverage ratios for the investors. In their calculations, the European Central Bank (2020) predicted around a 0,3% rise in the aggregated leverage ratio that was at the time (end-March 2020) 5,36%. In February 2022, the European Central Bank decided not to continue this relief measure and banks must include all relevant exposures in their leverage ratio again from April 2022 onwards.

The leverage ratio has been on the agenda of European supervisory authorities in another way as well. The European Banking Authority's (EBA) 2022 guideline for the Supervisory review and evaluation process (SREP) states that the supervisory authorities can assign pillar 2 requirement of leverage ratio (P2R-LR) for a bank in the SREP decision that requires the bank to hold more capital. SREP is a yearly exercise where the supervisory authority gives a bank a holistic assessment and score of its current state. The score ranges from 1-4, where one is the best and four is the worst. Banks are evaluated in four categories: business model, governance, risks to capital, and liquidity and funding. Once a year, the supervisory authority issues an SREP decision based on the supervisory activities conducted throughout the year. In this decision, the supervisory authority can give the bank qualitative measures that the bank needs to address. Additionally, the supervisory authority states the pillar 2 requirement (P2R), the pillar 2 guidance (P2G), and, from 2022 onwards, the P2R-LR. These are capital requirements that are bank specific on top of the general capital requirements. The P2R-LR addresses the risk of excessive leverage (European Banking Authority, 2022).

There has been some recent interest in the Basel leverage ratio definition as in April of 2022, three significant international associations: International Swaps and Derivatives Association, Institute of International Finance and Global Financial Markets Association, wrote a joint letter to the committee calling for the calculation of standardized approach for the counterparty credit (SA-CCR) risk to be reviewed. In the letter, they argue that the current SA-CCR is outdated as there have been some structural changes in the markets since 2014 as well as comprehensive updates in the overall regulatory framework in addition to the

current way of calculating the SA-CCR being lacing in the sense of risk sensitivity and harmonization across the markets (Dionysopoulos et al., 2022).

In this thesis, I aim to study what drives the leverage ratio held by the EU banks and, specifically, what drives the part of the leverage ratio that is in excess of the required 3%.

The rest of this thesis is structured in five parts. First is a deep dive in the workings and history of the Basel accords. The second part introduces the relevant previous literature. Third part will present the data and methodology used in this thesis, and the following part will present the results. The last chapter concludes.

2 THE BASEL ACCORDS

The Basel accords are published by the Basel Committee on banking supervision (BCBS), that was first created in 1974 by the G 10 countries' heads of central banks (Bank for International Settlements [later BIS], 2014.). Currently, the Basel committee has members from 28 different jurisdictions and 45 organizations (BIS, 2014). The goal of the BCBS is to improve international banking supervision and thereby decrease the risk of a financial crisis.

2.1 Basel I

The first Basel accord was released in 1988 (BIS, 2014). This was following the debt crisis in Latin America in early 1980, which highlighted the issue that in times of international crisis, many international banks experience lowering of their capital ratios. In the first accord set in 1988, the minimum capital-to-risk-weighted-assets ratio was set to 8%, and this was the standard set in most countries with internationally active banks (BIS, 2014). Over time new elements were introduced into the accord. In 1991 the capital adequacy calculations were adjusted so that the general loan loss reserves or general provisions could be added (BIS, 2014). In 1995 bilateral netting of banks' credit exposures in derivatives was considered alongside the expansion of the add-on factor matrix (BIS, 2014). In 1996 the market risk amendment announced capital requirements specifically for the market risk (BIS, 2014). This new requirement took into account exposures to foreign exchange, traded debt securities, equities, commodities, and options, and it was also the first time that banks got the opportunity to use internal models to calculate their capital requirement for the market risk (BIS, 2014).

2.2 Basel II

BCBS revised its framework in 2004, and Basel II accord was launched and this new accord introduced the idea of three pillars for the supervision of banks (BIS, 2014). The first of them is minimum capital requirements; the previous requirements from Basel I were expanded. The second pillar is the supervisory review process which aims to examine banks' capital adequacy and to ensure that the institutions' internal assessment processes are strong enough. The third pillar is disclosure; BCBS intends to use transparency to improve the market discipline and promote "good banking".

Before its publication in 2004, the Basel Committee had an extensive preparation period during which they consulted with the most important stakeholders, such as representatives from the banking industry, central banks, and financial supervisors across the jurisdictions (BIS, 2014). The new accord aimed to take into account the latest financial innovations better than before and enhance further the way the capital requirements take into account the various forms of risks in bank activities. The Basel II framework was later developed in 2005 when the framework for banks' trading books was introduced (BIS, 2014).

2.3 Basel III

The 2007-2008 financial crisis highlighted many problems in the banking industry, and the committee responded to this by introducing the third set of Basel accords. When the crisis started, one of the major issues was that many banks had much leverage and low liquidity buffers (BIS, 2014). Additionally, many banks had issues with the governance structure and inadequate risk management processes and/or functions. Many institutions also had incentive structures that encouraged the employees to take unnecessary risks.

The committee responded to these by publishing the first standards for liquidity management and risk management already in 2009, along with new standards for supervision (BIS, 2014). The standards, now referred to as Basel III, were published in 2010. This included reformed capital and liquidity package. After the financial crisis, the Basel Committee set out many new requirements. The requirements for regulatory capital have become stricter, and the quality of the capital has been enhanced as the role of common equity has grown (BIS, 2014). This is also shown with the capital conservation buffer, which complies entirely with common equity. The cyclical nature of credit market activities has been taken into consideration by introducing the countercyclical capital buffer, intended to reduce the systemwide credit boom and on the other hand, limit the industry's losses during a credit bust (BIS, 2014). The leverage ratio was also introduced in the framework to reduce the excess leverage of the industry at the aggregate level (BIS, 2014). Multiple liquidity requirements have also been set after the financial crisis. To cover for the risks related to the shorter-term liquidity needs, the committee has developed a Liquidity Coverage Ratio (LCR) requiring banks to hold enough cash and other most liquid forms of assets to cover the funding needs over a stressed period of 30 days (BIS, 2014). For longer-time liquidity needs, the committee has set out the Net Stable Funding Ratio (NSFR), which is to cover maturity mismatches over the whole balance sheet (BIS, 2014). The committee also introduced the concept of systematically important banks that face additional requirements such as additional loss absorbency and enables cross-border supervision and resolution (BIS, 2014).

In 2017 the Basel committee published the Basel III accord for finalizing the post-crisis reforms that introduced so many new elements that the industry

started calling it Basel IV. The calculation of capital requirements for credit risk and credit valuation adjustment risk were updated in the new reform (BIS, 2014). Also, the calculations for operational risk buffers were revisited. The leverage ratio calculations were updated and became more restricting for banks (BIS, 2014). The use of internal models was restricted by introducing the output floor that restricts the benefit received from using the internal models to 72,5% from the standard approach when fully phased in (BIS, 2014).

3 LITERARY REVIEW

3.1 Leverage ratio requirement and its benefits to the financial stability

According to the Bank for International Settlements (2017) the leverage ratio requirement is designed to prevent a situation where highly leveraged banks start to deleverage during a crisis moment and create "a vicious circle of losses" that would limit access to credit for the real economy and to complement the other risk-based capital requirements by providing "a simple, non-risk-based backstop". The leverage ratio aims to prevent the escalation of a crisis period and thereby improve financial stability. Many scholars also justify the use of the leverage ratio as a supervisory tool.

Dermine (2015) proved that the introduction of leverage ratio requirement can reduce the risk of a bank run in their study on the Basel III leverage ratio requirement and the probability of bank runs. Dermine (2015) analysed a model based on credit risk, short-term deposits, and imperfect information and found that the leverage constraints limit the risk of a bank run, especially in periods when the probability of loan default is low.

Dermine's (2015) model is supported by the model by Liu and Fan (2021), who studied the connection between banks' asset structure and credit supply expansion. Where Dermine (2015) focused on the effects of credit risk, short-term deposits, and imperfect information, Liu and Fang (2021) aimed to combine four characteristics of the housing boom before the 2007-2009 financial crises: the increase in house prices, the increase in mortgage to GDP ratio, the decrease in mortgage interest rate, and the increase of mortgages to firm loans ratio in the banks' balance sheets. The results of the two studies are in line. Liu and Fang (2021) found that regulating banks' assets and restricting their ability to increase the portion of mortgages in their asset portfolio can help reduce economic downturn.

There are also empirical studies suggesting that using a leverage ratio is good for financial stability. Brei and Gambacorta (2016) studied the Basel III leverage ratio to determine if it is more countercyclical than the risk-weighted capital ratios and how the Basel accords have affected the bank capital pro-cyclicality and are their differences between the "normal" times and crisis times. Using a dataset from 1994-to 2012 with banks headquartered in 14 different countries, Brei and Gambacorta (2016) found that in normal times the leverage ratio is more countercyclical compared to the risk-weighted capital ratio meaning that the leverage ratio requirement is more constraining to the banks during a

boom period. As one of the main ideas behind the leverage ratio requirement is to prevent the escalation of a crisis, the results provided by Brei and Gambacorta (2016) seem to justify the use of the leverage ratio requirement.
The crisis period affects different capital ratios differently. Drakos and Malandrakis (2021) studied the difference between global and non-global banks before and after the financial crisis. While the global and non-global banks had similar performance in their study Drakos and Malandrakis (2021), found that the period of a crisis affected the total capital ratio (defined as total capital over risk-weighted assets) positively. Still, the leverage ratio seemed not to be sensitive to the change in the economic environment. Bank profit also positively affected the leverage ratio, but the non-performing loans did not have an effect at all (Drakos & Malandrakis, 2021). In their study Drakos and Malandrakis (2021) conclude that the leverage ratio would work as a tool to measure capital adequacy.

Banks having enough tier 1 capital are beneficial for financial stability, as can be seen from the study by Agovino, Bartoletto, and Garofalo (2022), who looked at the performance of the Italian banking system over a long period of time. They use a capital ratio (Tier 1 capital ratio) to represent the financial strength of the bank and a non-core ratio (other liabilities / deposits + other liabilities) to capture the financial stability. Agovino et al. (2022) found that the Italian banking system's capacity to allocate resources was, in the short run, affected by the capital ratio. However, in a more extended time period the non-core ratio influenced the allocation more. In their conclusions, Agovino et al. (2022) highlighted the importance of the capital ratio and the non-core ratio as they can be used to identify the banking system's financial stability and strength.

As we can see, many academic studies support the use of the leverage ratio requirements (Dermine, 2015; Liu and Fang, 2021; Brei and Gambacorta, 2016), providing evidence that the requirement works towards the goals of the Basel committee. However, the leverage ratio requirement has divided opinions among scholars.

3.2 Incentive for the bank to take more risk

The Basel committee introduced the leverage ratio to be a non-risk-based capital requirement measure. This means that only the assets' nominal value is taken into consideration. As risky assets and non-risky assets are treated in the same way, one can question that does this give banks an incentive to purchase riskier assets with a low nominal value so that they can make more profit without having to tie up as much capital as they would have if they wanted to reach the same earning potential with less risky assets.

Acosta-Smith, Grill, and Lang (2020) studied the trade-off between leverage ratio and risk-taking. They performed theoretical and empirical

analyses looking at the EU-based banks. Acosta-Smith et al. (2020) found that the leverage ratio requirements can lead to higher risk-taking activities among banks that are restricted by them.

Choi, Holcomb, and Morgan (2020) found similar results in the US banks so that the asset risk for the whole banking system seems to shift towards riskier banks due to the new leverage ratio requirement. The shift was made by adding securities that were riskier instead of lowering the amount of less risky securities or loans (Choi et al., 2020). The timing of the change was not the year 2018 when the leverage ratio regulation took effect; instead, Choi et al. (2020) found that banks adjusted to the requirement beforehand, in the year 2014 when it was introduced how constraining the new regulation would be.

Different banks seem to adapt to the new regulation differently. Martynova, Tatnovski, and Valhu (2020) studied banks' risk-taking incentives and how the banks' profitability and leverage constraints might affect them. They created a model that separated the core business of the bank from the side activities that the bank might take. In the model, the banks consider the riskiness and scale of the side activities when the funding for the bank's core business is secured. The final part of the Martynova et al. (2020) model considers the bank's balance sheet style, which is controlled by leverage constraints. Martynova et al. (2020) finds that the more profitable banks might be more incentivized to take on riskier side activities as they can benefit from the scale of the action. When there are leverage ratio requirements, profitable banks can borrow more and use the borrowed funds to participate in large-scale, risky side activities (Martynova et al., 2020). Martynova et al. (2020) states that this "indirect scale-related effect" might be enough to counterbalance the conventional effect that profitable banks do not have much motivation to take on risk. In their study, Martynova et al. (2020) also find that risk-taking is more attractive when the riskier side activities can be financed with repos or other senior funding and when the leverage constraints are not as strict.

Kiema and Jokivulolle studied the leverage ratio in combination with the risk-based capital requirement. Kiema and Jokivuolle (2014) argued that leverage ratio would cause banks to diversify their loan portfolio as during previous regulation, banks had the incentive to specialize in either "high-risk loans" or "low-risk loans" and banks with "low-risk loan" portfolios would be affected by the leverage ratio more so they might want to adjust their portfolio to meet the requirement. According to Kiema and Jokivuolle (2014), this would make individual bank's loan portfolio more diversified but would make portfolios across the banking system more similar, making them vulnerable to contamination risk.

From these studies, we can conclude that there are situations when the leverage ratio requirement might not add to the financial stability as it was intended to. However, the leverage ratio is part of a larger regulatory framework, and the Basel committee has made risk-based requirements that could incentivize banks to avoid risk-taking when the leverage ratio does not. Acosta-Smith et al. (2020) also argue that the positive impact of the additional

loss-absorbing capacity of the capital required by the leverage ratio offsets the negative impact of banks taking more risk. Additional capital also forces the banks to have more skin in the game, which can restrain banks from seeking more risk (Acosta-Smith et al., 2020). Acosta-Smith et al. (2020) also studied bank stability and found that in the case of highly leveraged banks, the leverage ratio requirement leads to a lower probability of distress situation.

3.3 Effects outside the banking system

The leverage ratio requirement is restricting for the banks and aims to improve financial stability, but it does have effects outside the banking industry. The effects of the Basel III leverage ratio can be seen in the financial markets in many ways as banks adjust their activities to follow the regulation. Haynes and McPhail (2021) found that in the market of S&P 500 E-mini futures options, banks lost market share to non-banks due to the leverage ratio restrictions, and the US banks that face even stricter leverage constraints lost market share to the European banks. Additionally, Haynes and McPhail (2021) found that the leverage ratio constraints affected the most low-delta options, and the banks clearing activities were affected.

The leverage ratio requirements have also affected the financial markets in Europe. Du, Tepper, and Verdelhan (2018) studied arbitrage opportunities and showed that there are deviations from the covered interest rate parity in the markets that create arbitrage opportunities and that these deviations are more prominent after the financial crisis, and that they increase toward the quarter-end. Short-term trades that exploit the covered interest rate arbitrage opportunities expand the asset side of the bank's balance sheet and therefore affect the leverage ratio (Du et al., 2018). The arbitrage opportunities are not profitable enough to cover the cost of expanding the balance sheet; Du et al. (2018) also mention that banks' need to stick to their leverage ratios can explain why the deviations from the covered interest rate parity are the most common at the end of the quarter when European banks are required to report their leverage ratios.

The quarter-end effect was also observed by Ranaldo, Schaffner, and Vasios (2021), who studied what kind of effects prudential regulation has on the short-term interest rates in Europe and specifically in the repurchase agreements (repo) markets. The repurchase agreements are an essential source of funding liquidity. In the EU area, the Leverage ratio is reported as a snapshot at the quarter-end. Ranaldo et al. (2021) find that this can be seen as seasonality in repo rates as banks attempt to "window dress". This is because the purchased repo contracts increase banks' assets and therefore lower the leverage ratio, unlike the reverse repo, which does not affect the banks' leverage ratio. Ranaldo et al. (2021) found that both the supply and demand sides of the repos are affected by regulation where EMIR requires European clearinghouses to turn unsecured cash holdings into liquid securities. Ranaldo et al. discovered that the

clearinghouses do this by purchasing repos, which creates downward pressure on the short-term interest rates. The effect on the demand side is created by the leverage ratio introduced in the Basel III as repos are counted in the assets in the leverage ratio calculations, Ranaldo et al. (2021) found that there is even more downward pressure on the short-term interest rates around the time of the leverage ratio reporting days. Ranaldo et al. (2021) also find that the banks that have acted as counterparts for the clearinghouses tend to be more active lenders in the interbank market; the authors believe this to be an effort to prevent further decline in their leverage ratio by offsetting their cash surplus.

Events in the banking sector can affect the overall economy. Guevara, Maudos, and Salvador (2021) studied how financial variables can explain the variations in interest rates among firms. Guevara et al. (2021) studied over 176 000 Spanish firms over the period 2008-2016 and found that before the financial crisis, growth was associated with bank credit; after the crisis began, corporates started to deleverage, and this process was partly imposed by the banking sector that was in troubles. In their conclusions, Guevara et al. (2021) point out that after the financial crisis, the banks become more risk-averse, and this can be seen in other sector firms as the negative effect that indebtedness has on the investments becomes larger and linear.

Some consider the leverage ratio requirement too restricting and find that this could lead to rising shadow banking activities. Barth and Seckinger (2018) studied the effects of a binding leverage ratio by creating a novel mechanism of how they see that the banking sector works under a binding leverage ratio. Brath and Sechinger (2018) found three equilibrium states first being that existing banks are not able to absorb all the debt supply as the equity is considered expensive; this will lead to lower interest rates and lead to new banks coming into the industry who are not so skilled. The second equilibrium effect Barth and Seckinger (2018) found is the skin-in-the-game effect caused by limited liability that will cause banks to participate in high-risk action. Third, Barth and Seckinger (2018) discover that the lowered interest rate weakens banks' moral hazard behavior. The authors found that if the skill level of the bank officers varies much, the effects of the regulatory demands differ, and allocating resources becomes a problem. Barth and Sechkinger (2018) state that if rising additional capital is expensive and the profits from lending are limited, banks might start to offer their loan products through the shadow banking system.

Zhang (2020) studied how the existence of shadow banking affect the use of capital requirements as a regulatory tool by making an equilibrium model to study how the tightening of capital regulation affects the credit supply in a model where commercial banks are subjected to regulation and therefore have a higher cost of funding and demand higher interest rate when lending more and where the shadow banks were unregulated. In his study Zhang (2020) found two different kinds of effects when tightening the capital ratio; firstly, it causes the commercial banks' internal cost of funds to rise and therefore reduces the loaning by them. The second effect Zhang (2020) found is that if the customers can freely choose between a commercial bank and a shadow bank, tightening the capital

ratio can lead to the customers moving to the shadow banks where it is considered that the customer will take a larger loan and therefore the capital action can lead to increase in credit supply. Depending on which effect is dominant, tightening of capital requirements can lead to undesired outcomes (Zhang, 2020).
There have been many studies on Basel III's effect on the economy. Fidrmuc and Lind (2018) performed a meta-analysis of 48 previous studies as they found that the existing literature had not found conclusive results. In their study, Fidrmuc and Lind (2018) found that, on average, the previous studies discovered that increase of 1 percent in the capital requirement would translate to a -0,20 percentage change in the GDP. Fidrmuc and Lind (2018) also highlight that there is uncertainty in the estimates in the previous studies, and the field had some publication bias.

3.4 Optimal leverage ratio

The leverage ratio requirements have positive and negative effects on the banking sector and the financial market. The current leverage ratio requirement in the Basel framework is a minimum of 3%. However, there is some debate on what the optimal leverage ratio should be.

Many academics have an opinion about what would be the best leverage ratio requirement. Ambrocio, Hasan, Jokivuolle, and Ristolainen (2020) surveyed 149 academic researchers and found that most of them would prefer much higher requirements. Academics believed that the leverage ratio requirement should be higher, and the average answer of the preferred requirement was a minimum of 15 %, which is considerably higher than the current requirement (Ambrocio et al., 2020). In their research, Ambrocio et al. (2020) found a difference in the responses between the European and North American scholars, as Europeans' average answer was 13% and North Americans' 18%. The scholars studied by Ambrocio et al. (2020) believed that there could be benefits from higher capital requirements, such as banking crises becoming more unlikely and less severe, and that the higher requirements would most likely not result in a large effect on economic activity.

Ding, Hill, and Perez-Reyna (2020) created different models with different levels of asymmetric information to find out what the role of interest rates that are paid on deposits is and what would be the optimal leverage ratio. In the case of complete information, Ding et al. (2020) found that the leverage constraints were unnecessary as the interest rate paid on deposits was enough to control the banks' behavior. In the case where there is no information about the risks involved in bank activity, Ding et al. (2020) found that the leverage constraint helps to restrict the excessive deposit intake of the riskier banks and improve social welfare. Ding et al. (2020) also looked at a situation where market

participants got imperfect information about the bank's riskiness and found out that the tightest leverage constraints were optimal in the situation when the signals were most inaccurate instead of when the banks were at the riskiest.

Barth and Miller (2018) studied the benefits of higher leverage by looking at the issue from the perspective of the public. They started with an assumption that a higher leverage ratio requirement would benefit the public by lowering the probability of banking crises, and the cost of a higher requirement would be a decrease in banks' lending activities (Bart and Miller, 2018). Bart and Miller (2018) studied a large number of U.S. banks over a long period of time and found that if the leverage ratio is increased to 15%, there would be benefits to society, the main one being shorter crisis periods. The authors conclude that if the regulatory leverage ratio requirement were set to 15 %, its benefits would outweigh the marginal costs to society (Bart and Miller, 2018).

Many academics find that a higher leverage ratio would benefit society (Bart and Miller, 2018, Ding et al., 2020, Ambrocio et al., 2020). While there are good arguments for a high leverage ratio requirement, one must also consider how that would affect individual banks.

Chen, Kang, Wu, and Jeon (2022) studied how the macroprudential policies affect banks' efficiency and studied over 1000 banks from 36 emerging economies and found that the banks' efficiency tended to increase when the macroprudential regulatory measures became stricter. However, this effect was observed from macroprudential policy tools that aimed to smoothen the cyclicality of credit growth but not from supervisory actions that traditionally aim to strengthen financial stability, such as the leverage ratio (Chen et al., 2022). Chen et al. (2022) even found that the macroprudential tools that aim to strengthen financial stability can hinder the efficiency of the individual bank.

The independence of the financial supervisory authority also affects how the regulatory measures affect a bank's efficiency, as was found by Barth, Lin, Ma, Seade, and Song (2013). While they found that the increase in the supervisory actions and stricter regulation can hinder banks' efficiency overall, in countries with a financial supervisory authority that has a greater level of independence, the increasement of its supervisory power can increase the efficiency in banks (Barth et al., 2013). This effect was found more substantial when the financial supervisory authority had more experience (Barth et al., 2013).

Goel, Lewrick, and Tarashev (2019) made a model to investigate how banks change their internal allocation of capital when there is an event that affects one of the bank's business units, such as a change in regulation. In their study, Goel et al. (2019) provided evidence that regulatory measures aimed to control particular unit of the bank might have "spillover" effects in another unit of the bank.

Castro and Lopes (2021) studied how Portuguese banks adjusted their capital structure after the recent crises. They found that in Portuguese banks, the bank's leverage correlates positively with its size (Castro & Lopes,2021). Leverage and profitability correlated negatively in their study, Castro and Lopes (2021) state that this is expected as profitable banks can use their reserves instead of

taking new debt. Castro and Lopes (2021) found that the leverage in Portuguese banks is negatively correlated with collateral and positively correlated with the dividend the bank pays to the shareholders. In their conclusions, Castro and Lopes (2021) highlight that the capital structure of Portuguese banks is not determined by capital regulation.

Therefore, the optimal leverage ratio requirement is a combination of what is beneficial for the economy and what is beneficial for the individual bank. However, it would seem that many European banks have a leverage ratio higher than the required 3%.

4 DATA AND METHODOLOGY

4.1 Methodology

In this thesis I run the regressions:

$$excessY_{it} = \alpha + \beta X_{it} + \gamma Z_{it} + \varepsilon_{it} \quad (1)$$

Where $excessY_{it}$ is the ln value of banks leverage that is in the excess of the regulatory 3%. The subscripts i and j denote bank and time. On the right X_{it} represents bank specific variables and Z_{it} represents the macro-financial variables. The α is the constant and ε_{it} the error term. The regression is run separately for the full sample of banks, banks in the euro area, banks that's asset size is larger than 75% of the sample, and banks that's asset size is smaller than 75% of the sample. The regressions are made using the fixed-effects model and linear Ordinary Least Squares (OLS) model able comparison. All regressions are run twice once using one time period and once using one lagged time period on the independent variables.

For the independent (explanatory) variables, I take a mix from the previous research. I use a set of Bank-specific variables, a time dummy, and Macro-financial variables. To capture the effects of bank profitability, I use Net interest income to showcase banks' income and return on equity to show banks' profit, as capital regulation often affects banks' equity. To capture the riskiness of the bank, I use the 3 – year rolling -over standard deviation of banks' ROAA following Chen et al. (2022). I aim to capture also the effects of the cost of funding, and I use the interest expenses / total liabilities, the same as Acosta-Smith et al. (2020). To consider the effects of liquidity, I use gross loans /total deposits as used in the previous studies, e.g., Djalilov and Piesse (2019) and Acosta-Smith et al. (2020). The bank's capitalization structure can affect its likelihood of default, cost of liability, and efficiency, so I aim to capture the effects of capitalization using Equity/total assets (Chen et al., 2022; Djalilov & Piesse, 2019). I follow Barth et al. (2013) using total loans and loan loss provisions. As the negative interest rate era (after 2015) might influence banks' behaviour, I add a dummy variable from 2015 to 2020 to account for that. I also add to macro-financial variables GDP growth and inflation which are often used in previous literature, e.g., Acosta-Smith et al. (2020). I deviate a little from the earlier literature by using the variables Total loans, Loan loss provisions, and Net interest income by using them as a ratio of total assets to avoid mixing ratio variables and level variables. The variables are detailed in the TABLE 1.

TABLE 1 Variables

Variable	Description	Source
Dependent variable		
Leverage ratio	$\frac{Tier\ 1\ Capital}{Total\ assets + off\ balance\ sheet\ assets}$	Bank Focus + own calculations
Independent variables		
ROE	Return on Equity (as reported)	Bank Focus
Risk	3 – year rolling -over standard deviation of banks ROAA	Bank Focus + own calculations
Funding cost	Interest expense / Total liabilities	Bank Focus + own calculations
Liquidity Risk	Gross loans / Total deposits	Bank Focus + own calculations
Capital ratio	Equity / Total assets	Bank Focus + own calculations
Total loans	Loans / Total assets	Bank Focus + own calculations
Loan loss provisions	Loan loss provisions / Total assets	Bank Focus+ own calculations
Net interest income	Net interest income / Total assets	Bank Focus + own calculations
Negative interest rate era	Dummy 2015 -2020	
GDP	GDP growth (annual %)	World Bank
Inflation	Inflation, consumer prices (annual %)	World Bank

4.2 Data

The dataset consists of 1069 EU area banks between the years 2010 to 2020. Bank characteristics data are collected from the Moody's Analytics BankFocus database provided by Bureau van Dijk, and GDP and inflation data are collected from the World Bank. Bank-related data are annual observations and based on consolidated balance sheets. Due to poor data quality caused by missing data points, many banks needed to be dropped out of the sample to ensure that all variables would have enough observations (half of the observations). In the end, 447 banks were included in the calculations. To eliminate extreme outliers most likely caused by low data quality, the top and bottom 1% of the observations for each variable are winsorized out. Of the sample, 335 banks are located in the euro area.

From FIGURE 1, we can see an increasing trend in the leverage ratio of European banks from 2011 to 2019. In 2020 there has been a drop in the average leverage ratio that can be assumed to be caused by the COVID-19 pandemic that has affected the markets globally. In TABLE 2 are presented the descriptive statistic of the variables.

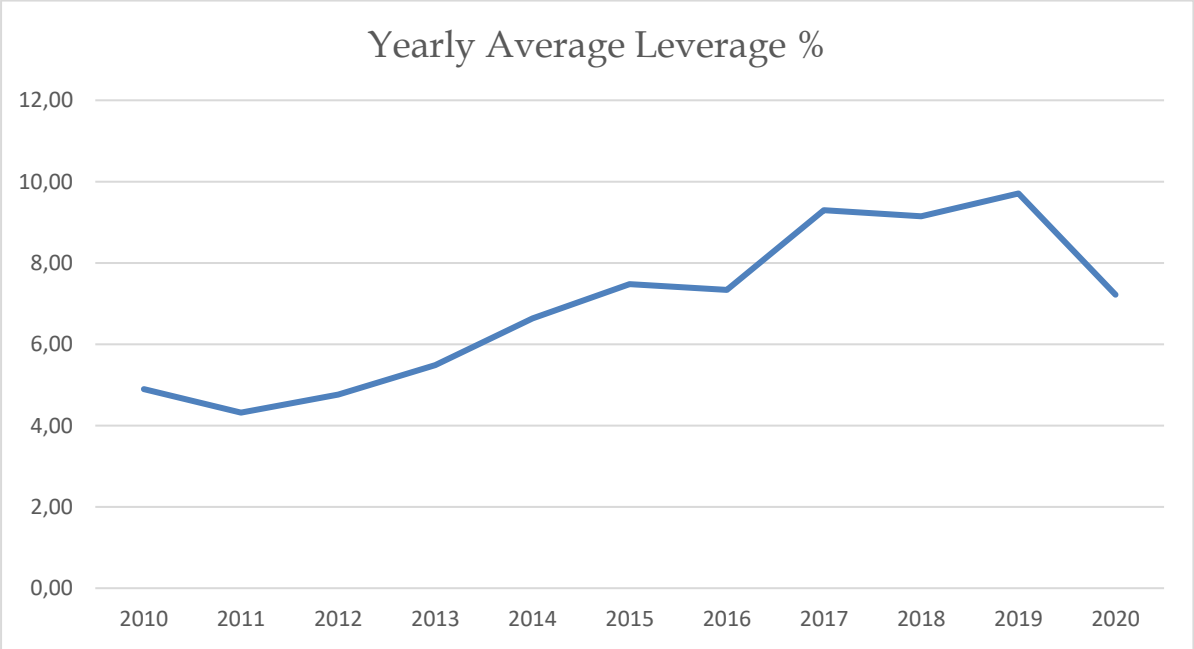

FIGURE 1 Yearly Average Leverage Ratio

TABLE 2 Descriptive statistics

Descriptive statistics dataset 2010-2020 EU banks (%)										
Variable	Mean	SD	p5	p25	p50	p75	p95	N	Skewness	Kurtosis
Excess Leverage	0,04018	0,05460	-0,00650	0,01353	0,02870	0,05329	0,10574	4105	6,10788	65,42595
ROE	5,25582	17,19463	-19,749	2,959	7,2815	11,777	21,372	4422	-4,88362	44,95242
Risk	1,28879	0,16576	1,07264	1,14049	1,26849	1,46867	1,59324	4917	0,437806	1,95597
Funding cost	0,01425	0,01490	0,00149	0,00498	0,01068	0,01831	0,03877	4370	3,851697	28,87974
Liquidity Risk	1.20011	3,61289	0,22670	0,62700	0,83783	1,01435	2,13212	4449	16,67456	355,9253
Capital ratio	0,09474	0,06860	0,03259	0,05780	0,08056	0,11243	0,19268	4408	4,41285	35,28183
Loans	0,53996	0,20853	0,13680	0,41256	0,58311	0,68952	0,82154	4403	-0,62145	2,70899
Loan loss provisions	0,00503	0,012372	-0,00105	0,00034	0,00179	0,00570	0,02139	4347	10,41318	206,0068
Net interest income	0,01720	0,01597	0,00277	0,00886	0,014235	0,02160	0,03725	4451	5,78421	64,5189
Size	9,55319	2,00528	6.27008	8.19021	9.47832	10.81508	13.14242	4456	0,159024	2.67289
GDP growth	1,08259	3,12185	-5,22898	0,42497	1,61958	2, 56793	4, 75764	4917	-0,61085	10,35241
Inflation	1,33252	1,18023	-0,32267	0,49737	1,27246	2,05316	3,33492	4917	0,41120	3,54163

5 RESULTS AND ANALYSIS

5.1 Results

In TABLE 3 are presented the results from the Fixed effects model. The first variable is ROE which represents the banks' profitability. The ROE has a negative effect on the excess leverage in most of the samples. The negative effect is economically small. The effect is statistically significant in all the samples where ROE has a negative effect (Full sample, Euro area, and the smallest banks). The only sample where ROE does not negatively affect the excess leverage is the sample of the largest banks where the effect is positive. Economically speaking, ROE's positive effect on large banks' excess leverage is small. In the regression without one lag is the positive effect of ROE on the large banks statistically significant. In the sample of the large banks, when the independent variables were not lagged one period, the result is not statistically significant.

The variable Risk presented with the 3 – year rolling -over standard deviation of banks' ROAA has varying results across the samples. The variable risk has varying results across the samples. For the full sample, risk has only a negative effect. For the samples Euro area and the sample with small banks, the effect was negative when the independent variables were not lagged for one period. When they were, the effect turned positive. The opposite holds true for the sample of large banks where the effect of risk to the excess leverage ratio is negative when the independent variables were lagged one period but positive when not. The variable risk is not statistically significant in any of the cases.

Funding cost represented by interest expense over total liabilities has a mostly negative effect on the excess leverage. Funding cost has a negative effect with and without the one lagged period for the full sample and the sample of small banks. For the sample of the bigger banks, the effect is positive when the independent variables are not lagged one period and negative when the lagged time period is used on the independent variables. The funding cost has varying results in the sample of the Euro area where the effect on the excess leverage is positive in the case of one lagged period and without it negative. Statistically, Funding cost does not appear to be significant, and the only case it has statistical significance is in the sample of Small banks and without the one lagged period. It is also the case where the effect of Funding cost is economically the largest.

Gross loans over total deposits are used to represent the banks' liquidity risk. The variable Liquidity risk has a mostly positive effect on the excess leverage. The effect is positive for the full sample, Euro area, and small banks, with and without the one lagged period. For the sample of large, the effect of Liquidity risk on the excess leverage is positive when the independent variables are lagged one time period and negative when there is no lagged period used on the independent variables. Economically the effect of Liquidity risk is small. Statistically, Liquidity risk has a significant effect on the excess leverage

on the full sample and Euro area, with and without using the one lagged period on the independent variables. For the samples of larger and smaller banks, liquidity does not affect the leverage ratio in a statistically significant way.

The Capital ratio, described as equity over total assets, positively affects the excess leverage. The effect is positive on all samples regardless of the lagged period. Economically the effect of the Capital ratio on the excess leverage is the most prominent across variables, less so in the case of the large banks. The effect of the Capital ratio is always statistically significant.

The variable Loans have a primarily negative effect on the excess leverage. The effect is always negative in the full sample and samples of the Euro area and small banks. For the sample of the large banks, the effect of Loans is negative when there is one lagged period used on the independent variables and positive when there is not. For the full sample and the sample of the small banks, the effect of the loans on the excess leverage is, in all cases, statistically significant. In the Euro area sample, the effect is statistically significant only when the independent variables are lagged for one period. For the large banks, the effect of the Loans is only statistically significant when the independent variables are not lagged for one period. This is also the only case where the effect is positive.

The following variable, Loan loss provisions, has primarily a positive effect on the excess leverage. In the full sample and the sample of large banks, the effect is positive in all of the cases. For the samples of the Euro area and small banks, the effect is positive when the independent variables are lagged for one period and when not, the effect is negative. Statistically, the effect is always significant for the sample of large banks. For the rest of the samples, the effect of Loan loss provisions is statistically significant only when the independent variables are lagged one time period.

Net interest income has a varying but mostly positive effect across the samples. For the samples of the large and small banks, the effect of Net interest income on the excess leverage is always positive. For the full sample and the Euro area sample, the Net interest income appears to have a positive effect when there is a lagged period but a negative one when there is no lagged period. In most cases, the effect of the Net interest income is not statistically significant. The exceptions to that in in the sample of the small banks, where the Net interest income appears significant, but only when the independent variables are not lagged one time period.

The variable Size has a mostly negative effect on the excess leverage. The effect is always negative for the full sample, the Euro area, and the small banks sample. For the large banks the effect of the Size is positive when the independent variables are lagged for one time period, but when not the effect is negative. In most cases, the effect of the Size variable is statistically significant. The only case the Size does not have a statistically significant effect on the excess leverage is in the full sample when the independent variables are lagged for one time period.

The first macro-variable, the GDP change, appears to have a mostly negative effect on the banks' excess leverage. The effect of GDP change is always negative for the Full sample, the Euro area sample and the small banks. In the sample of the large banks, the results vary so that the effect is negative when there is a lagged period used on the independent variables and positive when there is not. Economically the effect of GDP change is not that large. Also, statistically, the GDP change does not appear to be significant. Only in the full sample and without the lagged period and small sample when the one lagged period is used, does the GDP change appear to have a statistically significant effect on the excess leverage.

Inflation has mostly positive effects on the excess leverage ratio. For the full sample and sample of the small banks, the effect of the Inflation is positive, with and without the one lagged period. In the sample of the Euro area, the effect of Inflation on the excess leverage appears to be negative when the independent variables are not lagged for one time period. When they are, the effect is positive. The results vary also in the case of the large banks where the Inflation appears to have a negative effect when the one lagged period is used and positive when there is no lagged period. The effect is not large in economic terms in any of the cases. Statistically, the effect of Inflation is insignificant, except in the sample of the largest banks when the one-lagged period is used.

The time dummy representing the era of the negative interest rates has mostly positive effects. In all of the samples and with or without lagging the independent variables for one time period the effect is of the negative interest rate era is positive to the excess leverage. In all of the cases, the effect of the negative interest rate era is not economically huge. Statistically, the effect is significant for the Euro area and large banks sample. For the full sample and the small banks sample, the effect is not statistically significant when the independent variables are not lagged for one time period.

TABLE 3 Regression results from Fixed effects model

Dependent variable: Excess leverage, Fixed effects model

	Full sample		Euroarea		Top 25%		Bottom 25%	
ROE	-0,00015***	-0,00014***	-0,00020***	-0,00015***	0,00002	0,00007***	-0,00036***	-0,00041***
Risk	-0,00077	-0,00230	0,00347	-0,00038	-0,00169	0,00053	0,00126	-0,00882
FundingCost	-0,02839	-0,01026	0,02453	-0,03631	-0,00652	0,01688	-0,06475	-0,26120**
LiquidityRisk	0,00040*	0,00026**	0,00042**	0,00026***	0,00002	-0,00027	0,01032	0,00327
CapitalRatio	0,49757***	0,67835***	0,51397***	0,59294***	0,08656***	0,22637***	0,57180***	0,58862***
Loans	-0,02438***	-0,01417***	-0,02662***	-0,00475	-0,00926	0,01564***	-0,07878***	-0,03599***
LoanLossProvisions	0,20930***	0,04964	0,20441***	-0,02580	0,34280***	0,21511***	0,34248***	-0,02132
NetInerestIncome	0,06998	-0,05612	0,00921	-0,01538	0,46684***	0,072265	0,03309	0,42426***
Size	-0,00241	-0,00595***	-0,00456***	-0,00457***	0,00418**	-0,00397**	-0,00914**	-0,02127***
GDPchange	-0,00008	-0,00024**	-0,00013	-0,00003	-0,00025	0,00004	-0,00165**	-0,00046
Inflation	0,00039	0,00027	0,00006	-0,00018	-0,00099**	0,00006	0,00156	0,00041
time1	0,00285**	0,00040	0,00384***	0,00176*	0,00534***	0,00407***	0,00713*	0,00273
cons	0,02794	0,04521***	0,042582**	0,03154**	-0,04246*	0,03678*	0,08233**	0,16054***
lag	YES	NO	YES	NO	YES	NO	YES	NO
R2	0.3213	0,6948	0,4101	0,6599	0,1915	0,2921	0,4807	0,7218
obs	3569	3952	2648	2942	947	1030	812	939

* significant at the 0.10 level, ** significant at 0.05 level, *** significant at the 0.01 level

In TABLE 4 are presented results from the OLS regression. The variable ROE has a negative effect on the excess leverage across the samples. The ROE's effect remains negative regardless of whether the one lagged period is used. Economically the effect of the ROE on the excess leverage ratio is small, and there does not appear to be much variation across samples. Statistically, the effect of ROE is significant in the full sample, Euro area sample, and small banks sample. In the sample of large banks, ROE does not appear to be statistically significant.

The variable Risk has fluctuating results across the samples. A positive effect of the variable Risk can be seen in the samples of the Euro area in all cases. In the full sample and the sample of small banks, the effect of Risk is positive when the one-lagged period is used on the independent variables and negative when not. The effect of Risk is always negative in the sample of large banks. Statistically, the effect of the Risk to the excess leverage is, in most cases, insignificant. The only exceptions are in the samples of the Euro area and large banks when the one lagged period is used where the variable Risk seems to have statistical significance.

In all samples, with and without the lagged period, the effect of the Funding cost on excess leverage is positive. The effect is mostly larger when one lagged period is used, which can be seen best in the sample of the small banks where the difference in the results between the one lagged period and the no lagged period is the biggest. Funding cost has statistical significance in all of the cases. The statistical significance of the effect on the excess leverage does, however, dimmish a little in the sample of small banks when the one lagged period is not used.

The liquidity risk variable appears to have mostly negative effects on banks' excess leverage. The effect is always negative for the full, the Euro area, and large banks samples. Liquidity risk negatively affects the sample of small banks when the one lagged period is used on the independent variables, and without the lagged period, the effect is positive. The effect is not large economically, but it appears to be bigger in the sample of small banks. Liquidity risk does not seem to have a statistically significant effect in most cases. The only regression where Liquidity risk has statistical significance is in the sample of large banks when one lagged period is used on the independent variables.

Across the samples, the variable Capital ratio appears to affect the excess leverage positively. The effect also remains positive regardless of whether the lagged period is used. The effect of the Capital ratio on the excess leverage is the largest among the variables. The effect appears smaller in the sample of large banks compared to the other samples. The Capita ratio is also a statistically significant variable in all cases. However, the statistical significance seems to dim little in the sample of large banks when the one lagged period is used.

Loans have positive effects on excess leverage in all of the samples. Economically the effect is smallest then the effect of Capital ratio or the Funding cost. In all the cases, the effect of the Loans is economically small. The effect is statistically significant in all the cases in samples of small and large banks.

However, in the full sample and the Euro area sample the effect is statistically significant only when the independent variables are not legged one time period, when they are the effect loses its statistical significance.

The effect on the excess leverage from the Loan loss provisions appears to be positive in all of the cases. Economically the effect of Loan loss provisions is small and seems smaller when the independent variables are not lagged for one time period. Loan loss provisions appear not to have much statistical significance, only in the sample of the large banks when the lagged period is used is the result statistically significant.

Net interest income has adverse, yet mostly negative, effects on excess leverage. The effect is negative in all the cases in the full sample, the Euro area sample, and the sample of small banks. In the sample of large banks, the effect of Net interest income is positive with or without the independent variables being lagged for one time period. Net interest income has an economically small effect in most cases. The effect is larger in the sample of large banks when the one lagged period is used than in the other samples. Net interest income does not seem to have a statistically significant effect in most cases. The only time that the variable has statistical significance is in the sample of large banks when the independent variables are lagged one time period.

The variable Size has a negative effect on the excess leverage in all of the samples. Economically the effect of the Size is small but is a little larger in the sample of the small banks. Statistically, Size has a significant effect in all of the cases in all of the samples. However, the statistical significance is a bit smaller in the full sample compared to the other samples.

The GDP change in the macro variables category has mostly positive but varying results. It appears to affect the excess leverage positively in the samples of the Euro area and small banks with and without the one lagged period. The effect of the GDP change on the full sample and large banks sample is positive when the independent variables are lagged one time period but negative when not. The effect is economically small. There is no statistically significant effect from the GDP change to the excess leverage.

Also, the second macro variable, Inflation, has varying effects across the samples. When looking at the sample of small banks, the effect of Inflation is always positive. In the full and Euro area samples, the effect of Inflation is positive when one lagged period is used and negative when not used. For large banks, the effect of Inflation is always negative. Economically the effect of Inflation is small but not as small as some of the variables. The only case when Inflation gains statistical significance is in the sample of large banks when the one-lagged period is used. In other cases, the Inflation is not statistically significant.

The last macro variable, the time dummy representing the time of the negative interest rates, always affects the excess leverage banks positively. The effect is positive in all the samples, with and without the lagged period. Economically the effect is not large. The statistical significance of the effect of the

time dummy appears to be some variation. In the sample of the Euro area and the large banks, the Time dummy is always statistically significant. In the full sample and the small banks sample, there is statistical significance only when the one-lagged period is used.

The R-squared is larger when there is no lagged period used. It is the smallest in the sample of large banks and the largest in the sample of small banks.

TABLE 4 Regression results from linear OLS regression

Dependent variable: Excess leverage, OLS model

	Full sample		Euroarea		Top 25%		Bottom 25%	
ROE	-0,00022***	-0,00017***	-0,00023***	-0,00018***	0,00002	-6,53e-07	-0,00049***	-0,00046***
Risk	0,00208	-0,00164	0,00860**	0,00015	-0,00930**	-0,00577*	0,01013	-0,00400
FundingCost	0,26560***	0,15847***	0,27434***	0,15048***	0,11287***	0,13234***	0,46780***	0,14101*
LiquidityRisk	-0,00003	-0,00019	-0,00008	-0,00015	-0,00069***	-0,00024	-0,00665	0,00250
CapitalRatio	0,70006***	0,73986***	0,69370***	0,68977***	0,14942**	0,52284***	0,75920***	0,72056***
Loans	0,00368	0,00948***	0,00473	0,01012***	0,01126***	0,01214***	0,02757**	0,01769**
LoanLossProvisions	0,15455	0,06238	0,14717	0,01016	0,65399**	0,37854	0,15701	0,02313
NetInterestIncome	-0,10713	-0,10394	-0,08420	-0,02591	0,95038***	0,07662	-0,19980	-0,07991
Size	-0,00098*	-0,00070*	-0,00114**	-0,00107***	-0,00312***	-0,00207***	-0,00478**	-0,00656***
GDPchange	0,00021	-0,00007	0,00027	0,00008	0,00002	-2,71e-06	0,00050	0,00029
Inflation	0,00032	-0,00007	0,00062	-0,00009	-0,00170**	-0,00015	0,0023	0,00082
time1	0,00395***	0,00162	0,00444***	0,00295*	0,00657***	0,00290*	0,00948**	0,00297
cons	-0,02505**	-0,02616***	-0,03363***	-0,02309***	0,03386***	0,00443	-0,02913	0,01342
lag	YES	NO	YES	NO	YES	NO	YES	NO
R2	0,6744	0,7929	0,6923	0,7665	0,3804	0,4763	0,7292	0,7845
obs	3569	3952	2648	2942	947	1030	812	939

* significant at the 0.10 level, ** significant at 0.05 level, *** significant at the 0.01 level

5.2 Analysis

Return on equity (ROE) seems to have a mostly negative effect on the excess leverage that banks hold in both of the models. Only in the sample of large banks is there a difference in the results. The effect of ROE is more prominent in the OLS model. Also, the effect is little bit bigger in most cases in both models when one lagged period is used. There is not much difference in the statistical significance across the models.

Net Interest income has conflicting results between the used models. This is most clear in the sample of small banks where the fixed-effects model, the effect is positive and statistically significant. For the OLS model, the results are negative, while only the value without a lagged period and using the fixed-effect model is statistically significant. There is no large discrepancy for the large banks, but most notably, the effect is economically larger when using the OLS model. The full and Euro area samples have varying results between the models. Both models find a negative effect for the Euro area and full sample when the lagged period is not used, but it is not statistically significant. When the lagged period is used for the independent variables, the results conflict, but they are not statistically significant

Castro and Lopes (2021) found that the book leverage of the bank is negatively correlated with the bank's profitability. They explained that this could be because profitable banks are able to retain their earnings. They do not need to take on debt to finance their activities. Also, Drakos and Malandrakis (2021) found that the ROE positively affected the leverage ratio. I had two very different types of profitability indicators in my calculation (ROE and net interest income), and my results mostly do not seem to capture this effect. Most banks in my sample do not appear to retrain their earnings to fund their assets. This could indicate that the banks might distribute their earnings through dividend payouts.

The Risk appears to get mostly statistically insignificant results in both models. Only when using the OLS regressions is there some statistical significance, mainly for the large banks. Much of the previous research has been concerned that the Basel leverage ratio would result in banks taking on more risk as it does not account for the riskiness of the assets, only for the nominal value of the assets (Acosta-Smith et al., 2020; Choi et al., 2020; Kiema & Jokivuolle, 2014; Martynova et al., 2020). Based on this, it would be intuitive to assume that the risk would not be significant; my results are in line with the previous literature as the Risk variable does not appear to have much effect on the excess leverage.

There appears to be a difference in the results from the two models regarding the Funding cost. The results are always statistically significant when using the OLS model and when using the Fixed effects model, the results are mostly not statistically significant. When there is statistical significance, the variable's effect is mainly positive across the models. It can be that the banks

transform the raised funding cost further to their customers, which could result in lower lending activities and a higher leverage ratio. This would align with Barth and Miller's (2018) thinking.

Opposite to the Funding cost, Liquidity risk gets mainly statistically significant results when using the fixed effect model, and this is only true for the full and Euro area samples. This effect is positive and larger when using the one-lagged period. This makes sense as it might take time before customer activity is visible on the bank's balance sheet. This could also indicate that the banks increase liquidity by increasing deposits.

The capital ratio is commonly used in financial literature but is not the most traditional variable when looking at the leverage ratio, as it is similar. Therefore, it is unsurprising that the capital ratio has the most considerable effect of all the variables for both models.

Loans seem to have varying effect between the models. The effect seems to be mainly negative when using the Fixed effects model and mostly positive when using the OLS model. There is some statistical significance in both cases. Barth and Miller (2018) state that if banks pass on the costs of having higher leverage to customers, it could lead to reduced lending. From this, one could assume that a rise in lending activities in the bank would correlate negatively with leverage. In my calculations, this was mostly true when using the Fixed effects model. The loan loss provisions effect varies little between the regression but is mostly positive.

The variable Size affects the excess leverage mostly negatively in both regressions and seems statistically significant across the results.

The effect of the GDP change varies between the models and does not appear to be statistically significant. Inflation had some variation in its effects between models, but the effect is mostly positive. However, it does not appear to be statistically significant. The time of negative interest rates appeared to have a mostly positive and statistically significant effect across the board. There does not appear to be much difference between the models either. Interestingly, from the macro variables, only the time of the negative interest rate is statistically significant.

The OLS model appears to have a bigger R-squared value in all regressions.

6 CONCLUSIONS

This master's thesis focuses on the leverage ratio requirement introduced by the Basel Committee on Banking Supervision which defines the Leverage ratio as Tier 1 capital over on- and off-balance sheet exposures. The minimum leverage ratio that banks should hold is set to 3%, which is in the EU area adopted to legislation through the revised capital requirements directive and regulation. Many banks in the EU hold higher leverage ratios than the required 3 %. This master's thesis attempts to shed light on what drives the excess leverage the banks hold. To capture what affects banks' excess leverage, two different models were used: a fixed-effect model and a linear model. From the results, it can be concluded that the linear model better fits the data.

The impact of the leverage ratio requirement has been discussed in previous research. Many scholars (Dermine, 2015; Liu & Fang, 2021; Brei & Gambacorta, 2016) who have studied the leverage ratio requirement and its effect on the banking system have found that it has a positive effect on the financial system and helps to increase long term financial stability. Not all share this view, however. As the leverage ratio is not risk-sensitive, some researchers have found that it incentivizes banks to have more risky assets (Acosta-Smith et al. (2020); Choi et al. (2020); Martynova et al. (2020)).

From the results, it would seem that the main drivers behind the excess leverage the banks in the EU area hold are Capital ratio, time of negative interest rates, profit, loans, and funding costs. This would indicate that banks' excess leverage is mainly driven by internal figures and not the common macro variables. This could indicate that the excess leverage is somewhat protected from macro-level shocks. The capital ratio has a strong effect on the excess leverage ratio, and this could indicate that the off-balance sheet exposures are not that significantly affecting the leverage ratio of banks.

In this research, it was found that the profit negatively affects the banks' excess leverage. This can be if banks reduce their equity. ROE's effect could also indicate that banks might use their profits to finance their lending activities, thereby increasing the bank's assets and lowering the leverage ratio. This could also indicate that the banks pay off their profit to the owners of the banks and do not retain the profit for the next period. The funding cost has prominent results in this study, especially when using the OLS model. This can be affected by the time period of the study as the interest rates have been low and negative during the studied years, which would decrease the interest expense of the bank. The low interest rates can also disincentive the banks to increase their assets as they do not have that much to profit, and the fee income has been an important source of profits for banks. In the future, it could be interesting to study if the fee income would affect the leverage.

These results show a difference between the full and Euro area samples. The difference is not that big, but it is interesting as the two samples are pretty

close to one another. This could indicate that the outside of the Euro area banks have a substantial effect on the results. In the future, it would be interesting to study if the results on the leverage ratio differ between different economic areas and different currencies. It would also be interesting to study if there is a difference in what effect the excess leverage between banks that operate in a single currency and banks that operates in many different currencies.

The macro variables GDP change and Inflation did not significantly affect the excess leverage. In this, the selected time period might have, as both have been relatively stable in the last ten years in the EU area. A capable risk manager unit in the banks should be able to control the easily predicted changes and adjust the balance sheet.

The only macro variable that significantly affected the excess leverage is the era of the negative interest rates. While this has been relatively stable same as the other macro variables in the sample, it has a more substantial effect as it more closely affects the banks' profit-generating ability. It is interesting, though, that this variable's effect is more prominent when using a lagged period, especially as it is a dummy variable. This could be explained if the negative interest rate era affected more through the strategic actions of the banks rather than as a market activity.

The R-squared value seems larger when one lagged period is not used. This makes sense, as most banks report their results and leverage ratio once a quarter. Therefore, banks must act fast to keep their capital levels sound throughout the year. However, for the profit and macro variables, the effect seems more prominent when the one-lagged period is used. This can be because dividends are paid out once a year. Therefore it works in a slower cycle than, for example, liquidity management, as insufficient liquidity can bring down a bank quite fast. The macro variables affect the leverage slower as the effect might be indirect.

One of the limitations of this study is that the other risk-based capital requirements were not considered. They could have a significant effect on how banks compose their balance sheet and could, in part, explain some of the findings of this study, such as why the capital ratio has such a substantial effect. In the future, it could be interesting to study how the banks will adapt to the new possible P2R-LR requirements. In the future, it could also be interesting to do a study comparing my results in the US banks and see if the extra leverage ratio requirement would affect my results. Another limitation of this study is that the data has some skewness and kurtosis at times.

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