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Beyond Basel: Capital Structure Decisions in European Banks

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Abstract

The empirical analysis conducted in this study explores the determinants of leverage thus capital structure formation in the European banking sector from 2012 to 2023. Utilizing a panel data regression methodology, we analyze relationships among key financial factors and apply the theory of capital structure to the results presented, accounting for regulatory constraints. Our findings underscore the applicability of traditional corporate finance literature in explaining the determinants of leverage in major European-based public banks. Notably, bank size exhibits a positive effect on leverage, while profitability is negatively associated with leverage. Furthermore, market risk demonstrates a negative correlation with leverage. Finally, heightened market competition is associated with reduced leverage and an increase in the Tier 1 capital ratio. These findings further validate the significance of variables beyond regulation in explaining capital structure dynamics, thereby departing from the sole reliance on regulatory effects on the capital structure of large public banks in Europe.

Keywords: Capital structure, leverage determinants, bank leverage, market competition, Tier 1 capital, Basel regulation.

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1. Introduction

The capital structure of a bank is an indicator of its health, stability, and the ability to withstand economic fluctuations. The question on how firms optimally compose the capital structure used to fund operations has been a topic thoroughly discussed throughout the corporate finance literature in the 20th century. Until this point, banks were often excluded from research aimed at identifying capital structure determinants due to differentiating operational dynamics between banks and traditional firms. With Modigliani and Miller setting foundations of the capital structure for traditional firms, financing optimality means and capital management have become more evident. With the development of ideas on corporate finance, empirical research suggests a literal applicability of Modigliani and Miller propositions to real-world scenarios is not adequate. Thus, several theories discuss departures from Modigliani and Miller propositions. The agency theory (Jensen and Meckling, 1976) discusses conflicts of interest between managers (agents) and shareholders (principals) within a firm, arising from decisions managers make. The pecking order theory (Myers and Majluf, 1984) explains how information asymmetry between insiders and outsiders of the firm affects the capital structure decision making, establishing a hierarchy of preferred financing choices. The progression of the topic of capital structure led to attempts to specifically pinpoint determinants of leverage traditional firms take (Titman and Wessels 1988; Harris and Raviv 1991; Rajan and Zingales, 1995; Frank and Goyal, 2004).

The Great Financial Crisis (2007-2008) was primarily triggered by the collapse of the housing bubble in the United States. The crisis was exacerbated by the failure of major financial institutions, which sent shockwaves through global financial markets (Brunnermeier, 2009). Regulatory failures also played a crucial role as existing frameworks did not adequately address the risks posed by complex financial products and the interconnectedness of global financial markets (Baily et al., 2008). The period of financial turmoil underscored the need for comprehensive regulatory reforms to enhance the resilience of the financial system. The financial crisis revealed significant flaws in Basel II, particularly in its reliance on banks' internal risk models and the procyclical nature of its capital requirements, which amplified the effects of the crisis (Haldane, 2011). In response to regulatory deficiencies, the Basel Committee on Banking Supervision initiated Basel III, a more robust framework designed to enhance capital adequacy. Basel III introduced a leverage ratio and established new liquidity requirements to ensure the

stability of the banking sector (Basel Committee on Banking Supervision, 2010). Thus, the cost of capital and mandatory capital requirements reshaping led to altering the dynamics of banking operations and decisions regarding capital structure. More specifically, Basel III amendments provided motivation for banks to hold a more conservative leverage ratio, in order to mitigate risks arising from excessive leverage. Due to regulatory constraints encompassing financial institutions, Mishkin, 2011 claims the bank capital is determined solely by capital requirements, thus, disregarding the need to further explore determinants of leverage. In 2009, Gropp and Heider utilized previous research on the field of corporate finance and applied it to financial firms, showing factors of leverage identified for traditional firms also apply to financial firms. Their findings provide evidence ”that the similarities between banks’ and non-financial firms’ capital structure may be greater than previously thought” (Gropp and Heider, 2009).

1.1 Research Question

With strong foundations on determinants of bank leverage and its capital structure, we provide an empirical study which takes the most significant components from previous work done by Frank and Goyal (2009) and Gropp and Heider (2009) and applies it to a novel dataset. By conducting a panel data regression analysis, we apply previously confirmed determinants of capital structure to banks headquartered in Europe from 2012 until 2023. We specifically analyze public banks in Europe, while Gropp and Heider (2009) formulate a sample of public banks in both the United States and Europe. However, the period analyzed by Gropp and Heider (2009) is identified by the Basel I regulatory framework, whereas our research adheres to the enhancements of Basel II and encompasses the Basel III regulation timeline. Finally, we introduce market competition as an independent variable and analyze the effect it has on both leverage and Tier 1 capital ratio. By doing so, we obtain a deeper understanding of the relationship between capital structure decisions and market forces affecting banks in Europe. By running several models (further explained in the Empirical Method chapter), we obtain a clear insight into the significance of independent variables (market-to-book ratio, size, profits, collateral, dividends, and risk) on explained variables (book leverage, market leverage and Tier 1 capital ratio).

2. Literature Review

2.1 Modigliani-Miller

Capital structure decisions of non-financial firms has been a topic explored in the corporate finance literature over the last 60 years, following the seminal work of Modigliani and Miller (1958). Capital structure refers to the proportions of debt and equity used to finance total assets of a firm (Brealey et al., 2014). The Modigliani and Miller theoretical framework assumed perfect market conditions without frictions (taxes, bankruptcy costs, agency costs, symmetric information), thus paving the way for real-world complexities to develop their initial findings. More specifically, the proposition introduced was capital structure irrelevance, where the value of the firm is unaffected by the source of financing (Modigliani and Miller, 1958). In their later work, Modigliani and Miller incorporated market frictions, specifically corporate income tax and the tax shield benefits of debt (Modigliani and Miller, 1963). The second proposition states that the cost of equity increases linearly with the debt-to-equity ratio. As a firm takes on more debt, the risk to equity holders rises, leading them to demand higher returns (Modigliani and Miller, 1963).

2.2 Bridge Between Banks and Corporate Finance Literature

Since Modigliani and Miller, several studies have been conducted in an attempt to identify the level of optimal capital structure of firms (Myers, 2001; Titman and Wessels, 1988), thereby addressing the firm's value maximization problem (Harris and Raviv, 1991). Initial research in the field of financial firm's capital structure with market frictions present depicted an inadequate theoretical framework (Orgler and Taggart Jr, 1981), planting the seeds for further advancements. Since Basel I accord, introduced in 1988 by the Basel Committee, represents an additional departure from Modigliani and Miller theory, Mishkin, 2000 (revised in 2011), concluded that the bank capital is determined by regulatory capital requirements. His perspective implies there is no need to further investigate the determinants of financial firms' capital structure. However, Gropp and Heider (2009) unveiled inconsistencies between empirical observations and findings presented by Mishkin (2000). Specifically, Gropp and Heider (2009) were the first to establish a link between non-financial and financial firms' capital structure decisions, shedding light on the debate whether regulation or market forces determine banks' capital structure. Instead of relying on regulation as the primary capital structure determinant, they observed that banks with capital ratios not close to

the regulatory minimum are influenced by similar factors identified in corporate finance literature (Titman and Wessels, 1998; Harris and Raviv, 1991; Rajan and Zingales, 1995; Frank and Goyal, 2004). In accordance, Hoque and Pour (2018) find that the bank capital structure follows the corporate finance theory. Diamond and Rajan (2000) explain how bank capital decisions affect the creation of liquidity, costs associated with bank distress, and the enforcement of borrower repayments.

2.3 Internal Factors

When reviewing internal factors of a bank which affect the capital structure, market-to-book ratio, size, and risk are positively related, and profitability is negatively related to bank leverage (Gropp and Heider, 2009). The finding from Lim (2012) also reveals that size positively influences leverage. Khokher and Alhabshi, 2019 examine determinants of leverage in Islamic banks. The study reveals that growth, asset tangibility (collateral in our study), profitability and risk all affect leverage ratio, aligning with pecking order and trade-off theories. Additionally, a similar finding was presented in Jadah et al., (2021) whose research indicates that bank size, profitability, and bank age have a "dominant" role in explaining the variation in leverage of Iraqi banks. München (2022) investigates the effect of financial distress on the capital structure of Brazilian banks, demonstrating that its impact is context-dependent, with a positive effect during normal times and a negative effect during economic recessions.

2.4 External Factors

The capital structure of firms in various countries is significantly influenced by a complex interplay of factors such as legal and tax systems, corruption levels, and the preferences of capital suppliers. Research by Fan et al., (2012) indicates that firms operating in more corrupt environments and those with weaker legal frameworks tend to rely more heavily on debt financing, particularly the short-term debt. Similarly, Owolabi et al., (2012) underscore the impact of corruption, political dynamics, and the nature of financial markets on shaping the capital structure of firms, with Nigeria serving as a pertinent case study. Tran et al., (2020) suggested that factors at the country level, such as the legal system and economic forces specific to each country impact the capital structures of banks. More specifically, country-based underlying factors directly affect elements such as bankruptcy costs, agency costs, information asymmetry, and liquidity creation,

which collectively shape the financial composition of banks. Hemmelgarn and Teichmann (2015) explore the link between Corporate Income Tax (CIT) reforms and domestic banks' financing decisions, demonstrating that tax rate changes significantly affect leverage, dividend policies, and earnings management. On the contrary, Bond et al., (2016) found that a shift in tax does not always affect leverage when tax rates change, holding true when banks are close to regulatory minimums. Moreover, they found that smaller banks are more responsive to changes in tax rates, when compared to larger banks (Bond et al., 2016). These findings collectively emphasize the complex nature of capital structure determinants, reflecting the relationship between external, country-specific factors, and internal financial decision-making in different contexts.

2.4.1 Regulation

Much of the recent literature on bank capital structure has also been concerned with issues of regulation (Hellmann et al., 2000; Van den Heuvel, 2008; Admati et al., 2013; Achary et al., 2012). Castro and Lopez (2021) assessed determinants of the capital structure for Portuguese banks, providing evidence that regulatory capital has an effect on the management of capital in the banking industry. Gropp et al., (2019) explain that in order to stay within the rules on the capital requirements, banks may also boost capital ratios by reducing risk-weighted assets, rather than solely increasing the levels of equity, explaining how internal capital decisions are made when related to regulatory pressures. De Jonghe and Oztekin (2015) provide evidence that the speed of banks adjusting to more stringent capital requirements was higher in countries with stricter capital requirements, better-defined supervisory monitoring, more developed capital markets, and high inflation. Furthermore, in times of crises, banks tend to adjust capital structure significantly quicker than in ordinary times. Given the sample time period of this study covers the expansionary period in the aftermath of the Great Financial Crisis, it is important to note that determinants of leverage differ in recessionary and expansionary times (Tran et al., 2020).

2.4.2 Deposit Insurance

To protect depositors from overly risky activities of banks, governments worldwide implemented Deposit Insurance Schemes (DIS), which insure deposits up to a statutory limit. DIS can be governed by a separate legal entity, placed under a country's supervisory structure or positioned within the existing national central bank or other government ministry. The payout structure of DIS is usually per depositor per institution (Kunt et al., 2014). More specifically, deposit insurance

acts as a put option in which the claim on the bank is sold to the government at the face value in case a bank becomes insolvent. In this put option, the bank is the asset, and the buyer is the government (Merton, 1978; Ngalawa et al., 2016). Such insurance system increases the willingness of lenders to deposit the capital in the banking system, furtherly expanding the liquidity in financial markets. However, deposit insurance may inadvertently increase risk taking by banks (Merton, 1978). By knowing the cost of failure would partially be borne by the government, managers of banks may overextend the risk and thus endanger the solvency of a bank, as well as the capital from depositors. Additionally, a study by Demirguc-Kunt et al. in 2005 on 61 countries from 1980 to 1997 found that deposit insurance increases banking fragility as well. Ngalawa (2016), conducted an empirical study that suggested the moral hazard stemming from the introduction of deposit insurance "outweighs the positive effect of deposit insurance on banking stability". This finding is highly relevant to this study as countries from the sample all have some DIS scheme in place. Interestingly, Ashraf et al., (2020) concluded that the effect of capital regulation on bank risk is conditioned by explicit deposit insurance in crisis periods only.

3. Theoretical Framework

3.1 Banking Operations

Banks play an integral role in the modern financial landscape by acting as intermediaries that facilitate transactions between lenders (depositors) and borrowers (Gorton and Winton, 2003). Banks not only provide a secure repository for physical money but also serve as a source of capital (Mishkin, 2007). Banks earn their revenue primarily through the Net Interest Margin (NIM), which is generated by accepting deposits and lending out the capital to a diverse network of clients (Saksonova, 2014). This function allows banks to capitalize on the trade of financial assets and differing maturity preferences among an economy (Diamond and Dybvig, 1983). Banks engage in the process of money creation and a large component of their liabilities is accounted for deposits (Werner, 2014). According to the theory of the monetary circuit (Graziani, 2003), money is created when a bank grants a credit to one of its clients and is destroyed when this loan is reimbursed to the bank. However, reliance on deposits for financing exposes banks to a vastness of risks, categorized into financial and non-financial types. Financial risks encompass operational, market, and credit risks, while non-financial risks include those related to the operating environment,

reputation, legality, control mechanisms, technology, and strategic decision-making (Ghosh, 2012). Additionally, by attempting to deploy capital as efficiently as possible to maximize profits, banks sometimes expose themselves to an unsustainable degree of liquidity risk. By extending leverage to support lending and investing activities, banks shift the liquidity structure towards long-term commitments rather than short-term ones, thereby increasing the risk of illiquidity and potential insolvency (Liang et al., 2014). Thus, by committing to long-term returns, short-term liquidity risks arise. Given the complex linkage system among the banks where the financial health of one depends on the financial health of another, a run on a single bank may cascade into a wide-spread contagion (Liu, 2023).

Banks are distinct from traditional firms primarily because their balance sheets invert the typical asset-liability structure found in non-financial entities. Due to the high costs associated with external financing, banks are motivated to maintain a reserve of liquid assets, conforming to the pecking order theory (later discussed in Departures from Modigliani-Miller Propositions chapter). However, maintaining this liquidity buffer incurs costs for the bank, as it prevents the full utilization of capital. Consequently, banks face a fundamental tradeoff between risk management and the pursuit of profit (Kashyap et al., 2002). Additionally, the level of financial leverage differs significantly between banks and non-financial firms. Banks typically exhibit much higher leverage ratios, often exceeding 90%, compared to 20% to 30% in non-financial firms (Frank and Goyal, 2009). Higher leverage in banks can be attributed to their use of deposits as a primary financing method, complemented by the security of deposit insurance (Castro and Lopes, 2021), a tool that is not applicable to non-financial firms (Jucá et al., 2012). The presence of deposit insurance diminishes the incentive for banks to hold any capital that does not yield a positive net interest margin. Consequently, banks driven by profit maximization are likely to invest this capital rather than hold it unutilized. Focus on profit maximization also motivates banks to employ risk-seeking executives, which can compromise the perceived safety of the banking sector (Castro and Lopes, 2021). Finally, the reliance on deposits and other non-equity sources for capital means that banks are less inclined to raise funds through equity, given equity is assumed to be a more expensive form of financing than deposits (Allen et al, 2015). DeAngelo and Stulz (2013) show that high leverage is optimal for banks when there is a market premium for socially valuable liquid financial claims.

3.2 Bridge with Corporate Finance Theory

In order to approach the capital structure choice for banks, it is necessary to gain an understanding of existing leverage theories, and consequently explore the connection of the Modigliani-Miller capital structure irrelevance theorem to the banking industry. In examining the role of bank capital and financing decisions, research indicates that higher capital levels may be necessary to manage moral hazard issues associated with asset substitution (Jensen and Meckling, 1976). Equity can be viewed as a call option on a bank's assets, and its value can be increased by investing in riskier assets, favoring shareholders. Thus, when highly leveraged, banks might even opt to invest in negative Net Present Value (NPV) projects, which necessitates the capital buffer as protection (Greenbaum et al., 2016). Further developments in banking theory underscore the importance of capital for effective monitoring. Increased capital not only enhances a bank's ability to oversee borrower activities but also improves financial terms and access to credit for borrowers (Berger and Udell, 1995). This, in turn, boosts the bank's stability and the value of its loans, creating a positive feedback loop that enhances financial monitoring and stability.

In an effort to decompose the capital structure puzzle for banks, we seek to evaluate the applicability of Modigliani-Miller Theorem to existing non-financial firms. Miller (1995) explores this connection and starts with a simple but unclear answer: "Yes and no". He begins by explaining the common belief among bankers that equity capital in banking is very expensive. According to this view, forcing banks to increase their capital to meet higher requirements would lower the value for bank shareholders, and reduce the amount of money banks can lend (Miller, 1995). Later, he concludes that banks would not be harmed by having more capital, and believes that the cost of equity, or the money banks pay to get funding from shareholders, would go down because more capital makes the bank safer (Miller, 1995). In other words, Miller’s view is that the cost of equity capital in banking is too high because equity capital is too low. In a similar tone, Berger et al., (1995) argue that despite the exclusion of frictions in Modigliani-Miller theory framework, their propositions remain relevant to the banking environment. Thus, as a starting point for theoretical analysis of financial firms, we present the Modligliani-Miller capital structure theorem. The fundamental propositions of the Modligliani-Miller theorem, as well as departures from them, are presented in the next section.

3.3 Modigliani-Miller Propositions

The capital structure of a firm represented a challenge for researchers before Modigliani and Miller (1958) as well. A traditional view of capital structure suggested that by balancing debt and equity, a firm could minimize its cost of capital and, therefore, maximize its value. Moreover, the view emphasized benefits of debt financing via deductibility of interest payments, increasing payouts to shareholders. Findings supporting the present value of future cash flows were uncovered by Gordon and Shapiro (1956) via the Dividend Growth Model, and Williams (1938) who focused on firm share valuation. Although their work does not directly explain the optimality of capital structure of firms, it is evident that the present value of future cash flows determines the value of a firm. Finally, Durand (1952) contributed to the topic of capital structure by analyzing costs associated with different forms of financing, arguing that firms can lower the cost of capital via leverage. With this finding, Durand set the groundwork for Modigliani-Miller theorem and practical considerations of financial decisions in the corporate finance setting.

The Modigliani-Miller theorem, introduced in 1958 and revised in 1963 shed a new light on understanding the firm capital structure. The theorem is built on several assumptions which idealize the environment where propositions are tested. Firstly, firms operate in frictionless capital markets (absence of transaction costs, short sale constraints, and taxes). Secondly, the market is perfectly efficient implying that all information is available to all participants which can all costlessly process the information available (does not imply homogeneous preferences). Thirdly, capital markets are competitive and, in the economy, both firms and individuals are price takers. Finally, cash flows of a firm do not depend on its financial policy (absence of distress or bankruptcy costs; operational costs do not depend on the firm's capital structure). Based on the aforementioned assumptions, the research reveals two major findings in the modern finance field.

3.3.1 Proposition 1

Firstly, the value of a firm is independent of its capital structure. This finding implies that a firm’s decision to finance its operations with debt or equity has no effect on the overall valuation of the firm. Subsequently, leveraging does not provide any tax shield benefits and does not create any additional value (contrary to findings in research done in 1963). In this proposition, we observe three components: debt (B), equity (S), and value of the firm (V). Time span of the firm observed

is t=0 (beginning state) and T = j_1, j_2, j_3… etc. where j is the state of the firm at T (observing period).

Debt is defined as a claim to the face value of debt F at time T. If a firm remains profitable in a state j, the payoff to debt holders is the following:

$$\mathrm{B}_j(T) = min\{F, Vj(T)\} \tag{1}$$

This implies that at time T, debt holders will either claim the face value of debt of the firm or the entire value of the firm (in case the firm goes bankrupt).

Equity is defined as a residual claim on the value of the firm after debt has been paid. This implies that equity holders receive the rest of the value of the firm after the debt is fully paid. Equity payoff is defined as the following:

$$\begin{aligned} S_j(T) &= \{V_j(T) - \min\{F, V_j(T)\}\} \\ &= \max\{0, V_j(T) - F\} \end{aligned} \tag{2}$$

Thus, for an all-equity firm (unlevered firm):

$$\mathrm{S}_j(T) = V_j(T) \tag{3}$$

Finally, expressions for state-j payoffs to debt and equity imply that:

$$\mathrm{V}_j(T) = S_j(T) + B_j(T) \tag{4}$$

*All formulas (1-8) originate from Theoretical Foundations of Corporate Finance textbook by Joao Amaro De Matos, 2001

From this, the following can be concluded:

$$\begin{aligned} V_l &= S + B \\ V_l &= \textstyle\sum_{j=1}^{K} \psi_j [B_j(T) + S_j(T)] \\ V_l &= \textstyle\sum_{j=1}^{K} \psi_j V_j(T) = V_u \end{aligned} \tag{5}$$

The result of Proposition 1 implies that the manager cannot alter the fundamental value of the firm by solely adding leverage. Instead, the value of the firm relies on the operational efficiencies and the risk associated with underlying assets, thus the present value of future cash flows (Modigliani-Miller, 1958). More specifically, the value of cash flows determines the value of claims (debt and equity), which in return result in the overall value of the firm. The situation shifts as taxes are introduced. By using a tax shield to offset the amount of tax paid on income generated, the firm will create a larger net profit after tax. As the net profit transfers to debt and equity, both claims increase and thus, the value of the firm will increase as well (Modigliani-Miller, 1963). The proof is shown below:

$$\begin{aligned} V_l^T &= (1-\tau) \textstyle\sum_{j=1}^{K} \psi_j V_j(T) + \tau \sum_{j=1}^{K} \psi_j B_j(T) \\ &= V_u^T + \tau B \end{aligned} \tag{6}$$

3.3.2 Proposition 2

Secondly, the cost of equity increases as a firm takes on more debt. More specifically, as the firm takes on more debt, the equity portion becomes riskier and thus, investors require a higher return (due to the debt claim priority). For an unlevered firm, the cost of capital is simply the return on equity. For a levered firm, however, the cost of capital is determined by the cost of debt and the cost of equity as shown below:

$$\mathrm{R}_b = \frac{EB_j(T)}{B} \quad and \quad R_s = \frac{ES_j(T)}{S} \tag{7}$$

Where the levered cost of equity can be decomposed into the following:

$$\begin{aligned} R_s^l &= \frac{EV_j(T) - B_j(T)}{S} \\ &= R_s^l \frac{V}{S} - R_b \frac{B}{S} \\ &= \frac{R_s^l(S+B) - R_b B}{S} \\ &= R_s^l + \left(R_s^l - R_b\right) \frac{B}{S} \end{aligned} \tag{8}$$

As a conclusion, Modigliani-Miller concluded that a levered firm's cost of equity increases linearly with the debt-to-equity ratio. Due to this finding, it is evident that although the cost of debt might be smaller than the cost of equity, it would not be favorable to finance investment projects solely with debt. Moreover, from the investor's point of view, for a given amount of capital, the expected return on the investment can be increased by adding leverage, as long as the equity return on the investment exceeds the cost of debt. This finding also opens a gap for an arbitrage where investors could profit on short selling a levered firm and buying an unlevered firm with similar risk profile. Such arbitrage opportunities would push the price of equity of a levered firm down and conversely the cost of equity up, whereas the price of equity in the unlevered firm would increase (Modigliani and Miller 1958, 1963). Thus, the overall cost of capital is defined by total expected payoffs to debt and equity divided by their present values.

3.4 Departures from Modigliani-Miller Propositions

In their comprehensive analysis of capital structure theories, Harris and Raviv (1991) categorized the departures from Modigliani and Miller into four main categories: agency costs, information asymmetry, the nature of product or input markets, and corporate control considerations. One notable theory, the agency theory presented by Jensen and Meckling (1976), suggests that capital structure decisions are influenced by agency costs, which stem from conflicts of interest. There are two primary sources of conflicts. The first occurs between shareholders and managers as managers may prefer personal benefits and exert less effort in maximizing firm profits since they don't gain all the benefits from their efforts but incur all the costs. Introducing more debt can help reduce these agency costs by aligning managers' incentives with those of shareholders. On the other hand, a higher level of debt can lead to another type of agency cost, arising from conflicts

between shareholders and debt holders. This conflict is driven by shareholders' tendencies to favor highly risky projects. Debt holders have a claim that is capped in the form of fixed returns, while potentially losing the entire claim if investments fail. On the other hand, equity holders have an unlimited upside on their claim, thus they prefer risk. This is known as the "asset substitution effect." Therefore, the optimal capital structure needs to balance the advantages of debt, which reduces managerial agency costs, against the risks it introduces through the asset substitution effect (Jensen and Meckling, 1976).

The pecking order theory (Myers, 1984; Myers and Majluf, 1984) supports that a firm's capital structure choices are influenced by the degree of information asymmetry between insiders of the firm and external investors. With greater information asymmetry, external investors face higher risks and consequently demand a higher discount on the securities issued, leading firms to prioritize internal financing. Myers states that “If external capital is required, firms will opt to issue risk-free debt first, followed by low-risk debt, and consider equity only as a last resort”. Myers also introduced the static trade-off theory in 1984, which suggests that firms aim for an optimal debt ratio by balancing the benefits and costs associated with debt. The benefits include the tax advantages of interest deductions, while the costs involve an increased risk of bankruptcy and potential losses if bankruptcy occurs. Miller (1995), discussed the nature of demand deposits issued by banks, asserting that in a perfect capital market, demand deposits should not be seen as fundamentally different from other types of corporate securities. Characterized by high liquidity, low risk, and ease of transferability, demand deposits offer a relatively inexpensive financing option. Thus, in an ideal capital market, non-bank corporations would likely issue similar securities to finance their operations, making the Modigliani and Miller propositions applicable to banks under such circumstances.

Challenging traditional views, Baker and Wurgler in 2002 introduced the market timing theory within their research. Their theory argues that firms' decisions to issue equity are heavily influenced by perceptions on whether a stock is overvalued or undervalued. According to this theory, firms issue equity when they believe their stocks are overpriced and buy back shares when they are underpriced. Baker and Wurgler noted that firms often do not adjust their capital structures

following market timing activities, suggesting that a firm's capital structure is essentially a historical accumulation of market timing decisions.

3.4.1 Basel Committee

The Basel Committee on Banking Supervision was established by G10 central bank governors in 1974, to standardize global banking practices and ensure stability. The committee introduced the Basel I Accord in 1988, setting a minimum capital requirement ratio of 8% divided into Tier 1 and Tier 2 capital to avoid liquidity crises. Enhancements continued with the 1996 Market Risk Amendment, which permitted banks to use their own risk management models and introduced Tier 3 capital for covering diverse risk exposures. Basel II was introduced in 2004, maintaining the 8% capital requirement but altering risk assessment through the inclusion of asset credit ratings. Despite the comprehensive nature of Basel II, its limitations were exposed during the Great Financial Crisis of 2007-2008, leading to the introduction of Basel III in 2010. Basel III raised the total capital requirement from 8% to 10.5% (Tier 1 and Tier 2 capital combined with the capital conservation buffer), with a particular emphasis on Tier 1 capital (raised to 6%) and introduced both a countercyclical capital buffer and a conservation buffer to enhance financial stability during economic fluctuations. Additionally, it established the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR) to ensure banks could manage short-term cash outflows and maintain long-term solvency, respectively. Grundke and Kuhn (2020) revealed that while these measures did not significantly impact bank growth or equity returns, they effectively reduced default risks, suggesting that Basel III successfully balanced enhanced financial safeguards with the preservation of banking industry functionality.

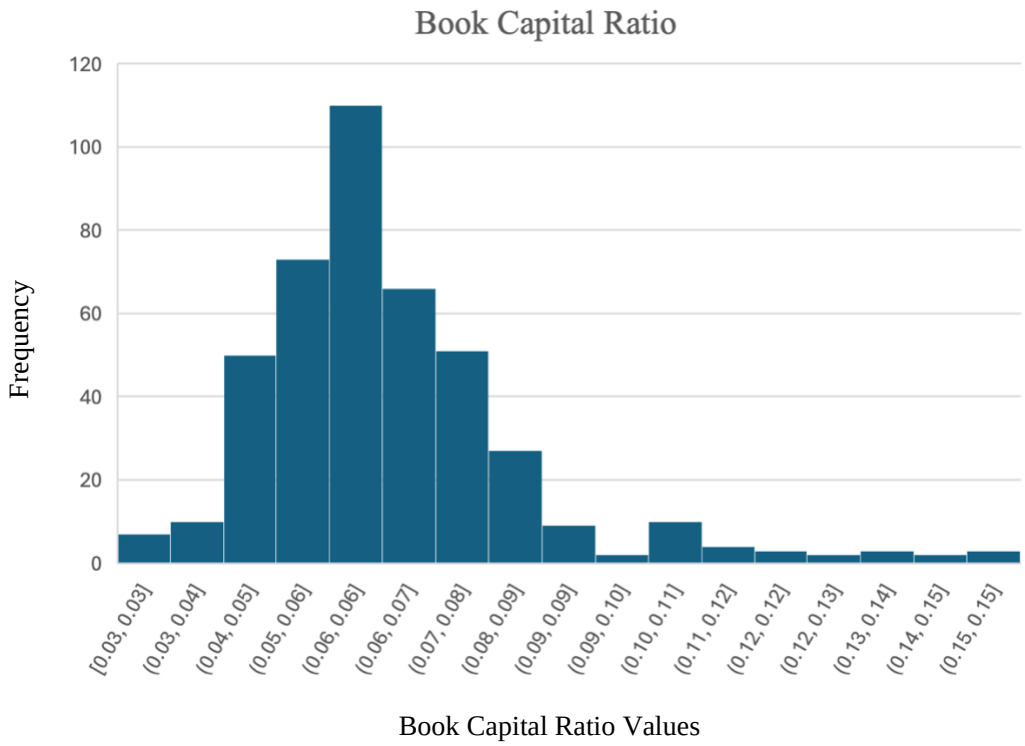
The question between the level of the government intervention in banking and the ability of banks to withhold enough capital available at any time remains. Ideally, banks hold so much equity that the probability of default is negligible. If Modigliani-Miller theorem is applied, this would present a simple solution. However, by increasing the equity level beyond the market demand, the value of the bank would be reduced, and its weighted average cost of financing increased. Thus, higher regulatory requirements would lead towards not only a decrease in valuation of banks, yet also potential social costs over time. Costs of such decisions would be passed onto customers via higher interest rates, decreasing the amount lent and shrinking the banking market. To conclude, capital

regulation poses a tradeoff between a social benefit via a safer banking environment via decreased risk of bank failures and the social cost of diminishing banking market (Santomero and Watson, 1977). As the Basel regulation sets the minimums of capital required, it directly affects banking capital structures. However, due to decisions managers make, explained previously by Modigliani and Miller, the suggestion that the capital regulation is the sole determinant of capital structure is insufficient. Regulation, however, adds a real-world friction to the complexity of the capital structure problem for banks.

3.5 Theory of Variables

The exploration of capital structure determinants for European banks presents significant challenges, especially when compared to non-financial firms. Along with the differing capital structure between financial and non-financial firms, banks are also required to maintain a certain level of capital under Basel regulations, which varies according to associated risk levels (Jouida and Hallara, 2015). Thus, as explained in the Banking Operations chapter, direct comparisons are limited when analyzing the capital structures of banks using studies conducted on non-financial firms. In addition, Jouida and Hallara (2015) and Khadi and Akin (2020) shared a similar perspective asserting that literature on banks has not yet come to a consensus on the determinants of capital structure. Gropp and Heider (2009) exemplify that banks not under financial distress, tend to hold a buffer of capital that is consistently higher than the one imposed by regulators. Moreover, given banks fall under a uniform capital ratio, little to no cross-sectional variation should be observed (Gropp and Heider, 2009). Similarly to Gropp and Heider, for our sample, we observe that data is skewed right, not normally distributed and showcasing variation, thus implying that regulation is not the sole determinant of banks' capital structure. Results are shown in Figure 1.

Figure 1:



In order to obtain a deeper understanding regarding the variables used in empirical models, we assess them theoretically. Following the path of studies such as Gropp and Heider (2009) and Frank and Goyal (2009), we aim to bridge the gap between theoretical expectations and observations within our sample. We begin by theoretically describing variables found significant by Gropp and Heider (2009) (Size, Profitability, Market-to-Book ratio, Risk, Collateral and Dividends). Furthermore, we introduce and analyze the Competition variable, along with explaining its expected influence on both leverage and the Tier 1 capital ratio.

Size

Existing research consistently demonstrates a positive correlation between firm size and leverage, indicating that larger firms are more likely to incur higher levels of debt, following the trade-off theory (Myers, 1984). Moreover, larger banks carry a higher systemic risk and are thus more likely to get bailed out by the government if insolvency occurs (Dell'Ariccia and Ratnovski, 2013). Additionally, larger firms typically incur lower agency costs and possess enhanced reputational

capital, which collectively foster a conducive environment for engaging in risk-taking activities (Rajan and Zingales, 1995; Frank and Goyal, 2009).

Profitability

The more profitable a bank is, the more likely it will generate reserves than rely on debt to fund its assets (Gropp and Heider, 2009). Considering profitable firms, based on the static trade off theory, it should be expected to observe a higher level of debt. Moreover, for profitable firms, the costs of financial distress are lower, and the advantage of tax shields is more effective. On the other hand, the opposite direction of debt levels would be expected if the dynamic trade-off theory holds.

Market-to-Book Ratio

A firm experiencing growth incurs substantial costs in the event of bankruptcy and a high market-to-book ratio deteriorates agency problems associated with debt. Consequently, there is a predicted negative effect of a high market-to-book value on a firm's leverage. This relationship suggests that as firms grow and their market valuation surpasses their book value, the risks and complexities associated with managing increased debt lead to a preference for lower leverage ratios. The agency problems, primarily arising from conflicts between debt-holders and equity-holders, tend to intensify as the perceived value of the firm increases, making debt financing less attractive. Therefore, growth-oriented firms often opt to finance their expansion through equity or retained earnings to mitigate bankruptcy risks and reduce potential conflicts associated with high levels of debt (Myers, 1977; Rajan and Zingales, 1995).

Risk

Gropp and Heider (2009) state that despite its prominent role in corporate finance theory, risk sometimes fails to show up as a reliable factor in the empirical literature on firms' leverage (Titman and Wessels (1988), Rajan and Zingales (1995), and Frank and Goyal, (2004)). Following the definition of Gropp and Heider, the risk variable captures variance in the returns of public banks' stock. Banks which project higher fluctuations in their stock (greater asset risk) are expected to have lower levels of leverage, given lenders perceive them as riskier borrowers.

Collateral

According to Gropp and Heider (2009), there is no significant relationship between collateral and leverage, as their findings indicated no statistical significance. In contrast, Jouida and Hallara (2015) observed a positive correlation between collateral and leverage. This relationship is attributed to the reduction of moral hazard related to a higher degree of transparency when issuing debt, leading to lower cost of borrowing. Thus, more credit-worthy banks should take on more leverage under an assumption that debt is the preferred financing choice. Theoretically, more collateral would encourage banks to increase their debt levels.

Dividends

Banks have the option to manage excess profits through retained earnings or dividend payouts (Modigliani and Miller, 1963). Research by Frank and Goyal (2009) and Gropp and Heider (2009) indicates that banks which distribute dividends tend to be more profitable and consequently, carry less leverage. However, it is observed that banks typically prefer raising additional debt over using retained earnings, suggesting that dividend payouts might contribute to higher overall leverage levels (Admati, 2016). Additionally, to comply with Basel regulatory capital requirements, banks may choose to disregard dividend payments in favor of bolstering their capital ratios.

Competition

According to Grundke and Kuhn (2020), while higher capital requirements enhance safety within the banking sector, they also diminish competition. Capital requirements elevate the financial hurdles for entering the market, disproportionately benefiting large, well-established banks. Large banks can retain their market share and profit margins more easily than new entrants (Berger et al., 2009). As a result, capital requirement regulations tend to disadvantage potential new market entrants more significantly, while providing protection to existing banks. The advantage grows when established banks use funds not only to stay competitive but also to better navigate new regulations (Leonida and Muzzupappa, 2018). The predicted effect of an increased level of competition is to observe less leverage. Given intense competition may erode profit margins, the environment makes it riskier for banks to take on additional leverage. Conversely, in markets with less competition, thus elevated profit margins and market power, banks may be motivated to take on more leverage. We also assume that a higher level of competition would result in a higher Tier

1 capital ratio. This is due to the fact that with more options, depositors will lean towards what are perceived as "safer" banks with more capital. It is important to mention that existing literature does not reflect our research method and is thus not directly comparable to the results we present.

3.6 Testable Hypotheses

Based on the detailed theoretical background, we establish the primary hypothesis for this study. Our hypothesis claims that capital requirements are not the sole determinants of banks' capital structure. Instead, traditional determinants identified in the corporate finance literature also play a significant role, alongside the Competition variable introduced in this study. To distinguish effects observed by standard determinants identified in the corporate finance literature from Risk and Competition, three models are presented in the next chapter. Along with the primary hypothesis derived from Gropp and Heider study (presented in Model 1 and Model 2), two additional hypotheses are to be examined (presented in Model 3):

1. Capital requirement impact on capital structure

The degree of competition is a motivator for higher capital holdings, even beyond regulatory requirements (Schaeck and Cihak, 2010). If we assume a bank to be a profit maximizing firm, it is assumed that managers have an incentive to deploy as much capital as possible in order to retain a higher return on the overall capital held. However, Schaeck and Cihak (2010) conclude that not all banks are profit-maximizing-oriented. This finding, thus, provides an explanation on why large banks may prefer a healthy financial reputation over maximization of profits on every dollar of capital held. Moreover, a bank with a healthy financial position attracts credit-worthy borrowers and reduces barriers of intense monitoring and elevated risks when borrowing from lenders.

2. Financial Stability

As a second argument, financial stability may be enhanced by increasing the competition within the market, rather than solely raising capital requirements. Goetz (2018) concludes that an increase in market competition significantly improves bank stability. An increase

in financial stability is obtained by increased competition as it reduces banks' probability of failure, share of non-performing loans, and increases profitability (Goetz, 2018). While capital requirements promote safety in the banking market, they also impose social costs by increasing market pricing power, reducing competition, and raising costs for borrowers. An increase in the borrowing cost reduces the amount of capital lent and constrains the banking market (Santomero and Watson, 1977). Enhanced competition can reduce the pricing power of dominant banks, potentially lowering interest rates. This would create a healthier lending environment, facilitate capital circulation, and support economic growth and financial stability.

4. Empirical Method

Previous literature findings for non-financial firms in the field of capital structure specified a set of variables that are credibly associated with leverage (Frank and Goyal, 2004). This specific study employs the empirical approach of Gropp and Heider (2009) used for publicly traded firms and is depicted below.

Model 1:

$$L_{ict} = \beta_0 + \beta_1 MTB_{ict-1} + \beta_2 Prof_{ict-1} + \beta_3 Size_{ict-1} + \beta_4 Coll_{ict-1} + \beta_5 Div_{ict} + c_c + c_t + u_{ict}$$

This regression model utilizes a set of explanatory variables that encompass the market-to-book ratio (MTB), the measure of profitability (Prof), the natural logarithm of the banks' size (Size), and the value of collateral (Coll), each taken from the preceding year, alongside a binary variable indicating whether a dividend was distributed (Div) for each bank in a given year. This model is applied to banks denoted by i, within country c, for the year t. Detailed variable descriptions are presented in the Appendix A. The model also incorporates fixed effects for both time and country (notated as c_c and c_t) to control for year-specific and country-specific unobserved factors which might influence the predictor variables.

Model 2:

$$L_{ict} = \beta_0 + \beta_1 MTB_{ict-1} + \beta_2 Prof_{ict-1} + \beta_3 Size_{ict-1} + \beta_4 Coll_{ict-1} + \beta_5 Div_{ict} + \beta_6 Risk_{ict-1} + c_c + c_t + u_{ict}$$

Similarly to the previous regression, panel data model is implemented, and the natural logarithm of banks' risk (detailed calculation shown in Appendix A) is incorporated as a lagged independent variable. Similar to the approach of Gropp and Heider, dependent variables are Market Leverage and Book Leverage. Model 2 aligns with corporate finance theory, particularly in understanding how risk affects leverage decisions, where heightened risk typically results in lower leverage due to increased financial distress costs. In the field of corporate finance, although the theoretical significance of risk influencing firms' leverage decisions is well-established, empirical investigations into this relationship have yielded inconsistent results (Gropp and Heider, 2009)

Model 3:

$$L_{ict} / T_{ict} = \beta_0 + \beta_1 MTB_{ict-1} + \beta_2 Prof_{ict-1} + \beta_3 Size_{ict-1} + \beta_4 Coll_{ict-1} + \beta_5 Div_{ict} + \beta_6 Risk_{ict-1} + \beta_7 Comp + c_t + u_{ict}$$

As discussed in the Theory of Variables chapter of this study, the introduction of higher capital requirements via Basel regulation may produce a diminishing effect on competition by raising the entry barrier into the market. Market competition is calculated as the weight based on the ratio of banks from any single country to the overall sample. With the theoretical background on the relationship among market competition, capital requirements, social well-being, as well as the growth of the banking market, in Model 3 we test how degree of competition affects market stability and capital structure decisions. Market Leverage and Tier 1 Capital ratio are used as dependent variables to examine capital structure decisions when Competition is included. Knowing that standard determinants revealed previously have statistical significance, we shift our focus on Competition and how it affects each dependent variable. Conversely to the previous two models, we deviate from the inclusion of the country fixed effect given the competition measure inherently accounts for variations between countries.

To test for robustness of the Model 3 and the validity of the Competition variable, the Herfindahl-Hirschman Index (HHI) is taken as an alternative explanatory variable for examining market competition. HHI index is defined as the sum of squared market shares of firms operating in the market. Index assigns a higher number when a high share of the market is concentrated among few firms within the same country. The minimum value is 1/n, where n is the number of firms in the market. A market with an HHI index level of less than 1,000 is a competitive market, an index level between 1.000 and 1.800 means that the market is moderately concentrated and an index level higher of 1,800 means that the market has a high level of concentration (Căpraru and Andrieș, 2015). To align the direction of the effect of the HHI index with the originally crafted Competition variable, a complement of HHI is used in the regression (1 - HHI value). HHI is defined as following:

$$\mathrm{HHI} = \mathrm{s}_1^2 + s_2^2 + s_3^2 + \ldots + s_n^2$$

4.1 Data

We collect a sample of "Europe's 50 Largest Banks by Assets, 2023" by Standard & Poor (2023). To make the sample applicable to the methodology, it must be synthesized to publicly traded banks only, thus resulting in 36 largest publicly traded banks (representing 80% of the total market capitalization in Europe). Balance sheets, income statements, and daily share prices were obtained from the Capital IQ database for 12 years spanning from 2012 until 2023. Market capitalizations of publicly available banks and data on dividend payouts are derived from the Refinitiv Eikon database. In our study, we conduct a panel data approach, therefore utilizing time-series and cross-sectional data analysis. Description of individual banks per country from the sample is included in the Appendix B.

4.1.1. Data Description

Ten variables used in this study are Book Leverage, Market Leverage, Tier 1 Ratio, Market-To-Book Ratio, Profits, LN(Size), Collateral, LN(Risk), Competition, and Dividends). Results are presented below in Table 1.

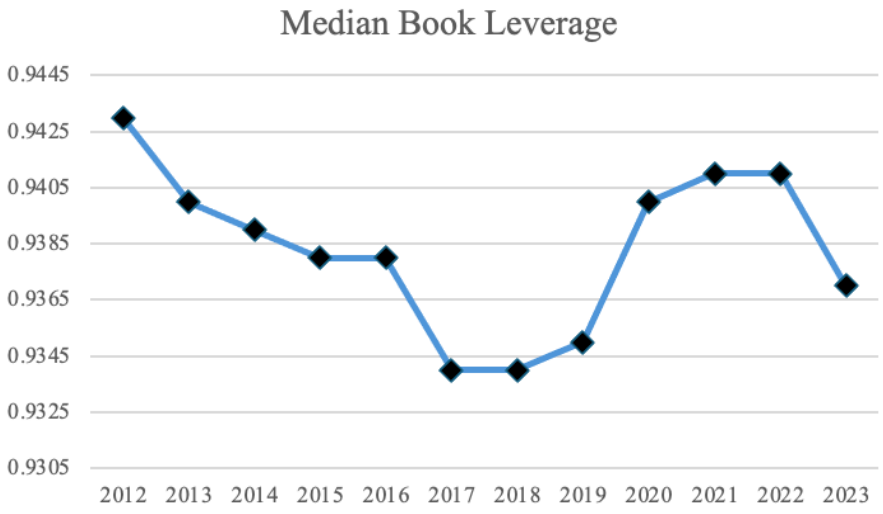
Table 1:

Variable	Mean	Median	Standard Deviation	Minimum	Maximum
Book Leverage	0.934	0.939	0.019	0.849	0.973
Market Leverage	0.948	0.957	0.038	0.648	0.997
Tier 1 Ratio	0.159	0.153	0.041	0.082	0.41
MTB	0.752	0.675	0.386	0.063	2.28
Profits	0.018	0.014	0.013	-0.027	0.074
LN(Size)	13.071	13.051	0.913	11.013	14.831
Collateral	0.362	0.342	0.139	0.115	0.701
LN(Risk)	-4.343	-4.2815	0.703	-7.963	-2.611
Dividends	0.799	1	0.402	0	1
Competition	0.067	0.056	0.043	0.028	0.167

Book leverage across European banks in our sample, appears stable with the lowest value being 84.9% and the highest 97.3%. When compared to market leverage, it has a lower median value and a lower standard deviation. Market leverage tends to deviate more significantly with a minimum value of 64.8% and a maximum value of 99.7%. Tier 1 capital ratio has a median value of 15.3%. On average, when accounting for the regulation requirement, banks appear to be well above the minimum limit. Moreover, no bank failed to meet the minimum Tier 1 requirement of 6%, given the minimum in the sample is 8.2%. The mean value of market-to-book ratio is 0.752, being slightly higher than the median value (0.675). The observed deviation of this variable is considerable with a minimum observation of 0.063 and a maximum of 2.28. The tendency of European banks to project low ratios can account for the notably low market-to-book ratio (Simoens and Vennet, 2021). Profits as a ratio slightly deviates from its mean across the sample with a median of 0.014. Negative values in the profits variable can be explained by the negative earnings before taxes for any observation year. Worth noting is that profits, on average, increase by almost 50% between 2012 and 2023 when observing the entire sample. Size scaled by the natural logarithm shows little to no variation among European banks over years and serves as a standardized variable used for estimating the book leverage. The median of the collateral to total assets ratio is 34.2%. Across the observation window, banks tend to have a stable collateral ratio with little deviation. However, larger banks tend to project a higher level of collateral than smaller banks do. The Dividends dummy variable mean explains that, on average, 80% of banks in Europe paid dividends. Competition on a national level as a measurement indicates that a single country, on average, represents 6.7% of the entire sample, while banks headquartered in the United Kingdom itself represents 16.7% of the sample.

The Book Leverage variable for the entire sample shows a slight decline during the implementation of Basel III regulation. A spike in 2020 is observed likely due to the COVID-19 pandemic where stock markets experienced a sharp decline, later correcting towards a new all-time high (in the S&P 500 index terms). However, the event appears to be a one-off and should not be considered as a change in the direction of the decreasing leverage trend. The results are shown in Figure 2:

Figure 2:



On the flip side, as leverage decreased during the period analyzed, there was an average increase of 36% in the Tier 1 capital ratio. Leverage refers to the liabilities section of the balance sheet, while the Tier 1 capital ratio represents the equity portion, weighted by the riskiness of assets. This shift indicates that, in response to Basel III regulation, banks had to replace some of their liabilities with reserve capital, namely, equity. The increase in Tier 1 capital ratio is shown in Figure 3:

Figure 3:

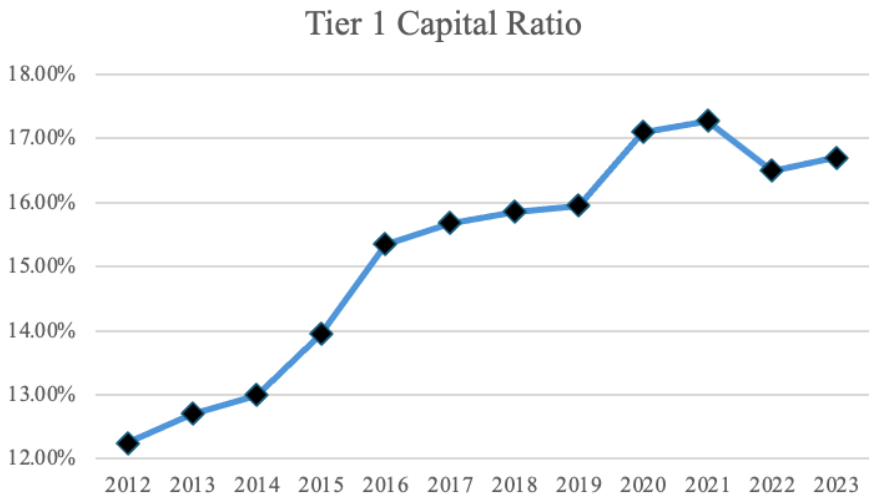


Table 2 represents the correlation matrix of all variables used in this study. Book Leverage has significant correlation with Profits, Size, Risk, and Collateral. Profits have a negative correlation

(-0.52) with Book Leverage indicating a possible hesitancy of banks to take on additional leverage in any profitable year. Moreover, the underlying asset risk of a bank is also negatively correlated with Book Leverage (-0.49) implying that the volatility of the stock may have an impact on the leverage a bank takes. On the other hand, Size and Collateral are positively correlated (0.35 and 0.22) with Book Leverage implying that larger banks with more collateral tend to prefer financing through debt. Size and Collateral have a strong positive correlation with each other of 0.71, thus indicating the validity of theory claiming larger banks have more tangible collateral to pledge against loans. Market leverage notes a strong correlation with market to book ratio and risk, -0.84 and -0.7, respectively. Both explanatory variables have a negative relationship with the dependent variable, indicating that as market to book ratio and risk increase, market leverage tends to decrease significantly. This observation suggests that higher levels of market leverage are associated with lower levels of perceived risk. Size and Collateral have a positive correlation with Market Leverage, as they do with Book Leverage. Tier 1 capital ratio has a pronounced correlation with the Market-to-Book ratio, Risk, Profits, and Dividends. A higher Market-to-Book ratio tends to influence the ratio of Tier 1 capital a bank holds in a positive direction. As Risk increases, the Tier 1 capital ratio is likely to decrease implying banks with less volatile underlying assets project a higher Tier 1 capital ratio. The negative correlation between Profits and Tier 1 capital ratio may suggest that in periods when a bank is profitable, its managers prefer to either distribute the earnings in form of dividends or reinvest them in future operations, rather than building a capital reserve. Finally, a positive correlation between Tier 1 capital ratio and Dividends may indicate that well capitalized banks are more likely to distribute earnings through dividends.

Table 2:

Correlation Matrix of Primary Variables

	BL	ML	Tier 1	MTB	Profits	Size	Risk	Collateral	Dividends
BL	1								
ML	0.45	1							
Tier 1	0.16	-0.13	1						
MTB	-0.02	-0.84	0.15	1					
Profits	-0.52	-0.42	-0.17	0.23	1				
Size	0.35	0.21	-0.05	-0.02	-0.04	1			
Risk	-0.49	-0.70	-0.23	0.57	0.34	-0.28	1		
Collateral	0.22	0.19	-0.05	-0.06	-0.23	0.71	-0.13	1	
Dividends	-0.03	-0.22	0.17	0.25	0.22	0.23	0.03	0.04	1

5. Results

Model 1 regression results, shown in Table 3, reveal that the model implemented by Gropp and Heider on banks, when applied on the sample of this study, explains 73% of variance in the Book Leverage that is explained by selected independent variables. This analysis indicates that Book Leverage is positively influenced by Size, while it is negatively associated with Profits, Market-to-Book ratio, Collateral, and Dividends. A strong negative influence from Profits aligns with the theory of capital structure discussed in the theory chapter of this study. Our results are similar to Gropp and Heider findings when directions of independent variables are observed. However, Collateral showcases a minor negative effect of -0.031 on the explained variable (Book Leverage). Moreover, all independent variables except for Dividends are statistically significant on all significance levels.

By setting Market Leverage as the dependent variable, we observe that none of the variables are statistically significant on any levels, except for the Market-to-Book ratio. Market-to-Book ratio impacts the Market Leverage negatively, implying that firms with a greater perceived value, than the one shown in financial statements, tend to take on less risk. This finding might imply another risk. As banks' shareholders expect the firm to continue generating positive cash flows, taking on additional risk has less value, while the downside remains large. If a bank would take on more risk and would, by doing so, create negative cash flows, the value of the bank would decrease drastically. The model explains 80% of the variance in Market Leverage with variables presented in Model 1. The results are shown in Table 3.

Table 3:

Model 1

Dependent Variable	Book Leverage		Market Leverage	
	Coefficient	P-Value	Coefficient	P-Value
Market-To-Book Ratio	-0.0089	0.000	-0.0567	0.000
Profits	-0.5711	0.000	-0.1179	0.436
Size	0.0058	0.000	0.0001	0.957
Collateral	-0.0308	0.000	-0.003	0.822
Dividends	-0.0015	0.358	-0.0009	0.764
R^2	0.73		0.80	

The incorporation of the risk variable (described in Appendix A) assumes significance within this analytical framework and represents the volatility inherent in the underlying stock of the bank. Consequently, the inclusion of this variable augments the explanatory robustness of the model, affording a deeper comprehension of the intricate mechanisms governing market behavior. When considering Book Leverage as the explained variable, Size is the only explanatory variable affecting it positively. This finding aligns with directions of explanatory variables in Model 1. Although, in the Gropp and Heider study Collateral has a positive effect on the dependent variable, our data reveals a negative relationship with Book Leverage. Results unfold that on all levels Profits, Size are statistically significant, whereas Market-to-Book ratio, Collateral, and Dividends are not . Most noticeably, our results deviate from the Gropp and Heider study in which all variables are statistically significant at 1% percent significance level, except for Market-to-Book ratio which is not statistically significant on any level. The results are shown in Table 4.

By using Market Leverage as a dependent variable, the model provides an adjusted R-squared of 82%, indicating a strong fit of the data in the model. Results further reveal that at the 5% significance level, only Market-to-Book, Profits, and Risk are statistically significant predictors of

Market Leverage, in contrast to Dividends, Collateral, and Size which do not reach statistical significance on any level. All of the three statistically significant coefficients affect the dependent variable in a negative way, underscoring a tendency for companies with higher market valuations relative to their book values, lower profitability, and greater underlying risk to hold lower levels of market-based debt. This may reflect market skepticism or a conservative approach towards debt financing in firms that are either not performing well financially or are seen as risky investments.

Table 4:

Model 2 - With Risk

Dependent Variable	Book Leverage		Market Leverage	
	Coefficient	P-Value	Coefficient	P-Value
Market-To-Book Ratio	-0.0042	0.211	-0.0473	0.000
Profits	-0.4594	0.000	-0.3622	0.005
Size	0.0047	0.000	0.0008	0.641
Collateral	-0.0123	0.145	-0.0020	0.859
Risk	-0.0065	0.000	-0.0064	0.001
Dividends	-0.0024	0.144	-0.0020	0.362
R^2	0.73		0.82	

In order to test whether both arguments hold in the existing banking system, we run two regressions with an additional independent variable: Competition. The market competition measure is obtained by the proportion of banks within a single country relative to the entire sample. Thus, if a market is more saturated, the coefficient of Competition is higher. The regression results for Market Leverage show that the inclusion of Competition yields a robust fit to the model, with an R-squared value of 79%. Individual coefficients depict statistical significance at all levels, aside from Collateral that is significant at the 10% level of significance and Dividends which is not significant at any level. More specifically, Market-to-Book and Profits reveal a negative effect on Market

Leverage, implying that banks with higher Market-to-Book which are also profitable, are inclined to use less leverage. In line with the theoretical framework, Competition has a statistical significance on all levels and is shown to impact leverage with a negative effect. Therefore, increased competition relates to lower leverage levels, highlighting that competitive pressures can lead banks to operate more cautiously, by maintaining lower leverage ratios. To support previously discussed trade-off theory, Size is positively associated with Market Leverage as constituted by Myers (1984).

Conversely, by taking Tier 1 as a dependent variable, with Competition included, variables explain 53% of the variance. More specifically, we show that Competition has a positive effect on Tier 1 capital ratio. Specifically, a one-unit increase in competition leads to a 0.13% increase in the Tier 1 capital ratio. The competition variable is statistically significant at all levels. This result supports the theory discussed in the Competition chapter that higher competition contributes to a higher Tier 1 capital ratio. All variables are statistically significant at all levels except for Profits and Dividends. Size negatively affects Tier 1 capital ratio implying a more aggressive strategy when managing capital. This finding might be related to the idea that larger banks, knowing their weight in the economy, employ riskier investing strategies knowing in case of failure, they would be bailed out.

Table 5:

Model 3 - Competition

Dependent Variable	Market Leverage		Tier 1 Capital Ratio	
	Coefficient	P-Value	Coefficient	P-Value
Market-To-Book Ratio	-0.0585	0.000	0.0841	0.000
Profits	-0.5545	0.000	-0.0132	0.934
Size	0.0068	0.000	-0.0196	0.000
Collateral	-0.0157	0.072	0.0569	0.001
Dividends	-0.0006	0.805	0.0051	0.270
Risk	-0.0073	0.000	-0.0434	0.000
Competition	-0.0796	0.000	0.1307	0.000
R^2	0.79		0.53	

As described in the Methodology chapter, two regressions are run to confirm the robustness of Model 3. Directions of effect of each variable remain the same as in Model 3, except for Collateral, which by introducing 1 - HHI turns positive. Market-to-Book, Size, Risk, and Competition remain statistically significant at all levels, while Profits, Collateral, and Dividends are not significant at any level. When taking Tier 1 capital ratio as the dependent variable, all directions of effects of explanatory variables remain consistent with Model 3. When observing p-values of individual explanatory variables, with the introduction of 1 - HHI, Collateral loses statistical significance at all levels. Market-to-Book, Size, Risk, and Competition retain statistical significance at all levels. Overall, by using an established index, the test confirms that the initially crafted Competition variable, used in Model 3 captures the true nature of the variable. By observing the equal direction of effect of the original and alternative measure of Competition, combined with statistical significance at all levels on both explained variables, robustness check confirms the viability of Model 3. As found in Model 3, increased competition within the sample decreases leverage banks

take. Furthermore, increased competition affects Tier 1 capital ratio positively, implying that in more competitive markets, banks tend to have a higher Tier 1 capital ratio.

Table 6:

Model 3 - Robustness Check

Dependent Variable	Market Leverage		Tier 1 Capital Ratio	
	Coefficient	P-Value	Coefficient	P-Value
Market-To-Book Ratio	-0.0545	0.000	0.0869	0.000
Profits	-0.1670	0.100	-0.0961	0.713
Size	0.0042	0.001	-0.0147	0.000
Collateral	0.0013	0.867	0.0265	0.197
Dividends	- 0.0023	0.229	0.0055	0.275
Risk	-0.0077	0.000	-0.0444	0.000
Competition	-0.0050	0.000	0.0115	0.002
R^2	0.83		0.51	

5.1 Limitations

Firstly, the study carried out contains a fixed sample of the 36 largest public banks in Europe in 2023, as mentioned in the Data chapter. Therefore, the sample does not address potential changes within the dynamics of which banks remain on the top 36 list over time (ranked by total assets). Therefore, the analysis is based on a static approach, reflecting only the most recent snapshot of the banking sector. Moreover, not all banks have been public for the entire term of the selected time of the study (2012-2023). Thus, to mitigate the potential introduction of spurious relationships in the model, few observations for certain variables are excluded. Secondly, considering that Basel III directives were not applied in the same year in every country may introduce inconsistencies in direct comparisons. Findings in this study might be influenced by timing decisions of financial

jurisdictions across Europe. Given that each country within Europe follows a native jurisdiction, the implementation of Basel regulations may occur at different points in time. Additionally, although all jurisdictions within Europe follow IFRS reporting standards, definitions of certain terms may differ across the board. Thirdly, the Competition variable in Model 3 is not dynamic over the sample time since it is based on the fixed ranking of largest banks in Europe. However, to account for this drawback, we conduct a robustness test with a conventional Herfindahl-Hirschman Index (HHI). Unlike the Competition variable from Model 3, the HHI provides a time-series representation of market competition levels in each country. Although HHI provides a reliable measure of competition presence, data for non-EU based countries (Norway, Switzerland, and Russian Federation) was not possible to obtain. Thus, those countries are excluded from the robustness test process. Finally, as discussed in the Related Literature chapter an increase in Tier 1 capital ratio should not be strictly associated with an increase in levels of equity capital. Following the study from Gropp, Mosk, and Wix (2019), banks may increase the Tier 1 capital ratio by either decreasing the riskiness of assets or by decreasing the level of risk-weighted assets. Therefore, inferences drawn from Model 3 where Tier 1 capital ratio is the dependent variable do not clearly indicate whether the change in Tier 1 capital ratio is attributed to the alteration of capital (numerator) or risk-weighted assets (denominator).

6. Conclusion

While the topic on determinants of capital structure in the corporate finance literature is vast, a strong conclusion on the banking field is yet to be established. With the Basel III regulation implementation, the already enigmatic nature of the problem intensifies. Following a well-rounded foundation from previous studies, we confirm that standard determinants of capital structure identified in corporate finance literature when applied to European banks for the time period between 2012 and 2023 hold considerable statistical significance.

Size tends to consistently produce a positive effect on leverage, indicating that larger banks are more inclined to use debt financing. Moreover, higher profitability of financial firms affects leverage negatively. These findings align with the pecking order theory developed by Myers (1984) and Myers and Majluf (1984). Primarily, firms tend to finance operations primarily by internal means of financing (retained earnings) and turn to debt as a secondary financing source. Market-to-Book ratio negatively influences leverage highlighting that banks with higher market value relative to their book value are less leveraged. Banks with a higher Market-to-Book ratio more carefully manage risk levels to avoid financial distress, which may in turn produce costs and potentially even bankruptcy. Collateral and Dividends do not consistently provide a statistically significant explanation of the level of leverage. Finally, the risk of the underlying asset of a bank negatively affects leverage. A riskier underlying asset prevents the bank from increasing leverage due to a higher cost of capital.

To confirm theories presented by Shack and Cihak (2010) and Goetz (2018), the significance of the market competition variable on leverage and Tier 1 capital ratio proves to be considerable. In markets where competition is high, leverage decreases and Tier 1 capital ratio increases. Results suggest that lower market dominance positively influences financial stability in the banking sector via lower leverage, higher capital ratio, and thus lower probability of default. Therefore, with greater financial stability, the adverse effect of systemic risk on the overall financial system is less likely to occur.

Appendices

Appendix A:

Variable	Notation	Definition
Book leverage	L	1- (book value of equity / book value of assets)
Market Leverage	L	1 - (market value of equity / market value of bank)
Tier 1	T	Tier 1 capital / Risk-Weighted Assets
Market to book ratio	MTB	Market value of assets / book value of assets
Profits	Prof	(Earnings before taxes + interest expenses) / book value of assets
Size	LN(Size)	Book value of assets
Dividend	Coll	Dummy variable, 1 if the bank pays a dividend in a given year
Collateral	Div	(Cash and cash equivalents + total investments + net property, plant and equipment) / book value of assets
Risk	LN(Risk)	Annualized standard deviation of daily stock price returns * (market value of equity / market value of bank)
Competition	Comp	Competition proportion to the relative sample

Appendix B:

Bank Name	Country
HSBC Holdings PLC (HSBA-LSE)	UK
BNP Paribas SA (BNP-ENXTPA)	France
Crédit Agricole Group	France
Banco Santander SA (SAN-BME)	Spain
Barclays PLC (BARC-LSE)	UK
UBS Group AG (UBSG-SWX)	Switzerland
Société Generale SA (GLE-ENXTPA)	France
Deutsche Bank AG (DBK-XTRA)	Germany
Lloyds Banking Group PLC (LLOY-LSE)	UK
Intesa Sanpaolo SpA (ISP-BIT)	Italy
ING Groep NV (INGA-ENXTAM)	Netherlands
UniCredit SpA (UCG-BIT)	Italy
NatWest Group PLC (NWG-LSE)	UK
Standard Chartered PLC (STAN-LSE)	UK
Banco Bilbao Vizcaya Argentaria SA (BBVA-BME)	Spain
Nordea Bank Abp (NDA SE-OM)	Finland
CaixaBank SA (CABK-BME)	Spain
Sberbank of Russia (SBER-MISX)5	Russia
Danske Bank A/S (DANSKE-CPSE)	Denmark
Commerzbank AG (CBK-XTRA)	Germany
ABN AMRO Bank NV (ABN-ENXTAM)	Netherlands
KBC Group NV (KBC-ENXTBR)	Belgium
Erste Group Bank AG (EBS-WBAG)	Austria
Nationwide Building Society (NBS-LSE)*	UK
Skandinaviska Enskilda Banken AB (publ) (SEB A-OM)	Sweden
VTB Bank PJSC (VTBR-MISX)	Russia
Svenska Handelsbanken AB (publ) (SHB A-OM)	Sweden
DNB Bank ASA (DNB-OB)	Norway
Swedbank AB (publ) (SWED A-OM)	Sweden
Banco de Sabadell SA (SAB-BME)	Spain
Raiffeisen Bank International AG (RBI-WBAG)	Austria
Banco BPM SpA (BAMI-BIT)	Italy
Bank of Ireland Group PLC (BIRG-ISE)	Ireland
BPER Banca SpA (BPE-BIT)6	Italy
AIB Group PLC (A5G-ISE)	Ireland
Banca Monte dei Paschi di Siena SpA (BMPS-BIT)	Italy

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