Moral Hazard and Banking Risk

A Euro Area Analysis

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Abstract

This study investigates the effects of capital regulations on risk-taking within the Eurozone banking sector from 2013 to 2019, specifically focusing on the impact of moral hazard stemming from bank charter value and ownership influence. Previous research suggests both bank charters and ownership influence can prompt different risk behaviours and potentially influence the effectiveness of capital regulations. Using a two-way fixed effects model on a dataset of 502 Eurozone banks, our analyses reveal a multifaceted relationship between bank risk, capital regulations, and moral hazard. More specifically, bank charter increases prudence while shareholder influence increases risk-taking. Moreover, our results suggest that the sign of Tier 1 capital's effect on risk changes with shareholder influence, where widely held banks become riskier with a higher Tier 1 ratio. For bank charters, we find evidence that banks with high charters are negatively affected by Tier 1 capital, but only for credit risk. The results provide insight into the dynamics of capital regulations in the Eurozone banking sector, with implications for future policy and regulatory frameworks.

Keywords: Moral Hazard, Capital regulation, Risk, Ownership Influence, Bank Charter, Profitability

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1 Introduction

The regulatory framework within the banking sector has undergone continuous development, with restrictions on risky banking operations being more rigorous now than in the past. The development of the regulatory environment has been particularly significant in the aftermath of the financial crisis (Bank for International Settlements, 2017). Still, defaults and instability within the financial sector remain prevalent. Moreover, evidence of a sub-optimal regulatory framework can be seen in the recent collapses of major banks in the US and Switzerland (Economics Observatory, 2023b,a). To this end, we will analyse the effects of capital regulations on risk and how they may vary depending on a bank's incentives to take risks stemming from moral hazard. Moreover, we also aim to study if capital regulation, in conjunction with moral hazard-related risk-taking, affects banking profitability.

Researchers have looked into the channels by which banks, independently of regulations, decide to either act prudently or take risks. One of these is bank charter values. Charter value, often defined as the value lost given closure and typically measured through the market-to-book value of a bank, is frequently seen as a bank's self-regulating device (Acharya, 1996; Palia & Porter, 2004; Keeley, 1990). Keeley (1990) discovered evidence that competition in the 80s led to a decrease in bank charter value, which increased risk-taking. The rationale behind this is that banks with low charter values have relatively little to lose in case of default, and if they default, they receive most of the value of the bank back thanks to the deposit insurance scheme. Hence, as charters decrease, the expected value from risky projects increases, encouraging risk-taking. The opposite held for banks with high charters.

Gonzalez (2005) considered bank charter value and regulatory environments. They found a connection between countries with low regulations and high bank charter values. Moreover, they found that banks with high charters acted prudently, even though regulations did not necessarily require them to. Furthermore, they also found a link between strict regulations and low charters, and in these countries, banks with low charters lacked incentives to act prudently.

Gropp & Heider (2010) found evidence that banks optimize their capital structure similarly to firms and that their optimal choice only depended on regulations if they were sufficiently close to minimum requirements. Hence, regulations can affect optimal decisions in certain situations. Furthermore, Acharya (1996) found that high charters still encouraged prudent behaviour even for nearly insolvent banks (those with close to no capital). Hence, for these banks, which would be affected by minimum requirements, the

high charter was enough for them not to exploit deposit insurance and take excessive risks. It may be that maintaining low levels of capital is optimal for these banks, and any requirements or increase in capital would distort their choice of optimal capital structure. To the best of our knowledge, there is a research gap regarding the combined effect of capital regulations and moral hazard in the Eurozone during recent years. Our purpose is to fill this gap and extend the body of knowledge within this area. To fill this gap in the literature, we form two hypotheses.

Another well established moral hazard dilemma in the world of banking is the effects of ownership influence on risk-taking incentives. Evidence from Laeven & Levine (2009) suggests that banks with influential owners take on more risks. The reasoning behind this follows the relationship described by Bebchuk & Spamann (2009), that equity owners are more prone to risk-taking than other stakeholders. Hence, banks, where equity owners have a substantial influence on banking operations, will inherently be riskier. Moreover, Laeven & Levine (2009) found that the same regulation may either have a risk mitigating or increasing effect depending on if the bank is widely held or not.

Firstly, given what earlier literature suggests, we hypothesize that high charter is linked to prudent behaviour, even for nearly insolvent banks. Moreover, similar to the hypothesis of Gonzalez (2005), we believe that the same regulation may have different effects depending on a bank's charter. For banks with high charters, capital regulations would only hinder their ability to diversify and choose capital structure optimally, ultimately leading to a negative effect on financial stability. For banks with low charters, the same regulation would mitigate moral hazard incentives to exploit the deposit insurance system through risky projects. Our second hypothesis related to banks with influential shareholders taking on more risks. Again, bank equity owners are generally more prone to risk, and if they exert influence on activities, the activities should be risky as well (Bebchuk & Spamann, 2009). Furthermore, similar to the hypothesis for bank charters, we hypothesise that the same capital regulation may either be mitigating or risk increasing, depending on the shareholder structure.

Lastly, evidence exists both in favour of and against capital regulations having a negative effect on banking profitability (Pasiouras, Tanna, & Zopounidis, 2009; Bitar, Pukthuanthong, & Walker, 2018). Hence, as this is one of the most prominent non-risk related externalities, we decided to test how moral hazard incentives in conjunction with capital regulations affect profitability.

To test our hypotheses, we apply a two-way fixed effects model with a set of time-varying controls on a panel dataset. The dataset includes 502 banks in the Eurozone for the time

period 2013 to 2019. We test our hypothesis on two risk measures: credit risk and overall banking risk. Furthermore, we test our hypotheses on a sample only, including listed banks. Naturally, the bank charter hypothesis can only be estimated for listed banks, given that we need the market value of said banks to calculate their charter.

Our results can be summarized as follows. Firstly, consistent across risk measures, increases in ownership influence for lowly capitalized banks are related to higher risks. Moreover, the effectiveness of Tier 1 capital in risk mitigation increases with ownership influence. Lastly, higher capital ratios for widely held banks are related to more risk, although this only holds for overall banking risk. These results perfectly align with Laeven & Levine (2009) and support the moral hazard relationship described by Bebchuk & Spamann (2009). When we test the sample only containing listed banks, the result for overall banking risk persists. For credit risk, however, the relationship is different, where Tier 1 capital has a strong risk mitigating effect, and there is no evidence in favour of the moral hazard hypothesis.

Our hypothesis related to bank charters also holds, but only for credit risk. Higher charters, even for nearly insolvent banks, are related to prudent behaviour. The effect that Tier 1 capital has on risk is an increasing one for banks with greater levels of charters, which already have prudent incentives. This may follow from an inability to choose an optimal capital structure, as suggested by Gropp & Heider (2010) for banks near the minimum requirements. Lastly, our results concerning effects on profitability were somewhat uninspiring and inconsistent across risk measures and samples. However, one could argue that although Tier 1 capital mitigates credit risk for sufficiently influential owners, it also reduces the net interest margin.

When considering a sample restricting certain banks, using total capital instead of Tier 1 capital, and addressing the potential endogeneity issue arising from simultaneous determination between bank valuation and risk, our results remain largely the same. The main difference is for overall banking risk, where, for both unlisted and listed banks, we find no evidence of capital distorting optimization or influential owners engaging in excessive risk-taking.

Our study contributes to the academic literature on banking regulations by analyzing the effectiveness of capital regulations in relation to moral hazard risk-taking incentives such as bank charter value and ownership influence. In addition, our focus on recent times adds to the literature on how fully phased-in capital regulations, partly enacted in response to the financial crisis, have functioned in the Eurozone. Furthermore, our decision to divide the sample and analyze the operations of listed banks and all banks separately extends

the body of literature, particularly for the Eurozone between 2013 and 2019. Lastly, our results should be of interest to policymakers shaping the capital regulatory framework within the Eurozone.

The remainder of the paper is structured as follows. Firstly, we go through the theoretical background on which our hypotheses are based. Secondly, we review other findings within the area of capital regulations and moral hazard. Both of these are included in Section 2. In Section 3, the reader will find the empirical strategy used to test our hypotheses, the data we use, and any discussion related to our approach's ability to generate unbiased results. In Section 4, we present and discuss our results. Section 5 addresses the robustness of our results, and Section 6 concludes.

2 Theoretical Background and Literature Review

2.1 Theoretical Background

2.1.1 Banking Regulations

Regulators enforce numerous restrictions on banking activities and operations to mitigate unnecessary risk-taking. Among these, capital requirements are one of the most prominent. The intuitive reasoning behind imposing capital requirements is to enable banks to absorb unexpected losses (Finansinspektionen, 2023). That is, for a given level of distress, more capitalized banks are less likely to default, making deposits held in these banks relatively safer. Furthermore, as capital regulations are calculated using risk-weighted assets, banks that behave riskily would be subject to higher capital requirements. Given that banks prefer not to hold excess capital as it could affect profit efficiency (Pasiouras, Tanna, & Zopounidis, 2009), this would incentivize them to invest in less risky assets to lower the required amount of capital. Therefore, capital requirements should increase stability in the banking sector.

One of the most prominent risks associated with banks relates to their primary activity - lending, credit risk. Banks, primarily financed by deposits, invest these deposits in loans. There is no guarantee that borrowers will repay the entire amount, which could ultimately impact depositors' ability to retrieve the full deposited amount (Bank of England, 2023). Hence, regulations such as capital requirements are imposed to ensure that, in the face of substantial losses from banking activities, depositors are not affected. The bank's equity should absorb the loss. There are other types of risks that banks must consider, such as market risk and operational risks, both of which capital requirement is designed to address (Finansinspektionen, 2023). This paper primarily intends to analyse risk from a credit risk perspective since it is the most prominent risk for banks. Secondly, we choose to analyse overall banking risk, incorporating all of the abovementioned risks.

The capital regulations come in different tiers (see Table 7.1, Appendix A). Indeed, not all capital is the same, and not all types of capital are equally reliable in the face of distress. Firstly, the most stable capital within a bank is Common Equity Tier 1 (CET1). At least 4.5% of the risk-weighted assets must be of this kind. Capital, such as common stock and retained earnings, would fall into this category. Secondly, in addition to CET1, there is Tier 1 capital, which includes CET1 but also other capital instruments. Banks must maintain at least 6% of their risk-weighted assets in this category. Lastly, the total capital, including all forms of capital (even capital who do not meet the criteria of Tier 1), must comprise at least 8% of a bank's risk-weighted assets (BIS, 2023c). Banks must also retain capital buffers in excess of the regulatory capital, such as a conservation and

counter-cyclical buffer. These should make up 0 - 2.5% of a bank's risk-weighted assets (BIS, 2023a). Together, these regulations compose the capital framework intended to create stability in the banking sector.

Raising capital and maintaining high levels of capital is costly, and some evidence suggests that profit efficiency decreases with more stringent capital requirements (Pasiouras, Tanna, & Zopounidis, 2009). However, there is also support for imposing capital requirements, as banks themselves do not have the incentives to capitalize sufficiently (Korinek, 2011).

Capital requirements are not the only form of regulation that regulators impose on banks. Other regulations include liquidity ratios, stress tests, and so forth (BIS, 2023a). Another important aspect of the banking sector is the deposit insurance scheme. Essentially, for up to €100,000 in the euro area, deposits within banks are fully insured against defaults (Deutsche Bundesbank, 2017). Deposit insurance acts as a safety net for banks and can be subject to exploitation. We further delve into this topic in the next section, examining how different factors may affect banks' willingness to act in a risky and to exploit the deposit insurance system.

2.1.2 Bank Charter

One of the factors that affect risk-taking behaviour, and that is not regulation, is bank charter value. Bank charter value is loosely defined as the value lost given closure (Acharya, 1996). One may also define it as the present value of all future value generated by a bank. Both of these definitions point to the same thing: the bank's value as estimated by the market and the value lost given that the market no longer believes a bank is able to generate this value, i.e., given default. Most often, given these definitions, charter value is proxied by Tobin's Q, the market-to-book ratio (Palia & Porter, 2004).

$$\text{Market-to-Book Ratio} = \frac{\text{MV(Firm)}}{\text{BV(Firm)}} = \frac{\text{MV(Equity)} + \text{MV(Debt)}}{\text{BV(Equity)} + \text{BV(Debts)}}$$

But it is often assumed that the market value of debt and the book value of debt are equivalent, hence the market to book value becomes the following

$$\text{Market-to-Book Ratio} = \frac{\text{MV(Equity)}}{\text{BV(Equity)}} = \frac{\text{Market Capitalization}}{\text{BV(Equity)}}$$

Bank charter value is often seen as a bank's own device to act prudently. Now, when competition increased in the US banking sector in the 80s, charters dropped, and this drop in charters led to more risk-taking (Keeley, 1990). To understand why, we must first

explain what occurs when a bank defaults. When a bank defaults, it will lose all of its market value because the market no longer has any confidence in the bank's ability to generate value, and any equity holder will have lost their investment. But thanks to the deposit insurance scheme, banks can recover most of their book value. Now, the deposit insurance scheme allows banks to recover the book value of all of their deposits (up to €100,000 per depositor). Given that banks are highly leveraged and that the main source of debt financing comes from deposits, recovering the book value of deposits implies recovering most of the total book value of the bank. Furthermore, due to equity holders having limited liability, any loss greater than the equity value is not to be covered by equity holders but by governmental authorities (via the deposit insurance scheme). Again, evidence of high charters affecting prudence was found by Gonzalez (2005), where these banks acted prudently even in low regulatory environments.

Banks with low charters or low market-to-book will lose relatively little if they default. This is because they have nearly no market value to lose, and they will recover the book value of deposits thanks to the deposit insurance scheme. For banks with low enough charter, engaging in highly risky projects may actually increase their expected value since if they succeed, they receive a lot, but if they fail, then they will recover most of their value. This mechanism is exactly what Keeley (1990) found, that competition caused low charters and charters in conjunction with deposit insurance created excessive risk-taking. Conversely, if a bank has a high charter or market-to-book value, defaulting means losing a lot of value. For these banks, receiving the book value of deposits is not sufficient enough to increase their risk-taking. Hence, these banks have a natural incentive to act prudently and to minimize the probability of default.

Moreover, capital regulations may both have a positive or negative effect on financial stability, depending on a bank's charter value. If a bank has a low charter value, they are naturally incentivized to exploit the deposit insurance scheme and take on risk. In those situations, capital regulations would likely be beneficial for financial stability and reduce the amount of risk that the bank takes. On the other hand, banks with high charter value could not recover sufficiently from the deposit insurance scheme to take on excessive risk. Hence, for such banks, who already have a natural incentive to act prudently, capital regulations would only hinder their ability to diversify and choose capital structure optimally. Gonzalez (2005) hypothesized this duality of the effects of regulations. They found evidence of an inverse relationship between charters and regulations and that even in environments with low regulations, high charter banks acted prudently.

To strengthen our reasoning about the duality, we further incorporate the results of Gropp & Heider (2010). They found that banks optimize their capital structure similarly to firms,

but only when they are sufficiently far from minimum requirements. Acharya (1996) found that even nearly insolvent banks, had they high enough charters, acted prudently. Hence, banks whose optimal capital structure may be below minimum requirements and who have high enough charters would be affected negatively without any risk-mitigating effect.

2.1.3 Ownership Influence

Another non-regulatory factor that can affect a bank's risk-taking is ownership influence. Banks with owners who own large amounts of total shares and have significantly large voting rights tend to take more risks (Laeven & Levine, 2009). The reasoning behind this is that equity owners, in general, are more prone to taking risks, often more so than what the management would deem suitable or what is in the best interest of all stakeholders. Therefore, if a bank has equity owners with sufficient influence on banking operations, then such operations will inherently be more risky.

Equity owners being more prone to excessive risk-taking stems from a standard moral hazard dilemma described by Bebchuk & Spamann (2009). However, before explaining this dilemma, let's state two stylized facts. Firstly, any potential loss in a bank greater than the equity value will not be covered by equity holders but by governmental authorities via the deposit insurance scheme. Again, as stated in the section before, this is limited liability. Secondly, debt is senior to equity, meaning that in case of default, debt holders get paid first by what is left. Any investment strategy where the return, if successful, is greater than the amount of equity in the bank will benefit equity holders, regardless of the potential loss. That is, since equity holders only reap the rewards if successful and do not face the losses if unsuccessful, equity holders prefer risky projects.

Now, limited liability and the seniority of debt are principles that are not exclusive to banks. In fact, these hold for all operating companies. Why does the moral hazard dilemma of excessive risk-taking of equity holders only hold for banks? The reason is that for regular companies, as activities become inherently riskier, creditors charge higher rates on the money they have lent these companies. This implies that the excessive risk is offset by the higher cost of financing via debt. Ultimately, equity holders will not receive excess returns from extra risk as this solely goes to creditors. For banks, however, creditors are uninformed consumer depositors. When banks increase their riskiness, there is no response of the credits to the bank, making the cost of financing via debt essentially the same. The excess return from higher risk is instead given to equity holders. Hence, a

potential gain can be made for equity holders from increased risk in banks.

Another way to illustrate the dilemma is that equity holders receive nothing if the project is unsuccessful, regardless of riskiness. They do, however, benefit more from the high-risk project if successful. Hence, even though a particular investment strategy may prove detrimental to the bank overall due to the above-stated moral hazard dilemma, such a strategy could still be favourable to equity holders (Bebchuk & Spamann, 2009).

Managers, conversely, do not appreciate defaults or bankruptcies as these events compromise their job stability and income. Managers do not reap the benefits of excessive risk but are highly exposed to the downside. Therefore, unlike equity holders, managers have a natural incentive towards prudence. As mentioned, banks with equity owners with significant influence over banking activities tend to take more risks. However, when a bank has numerous small shareholders, none can assert enough influence to override management decisions, which are inherently less risky (Laeven & Levine, 2009).

In conjunction with capital regulations, ownership influence operates similarly to bank charter value. For substantial owners, capital regulations should have a risk-mitigating effect. (Laeven & Levine, 2009) found evidence for this when ownership exceeded 20%, and defined a bank as being widely held if a single owner possessed less than 10%. It's important to note that if banks pursue riskier investment activities, necessitating capitalization, the equity investors become more invested and face higher losses if the activities are unsuccessful. Meaning that if they face higher losses, then surely, they would prefer less risky activities. This effect is less pronounced if smaller or outside investors cover the increased need for equity. Nevertheless, the typical risk-mitigating effect of capital also remains relevant. That is, higher capital requirements imply a greater ability for equity to cover losses, and the incentives to lower capital requirements through less risky activities persist. If banks are widely held, then capital requirements, much like bank charter values, only restrict bankers' ability to engage in optimal diversification given their specific circumstances (Laeven & Levine, 2009).

2.1.4 Profitability

Capital regulations, bank charter value, and ownership influence can impact risk in various ways. Analyzing risk alone does not provide a comprehensive understanding. While capital regulations can mitigate risk or have no significant effect on risk under certain circumstances, they can still produce externalities. Pasiouras, Tanna, & Zopounidis (2009) discovered that capital regulations indeed impact profit efficiency. They concluded that higher capital requirements incentivize banks to opt for less risky investments to meet

regulatory requirements (as these are calculated using risk weights) and that these less risky activities tend to yield lower returns. On the other hand, Bitar, Pukthuanthong, & Walker (2018) found that higher capital regulations improved profitability and emphasized the importance of capital quality over quantity, such as Common Equity Tier 1 or Tier 1 capital.

Hence, in a scenario where capital regulations have little to no impact on stability but lead to externalities in the form of decreased profitability, maintaining existing regulations may be suboptimal. Conversely, the current regulatory framework may be justified if capital regulations enhance profitability as suggested by Bitar, Pukthuanthong, & Walker (2018). This paper aims first to analyze how bank charter value and ownership influence work in conjunction with capital regulations on risk. However, to provide a broader picture, we will also investigate the effects of these factors on banking profitability.

2.2 Literature Review

The banking regulatory framework has been rigorously analysed concerning its effect on risk-taking and non-risk externalities. Furlong & Keeley (1989) employed a state-preference model to analyse the effects of capital stringency on the bank's incentive to increase the riskiness of their asset portfolio to offset the costs related to higher capital levels. The study found that a higher capital ratio does not lead to a riskier asset portfolio. On the contrary, an increased capital ratio decreases potential gains from pursuing riskier investment activities. Behr, Schmidt, & Xie (2010) conducted an empirical analysis of the effects of capital regulations on risk, measured through the proportion of non-performing loans to total loans. The authors only found risk-mitigating effects of capital regulations in markets where concentration and competition were low.

Interestingly, Calem & Rob (1999) discovered that the effect capital regulations have on risk-taking assumes a U-shape. Banks with low levels of capital generally take on more risk, implying that a moral hazard relationship exists for nearly insolvent banks. This specific moral hazard relationship is often called a gamble for resurrection. For these low-level banks, increased capitalisation makes them more resilient to losses and lowers their risk. Lastly, banks that are capitalised well beyond the moral hazard issue tend to take on more risks. The increased risk-taking stems from high capitalisation being costly, and banks, therefore, engage in riskier activities to offset this loss in profitability. Klomp & De Haan (2012) examined banks from 21 OECD countries and the effects that banking regulation and supervision had on risk. They found that regulations did have a risk-mitigating effect, but only for already highly risky banks. For low-risk banks, the effect was not present.

Some studies have investigated whether the market can capitalize sufficiently and if capital regulations are needed. Korinek (2011) examined the incentives that agents on financial markets have to recapitalize after episodes of financial distress such as the financial crisis. They found evidence that the incentives to capitalize sufficiently did not exist, providing support for mandatory capital requirements. Another paper, Gropp & Heider (2010) analyzed banks' choice of capital structure for large US and European banks. They found that capital requirements did not affect banks' choice of capital structure if they were sufficiently far away from minimum requirements. Neither did any regulatory buffer or the existence of a deposit insurance scheme. They found that banks sufficiently far from minimal requirements optimized their capital structure similar to firms and that long-term banks specific effects laid the ground for the choice.

Other studies have examined unwanted externalities from banking regulations. Pasiouras,

Tanna, & Zopounidis (2009) investigated the impact of regulations on profit and cost efficiency. They found evidence that capital requirements increased cost efficiency while it decreased profit efficiency. This result implies that although regulations made activities less costly, this was offset by lower revenue such that profitability efficiency ultimately decreased. Barth et al. (2013) found that increased capital stringency actually improved banking efficiency, where efficiency refers to technical efficiency that measures the relationship between a bank's inputs and outputs.

Other papers have examined the links that regulations have with other risk-related variables. Gonzalez (2005) conducted an empirical analysis on the risk mitigation effects of banking regulations, considering bank charter value. Bank charter value has a risk-mitigating effect through the replacement cost in case of default. Banks with high charter value will lose relatively more in case of default and hence have a natural incentive to act prudently. Keeley (1990) found evidence suggesting that banks with higher charter value were more capitalized and had lower risk premiums.

Furthermore, Gonzalez (2005) discovered that banks in countries with fewer restrictions, on average, had higher bank charter values, with bank charter value measured as the market-to-book value of the bank. Moreover, they found that banks with high charter values in countries with low restrictions did act prudently. In contrast, banks with low charter value in countries with high restrictions had no incentive to act prudently. Lastly, after isolating the effect that regulations have on charter value, regulations did mitigate risks. This result contrasts with Barth, Caprio Jr, & Levine (2001, 2004) who concluded differently. In summing up the results of Gonzalez (2005), banking regulations negatively affect prudent behaviour, but this mechanism is through charter value. The relationship is reversed when isolating the effect of regulation on charter value. That is, regulations have a direct mitigating effect on risk. However, regulations result in increased risk when considering the indirect effect going through charter value.

There is a close link between bank charter value and competition, where, in general, banks operating in less concentrated markets tend to have more market power and higher bank charter value (Keeley, 1990). However, the literature is less unified on whether competition is positively linked to risk. Schaeck & Cihák (2014) argues that competition benefits financial stability. They argue that in a competitive market, only efficient banks survive, and banks that better utilize their resources are generally more stable and do better in periods of financial distress. Conversely, Keeley (1990) argues that competition, through its negative effect on bank charter value, increases the moral hazard incentives to take

risks in the presence of a deposit insurance scheme.

Laeven & Levine (2009) incorporated ownership influence into their analysis. They examined whether banks with owners who have large cash flow rights took more risks. In general, owners with significant cash flow rights have more influence on banking operations. Since equity owners have a natural incentive to take risks, if they exert substantial influence on banking operations, these operations will inherently be more risky. Their results demonstrated that banks with influential owners take on more risk. Moreover, they found that banking regulations had different effects on risk depending on the ownership structure. Banking regulations had a risk-mitigating effect on banks whose owners had large cash flow rights. The opposite holds for banks that are widely owned.

Laeven, Ratnovski, & Tong (2016) examined how bank size and capital regulation, in conjunction with bank size, affect systemic and standalone risk. They found that larger banks take on more systemic risks while well-capitalized banks take on less. Well-capitalized banks holding less systemic risk is more prominent for large banks. The authors also argue that the positive correlation between systemic risk and bank size could be due to a too-big-to-fail effect.

Our contribution to the academic literature on banking regulations is as follows. Firstly, we analyse the effectiveness of capital regulations in the face of moral hazard-based risk-taking incentives. Two of the most prominent natural risk-taking incentives are bank charter value and ownership influence. Therefore, we intend to analyse both of them in conjunction with capital regulations. Secondly, we intend to analyse if capital regulations, again in conjunction with charter value and ownership influence, create any unwanted externalities. Given our results, policymakers could make more informed decisions regarding when capital regulations sufficiently mitigate risks and when naturally occurring prudent behaviour can be used to create financial stability. Lastly, our analysis focuses specifically on the eurozone. Hence, any result will be extra relevant for policymakers within this area.

2.3 Hypotheses

Given what other researchers have found and what the theories say about agents' behaviour and the relationship between charter value, ownership influence and capital regulations, we choose to define two hypotheses, which this thesis aims to examine.

Hypothesis 1: *High charter values encourage banks to act prudently, while low charter values motivate banks to exploit deposit insurance schemes and engage in excessive risk-taking. The impact of capital regulations on risk may be mitigating or exacerbating, depending on the bank's charter value.*

Hypothesis 1 directly follows the result of Gonzalez (2005) and Keeley (1990), both of whom argue for the positive relationship between charter value and prudent behaviour. Moreover, Gonzalez (2005) hypothesized that regulations may have a positive or negative risk-mitigating effect depending on a bank's charter values. In fact, they found evidence of an inverse relationship between the two. Gropp & Heider (2010) suggests that the optimal capital structure of banks does not depend on the minimum requirement as long as they are sufficiently far away from the thresholds. However, if a bank is sufficiently close to the minimum requirement, its choice of capital structure would be affected and, thus, might become suboptimal. For any bank with a natural incentive to act prudently, hindering the process of optimal capital structure would be negative. Moreover, it could affect optimal diversification, hence the last part of the hypothesis.

Hypothesis 2: *Equity owners tend to take excessive risks, and banks, where they influence operations, will inherently be riskier. Depending on whether a bank has a large enough owner or is widely held, the same capital regulations may either mitigate risks or hinder optimal diversification.*

Hypothesis 2 follows from the results of Laeven & Levine (2009) and the Moral Hazard dilemma proposed by Bebchuk & Spamann (2009). That is, sufficiently large direct shareholders influence banking activities, and due to the Moral Hazard dilemma described in section 2.1.3, these activities will inherently be riskier than what is preferred by management or creditors. Moreover, following the same reasoning as for bank charter value, regulations may either have a risk mitigating or increasing effect. Now, a bank's choice of capital structure is affected by capital requirements if they are sufficiently close to the minimum requirements (Gropp & Heider, 2010). Any bank whose optimal structure would be less than the requirement, and is widely held, could be negatively impacted by regulations without any added risk mitigating effect. Lastly, in situations where banks are inclined to take risks and whose capital structures are affected by minimum requirements, regulations likely have a risk-mitigating effect, hence the last part of the hypothesis

3 Empirical Strategy and Data

3.1 Data

The data in our analysis comes exclusively from the Bureau Van Dijk Orbis database, covering 502 listed and unlisted banks within the eurozone. The choice of these specific 502 banks comes down to several reasons. Firstly, these were the only ones for which data for direct shareholders existed for at least one time period within the sample. Secondly, we excluded branches whose direct parent was also in the data. The reasoning behind this is that these banks effectively have the same moral hazard dynamics as their parents but with significantly different direct ownership numbers. Unfortunately, this would cloud the data. To see why, let's assume that a bank is owned 100% by its parent. In that case, the data suggests 100% direct ownership, while in reality, it has the same ownership influence as its parent, which is not 100%. Moreover, having two different entities with the same moral hazard dynamics would cause these to be overrepresented in the sample, skewing the data.

The focus on the eurozone is due to its central role in European banking, and any findings relevant to this area will likely have implications for the broader European and global economy. Furthermore, banks within the eurozone, in part because of the harmonization of currency, face similar time-varying shocks, making them more comparable in terms of potential outcomes than if banks from other areas were included.

The data for this analysis spans from 2013 to 2019, with annual observations. The rationale for this choice is that this period is characterized by financial stability, devoid of major shocks. Hence, our results will apply to standard market and economic conditions. By starting from 2013, we exclude data from the financial and euro crises. Moreover, the phase-in period for the new Tier 1 and Tier 2 capital definitions began in 2013, making it an appropriate starting point for assessing capital requirements as they are presently defined. The sample period ends in 2019, which means we are excluding data from the Covid-19 pandemic — a period marked by abnormal market conditions. By including data up to 2019, we ensure that several Basel criteria have been fully phased in for at least one period. Such regulations include the minimum equity requirements and the conservation buffer. Furthermore, the Common Equity Tier 1 deductions would have been fully phased in for two periods within the sample timeframe (BIS, 2023b). We will now go through the variables used in our analysis. Note that a list of the variables and brief descriptions can also be found in Table 8.1, Appendix B.

Main Variables:

The **Tier 1 Ratio** is the ratio of quality Tier 1 capital (see table 7.1, Appendix A) to the bank's risk-weighted assets. The **Total Capital Ratio** is the ratio of Tier 1 and Tier 2 capital (see table 7.1, Appendix A) in relation to the risk-weighted assets. Our main estimation primarily focuses on the Tier 1 capital ratio, following Laeven, Ratnovski, & Tong (2016). However, for robustness, we substitute the Tier 1 capital ratio with the Total Capital Ratio (see section 5.2).

Additionally, to test Hypothesis 2, we include **Max Shareholder - Direct%**, calculated as the percentage of direct shares owned by the largest unique shareholder at the beginning of each year. The ownership data only includes direct owners and encompasses listed and unlisted banks. As previously mentioned, we exclude any branches from the sample since they are 100% owned by their parent bank, and it is the equity owners of the parent bank who may influence operations. Our measure of shareholder influence differs slightly from that of Laeven & Levine (2009). They include indirect and direct shareholders, identifying the ultimate owner of indirect shareholders to better assess their influence. Moreover, they focus on cash flow rights while we concentrate solely on the proportion of shares owned. However, they do argue that larger shareholders have a greater ability to influence operations. They also argue that cash flow rights are highly correlated with voting rights, which they identify as the "true" channel through which influence occurs. Given that we only include direct owners, we believe that the correlation between the proportion of shares owned and voting rights is stronger than if we were also to include indirect owners.

The **Market-to-Book** value, our proxy for bank charter value, is calculated as the market capitalization divided by the book value of equity, where market capitalization is the market value of equity. We use the Market-to-Book variable to test Hypothesis 1. Data for Market-to-Book is only available for listed banks. The listed banks make up 74 of the total sample of 502.

Risk:

In terms of risk, we use the **Non Perf. Loans / Gross Loans** ratio to measure credit risk. The Non Perf. Loans / Gross Loans ratio represents the ratio of loans on which lenders have defaulted in relation to all loans a bank has disbursed. The usage of Non Perf. Loans / Gross Loans as a measure for credit risk follows from Gonzalez (2005). To measure overall banking risk, we use the three-year trailing standard deviation of the return on assets, **SD(ROA) 3Y**, following Salkeld (2011). The goal of **SD(ROA) 3Y**

is to measure the volatility of a bank's ability to generate profit and create value.

Profitability:

Regarding external factors, we include the Return on Assets (**ROA**), calculated using the profit and loss statement before taxes. This variable is intended to capture a bank's profitability/efficiency and ability to generate value. We avoid measuring banking profitability via Return on Equity (ROE) because banks are typically highly leveraged, and high leverage tends to inflate ROE artificially. ROA as a measure of profitability follows from Staikouras, Wood et al. (2004). Finally, the **Net Interest Margin** is the difference between the interest income a bank earns from its lending activities and the interest it pays to depositors relative to the amount of its interest-earning assets. The Net Interest Margin is also a measure of the efficiency of banking operations. The use of Net Interest Margin as a measure of profitability follows from Dietrich & Wanzenried (2014).

Control Variables:

Total Assets, or bank size, is the value of total assets in millions of USD. We take the natural logarithm of total assets and include it as a control variable following Laeven, Ratnovski, & Tong (2016), Laeven & Levine (2009) and Gonzalez (2005). The variable **Net Loans / Total Assets** is the ratio of net loans to total assets and is intended to measure the magnitude of a bank's main operation, lending. The variable **Deposits / Total Assets** is the ratio of deposits to total assets and is intended to measure the magnitude of a bank's primary source of financing, deposits. Moreover, considering that the deposit insurance scheme is hypothesized to be exploited by certain banks, it makes sense to include the proportion of the bank that could be recovered in case of default. The usage of **Net Loans / Total Assets** and **Deposits / Total Assets** as control variables follows from Laeven, Ratnovski, & Tong (2016). To conclude, our controls intend to capture any bias stemming from too-big-to-fail (size) and compositional effects with respect to the bank's main activities.

Again, data for the **Market-to-Book** variable is only available for listed banks. Consequently, regressions using this variable will exclusively include listed banks. Data is not consistently available for all banks year-by-year, leading to an unbalanced data set. Table 3.1 and Table 3.2 present summary statistics for all and solely listed banks, respectively. Additionally, the variables **Tier 1 Ratio**, **Total Capital Ratio**, **Market-to-Book**, **Non Perf. Loans / Gross Loans**, **Net Interest Margin**, **Total Assets**, and **Equity / Total Assets** have been winsorized at the 99% level following several authors such as Klomp & De Haan (2012). We winsorize these variables to ensure that outliers do not significantly impact our results. Given that we use a fixed effects approach, any measure-

ment error will create bias Angrist & Pischke (2009). Hence, as these outliers are likely to stem from measurement errors, we choose to exclude them.

Table 3.1: Summary Statistics All Companies

Variable	Obs	Mean	Std. dev.	Min	25%	50%	75%	Max
Tier 1 Ratio	2,666	0.233	0.257	0.059	0.133	0.164	0.228	2.532
Total Capital Ratio	2,894	0.252	0.289	0.076	0.148	0.177	0.235	2.861
Max Shareholder - Direct %	2,711	0.557	0.391	0.000	0.203	0.510	1.000	1.000
Market-to-Book	416	0.857	1.113	0.011	0.285	0.591	0.911	7.324
Non Perf. Loans / Gross Loans	2,618	0.098	0.145	0.000	0.022	0.048	0.115	0.995
SD(ROA) 3Y	2,450	0.006	0.014	0.000	0.001	0.002	0.005	0.209
ROA	3,181	0.007	0.033	-0.487	0.002	0.005	0.011	0.392
Net Interest Margin	3,169	0.020	0.026	-0.012	0.009	0.016	0.023	0.255
Total assets (m USD)	3,191	55,173	209,018	6.400	492.210	2810.045	16435.529	1,768,645
Net Loans / Total assets	3,113	0.515	0.249	0.000	0.343	0.563	0.716	0.988
Deposits / Total assets	3,029	0.539	0.269	0.000	0.323	0.591	0.775	0.964
Equity / Total assets	3,186	0.133	0.147	0.009	0.063	0.092	0.136	0.942

Table 3.2: Summary Statistics Listed Companies

Variable	Obs	Mean	Std. dev.	Min	25%	50%	75%	Max
Tier 1 Ratio	357	0.149	0.042	0.079	0.122	0.139	0.169	0.397
Total Capital Ratio	393	0.169	0.040	0.096	0.143	0.163	0.186	0.397
Max Shareholder - Direct %	382	0.304	0.248	0.006	0.109	0.250	0.426	1.000
Market-to-Book	416	0.857	1.113	0.011	0.285	0.591	0.911	7.324
Non Perf. Loans / Gross Loans	396	0.103	0.131	0.001	0.025	0.049	0.108	0.610
SD(ROA) 3Y	387	0.006	0.011	0.000	0.001	0.002	0.005	0.070
ROA	416	0.010	0.032	-0.165	0.003	0.007	0.011	0.308
Net Interest Margin	416	0.018	0.011	-0.009	0.012	0.016	0.024	0.071
Total assets (m USD)	416	271,810	488,140	80.298	13,030.851	47,618.223	220,298.861	1,768,645
Net Loans / Total assets	405	0.590	0.178	0.017	0.492	0.623	0.740	0.932
Deposits / Total assets	395	0.507	0.184	0.143	0.328	0.519	0.637	0.919
Equity / Total assets	416	0.109	0.112	0.031	0.063	0.080	0.127	0.924

3.2 Model

To analyze the hypotheses in Section 2.3, we employ a two-way fixed effects panel data approach, incorporating a set of time-varying control variables. Moreover, we depict two equations below illustrating the regressions to be run. Please find brief descriptions of the variables and coefficients in the equations in Table 3.3.

$$\text{RISK}_{it} = \beta_0 + \beta_1 \text{T1R}_{it} + \beta_2 \text{MH}_{it} + \beta_3 (\text{MH * T1R})_{it} + \beta_4 \sum_{t=2013}^{2019} \text{TIME}_t + \mathbf{X}'_{it}\gamma + \eta_i + \epsilon_{it} \tag{3.1}$$

Equation 3.1: A two-way fixed effects regression of Tier 1 capital ratio, Moral Hazard (Max Shareholder - Direct % or Market-to-book), an interaction between Tier 1 capital ratio and Moral Hazard %, and controls on credit or overall risk.

$$\text{PROF}_{it} = \beta_0 + \beta_1 \text{T1R}_{it} + \beta_2 \text{MH}_{it} + \beta_3 (\text{MH * T1R})_{it} + \beta_4 \sum_{t=2013}^{2019} \text{TIME}_t + \mathbf{X}'_{it}\gamma + \eta_i + \epsilon_{it} \tag{3.2}$$

Equation 3.2: A two-way fixed effects regression of Tier 1 capital ratio, Moral Hazard (Max Shareholder - Direct % or Market-to-book), an interaction between Tier 1 capital ratio and Moral Hazard %, and controls on profitability.

Moreover, all equations include interaction terms. The inclusion of interaction terms follows from Gonzalez (2005), Laeven & Levine (2009), and others. These interaction terms provide a deeper insight into our analysis. Specifically, they allow us to examine how the effect of the **Tier 1 Ratio** on bank risk and profitability varies depending on the bank's **Market-to-Book** value and **Max Shareholder - Direct%**. This approach helps us understand how the relationships between capital ratios, charter value, and ownership structure simultaneously influence bank behaviour. Moreover, all estimations are run with clustered standard errors following Laeven & Levine (2009), Gonzalez (2005) to name a few.

Table 3.3: Description of Variables, Methodology

Variable	Description
RISK	Risk Measure, either Non Perf. Loans / Gross Loans for credit risk or ROA SD 3Y for overall risk
PROF	Profit Measure, either return on asset (ROA) or the net interest margin
T1R	Tier 1 Ratio
MH	Moral Hazard, either Max Shareholder - Direct % or Market-to-book
MH * T1R	Moral Hazard, either Max Shareholder - Direct % or Market-to-book, * Tier 1 Ratio Interaction Variable
TIME	Time specific effect (from 2013 to 2019)
$\mathbf{X}$	Control variables
β_0	Intercept
$\beta_1, \beta_2, \beta_3, \beta_4$	Coefficients for the explanatory variables
γ	Coefficients for the control variables
η_i	Bank specific effect
ϵ_{it}	Error term

3.3 The strict exogeneity assumption

Now, to obtain unbiased results, potential outcomes must be the same for all banks within the sample. If we were to use ordinary least squares (OLS), then for this to be the case, we would need to satisfy the **Zero Conditional Mean Assumption**. This assumption assumes that the error term (unobserved factors) should have an expected value of zero conditional on the explanatory variables. Formally, it can be written as:

$$E(\epsilon_{it}|X_{it}) = 0 \quad \forall i, t$$

However, this is an assumption we do not believe holds in our context, as there could be unobserved factors that are simultaneously correlated with our independent and dependent variables.

To deal with this, we first adopt the fixed effects approach. When using the fixed effect approach, we only need for the **Strict Exogeneity Assumption** to hold. The strict exogeneity assumption implies that our explanatory variables are uncorrelated with any unobservable covariate when controlling for all things fixed in time and space. Formally, it is expressed as:

$$E(\epsilon_{it}|X_{it}, \eta_i) = 0 \quad \forall i, t$$

That is, fixed effects allow us to control away all things that could cause endogeneity that is fixed in time and space. Let's illustrate why that is.

$$Y_{it} - \overline{Y_i} = (X_{it} - \overline{X_i})'\beta + (\epsilon_{it} - \overline{\epsilon_i} + \eta_i - \overline{\eta_i}) \tag{3.3}$$

In the above equation, the term η_i represents the individual-specific effect that is time-invariant. After the transformation, the term $\eta_i - \overline{\eta_i}$ cancels out, removing the time-invariant effects from the equation. Note that the strict exogeneity assumption should hold in this model, which means that the error term ϵ_{it} should not be correlated with the independent variables in any period, i.e., $E(\epsilon_{it}|X_{it}, \eta_i) = 0 \quad \forall i, t$.

Moreover, we use a large set of control variables that are simultaneously correlated with the dependent and explanatory variables, not fixed in time, to control for potential bias (Angrist & Pischke, 2009). The controls we use for this paper are consistent with other authors such as Laeven, Ratnovski, & Tong (2016), Gonzalez (2005), and Laeven & Levine (2009), who analyze the effects of shareholder influence, bank charter value, size and capital regulations on risks and externalities.

Finally, as we only use banks active within the Eurozone and due to the harmonization of currency, we likely keep any bias stemming from unobservable covariates that change over time and space to a minimum. We include a time-specific effect to further reduce bias arising from time-varying Euro area shocks. The inclusion of a time fixed effects makes our approach a two-way fixed effect. Given our approach, sample, and control variables, we believe our explanatory variables are uncorrelated with the error term, ensuring unbiased results.

3.4 Endogenous Bank Charter

Many researchers analyzing bank charters incorporate some form of endogeneity into their approach. Indeed, both Gonzalez (2005) and Laeven & Levine (2009) include sections specifically aimed at tackling endogeneity stemming from the simultaneous determination of bank value and risk. Both apply a two-stage least-squares approach to control for this. When controlling for endogeneity, we will not apply this method but rather use bank charters lagged by one period. Given our approach, specification, and choice of sample, we already argue for keeping endogeneity to a minimum. However, to test our results in relation to possible simultaneity, we run regressions with lagged charter value in the robustness section.

Now, the argument for why a lagged bank charter would solve simultaneity is simple. Surely, bank charter value cannot react to changes in our risk variables if the variation in our risk variables occurs after the bank charter value has already been determined.

Hence, the lagged bank charter specification in section 5.3 should control for endogeneity related to simultaneous risk and bank value determination.

4 Results and Discussion

4.1 Regression Results

4.1.1 Risk

Table 4.1 displays the regression results for equation 4.1. Columns (1) and (2) include regressions of ownership influence on credit and overall risk for all banks in the sample, both listed and unlisted. Columns (3) and (4) cover the same aspects but only for listed banks. Finally, Columns (5) and (6) present regressions of bank charters on credit and overall risk. It should be noted that the market-to-book variable is only available for listed banks. Furthermore, we are primarily interested in ownership influence, charter value, Tier 1 ratio, and interactions. Hence, we will only comment on those results.

Firstly, examining column (1), it's evident that for the sample containing all banks, Tier 1 does not significantly correlate with credit risk or the proportion of Non-Performing Loans. Hence, we find no evidence that widely held banks are influenced by capital regulations in terms of risk.

The Max Shareholder - Direct % variable is significant and equals 0.041. This suggests that for banks with close to zero Tier 1 capital (nearly insolvent), an increase of direct ownership by the largest holder by 1% unit increases the proportion of Non-Performing Loans by 0.041% units. The interaction term also produces significant results, implying that a 1% unit increase in the direct ownership by the largest holder makes a 1% increase in the Tier 1 Ratio decrease the proportion of Non-Performing Loans by 0.151%. This equates to the marginal risk-mitigating effect of Tier 1 capital being -0.151% per 1% unit increase of the largest owner. The result implies that as a bank is less widely held and the largest owner gains more influence, Tier 1 capital becomes more effective in mitigating credit risk.

We see slightly different results for the regressions run on overall risk (Column (2)). The Tier 1 Ratio is now significant, with a coefficient of 0.014. This indicates that for widely held banks, the Tier 1 Ratio is associated with an increase in overall risk. Similar to the credit risk results, the interaction variable suggests an increased mitigating effect of Tier 1 capital for banks with highly influential owners on overall risk (SD(ROA 3Y)), with a marginal effect of -0.024. Again, for nearly insolvent banks, an increase in direct ownership implies increased risk, with an effect of 0.004.

Looking at columns (3) and (4), which only consider listed banks, the results differ slightly once again. In column (3), only the Tier 1 ratio is significant. The credit risk mitigating

effect of the Tier 1 ratio is substantial (-0.441). As for overall banking risk (column (4)), for widely held banks, the Tier 1 ratio correlates with an increase in overall banking risk by 0.061% units. Additionally, a 1% unit increase in the proportion owned by the largest direct shareholder for nearly insolvent banks correlates with a 0.022% unit increase in overall banking risk. Again, the marginal effect that the Tier 1 Ratio has on overall banking risk for a 1% unit increase in the proportion owned by the largest direct shareholder is negative (-0.112). This implies that as Max Shareholder - Direct % increases, Tier 1 capital becomes more effective at mitigating overall banking risk.

Finally, let us examine columns (5) and (6), which focus not on ownership influence but on charter value or market-to-book value. In the overall risk regression (Column (6)), none of the variables of interest are significant. However, in the credit risk regression (Column (5)), both Market-to-book and the interaction variable do. Starting with Market-to-book, an increase of market-to-book value for nearly insolvent banks by 1% unit correlates with a decrease in the proportion of Non-Performing Loans by 0.053% units (-0.053). Moreover, the interaction term is positive and significant (0.280). Thus, a 1% unit increase in a bank's market-to-book value suggests that a 1% unit increase in a bank's Tier 1 ratio raises the proportion of Non-Performing Loans by 0.280% units. As a result, for higher market-to-book ratios, Tier 1 capital becomes increasingly associated with risk.

Generally, our fit is similar to what other authors receive in their regressions when testing similar hypotheses (see overall and within R-squared in Table 4.1). Moreover, we emphasize the importance of considering the results of cross-regression. **Max Shareholder - Direct %** and **Max Shareholder - Direct % * Tier 1 Ratio** consistently enter significantly and with the same sign. Hence the results for these are more reliable. In addition, **Tier 1 Ratio** is also consistent across bank samples for overall banking risk. However, for credit risk, there is a stark difference. It could be that listed and unlisted banks behave differently, but such conclusions should be taken cautiously. Indeed, for the control variables, no major discrepancies are observed. Their coefficients do not differ in sign and only exhibit slight differences in magnitude. Some minor differences in significance do occur, but these are not concerning.

Table 4.1: Results Risk Regressions

	(1)	(2)	(3)	(4)	(5)	(6)
	All Banks		Listed Banks		Listed Banks	
	NPL	SD(ROA) 3Y	NPL	SD(ROA) 3Y	NPL	SD(ROA) 3Y
Tier 1 Ratio	0.053	0.014*	-0.441**	0.061**	-0.345	-0.004
	(0.075)	(0.007)	(0.214)	(0.024)	(0.230)	(0.042)
Max Shareholder - Direct %	0.041**	0.004*	-0.062	0.022***		
	(0.017)	(0.002)	(0.074)	(0.008)		
Max Shareholder - Direct % * Tier 1 Ratio	-0.151**	-0.024*	0.403	-0.112**		
	(0.061)	(0.013)	(0.437)	(0.049)		
Market-to-Book					-0.053**	0.000
					(0.020)	(0.005)
Market-to-Book * Tier 1 Ratio					0.280*	0.024
					(0.154)	(0.022)
ln(Total Asset)	-0.027***	-0.006**	-0.050**	-0.005***	-0.079**	0.003
	(0.010)	(0.002)	(0.022)	(0.002)	(0.037)	(0.006)
Net Loans/Total Assets	-0.150***	-0.001	0.054	0.007	0.039	0.013*
	(0.032)	(0.002)	(0.059)	(0.008)	(0.061)	(0.007)
Deposits/Total Assets	-0.129***	-0.009	-0.221***	-0.029**	-0.251**	-0.031*
	(0.045)	(0.009)	(0.083)	(0.013)	(0.099)	(0.018)
Constant	0.466***	0.060**	0.797***	0.065***	1.165**	-0.016
	(0.096)	(0.025)	(0.251)	(0.021)	(0.441)	(0.071)
Observations	1694	1620	357	332	332	317
R-squared (Overall)	0.900	0.792	0.916	0.725	0.930	0.705
R-squared (Within)	0.107	0.051	0.140	0.151	0.172	0.111
Bank and Time Specific Effects	YES	YES	YES	YES	YES	YES

Standard errors in parentheses. NPL = Non Perf. Loans / Gross Loans. All regressions are Two-way FE with clustered errors at the bank level and time-specific effects.

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

4.1.2 Profitability

Table 4.2 presents the regression results for equation 4.2. Columns (1) and (2) include regressions of ownership influence on two profitability measures for all banks in the sample, listed and unlisted. Columns (3) and (4) perform the same function but solely for listed banks. Finally, columns (5) and (6) display regression results of bank charter on the two profitability measures. Again, note that the market-to-book variable is only available for listed banks. As before, we focus on ownership influence, charter value, Tier 1 ratio, and the interactions and will only comment on those results.

Looking at the table, nearly none of our variables of interest significantly enter any regression. Thus, except for the three that do enter significantly, we find no evidence of externalities in terms of profitability stemming from regulations, moral hazard, or interactions. However, in column (2), we see that the interaction between ownership influence and Tier 1 ratio is significant. This means that when Max Shareholder - Direct % increases by 1% unit, a 1% unit increase in Tier 1 capital correlates with a 0.008% unit decrease in the net interest margin. Hence, when measuring profitability through the net interest margin, as the largest direct owner holds a larger share, Tier 1 capital decreases profitability. Moreover, in column (3), we observe that for listed and widely held banks, Tier 1 capital correlates with a higher return on assets (0.089).

Additionally, in column (6), the interaction term between the market-to-book and Tier 1 ratio is significant and negative. This suggests that a 1% unit increase in the market-to-book value corresponds to a -0.021% unit change in the marginal effect of the Tier 1 ratio on the net interest margin. Moreover, concerning the cross-regression results, none of the variables are consistent. Therefore, these results should be interpreted with caution. Nevertheless, the fit is again what one could expect, given results from other scholars on capital regulations and moral hazard. No control variable exhibits significant differences in sign or magnitude, and they generally behave as expected. Indeed, it is anticipated that banks with a higher proportion of deposit financing (higher deposit-to-asset ratio) would be more profitable given the low cost of acquiring such financing. This hypothesis is supported by the evidence for the Return on Asset (ROA) regressions for listed banks.

Table 4.2: Results Profitability Regressions

	(1)	(2)	(3)	(4)	(5)	(6)
	All Banks		Listed Banks		Listed Banks	
	ROA	NIM	ROA	NIM	ROA	NIM
Tier 1 Ratio	0.002	0.005	0.089*	-0.036	0.048	-0.000
	(0.016)	(0.004)	(0.045)	(0.042)	(0.074)	(0.011)
Max Shareholder - Direct %	-0.003	0.001	0.009	-0.004		
	(0.005)	(0.001)	(0.013)	(0.007)		
Max Shareholder - Direct % * Tier 1 Ratio	-0.003	-0.010***	-0.014	0.032		
	(0.021)	(0.003)	(0.079)	(0.045)		
Market-to-Book					0.004	0.002
					(0.011)	(0.002)
Market-to-Book * Tier 1 Ratio					-0.045	-0.021*
					(0.039)	(0.012)
ln(Total Asset)	0.005	-0.003**	-0.004	-0.004*	0.001	-0.007***
	(0.006)	(0.001)	(0.004)	(0.002)	(0.006)	(0.002)
Net Loans/Total Assets	0.032	0.012**	-0.012	0.010	-0.039	0.002
	(0.027)	(0.005)	(0.011)	(0.007)	(0.033)	(0.004)
Deposits/Total Assets	0.013	-0.008	0.054***	0.001	0.058***	-0.003
	(0.025)	(0.006)	(0.018)	(0.006)	(0.011)	(0.006)
Constant	-0.056	0.045***	0.016	0.063**	-0.018	0.103***
	(0.050)	(0.013)	(0.047)	(0.027)	(0.060)	(0.017)
Observations	1961	1959	362	362	338	338
R-squared (Overall)	0.664	0.972	0.583	0.891	0.553	0.941
R-squared (Within)	0.029	0.063	0.142	0.058	0.093	0.215
Bank and Time Specific Effects	YES	YES	YES	YES	YES	YES

Standard errors in parentheses. NIM = Net Interest Margin. All regressions are Two-way FE with clustered errors at the bank level and time-specific effects.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.2 Discussion

4.2.1 Ownership Influence

Our findings for the ownership influence regressions align with previous literature. Starting with the impact of ownership influence on near insolvent banks (Table 4.1, column (1), row 2), we find a clear positive relationship with credit risk. For nearly insolvent banks, increased ownership influence correlates with higher levels of credit risk. This result aligns with the findings of Laeven & Levine (2009), though they used a slightly different risk measure. There are two mechanisms likely causing this outcome. Firstly, low levels of Tier 1 capital imply that equity owners, relative to the bank's size, have invested a small amount. Consequently, the potential loss for equity owners, in relation to the bank's size, is relatively small. Any high-risk strategy would, therefore, imply high return and low potential loss for the equity owners. This situation is a clear example of the moral hazard dilemma proposed by Bebchuk & Spamann (2009).

Furthermore, banks close to insolvency are likely to face default in the future, regardless of investment strategy. Thus, increased ownership influence may lead to riskier investment strategies, seen as a desperate measure to increase profitability, attract new investors, and keep the bank operating. Equity investors may be more willing to participate in these last-resort strategies than other stakeholders. Moreover, since these banks are in an unfavourable situation, we may interpret the adoption of risky projects as gambling for resurrection. Indeed, refer to Baldursson & Portes (2013) for evidence that owners played a key role in Icelandic banks pursuing such strategies in the face of turmoil. Note that these banks were not only dealing with solvency issues. However, the general principles remain the same.

Consistent with Laeven & Levine (2009), we find that for banks with owners who own a large proportion of direct shares, i.e., influence banking activities, Tier 1 capital has a risk-mitigating effect. Moreover, the more a single shareholder owns of the total amount of shares, the more effective capital regulations become. The prominent mechanism here is that equity investors become more invested in the bank when capital goes up. When equity owners become more deeply invested in the bank, their potential loss in case of default increases. Remember, any investment strategy where the potential gain is greater than the level of equity held in the bank is net positive for equity holders (Bebchuk & Spamann, 2009). For a given level of risk, any increase in equity held in the bank by a single shareholder is subject to higher potential loss. Therefore, some investment strategies may no longer increase the expected returns for investors when the equity held is large enough. Hence, the marginal risk-mitigating effect of Tier 1 capital increases with ownership influence, as the influential owner owns a larger proportion of equity and is,

therefore, more invested.

For overall banking risk (see Table 4.1 column (2)), the relationship between capital regulations for banks with large unique shareholders essentially remains the same. However, Tier 1 capital presents a risk-increasing effect for widely held banks. This could be because the operations of widely held banks are primarily influenced by management, who inherently act prudently. Therefore, capital regulations may limit bankers' ability to diversify optimally and restrict their freedom to choose capital structure. This line of reasoning aligns with Gropp & Heider (2010) findings that banks' optimal choice of capital structure is impacted by capital regulations if they are sufficiently close to minimum requirements. In other words, some banks may not freely choose capital structure due to adherence to minimum requirements, making these banks have a sub-optimal composition of liabilities. Moreover, it is not unreasonable to assume that banks with a sub-optimal composition of liabilities are inherently riskier, hence the result.

Furthermore, connecting with the findings of Pasiouras, Tanna, & Zopounidis (2009) regarding the negative impact of regulations on profit efficiency, we suggest that there might be a hidden effect on profitability. Higher Tier 1 ratios could impose costs on banks, reducing their profitability. However, rather than accepting this decrease in profitability, they might decide to increase the riskiness of their operations to offset this loss. This interpretation would also align with the results found for all banks in Table 4.2 (columns (1) and (2)), where we see no evidence of changes in profitability associated with increases in the Tier 1 ratio of widely held banks.

For the sample that only includes listed banks (column (3)), we find no evidence to suggest a relationship between influential equity owners and credit risk. Hence, any mechanism tied to equity owners being more invested likely is not at work here. The Tier 1 ratio, however, has a significant, large effect in mitigating credit risk. As found by Fraisse, Lé, & Thesmar (2020), banks reduce lending, their main activity, when capital increases. If banks' lending relative to their size decreases as Tier 1 increases, then loan composition must change too. Presumably, banks lend to the most reliable agents first. Indeed, our findings suggest that the proportion of Non-Performing Loans decreases with increases in Tier 1 capital as a bank becomes less widely held. So, if they have a smaller loan pool, it must contain higher-quality loans. Moreover, if the loan composition is of higher quality for banks with higher Tier 1 capital, then the proportion of Non Perf. Loans, and hence credit risk, must be lower. Hence, the result.

If we look at overall risk for listed banks (column (4)), then the picture is very much in line with Laeven & Levine (2009). Again, the mechanisms at work here for shareholder

influence are similar to those of all banks (column (2)). Again, the Tier 1 ratio enters positively, supporting the hypothesis that for widely held banks where management has the most influence on banking activities, capital requirements only hinder their ability to diversify optimally.

Lastly, none of the variables, other than the interaction term and Tier 1 ratio (see Table 4.2 column (2) and column (3)), showed any evidence of effects on profitability. Firstly, although Tier 1 capital has a risk-reducing effect for influential shareholders, it comes at a small cost in the interest margin. Again, this may be due to the amount of lending partaken by banks with higher capital ratios being less (Fraisse, Lé, & Thesmar, 2020). The loans the bank gives out are likely of higher quality, hence lower interest. Secondly, for listed and widely held banks, increases in tier 1 capital implies higher return on asset. Now, for the same set of banks, tier 1 capital decreases the proportion of Non Perf. Loans substantially. Banks with more loans by which they receive income likely also have higher revenue and hence higher return on assets.

Please note that we can draw conclusions with more confidence for variables where cross-regression results are similar. These include Max Shareholder - Direct % and Max Shareholder - Direct % * Tier 1 Ratio across risk measures and Tier 1 Ratio for overall banking risk.

4.2.2 Bank Charter Value

Considering hypothesis 1 stated in section 2.3, our results in Table 4.1 somewhat support it, but only when examining credit risk (see column (5)). For banks with almost no market valuation, which, according to Keeley (1990), are incentivized to exploit the deposit insurance schemes and increase risk, we find no evidence that a higher Tier 1 capital ratio mitigates risk.

Looking solely at the effect higher bank charter has on credit risk, banks with a high market-to-book ratio generally take less risk. This is again in line with Keeley (1990) and Gonzalez (2005). The underlying mechanism is that as a bank's charter value increases, the potential loss in market valuation outweighs the gains from exploiting the deposit insurance scheme through high-risk strategies. Moreover, Acharya (1996) found evidence that even close-to-insolvent banks appear to act prudently for high enough charters. This aligns completely with our results. Again, the underlying mechanism is the same; the expected loss in market valuation is large enough that it is not worth taking excessive

risks to exploit the deposit insurance scheme.

Lastly, for higher values of charter, an increase in Tier 1 capital corresponds to more credit risk. Now, banks with high charters are incentivized to act prudently and will do so even when the regulatory framework does not force them to (Keeley, 1990; Gonzalez, 2005). Hence, it may be as hypothesized that capital regulations only hinder optimal diversification and that nearly insolvent banks with high charters, who would already act prudently, now must change their capital structure to satisfy minimum requirements (Gropp & Heider, 2010). Moreover, it may be that these banks need to offset any loss in profitability from a higher Tier 1 ratio and that these offsetting activities exhibit a higher amount of credit risk. Banks with high charter values likely highly value how the market perceives them. Hence, they engage in higher-risk strategies to meet market expectations in the face of higher Tier 1 capital.

There is no link between overall risk and bank charter (see column (6)). The same can almost be said for charter and profitability, except for the interaction variable between charter and Tier 1 capital on the net interest margin. Now, again, any conclusion drawn from single results should be taken with caution. However, Tier 1 capital becomes substantially associated with risk for high charter values. The increase in risk may stem from activities aimed at compensating for losses in profitability from a higher Tier 1 ratio. Moreover, these activities may not be compensating enough, resulting in a lower net interest margin.

5 Robustness Checks

Please observe that Table 5.1 to 5.3 essentially includes the same variables as specified in Equation 3.1. However, for the sake of clarity, we have chosen only to display certain variables from the regressions that are of particular interest.

5.1 Exclusion of Certain Banks

There may be concerns that certain banks in the sample drove the results in section 3, and that a subset not containing these particular banks may alter the result. We, therefore, alter our sample slightly by excluding some banks to test whether the results still hold and, therefore, are robust. Firstly, we exclude banks whose largest equity owner is a public authority. It is not unreasonable to assume that the moral hazard dilemma argued by Bebchuk & Spamann (2009) does not hold for a public authority, as they likely have other motives than returns, such as financial stability. Hence, in the results presented in Table 5.1, we exclude such banks.

Moreover, there could be concerns that banks whose owner owns 100% of the bank skew the results. Suppose that a company owns 100% of a bank but that the owning company, in turn, is owned by a company by 30%. Now although the owner data suggest 100% ownership, in actuality, it is the owner's owner who influences the decisions, and the true number is 30%. Now, this issue is likely more prevalent for 100% owned companies as they are, to a larger extent, owned by holding companies, and it is the holding company's owner who influences banking operations. We, therefore, exclude these banks as well.

Looking at Table 5.1, we see almost no changes in the results compared to Table 3.1, either in magnitude or sign. One difference is that the interaction between Tier 1 capital and Market-to-Book in column (5) is no longer significant. Nevertheless, given the similarities in these results compared to the full sample (see Table 4.1), we conclude that banks owned by authorities or those with 100% ownership do not drive the results.

Table 5.1: Results Risk Regressions Robustness Subsample

	(1)	(2)	(3)	(4)	(5)	(6)
	All Banks		Listed Banks		Listed Banks	
	NPL	SD(ROA) 3Y	NPL	SD(ROA) 3Y	NPL	SD(ROA) 3Y
Tier 1 Ratio	0.069	0.018**	-0.390**	0.056**	-0.181	-0.019
	(0.092)	(0.008)	(0.173)	(0.022)	(0.245)	(0.045)
Max Shareholder - Direct %	0.039**	0.007***	-0.047	0.023***		
	(0.017)	(0.002)	(0.048)	(0.008)		
Max Shareholder - Direct % * Tier 1 Ratio	-0.152**	-0.031***	0.324	-0.103**		
	(0.074)	(0.012)	(0.359)	(0.051)		
Market-to-Book					-0.038**	-0.000
					(0.018)	(0.004)
Market-to-Book * Tier 1 Ratio					0.125	0.030
					(0.138)	(0.020)
Observations	1601	1527	344	321	314	303
R-squared (Overall)	0.911	0.814	0.942	0.732	0.938	0.708
R-squared (Within)	0.111	0.067	0.161	0.176	0.189	0.119
Bank and Time Specific Effects	YES	YES	YES	YES	YES	YES

Standard errors in parentheses. NPL = Non Perf. Loans / Gross Loans. All regressions are Two-way FE with clustered errors at the bank level and time-specific effects. Note that not all variables are displayed in the table.

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

5.2 Total Capital

Now, there are other measures of regulatory capital that we should consider. The Total Capital Ratio, a broader definition of capital, should essentially function in the same way as Tier 1, albeit less reliably in situations of financial distress. However, since the period we analyze doesn't include any major distress, the mechanisms with respect to risk should essentially be the same. Bitar, Pukthuanthong, & Walker (2018) did, however, argue for the importance of quality over quantity. Hence, given their assessment, we should potentially see a decreased effect of total capital on risk.

Indeed, looking at Table 5.2, there are some slight differences. For column (2), none of the variables enters significantly. This starkly contrasts the regression in Table 4.1 (column (2)) using Tier 1 capital. This result may be due to total capital having a less risk-mitigating ability due to it being of relatively poorer quality. It may also be that it has a less distorting effect on banks' optimization choices due to it being less costly to retain compared to Tier 1 capital. Moreover, in column (5), the interaction term no longer shows a significant effect (as it did in Table 4.1 column (5)). This is consistent with the understanding that maintaining Tier 1 capital is costlier than total capital. Hence total capital should affect diversification and optimal capital structure to a lesser extent. Other than these columns, the other results are similar for sign and magnitude, hence robust when controlling for other regulatory capital measures.

Table 5.2: Results Risk Regressions Robustness Total Capital

	(1)	(2)	(3)	(4)	(5)	(6)
	All Banks		Listed Banks		Listed Banks	
	NPL	SD(ROA) 3Y	NPL	SD(ROA) 3Y	NPL	SD(ROA) 3Y
Total Capital Ratio	0.054	0.006	-0.420**	0.050***	-0.164	-0.021
	(0.080)	(0.007)	(0.198)	(0.018)	(0.195)	(0.039)
Max Shareholder - Direct %	0.037*	0.003	-0.061	0.029***		
	(0.019)	(0.003)	(0.095)	(0.009)		
Max Shareholder - Direct % * Total Capital Ratio	-0.125*	-0.015	0.377	-0.142***		
	(0.069)	(0.012)	(0.432)	(0.047)		
Market-to-Book					-0.045**	0.003
					(0.018)	(0.007)
Market-to-Book * Total Capital Ratio					0.138	0.010
					(0.112)	(0.030)
Observations	1846	1770	388	363	343	334
R-squared (Overall)	0.890	0.787	0.915	0.724	0.941	0.712
R-squared (Within)	0.094	0.038	0.133	0.149	0.198	0.149
Bank and Time Specific Effects	YES	YES	YES	YES	YES	YES

Standard errors in parentheses. NPL = Non Perf. Loans / Gross Loans. All regressions are Two-way FE with clustered errors at the bank level and time-specific effects. Note that not all variables are displayed in the table.

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

5.3 Endogenous Bank Charter

There may be suspicions that bank charter or market-to-book does not enter the regression exogenously. Indeed, Gonzalez (2005) and Laeven & Levine (2009) both test and argue for the importance of considering bank charter value as endogenous. One issue here may be simultaneity, that the market-to-book value could react to changes in either credit or overall risk. To control for this, we lag bank charter value by one period. A more in-depth discussion on this topic can be found in Section 3.4.

Looking at Table 5.3, we see results similar to those in Table 3.1, columns (5) and (6). This implies that our results are robust when controlling for any endogeneity of bank charter with respect to simultaneity bias. Indeed, it is not the simultaneous determination of risk and bank value that drives our results.

Table 5.3: Results Robust Endogenous Charter Value

	(1)	(2)
	Listed Banks	
	NPL	SD(ROA) 3Y
Tier 1 Ratio	-0.379	-0.030
	(0.272)	(0.008)
Market-to-Book$_{t-1}$	-0.037**	-0.007
	(0.017)	(0.005)
Market-to-Book$_{t-1}$ * Tier 1 Ratio	0.296**	0.016
	(0.133)	(0.025)
Observations	270	257
R-squared (Overall)	0.935	0.716
R-squared (Within)	0.219	0.117
Bank and Time Specific Effects	YES	YES

Standard errors in parentheses. NPL = Non Perf. Loans / Gross Loans. All regressions are Two-way FE with clustered errors at the bank level and time-specific effects. Note that not all variables are displayed in the table.

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

6 Conclusion

Our thesis has analyzed the influence of banking regulations on naturally occurring moral hazard-related risks in banking. Many studies highlight the relationship between ownership influence, bank charter value, and risk-taking incentives. Gonzalez (2005) found that banks with a higher market-to-book value act prudently. Conversely, the opposite holds for banks with low charters (Keeley, 1990). As a result, the same capital regulation could positively or negatively impact financial stability, depending on a bank's charter value. Moreover, when a bank's direct owner holds a significant portion of the direct shares, their influence on banking activities increases. Due to a well-established moral hazard dilemma, these banks will inherently take on more risk (Bebchuk & Spamann, 2009). Once again, the impact of regulations on financial stability varies based on ownership structure (Laeven & Levine, 2009).

To confirm these hypotheses, we employed a two-way fixed-effects model with interaction terms between moral hazard and capital regulations for 502 Eurozone banks. Our results supported our hypotheses: higher charter value mitigated credit risk, while increased ownership influence led to more credit and overall banking risk. Moreover, the risk mitigation effect of Tier 1 capital increased with ownership influence, consistent across risk measures. Furthermore, capital regulations for banks with high charter levels tended to negatively impact financial stability. Our results remained largely consistent even after excluding specific banks, using the total capital ratio instead of the Tier 1 ratio and controlling for the simultaneous determination of bank charter and risk.

Our contribution to the existing literature on banking regulation and moral hazard involves confirming previously suggested relationships for Eurozone banks in the period 2013 to 2019. Moreover, overall banking risk stemming from ownership influence-related moral hazard is consistent across the sample. Furthermore, we find no evidence of simultaneity affecting bank charter regression results, suggesting that the importance of considering endogenous bank charters may have been overstated.

The implications of our results are several. Firstly, moral hazard in relation to influential shareholders is present and must be considered. Secondly, Tier 1 capital does impact risks differently contingent on the underlying moral hazard. Hence, policymakers should consider a framework where they either allow for flexible regulations or seek to standardize the shareholder composition in banks. Similarly, bank charter can be used to enhance prudence in the banking sector. Opting for a framework that incentivizes higher charters is, therefore, in regulators' best interest. Lastly, we find weak evidence of profitability being affected by Tier 1 capital or moral hazard. Thus, the risk-mitigating effect of the

current framework does not appear to directly impact profitability. It's important to note that while it may not affect profitability directly, it may incentivize higher-risk strategies, keeping profitability the same.

Our study has some limitations. Firstly, our sample does not include all of the banks active in the Eurozone, partly due to data limitations. Secondly, we do not opt for the instrumental variable approach to assess endogenous bank charter. It may be that the results would differ had we used this approach. Further research should focus on other measures in the regulatory framework, such as liquidity ratios. Liquidity is a real risk concern, and assessing the effectiveness of these measures is important. Lastly, confirming our results for other sets of banks and for other time periods should also be considered. Indeed, it may be that in other time periods with more financial distress, the results may be different.

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7 Appendix A

Definition of Capital

Table 7.1 displays the definitions of the different Tiers and quality of capital.

Table 7.1: Definition of capital in Basel III

Tier	**Sub-Tier**	**Description**	**Requirement**
Tier 1 (going concern)	Common Equity Tier 1 (CET1)	Sum of common shares (equivalent for non-joint stock companies*) and stock surplus, retained earnings, other comprehensive income, qualifying minority interest and regulatory adjustment	CET1 > 4.5%
	Additional Tier 1 (AT1)	Sum of capital instruments meeting the criteria for AT1 and related surplus, additional qualifying minority interest and regulatory adjustments	CET1 + AT1 > 6%
Tier 2 (gone concern)		Sum of capital instruments meeting the criteria for Tier 2 and related surplus, additional qualifying minority interest, qualifying loan loss provisions and regulatory adjustments	CET1 + AT1 + Tier 2 > 8%

Source: Bank for International Settlements

* The standard requires instruments issued by non-joint stock companies to meet a set of criteria to be deemed equivalent to common shares and included in CET1.

8 Appendix B

Definition of Variables

Table 8.1 presents all variables used in the analysis, along with brief descriptions.

Table 8.1: Description of Variables, Data

Variable	**Description**	**Data Source**
Tier 1 Ratio	Ratio of Tier 1 capital to the banks' risk-weighted asset	Bureau Van Dijk Orbis
Total Capital Ratio	Ratio of Tier 1 and Tier 2 capital to the banks' risk-weighted asset	Bureau Van Dijk Orbis
Max Shareholder - Direct%	% owned of total shares by the largest unique shareholder	Bureau Van Dijk Orbis
Market-to-Book	Market capitalization over the book value of equity (Bank Charter)	Bureau Van Dijk Orbis
Non Perf. Loans/Gross Loans	Ratio of loans which lenders have defaulted on in relation to all loans a bank has given out	Bureau Van Dijk Orbis
SD(ROA) 3Y	Three-year trailing standard deviation of the return on asset	Bureau Van Dijk Orbis
ROA	Return on asset before taxes	Bureau Van Dijk Orbis
Net Interest Margin	Difference between the interest income a bank earns from its lending activities and the interest it pays to depositors	Bureau Van Dijk Orbis
Total Assets	Total assets value in millions of USD	Bureau Van Dijk Orbis
Net Loans/Total Assets	Net loans in relation to total assets	Bureau Van Dijk Orbis
Deposits/Total Assets	Deposits in relation to total assets	Bureau Van Dijk Orbis