ISCTE Business School
Instituto Universitário de Lisboa

MACROECONOMIC FACTORS' IMPACT ON THE CAPITAL STRUCTURE OF PORTUGUESE NON-FINANCIAL FIRMS

Gabriela Garcês Reis

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Supervisor:

Prof. Luís Laureano, Assistant Professor, ISCTE Business School, Department of Finance

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Abstract

The present Dissertation mainly addresses the impact of macroeconomic factors on the Portuguese non-financial firms' capital structure. More specifically, this empirical Dissertation's objective is to understand and establish a link between the stylised facts on capital structure and the level of borrowed funding, namely through the critical analysis of four leverage ratios, of the Portuguese corporate sector. The present study was developed using firm and macroeconomic data for the period of 2008 to 2017. The Dissertation's main findings suggest that the firms' profitability, cost of Portuguese government bonds and cost of new loans operations present mainly an inverse relationship with the firms' leverage. Contrary to our expectations, the average rate on which individual firms are taxed on their earned income presents a weak negative impact on the firms' leverage ratios. Firms' external financing, according to our results, is positively influenced by the increase on the general price level of goods and services. The increase on the economy growing rate has a negative impact on the firms' short-term debt-to-assets ratio but a positive one with the long-term debt-to-assets ratio. Moreover, the model predicts that an increase on the Portuguese government debt has a positive effect on the amount of the firms' total liabilities and long-term debt. However, the increase in government debt causes a small reduction on the amount of firms' short-term debt. All our results were found to be strongly statistically significant.

JEL Classifications: F62, G01, G32, H32

Keywords: Macroeconomic Variables, Determinants, Capital Structure, Portuguese Industry, Non-financial Firms.

Resumo

A presente Dissertação aborda principalmente o impacto dos fatores macroeconomicos na estrutura de capital das empresas não financeiras portuguesas. Mais especificamente, o objetivo empírico desta Dissertação é compreender e estabelecer uma ligação entre os factos estilizados sobre a estrutura de capital e o nível de financiamento externo, nomeadamente através da análise crítica de quatro rácios de alavancagem, do setor empresarial português. O presente estudo foi desenvolvido com dados empresariais e macroeconómicos obtidos para o período de 2008 a 2017. As principais conclusões desta Dissertação sugerem que a rentabilidade das empresas, o custo dos títulos de dívida pública e custo das novas operações de empréstimo apresentam maioritariamente uma relação negativa com os níveis de alavancagem das empresas não financeiras portuguesas. Ao contrário das expectativas, a taxa de imposto média sobre o rendimento operacional das empresas apresenta um impacto negativo ténue nos rácios de alavancagem. O montante de financiamento externo das empresas, de acordo com nossos resultados, é positivamente influenciado pelo aumento no nível geral de preços de bens e serviços. A aumento da taxa de crescimento da economia apresenta uma relação negativa e positiva com o montante de dívida de curto prazo e longo prazo, respetivamente. Ainda, o modelo prevê que o aumento da dívida pública Portuguesa tem um efeito positivo no passivo total das empresas e na dívida de longo prazo. No entanto, o aumento da dívida pública tem um efeito redutor na dívida de curto prazo contraída pelas empresas. Todos os nossos resultados são estatisticamente significativos.

Classificações JEL: F62, G01, G32, H32

Palavras-chave: Variáveis Macroeconómicas, Determinantes, Estrutura de Capital, Industria Portuguesa, Empresas Não-Financeiras.

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1. Introduction

The thematic of leverage and capital structure is not new in corporate finance, however, the discussion on the matter is among the most important subjects in financial management as it influences the value, growth and continuity of businesses.

Firms have two main ways to finance themselves, they can use internal sources, namely retained earnings, or external sources, by issuing instruments of debt and equity (Mostafa and Boregowda, 2014). The fact that an inappropriate choice of capital structure can leave a firm in a financial distress situation, is a well-recognized issue for decades. Theories and empirical research regarding the determinants of capital structure have been studied since the yearly 1950's, being that the development of the main theories has driven with Modigliani and Miller's (1958) presentation of the irrelevance theorem. Several theories attempt to explain the key factors that determine the firms' decisions regarding the type of funding and capital structure. The trade-off and the pecking order theories are two of the most important theories on corporate capital structure decisions that have been tested and largely debated among researchers. Some evidence points to the fact that firm managers have to operate around a target debt ratio (Graham and Harvey, 2001), however it is still to understand what determines this target. Empirical research has found some key determinants of capital structure, mainly related to the firm's characteristics, such as tangibility, profitability and size (Frank and Goyal, 2009; Rajan and Zingales, 1995). Baker and Wurgler (2002) market timing theory, introduce the firms market valuation as a main decision factor for their indebtedness level.

The reality today is one of increasing globalization, expansion of market trading platforms and financial innovations that make capital flows much more diverse and volatile, affecting firms' investments and their ability to raise funds through the markets. Market integration also leads to greater dispersion of shocks and crisis; the perimeter and extension of impact of macroeconomic and external factors has expanded, which implies that disturbances in one place affect a larger amount of economies, adjacent policies, market prices and business structures. As many empirical findings have showed, not only intrinsic characteristics matter to the firms' decision on their level of debt, but also industry specific and macroeconomic

factors (Bokpin, 2009; Camara 2012; Frank and Goyal, 2009; Mokhova and Zinecker, 2014), and therefore their influence should be analyzed.

The existing literature on macroeconomic determinants of Portuguese firms' capital structure, to the best of our knowledge, is still limited when compared with international studies. The spectrum of empirical research in relation to the determinants of capital structure of Portuguese non-financial firms is concentrated on the impact of firm-specific factors (Barbosa and Pinho, 2016; Couto and Ferreira, 2010). Other research such as Oliveira (2012) and Matias and Serrasqueiro (2017), focus on small and medium-sized enterprises ("SMEs") due to the very large proportion of these firms in Portugal.

The present study aims to contribute to discussion on the determinants of capital structure, seeking to answer the following question: To what extent do macroeconomic variables and other external factors determine the choice of Portuguese non-financial firms' capital structure?

In order to answer our research question, we used accounting data from more than 273 thousand Portuguese non-financial firms, and data on stylized macroeconomic variables, such as the GDP growth, inflation rate, two interest rate measures and the government debt in percentage of GDP. The analysis period ranged from 2008 to 2017. The period chosen aimed to capture changes in the macroeconomic factors caused by the more recent financial crisis that affected Portugal. We tested the relationship between the economic indicators and four leverage ratios, total liabilities-to-assets, total debt-to-assets, long-term debt-to-assets and the short-term debt-to-assets ratios, considering different econometric methodologies. We found that that the most appropriate method was the estimation via Fixed Effects (FE), as it was the best fit for our database.

All our models presented strong statistical estimations, being that, the effective tax rate presented a negative impact on all the dependent variables, as opposed to most of the evidence presented in the literature, and the price level of goods and services, represented by the inflation rate, presented a positive impact on debt. Both the GDP growth and the long-term interest rate presented a negative relation with all the leverage ratios except for the long-term debt-to-assets ratio. The cumulative effect, in both variables, is a negative impact on the total debt of firms since the effect of the short-term debt-to-assets ratio is stronger.

The interest rate on new loans operations also presents, generally, a negative effect on leverage level, except for the effect on the short-term debt-to-assets ratio, which is positive. On the contrary, the change in Portuguese government debt (in percentage of GDP) presents an inverse relation with the narrower leverage ratio considered but a positive relation with all other dependent variables. For our firm-specific variables, representing the profitability and size, we expected to find results that were strong and consistent with literature. Although both variables presented statistically significant relations with the dependent variables, only the profitability (measured as return on assets) presented a negative impact with the leverage ratios, as expected. We find that, for our sample, the firm size, measured as the logarithm of assets, only has a positive effect on the short-term debt of firms, therefore, the increase in the amount of total assets decreases, in general, the amount of firms' liabilities and long-term debt.

This dissertation is structured in various sections. A brief introduction on the Portuguese corporate sector is presented in Section 2. The literature review is presented in section 3, and in the section 4 the description of the database and variables is given, as well as some descriptive statistics. Section 5 and 6 describe the econometric methodological approach, the empirical results and their discussion, respectively. Lastly, conclusions are drawn together with a reflection over limitations and future research.

2. Brief Characterization of the Portuguese Corporate Sector

Up to the end of the Second World War, the Portuguese economy was mainly isolated and predominantly agricultural. However, after the war, as many economies started to become more open to internationalization, Portugal joined the European integration movement and the free trade area, where the industrialization process has beginning. Since then, the Portuguese productive structure sifted on to the services sector and became a small open economy. Nonetheless, in the last decades the Portuguese economy suffered adjustments due to the changes in global markets, competition (more countries with low labour costs) and due to reactions to adverse external factors.

In 2008, the financial crisis that got to the European continent affected the Portuguese corporate sector dynamism. According to INE (2012), the establishment of new firms, in proportional terms, presented a growing trend up to 2007, where the birth rate of firms reached more than 15.4%, with the service sector presenting the higher growth. Due to the economic and financial crisis in which Portugal was submerged, the rate of creation of new firms decreased until 2010. Since 2013 the economic situation in Portugal has been strengthening and a recovery of the corporate sector has been observed.

An analysis made by BdP (2019) concluded that, from 2013 to 2017, the number of active firms increased for all business sectors, except in construction. The cumulative growth of 7% in the number of firms has been mainly driven by the positive variation of 19.9% in the number of big firms and the emergence of many sole proprietorship firms (micro enterprises). Additionally, the increase in the number of existing firms was transversal to various regions of Portugal though, Lisbon and the northern region contributed the most.

In 2017, 99.9% of Portuguese firms were micro and small enterprises, with medium and big enterprises representing, only 0.5% and 0.1%, respectively (BdP, 2019). The predominance of small and medium-sized enterprises ("SMEs") in Portugal is a characteristic of the Portuguese economy as well as the European ones. In Portugal, for the last decade, the majority of SMEs belong to the wholesale and retail trade sector, representing 17.4% of all SME in 2017. In the early 2000s, the construction sector represented about 11% of SMEs, however, the representation of SMEs in this sector has been decreasing in favour of the

agriculture, animal production, hunting, forestry and fishing. The representation of SMEs per business sector, from 2008 to 2017, can be found in Appendix A.

Moreover, Portugal is considered a bank-oriented economy since historically bank loans have been the main source of external funds for firms in Portugal, being that bank loans represented more than 60% of firms funding between 1995 and 2007 (Antão and Bonfim, 2008). In the decade leading to 2007, the level of corporate indebtedness in Portugal raised substantially as well as the recourse to capital markets. However, Antão and Bonfim (2008) emphasize that, in 2007, a significant proportion of the debt securities issued by firms was held by banks.

The leverage level of Portuguese non-financial firms in 2007 was about 100% of the national gross domestic product ("GDP") and increased until 2013 to about 127% of the GDP, according to an annual publication of Ministério da Economia (2018, 2019), which uses statistical data of Banco de Portugal. In the beginning of this period, 2007, according to the same source, bank loans and debt securities to Portuguese non-financial firms represented more than 80% and 10% of the country's GDP, respectively, having those percentages increased in 2013 to about 100% and 22%. However, since 2013 firms have been presenting a deleveraging trend and the loans granted by banks have been losing weight, representing about 76% of the GDP in 2017. The loans-to-deposit ratio has been keeping a declining path in line with firm's deleveraging, going from 151% in 2010 to about 93% in 2017.

Table 1 presents the main sources of financing to SMEs and big firms, between 2009 and 2017, in which it is possible to observe that in this period the predominant source of funding is "obtained financing". The data retrieved from Ministério da Economia (2018, 2019) was obtained from the database of the Central de Balanços, provided by Banco de Portugal, which relies on book values and provides detailed accounting information on Portuguese firms; this information is primarily used for economic and statistical purposes.

Table 1 - Funding Structure in % of total assets

Sources of financing / %	2009	2010	2011	2012	2013	2014	2015	2016	2017	Δ2009-2017
SMEs										
Equity	26,9	27,6	26,6	25,6	27,2	28,0	30,7	32,6	33,6	**6,7**
Obtained financing	**37,9**	**40,1**	**40,5**	**42,1**	**40,2**	**39,3**	**38,0**	**36,2**	**35,1**	**-2,8**
Trade creditors	12,5	12,5	12,4	11,9	11,6	11,2	10,8	10,8	10,6	**-1,9**
Others	22,6	19,7	20,5	20,3	21,0	21,4	20,5	20,6	20,6	**-2,0**
Large firms										
Equity	32,7	36,6	35,7	34,8	33,5	31,7	32,9	32,3	32,1	**-0,6**
Obtained financing	**35,9**	**35,4**	**38,0**	**39,1**	**39,1**	**38,7**	**38,1**	**38,5**	**38,6**	**2,7**
Trade creditors	10,9	11,5	11,2	10,4	9,9	10,8	10,8	11,3	11,8	**0,9**
Others	20,6	16,5	15,1	15,7	17,5	18,9	18,3	17,8	17,4	**-3,2**

Source: *Banco de Portugal - Base de Dados da Central de Balanços*

From the data presented on Table 1, we can also verify that SMEs gradually increased their level of capitalization, having surpassed, in the end of 2017, the capitalization level of big firms. Although SMEs reinforced their equity levels and reduced the resource to bank loans, the opposite is observed for big firms, between 2009 and 2017. However, when considering firms' funding structure in 2018 (Ministério da Economia, 2019), we detect that big firms increased their equity by 2.6 percentage points (pp), to 34.7%, and decreased the obtained funding by 3.6 pp, to 35%, which represents a change in the paradigm.

Since the emergence of the financial crisis, a general decrease in the interest rate of new loans has been observed. Though the gap is being reduced, the interest rates applied to Portuguese firms are still high – average of about 3% in 2017 – when compared with the euro area average – around 1.5%. It is to note that in Portugal, as in other European countries, interest rates charged by banks on loans up to 1 million euros (mainly destined to SMEs) are somewhat higher than those charged for higher amounts (Ministério da Economia, 2018, 2019).

Summing up, in the last few years the economic climate in Portugal became more favourable, being influenced both by internal and external factors, after the period of imbalance adjustments implied by a financial bailout and intense austerity policy. Even though, since 2013, firms begin to deleverage, and banks started to have more restrictions on granting credit

(due to European post-crisis measures), Portuguese firms, mainly SMEs who do not have easy access to other sources of financing, are still very dependent on bank loans. The changing conditions for granting loans and macroeconomic factors can present a challenge for firms to achieve an optimal/target debt structure, if they have one.

3. Literature Review

This section is devoted on presenting the main theories and studies developed to understand firm's choice of capital structure. We initially present the theoretical framework on the subject of corporate capital structure, then we present a brief highlight on the importance of understanding macroeconomic influence and conclude this section with a review of the literature concerning the impacts of the macroeconomic variables on firms' capital structure.

3.1. Theoretical framework of corporate capital structure

In the traditional view, presented by Durand (1952), firms hold an optimal capital structure that maximizes their value. The main theories concerning the choice of firm's capital structure appeared after Modigliani and Miller (1958) presented their irrelevance theorem. The irrelevance proposition, unlike Durand's view, states that, under very strong assumptions, the firm's financial policy does not affect its productivity and, therefore, it is irrelevant in determining its value. The assumptions made, for instance on the absence of taxes, and results obtained by Modigliani and Miller (1958), raised some counter-charges and led to the search for alternative explanations as to the decision-making process of choosing the leverage level. The assumption on taxes revealed to be determinant for Modigliani and Miller, being that they conclude, that due to the deduction of interest on debt, firms could be incentivized to only be financed by debt (Modigliani and Miller, 1963).

Three important theories on corporate capital structure decisions can be point out, viz., the trade-off, pecking order and market timing theories, being the first two the most debated among researchers (Mokhova and Zinecker, 2014).

The emphasis of the trade-off theory is that there is an optimal level of capital structure that firms achieve by a combination of external equity and debt financing (Kraus and Litzenberger, 1973). Accordingly, the debate on the costs and benefits of debt is central to this theory, where debt is taken upon the point where its positive effects (tax savings and managerial discipline) are balanced by its inherent costs, mainly bankruptcy and agency costs (Kraus and Litzenberger, 1973). In light of this theory, one can infer that companies with higher costs of financial distress would have less debt in their capital structure. This theory also predicts that profitable firms tend to be more levered since (i) bankruptcy costs decrease,

(ii) they expect higher tax rates on income but consequently have higher deductions related to debt, and (iii) those firms tend to have freer cash-flow and debt is used to reduce agency costs (Antão and Bonfim, 2008).

The pecking order theory developed in Myers (1984) does not offer much predictive power on leverage levels. Instead, it provides a ranking order on financing preferences by considering the matter of risk and asymmetric information, set in Myers and Majluf (1984). The theory implies that firms prefer to use internal funds as they are less exposed to asymmetric information and, in case of non-availability of funds, they would issue debt over equity. Only as a last resource would firms issue equity as it is more expensive since, due to a greater associated risk, investors would demand a higher discount in the price. Therefore, this theory contradicts the trade-off theory on the prediction of the impact of profitability, as it states that more lucrative firms will issue less debt and will most likely rely on retain earnings. Moreover, as they do not choose an optimal level of debt, the debt ratio represents the accumulated external financing required, as explained by Mostafa and Boregowda (2014).

The third theory worth mentioning suggests that the form of financing depends on which market appears more favourable. The market timing theory, by Baker and Wurgler (2002), does not assume a strong market efficiency but does not imply market inefficiency either. The authors aimed to study whether market timing had a short or long-run impact on the capital structure, and the results found comport the hypothesis that, timing the market has a large and persistent effect on the financial structure of firms. The paper presents evidence that firms with a lower level of debt tend to issue equity when their market valuation is high and the ones with a higher degree of leverage usually raise capital when their market valuation is low: *"…capital structure is largely the cumulative outcome of past attempts to time the equity market*." (Baker and Wurgler, 2002: 29). This theory implies that managers of firms take advantage of the market to benefit the firm's shareholders, which is in divergence with the pecking order theory. However, evidence supporting this theory has been found empirically (Baker and Wurgler, 2002; Bougatef and Chichti, 2010) and the importance of market timing theory has been recognized in the literature.

Other theoretical explanations have contributed to the understanding of the how firms chose the leverage level, for instance, the asymmetric information theory, particularly influence by Akerlof (1970), Spence (1973) and Stiglitz (1975), implying that insiders, having a better knowledge of the firm's value, will take advantage to signal the market. Since debt is less attractive to non-performing firms, in low market conditions the firm can issue debt and obtain financing since it is perceived that only quality firms will increase leverage. This theory also suggests that, due to asymmetric information, managers know the firm best and to avoid losing positive net present value ("NPV") investment opportunities during recessions they will use debt to capture funding (in addition, costs of equity are higher in poorer market conditions). The asymmetric information theory links the influence of macroeconomic conditions to the capital structure decisions. Jensen's (1986) free cash flow theory, explains how agency costs can be mitigated with debt, stating that the optimal amount of debt is a function of the free cash flow to manager. Managers will be more persuaded to invest in projects that are profitable due to the relation between their own compensation and the firm's profitability.

Camara (2012) studied the differences of capital adjustment speed to macroeconomic conditions between United States multinationals and domestic firms, finding that, although macroeconomic conditions have significant influence on the financial decisions of all firms, the adjustment speed was quicker on multinationals. The results imply that due to capital market imperfections, United States multinationals were able to better offset domestic macroeconomic variables than domestic firms. The author also found that over-levered firms adjusted faster than under-levered, supporting that element of the market timing theory.

A found consensus is that, firm level characteristics have influence on leverage – as internal factors are known by managers and shareholders and can be managed/changed. After finding differences in the way companies financed themselves through the years, Frank and Goyal (2009), using 53 years of data, found robust evidence that the most reliable factors to explain market leverage of publicly traded American firms were: medium industry leverage, market-to-book assets ratio, tangibility, profits, log of assets and expected inflation. Later, Öztekin (2015), using a sample composed with firms from 37 countries, also found that industry leverage, tangibility, profits and inflation, as well as firm size, were reliable determinants for leverage. Notwithstanding, the prediction on the impact of each internal factor on leverage

can differ depending on which capital structure theory is analysed, for instance, pecking order theory suggests that profitability and size have a negative relation with leverage while, for the same internal factors, the trade-off theory states that there is a positive relation.

Moreover, empirical evidence suggests that internal factors' impact on capital structure may differ from one country to another, but some similarities can also be found in countries belonging to the same economic region (Bastos, Nakamura and Basso, 2009; Jõeveer, 2013; Rajan and Zingales, 1995). For instance, Mokhova and Zinecker (2013) find evidence, based on 32 countries, that to some extent the European Union membership influences the relation between firm specific determinants and corporate capital structure. The rationale behind these findings is that *"…the capital structure of a firm is heavily influenced by the economic environment and its institutions, corporate governance practices, tax systems, the borrower-lender relation, exposure to capital markets, and the level of investor protection in the country in which the firm operates."* (Antoniou, Guney and Paudyal, 2008: 59). Aiming to study the determinants of capital structure of firms in market-oriented and bank-oriented economies, Antoniou, Guney and Paudyal (2008) used firm specific explanatory variables such as profitability, growth opportunities, firm size, effective tax rate, dividend pay-out and share price performance. The results showed that, in a general way, the economic environment influences the capital structure of firms, hence, firms located in common economic regions in countries geographically closer with economical and financial connections tend to present similar results. However, the level of impact of each variable in leverages was found to be country specific.

3.2. Studies concerning Portuguese firms

As mentioned in the previous section, the business structure in Portugal has been historically composed mainly by micro and small enterprises. Accordingly, many empirical Portuguese studies on the composition and dynamics of capital structure focus on SMEs (Matias and Serrasqueiro, 2017; Oliveira, 2012; Serrasqueiro, Matias and Salsa, 2016; Vieira and Novo, 2010). Nonetheless, it is also possible to find studies on capital structure concerning all Portuguese firms (Antão and Bonfim, 2008, 2014; Barbosa and Pinho, 2016) or specifically

big and listed Portuguese firms (Couto and Ferreira, 2010; Jorge and Armada, 2001; Serrasqueiro and Rogão, 2009).

Although, the studies mentioned above use different samples, they all mainly relate to the study of intrinsic factors or firm related variables such as profitability, tangible assets, size, growth opportunities (Barbosa and Pinho, 2016; Couto and Ferreira, 2010; Matias and Serrasqueiro, 2017; Oliveira, 2012; Serrasqueiro, Matias and Salsa, 2016; Vieira and Novo, 2010). To study the determinants of debt adjustment in listed companies in Portugal (those that are presumably more likely to be influenced by macroeconomic factors), Serrasqueiro and Rogão (2009) considered as specific determinants asset tangibility, size, profitability and market to book ratio and the results found suggested that *"[…] the capital structure decisions of listed Portuguese companies can be explained in the light of trade-off and pecking order theories, but not according to what is forecast by market timing theory.*" (Serrasqueiro and Rogão, 2009: 71). In 2010, Couto and Ferreira (2010) published their study on the determinants of capital structure of the PSI-20 firms and, in an attempt to update the work of Jorge and Armada (2001), using debt-to-equity ratio as the dependent variable, the authors added the dividend pay-out and share price performance to the intrinsic variables previously studied, i.e., asset tangibility, size, business risk and profitability. The results showed that, in line with the results found by Jorge and Armada (2001) and previous literature, asset tangibility, size, business risk and profitability were determinants on capital structure decision, as opposed to dividend pay-out and share price performance, which were intended to capture deviations on economic conjecture. However, the authors highlight the knowledge that other literature, such as Antoniou, Guney and Paudyal (2008), found negative relationships between leverage level and dividend pay-out and between leverage and share price performance, like Korajczk and Levy (2003) and Hovakimian et al. (2004). Moreover, Couto and Ferreira (2010) acknowledge that, other factors not capture by the variables utilized in the study, like the role of the financial manager, the technological advancement, financial markets accessibility in Portugal among others, may have an important repercussion on capital structure composition of Portuguese firms.

Antão and Bonfim (2014) focus their study on the adjustment speed and process of convergence to target leverage ratios of the Portuguese firms. The results of the study, which used data from the Central Balance Sheet database, provided by Bank of Portugal, showed

that most firms do converge to an optimal leverage level and the adjustment speed towards it is generally fast, being more so for smaller firms. Antão and Bonfim (2014) also consider the two adjustment trajectories, to increase or decrease of leverage depending on whether they are above or below their target. The authors' findings are very important to understand the firms' dynamics and try to predict their course of action within their financing possibilities.

Barbosa and Pinho (2016) in trying to find the main determinants of the corporate financing structure, considered in their study the different types of financing to which firms can rely, that is, bank financing and commercial loans, loans to shareholders, debt to the state and intra-group operations. The authors found that, in a general way, firm specific factors impact in different ways the different types of financing, except for profitability, that present a negative relationship with all sources of financing. Also, the results showed that the firm's dimension has a negative relation with the debt to the state and shareholders but a positive one with bank financing and commercial loans, which may be explained by the asymmetric information theory.

The lack of studies using macroeconomic variables as explanatory factors for the capital structure of Portuguese firms is quite understandable since Portuguese firms are predominantly SMEs, operating in more local markets and with less access to the capital markets and, literature provides solid evidence that intrinsic variables explain partially the leverage level of firms and debt adjustment.

3.3. Why do macroeconomic factors matter?

The continuous economic globalization and market integration, which allows for use of economies of scale, growth in trade of services and human capital at an international level, increases the competitiveness in business sectors and provides for the establishment of new companies in national and local economies. A country that offers higher growth opportunities and lower wages, can attract competitive firms and affect the profitability and retained earnings of national firms. Other macroeconomic indicators such as balance of payments, inflation and unemployment must be accounted for and its impact assessed because they also impact the financing choices of companies.

Portugal had issues with price stability and exchange rates after democracy was established in 1974, which affected directly all firms and the country's productivity. Portugal saw in the Exchange Rate Mechanism, which was being established in the European Union at the time, an opportunity to solve this problem. However, this decision implied a trade-off, since the liberty to depreciate the country's currency to manage some economic deregulation was lost. Nonetheless, business cycles could still be mitigated using fiscal policy or monetary policy, at least until the European Union was fully and formally integrated.

Monetary policy attempts to stabilize the economy by adjusting money supply or interest rates. Increasing monetary policy generally leads to lower interest rates which speeds up the economy and controls for unemployment. Lower interest rates decrease the financial burden for borrowers making it easier to taken on loans and to repay them. Contrarily, contractionary monetary policy reduces money availability, thus controlling for inflation. Inflation measures the increase in prices and in the cost of living and the expectation on its evolution influences the level of credit and the value of investment opportunities (Mokhova and Zinecker, 2014). Summing up, monetary policy affects interest rates which have an impact on the cost of financing for firms, meaning that its decrease makes debt a cheap source of finance without having to give up firm control, as per issuing stock. Since Portugal belongs to the Economic and Monetary Union ("EMU"), the monetary policy is defined by the European Central Bank ("ECB").

Mokhova and Zinecker (2014) investigated the relation between macroeconomic variables affected by monetary and fiscal policy for seven European countries, finding that macroeconomic factors are significant in the decision-making process regarding companies' leverage levels.

Currently, the Portuguese government can, however, control its fiscal policy. Through expansionary fiscal policy, that is, the increase of government spending or reduction of taxes, the government can stimulate private spending, leading to better results for firms, whom without the tax benefits of debt, tend to decrease their leverage level. However, the immediate effect of this policy can be cancelled out, in the long-run perspective, by the savings of this "extra" money, defeating the purpose of increasing aggregate demand. The global economic and financial crisis of 2008 had major consequences in the Portuguese economy. In 2010,

Portugal faced economic stagnation and the attempt of stimulating the economy just increased the countries debt level. These events led to external financial help and severe economic measures, which affected the Portuguese corporate reality. A good economic steering and well-functioning government debt market boosts the improvement of efficient financial markets, which are necessary for ensuring stable economic growth.

As per definition, GDP measures the level of everything that is produced in a country, accounting for personal consumption expenditure, business investment, government spending but also for imports and exports. Some countries and industries depend more on trade then others, which depends on the level of industrial development and financial markets, inflation and mostly of the exchange rate. Firms' growth opportunities may depend not only in their country's economic environment but also in the economic conditions of foreign countries if their cash-flows and value added are strongly related to them. Economic stability is important for the establishment and development of businesses.

3.4. Relationship and predictions between macroeconomic variables and capital structure

In the international context, several authors have been trying to assess the impact of macroeconomic variables on firms' capital structure and their debt adjustment. The research made until today, in an almost consensus, finds that there is causal relation between external factors and corporate capital structure, however, findings on specific variables vary according to the region studied, development of the country, type of debt analysed among other features. Some studies are more focused on similar groups of countries, like emerging market economies (Bastos, Nakamura and Basso, 2009; Bokpin, 2009; Temimi, Zeitun and Mimouni, 2016) or transitional economies (Hanousek and Shamshur, 2011; Jõeveer, 2013), and others on specific countries like Gajurel (2006) studying Nepalese firms or Camara (2012) and Frank and Goyal (2003, 2009) studying American firms.

In their study, comprising data on publicly traded American firms for 1971 to 1998, Frank and Goyal (2003) not only found evidence that large firms, in that period, tended to follow the pecking order theory, unlike small firms, but also determined that roughly 30 per cent of differences in the capital structure of American firms could be explained by firm-specific

determinants, suggesting that there are many other factors accounting for capital structure decisions.

We chose to study the relation between macroeconomic variables that have empirical support from previous literature and the capital structure level of Portuguese non-financial firms.

GDP growth

A very commonly adopted variable is the growth of GDP. When the economy is performing well and growing, firms tend to increase their profits and it is usually easier to undertake debt. Frank and Goyal (2009) argue that firms should borrow more during expansions since prices and income go up, bankruptcy costs decrease, and taxable income also increases. However, empirical results have not been consistent. Hanousek and Shamshur (2011) studying transition economies found a positive relation between GDP growth and leverage for all firms, but a negative one when considering only profitable firms[1]. Jõeveer (2013) and Temimi, Zeitun and Mimouni (2016) obtained mixed results about the direction of the relation of GDP growth with leverage, nevertheless, Bastos, Nakamura and Basso (2009), Bopkin (2009), for his study on 34 emerging countries (in which Portugal is included), and Gajurel (2006), all found that GDP has a significant negative relation with leverage. These results are in line with the pecking order theory, since in good economic conditions firms have more profits, and therefore, more internal funds which they rather use than resort to debt.

Hypothesis 1: There is a negative relationship between GDP growth and leverage.

Inflation

As we discussed before, inflation alters the relative price of debt, therefore, its impact of capital structure has been widely studied. The pecking order theory does not give a clear insight on the consequences of changes in inflation on leverage and neither does the trade-

[1] The results indicated report to estimates from the pooled OLS model. When estimating the fixed and random effects model the results obtained by the authors present a negative relation between GDP growth and leverage, significant at 1% level.

off theory, which predicts an ambiguous effect due to multiple direct and indirect effects of higher expected inflation. As such, the result obtained in empirical studies vary. For instance, Frank and Goyal (2009) found that the two variables were positively related when considering market leverage but found no reliable evidence when considering the book leverage values. Mokhova and Zinecker (2014), when investigated the relation between macroeconomic variables of monetary and fiscal policy for seven European countries, obtained different results for different countries[2]. Moreover, Hanousek and Shamshur (2011) found a strong and positive relation between inflation and leverage, while Bastos, Nakamura and Basso (2009) as well as Camara (2012) found no significant relation between leverage and most of the macroeconomic variables, including inflation. Conversely, Gajurel (2006) provided evidence that for Nepalese firms, inflation is negatively related to leverage, and Bokpin (2009) found that there is a negative but statistically insignificant relationship between inflation and three, out of the four, capital structure measurement variables.

From many of the existing literature, we can state that although the effect may be ambiguous, inflation is a dominant factor affecting leverage in many countries of the world (Öztekin, 2015).

Hypothesis 2: High inflation leads to higher levels of leverage.

Interest rate

Giving to the trade-off theory, the more profitable firms, those that have a higher level of tangible assets and profits, should enjoy more benefits from tax benefits, and therefore should have higher levels of leverage. Also, the same theory, states that as a proxy to the cost of debt, interest rates should be negatively related to leverage. Jõeveer (2013) argued for a negative relation of interest rates in debt financing. Mokhova and Zinecker (2014), studied the impact of short- and long-term interest rates in leverage and found a strong negative

[2] The seven countries were chosen to represent developed and emerging markets. The authors found a significant strong negative relationship between inflation and leverage for Czech Republic and a significant strong positive one for France. Additionally, a negative influence of inflation in leverage was found for Germany and other emerging markets except for Greece, for which the authors found a positive relationship between the variables.

relationship between leverage and long-term interest rates in Slovakia and a strong positive one for booth types of interest on leverage in Germany. Bokpin (2009) only found a positively and statistically significant effect of interest rate in short-term debt. The author argues that "*since cost of external financing directly reflects on weighted average cost of firms' capital, expectations of increasing interest rate positively influences the choice of short-term funds over equity rather than opting for long-term debt*" (Bokpin, 2009: 138). Frank and Goyal (2009) supported the view that tax benefits coming from interests reduce the tax burden. In his theoretical paper, Katagiri (2014) argues that the aggregate response of leverage depends on the relative cost of equity, since the latter is usually more expensive. Moreover, for younger and smaller firms the cost of equity is higher and therefore they tend to use more debt.

Hypothesis 3: There is a negative relation between interest and leverage.

Corporate tax rate

The research on the direct impact of taxes, through tax deductibility, was soon studied in the light of the different theories after it was added to the Modigliani and Miller (1958) irrelevance theorem. Jordan, Lowe and Taylor (1998) focused on the study of SMEs in the United Kingdom and found a significant and negative relation between the effective tax rate and all the models analysed, which considered different measures of leverage. Heider and Ljungqvist (2015) exploited changes in corporate income tax rates across United States of America, over the period from 1989 until 2011, and found that firms would adjust their leverage towards a tax increase but were not sensitive to tax cuts. Jõeveer (2013), despite arguing that higher tax rate leads to higher benefits and, consequently to higher debt financing, only found a small non-significant positive relation between tax rate and leverage. In its experiment, Katagiri (2014) found a fairly small effect of tax benefits on corporate capital structure. Temimi, Zeitun and Mimouni (2016) recent findings show that, additionally to the tax shield effect, whereby firms will be tending to take on more debt, taxes have an indirect result on capital structure by strengthening the effect of tangibility and GDP growth on leverage while declining the effect of profitability and liquidity. Graham and Harvey (2001) comprehensive survey surrounding corporate capital budgeting and capital structure

indicated that most companies, particularly larger, regulated, and dividend-paying firms, considered tax advantage in their choices. The authors also found that managers of larger firms, also considered foreign tax treatment, suggesting awareness to tax benefits. Faulkender and Smith (2016) focusing on multinational corporations found that firms operating in countries with higher tax rates have higher leverage ratios. We follow the literature and most empirical results on direct effects of corporate tax rate.

Hypothesis 4: Corporate tax rate is positively related to leverage.

Government debt

The management of government debt can have a great role in controlling economic crises, at least in the short-term. Mokhova and Zinecker (2014) found that government debt relationship with leverage depend on countries' specifics and can have a different repercussion on different capital structure measures. The authors found a positive relationship between government debt and leverage for most emerging markets, but strong significant and negative relationship for the developed markets studied. Graham, Leary and Roberts (2015) found that, for nonfinancial publicly traded American firms, there is a significant negative association between government borrowing and corporate leverage. Accordingly, Fan et al. (2012) found a negative relationship between government bond market and leverage – however only significant for developing countries – and also found that firms in countries with a larger government bond markets present lower debt ratios and shorter maturity dates, which may reflect a crowding-out effect of long-term corporate debt caused by the issuing of government debt. Ayturk (2017), while studying the effect of government borrowing on corporate finance in fifteen European countries (including Portugal), found a significant negative relationship between government debt and leverage, implying that the increase in government debt leads to a crowding out effect in develop European countries. Demirci, Huang and Sialm (2019) using data on 40 countries, for a period of 24 years, found a negative relation between government debt and the level of corporate leverage.

Hypothesis 5: There is a negative relationship between government debt and leverage.

4. Data

The current section addresses the database used in this dissertation (Subsection 4.1) and presents the description of all the variables as well as the descriptive statistics (Subsection 4.2).

4.1. Database

The main purpose of this study is to answer the question: "How do Macroeconomic factors influence the capital structure of non-financial firms in Portugal?"

Accordingly, this empirical research is constructed by three groups of variables. The set of explanatory variables includes two groups of variables, the macroeconomic group which includes variables related to the following economic indicators: GDP growth, inflation, interest rate and government debt; and the firm specific group which includes the variables related to the effective tax rate, profitability and firm size. The effective tax rate will be used as a proxy for explaining changes in corporate tax rate however, the remaining subset of internal variables are included in the estimation for control and aim to provide a better understanding of the impacts on firms with different characteristics. To understand the influence of explanatory factors on the capital structure of Portuguese non-financial firms, using the firms' information, we computed four leverage ratios which consider total liabilities, total debt, long-term debt and short-term debt, offering a more comprehensive analysis of the results, thus representing a direct link to the research question. A further description of the variables used in the estimation is presented in the next subsection.

The firms' information used to construct the variables representing the internal factors and the leverage ratios were obtained using accounting data of non-financial firms in Portugal, recorded from 2008 to 2017. This information was collected from the Amadeus database, which provides standardized comprehensive information on European firms, focusing on private companies, made available by Bureau van Dijk, a publisher of business information and company data, owned by Moody's Analytics. The original database retrieved contained more than 334 thousand non-financial Portuguese firms and the downloaded variables were presented in thousands of euros.

Before 2006 financial reporting in Portugal was not compulsory for all firms in Portugal, however, since the present study uses information from 2008 onwards, a vast quantity of information was available. Nonetheless, due to incorrect filled-out of the data or to other factors, some information was found to be scarce, missing or dubious. Therefore, to enhance the quality of the data used for our analysis and to obtain more appropriate results, the database was cleaned and processed. First, we removed from the dataset observations with a negative, or zero value, of total assets and negative values of debt and liabilities, as these variables are used to construct our leverage ratio (as explained in the next subsection) and removed observations with zero employees reported. Moreover, we proceeded to the removal of missing data on the dependent variables, that is, we drop the firms for which there were less than two consecutive years of data. Lastly, we winsorize the firm variables at the 0.5% level in both tails, which was sufficient to remove the most extreme observations, or misreported data - it is important to notice that this treatment process can however, bias the data.

The construction process led to the achievement of an unbalanced panel dataset, with information of 276 966 firms. Additionally, we verified that through the model estimation process some observations, and consequently 3 790 firms, were dropped by the STATA program. The main treatment process for how we dropped data from the initial sample to the regression analysis can be found in the table below:

Table 2 - Drop offs

Reasons for Dropping off	**Nº of firms**	**Drop Offs** nº firms	nº obs	**Nº of Observations**
Initial Sample	334 533			3 345 330
Cleaning process	334 530	3	245 498	3 099 832
Firms with fully missing data (1)	276 966	57 564	435 803	2 664 029
Droped by stata (2)	273 176	3 790	944 692	1 719 337
Final Sample	273 176			1 719 337

Notes: *(1) We exclude the variables that present less than two observations, regarding the dependent variables, during the period considered. (2) During the estimation process some variables are dropped by Stata due to missing data. In this table we present the observed values that results from the regression of the main model considering as dependent variable the total debt-to-assets ratio. The regression considering the total liabilities-to-assets ratio as dependent variable account for 273177 firms and 1719596 observations. The regressions*

estimation considering the long- and short-term debt-to-assets ratio represent 273176 and 273177 firms and 1719 395 and 1719539 observations, respectively.

***Source**: Own calculations based on the dataset*

The first column sets out the various reasons for dropping some observations. The second and fifth columns show the number of firms and observations, respectively, obtained in each step. The intermediate columns, column three and four show how many firms and observations, respectively, were dropped from the sample given the reasons in column one.

4.2. Variables and Descriptive Statistics

4.2.1. Dependent Variables

As there are many possible leverage measures that can be used, that lead to different results and have different interpretations, the choice of ratio has to be made carefully. For instance, the broadest definition of leverage is the ratio of total liabilities to total assets, but this ratio might not be the most adequate to indicate if the firm is likely to default (Rajan & Zingales, 1995). More narrow forms of the leverage ratio, for example that only consider financial loans, also have their limitations since they do not capture non-debt liabilities and accounts payable that can be influenced by external economic factors and drive the firms financially for some time.

Taking into account the purpose of this study, the Portuguese high dependence on the banking system and the national characteristics of the corporate sector, we constructed three leverage ratios that only consider the debt, excluding other liabilities such as accounts payable, reserves, among others. These debt-based leverage ratios that were constructed, and the approach followed, approximates the ones discussed in Rajan & Zingales (1995), Korajczyk and Levy (2003) and Frank and Goyal (2009). We set as leverage ratio, the debt (short, long and total) to assets ratio, since, as mentioned before, Portuguese firms are traditionally financed by bank loans, although, we acknowledge that this measure fails to incorporate other non-debt liabilities that offset some assets. Moreover, we used accounting data to build the group of dependent variables, meaning that only book values for debt and assets were used. The three leverage ratios adopted are as follow:

Short-term debt-to-total assets: $$SDA = \frac{Short\text{-}term\ debt\ (< 12\ months)}{Total\ Assets} \quad (1)$$

Long-term debt-to-total assets: $$LDA = \frac{Long-term\ debt\ (>12\ months)}{Total\ Assets} \quad (2)$$

To construct the SDA ratio, we retrieved from the Amadeus database the variable "LOANS", which include the current liabilities: bond borrowing, participating bond borrowing, debits to credit institutions and other short-term borrowings; and does not include other current liabilities such as suppliers, advances from customers and the current account. The ratio LDA only represents long-term debt, that is, does not include provisions and other accounts.

Total debt-to-total assets: $$TDA = \frac{Total\ debt}{Total\ Assets} \quad (3)$$

The ratio TDA was built by adding the long and short-term debt and dividing it by the book value of assets.

As to account for non-debt sources of financing and capture the possible differences on the impact of macroeconomic variables on the firms' general liabilities, an additional broader ratio of leverage was also considered and regressed. Therefore, our fourth leverage ratio, which has as its numerator the total current and non-current liabilities reported, is presented below:

Total liabilities to total assets: $$TLA = \frac{Total\ liabilities}{Total\ Assets} \quad (4)$$

4.2.2. Independent Variables

Macroeconomic Variables

The macroeconomic variables were selected considering past research, related findings and taking into account the principle of parsimony. The information used to generate the macroeconomic set of variables was retrieved from several official sources. This information was then also subject to transformations, as some variables had heterogeneous periodicities.

GDP is the measurement of a nation's monetary value of all finished goods and services produced within a country and is one of the most important macroeconomic indicators. The GDP growth rate intents to capture the variation in the economic conditions, by comparing one quarter of the country's GDP to the previous. Following Frank and Goyal (2009), Camara (2012) and Graham, Leary and Roberts (2015), for this analysis we used the Portuguese

annual real GDP growth rate ("GDPG"), which was retrieved from Pordata[3] (a database that obtains its information through official entities like the Instituto Nacional de Estatística ("INE") and Eurostat). The inflation rate ("INFR") was extracted from INE[4] in a monthly base and then annualized.

As Mokhova and Zinecker (2014), to capture monetary policy effects, we obtain data for the short and long-term interest rates that will allow for a representation of business cycles and expectations. The short-term interest rates ("STIR"), or money market rates, are based on three-month money market rates and represent the rate at financial institutions borrow from each other for the short-term, and the long-term interest rates ("LTIR") is the rate implied in the price at which the government bonds maturing in ten years are traded on financial markets. The values of the Portuguese short and long-term interest rates for the period of analysis, 2008 to 2017, were obtained, in a monthly basis, from OECD National Accounts Statistics[5] and then were annualized. Furthermore, since bank loans have been a major source of financing for Portuguese firms, we included as explanatory variables the interest rates on new loans operations to firms (annual average) ("IRNL"), which was retrieved directly from Pordata[6].

The sixth macroeconomic variable used is the growth in government debt in percentage of GDP ("GOVD"). The government debt-to-GDP ratio is a measure for the economic health of a country and, that according to the literature, has that impacts corporate leverage. Therefore, due to the financial and economic crisis that happened around the first decade of the 21st century, which lead to an increase in the Portuguese government debt-to-GDP ratio, the impact of this change in the Portuguese corporate sector will be assessed. The annual government debt-to-GDP ratio were extracted from the OECD database[7]. After obtaining the values we computed the growth ratio.

[3] https://www.pordata.pt/Portugal/Taxa+de+crescimento+real+do+PIB-2298 [viewed on: 1 May 2018]
[4] https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_indicadores&userLoadSave=Load&userTableOrder=7157&tipoSeleccao=1&contexto=pq&selTab=tab1&submitLoad=true [viewed on: 02 April 2018]
[5] https://data.oecd.org/interest/long-term-interest-rates.htm [viewed on: 31 May 2018]
[6] https://www.pordata.pt/Portugal/Taxas+de+juro+sobre+novas+opera%C3%A7%C3%B5es+de+empr%C3%A9stimos+(m%C3%A9dia+anual)+a+empresas+total+e+por+escal%C3%A3o+de+cr%C3%A9dito-2847 [viewed on: 1 May 2018]
[7] https://data.oecd.org/gga/general-government-debt.htm [viewed on: 31 May 2018]

A table presenting the periodicities and sources (including the direct links to the websites) for all the macroeconomic variables in the dataset is presented in Appendix B.

Firm specific Variables

Considering our research question, the most relevant variable included in this subgroup is the one related to taxes.

The general Portuguese corporate tax rate in 2008 was 25%, in 2014 it decreased to 23% and since 2015 has been 21%. However, SMEs benefit from a reduction on corporate taxes up to a specific amount of taxable income. In addition to the regular tax deductions, some firms, depending on their activity and business sector may benefit from further tax benefits. Therefore, to assess the impact of taxes on capital structure we will use the effective tax rate ("TAXRATE"), which underlies the effect of the reduction of statutory corporate tax.

Though it may be expected, in some countries, a positive relation between effective tax rate and leverage, due to the increased tax gains from borrowing, as identified by Antoniou, Guney and Paudyal (2008), the impact of effective tax rate on the capital structure of firms depends on the objectives of the tax policy of the country, which, for example, may favour dividend pay-out against earnings retention. Moreover, the complexity and implications of the tax structures might not be captured by the effective tax rate.

As a research variable to measure the relationship between the effective tax rate and the leverage ratios, we will use the ratio between taxes paid and pre-tax income reported by the firms, to measure the relationship between the effective tax rate and the leverage ratios:

$$TAXRATE = \frac{tax}{Pre{-}tax\ income} \qquad (5)$$

Empirical research has long determined that the firms' profitability impacts the capital structure choice. Nonetheless, it is interesting that, according to the trade-off theory, more profitable firms will probably be more leveraged since they are less concerned with bankruptcy costs, and according to the pecking-order theory, a higher profitability leads to an easier access to internal funds and therefore should be less leveraged. The contradictory

predictions of the above-mentioned theories can also be found in the empirical findings, as the impact is influenced by the other interactive factors and the environment/context of the firm. However, it is common to find a negative relationship between profitability and leverage (Rajan and Zingales, 1995; Frank and Goyal, 2009).

Similarly to Bauer (2004), Bokpin (2009) and Bastos, Nakamura and Basso (2009), the profitability measured used was the return on assets ("ROA"), which was directly retrieved from the Amadeus database.

Another firm-specific variable widely used in international research is the firm size. In this study we present the firms' size in terms of total amount of their assets through the logarithm of total assets ("ASSETS"), following the procedure adopted in most empirical research. Frank ang Goyal (2009), using the same metric, found that larger firms tend to have higher levels of leverage. This variable was also found by Öztekin (2015) to be a reliable determinant for leverage, being that there is a positive relation between the firm size and the leverage level.

4.2.3. Descriptive Statistics

This subsection presents the descriptive statistics for the variables of interest.

As mentioned previously, 99.9% of Portuguese firms are SMEs. In that sense, as to better understand the characteristics and composition of our database we created a categorical variable by firm size, for database description purposes only. This variable was constructed using the firm data we retrieved from the Amadeus database on total assets ("TA") and the number of employees ("STAFF"). We classified our firms based on the Recommendation 2003/361/EC of the European Commission of 6 May 2003, which divides firms by number of employees and annual balance sheet total or turnover, as shown in the table 3 below:

Table 3 - Classifications into micro, small and medium-size enterprise

	Micro firms	Small enterprises	Medium enterprises	Big enterprises
Staff Headcount	<10	< 50	< 250	≥ 250
Turnover or	≤ EUR 2 M	≤ EUR 10 M	≤ EUR 50 M	> EUR 50 M
Balance sheet total	≤ EUR 2 M	≤ EUR 10 M	≤ EUR 43 M	> EUR 43 M

Source: *Recommendation 2003/361/EC of the EC 6 of May 2003*

Our dataset presented some limitations for the accurate construction of this variable. After generating the categorical variable, that we called "SIZE", it was verified that this new variable did not incorporate all observations of our database since some firms fail to comply with the established parameters. Therefore, some firms were not included in any subdivision – for instance, some firms presented a number of employees accordant with the characterization of medium firms but a level of assets that would fall into the category of big firms, which lead them to appear as missing data ("MD"). The next table present the results obtain.

Table 4 – Tabulation of the categorical variable, "SIZE"

Variable: Size		Frequency	Percentage	Cumulative Percentage
1	Micro	1,496,930	56.19	56.19
2	Small	56,228	2.11	58.30
3	Medium	10,821	0.41	58.71
4	Big	2,824	0.11	58.81
.	MD	1,097,226	41.19	100.00
Total		2,664,029	100.00	100.00

Source*: Own calculations based on the dataset.*

Nonetheless, as shown in the table above, it was possible to confirm that most of the firms included in the dataset are micro firms, representing, at least, 56.19% of the total number of observations of our cleaned database.

Table 5 features information on the descriptive statistics of the base variables, dependent and independent, included in the models, for the period considered, that is, from 2008 to 2017. Tables 6,7 and 8 present the dependent and independent variables' means per year.

Regarding the second column of table 5, which presents the number of observations per variable, it is possible to note that there are less observations for the leverage ratios, built using the firm data, and for the firm-specific variables than for the macroeconomic variables due to missing data. The variable that accounts for less observations is the tax rate variable (built as shown in formula 5) due to non-reported information in the original data set.

As expected, the mean of the broader leverage ratio, i.e. total liabilities-to-asset ratios, is the highest among the leverage ratios, representing 91% of total assets. Although it was expected that the TLA ratio presented a higher average value than the other ratios, we can verify that it is well above the remaining leverage ratios comparing with the mean of about 25% of total debt-to-assets. During the period considered, the sample of firms in this study resorted more to a higher amount of long-term debt than to sort-term debt, being the SDA ratio the one with the lower mean of 5%.

Table 5 shows that the average GDP growth during the period under analysis, which comprises the period of the economic and financial crisis in Portugal that derived from the sub-prime crisis in the USA[8], was negative. Additionally, we can verify that the maximum value for the government debt in percentage of GDP was 27.13%, which was reached in 2012, as it is shown in table 7.

During the period studied, the average inflation rate was about 1,21%, below the generally acceptable "regular" inflation rate of around 2 percent. Regarding the different interest rates, we can observe that the long-term interest rate has a mean value of approximately 5.35%, the short-term interest rates has a mean of 0.84% and the average interest rate of new loans, for the period between 2008 and 2017, was 4.83%.

[8] The sub-prime crisis, which originated in the USA in 2007, was triggered by the burst of the housing bubble. The housing bubble was created due to the rapid increase in subprime mortgages and emergence and rapid growth of a market for mortgage-backed securities (MBSes) and collateralized debt obligations (CDOs), which were backed by many subprime mortgages.

Table 5 - Summary statistics of the database's variables. Sample period is from 2008 to 2017

	Obs	Units	Mean	Std. Dev.	Min	Max
Leverage ratios						
TLA	1,860,648	%	91.17083	128.8304	0	1225
TDA	1,860,316	%	24.86912	47.60224	0	425
LDA	1,860,382	%	18.93071	41.84985	0	368.5484
SDA	1,860,579	%	5.132625	14.58521	0	109.3502
Firm-specific variables						
TA	1,860,651	€ th	1114.532	4673.948	2	50894
TAXRATE	1,774,895	%	14.77703	27.91696	-100	183.3333
ROA	1,805,323	%	-.0525651	19.18143	-87	64
STAFF	1,856,913	#	10.27741	106.8674	1	24682
ASSETS	1,860,651	#	5.15215	1.742256	0.6931	10.8375
Macroeconomic Variables						
GDPG	2,664,029	%	-.0669168	2.174938	-4.03	2.64
INFR	2,664,029	%	1.207598	1.358532	-.83	3.65
LTIR	2,664,029	%	5.347283	2.735986	2.42	10.55
STIR	2,664,029	%	.8435785	1.38056	-.33	4.63
IRNL	2,664,029	%	4.827463	1.259625	2.7	6.66
GOVD	2,664,029	% GDP	6.693447	8.525981	-2,57	27.13

***Source**: Own calculations based on the dataset.*

It is possible to observe that, between 2008 and 2017, the average profitability of firms, measured by the return on assets, was negative for our dataset.

Concerning the sample demographics, we can observe the total assets average is about EUR 1.1 million, although the maximum value is approximately EUR 50.9 million, and the average number of employees in 10, which is consistent with the definition of micro firms. These variables confirm what is presented in table 4, where we verify that the majority of observations fall into the first category of the variable SIZE (remember that the category 1 represents the micro-sized firms). We can also notice in table 5 that the average tax rate was about 15%, which is well below the statutory tax rate of 21% in Portugal, that can be explain due to the high presence of SMEs in the database and the lower tax rates applicable to them.

Table 6 - Leverage ratios' average, by year

Year/ Average	TLA	TDA	LDA	SDA
2008	77.1627	22.1997	14.274	7.6360
2009	78.1493	22.9918	14.7977	7.8708
2010	79.8470	22.3805	17.3754	4.6358
2011	82.9293	23.5280	18.7342	4.2966
2012	89.7227	24.5455	19.1748	4.6338
2013	94.1496	24.9031	19.7377	4.3044
2014	99.1658	26.4762	20.4623	4.8813
2015	102.3061	26.9038	21.0279	4.6488
2016	103.7072	27.4360	21.6357	4.4926
2017	84.4389	21.0784	12.6161	8.0857
Total	91.1708	24.8691	18.9307	5.1326

***Source**: Own calculations based on the dataset.*

The observed deleveraging trend, since 2013, reported by the official Portuguese statistics made available by the competent authorities, is not reflected in our sample. In fact, according to our sample, the firm's burden with external funding increased during the financial crisis. Looking closer into the mean of the leverage ratios constructed, presented in the table above, we notice that the total liabilities-to-assets and the total debt-to-assets ratios increased, between 2008 and 2016, around 5.2 pp and 26.4 pp, respectively. The increase in the total debt-to-assets ratio is driven by the increase in the long-term debt-to-assets ratio since, for the sort-term debt-to-assets ratio we observe an initial decrease in the mean, from 2009 to 2010, of 3 pp, and later a stabilization of the average value. The low values of leverage for the total liabilities-to-assets, total debt-to-assets and long-term debt-to-asset ratios observed in 2017 are, in our opinion, the result of the fewer number of observations registered in the dataset, being that the same rational is applied to the sort-term debt-to-asset high mean observed in 2017.

Moreover, the mean of the total debt-to-assets ratio varies, during the considered period, between 20% and 30%, while the total liabilities-to-assets ratio's mean fluctuates among 77% and 104%. These results are not in line with the literature and official statistics that state that bank loans are the main source of financing for Portuguese firms. One possible explanation for the values obtained concerning the leverage ratios is the poor reporting by

firms. Also, it is possible that, since the Amadeus database retrieved uses book values for the firms balance sheet variables some correspondence is a bad match between the source and the output, and some debt values are registered only as non-current or current liabilities and not as long-term or short-term debt.

Table 7 - Macroeconomic variables' average, by year

Year / Average(%)	GDPG	INFR	LTIR	STIR	IRNL	GOVD
2008	0.2	2.59	4.52	4.63	6.66	5.97
2009	-2.98	-0.83	4.21	1.23	4.8	16.13
2010	1.9	1.4	5.4	0.81	4.61	8.28
2011	-1.83	3.65	10.24	1.39	6.12	3.63
2012	-4.03	2.78	10.55	0.57	6.15	27.13
2013	-1.13	0.27	6.29	0.22	5.51	3.15
2014	0.98	-0.28	3.75	0.21	4.89	7.05
2015	1.82	0.49	2.42	-0.02	3.77	-1.48
2016	1.62	0.61	3.17	-0.26	3.16	-2.57
2017	2.64	1.37	3.05	-0.33	2.7	-0.02
Total	-0.081	1.205	5.36	0.845	4.837	6.727

***Source**: Own calculations based on the dataset.*

Table 7 presents the mean of each macroeconomic variable from 2008 to 2017. The economic and financial crises that started in the USA, extended into Europe where a sovereign debt crisis arose. In Portugal, the crisis lasted approximately from 2011 to 2014, during which time the country underwent a Financial Assistance Programme. We can notice that in 2011 a relatively high change in the macroeconomic variables occurred, being that, in the peak of the crisis, in 2012, the growth of the gross domestic product presented a decrease of 4.03%, the long-term interest rate was at its highest, at 10.55%, as well as the government debt in percentage of GDP, reaching 27,13% as mentioned before.

The year 2009 also stands out since the mean values of the variables in this year are not consistent with the previous year and the following year, which may represent the unexpected strong influence of the sub-prime crisis in the European markets. It is also noticeable that from 2008, which corresponds to the beginning of the USA crisis, until 2012, the inflation rate presented a high volatility.

The Portuguese economic recovery can be perceived by the increase of the GDP growth, decrease of government debt in percentage of GDP and the stabilization of the remaining macroeconomic variables since 2014.

Table 8 - Firm-specific variables' average, by year

Year/ Average	ASSETS	TAXRATE (%)	ROA (%)	STAFF	TA
2008	5.3394	16.2818	0.7716	11.6182	1145.105
2009	5.3326	11.8238	0.8739	11.2308	1141.98
2010	5.3227	13.5265	0.6023	10.9705	1225.366
2011	5.2479	13.8183	-0.8038	10.8704	1194.346
2012	5.1596	17.6354	-2.8116	10.2309	1140.519
2013	5.0791	16.9119	-1.4658	9.6766	1098.519
2014	5.0203	13.9751	-0.2807	9.5040	1068.556
2015	4.9752	14.1065	0.9170	9.4607	1030.412
2016	5.0679	14.7052	1.6531	9.8741	1047.253
2017	7.8886	19.5395	0.2798	55.8919	8797.73
Total	5.1522	14.7770	-0.0526	10.2774	1114.532

***Source**: Own calculations based on the dataset.*

Regarding the firm-specific variables, it is possible to observe in table 8 that the values present in the year 2017 are far from the other years' mean. We found that there were only 222 observations for total assets in the year 2017, which compares with more than 160 thousand observations for the remaining years. The table presenting the number of observations for the leverage ratios and for the firm-specific variables per year is presented in Appendix C.

Regarding the remaining years, the highest mean for the variable total assets was around EUR 1,19 million obtained in 2011, which is in line with the means recorded in the remaining years. The lowest mean for the total assets was EUR 1,03 million in 2015. We can observe that it is in 2012, at the peak of the financial crisis in Portugal, that the highest mean for the effective tax rate variable is registered, with a value of 17,64% - globally the tax rate average was between 11,8% and about 17%. Regarding the return on assets' mean, we observe that it presents its lowest value, of -2.8%, also in 2012. We should be aware that the firm-specific variables are susceptible to errors of reporting and non-reporting of firms in some years (missing data); for instance, the value of the mean of total assets in 2017, can be the result of

fewer reported values for SMEs and the higher relative percentage of big firms represented in that year[9].

[9] Note that the firm-specific data was retrieved in yearly 2018, therefore, the firms' information regarding the year 2017 was found to be scarce, incomplete and less feasible.

5. Econometric Methodology

The current section addresses the methodology followed in this dissertation (Subsection 5.1), instrumental variables (Subsection 5.2) as well as the different models used in the analysis (Subsection 5.3).

As to start the econometric analysis, a correlation assessment was performed to allow for a better understanding of the relation between the variables considered and for more comprehensive results. The discussion of theses relations and the output of the Pearson correlation matrix are presented in the section 6.

5.1. Methodology

The empirical research design of this Dissertation follows the common methodology adopted in the literature.

We use panel data regression models to study the relationship between leverage ratios and the explanatory variables. Stata program was used for data treatment and estimation of the regression models. Considering the goal of this study and our sample of more than 273 thousand firms (cross-sectional units *(N)*) observed over a period of 10 years (time periods *(T)*), a panel data analysis was considered the most appropriate since it provides for a large number of data points (*N*T*), allowing for: (i) more degrees of freedom, thus improving the efficiency of the estimates and providing a more accurate inference of the model parameters, (ii) a decrease of collinearity (Hsiao, 2003). Moreover, panel data analysis provides means to control for unobserved variables that can be related with explanatory variables (Wooldridge, 2013). Yet, it is important to note that heterogeneity issues can arise from the use of panel data.

We intend to explain the effects of macroeconomic variables in the leverage level of non-financial Portuguese firms through a pooled model, which is as follows:

$$y_{i,t} = x_{j,t}\beta + \alpha_i + \varepsilon_{i,t} \qquad (6)$$

where $y_{i,t}$ is the debt ratio of the non-financial Portuguese firm *i* at the year *t.* We will estimate the model 6 four separated times considering our different leverage ratios using total

liabilities, total debt, long-term debt and short-term debt. $x_{j,t}$ is the vector composed by the different (firm-specific and macroeconomic) explanatory variables considered in each year *t*. To comply with the classical assumptions made, the model also considers the non-observed individual firm specific impacts (α_i) and a term for the idiosyncratic disturbance ($\varepsilon_{i,t}$), varying for each firm in each year, which represents all the other factors that influence the firm's capital structure, including the errors of measurement.

The Pooled Ordinary Least Squares ("OLS") regression is more restrictive since it specifies constant coefficients therefore, it is not used much in the literature being more applied in cross-sectional analysis.

The estimates of model (6) can be biased due to the existence of a correlation between the variables and the error term ($\mathrm{Cov}\ (\chi, \upsilon) \neq 0$). Since our primary goal is to capture the causal relationship between the dependent and independent variables, the OLS regression might not be the most appropriate, since its estimates will capture some effects from that otherwise would be attributed to omitted variables. For instance, if we consider that we omitted the variable that represents the unemployment rate or balance of payments, and these variables are correlated with one of our macroeconomic variables but also with the leverage level of firms, the OLS estimates will be biased. In this case, the error is related to the fact that the estimate ignores, for example, that the leverage level for one firm can decreases more with a surplus in the balance of payments, than another firm, even when considering the same growth in GPD. Hence, the existence of endogeneity problem in a regression can be understood as if there is omission of relevant explanatory variables. To deal with this possible problem we will discuss, in the following subsections, the usage of instrumental variables and panel data estimators, as to access which better fits the population data.

Furthermore, it is also important to discuss and identity further fragilities that may arise, such as heteroscedasticity. One of the classical assumptions of OLS is that the error term has a constant variance, i.e., existence of homoscedasticity. If this assumption turns out not to be true, we are in the presence of a heteroscedasticity problem meaning that the standard error estimated is not correct. Consequently, the coefficients are inefficient and confidence intervals are not reliable. Two commonly used test to detect heteroscedasticity are the Breusch-Pagan test and the White test. In the present study, the White test was performed, as

it validates for nonlinear heteroscedasticity. Additionally, to verify for collinearity or multicollinearity problems the Variance Inflation Factor ("VIF") was calculated for all pairs of variables included in the model. For this study we considered that VIF vales over 10 were indicative of collinearity or multicollinearity between variables.

5.2. Instrumental Variables: dealing with endogeneity

As mentioned, one way to work around the endogeneity problem is by using Instrumental Variables (IV) estimator. The IV method allows to obtain a consistent estimation when explanatory variables are correlated with the error term, by introducing a third variables, Z, that will account for the unforeseen performance of the variables. The IV process is an important tool used in econometrics since it makes changes in the explanatory variable but without having an autonomous effect on the dependent variable, allowing to see the correct causal relation between the explanatory and explained variable.

The base model for IV estimation is of the type:

$$y = x_i\beta + \varepsilon_i \qquad (7)$$

The impact of the explanatory variable x in our explained variable y, is translated by the parameter vector β. The variation of x can by separated in two parts: one correlated with the error and another part not correlated with the term ε, and that is essentially what the IV regression does. The present method solves the endogeneity problem by isolating the component of x that is not correlated with the error. Therefore, the way component of the process is to identify the instrumental variable (Z) that will make this "isolation". The instrument Z must satisfy two essential conditions: it must be correlated with the endogenous explanatory variable ($\mathrm{Cov}(Z,x)\neq 0$) and must be exogenous ($\mathrm{Cov}(Z,\varepsilon)=0$).

When the number of instruments is equal to the number of explanatory variables, i.e., where x is a N * M matrix, and Z is also a matrix N * M, then the estimator will be an invertible square matrix referred to as just-identified. However, if Z is a matrix N*P, where P>M, the estimator is called over-identifies. As an opposite case, we can also find under-identifies estimators where P>M.

A common computational procedure to implement empirically the IV estimator is to use the two-stage least squares ("2SLS") regression. In the first stage of the 2SLS method, the explanatory variable (x) is regressed on all the exogenous variables in the model, as follows:

$$x = Z\Pi + v \qquad (8)$$

being that:

$$\widehat{\Pi} = (Z'Z)^{-1}Z'x$$

The predicted values of the explanatory variables are given by the expression:

$$\hat{x} = Z\widehat{\Pi} = Z(Z'Z)^{-1}Z'x$$

In the second stage, the explained variable - the leverage level in this specific study - is regressed as usually, however the explanatory variables are replaced whit the predicted values obtained in stage 1:

$$y = \hat{x}\beta_{iv} + u \qquad (9)$$

Therefore:

$$\begin{aligned}\widehat{\beta_{iv}} &= (\hat{x}'\hat{x})^{-1}\hat{x}y = (Z(Z'Z)^{-1}Zx)'(Z(Z'Z)^{-1}Z'x)^{-1}(Z(Z'Z)^{-1}Z'x)'y \\ &= (x'Z(Z'Z)^{-1}Z'Z(Z'Z)^{-1}Z'x)^{-1}(x'Z(Z'Z)^{-1}Z')y \\ &= (x'Z(Z'Z)^{-1}Z'x)^{-1}x'Z(Z'Z)^{-1}Z'y\end{aligned}$$

In a just-identified case the estimator is given by the following expression:

$$\widehat{\beta_{iv}} = (Z'x)^{-1}(Z'Z)(Z'x)^{-1}x'Z(Z'Z)^{-1}\,Z'\mathrm{y} = (Z'x)^{-1}Z'y$$

Considering the present study, if we found that one of our macroeconomic variables were to be exogenous, then X=Z e $\mathrm{Var}(\beta\mathrm{IV}) = \mathrm{Var}(\beta\mathrm{OLS})$. If that has not to be the case, and the IV method produced estimates with a higher variance, than the OLS estimates would be more efficient by comparison

To compare the consistency of the OLS and IV estimators we can perform the Durbin-Wu-Hausman test. Under the null hypothesis both estimators are consistent, however the b_1 estimator is efficient. Therefore, if the null hypothesis is testing for the consistency of the OLS estimator and this hypothesis is rejected, we can conclude that the IV approach is more

accurate, meaning that the potential endogeneity of the explanatory variable will not conduct to inconsistent and biased estimated coefficients.

Due to the two mentioned conditions that the IV must satisfy, the implementation of this method is quite difficult. One problem related to the first condition is the selection of weak instruments, i.e., IV with low correlation to the endogenous explanatory variable, which can lead to biased coefficients. To assess this matter, the literature provides a rule of thumb to evaluate the relevance of the instrument chosen through the analysis of the F-statistic of the first stage of the 2SLS regression. Staiger and Stock (1997) suggest that the F-statistic of IV should be greater than 10 to prevent that the bias in the estimators would be larger than 10%. Still, it is quite difficult to empirically find IV not weak.

Concerning the second condition, as to test if the variable is unrelated to the error term, over-identification test should be conducted, which in turn can only be executed in over-identified cases (when there are more IV than endogenous explanatory variables). In this situation, and for the case of panel data analysis the statistics of the Sargan-Hausen test can extended to test the exogeneity hypothesis. The test is based on the regression of the residuals from the instruments. The null hypothesis considers that the IV are exogenous, therefore its acceptance leads to the conclusion that our IV are in fact exogenous.

Although the IV method is used in microeconomics, some of the literature resort to it and its application has been growing in macroeconomics (Stock and Watson, 2018; Casey and Klemp, 2018), for the purpose of this study, and considering the Portuguese economy, we considered that there were no instruments in our database that complied with the two compulsory conditions. However, we leave open the possibility to further explore and deepen this method in the future.

5.3. Panel data models

The panel data analysis allows us to measure and follow the effects of macroeconomic conditions on the capital structures of non-financial Portuguese firms (cross-sectional information) over several years (time series). Longitudinal data gives rich statistical information as it is possible to obtain chronological results and its study permits to control

for unobserved heterogeneity and invariant unobserved variables that could be related to the error term. Likewise, this type of studies can improve the efficiency of the estimators.

To obtain reliable results, we need to use proper models that will be adequate to the specificities of our variance and covariance matrixes since, due to the time sequence, the observations for the same firm are not independent. The OLS model, Fixed Effects Model ("FE model") and the Random Effects Model ("RE model") are models of interest that need to be appraised.

Considering the following generic model:

$$y_{i,t} = \beta_0 + x_{i,t,1}\beta_1 + x_{i,t,2}\beta_1 + \cdots + x_{i,t,k}\beta_k + \alpha_i + \varepsilon_{i,t}$$

$$y_{i,t} = X'_{i,t}\beta + \alpha_i + \varepsilon_{i,t} \qquad (10)$$

where i represents the firm; t represents the year; $X'_{i,t}$ is a vector of the k regressors, excluding the constant, with a dimension of t*k; and α_i is a term that includes the non-variant part of the firm i, that is, the unobserved specific heterogeneity of the firm i, which can contain observed or non-observed variables.

The three models mentioned present estimation possibilities, being that:

- The OLS model, as mentioned before is more applied in cross-sectional analysis, though, it produces consistent coefficients if all variables are observed;
- The FE model generates consistent estimates when there are unobserved variables in α_i correlated with the independent variables, i.e, the vector $X'_{i,t}$;
- The RE model accepts, like the OLS model, that the covariance of the unobserved heterogeneity and the independent regressors is null. Therefore, if this is true this model will provide for efficient estimates, if not, the estimates will be biased and inconsistent as a result of the unrecognized variables. Although the assumption is similar, the RE model differs from the OLS in the way it treats the information about the standard error.

The FE and RE are individual-specific effects models that assume that there is unobserved heterogeneity across individuals captured by a specific term in the equation. The difference

between both models is whether the individual-specific effects are correlated with the regressors. In the following subsections both models will be discussed in more detail.

5.3.1. Fixed Effects Model

The FE model allows for the individual-specific effects to be correlated to the regressors, meaning that these effects are the variation in the dependent variable which is not explained by the regressors (the individual-specific effect is the intercept term on the equation). Hence, the individual intercepts in equation (10) (whose coefficients are α_i) can be correlated with $\varepsilon_{i,t}$.

By opposition of the equation (10), which is defined at the individual level, let's consider the following equation (11), defined in matrix terms:

$$Y_i = X_i\beta + \|\alpha_i + \varepsilon_{i,t} \qquad (11)$$

Where each element is a vector, as for $Y_i = [y_{(i,1)}, y_{(i,2)}, \dots, y_{(i,T)}]'$; α_i is a unobserved component of the individuals and $\|$ is a column of 1's with T*1 dimension, where T is the number of observations per firm i.

For the purpose of this description we will assume that we have a balance panel, i.e., that all variables have the same number of observations for all firms.

One estimator that can be used for the FE model transformation can be achieved by eliminating the term α_i, which captures the differences between the firms (heterogeneity), and through differencing, i.e., by taking the first difference. Consequently, we obtain an OLS estimator not biased:

$$y'_{it} - y_{it-1} = (x_{it} - x_{it-1})'\beta + (\varepsilon_{it} - \varepsilon_{it-1}) \qquad (12)$$

In the FE formula we assume that the relationship between x_{it} and the disturbance term only dependents on α_i therefore, the term ε_{it} is a white-noise error term: $E(\varepsilon_{it}) = 0$; $Var(\varepsilon_{it}) = \sigma^2$ and $Cov(\varepsilon_{t,}\varepsilon_s) = 0, \forall_t \neq s$.

The solution based on the first difference, as shown above, is not very efficient as it implies losing an observation.

The FE estimator can also be called within estimator, since the FE model only considers the variance between the observations of the same firm (within effects) and disregards the variance between different firms (between effect) (Wooldridge, 2013). An alternative to obtain the FE estimator (or within estimator) is by applying the within transformation, which can be achieved by taking deviations from the means of each individual, where $\overline{y_i} = \sum_t y_{i,t}/T$ and $\overline{\alpha_i} = \alpha_i$, $\overline{\varepsilon_i} = 0$, subtracting from equation (10), gives:

$$y_{it} - \overline{y_i} = (x_{it} - \overline{x_i})'\beta + (\varepsilon_{it} - \overline{\varepsilon_i}) \qquad (13)$$

Again, this transformation eliminates α_i since it is equal to its mean. The equation above explains the deviations of the firm y_i to its mean, instead of the deviations from one firm to the other (y_i and y_j). Applying the OLS to the equation provides centric and consistent estimates. The consistency of the estimator is given by:

$$E((x_{it} - \overline{x_i})\, \varepsilon_{it}) = 0 \qquad (14)$$

whereas the variance and covariance matrix is given by:

$$\widehat{V(\hat{\beta})} = s^2(X'M_D X)^{-1} \qquad (15)$$

where,

$$s^2 = \frac{\left(M_D Y - M_D X\hat{\beta}\right)'\left(M_D Y - M_D X\hat{\beta}\right)}{nT - n - k}$$

Being that: M_D= I-D(D'D)$^{-1}$D' and D = [d_1, d_2, …, d_n]. In the present study this means that the matrix D has "n" columns (the number of firms), "n*T" rows (number of observations) and d_i corresponds to a vector of dummy variables that identify the firm i.

The within estimator has some similarities to the Least Squares Dummy Variable ("LSDV") estimator, where we use "N" dummy variables corresponding to the number of individuals. We can express the model as follows:

$$y_{i,t} = \sum_{j=1}^{N} \alpha_j d_{it}^j + x'_{i,t}\beta + \varepsilon_{i,t} \qquad (16)$$

The dummies are d^j, where $d_{it}^j = 1$ if i=j, and 0 otherwise. However, the within estimator is more utilized for large databases than the LSDV estimator, since computing this estimating

by OLS with one dummy per individual, when the N is large, requires more computational power and storage.

As it is perceivable, the FE model should only be applied if there are in fact individual specific effects of the firms, which can be assessed trough an F-test for the presence of fixed effects. The rejection of the null hypothesis implies that there is unobserved heterogeneity and FE estimation is accurate.

Panel data models can be estimated with several estimators. However, the properties of the estimators differ based on which model is used. The two main properties to verify are consistency and efficiency. If the model is appropriate the estimators will have the properties desired. One of the alternative estimators that can be used is the between ("BE") estimator, which, as the name indicates, only considers the variation between firms (across different individuals) and ignores the within variation. The estimation by this method consists in collapsing all the data of one variable into one line per individual, where each line of data represents the mean of the variable. The between estimator is not much used because the pooled and RE estimators are more efficient.

5.3.2. Random Effects Model

In the RE model it is presumed that the individual-specific effects are distributed independently of the regressors, meaning that each individual has the same slope parameters and the error term is composite, representing all the factors that impact de dependent variable but are not captured by the independent ones. ´

The RE model is given by the following equation:

$$y_{i,t} = \mu + x'_{i,t}\beta + \alpha_i + \varepsilon_{i,t} \qquad (17)$$

$$\varepsilon_{i,t} \sim IID(0, \varepsilon_{\varepsilon}^2) \quad ; \quad \sigma_i \sim IID(0, \varepsilon_{\alpha}^2)$$

The value α_i is specific for the individual, that is, in the present study the firm i. The component α_i is independent and identically distributed between the individuals, has mean zero and is time invariant. The error term ($\varepsilon_{i,t}$) is not correlated with the independent variables included in the model and there is no serial correlation associated with it.

The RE estimates are consistent by OLS if the regressors, $x_{i,t}$, are uncorrelated with α_i and $\varepsilon_{i,t}$, though, the standard errors are not correct since the errors structure is not considered, so it is usual to resort to the Generalized Least Squares ("GLS"). The GLS estimator ("$\hat{\beta}_{GLS}$") is a weighted average of the between and FE estimators, being that the weight depends on their variance.

$$\hat{\beta}_{GLS} = \Delta\hat{\beta}_{BE} + (I_k - \Delta)\hat{\beta}_{FE} \qquad (18)$$

In the equation (18), Δ is a weighted matrix that is proportional to the inverse variance and covariance matrix of $\hat{\beta}_{BE}$. Since the $\hat{\beta}_{GLS}$ estimator optimally combines the BE and FE estimators it generates more efficient results. Moreover, the GLS estimator is unbiased if the regressors are independent from all the error terms, α_i and $\varepsilon_{i,t}$.

Considering the following equation:

$$y_{it} - \upsilon\overline{y_i} = \mu(1-\upsilon) + (x_{it} - \upsilon\overline{x_i})'\beta + \upsilon_{it} \qquad (19)$$

The weight of the BE and FE estimators is given by:

$$\upsilon = 1 - \frac{\sigma_\varepsilon}{\sqrt{\sigma_\varepsilon^2 + \mathrm{T}\sigma_\upsilon^2}} \qquad (20)$$

In extreme cases the $\hat{\beta}_{GLS}$ can be equal to the between estimator (when it's equal to 0) or to the within estimator (when equal to 1).

5.3.3. Selecting between the models

The Breush-Pagan Lagrange Multiplier ("LM") test is based on the OLS residuals and test for the RE model. The LM null hypothesis is that the variance across the individuals is significantly different from zero. If the test is significant then the RE model should be used instead of the OLS model.

The FE estimator always provides for consistent estimates, although they may not be the most efficient. The RE estimator is inconsistent if the model appropriate for the study is the FE model, but it is consistent and efficient for the RE model.

Since the RE estimator is more efficient than the FE it is important to test which is more appropriate. The choice between FE or RE model can be assist by the Hausman test, in which the null hypothesis test if the regressors and α_i are uncorrelated, i.e., the null implies that the preferred model is the RE over the alternative (FE model).

The test statistic is given by:

$$H = \left(\hat{\beta}_{RE} - \hat{\beta}_{FE}\right)' \left(Var\left(\hat{\beta}_{RE}\right) - Var\left(\hat{\beta}_{FE}\right)\right) \left(\hat{\beta}_{RE} - \hat{\beta}_{FE}\right) \sim \chi^2_{(k)} \qquad (21)$$

where k is the number of degrees of freedom that is equal to the number of parameters for the time-varying regressors.

Under the null the RE estimator is consistent and efficient but is neither under the alternative hypothesis, whereas the FE estimator is consistent under the null and the alternative. Therefore, if the Hausman test is significant we reject the null hypothesis and should use the fixed effects model.

All the outcomes from our econometric analysis and the estimation results obtain from the different models (OLS, FE and RE) are presented in the subsequent section.

6. Empirical Results and Discussion

This section focuses on presenting the results of the application of the regression model explained by equation 6, which studies the effect of the six macroeconomic variables chosen on the leverage ratios (TLA, TDA, LDA and SDA) of the Portuguese non-financial firms. The exact specifications applied to each of the above four dependent variables ca be found in the Appendix E. The results of the various models will be exposed and analysed as well for the diagnostic tests performed. We conclude with a brief discussion on the overall results.

6.1. Correlation Analysis

As mentioned in the previous section, after selecting the variables and collecting the data we began the empirical analysis by generating the Pearson correlation matrix to measure if the variables have a strong or weak relation between them and if that relation is in the same direction or opposite. Therefore, the correlation matrix generated, presented in table 9, considers all base variables presented in section 4 and the four different independent variables used, namely, the total liabilities-to-assets ratio, total debt-to-assets ratio, long-term debt-to-assets ratio and the total short-term debt-to-assets ratio. Although our attention was focused on the analysis of the relationship between the dependent and independent variables, we also looked for strongly correlated independent variables.

The first thing to notice is that the correlations between the macroeconomic variables and the leverage ratios are generally weak, being 0.0729 the higher observed correlation coefficient, which corresponds to the linear relation between the government debt-to-GDP ratio and the total liabilities-to-assets ratio. By contrast, the lowest correlation value verified is the one between the long-term interest rate and the long-term debt-to-assets ratio.

Furthermore, the correlations coefficients between the macroeconomic variables and the leverage ratios are manly negative, being that for the total liabilities-to-assets ratio and total det-to-assets ratio only the variables of GDP growth government debt-to-GDP ratio present a (weak) positive relation, which is contrasting with the previsions in the existing literature. For the long-term debt-to-assets ratio the variable GDP growth also presents a positive correlation coefficient, however this variable presents a negative relation with the narrower leverage ratio. The short-term debt-to-assets ratio presents, unlike the other dependent

variables, a positive correlation coefficient with the short-term interest rate and with the variable representing the interest rate on new loans, being that these variables are highly correlated with each other. The government debt-to-GDP ratio is found to be negatively correlated with the long-term debt-to-assets and short-term debt-to-assets ratios.

Among the firm specific variables, the effective tax rate and the return on assets present a negative relation with all the leverage ratios. The log of assets presents a negative relationship with the variable total liabilities-to-assets ratio and with the total debt-to-assets ratio, although this relation is very weak for the latter, which reflects the impact of the positive relation between this firm specific variable and the short-term debt-to-assets ratio.

The bivariate correlation levels among the independent unlagged variables were not found to be overly high, with only two pairs of variables (LTIR- GDPG and IRNL-STIR) presenting a correlation coefficient above 0.7 (but below 0.8).

Table 9 - Correlation matrix of all variables considered for the analysis.

Period of 2008 - 2017													
	TLA	TDA	LDA	SDA	TAXRATE	ROA	ASSETS	GDPG	INFR	LTIR	STIR	IRNL	GOVD
TLA	1												
TDA	0.4839***	1											
LDA	0.4213***	**0.8915*** **	1										
SDA	0.0979***	0.3132***	-0.0853***	1									
ROA	-0.3717***	-0.2203***	-0.1988***	-0.0737***	0.1982***	1							
ASSETS	-0.2966***	-0.0426***	-0.0698***	0.1364***	0.1578***	0.1264***	1						
GDPG	**0.0352*** **	**0.0166*** **	**0.0214*** **	-0.0196***	-0.0179***	0.0502***	-0.0285***	1					
INFR	**-0.0318*** **	**-0.0169*** **	**-0.0106*** **	-0.0138***	0.0246***	-0.0283***	0.0306***	-0.2113***	1				
LTIR	**-0.0332*** **	**-0.0176*** **	**-0.0088*** **	-0.0206***	0.0260***	-0.0576***	0.0273***	**-0.7416*** **	0.6913***	1			
STIR	**-0.0569*** **	**-0.0284*** **	**-0.0466*** **	**0.0597*** **	0.0070***	0.0045***	0.0540***	-0.2281***	0.4234***	0.1539***	1		
IRNL	**-0.0514*** **	**-0.0272*** **	**-0.0325*** **	**0.0223*** **	0.0272***	-0.0477***	0.0394***	-0.6847***	0.4927***	0.6950***	**0.7002*** **	1	
GOVD	**0.0729*** **	**0.0359*** **	**-0.0527*** **	**-0.0585*** **	0.0141***	-0.0111***	-0.0735***	0.3057***	-0.3240***	-0.2174***	-0.8312***	-0.5569***	1

***Notes**: Significance levels are: *** p<0.01; **p<0.05 and *p<0.1*

***Source**: Own calculations based on the dataset.*

6.2. Empirical Results

After analysing the relations between the variables, and verifying that, including highly correlated variables, for example the short-term interest rate and the interest rate on new loans, provided for a model with multicollinearity problems, we chose the following final regressors for our model: the effective tax rate, the return on assets, the GDP growth, the inflation rate, the long-term interest rate, the interest rate on new loans and the government debt-to-GDP ratio. We should clarify that we chose the predictor interest rate on new loans over the variable short-term interest rate, due to its relevance to this study, since the interest rate on new loans represents the average interest rate on new lending operations to non-financial Portuguese and foreign firms that are based in the EMU.

We estimated the regression through three different models, in order to determine which model is best suited to our dataset and gives the most efficient and consistent coefficients. For comparability reasons, all models presented in this subsection consider the same explanatory variables.

Table 10 below presents the estimation results for the three models we used, that are described in the chapter 5 of this work, being that, the OLS model estimates are presented in their basic form and with robust standard errors. The models presented in table 10 considers as a dependent variable the broader leverage ratio of our analysis, i.e., the total liabilities-to-assets ratio.

Table 10 – Estimation results using as dependent variable the total liabilities-to-assets ratio: estimation models for panel data.

	Total liabilities-to-assets ratio (TLA)			
VARIABLES	OLS	OLS (Robust)	FE (Robust)	RE (Robust)
Effective tax rate (TAXRATE)	-0.1214***	-0.1214***	-0.0080***	-0.0228***
	(0.0021)	(0.0020)	(0.0012)	(0.0012)
Return on assets (ROA)	-1.5334***	-1.5334***	-0.5468***	-0.6921***
	(0.0030)	(0.0098)	(0.0059)	(0.0057)
Log of total assets (ASSETS)	-7.2476***	-7.2476***	-21.9090***	-14.7454***
	(0.0350)	(0.0868)	(0.3464)	(0.1781)
GDP growth (GDPG)	-0.2971***	-0.2971***	-0.3859***	-0.3360***
	(0.0591)	(0.0345)	(0.0256)	(0.0252)
Inflation Rate (INFR)	1.5326***	1.5326***	1.7007***	1.4752***
	(0.0900)	(0.0621)	(0.0514)	(0.0489)
Long-term interest-rate (LTIR)	-1.2761***	-1.2761***	-1.1357***	-1.0794***
	(0.0614)	(0.0403)	(0.0348)	(0.0338)
Interest rate on new loans (IRNL)	-1.5166***	-1.5166***	-1.5410***	-1.2019***
	(0.0905)	(0.0694)	(0.0585)	(0.0541)
Government debt in % of GDP (GOVD)	0.0929***	0.0929***	0.1628***	0.1410***
	(0.0032)	(0.0028)	(0.0031)	(0.0029)
R^2 within |R^2 between |R^2 overall	0.1770	0.1770	0.0932 |0.1066|0.0863	0.0875|0.1511|0.1203
Root MSE	75.416	75.416		
ρ			0.7651	0.7051
Observations	1,719,596	1,719,596	1,719,596	1,719,596
Number of id			273,177	273,177
F (Global significance)	46216.24	4220.94	2164.66	25998.05
Prob > F	0.0000	0.0000	0.0000	0.0000

Notes: *Significance levels are: *** p<0.01; **p<0.05 and *p<0.1. In parentheses are reported the standard-errors for the model OLS and the robust standard-errors for the models OLS (robust), FE (robust) and RE (robust).*

Source*: Own calculations based on the dataset.*

We started by estimating the regression by the most widely used form of estimation, i.e., the OLS, where it is possible to observe the adjusted coefficient of determination (R^2) is 17.70%, which represents the percentage of the total liabilities-to-assets ratio variation explained by our model/independent variables. The OLS model estimation results present positive significant coefficients for the inflation rate and government debt-to-GDP ratio.

Since one of the assumptions of the OLS is that the variance of the error terms is constant, we applied the White test as to verify this assumption. We rejected the null hypothesis of homoskedasticity, meaning that, although the OLS estimator is unbiased, it is inefficient

since the variance and covariance are underestimated. We also applied a test to verify the existence of serial correlation, which causes the standard errors to be biased and the results to be less efficient (Drukker, 2003), that resulted in the conclusion that there was serial correlation in our panel data. Considering the test results, in order to mitigate the problems found we generated the OLS model with robust standard-errors, which is presented in the third column of table 9. There is no difference between the estimated coefficients and the root mean squared error (Root MSE[10]) obtained from the OLS and the OLS (Robust) models. The difference between both models is seen in the standard error values (presented in parenthesis under the coefficients) and in the global significance value of the models (F value[11]).

Using the OLS model, we verify that, among the macroeconomic variables, the inflation rate is the variable that causes the higher impact on the dependent variable, being that an increase of 1 pp in the inflation rate increases the total liabilities-to-assets ratio by 1.53 pp. Furthermore, an increase of 1 pp in the government debt in percentage of GDP leads to a more modest raise, of about 0.09 pp, in the leverage ratio considered, when keeping everything else constant. The remaining independent variables considered in the OLS model present a negative estimation coefficient in relation to the total liabilities-to-assets ratio. We should highlight that the large estimation coefficient observed for the variable ASSETS has to be carefully interpreted, since this regressor is in the logarithm form (a further analysis of the estimation coefficients is presented later). It can also be verified that, the direction on the impact of all the control variables, meaning the signal of the estimation coefficients, does not change between models.

Table 10 also presents the fixed effects model and the random effects model, both considering robust standard errors. These models intent to control for the unobserved heterogeneity, a problem that arises when some unobserved characteristic of the firm (like the management policy of the firm) is correlated with some explanatory variable included in the model. After

[10] Root MSE is the standard deviation of the residuals (prediction errors); is a measure of how spread out the residuals are, i.e., it gives you the measure of how concentrated the data is around the line of best fit.
[11] The F-value is the ratio of the mean regression sum of squares divided by the mean error sum of squares. The p-values associated with the F-value represent the probability that the null hypothesis for the full model is true (i.e., that all of the regression coefficients are zero). For the models computed the p-values that were obtained are very small (0.0000).

estimating the regression through the fixed effect model, we verify through the output that the probability value ("p-value") of the global F test is approximately zero (0.000), and therefore, we reject the null (that all firm effects are equal to 0) and should prefer to use the FE model over the OLS. Afterwards, the Hausman test, which tests whether the unique errors are correlated with the regressors, was performed to help decide which model, between the FE and RE, was the most appropriate to our dataset. The null hypothesis of the Hausman test is that the unique errors are not correlated. The p-value obtained is approximately zero (0.000), meaning that we reject the null hypothesis (that the RE model gives consistent estimates), and it is preferable to use the FE model. The robust standard-errors of the OLS model and the FE model differ since the FE only applies the within (firms) variation of the data.

It should be noted that, all the models presented in table 10 are globally significant (p-value obtained was approximately 0.000) and the results obtained indicate that the variables are significant at 1% level.

As stated earlier, in order to better assess the extent of the impact of the macroeconomic variables on the Portuguese non-financial firms, we computed four leverage ratios. Having concluded that the FE model is the most appropriate for our dataset[12], and to follow the objective of this study, we present bellow, in table 11, the estimation results for the four regressions, each considering one of the different leverage ratios constructed, using the fixed effects model with robust standard errors.

[12] Note that as to confirm our choice for the most appropriate model, all models (OLS, FE and RE) as well as the Hausman test were computed for each leverage ratios (TLA, TDA, LDA, SDA). The output tables of the model OLS, FE and RE using as dependent variables TDA, LDA and SDA are presented in appendix D.

Table 11 – Estimation results by the FE model for each regression using a different leverage ratio.

VARIABLES	Expected signal	FE (Robust)			
		Total liabilities-to-assets ratio (TLA)	Total debt-to-assets ratio (TDA)	Long-term debt-to-assets ratio (LDA)	Short-term debt-to-assets ratio (SDA)
Effective tax rate (TAXRATE)	+	-0.0080***	-0.0063***	-0.0053***	-0.0016***
		(0.0012)	(0.0007)	(0.0007)	(0.0004)
Return on assets (ROA)	-	-0.5468***	-0.1839***	-0.1394***	-0.0390***
		(0.0059)	(0.0028)	(0.0025)	(0.0009)
Log of total assets (ASSETS)	+	-21.9090***	-1.1068***	-1.3878***	1.1887***
		(0.3464)	(0.1267)	(0.1099)	(0.0360)
GDP growth (GDPG)	-	-0.3859***	-0.2742***	0.2860***	-0.5412***
		(0.0256)	(0.0185)	(0.0180)	(0.0090)
Inflation Rate (INFR)	+	1.7007***	0.6273***	0.2862***	0.2413***
		(0.0514)	(0.0274)	(0.0258)	(0.0117)
Long-term interest-rate (LTIR)	-	-1.1357***	-0.4653***	0.2357***	-0.6486***
		(0.0348)	(0.0229)	(0.0220)	(0.0106)
Interest rate on new loans (IRNL)	-	-1.5410***	-0.5638***	-0.7744***	0.3046***
		(0.0585)	(0.0297)	(0.0281)	(0.0124)
Government debt in % of GDP (GOVD)	-	0.1628***	0.0608***	0.0744***	-0.0237***
		(0.0031)	(0.0017)	(0.0015)	(0.0006)
R^2 within|R^2 between|R^2 overall		0.093|0.107|0.086	0.019|0.043|0.031	0.018|0.031|0.026	0.016|0.051|0.040
ρ		0.7651	0.6540	0.0620	0.4855
Observations		1,719,596	1,719,337	1,719,395	1,719,539
Number of id		273,177	273,176	273,176	271,177
Prob > F		0.000	0.000	0.000	0.000

***Notes**: Significance levels are: *** p<0.01; **p<0.05 and *p<0.1. In parentheses are reported the standard-errors for the model OLS and the robust standard-errors for the models OLS (robust), FE (robust) and RE (robust).*

***Source**: Own calculations based on the dataset.*

All four models presented in table 11 are globally significant as all the p-values of the F test were approximately zero. Looking at the coefficients of determination, we can notice that they present higher values for the regression that considers as a dependent variable the total liabilities so assets, which is rational since this is the broader leverage and comprises more forms of debt that need explaining (recall that the mean of the TLA variable is around 91, which is much higher than the mean of the second larger leverage ratio, TDA, of around 25). The coefficients of determination decrease until the narrower form of debt.

Considering the R^2 within, which represents how much of the variance within the panel units (firms) does our model accounts for, we can verify that for our more comprehensive model this value is 0.093. The results of the FE (Robust) model indicate that, for the regression

using TLA, about 76,51% of the total variance of the composite standard error[13] is due to the fixed effects (ρ=0.7651). When considering the models using the TDA, LDA and SDA, the total variance of the composite standard errors due to fixed effects amount to 65.40%, 6.20% and 48.55%, respectively.

Effective Tax Rate

The effective tax rate variable presents a low negative estimation coefficient regardless of the dependent variable considered. The effective tax rate coefficient is statistically significant at a 1% level (p-value<0.01), for all models. We can see that, according to our model, the impact of a 1 pp increase on the effective tax rate would have, on average, an almost null, but negative, effect, of 0.16 basis points ("bp") on the short-term debt-to-assets ratio, ceteris paribus. The increase of 1 pp on the firms' effective tax rate decreases the total debt-to-assets ratio by 0.80 bp, keeping everything else constant. Additionally, our result show that the negative effect caused by the increase in effective tax rate is more material on long-term debt (or total debt) then on short-term debt.

Although the results do not agree with our hypothesis formulated in our literature review, we found that the impact of effective tax rate on leverage ratios is not consensual on the literature. Nonetheless, our results are similar to those found by Frank and Goyal (2009), who found a weak negative relation between corporate tax rate and the total debt-to-book assets ratio.

Return on Assets

The return on assets variable was included in the model for control. The results obtained imply that firms would decrease, on average, the total liabilities-to-assets ratio by around 0.55 pp when the firm's return on assets increases by 1 pp, ceteris paribus; this is in agreement with the predictions of the pecking order theory that imply that firms would prefer to use internal funds when available. Frank and Goyal (2009), Öztekin (2015) and Rajan and

[13] Recall that in a panel data model, the composite error term is the sum of the time-constant unobserved effect and the idiosyncratic error.

Zingales (1995), all using large and different datasets found that firms with a higher profitability tend to have lower leverage.

The estimation coefficients of all the models presented for this variable are statistically significant at a 1 % level. The magnitude of the negative effect of this variable decreases with the reduction of the width of the leverage ratio.

Log of Assets

The influence of the size of the firms, measured in term in terms of amount of assets, presents in our model, statistically significant (at a 1% level) negative impact with the three of the four leverage ratios considered. This is contrary to what we expected and to most of the results found in the literature. Moreover, we observe a difference between the magnitude of the impact of this variable in the total liabilities-to-assets ratio and the total debt-to-assets ratio. Therefore, the firm's size does not impact the debt as much as general liabilities.

Keeping everything else constant, the increase of 1% of the amount of total assets, on average, decreases the total liabilities-to-assets ratio by around 0.22 pp[14] and the total debt-to-assets ratio by 0.01 pp.

Considering the short-term debt-to-assets ratio we verify that there is a positive relation, which implies that larger firms have higher amounts of short-term commitments.

GDP Growth

For this variable we expected to find results in line with those found in the literature, such as Bastos, Nakamura and Basso (2009), meaning, results pointing to a significant negative relation between the growth of GDP and indebtedness levels. In fact, our results mostly corroborate our hypothesis in question. The GDP growth estimation coefficients show that there is a oposite relation between this variable and the TLA, TDA and SDA ratios but a positive effect when considering as dependent variable the long-term debt-to-assets ratio,

[14] This value is the result of the division of the estimation coefficient by 100 since the relationship observed is a linear-log.

although that all of them are statistically significant for our model at significance level of 1%. The increase in 1 pp in the GDP growth implies that on average, the LDA ratio increases 0.27 pp, ceteris paribus; however, in aggregate, the positive impact on the LDA ratio is overpowered by the negative effect of an increase in one unit of the GDP growth on the SDA ratio, of about -0.54 pp, ceteris paribus, which leads to a decrease on average of 0.27 pp in the total debt-to-assets ratio. This implies that in times of higher economic growth firms make more use of long-term financing.

Inflation Rate

Measured as the rate of change in consumer price index, the inflation rate estimation coefficients are significance at a 1% level for all leverage ratios studied.

As expected, the estimation by the FE (Robust) model exhibits a positive relation between the inflation rate and all the leverage ratios, being that we observe a positive effect of 1.7 pp in the TLA ratio when, keeping everything else constant, the inflation rate increases 1 pp. The extent of the inflation rate effect is very close when looking at the long-term and short-term debt-to-assets ratio, being slightly higher for the long-term debt (0.29 pp vs. 0.24 pp).

Long-term Interest Rate

Observing the estimation outputs for the long-term interest rate on the different regressions, we verify that this variable presents a statistically significant, at a 1% level, positive relation with the long-term debt-to-assets ratio, whereby an increase of 1 pp in the long-term interest rate increases by 0.24 pp the LDA ratio.

When considering the models with the remaining leverage ratios, all significant at a 1% level, keeping everything else constant, the impact of an increase in the long-term interest rate has a negative effect on the leverage ratios. Moreover, it is curious that considering the absolute values of the coefficients, the impact of a change in the long-term interest rate on the SDA ratio (0.65) is higher than on the LDA ratio (0.24).

Interest rate on New Loans

Similarly to what is observed for the long-term interest rate, the estimation coefficients of the interest rate on new loans are negative for all models with the exception of the one, in this case with the model considering the short-term debt-to-assets ratio; also the coefficients are all significant at a 1% level.

Through the output of the models, we see that a 1 pp increase on the interest rate on new loans, on average, decreases the TLA ratio by fairly 1.54 pp, ceteris paribus. This relation, with the broader leverage ratio, is stronger than the one observed for the TDA. Moreover, we verify that the magnitude of the change observed in the total liabilities-to-assets ratio is greater, by at almost 1 pp, than the one observed in total debt-to-assets ratio. Additionally, the change in one unit of the IRNL has a repercussion, standardly, of about 0.30 pp, in same direction, on the SDA ratio, when keeping everything else constant.

Government Debt in Percentage of GDP

Based on the literature we expected a negative relation between the government debt and leverage, as stated in the hypothesis 5 of section 3.4. However, this negative impact was only found for the model considering the narrowest leverage ratio.

All else unchanged, the increase of 1 pp in the government debt-to-GDP ratio, as a positive impact, on average, of 0.16 pp, 0.06 pp and 0.07 pp in the TLA, TDA and LDA ratios, respectively. Looking at the last column of table 11, we observed that a one-unit change in the government debt-to-GDP ratio causes an adjustment in the contrary direction of about 0.02 pp on the SDA ratio. It should be noted, however, that in all four models the coefficients of the variable GOVD are found to be statistically significant, at a 1% level.

The results we obtained (the positive relation) is in line with the findings of Mokhova and Zinecker (2014) concerning emerging markets.

6.3. Discussion

In order to conclude our analysis on this study's empirical findings, we intend to sum up the results obtained in all the models developed and presented in table 11 (since these are the models - FE (Robust) - that control for unobserved heterogeneity), debate possible explanations and establish a link between them with existing literature.

Concerning the firms' related variables, not surprisingly and as found by Barbosa and Pinho (2016), the profitability measures, in our models represented by the return on assets ratio, have a negative with all leverage ratios constructed. The firm size, represented by the log of assets, also presents a strong negative relation with the leverage ratios. Most of the literature on the topic of Portuguese firms' capital structure, as well of most international studies, present positive relations between the leverage and the log of assets. However, Hanousek and Shamshur (2011), focusing on the study of emerging markets (Eastern and Central European countries), using the fixed effects model also found a negative relation between the two variables unlisted firms. Jõeveer (2013) also found a negative relation between the log of assets and leverage for unlisted firms. Towards our results for the firm size, we can only speculate that, for our analysis period which includes the crisis years, smaller firms needed to resort to more debt than larger firms, that have more internal funds to manage their financial needs. Once more, our results are close to findings concerning emerging markets. We should recall however, that we found a positive relation between size and short-term debt-to-assets ratio.

Moreover, our research show that the increase of tax rates reduces the external funding for Portuguese non-financial firms although the degree of change is very small. These conclusions suggest that the firms included in our database may not be sensitive to the benefits of taxes or, the tax shield effect is overlapped by a negative effect resulting from the tax increase. Jordan, Lowe and Taylor (1998), who also found a strong negative relation between effective tax rate and leverage for SMEs, argue that the negative effect in the average level of debt may be simply the reflection of the effect on retained earnings.

The GDP growth is one of the macroeconomic variables most used to try to explain the changes in corporate leverage. Nonetheless, it seems that it is possible to find strong empirical evidence for positive and negative relations between this variable and leverage,

depending on which country, region or type of firms are being studied. Our results seem to indicate that, in an aggregate sense, good economic conditions make Portuguese non-financial firms borrow less, however the use of long-term debt seems to increase. Thus, it appears that when conditions are economically more favourable, companies are more comfortable taking on long-term debt. Gajurel (2006) also found that, in the Nepalese context, GDP growth was negatively related to total debt ratio and short-term debt ratio but positively related the long-term debt ratio.

The literature finds that changes in the inflation rate have direct and indirect impacts on leverage. We found a positive impact on all our models as a result of the increase in the inflation rate. One of the explanations for the regressions outputs we obtained is that, firms take into consideration that inflation decreases the relative value of debt (Jõeveer, 2013). Furthermore, inflation influences firms' activity and results in different ways; for instance, inflation causes prices to rise and can increase costs for firms, leading to a necessity to increase their external financing. On the other hand, the increase in inflation, if due to economic growth, can imply a higher demand from customers and higher returns, which, according to our model (as we can observe by the ROA variable), would have a negative impact on the leverage ratios. The conclusions that can be draw is that, for the firms included in our database, the positive effects of inflation on leverage are higher than the negative ones, being that these effects are noticeable both on the short-term and long-term debt acquisition.

The estimation results we obtained regarding the two measures of interest rates provide for some interesting interpretations. The long-term interest rate is positively related with the long-term debt-to-assets ratio which implies that decreasing the long-term interest lead to a decrease of long-term debt and vice-versa. This effect may be the product of the larger market offer for loans, since the increase in long-term interest rates make banks are more motivated to increase loans to private sector (Mokhova and Zinecker, 2014). Moreover, since interests are tax deductible firms may want to take advantage of this benefit. However, as mentioned above, changing the long-term interest rate has a higher effect on the short-term debt-to-assets ratio. This may be partly due to the replacement of short-term debt for long-term debt and partly due to the firms' prospects for the macroeconomic development. The interest rate on new loans was a smaller effect on the ratios considering debt than on the ratio using total liabilities; since this variable is directly link to the cost of loans we conclude that Portuguese

non-financial firms are less sensitive to the increases in loans' interest rate since they are more dependent on bank loans than other external sources of financing (Antão and Bonfim (2008) found that the Portuguese firms are heavily dependent on bank loans). Therefore, firms tend to cut on other forms of financing than on loans. The positive relation between the interest rate on new loans and the short-term debt-to-assets ratio can be justified by the fact that since the price of loans increase, firms prefer to take on more short-term financing, not having to commit with long-term financial responsibilities, as found by Bokpin (2009).

Notwithstanding the above, during our study, to defy the results and better understand them, some alternative regressions were computed, on which we found that if we estimate our model with all the base variables except for the interest rate on new loans, the variable long-term interest rate became also negative for the LDA ratio[15]; this could be an indication of a collinearity problem between the two interest rate variables[16]. On the other hand, the regression estimation in which we left all base variables but excluded the long-term interest rate, did not modify the estimation coefficient of the IRNL for any model, meaning that the relationship between IRNL and the SDA ratio remained positive.

We could argue that, since the majority of our dataset is composed by SMEs, the positive relation between government debt-to-GDP ratio and our TLA, TDA and LDA ratios, is due to the fact that small firms do not have the flexibility to substitute between different sources of financing. Therefore, our results only evidence a negative relation between the GOVD and the most liquid form of debt. Demirci, Huang and Sialm (2019) results show that that the crowding out effect is stronger for large and more profitable firms and in countries where the financial openness is low or when the government debt is held domestically.

The results derived from this empirical research confirm that, in fact, the change in macroeconomic conditions, limited to the extent of the representation provided by the independent variables utilized, have repercussions on Portuguese corporate leverage.

[15] No other changes were observed regarding the signal of the remaining estimation coefficient.

[16] Recall that when testing for multicollinearity issues through the VIF, the variable short-term interest rate was eliminated. After this elimination the re-estimation of the VIF did not indicate a multicollinearity problem however, we must admit that this could still be an issue for our model.

7. Conclusions

The determinants of capital structure have been widely studied for decades. When compared with the empirical research carried at an international level, the literature on macroeconomic determinants of capital structure of Portuguese firms is still limited. As noted in the introduction, this Dissertation's research question aims to provide some insight on the macroeconomic and external determinants of non-financial firms considering the Portuguese context. We focused on providing a quantifiable and contextualized answer to the question formulated, as well as providing possible explanations that could be the basis for deeper future analysis.

The answer to our question and objective emerges from the analysis of more than 1.719 million observations, with regard to more than 273 thousand Portuguese firms. Our panel accounts for individual firm-specific information, during the period from 2008 to 2017. Based on these data, we built our dependent variables: the total liabilities-to-assets ratio, the total debt-to-assets ratio, long-term debt-to-assets ratio and the short-term debt-to-assets ratio. For the same time period, we collected information on the following macroeconomic variables: GDP growth, inflation rate, two interest rate measures and the government debt in percentage of GDP. The construction of different leverage ratios aimed to capture possible distinctions between the magnitude of the effect of the macroeconomic variables on different sources of external financing. When using a panel data, it is necessary to account for unobserved characteristic of the individuals that are included in the models and can alter the results. If these intrinsic characteristics are related with the estimates obtained by the OLS will be biased and will not reflect correctly the causality inferences between the explanatory and explained variables. Thus, in respect to the methodology used we considered that the FE (fixed effects) model was the most appropriate, as it controls for the firms' fixed effects.

The research conducted led to the conclusion that, although in a modest degree, the variables representing the economic conditions have, in general, a strong statistically significant impact on the leverage ratios of the sample firms. Our findings suggest that the impact of the average rate on which Portuguese non-financial firms are taxed on their earned income is weak and negatively influences the firms' leverage ratios, which is contrary to most of the

evidence presented in the literature. By opposition, as we expected, albeit the literature is not consensual, the inflation rate has a strong positive relationship with all the measures of leverage considered. The variable representative the economic growth of Portugal presents a significant negative relation with most of the leverage ratios, apart from the long-term debt-to-assets ratio, for which it presented a positive impact strongly significant. The results concerning the GDP growth point to the fact that better economic conditions make firms decrease their general level debt but are more confident to commit with long-term responsibilities. Keeping everything else constant, the increase long-term interest rates, according to our model, decreases the amount of total liabilities held by firms. Our study also indications that the increase in the cost of new loans also has negative impact on the total liabilities-to-assets ratio of Portuguese non-financial firms, albeit its impact is less relevant than the one caused by the long-term interest rate. These results are in line with most of the literature regarding interest rates. Regarding the last macroeconomic variable analysed, it seems to exist a global positive externality associated with the increase of government debt in percentage of the GDP. Our model predicts that an increase on the government debt in percentage of the GDP has a positive effect on the total liabilities-to-assets ratio, the total debt-to-assets ratio and long-term debt-to-assets ratio. However, the short-term debt-to-assets ratio presents a small negative reaction when the government debt is increased.

In presenting our results our main focus was in the macroeconomic effects on the leverage ratios, however, we used two firm-specific variables as control variables, for which we expected to find strong results consistent with literature. We used the return on assets and the logarithm of assets to measure firms' profitability and size, respectively. Concerning the profitability of firms, we found results consistent with the pecking order theory. The increase in the return on assets leads to a decrease in the long-term debt-to-assets and short-term debt-to-assets ratios. Considering the broader measure of leverage, we verify that the increase in the firms' profitability also leads to a reduction of the firms' total liabilities. The firm size estimates (coefficients of the logarithm of assets), were found to be statistically significant but mainly negatively related to the response variables, which is contrary to most of the empirical findings. Furthermore, we found that an increase in the cost of new loan to firms, ceteris paribus, has a diminishing effect on the total liabilities-to-assets ratio and long-term

debt-to-assets ratio of Portuguese non-financial firms, but an increasing effect in their short-term debt-to-assets ratio.

It should be noted that all estimation coefficients obtained in this research are statistically significant at a 1% level.

Although our results are not always in agreement with the literature, and the size of the effects is not large (largest effect concerning macroeconomic variables was observed for the inflation variable), we still reject the null-hypothesis in the global significance test (F test) for all the models estimated, concluding that the macroeconomic variables chosen hold some explanatory value for our model.

This study presents some limitations among which we highlight the loss of observations, due to missing data, during the process of building and cleaning the database. Thus, we could find an alternative source of data through which we could obtain more detailed accounting information for the firms. Also, we could rethink the set of explanatory variables chosen. For instance, Jordan, Lowe and Taylor (1998) argue that the effective tax rate is not the best variable to measure non-debt tax shields since it fails to separate the debt and non-debt tax shields impact. The dataset could also be enriched by including other macroeconomic variables relevant to the Portuguese economic environment.

Yet, it is important to emphasized that the application of an alternative methodology may result in different conclusions.

As addressed by Antoniou, Guney and Paudyal (2008) and Jõeveer (2013), differences in geographic location and industries can cause large variations in the empirical findings. Therefore, for further research we consider that it would be fruitful to conduct an analysis considering the firms' business sector and regions, as Portugal has two autonomous region that benefit from a different tax regime. Additionally, these analyses could be enhanced with the segregation between listed and unlisted firms.

It is hoped that the present Dissertation may have contributed modestly to a better understanding on the impacts of macroeconomic and external factors on the Portuguese context, that could, in the future and with some expansion, be taken into consideration for policy decisions.

8. References

- Akerlof, G. 1970. The market for "lemons": quality uncertainty and the market mechanism. ***The Quarterly Journal of Economics***, 84(3): 488-500.
- Antão, P. & Bonfim, D. 2008. Decisões das empresas portuguesas sobre estrutura de capital. ***Relatório de Estabilidade Financeira,*** Banco de Portugal: 187-206.
- Antão, P. & Bonfim, D. 2014. The dynamics of capital structure decisions. Available at: https://ssrn.com/abstract=2512249 [Accessed 20 April 2019].
- Antoniou, A., Guney, Y. & Paudyal, K. 2008. The determinants of capital structure: capital market-oriented versus bank-oriented institutions. ***Journal of Financial and Quantitative Analysis***, 43(1): 59-92.
- Ayturk, Y. 2017. The effects of government borrowing on corporate financing: Evidence from Europe. ***Finance Research Letters***, 20: 96-103.
- Baker, M. & Wurgler, J. 2002. Market timing and capital structure. ***The Journal of Finance***, 57(1): 1-32.
- Banco de Portugal. 2019. Análise do dinamismo empresarial em Portugal, ***Estudos da Central de Balanços***, 35: February 2019.
- Barbosa, L. & Pinho, P. 2016. Estrutura de financiamento das empresas. ***Revista de Estudos Económicos***, Banco de Portugal, 3: 1-30.
- Bastos, D. D., Nakamura, W. T. & Basso, L. F. C. 2009. Determinants of capital structure of publicly-traded companies in Latin America: the role of institutional and macroeconomic factors. ***Journal of International Finance and Economics***, 9(3): 24–39.
- Bauer, P. (2004). Determinants of capital structure: Empirical evidence from Czech Republic. ***Czech Journal of Economics and Finance***, 54(1-2): 2–21.
- Bokpin, G. A. 2009. Macroeconomic development and capital structure decisions of firms: Evidence from emerging market economies. ***Studies in Economics and Finance***, 26(2): 129-142. Available at: https://doi.org/10.1108/10867370910963055 [Accessed 3 November 2017].

- Bougatef, K. & Chichti, J. 2010. Equity market timing and capital structure: Evidence from Tunisia and France. ***International Journal of Business and Management,*** 5(10): 167-177.
- Camara, O. 2012. Capital structure adjustment speed and macroeconomic conditions: U.S. MNCs and DCs. ***International Research Journal of Finance and Economics***, 84: 106–120.
- Casey, G. & Klemp, M. 2018. ***Instrumental variables in the long run***. Centre for economic Policy Research, Discussion Paper Nº DP12980.
- Couto, G. & Ferreira, S. 2010. Os determinantes da estrutura de capita de empresas do PSI-20. ***Rev. Portuguesa e Brasileira de Gestão,*** 9(1,2): 26-38. Available at: http://www.scielo.mec.pt/scielo.php?script=sci_arttext&pid=S1645-44642010000100004&lng=pt&nrm=iso [Accessed 19 November 2017].
- Demirci, I., Huang, J. & Sialm, C. 2019. Government debt and corporate leverage: International evidence. ***Journal of Financial Economics***, 133: 337-356.
- Drukker, D. 2003. Testing for serial correlation in linear panel-data models. ***The Stata Journal***, 3(2): 168-177.
- Durand, D. 1952. Cost of debt and equity funds for business: trends and problems of measurement. ***Conference on Research on Business Finance***: 215-247.
- Fan, J., Titman, S. & Twite, G. 2012. An international comparison of capital structure and debt maturity choices. ***The Journal of Financial and Quantitative Analysis***, 47(1): 23-56.
- Faulkender, M. & Smith, J. 2016. Taxes and leverage at multinational corporations. ***Journal of Financial Economics***, 122: 1-20.
- Frank, M. & Goyal, V. 2003. Testing the pecking order theory of capital structure**.** ***Journal of Financial Economics***, 67: 217-248.
- Frank, M. & Goyal, V. 2009. Capital Structure Decisions: Which Factors are Reliably Important**?** ***Financial Management,*** 1(38): 1-37.
- Gajurel, D. P. 2006. Macroeconomic influences on corporate capital structure. Available at SSRN: http://ssrn.com/abstract=899049 [Accessed 06 January 2019].

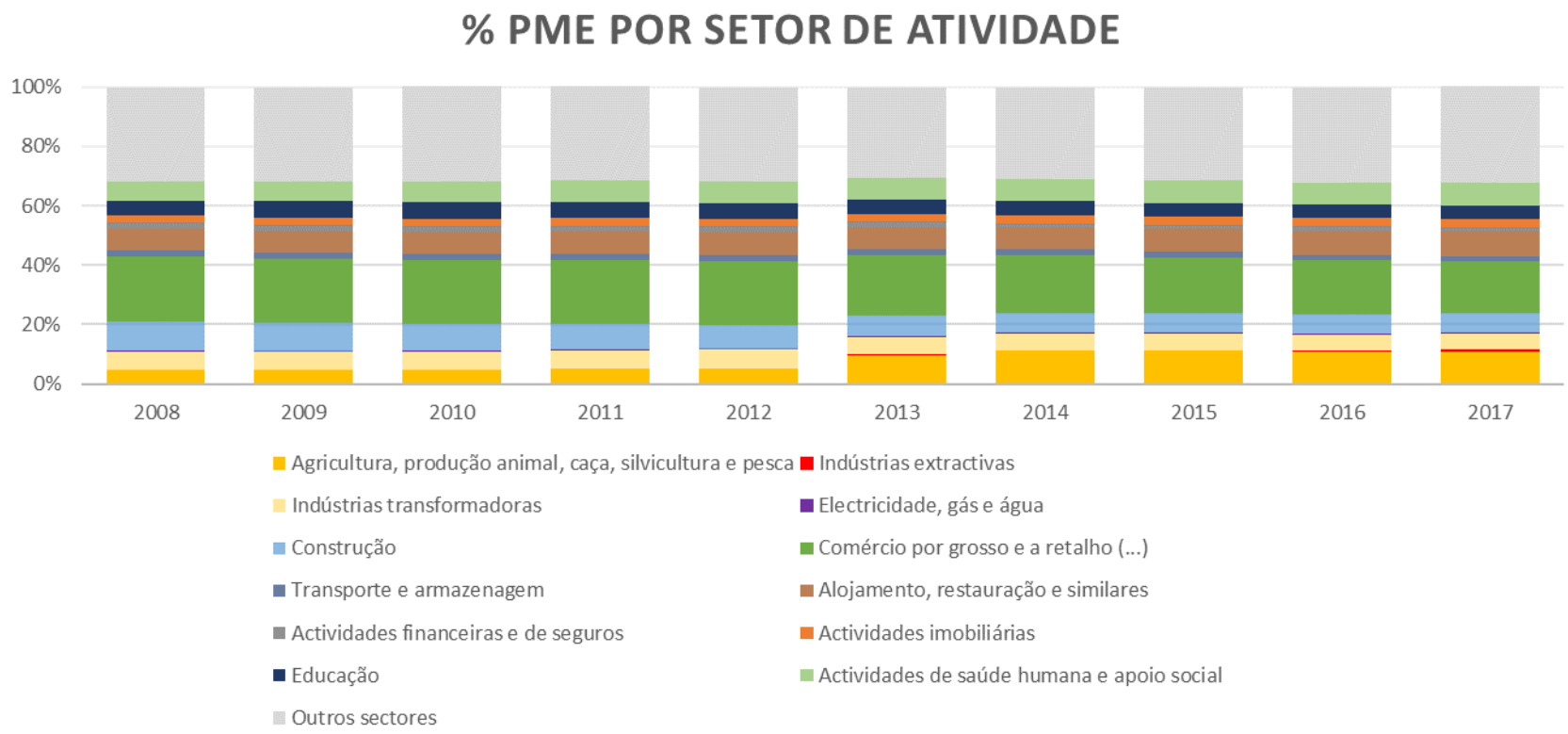
- Graham, J. & Harvey, C. 2001. The theory and practice of corporate finance: evidence from the field. ***Journal of Financial Economics***, 60 (2): 187-243.
- Graham, J., Leary, M. & Roberts, M. 2015. A century of capital structure: The leveraging of corporate America. ***Journal of Financial Economics***, 118(3): 658-683.
- Hanousek, J. & Shamshur, A. 2011. A stubborn persistence: Is the stability of leverage ratios determined by the stability of the economy? ***Journal of Corporate Finance***, 17(5): 1360-1376.
- Heider, F. & Ljungqvist, A. 2015. As certain as debt and taxes: Estimating the tax sensitivity of leverage from state tax changes. ***Journal of Financial Economics***, 118 (3): 684-712.
- Hovakimian, A., Hovakimian, G. & Tehranian, H. 2004. Determinants of target capital structure: The case of dual debt and equity issues. ***Journal of Financial Economics***, 71(3): 517–540.
- Hsiao, C. 2003. ***Analysis of Panel Data*** (Econometric Society Monographs). Cambridge: Cambrideg University Press. Available.
- Instituto Nacional de Estatística. 2012. ***Evolução do Setor Empresarial em Portugal***, ***2004-2010***.
- Jensen, M. 1986. Agency costs of free cash flow: Corporate finance and takeovers. ***The American Economic Review***, 76(2): 323-329.
- Jõeveer, K. 2013. Firm, country and macroeconomic determinants of capital structure: Evidence from transition economies. ***Journal of Comparative Economics***, 41(1): 294–308.
- Jordan, J., Lowe, J. & Taylor, P. 1998. Strategy and financial policy in UK small firms. ***Journal of Business Finance and Accounting***, 25 (1):1-27. Available at: https://doi.org/10.1111/1468-5957.00176 [Accessed 05 January 2019].
- Jorge, S. & Armada, M. 2001. Factores determinantes do endividamento: uma análise em painel. ***Revista de Administração Contemporânea***, 5(2): 9-31.
- Katagiri, M. 2014. A macroeconomic approach to corporate capital structure. ***Journal of Monetary Economics***, 66: 79-94.

- Korajczyk, R. & Levy, A. (2003). Capital structure choice: macroeconomic conditions and financial constraints. ***Journal of Financial Economics***, 68(1), 75–109.
- Kraus, A. & Litzenberger, R. H. 1973. A state-preference model of optimal financial leverage. ***The Journal of Finance***, 28(4): 911-922.
- Matias, F & Serrasqueiro, Z. 2017. Are there reliable determinant factors of capital structure decisions? Empirical study of SMEs in different regions of Portugal**.** ***Research in International Business and Finance***, 40: 19–33.
- Ministério da Economia. 2018, 2019. ***Painel sobre crédito, endividamento e investimento das empresas/ Dashboard on Credit, Indebtedness and Investment of Firms***. Gabinete de Estratégia e Estudos.
- Modigliani, F. & Miller, M. 1958. The cost of capital, corporation finance and the theory of investment. ***American Economic Review***, 48(3): 261-297.
- Modigliani, F. & Miller, M. 1963. Corporate Income Taxes and the Cost of Capital: A Correction, ***American Economic Review***, 53: 433-443.
- Mokhova, N. & Zinecker, M .2013. The determinants of capital structure: the evidence from the European Union, ***Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis***, Mendel University Press, 61(7): 2533-2546.
- Mokhova, N. & Zinecker, M. 2014. Macroeconomic factors and corporate capital structure, ***Journal Procedia - Social and Behavioral Sciences***, 110: 530-540.
- Mostafa, H. & Boregowda, S. 2014. A brief Review of Capital Structure Theories. ***Research Journal of Recent Sciences***, 3(10): 113–118.
- Myers, S. 1984. The capital structure puzzle. ***The Journal of Finance***, 39(3): 574-592.
- Myers, S & Majluf, N. 1984. Corporate financing and investment decisions when firms have information that investors do not have. ***Journal of Financial Economics***, 13(2): 187-221.
- Oliveira, I. G. 2012. ***Determinantes da estrutura de capital das PME portuguesas.*** Unpublished master dissertation, ISCTE-IUL, Portugal.
- Öztekin, O. 2015. Capital structure decisions around the world: Which factors are reliably important? ***Journal of Financial and Quantitative Analysis***, 50(3): 301-323.

- Ragan, R. & Zingales, L. 1995. What do we know about capital structure? Some evidence from international data. ***The Journal of Finance***, 50(5): 1421-1460.
- Serrasqueiro, Z., Matias, F. & Salsa, L. 2016. Determinants of capital structure: New evidence from Portuguese small firms. ***Dos Algarves: A Multidisciplinary e-Journa*l**, 28: 13-28.
- Serrasqueiro, Z. & Rogão, M. 2009. Capital structure of listed Portuguese companies: Determinants of debt adjustment. ***Review of Accounting and Finance***, 8(1): 54-75.
- Spence, M. 1973. Job Market Signaling. ***The Quarterly Journal of Economic*s**, 87(3): 355–374.
- Staiger, D. & Stock, J. H. 1997. Instrumental variables regression with weak instruments. ***Econometrica,*** 65(3): 557-586.
- Stiglitz, J. 1975. The theory of "screening," education, and the distribution of income. ***The American Economic Review***, 65(3): 283-300.
- Stock, J. H. & Watson, M. W. 2018. Identification and estimation of dynamic causal effects in macroeconomics using external instruments. ***The Economic Journal***, 128 (610): 917-948.
- Temimi, A., Zeitun, R. & Mimouni, K. 2016. How does the tax status of a country impact capital structure? Evidence from the GCC region**.** ***Journal of Multinational Financial Management***, 37-38: 71-89.
- Vieira, E. & Novo, A. J. 2010. A estrutura de capital das PME: Evidência no mercado Português. ***Revista Estudos do ISCA 2***. Available at: https://www.researchgate.net/publication/233986085_A_estrutura_de_capital_das_PME_Evidencia_no_mercado_Portugues [Accessed 12 December 2017].
- Wooldridge, J. 2013. ***Introductory econometrics: A Modern Approach***. Mason, Ohio: South-Western Cengage Learning.

9. Appendixes

Appendix A – SMEs per business sector, from 2008 to 2017



Appendix B – Periodicities and sources for dataset variables

Macroeconomic Variables			
Macroeconomic Variables	**Original Periodicity**	**Data source**	**Link to source**
GDP growth	Quarterly	INE	https://www.ine.pt
Inflation rate	Monthly	INE	https://www.ine.pt
Long-term interest rate	Monthly	OECD Data	https://data.oecd.org/interest/long-term-interest-rates.htm
Short-term interest rate	Monthly	OECD Data	https://data.oecd.org/interest/short-term-interest-rates.htm
Interest rate on new loans	Annual	Pordata	https://www.pordata.pt/
Government debt-to-GDP ratio	Annual	OECD Data	https://data.oecd.org/gga/general-government-debt.htm

Appendix C – Number of observations per variable and year

Year/ Nº obs	TLA	TDA	LDA	SDA	ASSETS	TAXRATE	ROA	STAFF	TA
2008	161 290	161 283	161 283	161 290	161 290	154 985	159 135	161 197	161 290
2009	170 451	170 443	170 444	170 452	170 453	163 911	167 838	170 362	170 453
2010	181 552	181 479	181 482	181 544	181 552	173 550	178 361	180 960	181 552
2011	190 668	190 632	190 633	190 667	190 668	181 457	186 326	190 285	190 668
2012	204 736	204 708	204 708	204 736	204 736	193 989	198 112	204 355	204 736
2013	219 980	219 935	219 947	219 968	219 980	208 283	212 390	219 493	219 980
2014	235 882	235 816	235 834	235 864	235 882	224 707	226 367	235 306	235 882
2015	252 203	252 154	252 164	252 192	252 203	240 681	241 827	251 573	252 203
2016	243 664	243 644	243 665	243 644	243 665	233 110	234 749	243 160	243 665
2017	222	222	222	222	222	222	218	222	222
Total	1 860 648	1 860 316	1 860 382	1 860 579	1 860 651	1 774 895	1 805 323	1 856 913	1 860 651

Appendix D – Regression Specifications and output tables

Regression for total liabilities-to-assets ratio:

$$TLA_{i,t} = \beta_1 + \beta_{2,i}TAXRATE_{i,t} + \beta_{3,i}ROA_{i,t} + \beta_{4,i}ASSETS_{i,t} + \beta_{5,i}GDPG_{i,t} + \beta_{6,i}INFR_{i,t} + \beta_{7,i}LTIR_{i,t} + \beta_{8,i}IRNL_{i,t} + \beta_{9,i}GOVD_{i,t} + \alpha_i + \varepsilon_{i,t} \quad \text{(A-1)}$$

Regression for total debt-to-assets ratio:

$$TDA_{i,t} = \beta_1 + \beta_{2,i}TAXRATE_{i,t} + \beta_{3,i}ROA_{i,t} + \beta_{4,i}ASSETS_{i,t} + \beta_{5,i}GDPG_{i,t} + \beta_{6,i}INFR_{i,t} + \beta_{7,i}LTIR_{i,t} + \beta_{8,i}IRNL_{i,t} + \beta_{9,i}GOVD_{i,t} + \alpha_i + \varepsilon_{i,t} \quad \text{(A-2)}$$

Table A-12 – Estimation results using as dependent variable the total debt-to-assets ratio: estimation models for panel data.

	Total debt-to-assets ratio (TDA)			
VARIABLES	OLS	OLS (Robust)	FE (Robust)	RE (Robust)
Effective tax rate (TAXRATE)	-0.0608***	-0.0608***	-0.0063***	-0.0147***
	(0.0011)	(0.0011)	(0.0007)	(0.0007)
Return on assets (ROA)	-0.4592***	-0.4592***	-0.1839***	-0.2374***
	(0.0015)	(0.0042)	(0.0028)	(0.0027)
Log of total assets (ASSETS)	1.5068***	1.5068***	-1.1068***	0.4998***
	(0.0178)	(0.0389)	(0.1267)	(0.0556)
GDP growth (GDPG)	-0.2628***	-0.2628***	-0.2742***	-0.2629***
	(0.0301)	(0.0203)	(0.0185)	(0.0184)
Inflation Rate (INFR)	0.6037***	0.6037***	0.6273***	0.5770***
	(0.0458)	(0.0309)	(0.0274)	(0.0268)
Long-term interest-rate (LTIR)	-0.5000***	-0.5000***	-0.4653***	-0.4538***
	(0.0312)	(0.0243)	(0.0229)	(0.0226)
Interest rate on new loans (IRNL)	-0.6079***	-0.6079***	-0.5638***	-0.5013***
	(0.0460)	(0.0330)	(0.0297)	(0.0285)
Government debt in % of GDP (GOVD)	0.0309***	0.0309***	0.0608***	0.0526***
	(0.0016)	(0.0015)	(0.0017)	(0.0016)
R^2 within |R^2 between |R^2 overall	0.0577	0.0577	0.0187|0.0429|0.0313	0.0178|0.0915|0.0546
ρ			0.6540	0.6057
Observations	1,719,337	1,719,337	1,719,337	1,719,337
Number of id			273,176	273,176
Prob > F	0.000	0.000	0.000	0.000

Source: *Own calculations based on the dataset.*

Regression for long-term debt-to-assets-ratio:

$$LDA_{i,t} = \beta_1 + \beta_{2,i}TAXRATE_{i,t} + \beta_{3,i}ROA_{i,t} + \beta_{4,i}ASSETS_{i,t} + \beta_{5,i}GDPG_{i,t} + \beta_{6,i}INFR_{i,t} + \beta_{7,i}LTIR_{i,t} + \beta_{8,i}IRNL_{i,t} + \beta_{9,i}GOVD_{i,t} + \alpha_i + \varepsilon_{i,t} \quad \text{(A-3)}$$

Table A- 13 – Estimation results using as dependent variable the long-term debt-to-assets ratio: estimation models for panel data.

	Long-term debt-to-assets ratio (LDA)			
	OLS	OLS	FE	RE
VARIABLES		(Robust)	(Robust)	(Robust)
Effective tax rate (TAXRATE)	-0.0551***	-0.0551***	-0.0053***	-0.0136***
	(0.0010)	(0.0010)	(0.0007)	(0.0007)
Return on assets (ROA)	-0.3597***	-0.3597***	-0.1394***	-0.1870***
	(0.0014)	(0.0037)	(0.0025)	(0.0024)
Log of total assets (ASSETS)	0.2834***	0.2834***	-1.3878***	-0.2363***
	(0.0162)	(0.0336)	(0.1099)	(0.0458)
GDP growth (GDPG)	0.3067***	0.3067***	0.2860***	0.2966***
	(0.0273)	(0.0194)	(0.0180)	(0.0180)
Inflation Rate (INFR)	0.2602***	0.2602***	0.2862***	0.2473***
	(0.0415)	(0.0285)	(0.0258)	(0.0253)
Long-term interest-rate (LTIR)	0.2286***	0.2286***	0.2357***	0.2463***
	(0.0284)	(0.0231)	(0.0220)	(0.0218)
Interest rate on new loans (IRNL)	-0.8278***	-0.8278***	-0.7744***	-0.7344***
	(0.0418)	(0.0306)	(0.0281)	(0.0271)
Government debt in % of GDP (GOV	0.0500***	0.0500***	0.0744***	0.0674***
	(0.0015)	(0.0014)	(0.0015)	(0.0014)
R^2 within |R^2 between |R^2 overall	0.0461	0.0461	0.0184|0.0305|0.0260	0.0175|0.0661|0.0415
Root MSE	34.823	34.823		
Observations	1,719,395	1,719,395	1,719,395	1,719,395
Number of id			273,176	273,176
Prob > F	0.000	0.000	0.000	0.000

***Source**: Own calculations based on the dataset.*

Regression for short-term debt-to-assets ratio:

$$SDA_{i,t} = \beta_1 + \beta_{2,i}TAXRATE_{i,t} + \beta_{3,i}ROA_{i,t} + \beta_{4,i}ASSETS_{i,t} + \beta_{5,i}GDPG_{i,t} + \beta_{6,i}INFR_{i,t} + \beta_{7,i}LTIR_{i,t} + \beta_{8,i}IRNL_{i,t} + \beta_{9,i}GOVD_{i,t} + \alpha_i + \varepsilon_{i,t} \quad \text{(A-4)}$$

Table A-14 – Estimation results using as dependent variable the short-term debt-to-assets ratio: estimation models for panel data.

	Short-term debt-to-assets ratio (SDA)			
	OLS	OLS	FE	RE
VARIABLES		(Robust)	(Robust)	(Robust)
Effective tax rate (TAXRATE)	-0.0041***	-0.0041***	-0.0016***	-0.0026***
	(0.0004)	(0.0005)	(0.0004)	(0.0003)
Return on assets (ROA)	-0.0705***	-0.0705***	-0.0390***	-0.0482***
	(0.0006)	(0.0009)	(0.0009)	(0.0008)
Log of total assets (ASSETS)	1.4241***	1.4241***	1.1887***	1.2814***
	(0.0064)	(0.0135)	(0.0360)	(0.0134)
GDP growth (GDPG)	-0.5533***	-0.5533***	-0.5412***	-0.5453***
	(0.0108)	(0.0091)	(0.0090)	(0.0089)
Inflation Rate (INFR)	0.2719***	0.2719***	0.2413***	0.2510***
	(0.0165)	(0.0122)	(0.0117)	(0.0116)
Long-term interest-rate (LTIR)	-0.6826***	-0.6826***	-0.6486***	-0.6582***
	(0.0113)	(0.0107)	(0.0106)	(0.0105)
Interest rate on new loans (IRNL)	0.2832***	0.2832***	0.3046***	0.2971***
	(0.0166)	(0.0127)	(0.0124)	(0.0121)
Government debt in % of GDP (GOV	-0.0245***	-0.0245***	-0.0237***	-0.0241***
	(0.0006)	(0.0006)	(0.0006)	(0.0006)
R^2 within |R^2 between |R^2 overall	0.0412	0.0412	0.0156|0.0512|0.0398	0.0155|0.0526|0.0405
Root MSE	13.828	13.828		
Observations	1,719,539	1,719,539	1,719,539	1,719,539
Number of id			271,177	271,177
Prob > F	0.000	0.000	0.000	0.000

Source: *Own calculations based on the dataset.*