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The Determinants of Portuguese Banks' Capital Structure

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Master in Economics

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Resumo

Esta dissertação analisa os determinantes de capital dos bancos portugueses tendo como base a teoria existente para os determinantes das empresas não-financeiras, pretendendo-se confirmar a validade desta teoria em Portugal. Este estudo utiliza dados em painel de 21 bancos no período de 1990 a 2018 (386 observações). Para testar esta teoria, estimou-se um modelo de efeitos fixos e um modelo de efeitos fixos com termo de erro AR (1), com o rácio da Dívida sobre os Ativos como variável dependente. As variáveis independentes utilizadas são a Rentabilidade, Dimensão, Colateral, Ativos Tangíveis, Depósitos, taxa de crescimento do PIB, taxa de Juro e taxa de Inflação. Na estimação por efeitos fixos, a única variável que não tem significância é o Colateral, com a estimação por efeitos fixos com termo de erro AR (1) a produzir resultados sem significância para a variável Colateral, Depósitos e as variáveis macroeconómicas. Os resultados indicam que a teoria das empresas também se verifica nos bancos portugueses, comprovando que a regulação não é o único fator que determina o seu nível de capital. Adicionalmente, estimou-se um modelo de efeitos fixos com uma variável *dummy* que assume o valor 1 no período de 2008-2013 e um modelo dinâmico com a variável dependente desfasada, onde se concluiu que o rácio de dívida apresenta persistência e que os bancos aumentaram os seus rácios de capital no período de crise para se protegerem da incerteza económica.

Abstract

This dissertation examines the capital determinants of Portuguese banks, based on the existing theory for the determinants of non-financial firms, aiming to confirm the effectiveness of this theory in Portugal. This study uses Panel Data of 21 banks from 1990 to 2018 (386 observations). To check this theory, a fixed effects model and a fixed effects model with AR (1) disturbance were estimated with Debt-to-Assets ratio as the dependent variable. The independent variables used were Profitability, Size, Collateral, Tangible Assets, Deposits, GDP growth rate, Interest Rate and Inflation Rate. In the estimation by fixed effects, the only variable that has no significance is Collateral, with the estimation by fixed effects with AR (1) disturbance generating results without significance for Collateral, Deposits and the macroeconomic variables. These results indicate that the non-financial firms' capital theory is also evident in Portuguese banks, proving that regulation is not the only factor that determines their level of capital. In addition, a fixed effects model was estimated with a dummy variable that assumes the value of 1 between 2008-2013 and a dynamic model with the lagged dependent variable, which indicates that the debt ratio is persistent, and banks increased their capital ratios during the crisis to protect themselves against the economic uncertainty.

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1. Introduction

Since the financial crisis of 2007, capital has been a common topic for both bankers and policymakers. Banks have the possibility to finance themselves in two ways, either through external funds or through equity capital. Policymakers, on the other hand, see capital as a way of assessing the bank's reaction towards a negative scenario in the economy. Since banks receive deposits, grant credit and have a big role in the functioning of the economy, capital is seen as a cushion against banks possible losses (European Central Bank, 2019).

Much has been said about what are the reasons behind the level of capital of banks. The economic crisis of 2007 has brought a strong supervision by banks authorities, that enforce a certain level of capital based on the banks activity and the risk they take, which in this case can be seen as a legal and institutional factor. Nevertheless, banks are still firms, in the sense that they are free to balance their levels of debt and equity in the way that suits them best, if they respect the mandatory capital requirements. So, besides the legal standpoint, banks, much like non-financial firms, have to decide what is their ideal balance between debt and equity in order to maximize their value and increase their profitability.

The capital determinants' theory started in the non-financial firm's side, with Modigliani and Miller (1958) capital irrelevance theorem despising any attempt to see the decision on capital as important, since it would not affect the value of the firm. This theory is often cited as the inspiration for several following theories that tried to understand how firms manage their level of debt and equity, such as, e.g. the Trade-off theory, the Pecking order theory and the Market Timing theory. Although banks have capital structures different from non-financial firms, given their highly leveraged structure (Berlin, 2011), the theory of non-financial firms has been also applied to banks' capital structure determinants.

A diverse number of empirical studies have been carried out to test the significance of the variables indicated in the non-financial firms' theory on banks debt ratios, using variables such as the size of the bank, its level of profitability, collateral, etc. These studies concluded that there is indeed a link between the determinants of non-financial firms and banks, and regulation is not the only explanation on banks' capital decisions (e.g. Gropp and Heider, 2010; Teixeira et al, 2014).

This conclusion guides the general objective of this dissertation, which is to understand the determinants of Portuguese banks' capital structure and see if the dominant theory of non-financial firms also applies to Portuguese banks' reality. Given the inexistence of recent studies on this topic, there's an opportunity in this dissertation to address this issue and test the theory in Portugal.

Using data of 21 banks extracted from the Balance Sheets and Income Statements published on Portuguese Association of Banks website in the period of 1990 to 2018, there will be an estimation of three types of variables, that are the result of the Literature Review on this topic: variables indicated

in the non-financial firms' capital theory; variables directly related to the banks' activity; macroeconomic variables.

Through the estimation of two fixed effects models, one with clustered standard deviations and the other with AR (1) disturbance, it's possible to conclude that the non-financial firms' capital theory also applies to Portuguese banks, indicating that regulation is not the single determinant on banks' capital ratios. A second dynamic estimation reveals the persistence of the dependent variable in the short run, since the adjustment costs inherent to equity and debt increases do not allow the ratio to vary much in the short-run. Finally, the estimation of fixed effects model with a time dummy in the period of 2008-2013 concludes that Portuguese banks increased their capital in the crisis period, in order to protect themselves from possible losses in the assets.

This dissertation is divided as follows: in the second chapter, there is the Literature Review on firms and banks' capital structure theories with empirical studies testing the determinants; in the third chapter, there's an analysis on the banking sector context, regulatory requirements and the evolution of the Portuguese banks' activity; on the fourth chapter there's the description of the model and the variables that were used, with their expected sign and theoretical explanation; in chapter five is the estimation of the models and the discussion of the results; and chapter six has the conclusion, limitations of the study and a description of possible analyses to be carried out in the future.

2. Literature Review

2.1 Introductory remarks

The Literature Review comes from the following research questions: what are the determinants of Portuguese banks' capital structure (equity capital or debt capital) and do non-financial firms' determinants also apply to banks' capital determinants.

Given these research questions, the Literature Review was divided into two, in order to guarantee a correct framework for the model construction.

First, the different theories on non-financial firms' capital determinants were analysed, since the goal is to identify these determinants and reflect on their impact on banks' capital structure. This chapter was complemented with a succinct review of empirical studies on non-financial firms' capital structure.

Since the non-financial firms' capital structure theories are the fundamentals of the empirical studies on banks' capital structure, the literature review on banks was focused on analysing empirical studies that are based on these theories and understand the impact of the variables in banks leverage decisions. It is also important to point out that most studies on banks' capital structure determinants are focused on addressing the similarities of non-financial and financial firms' determinants, having the same goal as this dissertation.

2.2 Non-financial firms' capital structure determinants

2.2.1 Introduction

The capital structure of every firm, regardless of its type (financial or non-financial) always stands as an important decision for the managers. The decisions on capital structure are the management between the proportion of debt and equity that a company will decide upon, since these are the funds available to finance its operations. Either way, both debtholders and shareholders want to have a return on their investments (Renzetti, 2015), so for firms it's important to manage these relationships in order to achieve the highest profit.

It is easy to agree with the idea that any firm who wants to successfully operate in the market needs to have money. If money is one of the key operators in firms' way of living, then it's important to analyse its sources. In this literature review, the goal is to understand why firms choose to finance themselves with internal or external funds and understand the costs and benefits in each one. The balance between debt and equity is an ongoing issue for firms, which makes it relevant to analyse the topic and understand its properties in the present chapter.

Before studying the different theories, it is important to understand the definitions of debt and equity capital. Equity capital is defined as the value of the firm attributed to its owners, which on the book information stands as assets minus liabilities, containing elements such as share capital and retained earnings, which increases with the emission of firm shares or the increase of retained earnings. On the other hand, debt is considered to be a direct external way of financing, on which the firm borrows money from lenders and has a period of payment, with a given interest rate. In this case, firms can finance themselves with bonds, loans, suppliers' credit, or other alternatives, each one having the possibility of different timeframes of payment (short-run, long-run).

Regardless of the type, each way of financing has its benefits and disadvantages. The financial cost of debt is the interest rate, or in other words, the price of money, which is the value that the firm has to pay to have access to the funds. Equity capital cost comes from the remuneration of shareholders, which in this case is called dividends.

2.2.2 Capital structure theories

The discussion on what is the best financing alternatives for non-financial firms exists for a long time and resulted on five main theories on non-financial firms' capital structure, which targets the desire to find the forces that lead firms to a specific level of debt/equity. In chapter 2.2.2 and 2.2.3 non-financial firms will be referred as "firms" for simplicity.

The bedrock of the capital structure theories on firms was built by Modigliani and Miller (1958), often called the capital structure irrelevance theorem, in which the value of the firm is completely irrelevant from the capital structure. So, if the capital markets are in perfect conditions, financial decisions are not important. In other words, given their assumptions, in a world without taxes, information costs, bankruptcy costs or other kinds of asymmetries, there is no connection between how the firms finance their operations and their market value, so there is no advantage in issuing equity or recurring to debt (Baker and Wurgler, 2002).

Despite the capital irrelevance theory being considered one of the cornerstones of capital structure theories on firms, it faced a lot of criticism, given the model assumptions that are proven not realistic, since there is no place in the world that verifies all of those conditions mentioned above (Ahmeti and Prenaj, 2015). A considerable number of theories on firms tend to see tax benefits, bankruptcy costs and asymmetric information as some of the crucial elements on describing the different capital arrangements of firms (Aljamaan, 2018).

In 1963, Modigliani and Miller readjusted their text, now acknowledging the existence of taxes in their model, since taxes reduce the weighted average cost of capital, titled the tax shield effect. In this case, interest payments can cut down the level of taxes and firms with more debt in their structure are considered to be more valuable. Equity financing becomes obsolete and it predicts an enormous level

of debt, making the debt-equity ratio infinite (Haugen and Senbet, 1978). However, the authors also defended that firms should not focus on financing their asset structure with just debt, since retained earnings can be a cheaper alternative of funding, in cases where the tax status of investors under the personal income of tax is considered.

Given the incapacity of the Modigliani and Miller theory to clearly illustrate the decisions on capital determinants, other studies expanded this investigation on the paradox of debt and equity, introducing bankruptcy costs in their models, and achieving the possibility of an optimal debt-equity ratio, that balances the trade-off between expected value of bankruptcy costs and tax savings abatement of interest payments (Haugen and Senbet, 1978).

One of these theories is the Trade-off theory, that includes taxes and bankruptcy costs in the analysis, defending that firms are usually financed by both debt and equity, since there are advantages and costs in both types of financing. This theory details the balance between the tax advantages of debt against the risk of financial distress, resulting in a moderate level of debt by tax paying firms (Myers, 2001). Financing with debt has tax benefits, making it economical for firms to finance their activity with debt instead of equity. Yet, the price of a high level of debt comes from the risk of financial distress, since the increased financing with debt could result in a higher risk of bankruptcy for firms. So, this means that the firms must find the correct level of debt in order to avoid having negative marginal benefits. It's simple to understand why firms don't have an enormous percentage of debt in their capital structure, given the risk of large interest payments and bankruptcy in the future. On the other hand, dividends, one of the monetary counterparts of equity financing, don't have these characteristics (Berlin, 2011).

As described by the theories, the tax rate has an important influence on the capital structure decisions, because interest payments are deductible on tax payments, so there is an incentive to have debt. In addition to this, the dividend pay-out ratio is also expected to be important in these financing decisions, with Rozeff (1982) stating that the relationship is inverse, with debt being negatively influenced by the dividend pay-out ratio, due to agency and transaction costs. Chang and Rhee (1990) defend that if the effective capital gain tax rate is lower that the dividend tax rate, firms with higher dividend pay-out ratios will borrow more when compared to firms with lower pay-out ratios, with both studies being cited by Antoniou, Guney and Paudyal (2008), which in their study mention that if increasing dividends is a sign for an increase in future earnings, the cost of equity will be lower, making it favourable to issue equity and not recur to debt. In other cases, the increase of dividends payment could also indicate less growth opportunities for the firm, with this increase being the result of lower necessities of cash flow.

From the Trade-off theory, the variables that have an effect on the probability of default also have an effect on leverage. Thus, it can be concluded that the variable tangible assets is significant to explain

the determinants of capital structure, with the Trade-off theory predicting a positive relationship between leverage and tangible assets, since the latter can stand as collateral and induce the firm to enrol in higher levels of debt, and so, lower the cost of financial distress (Acaravci, 2015). Size can also be considered an important variable, as larger firms are assumed to be capable of holding higher levels of leverage, having a lower probability of going bankrupt, resulting on a positive relationship between leverage and size. However, since small firms have higher costs of issuing equity when compared to bigger firms, they could also prefer to be more leveraged and issue short-term loans rather than long-term since the fixed costs are lower (Wessels and Titman, 1988).

In contrast to the Trade-off theory, there is the Pecking Order theory, built by Myers and Majluf (1984), which defends that the financing of a firm may come through three ways: retained earnings, debt and equity. These three financing tools have an order themselves, with retained earnings being preferred to debt, and debt preferred to equity. So, the firm will only borrow, and not issue equity, when the retained earnings are not enough to fund the capital expenditures, making the amount of debt an image of the firms need of external funds (Myers, 2001). Firms prefer internal financing because of adverse selection, and they prefer debt to equity because of the existence of lower information costs when issuing debt (Frank and Goyal, 2003). In this case, the profitability of a firm is also important to analyse the firms' capital determinants (Titman and Wessels, 1988), which means that more profitable firms will use more retained earnings, that is to say, leverage and profitability have an inverse relationship (Antoniou, Guney and Paudyal, 2008).

The Market Timing theory, first presented by Baker and Wurgler (2002), introduces a different approach on this matter, defending that the first order determinant of firms choosing their way of financing, with debt or equity, is the market timing, with the chosen being the one with the highest value for their market. So, they issue new equity when the price of the shares is quite high and they buy shares when the price of shares is low, when markets are inefficient or segmented.

There is also the model based on agency costs, introduced by Jensen and Meckling (1976), where they state the existing conflict between shareholders, equity holders and managers, with the reason being the fact that managers don't appropriate the entire gain of their work, but they endure the entire cost of their activity, so it gives them the intension to follow their personal interests. Since managers have more information than shareholders, they can convince them that they are pursuing the interests of the firm and not their own while doing exactly the opposite. However, this inefficiency reduces as the manager gets more equity from the firm. Because debt obligates the firm to make direct payments, this will reduce the possibility of managers appropriating the money to their own interest and explains the benefit of debt. There are also conflicts between debtholders and equity holders, since the former only receive a fixed amounted related to the value they lent and the latter receive the profits of the firm, which makes equity holders controllers of the activity of the firm, opposed to debtholders, that

only want to receive the money they are entitled to. In this case, firms might want to have more debt and less equity, and this increase of debt induces equity holders to invest less and in riskier projects. As stated by Titman and Wessels (1988), firms in growing industries, since they have more flexibility in future investments, have higher agency costs, indicating a negative relationship between expected future growth and long-term debt levels. The authors also cite Myers and his conclusion that the agency problem is reduced if the firm issues short-term debt instead of long-term debt, meaning that short-term debt is positively related to future growth. Equity capital also provides more financial flexibility, useful in economic sectors that are prone to uncertainty.

2.2.3 Empirical studies

Before moving forward in the analysis of capital determinants, it's important to mention the common formulas to assess the capital structure of firms: the ratio between debt and equity, that represents in a correct way the effects of past financing decisions, or, total debt divided by total assets, which is a direct definition of financial leverage (Rajan and Zingales, 1995). In either case, there are two possibilities of calculating these values. One is looking at book values, information present on the balance sheet of the financial statements of firms. In the banks' case, regulation plays an important role in capital decisions, so it's important to look at book values, since regulation considers book information (Gropp and Heider, 2010). The other is using market values, if the company is publicly traded. Given the fact that most Portuguese banks only have book values and are not publicly traded, for the empirical literature review it was primarily analysed the conclusions for book values.

Coming from the theoretical framework described in the previous chapter, it is relevant to analyse some empirical studies on the determinants of firms' capital structure, to compare with the empirical studies on banks' capital structure. This two-way analysis is important considering that one of the conclusions for banks are the similarities between the firm specific variables and bank specific variables.

Moradi and Paulet (2019) studied the firm specific determinants of capital structure before and after the euro crisis. Their study, of a balanced panel of 559 publicly traded firms in the period of 1999-2015, in six European countries (Austria, Belgium, France, Germany, Luxembourg and Netherlands) concluded that growth, profitability, tax shields and the effects of the euro crisis are negatively related to leverage. On the other hand, size, asset tangibility, non-debt tax shields and earnings volatility are positively related with leverage. Leverage was defined as the book leverage, namely total debt divided by total assets. In the case of the estimation using the dependent variable as debt-to-equity, the conclusions changed, with all variables affecting positively with the exception of growth, profitability and the effects of the euro crisis, that remained with a negative coefficient value.

Vergas, Cerqueira and Brandão (2015) analysed the determinants of the capital structure of Portuguese non-financial firms listed on the stock market, from the period of 2005-2012, with a total of 45 companies. The authors concluded that growth opportunities and other sources of tax optimization affect positively the level of debt, with profitability affecting it negatively. Tangibility, size and market-to-book ratio are not statistically significant. Leverage was defined as total liabilities divided by total assets. The authors also divided the sample into two, to consider the effects of the crisis in the determinants. In this case, the effects were more severe in market-to-book ratio, that became significant, negative in the period before the crisis and positive after the crisis, with profitability remaining negative and tangibility becoming significant in the post-crisis period, having a positive value.

Antoniou, Guney and Paudyal (2008) studied the determinants of firms' capital structure in market-oriented economies, United Kingdom and United States, and bank-oriented economies, France, Germany and Japan, from the period of 1987-2000, with a total of 4.854 firms. The conclusions stated that leverage is affected positively by tangibility and size and negatively by profitability, growth opportunities and share price performance. Book leverage was defined as total debt divided by total assets and market leverage as book value of total debt divided by market value of equity plus book value of total debt, with the authors concluding that firms have target leverage ratios, but the speed of adjustment towards this target depends on the country.

The analysis of the literature review on firms' capital structure concludes that there are a lot of different approaches, without a consensus view, and leaving room for a further study on the impact of the variables mentioned above on the leverage of firms, taking into account the existing theories.

2.3 Banks' capital structure determinants

2.3.1 Introduction

The theory of non-financial firms has been commonly applied to banks in interpreting their capital structure. Since banks can be considered has highly levered firms, it is assumed that they have similar determinants when deciding the capital structure (Berlin, 2011). However, Diamond and Rajan (2000) indicated that although most theories of non-financial firms' capital determinants in the past have been applied to banks, banks' capital structure is quite different from the one of non-financial firms, since it affects liquidity creation, credit-creation functions and stability. So, there is a difference between the dynamics of leverage of non-financial firms and banks, given the different effects that both have in the economy, and that's why regulation for banks' capital exists. This regulation, enhanced by the creation of additional procedures, such as the Deposit Insurance Scheme, which was created to rescue banks' depositors from losing their money, was important to this relationship and

reflects the higher priority of stabilizing the capital needs for banks. Nevertheless, this regulatory safety net imposed by the government on the banking system, such as the deposit insurance mentioned above, has had a high probability of affecting the reduction of banks' capital (Berger, Herring and Szegõ, 1995).

Not only that, but banks offer unique services, that gives them a different position in the economy (Gorton and Winton, 1995). In this case, banks need to be regulated in order to reduce the possible impacts of their actions in the economy, so there are regulations to reduce banks moral hazard. However, in practice, banks tend to hold capital above the regulatory minimum, and the changes in their capital structure are independent of the regulatory requirements changes (Allen, Carletti and Marquez, 2011).

Given these different statements, it's important to analyse the different empirical studies on the determinants of banks' capital structure and understand what are the variables that stand out. Since regulation is an important topic when discussing banks' capital structure, some empirical studies addressed the joint relationship of non-financial firms' determinants with regulatory determinants. The organization of the empirical Literature Review on banks' capital structure was divided as such: first the empirical papers made for Portugal, then the empirical studies made for countries in Europe and USA, and finally, for countries in the rest of the world. Since the goal of this dissertation is to analyse the determinants of banks' capital structure and understand if the determinants of non-financial firms also apply to banks, focus was given to papers that followed a similar structure.

2.3.2 Empirical studies

Marques and Santos (2004) studied the capital decisions by banks in Portugal in a non-econometric approach, gathering data through surveys on CEOs of Portuguese banks, having a total of 89.5 percent representation of banks in Portugal during the 1989-1998 period. Those surveys were done face to face with the CEOs, reducing the possibility of bias and the problems related with the target group not answering questionnaires, something that usually happens in other studies that require surveys. The authors concluded that banks' capital structure is a topic that matters to the decision makers and it's not random, which is opposed to the capital irrelevance theory built by Modigliani and Miller (1958). The authors also found little evidence of the Pecking Order capital theory, with 54.9 percent of the CEOs mentioning that banks' stock performance is relevant for the decision, in accordance to the Market Timing theory. In the case of regulation imposed by authorities, it is also important to the decisions on capital structure, being the major external factor in their decisions. The authors found a small evidence of banks taking excessive risk, often associated to the procedures such as deposit insurance scheme. Other important variables were ownership structure, managerial control, growth opportunities and banks' reputation in credit and deposit markets. Finally, taxation on a bank level,

bankruptcy and financial distress (related with the Trade-Off theory) only had a moderate impact on banks' capital structure decisions.

The other study made in Portugal was developed by Boucinha and Ribeiro (2008), in order to understand why Portuguese banks held capital ratios above the regulatory minimum, using data from financial statements reported to the Bank of Portugal, Statistical Bulletins issued by the Bank of Portugal and Reuters, with consolidated values of 17 Portuguese banking groups from the period of 1994-2004. It's also important to reinforce that the capital buffer is the ratio of excess capital taking into consideration the regulatory minimum. The conclusions revealed that capital buffers are persistent, associated to the adjustment cost hypothesis, because the lagged variable of capital buffers is statistically significant and positive. A negative coefficient variable was bank size, indicating that larger banks tend to hold less excess capital. The variable provisions had a negative coefficient, in favour of the theory that says that provisions are substitutes for capital buffers. There is also a negative relationship between the variable output gap and the dependent variable capital buffer, indicating that banks hold more excess capital in periods of economic recessions. Kleff and Weber (2008) also examined German banks from 1992-2001 with the same objective, and concluded that capital buffer theory verifies, and banks hold capital above the regulatory minimum to avoid regulatory costs.

Gropp and Heider's paper (2010) is one of the most cited works on banks' capital structure determinants, which studied the determinants of banks' capital structure of large USA and European banks between 1991-2004, with a total of 100 largest publicly traded commercial banks and bank-holding companies in the United States and the 100 largest publicly traded commercial banks and bank-holding companies in the 15 countries of the European Union, having a total of 2.415 bank-year observations. Their goal was to examine if the empirical literature on non-financial firms and their capital determinants also apply to large publicly traded banks. One of the main conclusions of this paper was the similarities between the determinants of non-financial firms and banks' capital structure, meaning that for banks, non-financial firms' determinants have a first order importance, with regulation possibly having only a second order importance. The dependent variable on the model was leverage, being one minus the ratio of equity over assets in market values, and the explanatory variables market-to-book ratio, profitability, size, collateral, all of them lagged by one year, and finally, a dummy for dividend payers, also including time and country fixed effects. The conclusions were that all coefficients were statistically significant at a one percent level, with the exception of collateral, only significant at a 10 percent level. Leverage is positively influenced by size and collateral, and negatively by market-to-book ratio, profitability and payment of dividends. The results for book leverage are equal to the ones for market leverage. The main conclusion of this paper stands on the strong relationship between the determinants of non-financial firms and banks capital structure (Jouida and Hallara, 2015).

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Teixeira et al (2014) studied what were the determinants of banks capital structure in the period of 2004-2010, in order to understand if regulatory requirements are a first order condition in these capital decisions, using panel data of 560 banks, 379 from USA and 181 from Europe. Their main conclusion is that factors affecting non-financial firms' capital decisions also affect banks, which means that the regulatory requirements are not a first order element in the capital structure decisions. One of their dependent variables is the share of equity capital in excess of the regulatory minimum of 4% expressed in book values, using one-year lagged bank specific variables related to the non-financial theory as independent, such as market-to-book ratio, profitability, size, collateral, if the bank is dividend payer and asset risk. In terms of macroeconomic variables, they used one-year lagged GDP growth rate, inflation, volatility of national stock market and the term structure spread. They also added a time dummy variable, in order to analyse the effect of the financial crisis on the excess capital, to see if the dependent explanatory variables have a different effect depending on the period (non-crisis and crisis). Their specific conclusions were the following: with excess equity valued in book values, banks' characteristics are statistically significant, which means the regulatory condition is not a first order determinant on banks' capital structure and the determinants of non-financial firms also apply to banks. In terms of the variables that positively affect the dependent variable, they are profitability and asset risk, with market-to-book ratio, size, collateral, GDP growth and stock market risk affecting it negatively. Finally, term structure spread, dividends and inflation are insignificant. These results were consistent with the analysis of the dependent variables in market values, with only market-to-book ratio changing to positive in this case and dividend becoming statistically significant, with a positive impact. The inclusion of the time dummy variable, associated to the financial crisis, leads to the conclusion that banks tend to have less excess capital in this economic period.

Sorokina, Thornton and Patel (2017) also studied the effect of standard non-financial firms' capital determinants and bank-specific variables, to understand its impact on the level of leverage of banks, with the dependent variable being market and book leverage, with quarterly data from 1973-2012, for USA banks. Their conclusions are that competition and diversification in lending, given the large number of banks in an economy, contribute negatively to banks leverage, and low liquidity in the past creates higher leverage in the future, with the economy cycle also affecting the determinants of banks' capital structure. In terms of classic determinants, market to book ratio (-), profitability (-), size (+), collateral (+), dividends (+) and risk (+) are determinant to explain both book and market leverage, with only collateral changing to negative in the market leverage. This is another study that concludes that banks' capital determinants are not solely affected by regulatory requirements. In terms of macroeconomic variables, inflation, term spread, macro growth and GDP growth are not statistically significant in book values, with inflation and macro growth becoming significant in market values, with a negative coefficient. In order to assess competition, the authors used the Lerner index, in which a

positive sign indicates a negative relationship between competition and leverage. On their tests, the coefficient is positive and statistically significant for both market and book leverage, indicating that competition affects in a negative way the level of leverage of banks. The use of the variable competition came from the necessity to address the impact of this variable on leverage, since some of the papers mentioned by the authors were contradictory, with Allen, Carletti and Marquez (2011) defending that competition in the loan market pursues banks to hold higher levels of equity capital, while DeAngelo and Stulz (2015) stated that leverage is higher when there's competition between banks.

Jouida and Hallara (2015) studied the determinants of banks' capital structure and regulatory capital of 172 French banks, between 2000 and 2012, with the dependent variable being the equity ratio, the ratio of equity to total assets, and independent variables deposits, collateral, profitability, growth opportunities, size, dividend and loan loss reserve. Their conclusions stated that all coefficients were significant at a one percent level, except for collateral. Since the lagged variable of leverage (equity ratio) is also significant, this indicates that this variable is persistent. Deposits, size and loan loss reserve have a positive impact on leverage, while profitability, growth opportunities and dividends have a negative impact. Collateral, has stated before, was not significant at a 1% level.

Anarfo (2015) studied what were the determinants of banks' capital structure in Sub-Saharan Africa, having a total of 37 countries, from the period of 2000-2006. In terms of the theoretical framework, there were a certain number of firm specific variables, such as: size, asset tangibility, profitability, assets growth and marginal corporate tax. To complement their analysis, they also used macroeconomic variables such as interest rate on deposits, inflation rate and GDP growth rate. The dependent variables used in this study were short-term debt ratio, long-term debt ratio and the total debt ratio, with the debt ratio being considered has debt/(total equity + debt), regressed against all the independent variables mentioned above. The conclusions taken were the following: the profitability of banks has a major impact in determining the level of debt ratio, for all timeframe of debt, with this relationship being negative; size also has an importance in explaining total debt, meaning that larger firms can be more leveraged and assume higher levels of debt; finally, asset tangibility is significant at 1% on total debt ratio and has a negative coefficient, which is contrary to the trade-off theory, that assumes that tangible assets are possible instruments to reduce the level of financial distress. The final conclusion state that taxes, interest rates and GDP growth rate do not affect banks' capital structure, meaning that inflation is the only macroeconomic variable that has an effect in Sub-Saharan Africa, in this case with a negative effect on banks' total debt ratio.

AL-Mutairi and Naser (2015) studied the determinants of commercial banks' capital structure, located in Gulf Cooperation Council and listed in the stock markets. The data was collected from 47 banks between the period of 2001-2010, with a total of 406 observations. The dependent variable

used in this study was leverage, defined as total liabilities over total assets. The following dependent variables were return on assets (profitability), liquidity (obtained from previous studies on Asian and African countries), tangibility, risk (calculated through the growth rate of profits), age of the firm, asset growth and finally, size. The conclusions of the study stated that there is a positive and significant relationship between banks leverage and bank growth and age, and a negative and statistically significant relationship between leverage and profitability, tangibility and size. Liquidity and risk were not statistically significant, so they are not relevant for the analysis.

Smaoui, Salah and Diallo (2019) studied the determinants of capital ratios in Islamic banks, with a sample of 122 banks, of 13 countries, from the period of 2000-2014. The dependent variables are the capital and assets ratio, the capital adequacy ratio, obtained by the ratio of risk-weighted assets and total capital, and the ratio of tier 1 capital to risk-weighted assets. The dependent bank specific variables are lagged size, profitability, liquidity, bank risk, loan growth and deposits. The model also has macroeconomic variables, specific to the country of the bank, such as GDP growth, inflation, bank competition (through the Lerner index) and protection of shareholder rights (through the Country Risk Guide's Law and Order index). The conclusions are the following for the variable capital and total assets ratio: the lagged variable of capital ratio is significant and positive, meaning that capital ratios have persistence; size affects negatively, profitability is not statistically significant, deposits affect negatively; liquidity, GDP growth, inflation, risk and loan growth are not statistically significant; the Lerner coefficient representing the competition is positive and significant; the level of protection of shareholder rights is significant and positive. Additionally, the authors included a dummy that is one when the country has a deposit insurance scheme, a dummy for the power of the deposit insurer and finally, a capital regulatory index. The coefficient of deposit insurance was negative and significant, and the other additional variables were insignificant. The authors also introduced a dummy variable to account for the crisis of 2008, that assumes the value of one after the crisis, which in their conclusions indicates that the financial crisis has no significant effect in the capital ratio.

Jonghe and Oztekin (2015) studied how banks conduct the management of bank capital, with global data from 64 countries in the period of 1994-2010. Their conclusions rely on the fact that banks reduce their leverage especially through raising equity, namely share sales or retained earnings, and not through the restriction on asset growth. On the other hand, banks reduce their level of leverage through a decrease in retained earnings and an expansion of the level of assets. Banks that are above the target capital ratio increase leverage with asset growth and not capital reduction.

Hoque and Pour (2018) studied the determinants of capital structure and funding sources of 347 large global banks in the world, from 57 countries between the period of 1998-2016. The dependent variable is both market and book leverage, with independent variables being market to book ratio, return on average assets (profitability), size, collateral, dummy for dividend payers, with all the

variables lagged by 1 year. Their conclusion states that market to book ratio, size and dividends are positively related to leverage and profitability is negatively related. Collateral is not statistically significant. These conclusions are also aligned with the idea that banks have capital structures determinants like non-financial firms.

2.4 Conclusion

On a general view, almost every study reaches the conclusion that non-financial firms' determinants also apply to banks, meaning that regulation is not the only determinant and firm-specific variables that come from the theoretical and empirical analysis on non-financial firms' capital structure also apply to banks. This conclusion increases the importance to address this issue in Portugal and see if this also fits our banks' reality.

Most studies combine the analysis of firm specific variables with macroeconomic variables, which is quite useful, since it's important to know how banks react to macroeconomic transformations and decide their level of leverage. This analysis of macroeconomic variables can be also complemented with the impact of the financial crisis, since it was a major economic and financial event that affected the way banks operate.

Since there aren't any recent studies in Portugal regarding banks' capital structure, or any direct studies on banks' capital structure determinants, there is an academic opportunity to address this issue and understand if the conclusions taken above also apply to Portuguese banks.

2.5 Empirical Literature Review summary

Table 1 - Empirical Literature Review summary

Year	Authors	Country and Sample	Method	Conclusion
2019	Amir Moradi and Elisabeth Paulet	Six European countries 559 firms 1999-2015	Fixed effects	Dependent Variable: Debt-to-equity; Positive effect: Size, Tangibility, Non-debt tax shields, Tax shields, Earnings volatility; Negative effect: Assets Growth, Profitability, Euro crisis.
2015	Nelson Vergas, António Cerqueira and Elísio Brandão	Portugal, 45 firms 2005-2012	Fixed effects	Dependent Variable: Leverage (Liabilities/Assets); Positive effect: Annual depreciation expense, Growth of Total Assets; Negative effect: Profitability; Insignificant: Tangibility, Size, Market-to-book ratio.
2008	Antonios Antoniou, Yilmaz Guney and Krishna Paudyal	UK, USA, France, Germany and Japan 4.854 firms 1987-2000	Two-step system GMM	Dependent Variable: Market and Book Leverage Positive effect: Tangibility, Non-debt tax shields, Equity premium, Size; Negative effect: Growth opportunity, effective tax rate, share price performance, term-structure, M&A activity;

				Insignificant: Earnings volatility, Dividend pay-out.
2004	Manuel Marques and Mário Santos	Portugal, 89.5 percent of CEOs 1989-1998	Survey	- Capital structure is a relevant topic for executives; - No evidence of the Pecking order theory; - Banks stock performance is an important factor; - Financial distress has a moderate impact on capital decision.
2008	Miguel Boucinha and Nuno Ribeiro	Portugal, 17 banking groups, 1994-2004	System GMM	Dependent Variable: Capital Buffer; Positive effect: Lagged dependent variable, Stock holdings; Negative effect: Provisions, Size, Output Gap; Insignificant: Credit Growth, Default ratio, M&A.
2010	Reint Gropp and Florian Heider	200 US and European banks, 1991-2014	Fixed effects	Dependent Variable: Leverage (one minus the ratio of equity over assets) Positive effect: Size, Collateral Negative effect: Market-to-book ratio, Profitability, Dividends
2014	João Teixeira, Francisco Silva, Ana Fernandes and Ana Alves	560 USA and European banks, 2004-2019	Random effects	Dependent Variable: Book excess equity capital; Positive effect: Profitability, Asset risk; Negative effect: Market-to-book ratio, Size, Collateral, GDP growth, Stock market risk, Financial crisis dummy; Insignificant: Dividend, Inflation, Term structure spread.
2017	Nonna Sorokina, John Thornton and Ajay Patel	USA banks, 1973-2012	Fixed effects and lasso-variable selection	Dependent Variable: Book leverage (Ratio of total debt to assets); Positive effect: Size, Collateral, Dividend, Risk; Negative effect: Market-to-book ratio, Profitability; Insignificant: Inflation, Term spread, Macro growth and GDP growth.
2015	Sameh Jouida and Slaheddine Hallara	172 French banks, 2000-2012	GMM	Dependent Variable: Equity to assets ratio; Positive effect: Lagged dependent variable, Deposits, Loan Loss reserve, Size; Negative effect: Profitability, Growth opportunities, Dividends; Insignificant: Collateral.
2015	Ebenezer Bugri Anarfo	37 countries in Sub-Saharan Africa, 2000-2006	Fixed effects	Dependent Variable: Leverage (Total debt/ equity + debt); Positive effect: Size; Negative effect: Profitability, Tangibility, Inflation; Insignificant: Growth rate of assets, Tax, GDP growth rate, Interest rate.
2015	Abdullah AL-Mutairi and Kamal Naser	47 banks, 2001-2010	Not referred	Dependent Variable: Leverage (Total Liabilities/ Assets); Positive effect: Age, Growth rate of assets; Negative effect: Profitability, Tangibility, Size; Insignificant: Liquidity, Risk.
2019	Houcem Smaoui, Ines Ben Salah and Boubacar Diallo	122 banks from 13 countries, 2000-2014	System GMM	Dependent Variable: Capital and assets ratio; Positive effect: Lagged dependent variable; Negative effect: Size, Deposits, Dummy if the country has a deposit insurance scheme;

16				Insignificant: Profitability, Liquidity, GDP growth rate, Inflation, Loan growth, Risk, Dummy for the power of the deposit insurer, Dummy for the capital regulatory index, Dummy for the financial crisis of 2008.
2015	Oliver De Jonghe and Ozde Oztekin	20.073 banks from 64 countries, 1994-2010	GMM	- Banks reduce leverage mainly through equity growth and not asset liquidation; - Banks leverage with decreases in earnings retention and asset growth; - In periods of economic crisis, banks are quicker in capital adjustments.
2018	Hafiz Hoque and Eilnaz Pour	347 banks from 57 countries, 1998-2016	Fixed effects	Dependent Variable: Book Leverage (one minus the ratio of equity to assets); Positive effect: Market-to-book ratio, Size, Dividends; Negative Effect: Profitability; Insignificant: Collateral.

3. Overview of the Banking Sector

3.1 Capital requirements

As mentioned above, from a theoretical point of view, an activity of a bank has a different impact on the economy when compared to a non-financial firm, since its core business is being the link between those who have too much liquidity and those who need it. After all, banks usually deal with a wide range of economic agents, and so, their operations need to be carefully monitored in order to prevent and reduce the systemic risk, thus decreasing the negative externalities of their actions and the influence they have on periods of economic crisis.

Recently, most countries were able to see the impact of a bank's action in the national and global economy, when Lehman Brothers, one of the largest investment banks in the USA, filed for bankruptcy in 2008. One of the main reasons for Lehman Brothers bankruptcy was their large amount of assets with too much risk and not enough cash flow to guarantee the stability of the bank if those assets turned to be toxic. This bankruptcy is often appointed as the main factor that triggered the economic crisis of 2008, given the global instability that was created, which increased the spreads of the sovereign debt of the countries, created a negative capital shock and decreased the liquidity in international markets (Burkhanov, 2011). Central banks were forced to an aggressive strategy that culminated in the expansion of the level of assets and the reduction of interest rates (zero or negative), and governments increased their debt level, in order to minimize the consequences of the crisis.

This situation was a perfect example of the systemic risk that exists in the financial and monetary markets, thus increasing the importance of the supervisors role in monitoring banks' assets and the risk they take, in order to prevent levels of leverage that compromise their reaction in an economic recession. In order to have a financial system that is stable and strong, there needs to be a joint effort between the agents and the regulators, since one of the conclusions of the Lehman Brothers bankruptcy is that its causes were not solely associated to the banks' irresponsible practices, they were combined with deregulation and lack of monitoring in the financial regulatory framework (Chadha, 2016). Another important consequence of the economic crisis of 2008 is the fact that it created a sense of distrust of the banking activity by the population all around the world because of the irresponsible management of some banks and the implications it had in the economy.

As a consequence, capital requirements are seen as a way of protecting banks and reducing their vulnerabilities, with the development of a shield that prevents them from being totally exposed to macroeconomic and specific risks. Banks receive deposits, so, in order to protect their clients, they need to operate in good and bad times, and capital is seen as cushion against banks possible losses

(clients that don't pay their loans or investments that fail), so in this case, the level of capital is a direct result of the risk a bank takes (European Central Bank, 2019).

Since the economic crisis of 2008, there is been a focus on banks' regulation and now they are more capitalized and capable to react to sudden shocks (Chadha, 2016), as opposed to what happened ten years ago. However, there's still some controversy on banks' capital requirements, especially on the level of this regulation, because it imposes some restrictions on banks' activity, reducing the possibility of riskier investments and, ultimately, increasing costs for banks' costumers and cutting down credit availability. It is important to recall that capital requirements serve as regulatory enforcements on the activity of banks, so they don't have total freedom when they are deciding their level of capital, a major difference when compared to non-financial firms.

3.2 The creation of the Basel Agreements

In 1974, the Basel Committee was created by the central bank governors of the G-10 countries (Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Sweden, Switzerland, United Kingdom, United States), a decision that came from the phenomenon of globalization and the need to have quality banking supervision. Since then, this organization served as a point of connection between these countries, guaranteeing a coordinated and consistent focus on banks' capital legislation across the countries of the organization. In 2019, the Basel Committee was composed by 45 members from 28 jurisdictions, reflecting the efforts on improving the quality of the banking supervision (Bank for International Settlements, 2020). Since the creation of the committee there is been an issue of three capital accords, with their changes being a reflection of the evolution of the economy and the banks' activity, that requires the existence of a dynamic regulatory structure capable of responding to changes in banks' business models.

Banks' capital requirements have an important milestone in 1988, with the release of the first capital accord by the Basel Committee, a directive that supported a standardization of capital regulation among all countries, by establishing minimum capital levels relative to the assets of the banks. This capital accord defined a minimum ratio of capital to risk-weighted assets of 8% for banks with an international activity and introduced the banks' asset classification system, a categorization of the risk of the assets, from 0% risk (e.g. Government debt, Central Bank debt) to 100% risk (e.g. Private Sector debt) (Glantz and Mun, 2011).

To consider the increase in risks and the complexity of the banking industry, Basel I was revised and culminated in the second accord in 2004, named Basel II. This accord was composed by three pillars: minimum capital requirements, with the definition of three tiers of regulatory capital and the redefinition of risk weighted assets, now also focusing on the credit rating of the assets when calculating the given weights; supervisory review, that makes banks obligated to analyse their internal

capital adequacy for covering the risks they are taking in the operations, with the supervisor monitoring the banks' assessment approaches and risks covered (Corporate Finance Institute, 2020); market discipline, to provide investors with important information regarding the banks risk profile, by making it compulsory to reveal market information (European Central Bank, 2004).

The last capital accord was created as a result of the financial crisis in the world and some gaps existing in the current legislation, given the high levels of leverage that banks had before the crisis. Therefore, Basel III was created in 2009, with a focus on requirements on regulatory capital, requirements on banks with a high systemic activity, creation of liquidity requirements, leverage ratio and countercyclical capital buffers.

3.3 Euro banks' capital requirements

Euro banks' regulation is commanded by the European Central Bank (ECB) and the national authorities of the countries, that together constitute the Single Supervisory Mechanism (SSM), that makes ECB the central supervisor of the financial institutions in the euro area and in non-euro countries that choose to join the SSM. ECB is responsible for directly overseeing the significant entities (classification based on quantitative and qualitative criteria) and the national authorities directly supervise the less significant entities, constantly reporting this information to the ECB. The SSM guarantees a consistent control among all the banks in the euro area and ensures a coherent and effective analysis with the highest quality. It is quite clear to understand that with the currency integration, banks, being the transmitters of this currency and the liquidity creators in the economy, must be supervised in the same manner given that they are financially integrated.

According to the information available on the ECB's website (2019), European banking supervision is divided into three elements: minimum capital requirements (Pillar 1); additional capital requirement (Pillar 2 requirement); buffer requirements. Regarding the first pillar, banks must have a total amount of capital equal to at least 8% of risk-weighted assets, that are the result of the total assets multiplied by their risk weights, which are determined by the risk of the asset. The additional capital requirement relates to the annual Supervisory Review and Evaluation Process, that reports if the bank needs to have additional capital to protect the risks they are taking. The last requirement is for banks to have additional capital buffers in cases of cyclical and non-cyclical systemic risk.

In recent years there's been a considerable increase in the number of digital banks, that only have online operations and business strategies that focus on the internet of things, through the use of technologies related to artificial intelligence, big data and blockchain. This trend created a bigger responsibility on supervision, since it's more challenging to assess the risk of this activity. In this case, the ECB as a policy called "same business, same risk, same supervision" (European Central Bank, 2019), meaning that the supervision will be the same as traditional banks. Supervisors are not focused on

whether banks are digital or traditional, they are only concerned about the specific risks of each bank, thus guaranteeing an appropriate and specific surveillance.

3.4 Portuguese Banking overview

3.4.1 Evolution of the banks' activity

A study developed by the historical heritage office of Caixa Geral de Depósitos by Carvalho, N. F. (2013) gives a quick summary of the banking activity in Portugal in the last 200 years. The first indicators of banking activity in Portugal were in the XIX century, a season where central banking became a reality, investment banking appeared through the creation of new banks and colonial banks were established, to foster the countries that at the time where under Portugal's administration. In this period, Portugal had a large number of currency-issuing banks, a responsibility that was later exclusively transferred to the Bank of Portugal, that became the only entity capable of issuing money.

The strong colonial activity at the time resulted in the creation of the Banco Nacional Ultramarino, that was responsible for the development of the economies of ultramarines parts of Portugal. In the following years, several commercial banks were created and most of them were linked to the financing needs of the state at that time. However, the financial crisis of 1891, a consequence of the speculation on Brazil transfers and the high levels of credit in the Portuguese economy, culminated in the disappearance of 20% of the banks of the time.

In the conversion of the national currency to escudo, Portugal experienced a long period of currency depreciation, that was only reverted in 1924, with the improvement of the world economy performance and the increase of the fiscal revenue in Portugal. However, the Wall Street crash of 1929 and the World War II brought back a long period of crisis in the banking sector.

With the publication of the Constitution in 1933, banks were subject to more incisive supervision by the finance ministry, which aimed to slow down the creation of new banks. This change was successful, since it effectively led to a decrease in the growth rate of banking institutions. As a consequence, credit and deposits market shares started to be concentrated in large financial groups, after several operations of acquisitions and mergers in this period.

The Carnation Revolution in 25th April of 1974 changed the national banking structure, through the decolonization of the countries that belonged to Portugal and the nationalization of practically all Portuguese banking institutions. The reprivatisation of these banks only started a decade after the revolution, when Portugal joined the European Union, and in the end of the century, with the adoption of the euro, the single currency in the European Union. In this period, Portugal had once again a large number of fusions and acquisitions, also due to the fact that joining the European Union and the euro area created the need to have larger banks, capable of competing internationally. This mergers and

acquisitions movement created the scenario that still exists today, with the banking activity being concentrated in a small number of financial groups.
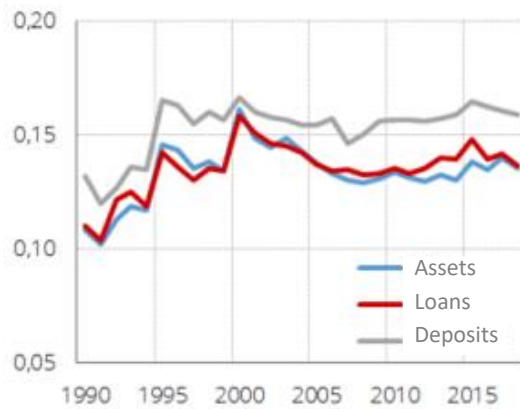
Graph 1 - Herfindahl-Hirschman's Index Portugal. Source: Bank of Portugal, Séries Longas do Setor Bancário

The graph 1 illustrates, through the calculation of the Herfindahl-Hirschman's Index by the Bank of Portugal, the phenomenon of sectorial concentration that occurred in the first and second half of 1990, that stabilized in the past 20 years.

3.4.2 Recent years in Portugal

As previously specified, the 2008 financial crisis affected almost the entire world economy, and Portugal was no exception, being one of the European countries that suffered the most with the global crisis, which was reflected in the increase of the government bond interest rates and the level of public debt in percentage of GDP, that reached a value of 10.5% and 132,9% (Pordata), in 2012 and 2014, respectively. The impact of this crisis brought the intervention of the International Monetary Fund and the European Union, with the Financial Assistance Program, which was designed to revive the Portuguese economy, based on three pillars: fiscal consolidation, stability of the financial system and structural adjustment of the Portuguese economy (Bank of Portugal, 2020).

The financial crisis also harmed the Portuguese banking system, due to the large levels of public and private debt in the economy and non-performing loans, which forced the state to inject capital in banks to prevent any possible risk of bankruptcy and to guarantee stability in the economy. According to data from the Court of Auditors (Executive Digest, 2019), since 2007, the Portuguese state has injected around 25.5 billion euros into the banks through recapitalization processes, a support that started with the nationalization of BPN – Banco Português de Negócios. Caixa Geral de Depósitos and Novo Banco, the bank that was created as a result of the Banco Espírito Santo resolution, were the banks that received the largest amount of state support.

This state intervention, in addition to providing more security to banks, also grants more protection to the economy and banks' customers, ensuring that banks are still able to finance the economy and its investments with reasonable interest rates, capable of being paid by firms and individuals. These capital injections were also reconciled with some control in the distribution of dividends, in order to captivate necessary internal resources to fund banks' activity. A side effect of the crisis was the slight increase in the concentration of the banking sector (Graph 1) and the increase of foreign capital and foreign banks in the Portuguese banking system (Haitong Bank, CaixaBank, Santander, Lone Star Funds).

One of the consequences of this turmoil in national banks and state intervention was the reputational crisis in the banking sector and the reduction in the confidence levels of the population, largely due to the management problems in banks that had a great public exposure, since these capital interventions are partly financed by individuals taxes.

The post-crisis period was heavily focused on Portugal's banking reconstruction in order to ensure that they had self-sufficient conditions to operate in the market with strong capital structures capable of reacting to positive and negative scenarios in the economy.

One of the main consequences of this crisis was the increase in the level of private debt, which was 224% of GDP in 2007 and increased to 263.3% in 2012 (Bank of Portugal), with one of the recent conclusions for the banking sector that was indicated by the Portuguese Banking Association in their study on the Portuguese Banking Sector Overview (2019) was the reduction of the importance of the banking sector in the economy, massively related to the decrease of leverage of non-financial firms and individuals, whose debt value in 2019 is 187.9% of GDP (Bank of Portugal), a percentage that is below the values of the pre-crisis period. This reduction in leverage resulted in a decrease of the fraction of loans to customers in the banks' asset structure, which went from 336.3 billion € in 2009 to 234.3 billion € in 2019 (Portuguese Banking Association, 2019).

On the other hand, the Portuguese banking reconstruction had good effects in banks' capital structures and the quality of their assets. Considering graph 2, it is worth noting the big effort made by banks to reduce the level of non-performing loans (NPL's), which now have a downward trend (Graph 2), as opposed to bank's equity capital ratios.

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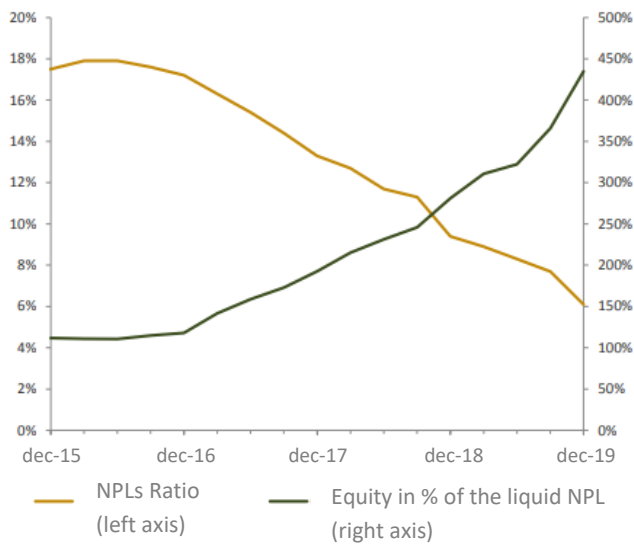
Graph 2 - Equity vs. Liquid NPLs. Source: Portuguese Banking Association, Banking Sector Overview 2019
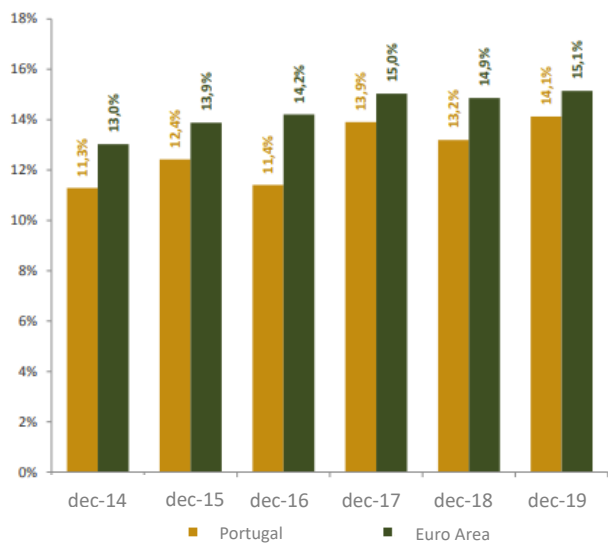
Graph 3 - Common Equity Tier 1 ratio (CET1). Source: Portuguese Banking Association, Banking Sector Overview 2019

There is also an increase in common equity tier 1 ratios (banks' core capital against risk weighted assets), from 11.3% in 2014 to 14.1% in 2019, a consequence of the effort to strengthen banks' capital ratios. However, Portugal is still below the Euro Area average.

Interest Rates in Portugal
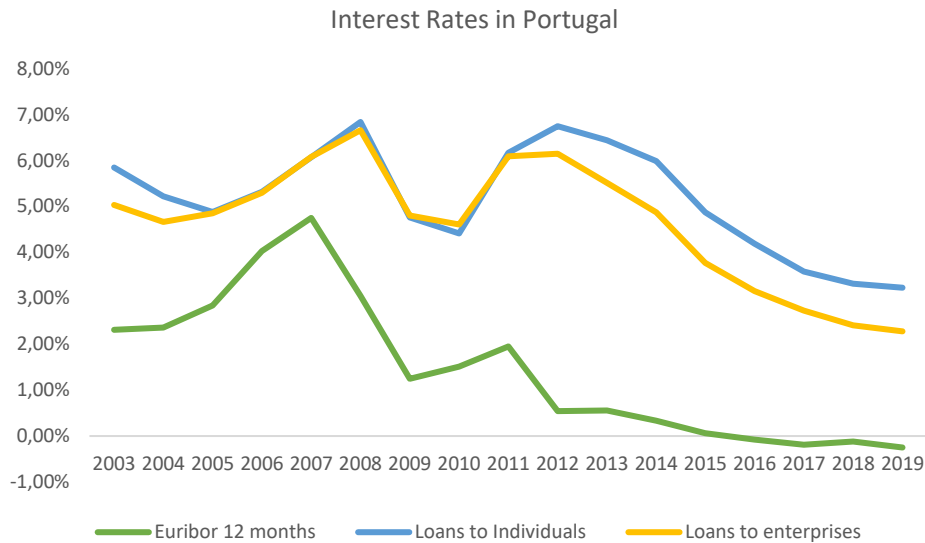
Graph 4 - Interest Rates in Portugal. Source: Pordata.

It is also relevant to analyse the evolution of the interest rates of the economy in the recent years. In graph 4 is possible to see a similar decreasing trend between the interest rate on individuals and enterprises since 2012. The decrease of the Euribor rate to negative values reflects the expansionary mindset of the ECB, to raise inflation and generate liquidity in the economy. The Euribor rate is the rate paid by banks when they finance themselves in the Interbank Money Market. In this sense, it turns out to be one of the indicators of the price of financing with external funds as opposed to equity. From the graph it is possible to conclude that this cost has fallen significantly since the economic crisis.

Another transformation that occurred in recent years was the drastic reduction of the number of agencies and counters in Portugal, a reduction that was also seen in the rest of the world. This choice is a consequence of the crisis and the banks need to improve their operational efficiency, through digital investments that reflect the change of the consumers' behaviour, who want to manage their many daily life tasks on their mobile phones and computers. The banks benefit from this cut because it reduces their fixed costs associated to the buildings and their respective rents, and also makes it possible to reduce the number of employees. Consequently, these funds are now channelled to digital investments. On top of this, these branch reductions also end up giving less emphasis to the banks' tangible fixed assets in their structure, a relevant point taking into account that it is one of the arguments mentioned in the determinants of the capital structure of non-financial firms, due to the fact that firms with more tangible assets have a greater capacity to borrow, due to the security that the assets provide, which can sometimes serve as collateral in these loans.

On another perspective and as previously mentioned, the appearance of digital financial institutions in the monetary system requires banks that are already in the market to update their

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business models, a phenomenon that has happened to incumbents from various sectors, such as accommodation, transport, etc.

4. Model

4.1 Focus of the study

This dissertation focuses on the investigation of the determinants of Portuguese banks' capital structure. The motivation behind this topic came from the need to check if the corporate capital structure theory also applies to banks in Portugal, since it was already proven in other studies, e.g. (Gropp and Heider, 2010; Teixeira et al., 2014; Sorokina, Thorton and Patel, 2017). This empirical confirmation of the theory encourages the study to be carried out in other countries to prove its effectiveness. Furthermore, there aren't any recent studies on this topic in Portugal, since the work of Boucinha and Ribeiro (2008) and Marques and Santos (2004) have different purposes and timeframes, with the former studying the determinants of excess capital of Portuguese banks in 1994-2004 and the latter studying the banks' capital decisions in the 90's, through surveys on the CEOs.

This dissertation approaches this topic by crossing the distinct features of banks with the macroeconomic reality around them and the dominant firms' capital theory that currently exists, which states that the determinants are the same for financial and non-financial firms. In chapter five, the goal is to test this theory in Portuguese banks, using a three-dimensional analysis, which comes from the literature review carried out on this theme: analysis of the variables indicated in the corporate capital theory and test their significance in the capital structure of Portuguese banks; analysis of the intrinsic variables of the banking activity and understand its impact on the capital decisions; analysis of the impact of macroeconomic variables on capital ratios. In the next section (4.2 and 4.3) there will be a description of the data and the variables used in this model, as well as their justification and expected sign, given the existing theories and the empirical studies made on the topic.

4.2 Data

This model has panel data of Portuguese banks, with the data being extracted from the Portuguese Banking Association (representative of the banking sector in Portugal), namely from Balance Sheets and Income Statements published on the Association's official website. The interval of the sample is 1990 to 2018, the period after the entry into the European Union and the respective privatization of banks, the adoption of the single currency, the 2007 financial capital crisis and the sovereign debt crisis of the euro area. The macroeconomic indicators were extracted from statistical databases, specifically Statista (firm specialized in market data) and Pordata (Portuguese database that gathers information

from the National Statistics Institute and Eurostat). The sample has a total of 21 banks and 386 observations, present in table 9 (Annexes).

It is also essential to clarify the process of extracting and validating the observations used in the model. For a bank to be considered in the sample, a minimum of eight observations were established, having only been considered banks that combine the two dominant banking activities, receiving deposits and granting credit. Banks only focused on investment banking were not considered, since their activity and capital structure is quite different from traditional banks, not relying on deposits funding. In this model, international subsidiary banks operating in Portugal were also considered, since these are relevant for the national analysis and they have a strong market presence. As expected, the data is unbalanced, as a result of banks leaving/entering Portugal, bankruptcy procedures and the creation of news banks, thus avoiding the survivorship bias in the estimation. Banks that in the sample period either changed their name or participated in acquisitions/fusions remained with the same ID in the sample (this assumption holds for banks that are still operating in Portugal in 2018 but suffered structural and branding changes previously). Finally, the data is from consolidated financial statements, because the individual statements have only been published since 2009.

4.3 Variables

As previously mentioned, the focus of this study requires an estimation using variables of three types: non-financial firm-specific, bank-specific and macroeconomic.

4.3.1 Leverage

The dependent variable used is the ratio Debt-to-Assets. This ratio is commonly used in papers on banks' capital determinants (see Literature Review), as it directly reflects firms' financing decisions. The values used for this variable were the book value of total Debt and total Assets. For this dissertation, it was only used values from the financial statements, given the impossibility of computing the market value of the variables of the study, since most banks are not quoted in the stock market.

Although it was considered, the variable debt-to-equity was not used, because this variable is more subject to outliers, especially when banks have negative equity or close to zero, which makes the ratio extremely high. Regarding the dependent variable Debt-to-Assets ratio, in this case, the ratio indicates the percentage of assets financing through debt, with the difference in the percentage being the share of equity in the assets funding.

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4.3.2 Profitability

Taking into account the Pecking Order theory (Myers and Majluf, 1984), which depicts the financing of a firm as a hierarchy of three possibilities, retained earnings, debt and equity, firms tend to prefer internal funds to finance their activity, which implies that more profitable firms tend to use less debt and more retained earnings. In this regard, it is important to use the variable Profitability to identify its role in banks' debt ratios, with a negative relationship to be expected, as mentioned in the literature review. This variable is the ratio of pre-tax profits over the book value of total assets. Pre-tax profits were used to avoid the effect of the differences in taxes paid by banks in the significance of the variable.

4.3.3 Size

From the Trade-off theory, Size was recognized as a significant variable to explain the companies' debt and capital ratio. In this case, larger companies tend to have higher levels of debt, at a lower cost, since their risk of default is considerably low when compared to smaller firms. These group of companies also have more flexibility when choosing their optimal level of debt and capital, and their higher profits allows them to bear the costs of debt (Anarfo, 2015). However, is also often pointed out that larger banks might hold less capital, given the "too big to fail" argument that they might be rescued by the government in bankruptcy scenarios (Smaoui, Salah and Diallo, 2019). Nevertheless, it's still expected a significant and positive sign for this variable. Size was calculated as the logarithm of total book assets, a transformation that was made in all the papers of the literature review.

4.3.4 Collateral

The variable Collateral is also a prediction of the Trade-off theory, which points out that firms with more collateral are also able to assume higher levels of debt at a consequently lower cost, since collateral reduces the risk of financial distress and allows the firm to finance itself with lower interest rates. In this case, collateral is also expected to have a positive impact on the debt ratio. This variable is calculated as the financial collateral, like the one used by Gropp and Heider (2010), through the sum of all book securities, treasury bills, other bills and bonds over the book value of assets.

4.3.5 Tangibility

The firm's total value of Tangible Assets also augments its debt levels, according to the Trade-off theory. In this case, these types of assets reduce the likelihood of the company's bankruptcy and guarantee the possibility of financing at lower interest rates, since the more tangible assets the firm has the more debt it can take (Anarfo, 2015). The effect of tangible assets on the debt ratio is expected to be the same as collateral, considering that these tangible assets can also be considered as collateral.

However, in this study, it was decided to divide the two variables, between collateral composed of investments in securities and bills and collateral composed of tangible assets. The purpose of this division is to infer whether differences in the liquidity of the assets influence the banks' debt ratio decisions. In this case, this variable is calculated as the ratio of book tangible assets to total assets.

4.3.6 Deposits

In this model, Deposits are the only variable that is not related to the capital theory of non-financial firms, since they can't finance themselves through deposits (Gropp and Heider, 2010). In this case, and as a result of the literature review, deposits might have an ambiguous effect on capital, because they compel banks to have more capital (less debt) in order to cushion possible losses, but they are also cheaper ways for banks to finance themselves (Smaoui, Salah and Diallo, 2019). This variable was calculated using the value of total book deposits divided by total assets.

4.3.7 GDP

The GDP growth rate is one of the variables that belongs to the category of the macroeconomic indicators that could affect the capital decisions of banks. In this case, it's expected a negative relationship between GDP and the debt ratio, because banks tend to increase their capital ratios in situations of economic expansion (Smaoui, Salah and Diallo, 2019). Anarfo (2015) also refers that in cases of growth in the economic activity, banks' income also increases, resulting in more retained earnings and less use of debt, according to the Pecking Order theory. The variable GDP is the growth rate of the Portuguese GDP.

4.3.8 Interest Rate

The Interest Rate has a double repercussion on banks, since a considerable share of their liabilities are deposits and a large part of their assets are credit, so the interest rate works simultaneously as the indicator of price and revenue of the banking activity, hence the relevance of the financial margin (difference between interest received and interest paid). For some banks, an increase of the interest rate might have a positive impact on their financial margin, especially in situations where their assets are indexed to variable interest rates, which reduces the debt risk of the bank and also increases its profits and retained earnings. It is also important to mention that in periods of high interest rates, the demand for banks' bonds and deposits increase, making it easier to finance through debt and more difficult to finance through equity. However, since interest rates are a direct cost of the banks' external financing, it can also have a negative impact on their levels of debt, since it becomes more expensive for banks to borrow money. So, in this case, the sign of the coefficient is not clear. Due to the lack of data of interest rates prior to 1999 in Portugal, the formula used is a combination of the Portuguese

treasury bond rate until 1998 and the Euribor rate after 1998. Given the importance of the variable, it was decided to maintain it with this designation.

4.3.9 Inflation Rate

Inflation Rate is another macroeconomic variable that is going to be studied, which in this case is expected to have a significant impact in the level of capital, in situations where banks can anticipate the level of the rate, since banks can adjust their interest rates and increase their level of debt (Anarfo, 2015). On the other hand, since Central Banks monitor the levels of inflation and adjust their interest rate given its evolution, higher inflation rates will lead to higher interest rates, making banks borrow less and increase their level of equity (Smaoui, Salah and Diallo, 2019). Unanticipated inflation tends to penalize investors who lend money, because it reduces their real gains, moving them away from these types of assets and making it difficult for banks to issue debt.

4.3.10 Summary of the models' variables

Table 2 – Models' variables

Variable	Method of calculation	Theory
Debt/Assets (DTA)	Ratio of total debt to total assets	Leverage ratio formula, that represents financing decisions
Profitability (PFT)	Ratio of pre-tax profits over the book value of assets	Considering the Pecking Order theory, more profitable firms use more retained earnings (internal funds)
Size (SZE)	Logarithm of total assets	From the Trade-off theory, larger firms are assumed to be capable of holding higher levels of leverage
Collateral (COL)	Sum of securities, treasury bills, other bills and bonds over the book value of assets	Collateral reduces the risk of financial distress, increasing the level of leverage
Tangibility (TGB)	Fixed tangible assets divided by total assets	Tangible assets can also stand as collateral and induce the firm to enrol in higher levels of debt
Deposits (DEP)	Ratio of total deposits to total assets	Different type of financing, when compared to regular firms. Deposits have an ambiguous effect in the values of debt
GDP	Growth rate of Portuguese GDP	In periods of economic expansion, the capital ratios are expected to increase
Interest Rate (IRT)	Combination of the Euribor rate (since 1999) and the Portuguese Treasury Bonds rate (prior to 1999)	The interest rate has an ambiguous effect on the level of debt
Inflation Rate (INF)	Annual inflation rate of Portugal	High levels of inflation increase banks' capital ratios

5. Estimation

5.1 Methodology

Since the model is Panel Data, the Hausman test was calculated in order to determine the best estimator for the equation, between random effects and fixed effects. The Hausman test concluded that the best estimator is the fixed effects, since it had a significance of 1% in the equation used in the study (Hausman test in Annex). In the case of omitted variables that are possibly correlated with the variables of the model, the fixed effects estimation provides a mean that controls this bias (Anarfo, 2015). In the fixed effects model, its assumed that the individual-specific effects are correlated with the dependent variable. A stationarity test was also carried out to identify the need to transform the variables of the model. This test concluded that all variables are stationary, which means that they don't require any type of transformation. In addition to the estimation through fixed effects, the model was also estimated using the method proposed by Cameron and Trivedi (2008) for models with more years than individuals, which uses the within estimator for the fixed effects model with AR (1) disturbance. This model is used because of the possibility of autocorrelation, which is usual in these types of estimations and is confirmed further on in the analysis when it's tested the significance of the lagged debt-to-assets ratio in the dynamic model. For panels with T>N, the model with AR (1) disturbance contributes to correct the autocorrelation and the standard errors, in situations where the asymptotic properties of N do not work properly. In this case, there will be a comparison of the result to understand if there are any substantial differences in the estimations methods. Additionally, there was also an estimation of the fixed effects model with a time dummy in the period of 2008-2013 to analyze the impact of this crisis in the debt ratio.

In order to evaluate the persistence of the dependent variable, an additional model was also estimated with the lagged dependent variable as explanatory, in order to understand its significance in explaining debt and capital decisions. The Arellano-Bond method was used in this estimation, which, although it's not the most suitable for short samples (N>T), still measures the significance of the lagged dependent variable as a predictor for the ratio debt-to-assets. In Arellano-Bond it's also assumed that time-invariant unobserved components are related to the variables of the model, taking the first differences to eliminate the individual effects and including lags of the dependent variable as instrumental variables to eliminate the endogeneity problem.

The three models used in the estimations of the determinants of Portuguese banks' capital structure are[1]:

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[1] Model 1 and Model 2 are the fixed effects estimations. Model 3 is the Arellano-Bond estimation.

$$DTA_{it} = B_0 + B_1 PFT_{it} + B_2 SZE_{it} + B_3 COL_{it} + B_4 TGB_{it} + B_5 DEP_{it} + B_6 GDP_{it} + B_7 IRT_{it} + B_8 INF_{it} + \alpha_i + u_{it} \ (1,2)$$

$$DTA_{it} = B_0 + B_1 DTA_{it-1} + B_2 PFT_{it} + B_3 SZE_{it} + B_4 COL_{it} + B_5 TGB_{it} + B_6 DEP_{it} + B_7 GDP_{it} + B_8 IRT_{it} + B_9 INF_{it} + \alpha_i + u_{it} \ (3)$$

5.2 Descriptive statistics

Table 3 - Description of the models' variables

Variable	Obs	Mean	Std. Dev.	Min	Max
id	386	-	-	1	21
t	386	-	-	1990	2018
DTA	386	.930345	.0697562	.2033801	1.004686
PFT	386	.0058262	.0074859	-.0342405	.038151
SZE	386	2.14e+07	2.73e+07	34826.22	1.26e+08
COL	386	.152174	.1036674	.0037543	.6313525
TGB	386	.0194691	.0125955	0	.0766738
DEP	386	.5670152	.1793874	.006787	.9204429
GDP	386	1.889223	2.326576	-4.06	7.86
IRT	386	5.28285	4.364278	-.19	15.4
INF	386	3.40399	2.871682	-.9	13.37

Concerning the dependent variable, the average ratio between Debt and Assets is 93.03% (0.9303). This value allows to conclude that, on average, Debt has a very high weight in the financing of banks Assets. Additionally, although it's not present in the table, the minimum values of the Debt-to-Equity ratio are negative, because in some particular years banks had a negative Equity value, which is justified by considerable losses in the net income in that year that surpass the positive amount of capital. Such situations also justify the ratio between Debt and Assets being larger than one in its maximum level. The Debt-to-Equity variable is very volatile because the standard deviation is higher that its mean and the minimum and maximum values are drastically different, indicating that it's not a trustworthy dependent variable, reflecting the decision of using the variable Debt-to-Assets.

Regarding the independent variables, Profitability has a negative value in the minimum because there are banks that in specific years had negative operational results. The variables Profitability, Size and GDP show volatility in particular due to their greater values of standard deviation when compared to their means.

Evolution of total Debt and total Equity
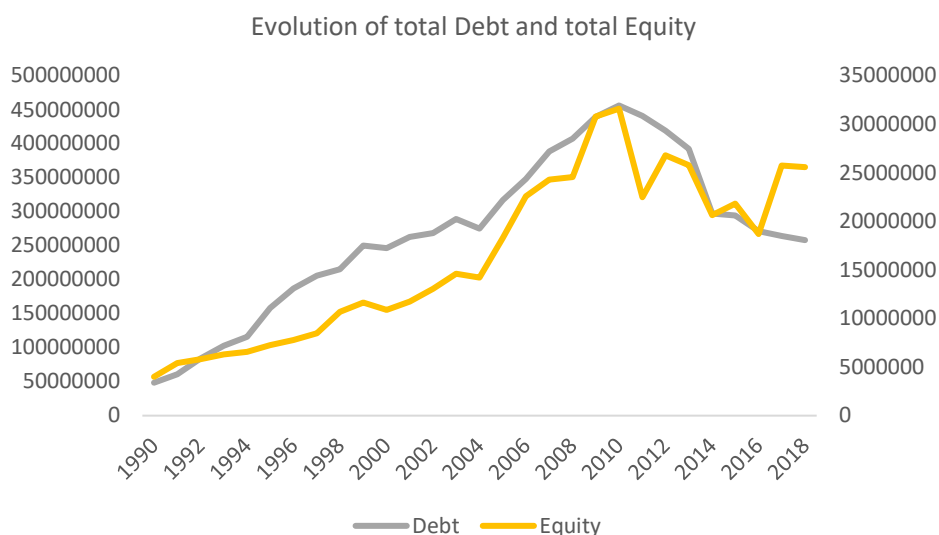
Graph 5 - Evolution of total Debt (left axis) and total Equity (right axis), sum of all banks in the sample – thousands €

Evolution of the debt ratios
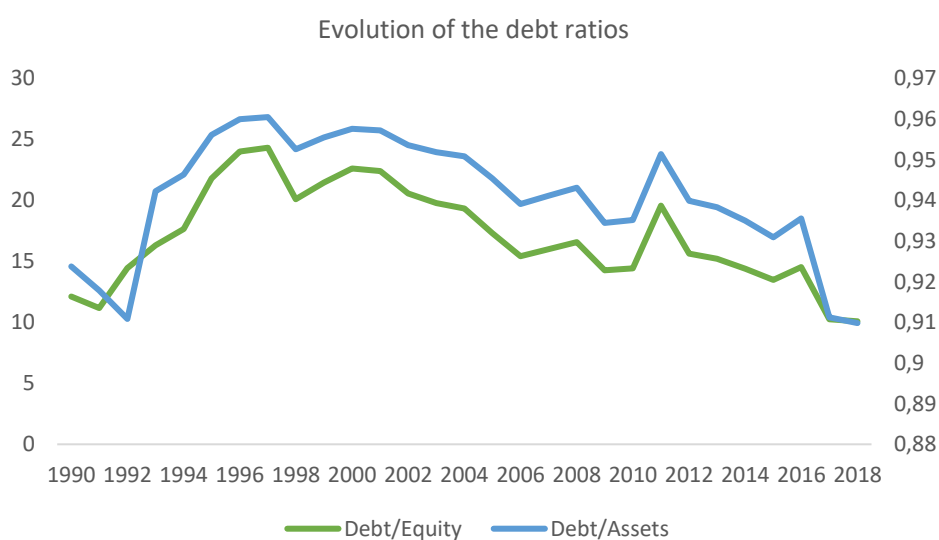
Graph 6 - Evolution of the debt ratios (Debt/Equity left axis, Debt/Assets right axis)

In Graph 5 it's possible to see the increase of the total values of the variables Equity and Debt between 1990 and the financial crisis period, where then it can be seen their simultaneous reduction. In particular, within the years of 2016 and 2018, the Equity variable shows some growth after an irregular decrease since 2008.

The following graph (6) reflects the evolution of the Debt-to-Assets and Debt-to-Equity ratio, and there it can be noticed their similar progression along the years and a steeper reduction after 2011. The weight of total debt has been decreasing consistently since 2011 and in the last years the values are quite low, meaning that the banks are now more capitalized.

In table 4 is represented the correlation matrix of the variables used in the model. As expected, the Interest Rate and the Inflation Rate have a high correlation (83%), given their economical link. The remaining variables don't have multicollinearity problems.

Table 4 - Correlation of the variables

Variable	DTA	PFT	SZE	COL	TGB	DEP	GDP	IRT	INF
DTA	1.0000								
PFT	-0.4319	1.0000							
SZE	0.1280	-0.1035	1.0000						
COL	0.0300	0.1058	0.1124	1.0000					
TGB	-0.4194	0.1930	-0.3098	0.0270	1.0000				
DEP	0.2460	-0.0057	-0.0438	-0.1205	0.2590	1.0000			
GDP	-0.0074	0.2557	-0.2782	0.0960	0.2054	0.1638	1.0000		
IRT	-0.1661	0.2614	-0.4014	0.2247	0.1700	0.4920	0.4545	1.0000	
INF	-0.1374	0.2311	-0.3001	0.1452	0.1422	0.3392	0.3774	0.8338	1.0000

5.3 Regression Results and Discussion

5.3.1 Main Model

Table 5 - Estimation of the two different models

Model	I - Fixed Effects Model[2]		II - Fixed Effects Model with AR (1) disturbance	
Observations	Number of obs = 386 Number of groups = 21		Number of obs = 365 Number of groups = 21	
R-Squared	within = 0.5666 between = 0.5578 overall = 0.4561		within = 0.2679 between = 0.3246 overall = 0.2946	
F-test	F (8,20) = 4.75 Prob > F = 0.0022		F (8,336) = 15.37 Prob > F = 0.0000	
DTA	Coef.	p>|t|	Coef.	p>|t|
PFT	-1.620702	0.056*	-1.005655	0.000***
SZE	.03774	0.008***	.0332194	0.000***
COL	.0193311	0.766	.0167958	0.408
TGB	-1.99187	0.034**	-.9313663	0.000***
DEP	.1339103	0.065*	.0210777	0.146
GDP	.0030072	0.024**	.0000837	0.884
IRT	.006878	0.015**	-.0015549	0.112
INF	-.0032788	0.031**	-.0015614	0.103
_cons	.2649968	0.278	.3966954	0.000***

*, ** and *** denote coefficients significance at 10%, 5% and 1% level, respectively

The first conclusion after the estimation of the models is that they have different results in terms of significance of the variables. Considering a 10% significance, the first estimation has a total of seven significant variables, with five of them having significance at a 5% level. As for model II, there are a

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[2]Cluster-robust standard errors for heteroskedasticity and autocorrelation.

total of three significant variables, with these three being significant at a 1% level. The signs of the coefficients are similar, except for the Interest Rate, that has a negative value in the second model.

In summary, in the fixed effects model the variables Size is significant at a 1% level, Tangibility, Inflation, GDP and Interest Rate are significant at a 5% level and Profitability and Deposits are significant at a 10% level. Collateral is not significant.

In the fixed effects model with AR (1) disturbance, Profitability, Size and Tangibility are significant at a 1% level. The remaining variables are insignificant.

In terms of the significance of the variables, there are two main differences between the conclusions of the estimations: in the model with AR (1) disturbance, the macroeconomic variables lose their significance, as well as the Deposits variable. These group of variables were expected to have a significant relationship with the dependent variable.

5.3.2 Comparison of results

Table 6 - Summary of the variables' effect according to the Literature Review

Variable	Positive Effect	Negative Effect	Insignificant
Profitability	**Financial firms:** Jouida and Hallara (2015). **Theories:** Trade-off theory.	**Non-financial firms:** Moradi and Paulet (2019); Vergas, Cerqueira and Brandão (2015). **Financial firms:** Gropp and Heider (2010); Teixeira et al (2014); Sorokina, Thornton and Patel (2017); Anarfo (2015); AL-Mutairi and Naser (2015); Hoque and Pour (2018). **Theories:** Pecking order theory.	**Financial firms:** Smaoui, Salah and Diallo (2019).
Size	**Non-financial firms:** Moradi and Paulet (2019); Antoniou, Guney and Paudyal (2008). **Financial firms:** Boucinha and Ribeiro (2008); Gropp and Heider (2010); Teixeira et al (2014); Sorokina, Thornton and Patel (2017); Anarfo (2015); Smaoui, Salah and Diallo (2019); Hoque and Pour (2018). **Theories:** Trade-off theory.	**Financial firms**: Jouida and Hallara (2015); AL-Mutairi and Naser (2015).	**Non-financial firms:** Vergas, Cerqueira and Brandão (2015).
Collateral	**Financial firms:** Gropp and Heider (2010); Teixeira et al (2014); Nonna Sorokina, John Thornton and Ajay Patel (2017). **Theories:** Trade-off theory.		**Financial firms:** Jouida and Hallara (2015); Hoque and Pour (2018).
Tangibility	**Non-financial firms:** Moradi and Paulet (2019); Antoniou, Guney and Paudyal (2008). **Theories:** Trade-off theory	**Financial firms:** Anarfo (2015); AL-Mutairi and Naser (2015).	**Non-financial firms:** Vergas, Cerqueira and Brandão (2015).
Deposits	**Financial firms:** Smaoui, Salah and Diallo (2019).	**Financial firms:** Jouida and Hallara (2015).	
GDP	**Financial firms:** Boucinha and Ribeiro (2008); Teixeira et al (2014).	**Theories:** Pecking order theory.	**Financial firms:** Sorokina, Thornton and Patel (2017); Anarfo (2015); Smaoui, Salah and Diallo (2019).

Interest Rate			**Financial firms:** Anarfo (2015).
Inflation Rate		**Financial firms:** Anarfo (2015).	**Financial firms:** Teixeira et al (2014); Sorokina, Thornton and Patel (2017); Smaoui, Salah and Diallo (2019).
Financial crisis	**Financial firms:** Teixeira et al (2014).	**Non-financial firms:** Moradi and Paulet (2019).	**Financial firms:** Smaoui, Salah and Diallo (2019).

In this section there will be an analysis of the sign and significance of each variable of the model and the comparison with its expected sign. Please check table 6 in the analysis of each variable to see the empirical papers that had similar or different results.

Starting with Profitability, it had a negative and significant coefficient in Model I and Model II, in line with the Pecking Order theory and the conclusion that retained earnings are a preferred method of funding, thus negatively affecting debt ratios. This means that Portuguese banks that are more profitable tend to use less debt and more retained earnings. In these cases, banks might opt to use internal funds to finance new investments instead of debt, even though they might have good opportunities to finance themselves externally (AL-Mutairi and Naser, 2015). This is a procedure that is often encouraged by political authorities, since it's a must cheaper way of increasing the banks' levels of capital. This conclusion is also in accordance with most of the empirical work carried out for both non-financial and financial firms, such as Gropp and Heider (2010), Anarfo (2015), Moradi and Paulet (2019). A highlight in this conclusion is that it differs from Marques and Santos (2004), that found no evidence of the Pecking Order theory in the surveys on Portuguese CEOs in the 90's decade.

Regarding the Size variable, the positive and significant result in Model I and Model II is also in line with the expectations of the Literature Review and the Trade-off theory, which indicates that larger banks can have higher levels of debt, consequently at lower costs, being more capable of diversifying their risk (Smaoui, Salah and Diallo, 2019). This result is shared by most empirical works cited in this thesis, such as Boucinha and Ribeiro (2008), Gropp and Heider (2010), Sorokina, Thornton and Patel (2017).

The variable Collateral produced positive but insignificant results in Model I and Model II. In this case, the variable goes against the Literature Review, that indicates that banks with more financial collateral have more capacity to have debt (Teixeira et al, 2014). This collateral can be used by banks when borrowing from the Central Bank (Gropp and Heider, 2010), thus reducing their level of financial distress, since they have better access to debt markets.

Tangible Assets is significant and has a negative value in Model I and Model II, a coefficient that was expected to be positive, due to the possible use of the assets as collateral. In this case, Tangible Assets affects negatively the debt ratio, an outcome that is opposite to the variable Collateral in the model. This conclusion is not in line with the Trade-off theory, which positions tangible assets as a way

for banks and companies to reduce their risk and be able to finance themselves at lower costs. Nevertheless, it's still possible to see a negative relationship between banks' debt levels and tangible assets, considering that banks with higher levels of tangible assets tend to be the ones that have more branches and are less digital, which can result in them taking less risk and so, having more capital.

The Deposits variable has a positive and significant coefficient in Model I, indicating that deposits are one of the preferred sources of assets financing by banks, thus reducing the capital ratio (Smaoui, Salah and Diallo, 2019). This coefficient also has a positive value in model II, but it's not significant. It is also important to highlight that most Portuguese banks have high levels of financing through deposits and these occupy a large share of their liabilities. As expressed in the descriptive analysis, deposits finance an average of 57% of total assets in the sample of this model and are considered to be one of the main forms of funding in the Literature Review on banks' capital theories, since equity capital is perceived to be more costly (Allen, Carletti and Marquez, 2015).

GDP has a positive coefficient and significance in Model I, indicating that banks tend to finance themselves with debt in periods of economic growth, a value that is opposite to what was seen in the theoretical literature review but in accordance to the empirical studies of Boucinha and Ribeiro (2008) and Teixeira et al (2014). In this case, banks increase their levels of capital in periods of downturns to cover the risk they are facing in that specific period (Boucinha, 2008).

Inflation has a negative coefficient and significance in Model I, meaning that increases in inflation tend to increase the levels of capital of banks, since in periods of high inflation, central banks interest rates tend to be higher, thus creating incentives for banks to hold larger levels of capital. In the empirical Literature Review, only the study of Anarfo (2015) produced significant results on inflation, with it also having a negative influence on the debt ratio.

The last variable estimated was the Interest Rate, that assumed a significant positive value in Model I, implying that banks tend to increase their level of debt when the interest rate increases. In this case, increases in the interest rate increases banks' profits, making them more capable of increasing their levels of debt, according to the Trade-off theory. As it was mentioned before, high interest rates also create the demand for banks' bonds and deposits, making it easier for banks to finance their activity with debt.

Note that the macroeconomic variables are not significant in model II, thus justifying a word of caution when interpreting their effects, and demanding further analysis on these variables, outside of the scope of this thesis.

One of the main conclusions of this estimation process is that the capital theory of non-financial firms is also verified on Portuguese banks, given the significance and the expected sign of the variables that come from this theoretical structure. It's possible to conclude that banks, despite having different assets and debt structures when compared to non-financial firms, since they are obviously much more

leveraged, have similar determinants in capital decisions. Finally, it is also critical to recognize that regulation is not the sole factor in determining the capital ratios of Portuguese banks, in accordance with the conclusion of several empirical studies such as Gropp and Heider (2010) and Teixeira et al. (2014), in the analysis carried out in Europe and the United States. Although capital regulations are relevant and have an increasing importance for banks due to tighter capital requirements, they are not the only determinant on capital decisions, considering that banks also take into account the same determinants that affect non-financial firms.

5.3.3 Dynamic Model

Table 7 - Estimation of the dynamic model

Model	III - Arellano-Bond dynamic panel-data estimation[3]	
Observations	Number of obs = 342 Number of groups = 21	
Chi-squared test	Wald chi2 (9) = 12049.08 Prob > chi2 = 0.0000	
DTA	Coef.	p>|z|
DTA$_{t-1}$	0.6675851	0.000***
PFT	-1.039089	0.017**
SZE	.0045671	0.280
COL	-.0054845	0.797
TGB	-.6145905	0.116
DEP	.0216253	0.299
GDP	.0001744	0.701
IRT	.002647	0.008***
INF	-.0018684	0.003***
_cons	.2376959	0.000***

*, ** and *** denote coefficients significance at 10%, 5% and 1% level, respectively

The estimation of the Arellano-Bond model concludes that the lagged dependent variable *t-1* is significant and contributes positively to the debt ratio in time *t*. This conclusion indicates that debt and capital are persistent, and capital has already been proven to be such in the studies for Portugal of Boucinha and Ribeiro (2008) and France of Jouida and Hallara (2015). This persistence reveals the existence of adjustment costs in the short-term (Smaoui, Salah and Diallo, 2019).

In this estimation, the sign of the coefficients are equal to the ones in the fixed effects estimations, with the exception of the variable Collateral that now has a negative value and the Interest Rate variable, which is positive, like the Model I. Yet, this estimation only produced significant results for the lagged dependent variable, Profitability, Interest Rate and Inflation, with Profitability being the only firm-specific variable with significance.

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[3] Cluster-robust standard errors for heteroskedasticity and autocorrelation.

To complement the analysis of the model's explanatory quality, R-Squared was calculated and is equal to 0.88, indicating that the estimated model has a strong explanatory capacity.

5.3.4 Impact of the Financial Crisis

The fixed effects model had an extra estimation that includes a time dummy related to the international financial crisis and the euro sovereign debt crisis mentioned in this study, which assumes the value of 1 between 2008 and 2013, in order to identify its impact on banks' capital decisions. It is expected that the dummy will negatively affect debt ratios, given the need for capital in these years, to protect banks from losses in their assets (Teixeira et al, 2014). Since this was a period when banks were undercapitalized, they felt a need to increase their capital ratios in order to absorb eventual losses that might occur in their operations. This obligation was also enforced by regulators and the government, to guarantee that banks would reduce their levels of leverage. There are no interaction variables in this model because it's not a goal of this dissertation to see if the firm and bank specific variables had different effects in these periods.

Table 8 - Estimation of the model with the dummy Financial Crisis

Model	Fixed Effects Model[4]	
Observations	Number of obs = 386 Number of groups = 21	
R-Squared	within = 0.5779 between = 0.5579 overall = 0.4569	
F-test	F (9,20) = 4.86 Prob > F = 0.0016	
DTA	Coef.	p>|t|
PFT	-1.882855	0.036**
SZE	.0403907	0.005***
COL	.0268438	0.681
TGB	-2.010141	0.032**
DEP	.1203135	0.081*
GDP	.001577	0.139
IRT	.0070917	0.010***
INF	-.0030207	0.039**
FCrisis	-.022221	0.006***
_cons	.2354146	0.327

*, ** and *** denote coefficients significance at 10%, 5% and 1% level, respectively

In this case, the dummy for the financial crisis has a negative significant coefficient, being in accordance to the theoretical Literature Review, which states that in the period of the economic crisis of 2007, banks were forced to hold higher levels of capital to prevent possible losses in the future. In order to reduce their risk, banks decreased, on average, 2.2 p.p of their level of leverage.

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[4] Cluster-robust standard errors for heteroskedasticity and autocorrelation.

6. Conclusion

6.1 Conclusions of the study

Since there aren't any recent studies on the determinants of Portuguese Banks' capital structure, this dissertation studied the connection between the theory of non-financial firms' capital and the determinants of banks' capital ratios. The main goal was to see if the most common variables used in theoretical and empirical studies were also significant for Portuguese Banks.

Through the use of the dependent variable Debt-to-Assets, which reflects the leverage decisions of banks, the model estimated comprises a set of three variables that come from the Literature Review: firm-specific variables of the corporate theory; bank-specific variables; macroeconomic variables that affect all firms. After estimating the model through fixed effects and fixed effects with AR (1) disturbance, it was concluded that the variable Profitability, Tangibility and Inflation negatively affect the debt ratio, with the sign on Profitability being in accordance with the Pecking order theory, and Size, Deposits, GDP and Interest Rate positively affecting the debt ratio, with the variables being in line with the Literature Review, with the exception of Deposits and the Interest Rate, which *a priori*, have an ambiguous effect. Collateral was the only variable that was not significant in any of the models. It is also important to mention that Deposits and the macroeconomic variables were not significant in the AR (1) disturbance model, revealing the difference in the output of the two estimation processes and showing that their effect is not firmly established.

A third estimation through a dynamic model shows that banks' debt ratio is persistent, the result of the existing adjustment costs, which do not allow substantial changes in banks' capital ratios in the short run.

A fourth and final estimation with the dummy of the financial crisis in period of 2008-2013 concluded that Portuguese banks in this period increased their capital ratios (deleveraging), a reflection of higher economy uncertainty, of the capital rules that were created, such as Basel III, and the pressure from the economic authorities for banks to have levels of capital capable of protecting themselves from the possible losses that would arise in the economy crisis, since this was a period in Portugal were individuals and firms were largely in debt and the non-performing loans fraction in banks' assets started to increase.

These conclusions are in line with the general empirical studies in the Literature Review, proving once again that regulation is not the only decision factor for banks' capital. Banks are firms which off course tend to be more indebted due to their activity that heavily relies on deposits. Nevertheless, they still decide their levels of capital considering the same factors as non-financial firms, such as firm-

specific variables like the size of the bank, their financial performance and the macroeconomic atmosphere that surrounds them.

With the increase of the importance of regulation and the covid-19 pandemic, this study leaves room to understand the impact of these events on banks' capital levels, with these events obviously pressuring banks to increase their capital ratios.

6.2 Limitations of the study

There are a number of study limitations that could affect the conclusions of the model, namely the fact that consolidated data was used, which implies that in the banks' financial statements there are also values associated with activities that are not directly related to the commercial side of banks, such as insurance or investment banking. Second, the use of financial statements, and since the balance sheet is a photograph of the end of the year for banks, their variables can be highly influenced by financing decisions at the end of this period.

6.3 Further research

An additional point of research will undoubtedly be the estimation of the impacts of covid-19 on the capital management of banks. Considering the existing moratoriums, banks must strengthen their capital ratios to absorb eventual losses after the end of the measure, given the possibility of default of some assets. There are a number of variables that can be estimated in the future which go beyond the variables predominantly used in the theories of non-financial firms, which focus more on the attributes of banks, such as variables related to banks' regulation and liquidity, financial margin, etc. It could be also relevant to test the impact of the evolution of capital regulation in banks' capital ratios, since regulation variables were not included in this study. This further analysis could be also extended to the effect of the macroeconomic variables, given the fact that their relationship with the debt ratio was not firmly established in this dissertation.

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8. Annexes

Table 9 - List of banks in the sample

Name	Period in the sample	Nº of observations
Banco BBVA (Portugal)	1992-2017	26
Banco BPI	1991-2018	28
Banco Espírito Santo	1990-2013	24
Banco Fonsecas & Burnray	1990-1997	8
Banco Mello	1992-1999	8
Banco Montepio	1990-2018	28
Banco Nacional Ultramarino	1990-2000	11
Banco Pinto & Sotto Mayor	1990-1999	10
Banco Português de Negócios	1993-2007	15
Banco Português do Atlântico	1990-1999	10
Banco Privado Português	1997-2007	11
Banco Totta & Açores	1990-2003	14
Banif	1990-2011	21
Barclays (Portugal)	1992-2015	24
Caixa Geral de Depósitos	1990-2018	29
Crédito Agrícola	1994-2018	25
Crédito Predial Português	1990-2003	14
Deutsche Bank (Portugal)	1999-2010	12
Finibanco	1993-2010	18
Millennium BCP	1990-2018	29
Santander Totta	1998-2018	21

Table 10 – Hausman test

	Prob >chi2
Hausman Test	0.001***

*, ** and *** denote significance at 10%, 5% and 1% level, respectively