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**Has the crisis impacted the determinants of  
capital structure for Portuguese public firms?**

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# **Has the crisis impacted the determinants of capital structure for Portuguese public firms?**

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## **Abstract**

The intention of the present dissertation is to identify the determinants of capital structure for Portuguese public firms for the period of 2005-2015 and in different sub-periods: before and during the global financial crisis, and during the European sovereign debt crisis. Thus, it proposes to empirically identify the firm characteristics and prevailing capital structure theories influencing managers' decision-making process regarding the level of leverage. For the period 2005-2015, information regarding 57 firms from the Euronext Lisbon index was collected and analysed. Empirical results concluded that i) for the entire sample period, profitability and growth opportunities influenced negatively the level of leverage, while size and non-debt tax shields revealed to be positively related to indebtedness; ii) during the global financial crisis, profitability and liquidity were the only firm characteristics explaining the level of debt and iii) when the European sovereign debt crisis hit, growth opportunities and non-debt tax shields were the sole determinants in explaining Portuguese public firms' leverage. The determinants influencing the proportion of long-term debt in the capital structure were also analysed for the same sample and time horizon.

# **A crise influenciou os determinantes da estrutura de capitais das empresas cotadas portuguesas?**

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## **Abstrato**

O objetivo da presente dissertação é identificar os determinantes da estrutura de capitais das empresas cotadas portuguesas, para o período de 2005-2015, e em diferentes sub-períodos: antes e durante a crise financeira global, e durante a crise europeia de dívidas soberanas. Propõe-se então a identificar empiricamente as características das empresas e principais teorias de estrutura de capitais que influenciaram o processo de decisão de gestores, relativamente ao nível de endividamento. Para o período 2005-2015, é analisada informação sobre 57 empresas pertencentes ao índice Euronext Lisbon . Os resultados empíricos permitem concluir que i) para todo o período, rendibilidade e oportunidades de crescimento influenciaram negativamente o nível de dívida, enquanto a dimensão da empresa e outros benefícios além da dívida revelaram-se positivamente relacionadas com o endividamento, ii) durante a crise financeira global, rendibilidade e liquidez foram as únicas características explicativas do nível de dívida e iii) durante a crise europeia de dívidas soberanas, oportunidades de crescimento e outros benefícios além da dívida foram os únicos determinantes a explicar o endividamento das empresas públicas portuguesas. Os determinantes que influenciaram a proporção de dívida de longo prazo na estrutura de capital foram também analisados, para a mesma amostra e período de tempo.

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# 1. Introduction

The present dissertation has the purpose of enriching the already vast empirical literature regarding the decision-making process of a firms' capital structure. Therefore, in this study the identification of the determinants of capital structure for Portuguese public firms, for the period 2005-2015, will be carried out. Furthermore, this analysis will be comprehensive to the sub-periods before and during the global financial crisis and during the European sovereign debt crisis. Besides analysing the level of debt, the proportion of long-term debt in the capital structure will also be considered. This is an interesting point to observe due to the importance of long-term funding to support investment and firm growth. Also, as the crisis affected mainly the banking sector, by analysing the determinants of capital structure influencing the proportion of long-term debt, one will be able to analyse the main motivations for the change in the behaviour of the bank financing in the Portuguese economy before and during the global financial crisis and during the European sovereign debt crisis.

Firms' capital structure has been an immensely discussed topic over the last decades and several empirical studies and theories have been proposed in order to explain it. It is widely known that firms can always choose between internal and external sources of financing, i.e. whether to issue debt or equity. Bearing in mind that in corporate finance the primary goal of a firm is to maximize its value, having an optimal capital structure is a premise to this matter. Agency costs, pecking order, trade-off, market timing or mechanical stock price are examples of capital structure theories developed in the last decades, which will be presented in the following section.

Likewise, different firm characteristics influence the capital structure choice of a firm. Such characteristics can be endogenous, i.e. related to the firm, as profitability, liquidity, tangibility, firm size, growth opportunities or non-tax related benefits, or exogenous, as for example the overall growth of the economy the business operates in.

As previously mentioned, the present dissertation focuses on the period between 2005 and 2015. This is a particularly interesting period for analysis, which includes the global financial crisis and the European sovereign debt crisis. Therefore, one of the main goals of this thesis is to understand how did the determinants of Portuguese public firms' capital structure changed during these periods.

The global financial crisis, or the subprime crisis, initiated in the United States of America, rapidly expanded causing repercussions all over the world. The collapse of the speculative housing market bubble compromised the entire mortgage industry. This industry has always been based on trust. Without trust, liquidity problems arise leading afterwards to insolvency in the real economy by preventing non-financial businesses to be granted financing in order to normally operate. At this point, the entire system begins to collapse leading to recession. In a global era, this rapidly spreads across the entire world, especially through trade and financial bonds.

The global financial crisis was also one of the causes of the European sovereign debt crisis. The European sovereign debt crisis occurred when several European countries were forced to ask for international financial help in order to avoid the collapse of their financial systems. Once again a problem of confidence affected businesses and economies. Portugal, together with countries such as Iceland, Greece and Ireland, was one of the countries to ask for financial help. In order to be granted bailout funds, the implementation of austerity measures and structural reforms took place which affected in multiple ways households and businesses.

The motivation of this study is based on the need to evaluate the impact of such events in the determinants of Portuguese public firm's capital structure.

The remainder of the present dissertation is structured as follows. Section 2, presents the most prevalent empirical literature regarding capital structure theories. Section 3, describes the methodology implemented in this study. Section 4 presents the empirical results from the descriptive statistics and the model while Section 5 displays the robustness tests' outputs. The main conclusions are presented in Section 6. In Section 7 one can find the limitations faced and suggestions of topics for further research. Finally, Sections 8 and 9 display, respectively, the tables' outputs that support the empirical findings and main references consulted.

## 2. Literature Review

In corporate finance, a lot of research has been conducted over the past decades and a number of theories have been proposed regarding whether firms have an optimal capital structure or not, meaning if they are financed through an optimal mix of equity and debt.

The Modigliani and Miller (MM, 1958) theorem can be considered as the first theory to emerge regarding capital structure. This model states that under circumstances of perfect capital markets, i.e. absence of taxes, transaction and bankruptcy costs, similar borrowing costs for both firms and investors, symmetry of market information and no effect of debt on a firm's earnings before interest and taxes (EBIT), the way a firm is financed does not affect the value of the firm. In other words, the firm's value is independent of the firm's financing policy.

The first proposition of this theorem, known as the capital structure irrelevance proposition, states that a firm's market value is not affected by the firm's capital structure. This is supported by the above mentioned unrealistic assumptions as in the real world perfect capital markets do not hold. It is assumed that investors have homogeneous expectations concerning future cash flows and one is in presence of a perfect capital market, meaning there are no taxes, transaction or bankruptcy costs and all agents have symmetric information. Also investors borrow and lend at the same rate, there are no agency costs and investment and financing decisions are independent of one another. Here firms are indifferent to the source of capital and the weighted average cost of capital ( $r_{wacc}$ ) remains constant even when the firm's capital structure changes, so there is no benefit from increasing borrowing as there is no interest deductibility.

The second proposition states that the cost of equity increases as the firm increases its leverage, meaning the cost of equity is a linear function of the firm's capital structure. As bondholders have a senior claim over the firm's assets in comparison to equity holders, the cost of debt is less than the cost of equity. Being debt a cheaper source of capital it is more used. The  $r_{wacc}$  remains constant, as the increase of debt in the capital structure is balanced out with the increase in the cost of equity, so there is no benefit in using debt over equity.

In 1963, Modigliani and Miller refined the model by introducing corporate taxes. The introduction of taxes enhances the value of the firm resultant from the tax shield provided by interest deductibility. By acknowledging tax savings, this approach assumes that a

change in the firm's capital structure affects the  $r_{wacc}$ . Therefore an increase in debt, lowers the cost of capital, increasing in this way the value of the firm, so the higher the leverage, the higher the value of the firm.

MM theorem was then contested by Ross, Westerfield & Jaffe (1993) that stated that this theory was incompatible with the empirical evidence found. However, they also stated that the MM contribution was essential to the understanding of capital structure. Myers (2001) found difficulty in testing MM (1958) propositions. However, MM unrealistic approach by assuming perfectly efficient markets and ignoring realities such as taxes, bankruptcy, transaction and agency costs, or asymmetry of information, triggered most of the corporate finance research that has focused in disproving the irrelevance of capital structure (Stiglitz, 1969) and in attempting to explain these imperfections giving origin to different capital structure theories.

For instance, the imperfection of bankruptcy costs occurs when a firm is struggling to meet its obligations, fact that is neglected by MM (1958). Scott (1976) stated that a firm's probability of incurring bankruptcy costs increases as the level of debt increases. Barclays et al. (1999) found that though the direct bankruptcy costs seem to have a small impact on a firm's market value, the indirect costs can be substantial. As the relative level of debt in the capital structure increases over the optimal amount, the expected cost of financial distress increases as well. Therefore, a highly indebted firm faces a higher chance of going bankrupt than a firm with a low level of debt.

Agency costs are inherent to conflicts arising from the separation of ownership and management of a firm (Jensen and Meckling, 1976; Myers, 1984). According to Jensen and Meckling (1976), the managers' (agent) interests are not perfectly aligned with the ones of the shareholders (principal) which may lead to managers' actions that are not in the best interest of shareholders. Appropriate incentives are necessary to prevent harmful actions by the agent and to align both interests of owners with the ones of the management. This is not possible without incurring costs, therefore Jensen and Meckling (1976) defined agency costs as the sum of: the monitoring costs, costs incurred by the principal in an attempt to control the agent; the bonding costs, expenses incurred by the agent in order to restrict his own potential harmful actions; and the residual loss, resultant of the wealth loss when agent's behaviour does not maximize principal's welfare. Hill (1998) stated that a firm with low level of leverage in its capital structure may not face

agency costs until it reaches a given threshold in terms of debt. Beyond this, the firm will start to be perceived as risky by debtholders which will rapidly trigger its agency costs.

The more profitable the firms are, the higher the portion of earnings used to make debt payments, and the more investments a firm has, the lower the level of debt in its capital structure (Jensen and Meckling, 1976). This happens as in this way there are less shareholders' funds available for managers to spend in perquisites and works as a way to prevent agency problems. On the other hand, management under and overinvestment practices potentiate conflicts between shareholders and debtholders (Myers, 1977, 1993).

As seen, conflicts arise not only from manager-shareholder relationship, but also from debtholder-shareholder relationship (Jensen & Meckling, 1976), due to the benefits of debt financing in the first case and agency costs in the last one. By balancing the benefits against the costs of debt financing one can find the firm's optimal capital structure. It is also worth to mention that research regarding agency costs models found that a firm's capital structure is positively correlated with its market value, free-cash flow, default probability and importance of managerial reputation (Harris & Raviv, 1990; Stulz, 1990).

MM (1958) suggested that investors have homogeneous expectations concerning future cash-flows which in reality does not hold. For instance, managers have more timely and accurate information regarding current and future performance of a firm than other stakeholders. When having access to inside information, investors may benefit from a trading advantage which deteriorates capital market imperfections. According to Myers and Majluf (1984), information asymmetry between managers and new investors leads to an undervaluation in stock prices. This is the foundation of the pecking order theory.

The pecking order theory (Myers and Majluf, 1984; Myers, 1984) states that firms have a hierarchical preference in terms of financing sources. Firms prefer to use in the first place internally generated funds to finance their operations, as this avoids being exposed to the asymmetric information problem. When retained earnings are insufficient, firms issue debt securities which pay a predefined remuneration, are less sensitive to information and are less risky, being therefore less costly. Only when issuing debt is no longer possible, the least preferred source of capital is considered, i.e. firms consider to go public by issuing equity. Shyam-Sunder and Myers (1999) and Frank and Goyal (2003) research supports the pecking order theory. On the other hand, this theory contradicts the MM (1958) theorem, as according to the pecking order theory, firms prefer

internal funds rather than external funds to finance themselves, therefore not benefiting from the tax shields resultant from holding debt (Fama and French, 1988). According to this theory, profitability and leverage are negatively correlated (Graham, 2000; Fama and French, 2002; Korajczyk and Levy, 2003). This happens as more profitable firms have more internal funds available to finance their operations therefore borrow less, and less profitable firms require external sources of financing which leads them to accumulate debt (Myers, 2003).

The introduction of corporate taxes by MM (1963) originated the trade-off theory which weights the benefits against the costs associated to the use of leverage in a firm's capital structure. According to Kraus and Litzenberger (1973), the optimal level of debt results from the trade-off between tax benefits of debt and bankruptcy costs. They state that an increase in the level of debt increases the probability of bankruptcy, increasing therefore expected bankruptcy costs. A firm will take on leverage until the optimal capital structure is reached, i.e. the point where the incremental tax shield benefit on additional debt is exactly offset by the incremental present value of possible costs of financial distress (Myers, 2001).

According to the pecking order theory, profitability is negatively related with the level of debt as the firm will in the first place use its own resources to finance its activities (Myers, 1984). Conversely, and as previously stated, according to the trade-off theory, profitability and level of debt are positively related. DeAngelo and Masulis (1980) also found that more profitable firms benefit more from the tax advantages of debt. Also, more profitable firms have more free cash flows available so by having to make debt payments helps to align the interests of both managers and shareholders and to monitor management (Jensen and Meckling, 1976; Jensen, 1986). Tangibility is also a predictor of leverage as firms with more tangible assets hold more debt as these are easy to collateralize, thus reducing the agency costs of debt (Rajan and Zingales, 1995).

The risk of bankruptcy is seen as the main disadvantage of debt financing, even when accounting for the benefits of tax shields resultant from holding high gearing (Graham and Lemmon, 1998). Therefore, when a firm holds a high level of debt it is probably a way to control and monitor management. According to Shyam-Sunder and Myers (1999) leverage is negatively correlated with the rate of investment, hence firms with more investments bear less leverage. In the same way, Nolan (2002) states that start-up firms may face higher chances of financial distress as their tangible asset base is low. With this,

one can infer that the trade-off theory suggests that firms with stable cash flows and a solid asset base may face a lower risk of bankruptcy. As a result, these firms tolerate relatively higher levels of debt in their capital structure.

It is also worth to mention that personal taxes can be considered as a disadvantage of debt financing as according to Miller (1977) their existence may offset the benefits raised by interest deductibility, in which case no gain is reaped from using tax-deductible debt instead of equity.

For Myers (1984), a firm that bases the choice of its capital structure in the trade-off theory gradually moves towards a set target debt ratio. Then, Frank and Goyal (2005) suggested the static and dynamic trade off theory. In the static trade-off theory, by trading off the interest deductibility with the financial distress costs, the optimal capital structure is reached. In the dynamic trade-off theory, the firm adjusts its behaviour in order to gradually reach the target capital structure.

As seen, the pecking order and the trade-off theories diverge in terms of determining a firm's optimal capital structure. However, both theories have a common view regarding the determinant of leverage, tangibility, as both state a positive correlation between tangibility and leverage (Fama and French, 2002).

Meanwhile, the market timing theory was proposed by Baker and Wurgler (2002) which suggests that managers tend to identify more favourable periods of time to issue equity, i.e. when the firm's market value is high which makes the cost of equity lower. This entails that firms choose their financing sources according to the relative costs incurred. Therefore firms prefer and are more likely to issue equity when the cost of equity is low and opt by debt under other circumstances. The authors also found that fluctuations in the market value of equity have long-lasting effects on the firm's capital structure which was contradicted by Hovakimian (2006) and Kayhan and Titman (2007). Frank and Goyal (2004) went further stating this could not be considered a capital structure theory as there was not sufficient research to support it. After this, several authors presented empirical evidences that support the market-timing theory (Huang and Ritter, 2005; Hovakimian, 2006; Kayhan and Titman, 2007).

In 2004, Welch presented the mechanical stock price explanation which claims that managerial inertia allows share price fluctuations to have a significant impact on the firm's capital structure by stating that "(...) over reasonably long time frames, the stock

price effects are considerably more important in explaining debt-equity ratios than previously identified proxies” (pp.107).

As seen many theories have been proposed regarding the optimal capital structure decision and the determinant factors that influence that choice such as tangibility, profitability, liquidity, firm size, growth opportunities and tax related benefits (Rajan and Zingales, 1995; Jensen and Meckling, 1976; DeAngelo and Masulis, 1980; Frank and Goyal, 2009; Graham, Lemmon, and Schallheim, 1998). However there is still evidence lacking on whether the global financial crisis and the European sovereign debt crisis influenced the choices of Portuguese public firms’ managers when selecting the level of total and long-term debt on the capital structure. This is the gap that the present dissertation aims at filling in, i.e. estimating the determinants of the level of debt in Portuguese public firms’ capital structure before and during the global financial crisis and during the European sovereign debt crisis.

### **3. Methodology**

The present dissertation aims at understanding and analysing the determinants of capital structure, in terms of total debt and proportion of long-term debt, for Portuguese public firms, listed in the Euronext Lisbon index. This study is conducted from 2005 until 2015. This time horizon comprises the time before and during the global financial crisis and during the European sovereign debt crisis.

Following an analysis on the literature review regarding the already existent capital structure theories and the factors influencing a firm's capital structure, in this chapter one will present the data, describe how the sample was constructed and identify the variables which will be used to carry out this study. After defining the variables, the research hypothesis tested and the empirical approach selected to validate the research hypothesis are presented.

#### **3.1. Data**

In order to select the sample, the software Thomson Reuters Worldscope via Datastream was used as it has available all the financial information regarding Portuguese public firms. The necessary financial information was then extracted for all the firms present in the Euronext Lisbon index spanning the period 2005-2015, including for the firms that were already delisted. All data is in Euros.

From this selection a total of 64 firms was found, from which 46 firms are currently part of the Euronext Lisbon index and the remaining 18 were delisted from the index since 2005 until 2015. From this sample of 64 firms, the ones which operate in the financial sector were excluded. A total of 7 financial institutions were removed as these firms are responsible for granting credit to the economy and have a capital structure composition that differs from the remaining firms being analysed. Authors as Frank and Goyal (2003) and Fama and French (2002) have also excluded the financial sector from their research.

After this adjustment a total of 57 firms remained relevant for the study which in the end formed the final sample (Table 1). From the 57 firms, 42 are currently part of the Euronext Lisbon index and the remaining 15 were delisted from the index at some point in time since 2005.

### **3.2. Variables Definition**

In order to estimate the model, some of the factors addressed in the literature review regarding the determinants of a firm's capital structure will be used. So far, several authors have conducted empirical research on this theme which will serve as support to this study (Bradley, Jarrel and Kim, 1984; Titman and Wessels, 1988; Harris and Raviv, 1991; Rajan and Zingales, 1995; Myers and Sunder, 1999; Fama and French, 2002, among others).

In this dissertation the variables i) Leverage (LEV) and ii) Long-term Leverage (LTLev) are used to describe the capital structure of each firm (Table 2). Leverage is estimated as the ratio of Debt to Total Assets, while Long-term Leverage results from the ratio of Long-term Liabilities to Total Debt. These two dependent variables differ from one another as the first one measures the level of debt in the capital structure while the second one tries to measure the proportion of long-term debt in the capital structure.

As previously stated, when choosing a firm's capital structure several firm characteristics proved to influence this decision. Therefore the most relevant factors will be verified as independent variables, according to several studies and theories related to the theme.

The firm characteristics selected were i) Profitability, ii) Liquidity, iii) Tangibility, iv) Size, v) Growth opportunities and vi) Non Debt Tax Shields (Table 3).

i) Profitability is measured using the indicator Return on Assets (ROA) (Myers, 1984; Rajan and Zingales, 1995). According to the pecking order theory, the greater the profitability of a firm, the lower the level of debt in the capital structure as the firm will in the first place use its own resources to finance its activities. Therefore Myers (1984) relates negatively profitability and level of debt. On the other hand, according to the trade-off theory, profitability and level of debt are positively related as more profitable firms have greater facility to borrow debt and negotiate more advantageous conditions.

Despite these two different perspectives, this determinant behaviour is expected to be negatively related with the level of debt, as this result seems to be very consistent across several empirical studies (Titman and Wessels, 1988; Harris and Raviv, 1991; Rajan and Zingales, 1995; and Fama and French, 2002).

Nonetheless the sign of the relation between profitability and the level of debt will signal the evidence of Portuguese public firms to base their capital structure decisions according to the pecking order theory or not.

- Hypothesis 1: Profitability has a negative effect on leverage.

ii) Liquidity was measured using the Current ratio, which relates Current Assets with Current Liabilities. This determinant is related to the degree of easiness a firm has to meet its financial obligations as they come due with the liquid assets in its possession.

Graham (2000) relates these two variables negatively. Authors as Frieder and Martell (2006) and Lipson and Mortal (2009), found that more liquid firms not only have a considerably low level of debt in its capital structure, as they are more likely to raise equity instead of debt when in need for external financing. Submitter and Anderson (2002) and Sibilkov (2007) found empirical evidence that firms with more liquid assets bear a higher level of debt in its capital structure, relating therefore these two variables positively.

- Hypothesis 2: Liquidity has a negative effect on leverage.

iii) Tangibility is calculated using the ratio of Tangible Assets to Total Assets. Regarding this determinant, the relationship with the level of debt is expected to be positive, meaning that the higher the level of tangible assets, the higher the level of leverage in a firm's capital structure. This relationship is supported by both the pecking order and trade-off theories (Harris and Raviv, 1991; Rajan and Zingales, 1995; Baker and Wurgler, 2002; Frank and Goyal, 2003). However, authors as Titman and Wessels (1988) found no empirical conclusion regarding this variable on the level of debt.

- Hypothesis 3: Tangibility has a positive effect on leverage.

iv) Size is used as proxy to infer a firm's ability to obtain financing, as larger firms usually obtain a lower cost of financing as they appear to have a lower risk of default (Rajan and Zingales, 1995). Size is measured as the natural logarithm of Total Assets (Frank and Goyal, 2003; Ramadan, 2009; Novo, 2009). This determinant is expected to yield a positive relation with the level of debt as the higher the dimension of the firm, the higher the likelihood to support more debt on its capital structure (Rajan and Zingales, 1995; Baker and Wurgler, 2002; Frank and Goyal, 2003). Nonetheless some authors could not find empirical evidence to prove the pecking order theory as inconclusive results were

found regarding the relation between the size of a firm and its level of debt (Kremp et al., 1999; Ozkan, 2001).

- Hypothesis 4: Firm size has a positive effect on leverage.

v) A firm's growth opportunities will be measured through the Tobin's Q ratio which relates the Market Value of the firm with its Total Assets (Myers, 1977; Rajan and Zingales, 1995). According to the trade-off theory, growth opportunities and level of leverage are inversely correlated as firms and creditors have a lower predisposition to engage on new projects with high costs and uncertainty associated (Titman and Wessels, 1988; Rajan and Zingales, 1995; Fama and French, 2002). Conversely, it is expected that growth opportunities and the level of debt are positively related, according to the pecking order theory, which states the hierarchy of the different sources of funding (Myers and Majluf, 1984; Ramalho and Silva, 2009). Similar results are associated with the agency costs theory as engaging in high growth opportunities, which leads to a higher indebtedness, serves the purpose of controlling management behaviour (Jensen, 1986).

- Hypothesis 5: Growth opportunities have a negative effect on leverage.

vi) Non-Debt Tax Shields will be measured as the ratio between Depreciation and Amortizations to Total Assets (Titman and Wessels, 1988). This determinant is related to the tax optimization solely achieved by depreciation and amortization when financing is not considered (DeAngelo and Masulis, 1980).

Regarding this determinant it is expected an inverse relation with the level of debt, according to Myers (1977). On the other hand, authors as Bradley, Jarrel and Kim, (1984) and Titman and Wessels (1988) found a positive relation.

- Hypothesis 6: Non Debt Tax Shields have a positive effect on leverage.

Following the presentation of the firm characteristics which will be object of study, and bearing in mind that the present dissertation aims at analysing the determinants of capital structure for Portuguese public firms, throughout the time encompassing the sub-periods before and during the global financial crisis and during the European sovereign debt crisis, 3 dummy variables were defined to control these temporal incidents. Therefore the period 2005–2007 will be considered the “normal times”, prior to the crisis, from 2008 until the end of 2010, it will be measured the impact of the global financial crisis, and the following years 2011–2014 will quantify the effect of the European sovereign debt crisis.

Besides testing the Hypotheses related with the level of leverage in the capital structure, so far presented, one will also observe which determinants of capital structure influenced the proportion of long-term debt, during the 3 different sub-periods in analysis, which include periods of economic breakdowns. Bearing in mind the importance of long-term funding to support investment and firm growth, this will permit to observe not only the behaviour of firms regarding their own financing decisions but also the behaviour of banks when granting credit to businesses, when in normal times and in times of a struggling economy.

### **3.3. Empirical Approach**

The following model has the purpose of evaluating the research hypothesis previously proposed. It is going to be used an unbalanced panel data as the available data sample consists of a group of firms, analysed during a period of time, in which information regarding some variables is sometimes missing. This approach is seen as advantageous as it is able to combine both time series and cross sectional data which is the case of the analysed sample.

Similar to previous empirical studies as Bradley, Jarrel and Kim, (1984) and Frank and Goyal (2003), in order to identify the determinants of Portuguese public firms' capital structure, it is going to be used a multivariate linear regression model in order to assess the relation between the dependent and the independent variables.

Before choosing a model to evaluate the data, a LM test was conducted to test the relevance of firms' unobservable individual effects and the results indicated a pooled OLS regression to be an inappropriate model to analyse the relation between debt and its determinants. This was the expected result as this model does not allow to control for unobserved heterogeneity.

Following this, the fixed effects and the random effects models were the available alternatives. In order to choose between them, a Hausman test was conducted. This test checks for the absence of correlation between firms' unobservable individual effects and the determinants of debt. After running the test, for a 5% significance level, evidence showed the panel model of random effects to be the most accurate way to carry out the study. Although for a 10% significance level, the panel model of fixed effects was the best alternative. The 5% significance level was selected, therefore the panel model of random effects was used. Furthermore, every regression was then corrected for the

presence of heteroscedasticity, using robust standard errors. Although the random fixed effects is the model used to carry out this study, the results obtained using the fixed effects model are presented in the Appendix.

To evaluate the research hypothesis, the following multivariate regression was used:

$LEV_{it} = \beta_0 + \beta_1 PROF_{it} + \beta_2 LIQ_{it} + \beta_3 TANG_{it} + \beta_4 SIZE_{it} + \beta_5 GROW_{it} + \beta_6 NDTS_{it} + U_{it} + \epsilon_{it}$  (1), in which  $LEV_{it}$  is the dependent variable and represents the leverage ratio of firm  $i$  at year  $t$ . The independent variables are: i)  $PROF_{it}$  that corresponds to the return on assets of firm  $i$  at year  $t$ ; ii)  $LIQ_{it}$ , is the current ratio of firm  $i$  at year  $t$ ; iii)  $TANG_{it}$  corresponds to the asset tangibility ratio of firm  $i$  at year  $t$ ; iv)  $SIZE_{it}$  is measured by the natural logarithm of total assets of firm  $i$  at year  $t$ ; v)  $GROW_{it}$  is computed through the Tobin's Q ratio of firm  $i$  at year  $t$ ; and vi)  $NDTS_{it}$  corresponds to the ratio between Depreciation and Amortizations to Total Assets of firm  $i$  at year  $t$ .  $\beta_0, \beta_1, \dots, \beta_6$  are the coefficients of the regression,  $U_{it}$  represents the unobserved individual effects and  $\epsilon_{it}$  corresponds to the error term.

As the purpose is to assess the changes in the determinants of capital structure for Portuguese public firms before and during the global financial crisis and during the European sovereign debt crisis, the following 3 dummy variables were added to the model:  $BEF_{GFC}$  for the period 2005-2007;  $DUR_{GFC}$  for the period 2008-2010; and  $DUR_{ESD}$  for the period 2011-2014.

After checking the results regarding the determinants of debt for Portuguese public firms, from 2005 to 2015 and in the 3 different sub-periods, the results for the determinants for the proportion of long-term debt in the capital structure for the same firms and for the same time horizon were analysed. To evaluate the research hypothesis, the multiple regression used was:

$LTLev_{it} = \beta_0 + \beta_1 PROF_{it} + \beta_2 LIQ_{it} + \beta_3 TANG_{it} + \beta_4 SIZE_{it} + \beta_5 GROW_{it} + \beta_6 NDTS_{it} + U_{it} + \epsilon_{it}$  (2), in which  $LTLev_{it}$  is the dependent variable which measures the proportion of long-term debt in the capital structure of firm  $i$  at year  $t$ . Regarding the independent variables, these are equal to the ones used in the previous regression.

## 4. Empirical Results

Before analysing the results regarding the determinants of capital structure for Portuguese public firms, from 2005 until 2015, the descriptive statistics for the entire sample are presented in Table 4.

Regarding the dependent variables, leverage (LEV) and proportion of long-term debt present in a firm's capital structure (LTLev), it can be inferred that Portuguese public firms have, on average, 44% of debt on their capital structure. Besides this, these firms depend more, on average, on long-term debt than on short-term debt as the average percentage of long-term debt in their capital structure is about 62%.

The descriptive statistics results suggest that there is no strong evidence for the presence of outliers in the sample group, as the difference between the medians and the means is not very significant for most of the variables. However, for the dependent variable, LEV, and independent variables, LIQ, PROF and GROW, the minimum and maximum values depart considerably from their means which might suggest the presence of outliers. In order to deal with this, a 90% winsorization of the sample will be later conducted and the respective results presented.

From the Pearson's correlation matrix (Table 5), it can be inferred that the correlation coefficients are, in general, relatively low among all variables. However, there seems to be one exception, a case of moderate correlation between the independent variable SIZE and the dependent variable, LTLev, of 51%. For the remaining variables, according to Gujarati (2003), multicollinearity can be safely ignored as the existence of a linear relation between one or more explanatory variables appears not to be identified in the present sample data, therefore the validity of the regression model is verified.

Now, the outputs estimated by the regression model are going to be presented (Table 6). Regressions (1) and (2) have as dependent variables, the leverage ratio (LEV) and the ratio of long-term debt to total debt (LTLev), respectively. The explanatory variables are the same for both regressions: profitability (PROF), liquidity (LIQ), tangibility (TANG), size (SIZE), growth opportunities (GROW) and non-debt tax shields (NDTS).

The overall goodness of fit of the model is firstly evaluated by running the F-test in order to assess the joint significance of the several coefficients. The null hypothesis that the

coefficients are equal to 0 is rejected for both regressions, at 1% significance level, meaning the coefficients are jointly different from 0.

Following this, the z-statistics are evaluated. It is concluded that when leverage (LEV) is the dependent variable (1), profitability (PROF), liquidity (LIQ), growth opportunities (GROW) and non-debt tax shields (NDTS) are, at 1% significance level, statistically significant, and size (SIZE) is at 5% significance level. This means that for these variables, the null hypothesis that the coefficients are equal to 0 is rejected. For regression (2), liquidity (LIQ), tangibility (TANG) and size (SIZE) are statistically significant at 1% significance level, and profitability (PROF) is at 5% significance level. For regression (1), tangibility, and for regression (2), growth opportunities and non-debt tax shields, do not add any statistical significance to the model, therefore there is no purpose in evaluating their effect on the dependent variables.

In regression (1), results demonstrate that the level of debt of Portuguese public firms is negatively related with profitability, liquidity and growth opportunities, therefore verifying Hypotheses 1, 2 and 5, respectively. On the other hand, results show a positive relation between size and non-debt tax shields with the level of leverage, therefore verifying Hypotheses 4 and 6. These findings suggest that Portuguese public firms' managers, from 2005-2015, based their decisions according to the pecking order theory, when solely looking at the profitability coefficient. This means that Portuguese public firms had a hierarchical preference in terms of financing sources, preferring firstly to use internally generated funds, then to issue debt and only to issue equity when the other two alternatives were no longer available. Regarding the determinant liquidity, the results support Graham's (2000) findings. When analysing growth opportunities, evidence is in accordance with findings of Titman and Wessels (1988), Rajan and Zingales (1995) and Fama and French (2002), and relate the trade-off theory with these firms. This indicates that Portuguese public firms weighted the benefits against the costs associated to the use of leverage when choosing the firm's capital structure. Likewise, evidence related with the variable size is similar to the findings of Rajan and Zingales (1995) and Frank and Goyal (2003) and evidence related with variable non-debt tax shields is supported by Bradley, Jarrel and Kim (1984) and Titman and Wessels (1988).

Regarding regression (2), which relates the firm characteristics with the amount of long-term debt in the capital structure, and comparing the results with regression (1), it is concluded that profitability and liquidity are positively related with the level of long-term

debt, conversely to what is witnessed for the level of leverage. Besides this and similarly to what is observed for the level of leverage, firm size yields a positive effect on the proportion of long-term debt. Finally, tangibility reveals a negative association with the amount of long-term debt in the capital structure. Bearing in mind the importance of long-term funding to support investment and firm growth, these results demonstrate that when accessing to financing, banks granted credit to larger firms that demonstrated to be more profitable and liquid, which signalled a higher ability to support debt on their capital structure.

After analysing the results for the overall sample period, the sample period is going to be split in order to infer the results for the periods before and during the global financial crisis and during the European sovereign debt crisis (Table 7).

Evidence shows that prior to the global financial crisis, 2005-2007, the firm characteristics influencing the choice of the level of debt for Portuguese public firms were growth opportunities, at 1% significance level, size, at 5% significance level, and tangibility, at 10% significance level. These findings validate Hypotheses 4 and 5 as the effects of size and growth opportunities on level of debt are positive and negative, respectively. This means that prior to the crisis, Portuguese public firms' management decisions regarding capital structure was supported both by the pecking order and the trade-off theories. Also, according to Rajan and Zingales (1995) and others, larger firms have a higher likelihood to support more debt on their capital structure, which is supported in this study, as the analysed firms comprise mostly the larger firms in Portugal. Furthermore, regarding growth opportunities, the small size of the Portuguese market may inhibit creditors to engage on new projects with high costs and uncertainty, fact observed by the negative correlation with the level of debt. As for tangibility, the impact reveals to be negative, therefore rejecting Hypothesis 3.

During the global financial crisis, from 2008-2010, Hypotheses 1, 2 and 6 are verified as profitability and liquidity, at 1% significance, are negatively related with firm's indebtedness, and non-debt tax shields, at 5% significance level, has a positive impact on the level of debt. During this period, the pecking order theory was one of the main foundations of capital structure decisions. This is easily observed by the negative relation between profitability and the level of debt, which demonstrates that more profitable Portuguese public firms decided to finance themselves firstly with internally generated funds and only then to recur to debt, having therefore a lower level of debt in their capital

structure. At this point, the repercussions of the global financial crisis began to make an impact and the Portuguese economy started to slow down. Markets started to freeze and to become highly illiquid. Typically, more liquid firms when in need for financing prefer to liquidate their assets in order to finance themselves. Although, during the crisis, firms faced a market with no buyers or buyers only available to trade at big discounts, therefore preferring to recur to debt. Besides this, firms began to feel the recession and started to incur in losses and mostly decided to finance them through debt. At the same time, the operating businesses needed to continue to operate in order to grow, therefore incurring in maintenance and capital expenditures. These expenditures increased the value of depreciation and amortization, thus explaining the positive relation between non-debt tax shields and the level of leverage.

When the European sovereign debt crisis hits Europe and the implementation of austerity measures is felt in Portugal, from 2011-2014, Hypotheses 1, 2, 5 and 6 are verified. This means that profitability and growth opportunities, at 1% significance level, and liquidity, at 10% significance level, are negatively related with the level of debt, conversely to what is observed for non-debt tax shields, at 1% significance level. According to these results, the trade-off theory re-appeared to, together with the pecking order theory, justify the choice of capital structure for Portuguese public firms. Here, besides the above mentioned reasons, the credit crunch and the imposition of austerity measures in Portugal obliged banks to become more conservative in granting credit, especially to finance new projects with high costs and level of uncertainty. This explains the negative relation observed between growth opportunities and the level of debt.

Regarding regression (2), before the global financial crisis, liquidity and size, at 1% significance level, appear to positively influence the proportion of long-term debt in the capital structure. During the global financial crisis, the same results are obtained. In the following period, of the European sovereign debt crisis, the results yielded in the previous two sub-periods are again confirmed. Although, in this period, besides liquidity and size, additional firm characteristics are considered statistically significant, at 1% significance level: profitability, tangibility and growth opportunities. Regarding these three variables, profitability influences positively the amount of long-term debt in the capital structure, contrarily to the negative effect exercised by tangibility and growth opportunities. Due to the importance of long-term funding to support investment and firm growth, these results demonstrate that during “normal times” and during the global financial crisis, when the

repercussions of the crisis started to be felt in Portugal, banks conceded credit by only taking into account the dimension and liquidity of the firm. Therefore, larger and more liquid firms, indicators of a robust presence in the market, tended to have a higher proportion of long-term debt in their capital structure. After this, when Troika appeared and imposed the implementation of austerity measures, banks started to become more cautious when granting credit and, besides observing the dimension and liquidity of the firm, started to also evaluate the indicators of profitability, tangibility and growth opportunities.

## 5. Robustness

In this section the validity of the model is assured by checking the robustness of the empirical results so far presented. The regressions are run again for a winsorized sample. In this case, it was implemented a 90% winsorization. This process is achieved by identifying all the data below the 5th percentile and above the 95th percentile, and set that data to the 5th and 95th percentiles, respectively, for all the variables presented in regressions (1) and (2), for the entire sample period. This transformation allows for the elimination of potential outliers present in the data sample.

The results obtained (Table 8) are consistent with the ones previously achieved. Although some variables lose their significance, the effect of the firm characteristics on the level of debt and on the proportion of long-term debt, previously observed, is sustained for the winsorized sample.

Regarding the entire sample period, results show, for regression (1), that profitability, growth opportunities, size and non-debt tax shields are statistically significant, at 1% significance level, when the level of debt is the dependent variable. Size and non-debt tax shields are positively associated with the level of leverage for Portuguese public firms, therefore verifying Hypotheses 4 and 6. Conversely, evidence demonstrates a negative relation between profitability and growth opportunities which confirms Hypotheses 1 and 5. For the winsorized sample, Hypothesis 2 which states that liquidity is negatively related with the level of debt, is not confirmed as previously occurred, as this variable is no longer statistically significant.

The relation between firm characteristics and the proportion of long-term debt in Portuguese public firms' capital structure is analysed by regression (2). As previously observed for the entire sample, and conversely to what is seen for the level of leverage, liquidity, at 1% significance level, is positively related with the level of long-term debt. Further and similarly to what is observed for the level of leverage, firm size impacts positively the amount of long-term debt. As for tangibility, at 10% significance level, reveals a negative association with the amount of long-term debt in the capital structure. For the winsorized sample it is also observed that profitability no longer impacts the proportion of long-term debt.

Winsorized results for the sub-periods before and during the global financial crisis and during the European sovereign debt crisis are presented in Table 9.

Evidence demonstrates that prior to the global financial crisis, 2005-2007, during the “normal times”, almost all variables proved to be statistically significant. Size, profitability and growth opportunities, at 1% significance level, and liquidity and tangibility, at 5%. With this, Hypotheses 1, 2 and 5 are verified as profitability, liquidity and growth opportunities are negatively related with the level of debt and Hypothesis 4 is also confirmed as firm size is positively related with leverage. Regarding Hypothesis 3, it is rejected as results demonstrate that tangibility impacts negatively the level of debt.

From 2008-2010, during the global financial crisis, solely Hypotheses 1 and 2 are confirmed as profitability, at 10% significance, and liquidity, at 5% significance level, are negatively related with firm’s indebtedness. For the winsorized sample, the impact of the crisis is more intensely observed as the significance levels increased regarding the statistically significant variables and Hypothesis 6 is no longer verified.

Likewise, for the sub-period of the European sovereign debt crisis, for the winsorized sample, solely Hypotheses 5 and 6 are verified. This means growth opportunities, at 1% significance level, impacts negatively the firm’s leverage, while non-debt tax shields, at 5% significance level, have a positive impact on it. Now, profitability and liquidity, no longer affect the level of debt as previously observed for the non-winsorized sample. This means these variables do not appear to impact managers’ decisions when choosing the firm’s capital structure, when austerity times were felt in Portugal.

Regarding regression (2), for the winsorized sample, from 2005-2007, liquidity and size, at 1% significance level, continue to positively influence the proportion of long-term debt in the capital structure. During the global financial crisis, the same results are obtained. During the European sovereign debt crisis, the results yielded in the previous two sub-periods are once again confirmed. Although in this period, besides liquidity and size, tangibility, at 1% significance level, is also considered statistically significant, proving to positively influence the level of long-term debt in the capital structure. In this period, winsorization turned profitability and growth opportunities no longer significant in explaining the proportion of long-term debt in the capital structure of Portuguese public firms.

Furthermore, as previously mentioned, the regressions using the fixed effects model were also estimated. The results, presented in the Appendix, are broadly consistent with the ones obtained using the random effects model.

## 6. Conclusions

The present dissertation aims at understanding and analysing the determinants of capital structure, in terms of total debt and proportion of long-term debt, for Portuguese public firms, listed in the Euronext Lisbon index. A total of 57 firms are considered relevant for the study.

As previously stated, when choosing a firm's capital structure, several firm characteristics proved to influence the decision regarding the level of leverage in the capital structure. Thus the most relevant factors verified were i) profitability, ii) liquidity, iii) tangibility, iv) size, v) growth opportunities and vi) non-debt tax shields.

From the results, it can be inferred that Portuguese public firms have, on average, 44% of total debt on their capital structure and depend more, on average, on long-term debt than on short-term debt.

Regarding the determinants influencing Portuguese public firms' capital structure, for the winsorized sample and the entire sample period, 2005-2015, results demonstrated that larger firms and firms with higher levels of non-debt tax shields tend to be more leveraged, while more profitable firms and firms with more opportunities to grow are less indebted. Evidence also demonstrated that, prior to the global financial crisis, 2005-2007, more profitable, more liquid, more tangible and high growing firms supported less debt on their capital structure, while larger and firms with more tangible assets supported more. During the global financial crisis, results solely showed that more profitable and more liquid firms supported a lower level of debt in the capital structure. And during the European sovereign debt crisis, firms with more opportunities to grow were less leveraged while firms with higher non-debt tax shields were more leveraged.

The above presented results, from regression (1), for the entire sample period, 2005-2015, demonstrate that the pecking order theory is followed, as the negative relation found with profitability, sustains that firms firstly used the internally generated funds to finance their operations. Also, the low predisposition of creditors in engaging in new projects of Portuguese public firms, with potential risks, is revealed by the negative relation found with growth opportunities, revealing the presence of the trade-off theory too. For the Portuguese public firms which are mainly the larger firms in the country, the reasoning of Rajan and Zingales (1995) is verified, that larger firms tend to have higher levels of leverage. Furthermore, evidence related with variable non-debt tax shields is supported

by Bradley, Jarrel and Kim (1984) and Titman and Wessels (1988). For the period before the crisis, 2005-2007, the determinants liquidity and tangibility also appeared to influence, negatively, the level of leverage of Portuguese public firms. This suggests the presence of the pecking order theory, as more liquid firms have a higher facility to liquidate their assets, in order to finance their operations, before recurring to debt. Regarding the negative relation with tangibility, it can be explained by the strong investment in R&D and innovation made by Portuguese public firms, to be more competitive. During the global financial crisis, the negative relation between liquidity and profitability with the level of debt demonstrated that firms with worst results financed their losses firstly with internally generated funds and by liquidating their assets, following the reasoning of the pecking order theory. Finally, at the time of the European sovereign debt crisis, the imposition of austerity measures made creditors less predisposed to finance new risky projects.

Regarding regression (2), related with the proportion of long-term debt in the capital structure, for the entire sample period, 2005-2015, and during the European sovereign debt crisis, 2011-2014, results show that larger and more liquid firms have more long-term debt on the capital structure, while more tangible firms have a lower level of long-term debt. For the sub-periods, before and during the global financial crisis, 2005-2007 and 2008-2010, respectively, results only demonstrated that more liquid and larger firms supported a higher proportion of long-term debt.

Bearing in mind the importance of long-term funding to support investment and firm growth, possible reasons behind the results of regression (2), for the entire sample period, 2005-2015, include, for the negative relation with tangibility, the strong investment in start-ups, highly intangible firms, and in innovation made by Portuguese public firms to become more competitive. The positive relation of liquidity with debt financing demonstrate that firms with highly liquid assets are able to be more reliable in terms of collateral, as in a case of a distress scenario, firms are able to sell faster their assets at prevailing market prices without a considerable discount to meet the obligations from the use of debt. And regarding the positive relation with size, larger firms are seen as safer and more sustainable businesses to invest, from the banks perspective. Furthermore, the 3 sub-periods results, especially during the crisis, indicate low levels of scrutiny and highly flexible criteria of the banking sector in granting credit, as only the size and liquidity of the firms' assets were taken into consideration.

## **7. Limitations**

Besides the validity of the conclusions reached by the present dissertation, it must be outlined that this study faces some limitations. Firstly, the analysed sample is reduced as a result of the size of the Portuguese capital market, i.e. listed firms in the Euronext Lisbon index. Besides this, the data is only available on a yearly basis which also reduces the number of observations.

It is also important to bear in mind that larger firms, mostly the ones that are object of this study, i.e. present in the stock exchange, face an easier access to financing than small and medium firms, which represent more than 90% of the business sector in Portugal.

Furthermore, the aftermath of the European Sovereign Debt crisis, from the year 2015 onwards, is not analysed as the data available is limited to reach accurate conclusions.

Bearing in mind such limitations, suggestions for future research should include small and medium Portuguese companies in the analysed sample. This would allow to observe the differences regarding the effect of firm characteristics in the level of debt and in the proportion of long-term debt in the capital structure, not only between public and private firms but also across small, medium and large firms in Portugal. Also an analysis across industries would be advisable as there are sectors that rely more on external financing than others. And finally, it would be interesting to apply this study to different realities, as an example, to compare results across different European stock exchanges.

## 8. Tables

**Table 1: Sample analysed per activity on the Euronext Lisbon index**

This table presents the number of firms analysed per activity on the Euronext Lisbon index: firms currently traded at index, firms already delisted from the index, and the overall number of firms.

	Traded	Delisted	All firms
Description	# Obs.	# Obs.	# Obs.
Total	42	15	57

**Table 2: Dependent Variables analysed**

This table defines the dependent variables evaluated in the present dissertation.

Description	Abbreviation	Formula
Leverage	LEV	Total debt divided by total assets
Long-term Leverage	LTLev	Long-term debt divided by total debt

**Table 3: Independent Variables analysed**

This table defines the independent variables evaluated in the present dissertation.

Description	Abbreviation	Formula
Profitability	PROF	Earnings before interest and taxes divided by total assets
Liquidity	LIQ	Current assets divided by current liabilities
Tangibility	TANG	Tangible assets divided by total assets
Size	SIZE	Natural logarithm of total assets
Growth Opportunities	GROW	Market value of firm divided by total assets
Non-Debt Tax Shields	NDTS	Depreciation and amortization divided by total assets

**Table 4: Descriptive Statistics for the entire sample (2005 – 2015)**

In this table are presented the descriptive statistics for the entire sample (2005-2015). These include the sample mean, median, minimum, maximum, standard deviation, skewness and kurtosis for the dependent and independent variables. Leverage (LEV) is calculated by dividing total debt with total assets. Long-term leverage (LTLev) is computed by the ratio of long-term debt to total debt. Profitability (PROF) is measured by the indicator ROA, earnings before interest and taxes divided by total assets. Liquidity (LIQ) is estimated by dividing current assets with current liabilities. Tangibility (TANG) results from the ratio of tangible assets to total assets. Size (SIZE) is obtained by the natural logarithm of total assets. Growth opportunities (GROW) is measured by the Tobin's Q, which results from the ratio of the market value of firm to total assets. Non-debt tax shields (NDTS) is given by the ratio of depreciation and amortization to total assets. Dummy BEF<sub>GFC</sub> corresponds to the period 2005-2007, prior to the crisis. Dummy DUR<sub>GFC</sub> identifies the period 2008-2010, correspondent to the global financial crisis. Dummy DUR<sub>ESD</sub> relates to the period of the Euro Sovereign Debt crisis, from 2011-2014.

Variable	Obs.	Mean	Median	Min	Max	St. Dev.	Skewness	Kurtosis
LEV	498	0.44	0.43	0.00	2.50	0.24	2.02	15.98
LTLev	497	0.62	0.66	0.00	1.00	0.26	(0.74)	2.79
PROF	497	0.03	0.05	(2.24)	1.66	0.15	(4.59)	123.41
LIQ	489	1.02	0.90	0.02	7.65	0.79	4.28	31.56
TANG	495	0.78	0.85	0.12	1.00	0.22	(1.19)	3.52
SIZE	498	5.83	5.78	3.55	7.63	0.75	0.10	2.53
GROW	461	0.41	0.27	0.01	3.33	0.44	3.07	16.75
NDTS	494	0.05	0.04	0.00	0.16	0.03	1.29	4.24
BEF <sub>GFC</sub>	498	0.27	0	0	1	0.45	1.02	2.04
DUR <sub>GFC</sub>	498	0.27	0	0	1	0.45	1.02	2.04
DUR <sub>ESD</sub>	498	0.36	0	0	1	0.48	0.57	1.32

**Table 5: Pearson's Correlation Matrix**

This table displays pair-wise correlations between the dependent and independent variables, from 2005 to 2015. Leverage (LEV) is calculated by dividing total debt with total assets. Long-term leverage (LTLev) is computed by the ratio of long-term debt to total debt. Profitability (PROF) is measured by the indicator ROA, earnings before interest and taxed divided by total assets. Liquidity (LIQ) is estimated by dividing current assets with current liabilities. Tangibility (TANG) results from the ratio of tangible assets to total assets. Size (SIZE) is obtained by the natural logarithm of total assets. Growth opportunities (GROW) is measured by the Tobin's Q, which results from the ratio of the market value of firm to total assets. Non-debt tax shields (NDTS) is given by the ratio of depreciation and amortization to total assets.

	LEV	LTLev	PROF	LIQ	TANG	SIZE	GROW	NDTS
LEV	1							
LTLev	(0.08)	1						
PROF	(0.19)	0.12	1					
LIQ	(0.32)	0.29	(0.22)	1				
TANG	(0.03)	(0.13)	(0.09)	0.23	1			
SIZE	(0.09)	0.51	0.18	0.12	(0.05)	1		
GROW	(0.29)	0.14	(0.07)	0.21	(0.06)	0.18	1	
NDTS	0.21	(0.10)	(0.01)	(0.25)	(0.01)	(0.12)	0.03	1

**Table 6: Summary Regressions Outputs for the entire sample (2005-2015)**

In this table are presented, for the entire time period, the coefficients, z-statistics, number of observations, number of firms, R<sup>2</sup> and F for the regressions with LEV as dependent variable (1) and LTLev as dependent variable (2), respectively. The independent variables of both regressions are: PROF, measured by the indicator ROA; LIQ, estimated by the current ratio; TANG, resultant of the tangibility ratio; SIZE, obtained by the natural logarithm of total assets; GROW, measured by the Tobin's Q; and NDTS, yielded by the ratio of depreciation and amortization to total assets. The significance of 1, 5 and 10 per cent of the coefficients are represented by \*\*\*, \*\* and \*, respectively.

Period	2005 - 2015			
Dependent Variable	LEV (1)		LTLev (2)	
	Coefficients	z	Coefficients	z
PROF	(0.30)***	(6.66)	0.13**	2.36
LIQ	(0.05)***	(4.38)	0.10***	7.23
TANG	0.06	0.94	(0.22)***	(3.09)
SIZE	0.06**	2.10	0.13***	4.67
GROW	(0.10)***	(4.54)	(0.04)	(1.57)
NDTS	2.90***	6.95	(0.08)	(0.16)
Constant	0.02	0.12	(0.08)	(0.41)
# Obs.	450		450	
# Firms	57		57	
R <sup>2</sup>	16.09%		34.15%	
F	171.98***		95.97***	

**Table 7: Summary Regressions Outputs for sub-period samples**

In this table are presented the coefficients, z-statistics, number of observations, number of firms,  $R^2$  and F for the regressions with LEV as dependent variable (1) and LTLev as dependent variable (2), respectively, considering the sub-periods from 2005-2007, from 2008-2010 and from 2011-2014. The independent variables of both regressions are: PROF, measured by the indicator ROA; LIQ, estimated by the current ratio; TANG, resultant of the tangibility ratio; SIZE, obtained by the natural logarithm of total assets; GROW, measured by the Tobin's Q; and NDTs, yielded by the ratio of depreciation and amortization to total assets. The significance of 1, 5 and 10 per cent of the coefficients are represented by \*\*\*, \*\* and \*, respectively.

Period	2005 - 2007				2008 - 2010				2011 - 2014			
Dependent Variable	LEV (1)		LTLev (2)		LEV (1)		LTLev (2)		LEV (1)		LTLev (2)	
	Coefficients	z	Coefficients	z	Coefficients	z	Coefficients	z	Coefficients	z	Coefficients	z
PROF	(0.14)	(1.11)	(0.18)	-0.93	(1.18)***	(6.91)	(0.03)	(0.15)	(0.33)***	(5.33)	0.23***	3.05
LIQ	(0.04)	(1.51)	0.17***	4.08	(0.06)***	(2.65)	0.15***	4.57	(0.03)*	(1.73)	0.10***	5.31
TANG	(0.24)*	(1.81)	(0.29)	-1.63	0.00	0.01	(0.11)	(0.96)	0.06	0.55	(0.28)***	(2.83)
SIZE	0.07**	2.01	0.14***	3.21	0.02	0.53	0.20***	5.26	0.02	0.45	0.17***	5.30
GROW	(0.15)***	(3.54)	0.00	-0.04	(0.02)	(0.36)	(0.04)	(0.72)	(0.20)***	(3.93)	(0.15)***	(2.65)
NDTS	(0.12)	(0.20)	(0.17)	-0.20	0.02**	2.04	0.98	1.24	1.65***	2.61	(0.05)	(0.08)
Constant	0.35	1.46	(0.09)	-0.30	0.42	1.61	(0.66)***	(2.69)	0.34	1.52	(0.26)	(1.21)
# Obs.	124		124		123		123		162		162	
# Firms	47		47		44		44		43		43	
$R^2$	15.79%		32.05%		48.80%		39.29%		29.71%		38.85%	
F	19.80***		33.48***		63.42***		55.75***		70.01***		70.39***	

**Table 8: Summary Regressions Outputs from winsorized sample, 2005-2015**

In this table are presented, for the entire time period, the coefficients, z-statistics, number of observations, number of firms, R<sup>2</sup> and F for the regressions, with LEV as dependent variable (1) and LTLev as dependent variable (2), respectively, considering winsorized sample. The independent variables of both regressions are: PROF, measured by the indicator ROA; LIQ, estimated by the current ratio; TANG, resultant of the tangibility ratio; SIZE, obtained by the natural logarithm of total assets; GROW, measured by the Tobin's Q; and NDTS, yielded by the ratio of depreciation and amortization to total assets. The significance of 1, 5 and 10 per cent of the coefficients are represented by \*\*\*, \*\* and \*, respectively.

Period	2005 - 2015			
Dependent Variable	LEV (1)		LTLev (2)	
	Coefficients	z	Coefficients	z
PROF	(0.49)***	(3.44)	0.04	0.18
LIQ	(0.05)	(1.63)	0.25***	7.50
TANG	0.01	0.19	(0.23)*	(1.83)
SIZE	0.12***	3.73	0.13***	4.00
GROW	(0.10)***	(2.76)	(0.04)	(0.74)
NDTS	1.31***	3.03	0.02	0.03
Constant	(0.26)	(1.23)	(0.21)	(0.99)
# Obs.	450		450	
# Firms	57		57	
R <sup>2</sup>	9.80%		35.07%	
F	85.57***		134.67***	

**Table 9: Summary Regressions Outputs for winsorized sample, for the sub-period samples**

In this table are presented the coefficients, z-statistics, number of observations, number of firms, R<sup>2</sup> and F for the regressions with LEV as dependent variable (1) and LTLev as dependent variable (2), respectively, considering the sub-periods from 2005-2007, from 2008-2010 and from 2011-2014, for the winsorized sample. The independent variables of both regressions are: PROF, measured by the indicator ROA; LIQ, estimated by the current ratio; TANG, resultant of the tangibility ratio; SIZE, obtained by the natural logarithm of total assets; GROW, measured by the Tobin's Q; and NDTS, yielded by the ratio of depreciation and amortization to total assets. The significance of 1, 5 and 10 per cent of the coefficients are represented by \*\*\*, \*\* and \*, respectively.

Period	2005 - 2007				2008 - 2010				2011 - 2014			
Dependent Variable	LEV (1)		LTLev (2)		LEV (1)		LTLev (2)		LEV (1)		LTLev (2)	
	Coefficients	z	Coefficients	z	Coefficients	z	Coefficients	z	Coefficients	z	Coefficients	z
PROF	(0.39)***	(2.91)	0.15	0.46	(0.43)*	(1.79)	(0.42)	(0.89)	(0.36)	(1.05)	0.23	0.63
LIQ	(0.05)**	(2.34)	0.19***	3.16	(0.04)**	(2.17)	0.22***	3.92	0.00	(0.02)	0.25***	8.06
TANG	(0.27)**	(2.19)	(0.31)	(1.38)	0.03	0.58	(0.12)	(0.85)	0.00	0.00	(0.34)***	(3.92)
SIZE	0.10***	2.74	0.15***	2.95	0.05	1.09	0.22***	6.50	0.05	1.13	0.14***	3.81
GROW	(0.23)***	(4.58)	(0.01)	(0.12)	0.01	0.36	(0.03)	(0.47)	(0.19)***	(3.03)	(0.09)	(1.57)
NDTS	(0.28)	(0.48)	(0.04)	(0.04)	0.80	1.03	0.99	1.22	1.81**	2.54	0.28	0.34
Constant	0.24	1.11	(0.14)	(0.39)	0.16	0.65	(0.82)***	(3.97)	0.14	0.54	(0.20)	(0.94)
# Obs.	124		124		123		123		162		162	
# Firms	47		47		44		44		43		43	
R <sup>2</sup>	25.33%		34.91%		9.29%		39.29%		20.85%		43.09%	
F	30.11***		48.45***		15.01**		86.96***		25.14***		193.03***	

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## Appendix

**Table 10: Summary Regressions Outputs for the entire sample (2005-2015) using Fixed Effects model.**

In this table are presented, for the entire time period, the coefficients, t-statistics, number of observations, number of firms,  $R^2$  and F for the regressions with LEV as dependent variable (1) and LTLev as dependent variable (2), respectively. The independent variables of both regressions are: PROF, measured by the indicator ROA; LIQ, estimated by the current ratio; TANG, resultant of the tangibility ratio; SIZE, obtained by the natural logarithm of total assets; GROW, measured by the Tobin's Q; and NDTS, yielded by the ratio of depreciation and amortization to total assets. The significance of 1, 5 and 10 per cent of the coefficients are represented by \*\*\*, \*\* and \*, respectively.

Period	2005 - 2015			
Dependent Variable	LEV (1)		LTLev (2)	
	Coefficients	t	Coefficients	t
PROF	(0.30)***	(6.62)	0.14**	2.43
LIQ	(0.04)***	(2.99)	0.09***	6.20
TANG	0.10	1.44	(0.22)***	(2.57)
SIZE	0.13**	2.56	0.10	1.58
GROW	(0.07)***	(3.28)	(0.05)*	(1.79)
NDTS	3.75***	7.96	(0.50)	(0.84)
Constant	(0.47)	(1.49)	0.14	0.36
# Obs.	450		450	
# Firms	57		57	
R2	8.01%		31.58%	
F	29.43***		11.18***	

**Table 11: Summary Regressions Outputs for the sub-period samples, using Fixed Effects model.**

In this table are presented the coefficients, t-statistics, number of observations, number of firms, R<sup>2</sup> and F for the regressions with LEV as dependent variable (1) and LTLev as dependent variable (2), respectively, considering the sub-periods from 2005-2007, from 2008-2010 and from 2011-2014. The independent variables of both regressions are: PROF, measured by the indicator ROA; LIQ, estimated by the current ratio; TANG, resultant of the tangibility ratio; SIZE, obtained by the natural logarithm of total assets; GROW, measured by the Tobin's Q; and NDTs, yielded by the ratio of depreciation and amortization to total assets. The significance of 1, 5 and 10 per cent of the coefficients are represented by \*\*\*, \*\* and \*, respectively.

Dependent Variable	2005 - 2007				2008 - 2010				2011 - 2014			
	LEV		LTLev		LEV		LTLev		LEV		LTLev	
	Coefficients	t	Coefficients	t	Coefficients	t	Coefficients	t	Coefficients	t	Coefficients	t
PROF	(0.11)	(0.82)	(0.10)	(0.44)	(0.54)***	(3.24)	0.07	0.24	(0.34)***	(5.46)	0.20***	2.61
LIQ	(0.00)	(0.14)	0.16***	3.14	(0.02)	(1.05)	0.20***	5.16	(0.05)**	(2.39)	0.13***	5.36
TANG	(0.14)	(0.69)	(0.53)	(1.51)	0.11	1.18	0.21	1.22	0.68***	2.94	(0.62)**	(2.16)
SIZE	0.40***	3.40	(0.03)	(0.17)	0.39*	1.97	0.15	0.40	0.22*	1.96	(0.00)	(0.03)
GROW	(0.13)*	(1.86)	0.01	0.05	0.06	1.48	(0.00)	(0.03)	(0.12)*	(1.76)	(0.33)***	(3.76)
NDTS	0.77	1.00	(2.47)*	(1.90)	4.10***	4.41	3.75**	2.18	1.85*	1.97	0.66	0.56
Constant	(1.69)**	(2.23)	1.20	0.94	(2.10)*	(1.75)	(0.79)	(0.36)	(1.33)*	(1.85)	1.02	1.13
# Obs.	124		124		123		123		162		162	
# Firms	47		47		44		44		43		43	
R <sup>2</sup>	0.76%		2.57%		0.23%		17.46%		1.17%		5.34%	
F	3.37***		2.99**		8.73***		4.7***		11.06***		7.36***	