DETERMINANTS OF BANK CAPITAL STRUCTURE:

VOLUNTARY OR INVOLUNTARY DECISIONS, WHAT REALLY MATTERS?

Master in Finance Dissertation

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About the Author

Filipe Alves Domingues was born on December 10th, 1978, in Miranda do Douro. He holds a 5 years degree in Management from Faculdade de Economia da Universidade do Porto, attributed in 2001. In 2010 he started postgraduate studies by joining the Master in Finance at the same University.

Filipe has a professional experience of more than 12 years. From May 2007 onwards, he has been working for the planning and controlling department of EDP Renováveis as senior financial analyst. Previously, he worked in the banking sector, firstly in investment banking, then in the accounting and financial department and finally as head of planning and controlling.

Abstract

The purpose of this dissertation is to shed some light on which are the main capital structure determinants of the EU27 listed banking firms. Do the standard capital structure factors apply to this sample of banks? Or instead, are the regulatory capital and capital buffers the main factors considered by banks in their capital structure choice? Our results seem to indicate that, in some extent, standard cross-sectional determinants of non-financial firms' capital structure also apply to our sample of EU27 listed banks, from 1998 to 2011. However, this evidence is stronger for market leverage than for book leverage. Controlling for asset risk does not exclude the remaining variables. In contrast, the regulatory view seems to have weaker explanatory power of banks' capital structure changes.

Keywords: banks, capital structure, leverage, capital regulation.

JEL codes: G32, G21

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Chapter 1 - Introduction

The firm's capital structure refers to the combination of equity and long-term debt the company uses to finance its investments/assets. The source of capital can be internal, meaning cash flow from operations, or external, when the financial needs surpass the amount of cash-flow generated leading to the issuance of new equity or debt securities. These securities vary in terms of rights over the returns and the assets control. Moreover, accessing the markets to raise funds is costly. Since the choice of the capital structure, as all the other corporate finance decisions, is relevant to the firm's value, it is particularly appropriate to consider the marginal costs of using each type of available funding.

Since the theorem of Modigliani and Miller (1958) which states that, in perfect capital markets, capital structure choice is irrelevant to firm value, many theoretical models have been proposed, based on the existing market imperfections, to respond to all these questions and to better understand why the capital structure decisions really matter.

The static trade-off theory, in simple terms, assumes that the firm decides its sources of funding in order to find a debt ratio that maximizes the tax benefits offered by the interest payments on debt and minimize the probability of bankruptcy and the loss if a failure occurs. The Agency theory of Jensen and Meckling (1976) introduce the concept of agency costs, due to the conflicts of interest mainly between equityholders and managers and between debtholders and equityholders, and how it relates to the existence of an optimal mix of funding.

Subsequently, asymmetric information based theories of capital structure arose. The pecking order theory suggests that firms have good reasons to avoid issuing common stock or other risky securities to finance new investments. Rather, they should accumulate operational cash-flow to prevent the dilemma of either passing by positive NPV projects or issuing stock at a low price. The signaling theory suggests that the market values the firm according to its perceived stream of returns. Thus, changes in the capital structure of such a firm may alter that market perception, since it leads to changes in the market perceived firm's risk class although the actual risk class in fact remains unchanged. In their turn, underlying the market timing approach is the

empirical evidence that the observed capital structure is the cumulative outcome of past attempts to time the market, although it has limited explanatory power in the long-run.

Some empirical studies on non-financial firms, have found that capital structure is cross-sectionally correlated with certain factors. Harris and Raviv (1991) suggest that leverage increases with fixed assets, non-debt tax shields, growth opportunities, and firm size and decreases with volatility, advertising expenditures, research and development expenditures, bankruptcy probability, profitability and uniqueness of the product. Frank and Goyal (2004) found that the most reliable factors in the leverage decisions are median industry leverage (positive effect), market-to-book ratio (negative), collateral (positive), profits (negative), dividend paying (negative), log of assets (positive), and expected inflation (positive). Rajan and Zingales (1995) found that leverage correlates positively with size and tangibility and negatively with market-to-book ratio and profitability.

Despite these important theoretical and empirical findings, some authors (e.g. Rajan and Zingales, 1995; Frank and Goyal, 2004) suggested that it is necessary to strengthen the relationship between these theoretical models of capital structure and the empirical facts.

Furthermore, this empirical research is usually restricted to non-financial firms. Due to their special characteristics, financial firms (notably banks) have been excluded from corporate finance studies on capital structure determinants. Since banks are subject to a regulatory framework that establishes mandatory capital levels, they are involved in both voluntary and involuntary capital structure decisions (Besanko and Kanatas, 1996; Marques and Santos, 2003). Moreover, banks raise most of their funds in the form of deposit contracts. Marques and Santos (2003) assert that *"the investigation of capital structure of financial firms such as banks has been largely overlooked."* Gropp and Heider (2009) also conclude that, "*there is a long tradition in corporate finance to investigate the capital structure decisions of non-financial firms. But what determines banks' capital structures?*"

Aiming to answer this question, Gropp and Heider (2009), using a sample of 200 large U.S. and European banks, examined whether the standard determinants of capital structure usually applied to non-financial firms (size, profitability, market-to-book ratio, asset tangibility, and dividend paying) are also relevant to banks. They also introduced

asset risk and macroeconomic factors. They further tested whether asset risk captures the effect of risk adjustments or if it rather excludes the corporate standard variables. Overall, their results show that standard corporate finance determinants of capital structure also apply to banks. Furthermore, their empirical facts suggest that capital regulation and capital buffers may only be of second order importance in determining the capital structure of most banks.

The approach followed in this empirical study is similar to Gropp and Heider (2009). Using a sample of 145 listed commercial banks and bank-holding companies from 25 countries, between 1998 and 2011, we explore whether the standard determinants of capital structure are significant factors in determining the level of bank leverage in the European Union (EU27). We also control for asset risk and examine whether the regulatory framework, that imposes minimum capital ratios on banks, influences the choice of capital structure by banks.

The remainder of this dissertation is organized as follows. Chapter 2 presents an overview of the firm's capital structure most prominent theories. Chapter 3 introduces the capital structure of banking firms. Chapter 4 comprises an empirical study to test whether standard determinants of capital structure have any explanatory power when applied to banks. We summarize and conclude in Chapter 5.

Chapter 2 - Firm's Capital Structure Theory: Overview of the Literature

"*The study of capital structure attempts to explain the mix of securities and financing sources used by corporations to finance real investment.* […] *There is no universal theory of the debt-equity choice, and no reason to expect one. There are several useful conditional theories, however.*"

(Myers, 2001)

2.1. Modigliani and Miller's (1958) Theorem

Modigliani and Miller (1958) is recognized as the seminal academic work on firm's capital structure. In their study, the authors argue that, in perfect and frictionless markets, capital structure is irrelevant[1]. They suggest that capital structure should not influence the market value of the firm, based on a set of theoretical assumptions that have their basis in the market efficiency postulate. Therefore, we should look at the Modigliani and Miller irrelevance theorem as an outcome based on a theoretical corporate environment, without any kind of frictions and market imperfections[2].

In 1963, Modigliani and Miller made a correction to their previous study which consist in introducing the effect of tax deductibility of interest payments in their model (the absence of taxes, previously considered one of the main assumptions, is now relaxed). Thus, the firm benefits from using debt financing because the higher the debt level the greater the firm's value[3]. However, Modigliani and Miller (1963) recognized that, despite the tax advantage of debt, firms should not use 100 percent debt because of "*the need to preserving flexibility*" regarding its treasury management and the choice of

[1] Modigliani and Miller (1958): "*the capital structure of a firm is a matter of indifference; and that, consequently, one of the core problems of corporate finance - the problem of the optimal capital structure for a firm - is no problem at all*".

[2] Modigliani and Miller (1958) assume perfect markets in the absence of taxes, bankruptcy costs and transaction costs; investors are rational and have homogeneous expectations about the investment opportunities of firms; absence of agency costs.

[3] The firm's value becomes equal to its value when financed only with equity plus the present value of the tax benefits resulting from debt. In the extreme situation, the firm's maximum value would occur when its assets are fully financed by debt, which corresponds to a tax saving maximization.

their sources of funding and because creditors can impose restrictions to the amount of financing.

Although controversial, the theory of Modigliani and Miller gave a very important contribution to explain the firm value formation and the flexibility of its assumptions becoming crucial to the formulation of many theories of capital structure. Since then many capital structure studies have been produced and many models and theories have been proposed, looking for a better understanding of the capital structure foundations and overcome the theoretical assumptions subjacent to Modigliani and Miller (1958).

2.2. Tax Based Trading-Off Models of Capital Structure

According to the trade-off theories, the firm decides its sources of funding in order to find a debt ratio that maximizes the tax benefits offered by debt and minimize the costs of bankruptcy in which the company may incur.

Hasan (1997) illustrates it, saying that "[…]*the trade-off between gains from leverage-induced tax shields and expected bankruptcy costs may well account for the traditional cost of capital curve, declining at low levels of debt but rising with substantial leverage and hence an optimal capital structure.*" As debt increases, the marginal benefits decrease and marginal costs increase and vice-versa. Therefore, the optimal capital structure entails balancing the tax benefits of debt against the costs related with financial distress.

Miller (1977) suggests that when determining the optimal capital structure, it is important to not simply consider corporate taxes but also add the effect of personal taxes. This Author argues that, considering this effect, the gain from leverage is less than previously believed because in a world of differential personal taxes, the marginal personal tax disadvantage of debt combined with supply side adjustments by firms will override the corporate tax advantage of debt and drive market prices to equilibrium.

DeAngelo and Masulis (1980) added to Miller's (1977) work the effect of deductible non-cash charges substitutes of interest payments on debt, such as accounting depreciation and investment tax credits. In their study they state that "*for relatively low levels of leverage, the marginal value of debt is positive because there is a relatively high probability that additional debt can be fully utilized to reduce the*

firm's tax liabilities and this corporate tax reduction outweighs the higher personal taxes paid on additional debt. For relatively high levels of debt, the marginal value of debt is negative because the tax shield substitutes imply a relatively high probability that the potential corporate shield from additional debt will be partially or totally lost because of insufficient earnings, while an additional personal tax liability for holding debt is incurred." Therefore, assuming that the only benefit of using debt is the tax saving associated to it, the use of debt is good only as long as the interest on debt can be deductible[4]. Thereby, the incremental value of interest tax shields decreases as the firm financial leverage increases. Consequently, as stated by Hasan (1997), a high degree of leverage increases the probability of bankruptcy and, therefore, increases the overall riskiness of the earnings stream. Moreover, the rate of interest on debt may start to rise and may cause the cost of capital to increase.

Myers (2001) states that this theory supports the existence of moderate debt ratios and is consistent with the fact that companies with relatively safer investments and tangible assets tend to borrow more than firms with higher risk investments while DeAngelo and Masulis (1980) suggest in their study that each firm has a unique interior optimum leverage decision, due solely to the interaction of personal and corporate tax treatment of debt and equity, even with the existence of positive default costs and with or without tax shield substitutes for debt.

2.3. Agency Theory and Capital Structure Decisions

One of the main fragilities of the neoclassical theory lies in overlooking the possibility of separation between ownership and management. However, in the real economy, the specialization of the management has been increasing. Therefore, it is not surprising that in more recent literature, researchers became interested not only in understanding how the capital structure affects the firm value but also how it affects the ownership and governance of the firm.

Assuming the separation between ownership and management, owners (securities holders) no longer have control over the cash-flows. Although the objective

[4] DeAngelo and Masulis (1980): "*The tax codes set a ceiling to ensure that the expected marginal corporate tax saving from additional debt declines as debt is added to the capital structure.*"

of managers (agents) should be maximizing the shareholders' return, they do not always run the firm with this objective, thereby originating an agency problem. As mentioned by Jensen and Meckling (1976) "*If both parties to the relationship are utility maximizers, there is good reason to believe that the agent will not always act in the best interests of the principal.*"

The managers' information advantage may conduct to an opportunistic exploitation, using the available firm free cash-flow to accomplish their personal goals. Thus, the agency risk becomes a critical determinant of firm's performance.

Based on the existence of these agency relationships, in their influential work, Jensen and Meckling (1976) suggest that taxes are not the only condition for the existence of an optimal capital structure. They introduce the concept of agency costs and how it relates to the existence of an optimal mix of internal (retained earnings) and external financing (debt or equity). They identify two different types of conflicts that are present in every publicly-traded firm: conflict between equityholders and managers and conflict between debtholders and equityholders.

The securities holders do not have control over the cash-flows, therefore in order to protect their rights they have to monitor the managers' actions to ensure that their decisions follow the objective of increasing the firm's value instead of wasting resources. The following question arises: How does one formulate the contractual relation between the principal and agent in order to create the right incentives for the manager behavior to maximize the principal's welfare? The principal may implement several monitoring mechanisms, create compensation schemes or limit the resources available for the agent by changing the capital structure[5].

By increasing leverage while keeping the level of manager's equity ownership constant, the firm mitigates the agency problem between managers and equityholders since managers are holding a larger stake in the firm. Increasing the level of debt also forces a firm to pay out cash (in the form of interest payments) and consequently reduces the amount of "free" cash available for managers to engage in their self-centered activities. On the other hand, increasing the debt level may also lead to higher costs of debt arising from the conflict between debtholders and equityholders.

[5] However, as pointed by Jensen and Meckling (1976) "*is generally impossible for the principal or the agent at zero cost (pecuniary or non-pecuniary) to ensure that the agent will make optimal decisions from the principal's viewpoint.*"

According to the literature, the conflict between shareholders and debtholders can take two distinct forms: asset substitution and underinvestment problems. Regarding the asset substitution, Jensen and Meckling (1976) argue that once a debt is in place, the equityholders will have incentives to increase the risk of the firm to enhance the equity value at the expense of debtholders. It means that equityholders prefer a riskier project to a safer one because it gives them a potentially higher return while they are subject to the risk of losing the same amount of investment. However, this incentive to increase risk can be mitigated since future debt issuances will be priced taking into account this higher risk. The underinvestment problem arises when equityholders refuse positive NPV projects because they bear the full costs of the investment while having to share the proceeds with the debtholders. In particular, when a firm is on the edge of bankruptcy, the equity holders might reject to undertake positive NPV projects because in the event of bankruptcy the liquidation proceeds go first to the debtholders.

2.4. Asymmetric Information Models of Capital Structure

2.4.1. Pecking Order

Myers and Majluf (1984) developed a new model, combining financing and investment decisions, to explain corporate finance behavior, under the assumptions that managers know the firm better than potential investors and the latter interpret the firm's actions rationally. The model suggests explanations for the tendency to rely on internal sources of funds, and the preference of debt to equity if external financing is required, which generally means that it is better to issue safe securities than risky ones.

Due to information asymmetry between the managers and the market, there is a hierarchy of funding sources. Preferably the company is financed with retained cash flows, then with the issuing of new debt and, only after exhausting the previous alternatives, with the issuing of equity. There are several reasons to explain the preference for internal financing. Signaling, since issuing equity may be a sign that the shares are overvalued and issuing debt can be a sign that the company is experiencing difficulties. Flexibility, given that external financing reduces the flexibility to face upcoming funding needs. Control, because debt contracts have covenants and new

shares issuing brings new shareholders to the company. Costs of new issuances, contrary to internal funding that have no issuance costs.

Myers (1984) argues that "*the firm may also plan to cover part of normal investment outlays with new borrowing, but it tries to restrain itself enough to keep the debt safe - that is, reasonably close to default-risk free. It restrains itself for two reasons: first, to avoid any material costs of financial distress; and second, to maintain financial slack in the form of reserve borrowing power*[6]." Myers and Majluf (1984) suggest that firms whose investment opportunities outstrip operating cash flows, and which have used all their ability to issue low-risk debt, may forego good investments rather than issue risky securities to finance them. In this way, firms should carry sufficient financial slack to undertake good investment opportunities as they arise.

Myers (1984) also argues that there are two conditions under which issuing equity might not be optimal for the firm. The first being that both managers and investors recognize that managers know better the exact condition of the firm and the future investment opportunities than the investors - asymmetric information problem. The second being that managers act in the best interest of the existing equityholders.

Myers and Majluf (1984) also argue that if managers have superior information and stock is issued to finance investment, the stock price will fall, *ceteris paribus*. If the firm issues safe (default-risk-free) debt to finance investment, the stock price will not fall.

Firms may prevent these troubles by building up financial slack by restricting dividends, when investment requirements are modest or by issuing stock in periods when managers' information advantage is small. However, as noted by Myers (1984), since target dividend payout ratios are sticky, and investment opportunities fluctuate relative to internal cash flow, the firm will, from time to time, exhaust its ability to issue safe debt. When this happens, the firm first turns to less risky securities - for example, risky debt or convertibles before common stock.

The pecking order theory indicates that when firms make capital structure decisions they do not have a target leverage ratio. Leverage will adjust in accordance with the need to obtain external financing and not because of trying to reach an optimal

[6] Myers (1984): "'*Reserve borrowing power' means that it can issue safe debt if it needs to.*"

capital structure. It contrasts with a static trade-off framework in which the firm is viewed as setting a target debt-to-value ratio and gradually moving towards it.

2.4.2. Signaling

If we assume that market prices do not reflect all the information, especially that is not publicly available, then capital structure decisions could be used as a signaling mechanism. Modigliani and Miller irrelevance proposition implicitly assumes that investors know the random return stream of the firm and they value the firm accordingly. This is the basis for signaling approaches of optimal capital structure. The market values the firm according to its perceived stream of returns, thus changes in the capital structure of such a firm may alter that market perception. Changing the capital structure can influence the value of the firm since it leads to changes in the market perceived firm's risk class although the actual risk class in fact remains unchanged.

Building on this, Ross (1977) proposes the signaling approach to explain the changes in capital structure. He argues that managers who are better informed than the investors about the firm's expected cash flows may change the capital structure to send out clear signals to the market about the future performance of the firm, if they have the appropriate incentive to do so. However, without incentive schedules to truthful signaling, incentive signaling equilibrium does not exist.

One empirical implication of the Ross's (1977) incentive-signaling theory is that in a cross-section the values of firms will rise with leverage since increasing leverage increases the market's perception of value and, in equilibrium, firms are correctly distinguished by their financial choices.[7]

Leland and Pyle (1977) developed a model of capital structure based in the informational asymmetries, in which it is assumed that owners (the insiders) are better informed about firm's projects than the investors (the outsiders). The greater the owner's willingness to invest in his own projects or company, the more positive signal

[7] Ross (1977): "*Despite these somewhat paradoxical results, a great deal of care must be taken in actual empirical testing. […] In a continuous time model it is certainly the case that for a given firm, with true bankruptcy costs, value will fall with increases in the debt-equity ratio; in fact D/E must approach infinity as bankruptcy is approached (in a diffusion model). Even without such costs, D/E and V will move in opposite directions. These effects will tend to counter the initial incentive-signaling effects and may make empirical testing more difficult.*"

the firm is sending out to investors. It can serve as a signal of project quality and the value of the firm is expected to increase.[8]

About this signaling model, Hasan (1997) underlines two implications. "[A first is that] *if the original owners of a company going public decide to keep a large fraction of the stock, then these firms should experience greater price earnings multiples (Copeland and Weston, 1988). Thus, in contrast with MM (1958), even in the absence of taxes, the financial structure of the firm will be related to project or firm value. A second implication is that if the firm's value is positively related to the fraction of the owners' wealth held as equity in the firm, then the firm will have greater debt capacity and will use a greater amount of debt. Hence, although debt is not a signal in this model, its use will be positively correlated to the firm's value.*"

This financing equilibrium proposed by signaling models diverges from models which ignore asymmetric information. In contrast with Modigliani and Miller (1958), the financial structure is related to the firm value even in absence of taxation and firms with riskier returns will have lower leverage ratios even without bankruptcy costs. Furthermore, Leland and Pyle (1977) suggest that financial intermediation, which is difficult to explain in classical models of financial equilibrium, can be seen as a natural response to the asymmetric information.

2.4.3. Market Timing

In addition to the theoretical models we presented so far, which have been subject to major theoretical and empirical research, other approaches have emerged in an attempt to explain the capital structure decisions. Among them, Baker and Wurgler (2002) introduce a new approach, supported in the empirical evidence that market timing is an important determinant of real financing decisions. They suggest that firms issue equity when their market values are high, relative to book and past market values, and repurchase equity when their market values are low. They also find that low-leverage

[8] Leland and Pyle (1977): "[…] *information on project quality may be transferred if the actions of entrepreneurs ("which speak louder than words") can be observed. One such action, observable because of disclosure rules, is the willingness of the person(s) with inside information to invest in the project or firm. This willingness to invest may serve as a signal to the lending market of the true quality of the project; lenders will place a value on the project that reflects the information transferred by the signal.*"

firms tend to raise funds issuing more equity when their valuations are high and, conversely, high-leveraged firms tend to raise funds issuing more debt when their valuations are low. Hence, they consider that the observed capital structure is the cumulative outcome of past attempts to time the market. Like in the pecking order, also in the market timing theory there is no optimal leverage ratio.

Frank and Goyal (2004) suggest that the basic idea behind this theory is the following: "*managers look at current conditions in both debt markets and equity markets. If they need financing, then they will use whichever market looks more favorable currently. If neither market looks favorable, then fund raising may be deferred. Alternatively, if current conditions look unusually favorable, then funds may be raised even if they are not currently required.*"

Alti (2006) said that despite the fact that market timing is important to explain changes in capital structure in the short-run, it has limited explanatory power in the long-run. He suggests that the long-run capital structure policies of a firm appear to be largely consistent with the existence of leverage targets, in accordance with trade-off model.

Chapter 3 – Capital Structure of the Banks: Overview of the Literature

3.1. Market (In)Eficiency and Banks' Role

As a firm, banks dovetail with the same capital theory of non-financial firms. However, as financial intermediaries, banks are a specific industry with a particular function and special features that should be incorporated in their capital structure analyses. Moreover, banks develop their activity under a regulatory and supervisory framework that establishes mandatory capital levels.

Banks, as important payers in the financial system, have the primary function of facilitate the allocation and deployment of economic resources, both spatially and temporally, in an uncertain environment (Merton, 1995).[9] Under the traditional view of financial intermediation, banks are in competition with markets to offer an increasing range of financial products and, thus, in many aspects they are substitutes. The increasing market globalization and continuous improvement of technologies led to an increasing sophistication of financial products and a reduction of transaction costs. This tendency adds to competition between financial intermediaries and financial markets and, hence, contributes to the market efficiency.

According to this traditional view, in perfect capital markets characterized by the inexistence of frictions, transaction and informational costs, no benefits would emerge from the existence of financial intermediaries. In contrast, market imperfections underlie the existence and rationality of the financial intermediaries. Banks would contribute to solve or mitigate some of these imperfections.

Merton (1995) introduces a new conceptual framework to analyze the dynamics of financial intermediation. According to his *dynamic perspective*, intermediaries are better suited to handle highly customized and low volume products whereas financial markets tend to be a more efficient alternative to financial institutions when products are standardized, traded in large volumes, serving a large number of investors who are

[9] "*Under the traditional theory of financial intermediation, a banking firm is portrayed as an asset transformer (see, e.g., Gurley and Shaw 1960), which pools resources in an attempt to match / intermediate economic agents' profiles of consumption and investment. Under this approach, the banking firm's most prominent function is to intermediate between savers and borrowers*" (Santos, 2003)

comfortable to evaluate their prices. According to this view, further to their resources' allocation function, banks also play an important role in the financial innovation process, creating and testing new products constantly and, hence, contributing to increase the market efficiency. [10]

As per this Merton's (1995) new *dynamic perspective* of complementarities and interactions, it no longer makes sense to say that financial institutions and markets compete amongst themselves but say that the two are just as surely complementary institutions, each reinforcing and improving the other in the performance of their functions.

There is some literature arguing that the main driver behind this financial innovation is the attempt to reduce the constraints of regulation, including taxes accounting rules and transaction costs, thus contributing to market efficiency[11]. However, during the present global financial crisis, a large number of economists have come to argue that financial innovation played an important role in causing the financial crisis due to an excessive risk-taking by financial institutions. This moral hazard behavior is largely motivated by the government safety net and the prospect of bailouts for banks[12]

Among academics is widely accepted that innovation in finance contributes to market efficiency, but only the innovation which makes the securities more flexible and

[10] See Merton (1995) for more detail on the role and institutional dynamics of the financial intermediation, under a functional perspective.

[11] e.g. Finnerty (2008): "*Securities innovation improves capital market efficiency by offering more cost-effective means of transferring risks, increasing liquidity, and reducing transaction costs and agency costs. It is a profit-driven response to changes in the economic, tax, and regulatory environment.*"

[12] There is no consensus about the implications of financial innovation, for instance while Sánchez (2010) argues "*My central point is that although financial innovation has lately fallen out of favor because some of its products acted as vehicles in the credit boom that led to the crisis, criticism should be taken with caution. Innovation has been with us for a long time, and its overall contribution to finance and welfare has been positive. Provided that we strengthen prudential regulation to discourage excessive risk taking in the future, innovation can continue to benefit our societies.*"; Park (2009) argues "*The current crisis is primarily the direct result of the abuse of some of the latest and most innovative financial techniques. Most of which are too esoteric and technical to be comprehended correctly by both government regulators and academic economists. Many crises are usually a byproduct of the cycle of financial innovations.*"; and Pearson and Henderson (2011) point out "*Our findings are, however, consistent with the recent hypothesis that issuing firms might shroud some aspects of innovative securities or introduce complexity to exploit uninformed investors.*"

less costly, hence, accessible for a larger number of people, allows improving the risk management and contributes to the transparency and better functioning of the markets.[13]

Comparing to other industries, another major peculiarity of banks is the fact that customers are simultaneously debtholders because banks raise most of their funds in the form of deposits. This also makes banks have a distinctive capital structure, since deposits are a component of debt. An additional feature that distinguishes banks from non-financial firms is their comparative higher default risk sensibility, since their performance is highly determined by the client's liabilities probability of default.[14]

3.2. Tax Advantages of Debt and Bankruptcy Costs

Santos (2003) point out that, similarly to non-financial firms, "*in the banking industry and under many tax regimes, the deductibility of borrowing costs for income taxes purposes also represents an element of the tax advantage of debt financing over equity (e.g., Osterberg and Thompson 1996; and Marcus 1983).*" However, as we have seen in the previous chapter, Miller (1977) considers that, by adding the effect of personal taxes, this tax shield effect is partly offset. Besides the tax advantages of debt, in the same fashion as non-financial firms, banks have other tax deductible substitutes of debt as tax shields, e.g. depreciation of fixed assets, goodwill and provisions for loan losses.

Osterberg (1990) presents a model where, in the absence of capital regulation, income tax and bankruptcy costs are relevant for a particular bank to decide its leverage ratio. When Osterberg (1990) accounts for capital regulation, it becomes clear that the impact of such regulation depends on market forces (market factors considered in his model are tax rates, nondebt tax shields and municipal securities). This means that market forces and regulatory influences on banks' capital structure are interconnected.

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[13] "*Financial innovation does have a dark side; it can have detrimental effects. There is evidence that financial innovations are sometimes undertaken to create complexity and exploit the purchaser. As far as the financial crisis that started in 2007 is concerned, securitisation and subprime mortgages may have exacerbated the problem.* [...] *There are also many financial innovations that have had a significant positive effect. These include venture capital and leveraged buyout funds to finance businesses. In addition, financial innovation has allowed many improvements in the environment and in global health. On balance it seems likely its effects have been positive rather than negative.*" (Franklin Allen. European Financial Management, Vol. 18, No. 4, 2012, 493–514)

[14] "*Thus, risk management is almost always an activity of first order importance to the efficient operation of an intermediary but, in general, need not be so for business firms.*" (Merton, 1995)

Scholes et al. (1990) developed a model[15] that predicts a relationship between banks' marginal tax rates and their investment and financing strategy. This evidence supports the existence of tax clienteles in the sample of U.S. Banks used in their empirical tests.[16] Nevertheless, they also document that banks seemingly consider nontax costs in their tax planning, for instance, the regulatory capital penalties.

Scholes et al. (1990) state that "*the evidence suggests that banks are more inclined to take actions that reduce taxes when the costs of doing so, in terms of the effects on income reported to shareholders and regulators are relatively small and the magnitude of the potential tax benefits is large.*" Their findings also suggest that when regulatory capital falls to close the minimum required or bellow it, banks are more willing to forgo tax benefits by selling appreciated securities or defer the sale of losers to improve their regulatory capital positions, by increasing earnings. In these circumstances, may be keen to use both the accounting standards and fiscal law available means in order to improve the earnings, even paying more taxes, to increase the capital book value and consequently, the regulatory capital. In contrast, as regulatory capital increases, banks can better afford to accelerate the sale of losers or defer the sale of appreciated securities to save on taxes.

Admitting absence of supervision and regulation, increasing the financial leverage led to an increment of financial distress and bankruptcy risk. Are these risks different from non-financial firms? Santos (2003) suggest three major reasons to explain why banking firms are likely to face lower expected bankruptcy costs than non-financial firms, for the same level of financial leverage. "*The first factor is related to the effectiveness of bankruptcy administrative proceedings, the second factor is related to the governmental safety net regime, and the third effect is related to the so-called to-big-to-fall doctrine.*" Relating to the first, some authors argue that the losses for creditors resulting from a bank's bankruptcy process are smaller than those from non-financial firms, because the insolvency process of banks is handled more efficiently. Regarding the second, the safety net includes a combination of measures and rules

[15] They test a model where banks trade-off the tax advantages of realizing securities losses against the costs of reporting reduced regulatory capital and financial income.

[16] "*We find that banks with net operating losses take fewer long positions in tax favored assets (municipal bonds and direct lease assets) and more short positions in tax-favored assets (preferred stock and common stock) than do tax-paying banks.*" (Scholes, Wilson and Wolfson, 1990)

emerged from public authorities, regulators and other market players, aiming to ensure the stability and soundness of the banking system and protect the bank customers. The third argument, *to-big-to-fall*, is based on the widely negative impact of a bank failure in the economy as a whole. Thus, according to this, the probability of a big bank going into bankruptcy is lower than the probability of failure of a non-financial firm in the same circumstances. Therefore, large banks might take more risks than they would, increasing the probability of bankruptcy.

The results of the survey conducted by Marques and Santos (2003)[17] shows moderate support for the trade-off theory. With regard to this theory, they argue that "*it is manifestly clear that it cannot resolve the central problem of identifying and measuring these costs and benefits, thus leaving undetermined the economic framework that could explain the capital structure conundrum.*"

In contrast, we can find a number of authors that present arguments in support of the hypothesis that the problem of the banking firm's capital structure choice can be approached and explained, similar to non-financial firms, trading-off the benefits of debt in terms of tax shield against the increase of the costs of bankruptcy.

3.3. Agency Problems and Bank's Capital Structure Decisions

In both non-financial and financial firms we can find conflicts of interest among the different stakeholders[18]. As noted earlier in chapter 2, in non-financial firms the most prominent conflicts, and also the most present in the literature, arise among shareholders, managers and debtholders. In the banking sector, other stakeholders assume the same relevance as the previous, due to the idiosyncrasies of this industry. They are the regulators, the depositors and the tax payers. The existence of these agency problems may influence the decisions about the bank's capital structure.

Regarding the conflicts between shareholders and managers in banking, Santos (2003) argues that "*are of the same nature as the ones emerging in a non-banking firm.*"

[17] Marques and Santos (2003) conducted a survey to a sample of 89.5 percent of the Chief Executive Officers (CEOs) of Portuguese banks in office during the period of 1989-1998.

[18] Those individuals and/or organizations that have interest or concern in a certain firm and, thus can affect or be affected by the firm's actions, objectives and policies. In addition to the most studied in the corporate finance literature (debtholders, shareholders and managers) we can enumerate others such as employees, public entities (e.g. government and its agencies), clients, suppliers, community, etc.

Besanko and Kanatas (1996) argue that regulatory capital may not have the desirable effect in promoting bank safety if the agency problem between insiders and outside investors has economic significance because issuing equity may dilute the ownership of bank insiders sufficiently to reduce their incentives to expend effort on behalf of the bank's stockholders. The results of the Marques and Santos (2003) survey indicate that the "*managers appear to be primarily concerned with the influence of the incentives associated with the governance arrangements and the control rights allocation determined by capital structure decision-making*", which is consistent with the relevance of the agency relationships in the capital structure decision making in banking firms.

One of the idiosyncrasies of banks is their liabilities structure since they are, to a large extent, held by small depositors and other financial institutions. Concerning the small depositors, due to both insignificant portion each one holds on the firm's total debt and their lack of skills, they are unable or unwilling to assess the banks riskiness, creating a free-riding problem. As we know, in the absence of such monitoring, managers' decisions might result in moral hazard. For this reason small depositors need any public or private authority acting on their behalf (agent) to mitigate the costs arising from the conflict of interests between bank owners and them. On the other hand, once the public authorities' safety net mechanisms[19] protect the depositors' wealth against the consequences of risk taking by the banking firm, the incentive of depositors to monitor and control the banks performance are sorely reduced. Moreover, the existence of this government guarantee creates a moral hazard problem in the form of an incentive for excessive risk-taking by banks, while depositors have little or no incentive to monitor them.

When the depositors' protection against opportunistic risk-taking by banks is achieved by a fixed-premium deposit insurance regime, insensitively to asset risk, banks' owners have an additional incentive to leveraging-up and invest in riskier assets. Thus, shareholders instead of using their own financing or resorting to risk sensitive debt-financing to fund incremental asset growth, are very likely to resort to deposit

[19] The safety net mechanism can take different forms and provides a cushion that protects lenders against bank's economic losses. Among the different mechanisms included in the safety net, deposit insurance is one of the most used. However, such protection limits the incentive to control risk taking, creating a moral hazard problem.

financing because it is advantageous due to the subsidy granted by public deposit insurers at taxpayers' expense. Such decision reduces the capital ratio and further increases the probability of potentially disruptive and costly insolvency. (Santos, 2003)

Gropp and Heider (2009) find some evidence that higher deposit insurance coverage is associated with higher market leverage, which is consistent with an effect of regulation on capital structure. However, this effect disappears once they control for bank characteristics. Thus, their study fails to find evidence that deposit insurance coverage has impact on banks' capital structure.

Depositors who do not benefit from the deposit insurance protection can mitigate the agency cost assessing the risk level of such a bank and withdraw their deposits if they perceive that the bank insiders' decisions are increasing the probability of failure and, therefore, their money is at risk. Thus, in the absence of deposit insurance the agency problem between shareholders and depositors becomes the typical agency problem between shareholders and creditors. Due to their limitations, the most common reaction of small depositors to a bank's risk increasing, and perhaps the only one, is withdrawing their deposits, which usually happens as a result of a market or public authority notice that the bank is experiencing difficulties and not as a result of their own assessment.

Santos (2003) argues that governmental intervention in deposit markets "[…] *grants banks' owners a 'free' put option on the assets of the bank, enabling them to honor deposit obligations under all circumstances and 'transforming' deposits into risk free assets.*" Concerning the agency conflict between bank shareholders and regulators, it arises once regulators should act in behalf and best interests of depositors. To overcome the agency conflict between bank owners and regulators, the latter set a regulatory framework such as minimum capital requirements and implement supervisory activities, which intended to control bank owners' incentives to undertake moral hazard decisions.

Also the agency relationship between taxpayers and regulators, such as government and central bank, is a source of agency risk, once taxpayers expect the public entities and regulators to act in their interest. But, at the same time, they are dispersed and do not have the incentives and the tools to monitor the public entities intervention.

3.4. Regulation on Banking

Capital structure of banking firms is somewhat non-discretionary, since they have regulatory capital requirements. According to the literature, the main foundations for banking regulation are the market inefficiencies (asymmetric information, adverse selection and moral hazard), the inability of depositors to monitor banks (mostly explained by the associated costs and the free riding problem) and the risk of a systemic failure (banks receive deposits and have a monetary function, which exposes them to runs that can be transmitted to the entire financial system).

The supporters of banking regulation use the classical argument that financial markets (in particular banks) must be strongly regulated to mitigate the risk of a systemic financial crisis[20], due to the important role they play in the economy (Santos, 2001). However, due to the lack of consensus on the nature of the market failure, there is still no consensus on whether banks need to be regulated and, if so, how they should be regulated (Santos, 2001). More recently, if the current EU sovereign debt crisis, with global impact, strengthens the idea that bank regulation and supervision are needed, also evidences the failure of the objective of stability in the financial system.

In the literature, the two most prominent aspects of banking regulation are the regulatory capital and the deposit insurance. Consistent with the objective of the dissertation, this section only focus in the first aspect and try to understand how it can influence the banking capital structure decisions. According to the regulatory view, it is believed that if the banks' capital is at an appropriate level and large enough to absorb losses in case of severe events, it can avoid major failures in the financial system. Though, based on their empirical results, Gropp and Heider (2009) suggest that capital regulation and capital buffers may not be of first-order importance in determining the capital structure of most banks.

The Basel accords are the most visible outcome of a continuous effort to improve the banking regulatory framework and incorporate, albeit slowly, some of the suggestions produced by the literature in this field. The successive accords are the most relevant contributions for the general use of capital ratios as an instrument of banking regulation and for its convergence worldwide. Therefore, in what respects capital

[20] See Santos (2001) section 3.1 for a resume of the literature proposals to prevent systemic failure.

structure involuntary decisions in banking is essential, nevertheless some conceptual shortcomings and ineffectiveness, take a trip through the Basel Accords.

3.4.1. Basel Accords

Basel I

The international convergence of bank capital regulation started with the 1988 Basel I Capital Accord that intended to state a minimum level of capital for banks with relevant international business, to ensure the capital adequacy in relation to the counterparty credit risk[21]. Basel I set out the target standard ratio of capital to weighted risk assets at 8% (of which the tier 1 capital element will be at least 4%), which banks would be expected to accomplish by the end of 1992. The bank's capital is then related to different categories of assets or off-balance-sheet exposure, which are risk-adjusted according to broad categories of relative risk[22] in order to assess the banks' capital adequacy. About this accord, Santos (2001) refers that "*its conceptual limitations together with financial innovation have created incentives and opportunities for regulatory capital arbitrage, and have consequently led to a reduction in its effectiveness*", which emphasized the need to redesign this regulatory framework and gave space to the emergence of new research and contributions on this field.

The first amendment took place in 1996 and aims to amend the 1988 Capital Accord, which considered solely the risk of counterparty failure, to accounts and set capital requirements for market risks[23] and also defined a Tier 3 capital to cover these risks.

[21] The counterparty credit risk is defined as the risk that the counterparty to a transaction could default before the final settlement of the transaction's cash flows. An economic loss would occur if the transactions or the portfolio of transactions with the counterparty have a positive economic value at the time of default.

[22] The set of risk weights available to classify the assets is 0%, 10%, 20%, 50 and 100%.

[23] Market risk is defined by the Basel Committee as "*the risk of losses in on and off-balance sheet positions arising from movements in market prices. The risks subject to this requirement are: the risks pertaining to interest rate related instruments and equities in the trading book; foreign exchange risk and commodities risk throughout the bank.*"

Basel II

Later, in June 2004, the Basel Committee on Banking Supervision presented the Basel II accord, which sets more risk-sensitive capital requirements because is more aware of particular features of the supervisory and accounting systems, as well as the different risk profiles of the banks. This new approach builds on two main ideas: banks are better informed about its risks than the regulators and the capital charges must be more correlated with the credit risk of bank's assets (risk sensitive). Basel II lays on the following three pillars approach: minimum capital requirements, supervisory review and market discipline. The First Pillar adjusts the total minimum capital requirements calculation to cover credit, market and operational risks. Despite the great changes in the calculation basis, the target capital ratios remain unchanged (target standard ratio of capital to weighted risk assets at 8%; tier 1 capital ratio at 4%). The total risk-weighted assets is obtained multiplying the capital requirements for market risk and operational risk by 12.5 (i.e. the reciprocal of the minimum capital ratio of 8%) and adding the sum of risk-weighted assets for credit risk.

This new accord consents banks to choose between two broad methodologies for calculating their capital requirements for credit risk: the standardized approach which is largely supported on ratings published by external credit assessment institutions recognized for this purpose and came to replace the existing risk-weighting bucket scheme and the internal ratings-based approach, which allows banks to use their internal rating systems for credit risk.

Undoubtedly, Basel II is intended to create a set of incentives to award the best practices of banks in terms of risk assessment and management. The Basel Committee believed that such objective could be achieved by combining the risk sensitive capital requirements of the pillar 1 with the efforts by banks to assess their capital adequacy and by supervisors to review such assessments, supported by pillar 2, and the market discipline required under the pillar 3.

In 2005, the Basel Committee started working in the enhancement of the Basel II market risk framework. This work, influenced by the financial crisis that began in the middle of 2007, culminates with the publication of the Basel 2.5 Accord, in 2009, and results in a greater capital charge against the market risks that banks run in their trading operations.

During the financial crisis, the losses verified in most of the banks' trading books were much higher than the capital charges to cover market risks fixed by Pillar 1 and it became an important source of losses and leverage increase. The main objective of Basel 2.5 is to encourage banks to derisk and deleverage the trading book activities by introducing both a stressed value-at-risk (SVaR) which adds to the Basel II VaR capital requirement and an incremental risk charge (IRC). Banks were expected to comply with Basel 2.5 by no later than 31 December 2011.

Basel III

More recently, in 2011 the Basel Committee introduced the Basel III, aiming to strengthen global capital (capital ratios calibration, in order to increase both the quality and quantity of the regulatory capital base) and liquidity rules with the goal of promoting a more resilient banking sector. The Basel Committee (2011) argued that "*One of the main reasons of the economic and financial crisis, which began in 2007, became so severe was that the banking sectors of many countries had built up excessive on and off-balance sheet leverage. This was accompanied by a gradual erosion of the level and quality of the capital base.*" Hence, innovative hybrid capital instruments currently allowed in Tier 1 capital base, although limited to 15%, will be ruled out, Tier 2 capital instruments will be harmonized and Tier 3 capital instruments will be removed. In complement to capital ratios, a leverage ratio requirement will be introduced to drive down the leverage and enhance the risk-based measures with a straightforward and independent measure of risk.

Chapter 4 – European Banks: Empirical Study

4.1. Objectives

The purpose of this empirical study is to identify the main capital structure determinants of the European Union listed banks. Do the standard capital structure factors apply to banks? Or instead, are the regulatory capital and capital buffers the main factors considered by banks in their capital structure choice? The answer to these questions shed some light on the relative prominence of the capital structure voluntary and/or involuntary decisions of banks.

The methodology followed is similar to Gropp and Heider (2009), who suggest that standard cross-sectional determinants of non-financial firms' leverage carry over to large U.S. and European banks, from 1991 to 2004, except for banks whose capital ratio is close to the regulatory minimum. Their results also show that mispriced deposit insurance and capital regulation were of second order importance in determining the capital structure of these banking firms.

This chapter is organized as follows. Firstly, we describe the sample and present the descriptive statistics in the sections 4.2 and 4.3, respectively. We examine the components of bank capital structure in Section 4.4. Then, methodology is delineated and predictions about the relationship between variables are given, in section 4.5. Section 4.6 presents and discusses the results.

4.2. Data sources and Sample Description

The data used in this empirical study comes from the following sources:

a) A sample of listed banks from the EU27 was initially collected from the Bankscope of the Bureau Van Dijk. The sample only includes banks which are classified as commercial banks and bank-holding companies according to the Bankscope. All the financial statements data are from this database;
b) All market data which comprise banks' stock prices, number of shares outstanding and dividends were obtained from Thompson Financial's Datastream.

The analysis period starts in 1998 and ends in 2011, according to the data available in the Bankscope. The sample comprises 145 banks[24], from 25 countries[25], and has 1,452 bank-year observations.

Here, we face at least two potential sources of bias. Firstly, we use an unbalanced panel of banks due to the missing data. While some studies (e.g. Frank and Goyal, 2004) use the multiple imputation method[26] to predict the data that has not been recorded, we assume that the lack of data for some bank-year is purely random and therefore does not result in a biased sample. Secondly, the survivorship bias[27], since the Bankscope includes only data on banks that continue to exist at the last release of the database. The Table 1 shows the details of the sample for each EU27 country.

In their empirical study, Gropp and Heider (2009) decided on 2004 as the end point in order to avoid the confounding effects of i) banks anticipating the implementation of the Basle II regulatory framework and ii) banks extensive use of off-balance sheet activities in the run-up of the subprime bubble leading to the 2007-09 financial crisis. We also share this concern and will analyze two distinct periods, 1998-2004 and 2005-2011, to isolate the effects of the Basel II and the recent financial crisis. Nevertheless, we will also report the results for the entire sample (1998-2011).

[24] The initial sample collected from Bankscope consisted of 163 Banks, but not all could be included due to lack of data.

[25] Estonia and Latvia have no banks in the sample.

[26] "*The idea of multiple imputation is to use the facts that you can observe about a firm in a given year to predict the data that has not been recorded.*" (Frank and Goyal, 2004)

[27] "*This leads to the well known problem of survivorship bias. Early studies such as Titman and Wessels (1988) examined balanced panels of data. Only firms that existed over the full time period were included. In recent years this practice has been replaced by the now common use of unbalanced panels of firms. We use unbalanced panel methods.*" (Frank and Goyal, 2004)

Table 1 - Number of unique banks and bank-year observations across countries

The sample consists of all the listed commercial banks and bank-holding companies, in the 27 countries of the European Union, from 1998 to 2011, with available data in the Bankscope database.

Country	Number of unique banks	Number of bank-year observations
AUSTRIA	5	62
BELGIUM	4	26
BULGARIA	3	13
CYPRUS	2	14
CZECH REPUBLIC	1	13
DENMARK	28	311
FINLAND	3	13
FRANCE	9	101
GERMANY	10	89
GREECE	7	59
HUNGARY	1	14
IRELAND	2	27
ITALY	16	175
LITHUANIA	2	15
LUXEMBOURG	3	27
MALTA	2	11
NETHERLANDS	5	36
POLAND	12	126
PORTUGAL	3	42
ROMANIA	3	21
SLOVAKIA	4	32
SLOVENIA	2	7
SPAIN	6	74
SWEDEN	3	38
UNITED KINGDOM	9	106
TOTAL	145	1,452

4.3. Descriptive Statistics

Frank and Goyal (2004) pointed out that the older academic literature tends to focus on book debt ratios, while more recent academic literature tends to focus on market debt ratios. In this investigation we use both market and book leverage ratios and, in both cases, we consider not only the long term debt but instead the total debt. When equity is measured at book value, it's called book leverage and when measured at market value

it's called market leverage.[28] In both cases debt (or more precisely liabilities) is measured at book value.

In Table 2 we describe in detail how we construct the variables. In appendix 1 we provide additional information, namely, the fields collected from each data source to construct these variables.

Table 2 - Variables definition

Variables	Definition
Book Leverage Ratio	1- (book value of equity / book value of assets)
Market Leverage Ratio	1- (market value of equity (=number of shares * end of year stock price) / market value of bank (=market value of equity + book value of liabilities)) *Total Book Value Liabilities = Total Assets - Equity*
Size	Total book value of assets
Market-to-Book Ratio	Market value of assets / Book value of assets *Market value of assets = Market value of bank*
Profits	EBIT / book value of assets *EBIT = (pre-tax profit + interest expenses)*
Collateral	(Total securities + Cash and due from + Other tangible assets) / Book value of assets
Dividend dummy	1 if the bank pays a dividend in a given year, 0 otherwise
Asset risk	Annualised standard deviation of daily stock price returns * (market value of equity / market value of bank)
Deposits (Book)	Total deposits / Book value of assets
Non-deposit liabilities (Book)	Book leverage – Deposits (Book)

Table 3 provides descriptive statistics for the variables. Following the initial orientation proposed for this study, we find valuable to compare the descriptive statistics with those of Gropp and Heider (2009, Table II), obtained for a sample of the largest 200 publicly traded banks in the US and UE and with those of Frank and Goyal (2004, Table 3), obtained for a typical sample of listed non-financial firms.

[28] Rajan and Zingales (1995): "*Given the observed differences in the composition of liabilities, before undertaking any investigation of leverage it is appropriate to define what we mean by this term.*"

Several variables have mean values that quite diverge from the median, which indicates that there is a large cross-sectional diversity. Despite having selected only the listed banks, the sample displays substantial heterogeneity since the largest bank in the sample has total assets of €2.6 trillion while the smallest has only total assets in the amount of €42 million. Total book assets mean (median) is equal to €133,460 million (€8,592 million). In Gropp and Heider (2009), the total book assets mean (median) is €64,100 million (€14,900 million), which means that although their sample is also heterogeneous, is not so much as ours. For both, banks and non-financial firms the median market-to-book ratio is close to one, although the non-financial firms exhibit an higher mean market-to-book ratio. The median profitability of our sample of banks is 3.6% of assets, which is a little less than the 4.9% of the largest 200 listed banks in the US and UE and about one third of non-financial firms profitability (12%). Banks hold much less collateral[29] than non-financial firms, respectively, an average of 28.4% of the book assets (27% in Gropp and Heider (2009)) versus an average of 56%. Around 81% of listed banks from EU27 pay dividends (94% in Gropp and Heider (2009), while only 43% of non-financial firms do so. Regarding the assets risk, Gropp and Heider (2009) pointed that "*the assets of firms are typically three times as volatile as the assets of banks (12% versus 3.6%)*" and our sample also supports that evidence (4.7%).

Analyzing these descriptive statistics, banks seem to be less profitable and less risky when compared to non-financial firms. This matches the earlier finding by Gropp and Heider (2009). Nevertheless, looking at the banks' leverage, it shows that the banking industry is more leveraged than non-financial firms. Median book leverage is 92.5% and median market leverage is 90.5% and in Gropp and Heider (2009) are respectively 92.6% and 87.3%, while in Frank and Goyal (2004), non-financial firms exhibit a median book leverage of 24% and a median market leverage of 23%.

In Appendix 2 we present the correlations among the variables. Bank size is inversely correlated with profit and positively correlated with leverage which seems to indicate that larger banks tend to have lower profits and more leverage. Banks with more profits have also less leverage. Rajan and Zingales (1995) show that, in all countries except in Germany, size is positively correlated with leverage and profitability

[29] Our definition of collateral for banks includes liquid securities that can be used as collateral when borrowing from central banks and is similar to that used by Gropp and Heider (2009).

is negatively correlated with leverage. Bank's market-to-book ratio correlates positively with asset risk and profits and negatively with leverage.

Banks with more asset risk have less leverage, since these two factors are strongly and negatively correlated. All these correlations match those obtained by Gropp and Heider (2009) and those typically found for non-financial firms, including in Frank and Goyal (2004) and Rajan and Zingales (1995).

In contrast to the typically expected for non-financial firms and particularly to what is presented by Frank and Goyal (2004), bank's collateral and leverage are negatively correlated, which is consistent with Gropp and Heider (2009). Also Rajan and Zingales (1995) assert that "*tangibility is always positively correlated with leverage in all countries (both for the book leverage and market leverage regressions)*".

Table 3 - Descriptive statistics

The sample consists of all the listed commercial banks and bank-holding companies, in the 27 countries of the European Union, from 1998 to 2011, with available data in the Bankscope database. Total book assets are in millions of euros. Market-to-book ratio is the ratio of market value of assets to book value of assets. Profits are the return on assets given by the EBIT over the book value of assets. Collateral is the total tangible assets as a percentage of the total book value of assets. Dividend payer is a dummy variable whose value is equal to 1 if a bank pays dividends, 0 otherwise. Asset risk is the annualised unlevered standard deviation of daily stock return. Book leverage ratio is equal to 1 minus book value of equity divided by the book value of assets. Market leverage ratio is equal to 1 minus market value of equity divided by market value of assets. Deposits (book) are the total deposits as a percentage of the total book value of assets. Non-deposits liabilities (book) is the book leverage ratio minus deposits (book). See Appendix I for further information about the variables.

	Mean	Median	Standard desviation	Maximum	Minimum	Gropp and Heider (2009, Table II)		Frank and Goyal (2004, Table 3)
						Median	Standard desviation	Median
Total book assets	133,460	8,592	332,847	2,586,701	42	14,900	126,000	-
Market-to-Book ratio	1.053	1.019	0.165	3.064	0.548	1.039	0.105	0.980
Profits	0.037	0.036	0.034	0.406	-0.436	0.049	0.019	0.120
Collateral	0.284	0.257	0.159	1.082	0.006	0.260	0.130	0.560
Dividend payer	0.814	1.000	0.389	1.000	0.000	1.000	0.231	0.000
Asset Risk	0.047	0.025	0.074	1.272	0.000	0.028	0.034	0.120
Book leverage ratio	0.895	0.925	0.111	1.045	0.046	0.927	0.029	0.240
Market leverage ratio	0.865	0.905	0.139	0.999	0.062	0.888	0.083	0.230
Deposits (book)	0.684	0.750	0.189	1.001	0.000	0.706	0.153	-
Non-deposits liabilities (book)	0.211	0.160	0.173	0.874	0.004	0.218	0.156	-

4.4. Financial Structure of Banks

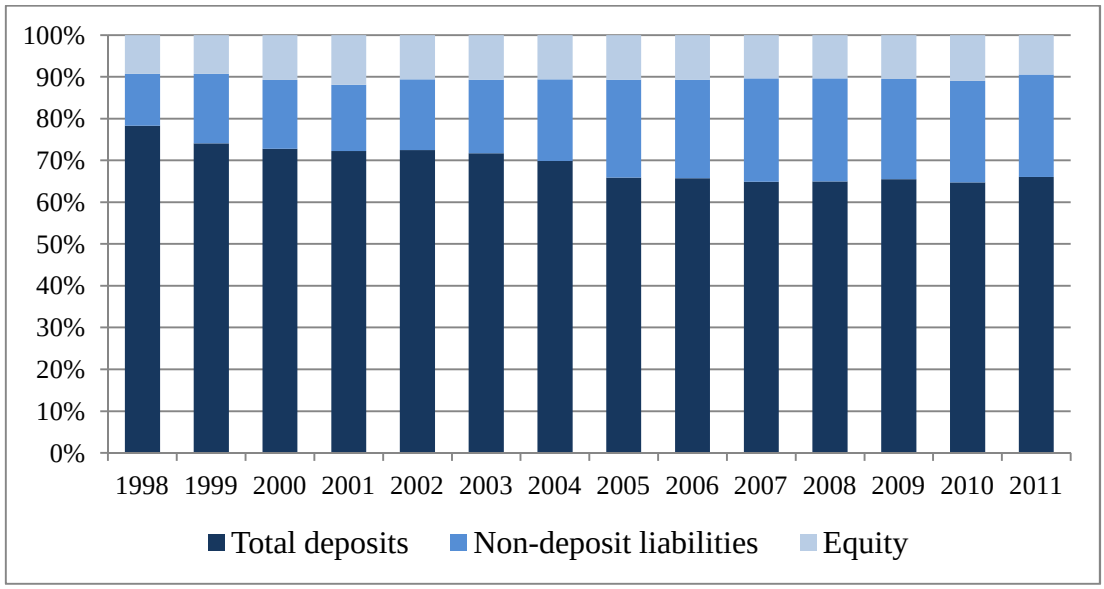
Capital structure of banks differs from the one of non-financial firms, essentially, because it includes deposits, a source of funding not available to non-financial firms. Looking at the balance statement of a bank, the assets are financing by equity and liabilities, and the latter are decomposed into deposits and non-deposits liabilities.

Graph 1 presents the evolution of the financial structure of the UE27 listed banks, over time. The ratio of equity to total assets increased from 9.29% in 1998 to 11% in 2010, and decreased to 9.44% in 2011. At the end of 2004, the ratio of equity to total assets was 10.58%. Therefore, it is not in the period in which both Basel II implementation and financial crisis take place that the equity increase is more notable.

The ratio of deposits to total asset decreases from 78.33% in 1998 to 64.73% in 2010, and increase to 66.05% in 2011. In 2006, before the beginning of the financial crisis, deposits represented 65.72% of banks total financial resources. Thus, during our sample period banks have substituted deposits for non-deposits liabilities, which is not consistent with the role of the banking regulation as a driver of deposits. Gropp and Heider (2009) pointed out that "*the shift away from deposits towards non-deposit liabilities as a source of financing further supports a much reduced role of regulation as a determinant of banks' capital structure*."

Graph 1 - Banks book financial structure over time

Total deposits are the total deposits as a percentage of the total book value of assets. Non-deposit liabilities are the book leverage ratio minus Total deposits. Equity is equal to 1 minus Total deposits and Non-deposit liabilities. See Appendix I for further information about the variables.



4.5. Methodology and Predictions

Although there are a number of studies that offer some insights into how firms choose their capital structure, it is recognized that there is still much work to be done in order to strengthen the relationship between theoretical predictions and empirical results. Thus, in order to test the determinants of the capital structure of the UE27 banks the following regression was estimated:

$$L_{ict} = \beta_0 + \beta_1 Ln(Size_{ict-1}) + \beta_2 Profit_{ict-1} + \beta_3 MtB_{ict-1} + \beta_4 Coll_{ict-1} + \beta_5 Div_{ict} + c_c + c_t + u_{ict} \quad (1)$$

The dependent variable leverage ratio (*L*) will be both the market leverage ratio and the book leverage ratio of bank *i*, in country *c* in year *t*. The explanatory variables are the natural logarithm of size (*Ln(Size)*), profitability (*Prof*), the market-to-book ratio (*MtB*), collateral (*Coll*), all lagged by one year, and a dummy for dividend payers (*Div*). Further ahead, we also add the risk (natural logarithm of asset risk, lagged one year) as explanatory variable, although its explanatory power has not been always consensual. The definition of all variables can be found in section 4.3 and Appendix 1.

The regression includes time and country fixed effects (c_t and c_c) to account for unobserved heterogeneity at the country level and across time that may be correlated with the explanatory variables. Standard errors are clustered at the bank level to account for heteroscedasticity and serial correlation of errors (Gropp and Heider, 2009).

Several alternative definitions of leverage have been used in the empirical research. Frank and Goyal (2004) consider five alternative definitions of leverage, although they focus more on the ratio of total debt to market value of assets (TDM). Gropp and Heider (2009) advance the following arguments in favor of using leverage (including non-debt liabilities) rather than debt as the dependent variable: 1) "*unlike debt, is well defined (see Welch, 2007)*"; and 2) "*Leverage is a structure that increases the sensitivity of equity to the underlying performance of the (financial) firm*". Here, we adopt the same approach as Gropp and Heider (2009). The difference between market leverage (one minus the market equity ratio) and book leverage (one minus the book equity ratio) is particularly relevant for banks, because the regulatory capital is set on book capital, therefore using book leverage as the dependent variable can be directly

related to the regulatory view of bank's capital structure. Later in this section we also report the results when using Tier 1 regulatory capital as alternative dependent variable.

As previously discussed, there are two different approaches on capital structure that are particularly prominent and under which the different theories can be grouped. They are the trade-off theories (tax based or agency costs based theories) and the asymmetric information theories (pecking order, signaling and market timing). Since these two perspectives are influential we will provide some discussion about which would be the probable patterns that might be expected underlying each theory.

On the other hand, the regulatory capital may be considered the main driver of banks capital structure. Although, this pure regulatory perspective does not appear to apply to our sample of banks since the estimated coefficients in the equation (1) are statistically significant (see Tables 6 and 7). This means that the standard determinants of capital structure have at least some explanatory power of the bank's capital structure decisions. Alternatively, Gropp and Heider (2009) suggest a *less stark view* of the impact of regulation in the banks' capital structure decisions, called buffers view. According to this view, banks might hold capital buffers, if they face higher costs of issuing equity at short notice, in order to avoid falling below the minimum capital requirement. "*It follows that banks facing higher cost of issuing equity should be less levered*" (Gropp and Heider, 2009).

Table 5 shows the predictions of each theory, concerning the relationship between leverage and each variable in analysis. Note that the regulatory view predictions were taken solely from Gropp and Heider (2009).

Table 5 – Theory predictions

Variable	Assymetric Information Models			Trade-off	Buffers View
	Pecking Order	Signaling	Market Timing		
Log(Size)				+	+/-
Market-to-Book Ratio		+	-	-	+
Profits	-			+	+
Collateral				+	
Dividends	+			-	+
Risk	+			-	-

Size

Since size is an inverse proxy for volatility and for the costs of bankruptcy (Frank and Goyal, 2004), trade-off theory predicts that larger and more mature firms use more debt. Therefore, size (calculated as the logarithm of total assets[30]) should have a positive impact on debt capacity. However, the size can also send information about the firm to the investors and increase their preference for equity relative to debt. In this case, signaling theory would entail a positive relationship between size and leverage.

Frank and Goyal (2004) pointed out that the pecking order predictions are unclear concerning the firm size impact on leverage. "*On the one hand, larger firms might have more assets in place and thus a greater damage is inflicted by adverse selection as in Myers and Majluf (1984). On the other hand, larger firms might have less asymmetric information and thus will suffer less damage by adverse selection as suggested by Fama and French (2002)*" (Frank and Goyal, 2004).

Buffers view suggests that the effect of bank size on the level of buffers is ambiguous ex-ante (Gropp and Heider, 2009). Larger banks may hold smaller buffers if they are better known by the market, but is also plausible that larger banks hold larger buffers if they are more complex and, therefore, asymmetric information became more relevant.

Market-to-book ratio

Following the trade-off theory, higher market-to-book ratio implies higher growth opportunities and thus higher costs of financial distress, therefore less debt is used. According to Myers (1977), highly levered companies are more likely to waste valuable future investment opportunities. Thus, firms expecting future growth opportunities ought to use a greater amount of equity finance.[31]

If the market-to-book ratio is high, then issuing equity seems attractive and thus leverage will decline, which is in line with the Market-timing prediction. This recent theory suggests that when the equity market is relatively favorable (for instance, if the market-to book-ratio is high), firms tend to issue more equity. Frank and Goyal (2004) assert that Market-timing theory "*makes correct predictions for the market-to-book* […]

[30] Alternatively, several studies compute size as the logarithm of net sales.

[31] We follow e.g. Rajan and Zingales (1995) that stated "*As suggested in Myers (1977), we use the ratio of the market value of assets to the book value of assets as a proxy for growth opportunities"*.

However, by itself market-timing does not make any predictions for many of the patterns in the data that are accounted for by the tradeoff theory. If market timing is to stand as an independent theory, then considerable theoretical development is needed."

One empirical implication of the Ross (1977) signaling theory is that in a cross-section the values of firms will rise with leverage, since increasing leverage increases the market's perception of value. Thus, it is expected a positive relationship between the variables leverage and market-to-book ratio.

According to buffers view, banks with higher market–to-book ratios are expected to hold smaller buffers of equity, and then are higher leveraged. Since they are better known by investors and have more financial slack, they are expected to face lower costs associated with having to issue equity at short notice. (Gropp and Heider, 2009).

Profitability

According to the trade-off theory higher profitability implies lower expected costs of financial distress. Hence, more profitable firms are expected to have more debt relative to assets. Furthermore, more profitable firms should carry more debt since they have more profits that need to be shielded from taxation.[32] Nevertheless, "*this prediction has often been criticized (see Myers, 1984; Titman and Wessels, 1988; and Fama and French, 2002).*" (Frank and Goyal, 2004)

Rajan and Zingales (1995) state that "*Jensen (1986) predicts a positive* [effect of profitability on leverage] *if the market for corporate control is effective and forces firms to commit to paying out cash by levering up. If it is ineffective, however, managers of profitable firms prefer to avoid the disciplinary role of debt, which would lead to a negative correlation between profitability and debt.*" From the lenders perspective, it is preferable financing firms with higher estimated future operational cash-flows.

According to the pecking order theory of Myers and Majluf (1984) firms will prefer to finance with internal funds rather than debt, which predicts a negative relationship between profitability and leverage.

[32] Frank and Goyal (2004) "*Higher profitability implies lower expected costs of financial distress and a greater desire for firms to shield profits from taxes, hence profitable firms are expected to have more debt relative to book assets. Predictions about how profitability affects market leverage ratios are unclear.*"

We conclude that theoretical predictions regarding the relationship between profitability and leverage are contradictory. While models based on the trade-off the tax benefits of debt and the costs of financial distress predict a positive and strong relationship between debt ratios and past profitability, pecking order models predict a strong negative relationship between debt ratios and past profitability.

Buffers view predicts a positive relationship between profitability and leverage based on the same explanation as given for the variable market-to-book ratio.

Collateral

If a large portion of a firm's assets are tangible, these can serve as collateral, reducing the risk of the lender experiencing agency costs of debt and, in the event of liquidation, these assets have more value. Therefore, the higher is the percentage of tangible assets on the balance sheet (tangible assets divided by total assets), the more lenders are willing to finance the firm. Thus, we can say that the trade-off theory predicts a positive relation between this factor and leverage. According to Frank and Goyal (2004) "*Advertising and R&D often represent discretionary future investment opportunities, which are more difficult than "hard" assets for outsiders to value. The costs of financial distress are higher if a firm has more of these types of investments.*"

Dividends

Within a trade-off perspective, Frank and Goyal (2004) give two possible explanations that support the idea that dividend paying firms would have less leverage. Firstly, they argue that dividend-paying firms have lower agency costs of equity and this allows firms to raise more equity. If so, then dividend payers should have less leverage. Secondly, they argue that perhaps dividend paying firms are those that generate more cash from operations relative to their investment opportunities, and so they pay out the difference. Such firms would be unlikely to raise more debt since that would incur the unnecessary transactions costs.

What Frank and Goyal (2004) consider "*worst*" in the pecking order theory is its incorrect prediction that dividend paying firms should have greater leverage. "*The dividend prediction stems from the fact that dividends require funds, and as discussed by Shyam-Sunder and Myers (1999), they are treated as exogenous within the pecking*

order." Since dividends are part of the firm's financing deficit (cash-out flow), it is expected that a dividend-payer firm use more debt, according to the order of preference of external sources of funds underlying the pecking order theory.

Regulatory view follows that dividend paying banks, can be expected to face lower costs of issuing equity because they either are better known to outsiders, have more financial slack or can obtain a better price. (Gropp and Heider, 2009) Therefore, dividend paying banks would be less leveraged.

Risk

Frank and Goyal (2004) state that "*firms with more volatile cash flows face higher expected costs of financial distress and should use less debt. More volatile cash flows also reduce the probability that tax shields will be fully utilized.*" This is consistent with the trade-off theory.

Not surprisingly, if buffers are an important determinant of banks' capital structure, we expect the level of banks' leverage to be negatively related to risk.

According to the pecking order, we can expect that firms with volatile stocks are firms whose perceptions are also quite volatile. It seems plausible that such firms suffer more from adverse selection and, therefore, have higher leverage.

4.6. Results

4.6.1. Market Leverage as Dependent Variable

Table 6 shows the results of the estimating regression (1) when the dependent variable is market leverage, and compares these with the results obtained by Gropp and Heider (2009), Frank and Goyal (2004), Rajan and Zingales (1995). Although, they use similar models and we think it is appropriate to make this comparison to support our results, we should pay attention to the differences among all these studies, such as in the sample characteristics and alternative leverage measures.

All estimated coefficients are statistically significant at 1% level, except on Dividend payer, which is significant at 5% or 10% level, depending on the sample period. R^2 varies between 65% e 71%, what indicates a well explanatory power of our model. Banks Market leverage is positively related with Log Size and negatively related

with Market-to-book ratio, Collateral and Dividend payer. The relation between leverage and profitability is unclear, because the estimated coefficient sign varies, depending on the sample period. When compared to the results found in Gropp and Heider (2009), Frank and Goyal (2004), Rajan and Zingales (1995), estimated coefficients on Log Size, Market-to-book ratio and Dividend payer have the same sign, while on Collateral has opposite sign and on Profits is ambiguous (depending on the sample period).

The negative sign of the coefficient on Profits in the period 2005-2011, in which the access to equity markets became tougher, is consistent with the pecking order theory prediction and follows Gropp and Heider (2009), Frank and Goyal (2004) and Rajan and Zingales (1995). If in the short run, dividends and investments are fixed, and if debt financing is the dominant mode of external financing, then changes in profitability will be negatively correlated with changes in leverage (Rajan and Zingales, 1995). In this period, the sign is also consist with the regulatory view predictions. In the period 1998-2004, the sign of the coefficient on Profits is consistent with the trade-off theory in the sense that more profitable firms hold more debt in order to shield such profits from taxation.

The negative sign of the coefficient on Collateral is the opposite of the results presented for the non-financial firms and the 200 large U.S. and European banks and do not confirm the positive relationship with leverage predicted by trade-off theory. A possible explanation is given by Rajan and Zingales (1995), by quoting Berger and Udell (1994) who show that firms with close relationships with creditors need to provide less collateral. The reason why they argue this is because the relationship (and more informed monitoring by creditors) substitutes for physical collateral.

The effect of Log Size, Market-to-book ratio, Profits (only in the period 1998-2004) and Dividend payer on bank leverage supports the trade-off theory. Pecking order only predicts the effect of Profits in the period 2005-2011. The buffers theory of excess capital seems to holds only for Log Size and Profits (only in the period 1998-2004).

Table 6 – Explanatory power of standard determinants of bank market leverage

The columns 1, 2 and 3 show the result of estimating the regression (1). The sample consists of all the listed commercial banks and bank-holding companies, in the 27 countries of the European Union, from 1998 to 2011, with available data in the Bankscope database. The dependent variable is market leverage. The regression includes time and country fixed effects. Standard errors are adjusted for clustering at the bank level. The column 4 reproduces estimates from Table V, column 1 of Gropp and Heider (2009). The column 5 reproduces estimates from Table 8, column 7 of Frank and Goyal (2004). The column 6 reproduces estimates from Table 9, panel B, first column of Rajan and Zingales (1995). Note that the definition of leverage differs across the papers and that Frank and Goyal (2004) and Rajan and Zingales (1995) do not use country or time fixed-effects. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level respectively. Size is defined as the total book assets in millions of euros. Market-to-book ratio is the ratio of market value of assets to book value of assets. Profits are the return on assets given by the EBIT over the book value of assets. Collateral is the total tangible assets as a percentage of the total book value of assets. Dividend payer is a dummy variable whose value is equal to 1 if a bank pays dividends, 0 otherwise. Market leverage ratio is equal to 1 minus market value of equity divided by market value of assets. See Appendix I for further information about the variables.

Dependent variable Market leverage	EU27 Banks 1998-2004	EU27 Banks 2005-2011	EU27 Banks 1998-2011	Gropp and Heider (2009) Table V, col. 1	Frank and Goyal (2004) Table 8, col. 7	Rajan and Zingales (1995) Table 9, Panel B (US)
Log(Size)	0.023 ***	0.027 ***	0.027 ***	0.006 ***	0.021 ***	0.03 ***
standard error	*(0.003)*	*(0.004)*	*(0.004)*	*(0,001)*	*(0,000)*	*(0,00)*
elasticity				*[0,007]*	*[0,082]*	
Market-to-Book Ratio	-0.463 ***	-0.267 ***	-0.335 ***	-0.560 ***	-0.022 ***	-0.08 ***
standard error	*(0.034)*	*(0.048)*	*(0.038)*	*(0,034)*	*(0,000)*	*(0,01)*
elasticity				*[-0,683]*	*[-0,170]*	
Profits	0.758 ***	-1.007 ***	0.025 ***	-0.298 ***	-0.104 ***	-0.60 ***
standard error	*(0.217)*	*(0.302)*	*(0.335)*	*(0,097)*	*(0,003)*	*(0,07)*
elasticity				*[-0,018]*	*[-0,008]*	
Collateral	-0.343 ***	-0.210 ***	-0.247 ***	0.020 *	0.175 ***	0.33 ***
standard error	*(0.104)*	*(0.051)*	*(0.057)*	*(0,012)*	*(0,004)*	*(0,03)*
elasticity				*[0,006]*	*[0,314]*	
Dividend payer	-0.028 *	-0.019 **	-0.017 **	-0.019 ***	-0.092 ***	
standard error	*(0.016)*	*(0.009)*	*(0.008)*	*(0,004)*	*(0,002)*	
elasticity				*[-0,020]*	*[-0,106]*	
Industry Leverage					0.618 ***	
standard error					*(0,007)*	
elasticity					*[0,529]*	
Constant	1.269 ***	1.026 ***	1.079 ***	1.360 ***	-0.037 ***	
standard error	*(0.044)*	*(0.075)*	*(0.063)*	*(0,039)*	*(0,004)*	
Number of observations	486	826	1,312	2,415	63,144	2,207
R^2	0.69	0.71	0.65	0.79	0.29	0.19
F-test (p-value)	0.00	0.00	0.00			

4.6.2. Book Leverage as Dependent Variable

In the case of banks the difference between market and book values is of central importance, since capital regulation is imposed on book but not on market values. Table 7 shows the results of the estimating regression (1) when dependent variable is book leverage[33], and compare these with the results obtained by Gropp and Heider (2009), Frank and Goyal (2004) and Rajan and Zingales (1995). When statistically different from zero, the estimated coefficients have quite similar signs to those observed when market leverage is the dependent variable. However, the coefficients on Market-to-book ratio in the periods 2005-2011 and 1998-2011, on Profits in the period 1998-2011 and Dividend payer in the periods 1998-2004 and 2005-2011 are not statistically significant, therefore no conclusions can be drawn in these particular cases. R^2 varies between 50% e 63%, and although quite satisfactory, indicates a weaker explanatory power than that obtained using market leverage.

Recalling the predictions of buffers view presented in Table 5, banks with higher market-to-book ratios, higher profits and that pay dividends should be more leveraged (hold less discretionary capital) because it is expected that they face lower costs of issuing new equity if they fall below the minimum regulatory capital. Therefore, such banks do not need to carry large capital buffers, instead they can be highly leveraged. Regardless of using either market or book leverage to estimate regression (1), the effect of these three explanatory variables indicate the opposite of the regulatory view prediction (only the sign of the estimated coefficient on Profits is in line with the buffers view in the period 1998-2004 for both market and book leverage; and in the periods 1998-2004 and 1998-2011 for market leverage). The effect of the bank Size on leverage is consistent with the predictions of both trade-off theory and regulatory view.

So, we do not find strong evidence that the sign and significance of the effect of most variables on bank leverage are consistent with the buffers view of banks' capital structure. On the contrary, the standard cross-sectional determinants of firms' capital structure seem to have stronger explanatory power of capital structure decisions of EU27 listed banks, either using market or book leverage. Together, these results may suggest that a pure regulatory view does not apply to banks' capital structure, in the same fashion as suggested in Gropp and Heider (2009).

[33] We report the results when using the Tier 1 regulatory capital ratio as the dependent variable later in this section.

Table 7 – Explanatory power of standard determinants of bank book leverage

The columns 1, 2 and 3 show the result of estimating the regression (1). The sample consists of all the listed commercial banks and bank-holding companies, in the 27 countries of the European Union, from 1998 to 2011, with available data in the Bankscope database. The dependent variable is book leverage. The regression includes time and country fixed effects. Standard errors are adjusted for clustering at the bank level. The column 4 reproduces estimates from Table VI, column 1 of Gropp and Heider (2009). The column 5 reproduces estimates from Table 9, column 7 of Frank and Goyal (2004). The column 6 reproduces estimates from Table 9, panel A, first column of Rajan and Zingales (1995). Note that the definition of leverage differs across the papers and that Frank and Goyal (2004) and Rajan and Zingales (1995) do not use country or time fixed-effects. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level respectively. Size is defined as the total book assets in millions of euros. Market-to-book ratio is the ratio of market value of assets to book value of assets. Profits are the return on assets given by the EBIT over the book value of assets. Collateral is the total tangible assets as a percentage of the total book value of assets. Dividend payer is a dummy variable whose value is equal to 1 if a bank pays dividends, 0 otherwise. Book leverage ratio is equal to 1 minus book value of equity divided by the book value of assets. See Appendix I for further information about the variables.

Dependent variable Book leverage	EU27 Banks 1998-2004	EU27 Banks 2005-2011	EU27 Banks 1998-2011	Gropp and Heider (2009) Table VI, col. 1	Frank and Goyal (2004) Table 9, col. 7	Rajan and Zingales (1995) Table 9, Panel A (US)
Log(Size)	0.022 ***	0.024 ***	0.025 ***	0.006 ***	0.013 ***	0.06 ***
standard error	*(0.003)*	*(0.005)*	*(0.004)*	*(0,001)*	*(0,001)*	*(0,01)*
elasticity				*[0,006]*	*[0,050]*	
Market-to-Book Ratio	-0.212 ***	-0.012	-0.066	-0.066 ***	-0.002 ***	-0.17 ***
standard error	*(0.071)*	*(0.061)*	*(0.05)*	*(0,016)*	*(0,001)*	*(0,01)*
elasticity				*[-0,076]*	*[-0,012]*	
Profits	0.434 *	-1.048 ***	-0.222	-0.210 ***	-0.214 ***	-0.41 ***
standard error	*(0.247)*	*(0.38)*	*(0.277)*	*(0,063)*	*(0,004)*	*(0,10)*
elasticity				*[-0,012]*	*[-0,013]*	
Collateral	-0.341 ***	-0.205 ***	-0.247 ***	0.032 ***	0.157 ***	0.50 ***
standard error	*(0.105)*	*(0.064)*	*(0.064)*	*(0,009)*	*(0,005)*	*(0,04)*
elasticity				*[0,009]*	*[0,270]*	
Dividend payer	-0.020	-0.016	-0.014 **	-0.009 ***	-0.078 ***	
standard error	*(0.015)*	*(0.01)*	*(0.007)*	*(0,003)*	*(0,086)*	
elasticity				*[-0,009]*	*[-0,009]*	
Industry Leverage					0.649 ***	
standard error					*(0,009)*	
elasticity					*[0,532]*	
Constant	1.046 ***	0.795 ***	0.839 ***	0.886 ***	0.038 ***	
standard error	*(0.065)*	*(0.085)*	*(0.057)*	*(0,022)*	*(0,005)*	
Number of observations	486	826	1,312	2,415	64,057	2,079
R^2	0.63	0.55	0.50	0.54	0.16	0.21
F-test (p-value)	0.00	0.00	0.00			

4.6.3. Controlling for Asset Risk

Corporate finance theory comprises diverse predictions about the effect of risk on the capital structure decisions. While pecking order theory supports a positive relationship between risk and leverage, trade-off and signaling theories and buffers view drive a negative relationship between these two variables. However, Gropp and Heider (2009) suggest that the negative effect of risk on leverage is in line with standard corporate finance arguments. In order to test if risk holds in our sample, we add to the equation (1) the natural logarithm of Assets risk (Risk), lagged by one year, as explanatory variable. We obtain the equation (2). The results are shown in Table 8, using either market leverage or book leverage as dependent variable, and are confronted with those obtained by Gropp and Heider (2009) for the same empirical specification.

$$L_{ict} = \beta_0 + \beta_1 Ln(Size_{ict-1}) + \beta_2 Profit_{ict-1} + \beta_3 MtB_{ict-1} + \beta_4 Coll_{ict-1} + \beta_5 Div_{ict} + \beta_6 Ln(Risk_{ict-1}) + c_c + c_t + u_{ict} \quad (2)$$

Gropp and Heider (2009) wanted to examine if regulation in its pure form, which constitutes an overriding departure from the Modigliani and Miller irrelevance proposition, could force riskier banks to hold more book equity. If so, omitting risk from the equation would result in spurious significance of the remaining variables. Our results show that, although estimated coefficient on risk is always significant at the 1% level (except on book leverage 1998-2004 that is 5%), it does not exclude the remaining variables that keep its significance almost unchanged. When market leverage is the dependent variable, only the coefficients on profit (period 1998-2011) and on Dividend payer (periods 1998-2004 and 2005-2011) are no longer statistically significant. Comparing to the results of Table 7, estimated coefficients on Market-to-book ratio (1998-2004) and Profits (1998-2004) lose their statistical significance when using book leverage ratio. This result also indicates that our model fits better when dependent variable is market leverage.

Introducing risk, R^2 slightly increase (lies between 72% and 76% when using market leverage and between 56% and 65% when using book leverage). Risk has a negative effect on bank leverage, measured either in market or book values, in every

tested period, what is consistent with the regulatory view.[34] Although, Gropp and Heider (2009) refer two studies where is suggested that regulation itself does not explain the negative relationship between risk and leverage.[35] Frank and Goyal (2004) stated that "*firms with more volatile cash flows face higher expected costs of financial distress and should use less debt. More volatile cash flows also reduce the probability that tax shields will be fully utilized.*" This is also consistent with the trade-off view.

[34] It is important to note that during our sample period, different regulation was in place (Basel I until 2004 and Basel II 2005 onwards) and a financial crisis onset in mid 2007.

[35] "*For example, Flannery and Rangan (2008) conclude that regulatory pressures cannot explain the relationship between risk and capital in the US during the 1990s. Calomiris and Wilson (2004) find a negative relationship between risk and leverage using a sample of large publicly traded US banks in the 1920s and 1930s when there was no capital regulation."* (Gropp and Heider, 2009)

Table 8 – Explanatory power of standard determinants of bank market and book leverage after controlling for asset risk

The columns 1, 2, 3, 5, 6 and 7 show the result of estimating the regression (2). The sample consists of all the listed commercial banks and bank-holding companies, in the 27 countries of the European Union, from 1998 to 2011, with available data in the Bankscope database. The dependent variable is market leverage on columns 1, 2 and 3 and is book leverage on columns 5, 6 and 7. The regression includes time and country fixed effects. Standard errors are adjusted for clustering at the bank level. The column 4 reproduces estimates from Table VII, column 1 of Gropp and Heider (2009) and the column 8 reproduces estimates from Table VII, column 3 of Gropp and Heider (2009). Note that Gropp and Heider (2009) also use country and time fixed-effects. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level respectively. Size is defined as the total book assets in millions of euros. Market-to-book ratio is the ratio of market value of assets to book value of assets. Profits are the return on assets given by the EBIT over the book value of assets. Collateral is the total tangible assets as a percentage of the total book value of assets. Dividend payer is a dummy variable whose value is equal to 1 if a bank pays dividends, 0 otherwise. Asset risk is the annualised unlevered standard deviation of daily stock return. Book leverage ratio is equal to 1 minus book value of equity divided by the book value of assets. Market leverage ratio is equal to 1 minus market value of equity divided by market value of assets. See Appendix I for further information about the variables.

	Market leverage				Book leverage			
	EU27 Banks			Gropp and Heider (2009) Table VII, col. 1	EU27 Banks			Gropp and Heider (2009) Table VII, col. 3
	1998-2004	2005-2011	1998-2011		1998-2004	2005-2011	1998-2011	
Log(Size)	0.018 ***	0.019 ***	0.019 ***	0.005 ***	0.019 ***	0.018 ***	0.020 ***	0.006 ***
standard error	*(0.003)*	*(0.004)*	*(0.003)*	*(0,001)*	*(0.003)*	*(0.004)*	*(0.003)*	*(0,001)*
elasticity				*[0,105]*				*[0,102]*
Market-to-Book Ratio	-0.328 ***	-0.196 ***	-0.223 ***	-0.472 ***	-0.128	0.049	0.021	-0.020
standard error	*(0.057)*	*(0.049)*	*(0.042)*	*(0,036)*	*(0.081)*	*(0.073)*	*(0.059)*	*(0,015)*
elasticity				*[-0,576]*				*[-0,023]*
Profits	0.525 ***	-0.864 ***	-0.032	-0.262 ***	0.288	-0.979 ***	-0.280	-0.192 ***
standard error	*(0.196)*	*(0.243)*	*(0.251)*	*(0,087)*	*(0.229)*	*(0.341)*	*(0.216)*	*(0,058)*
elasticity				*[-0,015]*				*[-0,011]*
Collateral	-0.284 ***	-0.165 ***	-0.198 ***	0.020 **	-0.305 ***	-0.173 ***	-0.212 ***	0.032 ***
standard error	*(0.094)*	*(0.044)*	*(0.049)*	*(0,010)*	*(0.095)*	*(0.059)*	*(0.058)*	*(0,008)*
elasticity				*[0,006]*				*[0,009]*
Dividend payer	-0.023	-0.010	-0.014 **	-0.019 ***	-0.017	-0.009	-0.011 **	-0.009 ***
standard error	*(0.014)*	*(0.007)*	*(0.006)*	*(0,004)*	*(0.015)*	*(0.009)*	*(0.006)*	*(0,003)*
elasticity				*[-0,021]*				*[-0,009]*
Log(Asset risk)	-0.042 ***	-0.042 ***	-0.047 ***	-0.024 ***	-0.026 **	-0.032 ***	-0.035 ***	-0.013 ***
standard error	*(0.01)*	*(0.011)*	*(0.009)*	*(0,004)*	*(0.011)*	*(0.011)*	*(0.01)*	*(0,002)*
elasticity				*[-0,028]*				*[-0,014]*
Constant	0.960 ***	0.826 ***	0.810 ***	1.195 ***	0.853 ***	0.636 ***	0.635 ***	0.799 ***
standard error	*(0.098)*	*(0.088)*	*(0.084)*	*(0,047)*	*(0.108)*	*(0.114)*	*(0.088)*	*(0,022)*
Number of observations	486	824	1,310	2,415	486	824	1,310	2,415
R^2	0.73	0.76	0.72	0.80	0.65	0.61	0.56	0.58
F-test (p-value)	0.00	0.00	0.00		0.00	0.00	0.00	

4.6.4. Introducing Leverage as Lagged Dependent Variable

Now, we introduce dynamics in the model by adding the lagged dependent variable ($L_{\text{ict-1}}$) on the right side of the regression (2) as explanatory variable. Given the continuity of many time series processes, it could be particularly interesting to test if its value in a given year is influenced by its value in the previous year. Consider the following equation.

$$L_{ict} = \alpha + \beta_1 Ln(Size_{ict-1}) + \beta_2 Profit_{ict-1} + \beta_3 MtB_{ict-1} + \beta_4 Coll_{ict-1} + \beta_5 Div_{ict} + \beta_6 Ln(Risk_{ict-1}) + \delta L_{ict-1} + c_c + c_t + u_{ict} \quad (3)$$

It is possible rewritten the equation (3) considering that $\mathbf{X}_{\text{ict-1}}$ collects the bank level variables (Log Size, Market-to-book ratio, Profits, Collateral, Dividend payer and Asset Risk) and **B** collects the beta coefficients.

$$L_{ict} = \alpha + \boldsymbol{BX}_{ict-1} + \delta L_{ict-1} + c_c + c_t + u_{ict} \quad (4)$$

According to equation (4) it can be seen that two factors are responsible for the variation of L_{ict} over time, the direct effect of the variation in X, called short-run effect and the continuous variation of the short-run relationship, called long-run effect. This long-run effect by each variable is given by the factor B/(1 – δ), which provides the effect of one-unit change in equilibrium X on equilibrium L_{ict}.

The results of the model estimation are shown in Table 9. R^2 lies between 90% and 97%. Lagged variable estimated coefficient in the period 1998-2004 is not statistically significant, either for market or book leverage, which might seem that the adjustment occurs entirely in the short run (lag of one year), due to the variation in X.

On the contrary, in the period 2005-2011, the coefficient sign of the lagged variable, is statistically significant at 1% level and positive (respectively 0.451 and 0.410, for market and book leverage), what means that the variation of the 6 explanatory variables lasts in time. Bring it together with the fact that these variables are no longer statistically significant, it suggest that from 2005 onwards capital structure of banks

takes longer time to adapt to changes in these standard cross-sectional determinants. Thus, changes to the banks' capital structure carry out slower.

This can eventually be explained by the remarkable changes in those variables that do not allow the immediate adjustment of bank's capital structure. The introduction of Basel II in 2005, that define tighter rules concerning the bank capital ratios, and the financial crisis that began in mid 2007, may help to explain these results, since both changes required from banks a great and protracted capital adjustment.

Table 9 – Including lagged dependent variable as explanatory variable

The columns 1, 2 and 3show the results of estimating the regression (4) when the dependent variable is market leverage. The columns 4, 5 and 6 show the results of estimating the regression (4) when the dependent variable is book leverage. The sample consists of all the listed commercial banks and bank-holding companies, in the 27 countries of the European Union, from 1998 to 2011, with available data in the Bankscope database. The regression includes time and country fixed effects. Standard errors are adjusted for clustering at the bank level. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level respectively. Size is defined as the total book assets in millions of euros. Market-to-book ratio is the ratio of market value of assets to book value of assets. Profits are the return on assets given by the EBIT over the book value of assets. Collateral is the total tangible assets as a percentage of the total book value of assets. Dividend payer is a dummy variable whose value is equal to 1 if a bank pays dividends, 0 otherwise. Asset risk is the annualised unlevered standard deviation of daily stock return. Book leverage ratio is equal to 1 minus book value of equity divided by the book value of assets. Market leverage ratio is equal to 1 minus market value of equity divided by market value of assets. See Appendix I for further information about the variables.

Dependent variable	Market leverage			Book leverage		
	1998-2004	2005-2011	1998-2011	1998-2004	2005-2011	1998-2011
Log(Size)	0.030 **	0.051 ***	0.036 ***	0.026 **	0.011	0.010
standard error	*0.013*	*0.020*	*0.012*	*0.011*	*0.010*	*0.011*
Market-to-Book Ratio	-0.226 ***	0.011	-0.114	-0.041 *	-0.021	-0.048 *
standard error	*0.046*	*0.052*	*0.079*	*0.024*	*0.019*	*0.028*
Profits	0.283 ***	-0.128	0.131	0.079 *	-0.164	0.053
standard error	*0.108*	*0.187*	*0.117*	*0.043*	*0.106*	*0.093*
Collateral	0.048	-0.103 **	-0.036	0.050	-0.079	-0.035
standard error	*0.039*	*0.046*	*0.037*	*0.033*	*0.049*	*0.036*
Dividend payer	-0.031 ***	0.008	0.002	-0.018 ***	0.011	0.003
standard error	*0.012*	*0.007*	*0.006*	*0.007*	*0.007*	*0.005*
Log(Asset risk)	-0.018 ***	-0.002	-0.008 **	-0.004	-0.003	-0.001
standard error	*0.006*	*0.003*	*0.004*	*0.003*	*0.002*	*0.001*
Market Leverage (t-1)	-0.122	0.451 ***	0.313 *			
standard error	*0.104*	*0.109*	*0.169*			
Book Leverage (t-1)				-0.048	0.410 ***	0.421 **
standard error				*0.105*	*0.145*	*0.191*
Constant	0.881 ***	0.010	0.361	0.739 ***	0.460 ***	0.475 **
standard error	*0.130*	*0.219*	*0.254*	*0.127*	*0.135*	*0.198*
Number of observations	500	841	1,341	500	841	1,341
R^2	0.93	0.92	0.90	0.97	0.94	0.92
F-test (p-value)	0.00	0.00	0.00	0.00	0.00	0.00

4.6.5. Regulatory Capital as Dependent Variable

Finally and following Gropp and Heider (2009), we are going to test the capital Tier 1 ratio as an alternative dependent variable. The Tier 1 capital ratio has risk-weighted assets in the denominator, so it is different from the book equity to book assets ratio used before to compute the book leverage ratio. This alternative analysis tests in what extent the standard determinants of capital structure decisions still have explanatory power when the dependent variable is a capital ratio set by regulators.

Looking at our sample, we conclude that there is no wide variation in tier 1 capital ratio across banks and time, and banks hold discretionary capital quite above the minimum of 4% required under Basel I and Basel II (see the distribution of Tier 1 capital ratio in Appendix 3).

Rewriting the Equation (2) using the alternative dependent variable Tier 1 capital ratio (E), we obtain the Equation (5).

$$E_{ict} = \beta_0 + \beta_1 Ln(Size_{ict-1}) + \beta_2 Profit_{ict-1} + \beta_3 MtB_{ict-1} + \beta_4 Coll_{ict-1} + \beta_5 Div_{ict} + \beta_6 Ln(Risk_{ict-1}) + c_c + c_t + u_{ict} \quad (5)$$

The results are shown in Table 9. R^2 lies between 30% and 38%, that is quite bellow the values obtained when estimating equation (2). Market-to-book ratio and Dividend payer estimated coefficients are no more statistically significant for any period of our sample, in line with the results of Gropp and Heider (2009). Whenever a coefficient is significant, the effect is consistent with the results obtained in the equation (2), when book leverage ratio is the dependent variable. Thus, it confirms our initial results that recognized some ability to standard determinants of non-financial firms to explain the capital structure decisions of EU27 banks, during our sample period.[36]

The estimated coefficient on asset risk is statistically close to zero in the period 1998-2004, but becomes significant at the 1% level in the period 2005-2011. A plausible reason to this happening can be the capital requirements generally risk insensitive, until 2004 under Basel I (the relevant regulation during the period 1998-2004). From 2005 onwards, with the Basel II introduction, riskier banks can be formally required to hold more capital. This evidence is in favor of the regulation as a determinant of bank's capital structure. However, Gropp and Heider

[36] Gropp and Heider (2009) carry out a deeply analysis of the effect of regulation by examining the situation of banks that are close to violating their capital requirement.

(2009) refer complementary evidence, in the literature, which suggest that regulatory pressures cannot explain the relationship between risk and capital.

Table 10 – Explanatory power of standard determinants of bank leverage using regulatory capital as the dependent variable

The columns 1, 2, 3 show the result of estimating the regression (2). The sample consists of all the listed commercial banks and bank-holding companies, in the 27 countries of the European Union, from 1998 to 2011, with available data in the Bankscope database. The dependent variable is Tier 1 capital ratio.. The regression includes time and country fixed effects. Standard errors are adjusted for clustering at the bank level. The column 4 reproduces estimates from Table XII, column 1 of Gropp and Heider (2009. Note that Gropp and Heider (2009) also use country and time fixed-effects. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level respectively. Size is defined as the total book assets in millions of euros. Market-to-book ratio is the ratio of market value of assets to book value of assets. Profits are the return on assets given by the EBIT over the book value of assets. Collateral is the total tangible assets as a percentage of the total book value of assets. Dividend payer is a dummy variable whose value is equal to 1 if a bank pays dividends, 0 otherwise. Asset risk is the annualised unlevered standard deviation of daily stock return. Tier 1 capital ratio as defined by the Basel Committee. See Appendix I for further information about the variables.

Dependent variable Tier 1 capital ratio	EU27 Banks			Gropp and Heider (2009) Table XII, col. 1
	1998-2004	2005-2011	1998-2011	
Log(Size)	-0.011 ***	-0.008 ***	-0.010 ***	-0.009 ***
standard error	*(0.002)*	*(0.002)*	*(0.003)*	*(0,001)*
elasticity				
Market-to-Book Ratio	-0.076	0.021	0.002	-0.019
standard error	*(0.049)*	*(0.04)*	*(0.025)*	*(0,020)*
elasticity				
Profits	0.465	0.717 ***	0.626 ***	0.423 ***
standard error	*(0.419)*	*(0.203)*	*(0.174)*	*(0,090)*
elasticity				
Collateral	0.141 ***	0.067 **	0.092 ***	0.097 ***
standard error	*(0.024)*	*(0.031)*	*(0.025)*	*(0,012)*
elasticity				
Dividend payer	-0.005	-0.013	-0.008	0.004
standard error	*(0.014)*	*(0.008)*	*(0.006)*	*(0,004)*
elasticity				
Log(Asset risk)	0.012	0.017 ***	0.011	0.010 ***
standard error	*(0.009)*	*(0.006)*	*(0.004)*	*(0,002)*
elasticity				
Constant	0.278 ***	0.194 ***	0.193 ***	0.265 ***
standard error	*(0.092)*	*(0.045)*	*(0.039)*	*(0,028)*
Number of observations	387	713	1,031	2,007
R^2	0.30	0.38	0.36	0.51
F-test (p-value)	0.00	0.00	0.00	

Chapter 5 - Conclusions

Despite the abundant research that has been produced on the firm's capital structure, a theory based on robust empirical support and widely accepted among academics and real world firms has not yet been reached. The optimal capital mix still remains a puzzle (Frank and Goyal, 2004; Marques and Santos, 2003; Myers, 1984).

Furthermore, such considerable research excludes or gives little attention to banks[37] (and financial institutions in general). Thus, there is still room for empirical validation of various theoretical prepositions applying to capital structure decisions of banks. This dissertation, although not absent of limitations and shortcomings, aims to be a modest contribution to fill this gap.

We explored whether the standard determinants of capital structure are significant factors in determining the level of bank leverage in the EU27 countries, using a sample of 145 listed commercial banks and bank-holding companies from 25 countries, from 1998 to 2011. We used a number of standard factors, proposed by previous empirical research, that are related to the capital structure decisions (Size, Profit, Market-to-book Ratio, Collateral, Dividend, Asset Risk) to test if they still hold for our sample of EU27 banks.

The evidence in this empirical study suggests that larger banks, banks with lower market-to-book ratio or non-dividend paying banks have higher leverage, confirming the previous empirical evidence.[38]

The relationship between leverage and profitability is unclear, because the effect of profits over the banks' leverage varies depending on the period analysed. During the period between 2005 and 2011, in which the access to capital markets became tougher, banks with higher profits hold less debt, what is consistent with the pecking order theory prediction and follow the prior empirical findings. During the period between 1998 and 2004, the positive relation between banks' profitability and leverage is consistent with the trade-off theory in the sense that more profitable firms hold more debt in order to shield such profits from taxation.

[37] More recently, to the best of our knowledge, Hasan (1997), Santos (2003), Marques and Santos (2003), Gropp and Heider (2009).

[38] Gropp and Heider (2009), Frank and Goyal (2004), Rajan and Zingales (1995).

What is striking is the negative relationship established in this study between the ratio of assets eligible as collateral and the leverage (measured by the market leverage ratio), which contradicts all the theoretical predictions and empirical facts. Our findings are the opposite of the results presented for both non-financial firms and large U.S. and European banks and do not confirm the positive relationship predicted by the trade-off theory. In fact, firms holding more collateral should be likely to have more leverage, since the collateral might be given as guarantee to the creditors. The only possible explanation we can see to support our results is that creditors would substitute collateral for monitoring actions on banks activity, when have a closer and trusty relationship with them. Further investigation is needed to clarify this point.

The buffers theory of excess capital holds only for the relationship between leverage and banks' size and profits (the latter only in the period 1998-2004). Banks with higher profits can be expected to face lower costs of issuing equity, if need it, because they should be better known in the market (lower asymmetric information) and should have more financial slack, so they do not need to hold relevant capital buffers (capital above the regulatory minimum). Regarding the predicted effect of the bank size on leverage, our findings also confirm that larger banks may hold smaller buffers because they are better known in the market.

Since capital regulation is imposed on book values, for banks the difference between market leverage ratio (calculated using the market value of equity) and book leverage ratio (calculated using the book value of equity) is of central importance. When we use the book leverage ratio, some of the 5 corporate standard determinants of capital structure lose their explanatory power, but whenever they remain relevant they confirm the findings established for market leverage. This result indicates that our model fits better for market leverage.

According to the buffers view, banks with higher market-to-book ratios, higher profits and that pay dividends do not need to carry large capital buffers and so they can be higher leveraged. Nevertheless, the results of our model do not confirm these predictions, excepting for the relationship between profits and leverage from 1998 to 2004. Instead, standard cross-sectional determinants of firms' capital structure seem to have stronger explanatory power of capital structure decisions of EU27 listed banks, either using market or book leverage. These results suggest that a pure regulatory view

does not apply to banks' capital structure, in the same fashion as suggested in Gropp and Heider (2009). Even when we test the capital Tier 1 ratio as an alternative dependent variable, after controlling for Asset risk, the results still suggest that regulation and capital buffers are not the main factor influencing the choice of capital structure by banks.

In order to test the effect of the level of risk on the capital structure decisions, a proxy for risk was added to the model as explanatory variable of the leverage ratio[39]. Our results show a significant relationship between risk and leverage, although it does not exclude the remaining factors that keep their importance almost unchanged. Risk has a negative effect on leverage (measured either in market or book values), what is consistent with both the trade-off theory and buffers view. For instances, regulators should impose higher levels of capital on banks with riskier assets, in other to deleverage their balance sheet, banks with riskier cash flows face higher expected costs of financial distress and thus should use less debt and more volatile cash flows diminish the probability that tax shields will be fully used.

Moreover, the results suggest that, from 2005 onwards, the effect of the standard cross-sectional determinants of banks leverage lasts in time. Thus, the capital structure of banks takes longer time to adapt to changes in these variables. The introduction of Basel II in 2005, that defines tighter rules concerning the bank capital ratios, and the financial crisis that began in mid-2007, may help to explain these results, since both changes required a great and protracted capital adjustment by banks.

In sum, our results seem to indicate that, in some extent, standard cross-sectional determinants of non-financial firms' capital structure also apply to EU27 listed banks. However, the result holds better for market leverage ratio than for book leverage ratio. In contrast, our results offer weak support to the capital regulation as an important driver of banks' capital structure decisions, i.e., the specific regulation faced by banks related to their capital appears to have little impact on banks' capital structure changes.

[39]According to Gropp and Heider (2009), when the objective is to examine whether regulation in its pure form could force riskier banks to hold more book equity, omitting risk from the equation would result in spurious significance of the remaining variables.

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Appendixes

Appendix 1 – Variables definition and source

Appendix 2 – Correlations matrix

Appendix 3 – Distribution of Tier 1 Capital Ratio

Appendix 1 – Variables definition and source

Variables	Definition	Bankscope/Datastream fields
Book Leverage Ratio	1- (book value of equity / book value of assets)	Equity (eur million) Total Assets (eur million)
Market Leverage Ratio	1- (market value of equity (=number of shares * end of year stock price) / market value of bank (=market value of equity + book value of liabilities)) *Total Book Value Liabilities = Total Assets - Equity*	Equity (eur million) Total Assets (eur million) Number of shares End of year stock price
Size	Total book value of assets	Total Assets (eur million)
Market-to-Book Ratio	Market value of assets / Book value of assets *Market value of assets = Market value of bank*	Equity (eur million) Total Assets (eur million) Number of shares End of year stock price
Profits	EBIT / book value of assets *EBIT = (pre-tax profit + interest expenses)*	Profit before Tax (eur million) Interest expenses (eur million) Total Assets (eur million)
Collateral	(Total securities + Cash and due from + Other tangible assets) / Book value of assets	Total Securities Cash and Due From Banks Fixed Assets
Dividend dummy	1 if the bank pays a dividend in a given year, 0 otherwise	Cash Dividend Paid (eur million)

Variables	Definition	Bankscope/Datastream fields
Asset risk	Annualised standard deviation of daily stock price returns * (market value of equity / market value of bank)	Daily adjusted price Equity (eur million) Total Assets (eur million) Number of shares End of year stock price
Deposits (Book)	Total deposits / Book value of assets	Total Deposits, Money Market and Short-term Funding (eur million) Total Assets (eur million)
Non-deposit liabilities (Book)	Book leverage – Deposits (Book)	(see above)

Appendix 2 – Correlations matrix

The sample consists of all the listed commercial banks and bank-holding companies, in the 27 countries of the European Union, from 1998 to 2011, with available data in the Bankscope database. Total book assets are in millions of euros. Market-to-book ratio is the ratio of market value of assets to book value of assets. Profits are the return on assets given by the EBIT over the book value of assets. Collateral is the total tangible assets as a percentage of the total book value of assets. Dividend payer is a dummy variable whose value is equal to 1 if a bank pays dividends, 0 otherwise. Asset risk is the annualised unlevered standard deviation of daily stock return. Book leverage ratio is equal to 1 minus book value of equity divided by the book value of assets. Market leverage ratio is equal to 1 minus market value of equity divided by market value of assets. Deposits (book) are the total deposits as a percentage of the total book value of assets. Non-deposits liabilities (book) is the book leverage ratio minus deposits (book). See Appendix I for further information about the variables.

	Total book assets	Market-to-Book Ratio	Profits	Collateral	Dividend payer	Asset Risk	Book leverage ratio	Market leverage ratio	Deposits (book)	Non-deposits liabilities (book)
Total book assets	1.000									
Market-to-Book ratio	-0.100	1.000								
Profits	-0.097	0.381	1.000							
Collateral	0.249	0.059	0.013	1.000						
Dividend payer	0.097	-0.014	0.127	0.059	1.000					
Asset Risk	-0.153	0.669	0.252	0.305	-0.064	1.000				
Book leverage ratio	0.193	-0.145	-0.151	-0.493	-0.052	-0.629	1.000			
Market leverage ratio	0.222	-0.565	-0.272	-0.414	-0.059	-0.785	0.854	1.000		
Deposits (book)	-0.272	-0.092	-0.033	-0.353	-0.089	-0.278	0.426	0.308	1.000	
Non-deposits liabilities (book)	0.427	-0.040	-0.061	0.121	0.073	-0.113	0.178	0.195	-0.815	1.000

Appendix 3 – Distribution of Tier 1 Capital Ratio

The chart shows the distribution of banks' regulatory Tier 1 capital ratio (equity over risk weighted assets as defined in the basel regulatory framework) for 1,114 bank-year observations in our sample of all the listed commercial banks and bank-holding companies, in the 27 countries of the European Union, from 1998 to 2011, with available data in the Bankscope database.