U.PORTO

FEP FACULDADE DE ECONOMIA
UNIVERSIDADE DO PORTO

Interest Rate's Effect on Capital Structure: Evidence from US Listed Companies

Pedro Miguel Gonçalves Matos

Dissertation

Master in Finance

Supervised by

Miguel Sousa, PhD

Natércia Fortuna, PhD

2018

Biographical Note

Pedro Miguel Gonçalves Matos was born in Barcelos at August, 1995. He completed the BSc in Management in 2016 at School of Economics and Management of University of Minho.

In 2016, after completing the BSc degree, Pedro moved to the University of Porto to enrol the Master in Finance of the Faculty of Economics of Porto.

While he was doing this dissertation to obtain the master degree in finance, he also accumulated functions as an Accountant at adidas Group in the Global Business Services of Porto.

Acknowledgements

In the first place, I would like to thank professor Miguel Sousa for the support during the whole dissertation period. His contribution, knowledge and the motivation were fundamental to the success of this study. Also, to thank professor Natércia Fortuna for the support, knowledge and patience.

To my family, I'm so grateful for being at my side in my life and my academic years. My father and my mother were my big mentors during my life, and always supporting me in pursing what I love and what I want to be.

To Magda Gonçalves, my girlfriend, a big thank you for all the efforts and patience to help me during the day we met. She is my inspiration to be a better person and always encouraging and motivating me to be always more ambitious.

Last but not the least, to all my friends that make my life and the academic years much happier.

Abstract

Capital structure is a well know topic in finance. Many studies try to predict the behaviour of financing decisions and the capital structure's choices. Many theories emerged about that but not many of them rely on interest rates and industry. Market timing theories tend to rely on the equity market, but they forget that capital structure relies on equity and also debt market. Interest rates timings can also impact the choice of which financing sources should be used to finance the operational activity. This study will try to give answer to this lack of literature and contribute with insights on this topic about capital structure. Industry also can impact the ways companies take more or less leverage. This is empirically evident on the different debt ratio averages across the industries, where companies in some industries tend to have more leverage than other companies in different industries. Inside of the same industry, companies then to follow their peers. Additionally, they tend to access to more similar interest rates. Therefore, to analyse the interest rates, in this study it will be analysed not only risk-free rates, which are the same for all the companies, but also the industry cost of debt, which are equal to the companies in the same sector of activity.

The results confirm that debt market timing is real, and managers tend to time the market in the moment to choose whether increase debt or not.

Keywords: Capital structure; Optimal Capital Structure; Interest Rates; Debt Market Timing; Industry.

JEL Codes: C33; E43; G32

Sumário

Estrutura de capital é um tópico bem conhecido nas finanças. Muitos estudos tentam prever o comportamento das decisões de financiamento e da estrutura de capitais. São muitas as teorias que nasceram acerca deste tópico, mas não muitas são aquelas que focam nas taxas de juro e na indústria. As teorias acerca da análise dos tempos do mercado tendem a focar no mercado acionista, esquecendo que o mercado obrigacionista faz parte da estrutura de capitais. As evoluções das taxas de juro podem influenciar a escolha do meio de financiamento a ser usado para financiar a atividade das empresas. Este estudo irá tentar dar resposta à falta de literatura e contribuir com análises nesta área da estrutura de capitais. O setor de atividade também pode impactar a decisão de aceitar mais divida ou não. Isto é comprovado empiricamente ao observar o nível médio de divida dos vários setores de atividade, onde empresas de certas indústrias apresentam níveis médios superiores a outras. Dentro da mesma indústria, as empresas tende a olhar umas para as outras na hora de decidir o nível de divida. Ainda, empresas da mesma indústria tendem a ter acesso a taxas de juro mais semelhantes. Consequentemente, para analisar o efeito das taxas de juro, este estudo irá focar não só nas taxas de juro isentas de risco, que é comum a todas as empresas, como também no custo de dívida do setor, que já só é igual para empresas dentro do mesmo setor de atividade.

Os resultados confirmam que a observação das variações das taxas de juro por parte dos gestores é real e que eles tendem a olhar para o mercado obrigacionista no momento de aumentar ou diminuir o nível de dívida.

Index of contents

Index of tables

Index of graphs

Index of attachments

1. Introduction

Capital structure is a well know topic and highly debatable since 1958 with Modigliani and Miller. In practical terms, capital structure means how companies will finance their investments and achieve the lower costs of financing, increasing the levels of profitability. For the two authors, capital structure means nothing since it does not increase value to the company. This created lots of debates and studies that tried to contradict this argument. However, they have corrected the model and, in 1963, for them, capital structure is important to the value of the company. As like they recognized, many other authors concluded that, capital structure's management can really add value to a company.

Many theories about capital structure emerged to track the capital structure decisions and lots of determinants were used to predict the optimal capital structure of a company. Among them, the main theories about capital structure that it will be analysed are: *Trade-off Theory*, *Pecking Order Theory*, *Market Timing Theory* and *Agency Costs Theory*. Regarding the determinants, the main ones that explain why some companies take more debt than others are: Firm Size, Profitability, Non-Debt Tax Shield, Stock Returns, Assets Tangibility, Risk and Growth Opportunities. Besides that, there are space to new ideas and new insights about this topic.

The industry characteristics are almost neglected. There are not many studies that goes deep to see how industry can really impact capital structure model. If well developed, it can be interpreted as a way to reduce omitted variables that the current determinants cannot measure, Hovakimian, Hovakimian, and Tehranian (2004).

Additionally, the main literature about market timing is related to equity market timing. This suggests that in times of "cheap" equity, companies will tend to raise equity to finance their investments. But, what happens in times of "cheap" equity and "cheap" debt, the behaviour will only dependent on equity? Capital structure concerns on debt and equity. So, this implies that financial decisions can be affected by the current situation of the whole market and not only by equity market.

So, this study aims to answer how industry and debt market timings can change the behaviour of capital structure across companies and, attending the industry characteristics, how they change from industry to industry. For this, it was used a sample of 3864 US listed firms.

The findings from this study shows that there is no single theory that explains all the behaviours behind capital structure decisions. All have contributed with new developments to the literature but none of them was enough to justify all the decisions made on this field.

To analyse the Interest Rates, two measures were used for this: Risk Free Rate and Industry Spread. The risk-free rate is common to all the companies. But, not all the companies have access to the same interest rates, which depends on the industry they belong, its financial indicators, among others. So, the industry spread will be closer to the interest rates companies gets to finance their activity.

Both interest rates and almost all industry dummies are statistical significant in the model used. In times of high risk-free rates, companies tend to decrease their leverage. The same happens with the industry premium applied to the companies, according to the industry they belong. This means that managers really timing the market but not only the equity market. In periods of high interest rates, both Risk Free Rate and also the Spread applied to the companies to belong to a sector. In other hand, the fact that industry dummies have statistical significance could means that they represent omitted variables and, by attending the industry features, they are included in the model.

Additionally, in order to see how industry dummies react to the variations of interest rates, it was multiplied the Risk Free rates by Industry Dummies in order to get the combined effect of both. This will allow to observe that different industries do not have the same relation of Risk Free rates with companies leverage and some industries are more sensible, in terms of companies' leverage, to the variations of interest rates.

Regarding the determinants, except the variable NDTS (non-debt tax shield) was against the expectations and it was found a positive relation with companies' leverage. This could be related, as stated by Bradley, Jarrell, and Kim (1984), by the fact that "non-debt tax shields are an instrumental variable for securability", being the companies more likely to get better debt deals. Variables like Profitability, Firm Size, Growth, Stock Returns, Risk Free Rate and Industry Spread are negative related with companies' leverage, supporting the literature. Regarding Tangibility and Volatility, they have a positive relation with corporate debt.

To present these findings, this dissertation is divided in 3 main parts: initially, (1) it is presented the literature review about this topic; next (2) it is presented the determinants that will be used; (3) followed by the description of methodology used to proceed with this study; and, finally, (4) the results of the investigation.

2. Literature Review

The importance and the studies in favour of capital structure's management started with the irrelevance of capital structure's management by Modigliani and Miller (1958). At the time they stated an independence of capital structure decisions and companies' value. This study was criticized by many authors and the studies to contradict this one started to appear. Although the correction of the model to represent the importance of taxes, it was not enough since the model works only in a perfect market without frictions.

After the irrelevance theory, the main theories that emerged after that was the following: (1) *Trade-Off Theory* developed by Kraus and Litzenberger (1973), where they argue a trade-off between tax benefits and bankruptcy cost and on optimal capital structure that maximizes the value of a company; (2) *Pecking Order Theory* suggested by Myers and Majluf (1984) where they present a hierarchical source of financing, stating internal resources as the main source of financing, followed by debt and equity, respectively, which implies an existence of no optimal capital structure; (3) *Market Timing Theory* presented by Baker and Wurgler (2002) where they defend that managers follow the equity timings of the market in their financial decisions of issue equity or repurchase shares; (4) *Agency Costs Theory* created by Jensen and Meckling (1976) it works also as a trade-off between conflict between managers-shareholders and shareholders-debtholders, suggesting an optimal point between the two conflicts, which represents the optimal capital structure.

In this section, it will be presented the main theories that exists in the literature that try to explain how firms manage their sources of financing.

2.1. Modigliani and Miller insights

These two authors enhanced the studies about capital structure due to their insights in this field Modigliani and Miller (1958). With the theory of irrelevance, the authors demonstrated the irrelevance of capital structure's management to the value of a firm. A firm wants acquire assets in order to growth. However, there are many different types of financing sources, which means that the company has to identify which one could lead to the maximization of profits and the maximization of market value. The Preposition I provided by these two authors argued that "the market value of any firm is independent of its capital structure", suggesting that financing decisions has no implications in the value of a company. Related to the Preposition II, they argued that "average cost of capital to any firm is completely independent of its capital structure and is equal to the capitalization rate of a pure equity stream of its class", which means that, although required rate of return of debt is lower than equity, as more debt is used, it will increase the cost of equity, which will remain the weighted average cost of capital unchanged. In this first study, the authors considered the tax benefits provided by the debt. However, the magnitude of difference between using debt or equity is not so significant.

In the second paper, Modigliani and Miller (1963), they corrected the initial idea that taxes are not relevant. Although they argued that taxes produce insignificant differences," tax advantages of debt financing are somewhat greater than the originally suggested". The main implications compared to the previous one is that, since interest payments are tax deductible, in Preposition I, the value of a company increase as debt increase, which implies that the value of a company is maximized when is financed integrally by debt. Concerned the Preposition II, the average cost of capital decrease as tax shield increase, which suggests that the cost of capital is minimized when debt is the only source of financing, maximizing the tax shield. Although the conclusions of the model, the authors argued that "does not necessarily mean that corporations should at all times seek to use the maximum possible amount of debt" due to limitations imposed by lenders and also by the fact that, in some circumstances, other forms of financing (mainly retained earnings) could be cheaper than debt, even with tax benefits.

2.2. Capital structure's theories

2.2.1. Trade-Off Theory

The *trade-off theory* emerged as an improvement of Modigliani and Miller theory that was developed by Kraus and Litzenberger (1973). As it was mentioned before, the irrelevance theory was criticized due to the strong assumptions required to confirm the validity of the theory. Some assumptions rely on perfect markets, which not corresponds to the reality since market have frictions, such as corporate taxes and bankruptcy penalties Robichek and Myers (1965) and Hirshleifer (1966).

This theory suggests that there is an "optimal" capital structure level that maximizes the market value of the company, which corresponds to the best combination of tax benefits and bankruptcy penalties. Thus, the market value of firm increases as debt increase due to tax benefits. However, as debt increase, the risk of a financial distress also increases, and the company start to be penalized by the levels of leverage. Because of that, firms were to take into account this trade-off between benefits and disadvantages in order to find their optimal capital structure. The implications are that the market value of a company increases as debt increases but only at a certain point, which is the "optimal" capital structure.

However, Myers (1984) stated that there is costs in adjust the capital structure causing some lags in the adjustments of capital structure when random events bump them away from the optimum and "there should be some cross-sectional dispersion of actual debt ratios across a sample of firms having the same target ratio". Although the costs of adjustments, the empirical study made by Flannery and Rangan (2006) showed that companies pursue their optimal financial leverage, making partial adjustments with fixed effect even when they are above or below the financial target.

Additionally, according to Kim (1978), although firms try to achieve the optimal capital structure, their debt capacities could not be enough to achieve the intended leverage. By debt capacity, the author says that "is defined as the maximum amount that a firm with given investments can borrow". If the debt capacity is lower than the optimal capital structure, "the question of an optimal capital structure would become irrelevant. This could be emerged by risk-aversion of lenders, Miller (1962), or just by the trade-off between present value of bankruptcy costs that increase as debt increase, against the claim of bankruptcy cost that are satisfied prior the claims of debtholders, Kim (1978).

2.2.2. Pecking Order Theory

Another theory regarding capital structure was developed by Myers and Majluf (1984) that is called *pecking order theory*. This theory starts with an assumption that managers have much more information than investors, which indicates an asymmetry of information. Facing that, investors will interpret the actions of the management and managers have to deal with the consequences of their decisions that will affect the behaviour of investors and firm market value. In this theory, it is considered three sources of financing: retained earnings, debt and equity.

When a firm use external financing, there are not only administrative costs, underwriting costs or, in some cases, under-pricing costs. The asymmetric information plays also an important role in this issue and may lead firms not to opt by external source and prefer to use retained earnings which avoid this problem with adverse selection.

The second concern is the "advantages of debt over equity". Myers (1984) says "issue safe securities before risky ones". In the side of outside investor, he considers equity riskier than debt and investors tend to re-evaluate the firm when an equity issue occurs. The investors interpret the issue of equity as a signal that company is saying that their shares' prices are overvalued, which lead to a drop on share price. On the other hand, debt is more secure, and investors interpret a debt issue as a signal that the company can fulfil their debt obligations.

This theory suggests that there is no notion of optimal capital structure and managers should choose, in the first place, as financing's source, the retained earnings. When retained earnings are not enough to the investment opportunities, debt should the first option as external financing's source and, the last one, equity issue. Although this hierarchy relies on asymmetry of information, it can be generated from tax and agency considerations M. Z. Frank and Goyal (2007) and also by behavioural considerations Heaton (2002).

Another point that was mentioned by Myers (2001) is that this theory has the capability to distinguish between the more profitable companies and the less ones. The capital structure will reflect if a certain company is cumulatively generating internal financing enough to finance their investments (profitability companies) or it cumulatively needs to use external financing (less profitability companies).

2.2.3. Market Timing Theory

The *market timing theory*, also called *"equity market timing"* by their authors Baker and Wurgler (2002), consists in managers take into account the market to issue or repurchase shares. According to the authors, when the market value of a company is high, it seems to be a good opportunity for the company to issue new shares. Contrarily, when market value of a company is low, firms tends to repurchase their shares.

This theory is supported by a survey realized by Graham and Harvey (2001) were they found that 67% of 392 CFOs consider that the amount which the stock is undervalued or overvalued it is an important issue regarding financing decisions. The same CFOs argued that "if our stock price has recently risen, the price at which we can sell is high" which can be the reason behind this theory.

The results of Baker and Wurgler (2002) confirms that "low leverage firms are those that raised funds when their market valuations were high". Another issue in their study is the fact that these fluctuations on market valuations have long-term impact on capital structure of the firms.

Prior to this theory, there are theories related with *equity market timing* that served as base to this theory. The first one is the dynamic adverse selection model that combines elements of *pecking order* and *market timing* used by Lucas and McDonald (1990). In their study, they concluded that adverse selection can explain the cumulative abnormal returns prior the equity issue's announcements. However, it cannot explain why stock prices underperform after an issue since "the manager never has private knowledge of more that next period's valuation", suggesting a short information asymmetry's effect. The second version is related to the irrationality of the investors. In this version, firms tend to issue new shares when the costs of issue is irrationally low and repurchase when the costs is irrationally high. La Porta (1996) connected the extreme values in Market-to-Book ratio with extreme investors' expectations and found that equity issues are positively related with Market-to-Book ratio.

2.2.4. Agency Costs Theory

The *agency costs theory* developed by Jensen and Meckling (1976) could be interpreted as an extension of *trade-off theory*, introducing the agency perspective. In this theory, it takes into account the trade-off between agency problems. One of the benefits of using debt is that can be a way to discipline managers, since they have to make efforts in cash flow generation to repaid debt obligations, mitigating the conflict of interests between managers and shareholders. As debt increase, the necessarily efforts also increase, preventing managers of taking "bad" investments and decrease the profitability of the company, and the conflict of interests is lower Jensen (1986). On the other hand, not only the bankruptcy risk increases but also the conflicts of ownership between shareholders and debtholders.

Shareholders put their firms in the hand of managers. Managers can action in the interest of shareholders or not. Stulz (1990) says that "Management derives perquisites from investment and invests as much as possible". The consequence of that is that managers are forced to invest low when cash flow is low and invest too much when cash flow is high. In order to prevent costs of over and under investment, debt is used to prevent a lower cash flow generation (managers have to make efforts to fulfil debt payments) and decrease the level of investment in times of high cash flow, not spending indiscriminately.

In the other side of trade-off, when debt increase, the conflict of interests between managers-shareholders reduce but emerge a new conflict between shareholders-debtholders. According to Grinblatt and Titman (2002), the conflict exists due to the projects' preferences. Debtholders receive a fixed amount, having no interests if the company have a lot of cash flow or not, the main interest is that they can repaid the debt obligations. The same does not happen with shareholders since they can benefit from huge cash flows. Because of that, they will incentive managers to take risky projects, decreasing the value of current debtholders. This problem can be mitigated by reducing the amount of debt, using covenants in debt contracts to prevent risk positions (debtholders' protection) or using short-term debt Jensen and Meckling (1976).

3. Determinants

3.1. Debt Market Timing

The survey of Graham and Harvey (2001) contributed with insights not only for equity market timing but also that, as result of the survey, managers also tends to timing the issues of debt when interest rates are lower. This indicates that market tends to drive financing decisions of managers.

Based on the findings of this survey, it emerged the study of Barry, Mann, Mihov, and Rodríguez (2008). In their study, they found that companies issue substantially more debt when interest rates are lower compared to historical levels. Even when we exclude refinancing, meaning that when the interest rates of "old" debt is higher than the current interest rates, the company should issue new debt to pay the old one and have lower interest rate payments, the results support the effect of interest rates on the issue of debt. So, "debt timing is not merely driven by refinancing". However, this interest rates effects on debt issues are different from companies to companies. As the authors founded, companies that has less financing flexibility due to many reasons, such as high leverage, are the ones that are less sensitive to changes in interest rates. On other side, firms that are more profitable and larger firms are the ones that are more able to follow the timings of interest rates.

H1: Interest rates have a negative effect on companies' leverage

3.2. Industry effect

Industry represents a group of companies that share between them special features that could not have in a different industry. Because of that, industry could be used to identify omitted variables in traditional capital structure models and, by the way, increase the representativeness of them. Industry effect has been studied since early, for example, Ferri and Jones (1979) suggested a relationship between debt levels and industry classification. Bradley et al. (1984) argue a strong evidence of industry effect in companies that belong to the same industry. This industry differences have several different possible explanations.

The first one, as many authors stated, such as Gilson (1997), Flannery and Rangan (2006) and Hovakimian, Opler, and Titman (2001), is that industry median leverage is used as optimal leverage ration's benchmark. This implies that companies look to their peers in the moment to choose the optimal capital structure and look to achieve the average leverage of the industry that they are in.

One other hand, as Bradley et al. (1984) and latter one, Hovakimian et al. (2004) is the fact that industry effect reflect a correlation between omitted factors. Since companies in the same industry share common singularities in many areas, such as type of assets, business risk and others, could be reflected in industry variables, such as the case of industry average leverage. Almazan and Molina (2005) represented intra industry equilibrium models, where they go inside industry effect in order to see dispersion of capital structure in companies of the same industry, suggesting differences, even in an industry levels.

Titman and Wessels (1988) studied other industry variable in order to distinguish companies in different industries, which is a dummy variable of firms that make specialized products, spare parts or specialized servicing. The reason behind that is the high liquidation costs that they will occur (increasing the expected bankruptcy costs) and, because of that, they should be financed with less debt.

3.3. Common determinants

3.3.1. Profitability

According to the *trade-off theory*, profitable companies are the ones that have less expected bankruptcy costs and can hang on with more debt and take advantage of tax shield provided by debt. So, there is a positive relation between profitability and leverage, where the most profitable companies are the ones who have higher levels of debt. Indeed, the same intuition applies to *agency costs theory*. Since profitable companies are the ones that can have higher amounts of Free Cash Flow (FCF), debt can be used to discipline the management in order to control the way that managers spend this internal resource, Jensen (1986).

However, in a dynamic trade-off model presented by Strebulaev (2007) said that, in a dynamic economy with frictions, “the leverage of most firms, most of the time, is likely to deviate from the optimal leverage” and profitability can be negative correlated with leverage. Kayhan and Titman (2007) argue that this negative relation could be due to firms passively accumulate profits. The *pecking order theory* argue the same relation between profitability and leverage. Since profitable companies are the ones that have higher internal resources, according to the financing hierarchy, this is the first source to be used and, consequently, the demand for external resources will decrease, *ceteris paribus*. So, Profitability is expected to have a negative impact on companies’ leverage.

3.3.2. Firm Size

About firm size, the *trade-off theory* argues that there is a positive relation between size and leverage. Empirically, Ferri and Jones (1979) justified this positive relation by the fact that big firms tend to be more diversified and, consequently, have lower risk levels. Having that, they have better access to debt markets, higher credit ratings and lower interest rates, being more likely to have more debt. In addition, the maturity of firms has also positive impact on debt since older firms with good reputation in debt markets are more able to get better debt deals.

Contrary, the *pecking order theory* interpret that large firms are better known, since they have been around more time than small ones, and they already had the chance to retain more earnings, becoming the usage of external financing less likely. So, according to this theory, there is a negative relation between size and leverage. Based on the ambiguity of this determinant, Firm Size has a positive or negative impact on companies' leverage.

3.3.3. Growth Opportunities

The agency problems related with bondholders and shareholders is presented in equity and debt-controlled firms, as it was mentioned in *agency costs theory*. However, in growth industries/firms, the costs are higher than usual, since these type of firms have more flexibility in choosing their future investments, due to high growth opportunities Titman and Wessels (1988). Thus, the *agency costs theory* suggests a negative relation between growth opportunities and long-term leverage. Nevertheless, this problem could be mitigated by two ways: Myers (1977) argued the use of short-term debt rather than long term debt to mitigate the problem, suggesting a positive relation between short-term debt and growth opportunities; and Jensen and Meckling (1976) suggested that agency costs will be reduced if the firms choose to issue convertible bonds, which implies a positive relation between leverage and convertible bonds. In terms of *trade-off theory*, the growth opportunities are not a tangible asset, which cannot be used as a collateral. Because of that, growth opportunities increase the costs of financial distress, suggesting a negative relation with leverage.

Contrarily, the *pecking order theory* argues that firms with more growth opportunities needs more external financing, since internal resources are not enough, and debt comes before equity. Thus, according to the *pecking order theory*, firms with high growth opportunities tends to have higher levels of debt, existing a positive relation between leverage and growth.

Additionally, Adam and Goyal (2008) argued that the most reliable determinant for growth opportunities is the Market-to-Book ratio. The more the market value of assets in relation to the book value of assets, the higher the growth opportunities. However, the high firm value could be resulted from a mispricing. Thus, according to market timing, managers will issue new shares when the share prices of their firms are higher, issuing shares at high price and reducing the debt in the capital structure. So, *market timing theory* suggests a negative relation between growth opportunities and leverage. Aligned with that, it is expected that Growth Opportunities have a negative impact on companies' leverage

3.3.4. Nature of Assets

Firms that have lots of tangible assets, like buildings, plants, machinery and equipment have less bankruptcy costs, since they can use those assets as a collateral for debt. Additionally, firms that have much fixed assets have difficulties in changing their investments into risk ones since debt is secured by those assets, reducing the debt-related agency problems Johnson (1997). So, both *agency costs theory* and *trade-off theory* suggest a positive relation between leverage and tangible assets.

The *pecking order theory* follow the inversed idea of the previous theories because of the lower information asymmetry in tangible assets (intangible assets are more difficult to value). The lower the asymmetry of information, less costly will be equity issues and tangibility will be negatively correlated with leverage. However, Murray Z. Frank and Goyal (2009) said that, if the adverse selection is related to assets in place, "tangibility increases adverse selection and results in higher debt".

Additionally, the uniqueness of the products that firms produce (such as durable goods) should be followed by low levels of debt Titman (1984). The high specialized products and labour have their financial distress costs higher due to the lower value of those assets in the moment of liquidation. So, first with in unique industries should have less debt, indicating a negative relation between uniqueness and leverage. However, it is expected that Tangibility on assets has a positive impact on companies' leverage

3.3.5. Non-Debt Tax Shield

The tax shield provided by debt results in less tax costs for companies, which represents an incentive in using debt to finance their activities. However, as DeAngelo and Masulis (1980) stated, the firms that the existence of non-debt tax shield, such as depreciations or investment tax credits (federal tax incentives for business investment) act as substitute of debt-tax shield. Thus, companies that have lots of depreciation and investment tax credits presents lower levels of leverage, since tax shield provided by debt is no longer needed. This argument is supported by the *trade-off theory* in the way that firms should use debt because of tax benefits, when a firm has a huge amount of non-debt tax shield, the tax benefits provided by debt will become less useful and with little benefits.

However, Bradley et al. (1984) found a strong positive relation between non-debt tax shield and leverage, contradicting the substituting theory between debt and non-debt tax shield. They argue that a possible explanation for this relation is that "non-debt tax shields are an instrumental variable for securability", and then, those secured assets can be used to get better debt deals. So, this suggests a positive relation between secured assets and leverage. In this study, it is expected the reverse effect of this, which means that Non-Debt Tax Shield has a negative impact on companies' leverage

3.3.6. Risk

The volatility of firm's earnings also affects the capital structure in the way that the probability of a financial distress is higher. Thus, the costs of financial distress will be higher and, according to *trade-off theory,* the debt levels should be lower in this type of companies. This evidence was confirmed by many authors, such as Titman and Wessels (1988) and Bradley et al. (1984).

However, according to Murray Z. Frank and Goyal (2009), "we might expect firms with volatile stocks to be those about which beliefs are quite volatile", suggesting an adverse selection of the investors. So, according to the *pecking order theory,* the relation between leverage and firms' risk will be positive because firms with more volatile cash flows might need to use external financing periodically and, due to adverse selection problem, debt is much more favourable than equity. Since the literature does not define well the behaviour of this determinant, Volatility of earnings could have a negative or positive impact on companies' leverage.

3.3.7. Stock Market Conditions

In terms of market conditions, Welch (2004) argues that capital structure is not changed by stock price shocks. Additionally, in relation to the previous determinants, the author defends that "stock price effects are considerably more important in explaining debt-equity ratios than previously identified proxies", considering stock price returns the primary motivator for changes in capital structure. According to market timing theory, managers try to exploit the mispricing of their stock by timing the issue equity when stocks are overpriced. Choe, Masulis, and Nanda (1993) introduced the time-varying adverse selection where they found that managers choose to make equity issue when the costs of adverse selection are lower. They measured adverse selection costs as the average negative price reaction to seasoned common stock offering announcements and they found that these costs are "lower in expansionary periods and in periods with a relatively large volume of equity financing". Although the different points of view about how stock market conditions affect the leverage of the company, all of them suggests a negative relation between debt and strong market performance.

The *trade-off theory* suggests a different approach where debt market ratio will encourage the company to issue more debt in order to achieve the optimal capital structure regarding debt book ratio. This implies a positive relation between book debt ratios and strong market performance. In other hand, the *market timing theory* defends that strong market performance leads to a reduction on company's leverage, even when we talk about book values of debt. In terms of Cumulative market returns, it is expected to follow the negative relation on companies' leverage defined by *Market Timing Theory*.

4. Methodology

4.1. Model Specifications

In order to represent the impact and the relation of the determinants on companies' leverage, it will be used the following theoretical statistical model where it will be estimated the parameters through statistical inference based on the sample used:

[1] $$DEBT_{i,t} = \beta_1 + \beta_2 SPREAD_{i,t} + \beta_3 RF_t + \beta_4 PROF_{i,t} + \beta_5 LSIZE_{i,t} + \beta_6 GROWTH_{i,t} + \beta_7 TANG_{i,t} + \beta_8 NDTS_{i,t} + \beta_9 VOL_{i,t} + \beta_{10} STK_{i,t} + u_{i,t}$$

In the model, the i represents the companies and the t represents the years.

First, this model will be applied to all companies to see the level of representativeness of firms' leverage. In order to compare the level of representativeness of the variables SPREAD and RF, they will be excluded in the model to see if equation [1] really improves the representativeness of capital structure definition.

4.2. Variables Definition

A. Defining Leverage

There are many different approaches to define companies' leverage on the existing literature regarding capital structure. They could go from market values to book values; go from debt ratio/debt-to-equity ratio to interest coverage ratio; and also from total debt over total assets to long-term debt over total assets. There are reason for existing many different definitions, according to Titman and Wessels (1988), "some of the theories of capital structure have different implications for the different types of debt". However, for this study, it will be used the same approach as Ferri and Jones (1979) in using the total debt over total assets. According to them, the use of this ratio is because of "conceptual simplicity and the variable's ability to more completely reflect a firm's total reliance on borrowed funds", being less exposed to fluctuations of the market.

$$DEBT_{i,t} = TOTAL\ DEBT_{i,t} / BOOK\ VALUE\ OF\ TOTAL\ ASSETS_{i,t}$$ [1]

[1] Firm *i* and year *t*

B. Independent Variables

Interest Rates – Regarding the interest rates, it will be used two types of interest rates. First, the common to all companies is the risk-free rate. As risk free rate, it will be used the interest rates of 30-years US government bonds. Second, in order to reach some specification on interest rates (in reality, all the companies do not have the same cost of debt), it will be used the Damodaran's cost of debt by industry available on his website. With this cost of debt, it will be deducted the risk-free rate to get only the values referred to the industry.

$$RF_i = 30YEARS\ US\ GOVERNMENT\ BONDS\ INTEREST_i$$

$$SPREAD_{i,t} = COST\ OF\ DEBT\ OF\ INDUSTRY_{i,t} - RF_i$$

Profitability – In terms of profitability ratios, there are different measurements in the existing literature. In the study of Rajan and Zingales (1995), they used EBITDA over Book Value of Total Assets. Another one was used by Titman and Wessels (1988) which was Operating Income over Total Sales and Operating Income over Total Assets. Since depreciations leads to a decrease of production's capacity and companies have to replace the older assets to keep the same level of production thus, it will be used EBIT (instead of EBITDA) over Total Assets to represents companies' profitability.

$$PROF_{i,t} = EBIT_{i,t}/BOOK\ VALUE\ OF\ TOTAL\ SALES_{i,t}$$

Size – Regarding the companies' size, it can be found in the literature two possible representations of size: the first one is the natural logarithm of net sales used by Rajan and Zingales (1995) and Ferri and Jones (1979); on the other hand, there is the natural logarithm of total assets that was also used by Ferri and Jones (1979) and Murray Z. Frank and Goyal (2009). For this study, it will be used the natural logarithm of total assets to represent the size of the companies.

$$LSIZE_{i,t} = Log(TOTAL\ ASSETS)_{i,t}$$

Growth – In the study of Titman and Wessels (1988), they suggested three definitions for company's growth: CAPEX over Total Assets; R&D over Total Sales; and the percentage change in Total Assets. A different approach was used by Rajan and Zingales (1995) where they define growth as Market-to-Book ratio. As it was referred above, this approach was supported by Adam and Goyal (2008) and they also consider the market value of assets over book value of assets as the best way to represent companies' growth. Therefore, it will be used this approach in this study to represent the growth's determinant.

$$GROWTH_{i,t} = MARKET\ VALUE\ OF\ ASSETS_{i,t}/BOOK\ VALUE\ OF\ ASSETS_{\ i,t}$$

<u>Assets Tangibility</u> – To measure the assets tangibility, since this is related with "collateral" value of assets in terms of debt issue, Titman and Wessels (1988) used two indicators for this determinant: Intangible assets over Total Assets; Inventory plus Gross Plant and Equipment over Total Assets. Another perspective was used by Rajan and Zingales (1995) were they used the ratio of Fixed Assets over Total Assets. Murray Z. Frank and Goyal (2009) also used the R&D expenses over Total Sales to represent tangibility. For this study, it will be used to represent tangibility the ratio of Fixed Assets over Total Assets.

$$TANG_{i,t} = FIXED\ ASSETS_{i,t}/TOTAL\ ASSETS_{i,t}$$

<u>NDTS</u> – Non-debt tax shield, as it was said in the literature review, corresponds to the tax shield's effect provided by depreciations and investment tax credit. So, as many authors used, the ratio that they used to represent NDTS was the Depreciations over Total Assets and Investment Tax Credit over Total Assets. DeAngelo and Masulis (1980) found a positive relation between NDTS and leverage. However, the ratio used was the sum of 20-year sum of Annual Depreciations and Investment Tax Credit over EBITDA. To represent NDTS, it will be used the ratio of Depreciations over Total Assets in this study.

$$NDTS_{i,t} = DEPRECIATIONS_{i,t}/TOTAL\ ASSETS_{i,t}$$

<u>Volatility</u> – For the definition of volatility, Titman and Wessels (1988) calculated the volatility of company as the standard deviation of the percentage changed in operating income. Another perspective was presented by Bradley et al. (1984) were they used the standard deviation of return on assets, based on the EBIT over Total Assets. Since EBIT is independent of capital structure, it will be used the standard deviation of this ratio in the last five years of each year as a measure of firm's volatility

$$VOL_{i,t} = STD\ DEV\ (EBIT/TOTAL\ ASSETS)_{i,t-(t-5)}$$

<u>Stock Market Conditions</u> – According to Baker and Wurgler (2002), the measure that they used was the Market-to-book ratio as a measure to find if the markets are "high" or "low". The indicator gives the ratio of market value over book value, suggesting an optimal timing when the market value is very high in relation to book values. However, other authors considered a different approach and stated that, the recent evolution of stock prices will determine the capital structure, as stated by Lucas and McDonald (1990), serving as an window of opportunity for companies that suffer from adverse selection. Murray Z. Frank and Goyal (2009) also followed the same intuiting and used the cumulative stock returns to measure the impact of the stock market in capital structure. Based on that, since capital structure, according to the literature, is affected by the recent movements of stock prices, it will be used the cumulative return in the previous year as the predictor for the capital structure in the following year.

$$STK_{i-1} = (STOCK\ PRICE_{i-1} - STOCK\ PRICE_{i-2})/STOCK\ PRICE_{i-2}$$

4.3. Additional models

Additionally, this study also aims to analyse the industry effect on the definition of companies' capital structure. To do that, it will be used the following equation to estimate the coefficients using the same approach as the equation above.

[2] $$\begin{aligned} DEBT_{i,t} = {} & \beta_1 + \beta_2 SPREAD_{i,t} + \beta_3 RF_t + \beta_4 PROF_{i,t} + \beta_5 LSIZE_{i,t} \\ & + \beta_6 GROWTH_{i,t} + \beta_7 TANG_{i,t} + \beta_8 NDTS_{i,t} + \beta_9 VOL_{i,t} \\ & + \beta_{10} STK_{i,t} + \beta_{11} D1 + \beta_{12} D2 + \beta_{13} D3 + \beta_{14} D4 + \beta_{15} D5 \\ & + \beta_{16} D6 + \beta_{17} D7 + \beta_{18} D8 + \beta_{19} D9 + \beta_{20} D10 + \beta_{21} D11 + u_{i,t} \end{aligned}$$

The industry dummy variables included in this model was based on Fama and French (1997) 12 Industry Classification: *D1* represents the Consumer Nondurables industries; *D2* represents the Consumer Durables industries; *D3* represents the Manufacturing industries; *D4* represents the Energy industries; *D5* represents the Chemicals industries; *D6* represents the Business Equipment industries; *D7* represents the Telecom industries; *D8* represents the Utilities industries; *D9* represents the Shops industries; *D10* represents the Healthcare industries and *D11* represents the Finance industry. The *D12* dummy, which represents Other industries like mines, construction, entertainment and other industries was the dummy excluded from this model in order to do no have a perfect multicollinearity and due to lack of industry specification, since represents many different industries. More information about the definition of these dummy variables can be found in attachment [5]. The dummy variables assume a value of 1 of they belong to the respective industry, and 0 if not.

In order to study a mutual effect of industry classification and interest rates, it was also used the multiplicative dummy combining industry classification and risk-free rate to see how risk-free rate behave across the different industries. So, to do that, the equation [3] was used:

[3] $$DEBT_{i,t} = \beta_1 + \beta_2 SPREAD_{i,t} + \beta_3 RF_t + \beta_4 PROF_{i,t} + \beta_5 LSIZE_{i,t} + \beta_6 GROWTH_{i,t} + \beta_7 TANG_{i,t} + \beta_8 NDTS_{i,t} + \beta_9 VOL_{i,t} + \beta_{10} STK_{i,t} + \beta_{11} D1 \times RF_t + \beta_{12} D2 \times RF_t + \beta_{13} D3 \times RF_t + \beta_{14} D4 \times RF_t + \beta_{15} D5 \times RF_t + \beta_{16} D6 \times RF_t + \beta_{17} D7 \times RF_t + \beta_{18} D8 \times RF_t + \beta_{19} D9 \times RF_t + \beta_{20} D10 \times RF_t + \beta_{21} D11 \times RF_t + u_{i,t}$$

In this model, the variable *RF* (Risk Free Rate) was multiplied by each industry dummy.

4.4. Data selection

To develop this study, it will be used EIKON DataStream's database to get financial data of the US listed companies from the period of 2000 until 2016 in order to calculate all the determinants of the model (Debt, Profitability, Size, Growth, Tangibility, NDTS, Risk and Stock Returns). Additionally, it will also be used data from Damodaran's website to get the cost of debt by industry. Regarding the risk-free interest rate variable, since it will be used the 30 years US government bonds interests, the data was retrieved from US Treasury department's website.

The list of companies was retrieved from Damodaran's website. Since the data from Industry's Cost of Debt was calculated by Damodaran, it was used the same companies list to conduct the study. Consequently, the cost of debt of the industry followed the same desegregation by the companies that was used by Damodaran to calculate the variable.

As already indicated, it will be used the 12 industry classification provided by Fama and French (1997) as dummy variables to control the capital structure by industry designation.

The total number of companies was 3864 US listed firms. For the study, it was used data from 2000 until 2016. However, this was only a requirement from some variables that needs historical data to be calculated. So, the real period of analysis goes from 2005 until 2016 (12 years analysis).

Additionally, in order to prevent collinearity between debt ratio and industry spread, it was only included companies that total assets represents less than 5% of industry's total assets. This was to reduce the influence of debt ratio of these companies on industry's cost of debt since, if a company has many influence on the industry, the debt ratio of this company can influence the level of cost of debt of the same industry. In order to prevent this, it was limited by 5% the influence of the companies on the industry, using the weight of total assets on total assets of industry as reference.

4.4.1. Descriptive statistics

In the Table 1, it shows the main descriptive statistics of the variables in this study.

Table 1 *- Descriptive statistics of the variables prior winsorizing technique*

This tables shows the main descriptive statistic indicators of the data used. These values are in percentage format where, for example, the mean of SPREAD can be 0.0137 or 1.37%. This is applied to all the indicators and variables (except to the natural logarithm of SIZE).

Descriptive statistics/ Variables	Mean	Median	Max	Min	Standard Deviation
DEBT	1.9217	0.1599	29106.57	0.0000	177.7321
SPREAD	0.0137	0.0108	0.047600	0.0000	0.0102
RF	0.0360	0.0306	0.048100	0.0269	0.0079
PROF	-1.7742	0.0378	27761.27	-33460.86	278.9931
LSIZE	19.6499	20.1125	27.81989	6.9077	2.7427
GROWTH	0.1154	0.0161	2145.721	-47.3310	13.0450
TANG	0.2293	0.1180	1.394755	0.0000	0.2651
NDTS	0.2600	0.0299	5373.000	0.0000	32.6182
VOL	3.7207	0.0385	13384.24	0.0002	166.1847
STK	16.8007	0.0708	438999.0	-0.9994	2657.523

As it can be seen, the data has outliers that causes not only big discrepancies between maximum and minimum, but also significant differences between means and medians. So, the variables will be winsorized at 1%. This will lead to the descriptive statistics of the Table 2.

Table 2 *- Descriptive statistics of the variables after winsorizing technique*

This tables shows the main descriptive statistic indicators of the data used. These values are in percentage format where, for example, the mean of SPREAD can be 0.0137 or 1.37%. This is applied to all the indicators and variables, except the natural logarithm of SIZE. Additionally, the results differ from the table 1 since these descriptive statistics are the values after applied the winzoring technique at 1% to the data. The values are in percentage format where, for example 0.3208 can be write as 32.08% (except the variable LSIZE, since it is a natural logarithm of size).

Descriptive statistics/ Variables	Mean	Median	Max	Min	Standard Deviation
DEBT	0.3208	0.1599	6.0885	0.0000	0.7377
SPREAD	0.0137	0.0108	0.0476	0.0000	0.0102
RF	0.0360	0.0306	0.0481	0.0269	0.0079
PROF	-0.1940	0.0378	0.4805	-8.7137	1.0994
LSIZE	19.6555	20.1125	24.6867	11.8348	2.6774
GROWTH	0.0225	0.0161	0.4187	-0.3256	0.0700
TANG	0.2290	0.1180	0.9441	0.0000	0.2643
NDTS	0.0377	0.0299	0.2402	0.0000	0.0397
VOL	0.3819	0.0385	13.113	0.0009	1.6007
STK	0.1862	0.0708	4.1724	-0.8648	0.7314

Comparing the different variables, they can be split according to the standard deviation where variables like tangibility (TANG), risk free rate (RF), industry spread (SPREAD), non-debt tax shield (NDTS) and growth (GROWTH) tend to assume values around the mean across the years and also across the companies. In the other side, variables like debt ratio (DEBT), profitability (PROF), size (LZISE), volatility (VOL) and stock returns (STK) tend to assume values more dispersed across the years and companies.

Regarding the profitability, this variable is the only one that have a negative mean. This can be due to the sample only includes companies that represents less than 5% of the total assets of the industry. This could be the reason because the most profitable companies can be excluded due to this condition.

In the Table 3, it shows the main descriptive statistics of debt ratio (total debt over total assets) by industry dummy and respective industry category by each dummy.

Table 3 *- Descriptive statistics of debt ratio across industry dummies*

This table shows the main descriptive statistics of the variable debt ratio according to the different industries classifications. The values are in percentage format.

Descriptive statistics of Debt Ratio / Industry classification	Dummy Variable	Weight (%)	Mean (%)	Median (%)	Standard Deviation
Consumer Non-Durables	D1	3.91%	29.91%	21.81%	0.5861
Consumer Durables	D2	1.92%	28.21%	13.90%	0.6956
Manufacturing	D3	7.84%	26.35%	20.73%	0.4528
Energy	D4	4.24%	39.87%	21.79%	0.8330
Chemicals	D5	2.20%	53.50%	27.71%	1.0932
Business Equipment	D6	16.46%	30.86%	9.05%	0.8881
Telecom	D7	1.84%	63.66%	39.49%	1.0272
Utilities	D8	1.97%	37.27%	33.05%	0.3877
Shops	D9	7.61%	25.86%	16.49%	0.4674
Healthcare	D10	12.19%	38.69%	8.46%	1.0045
Finance	D11	23.42%	22.80%	12.52%	0.3762
Others[2]	D12	16.41%	41.63%	20.40%	0.9365

The dummy variables regarding the type of industry was designed based on Fama's and French's 12 industry classification.

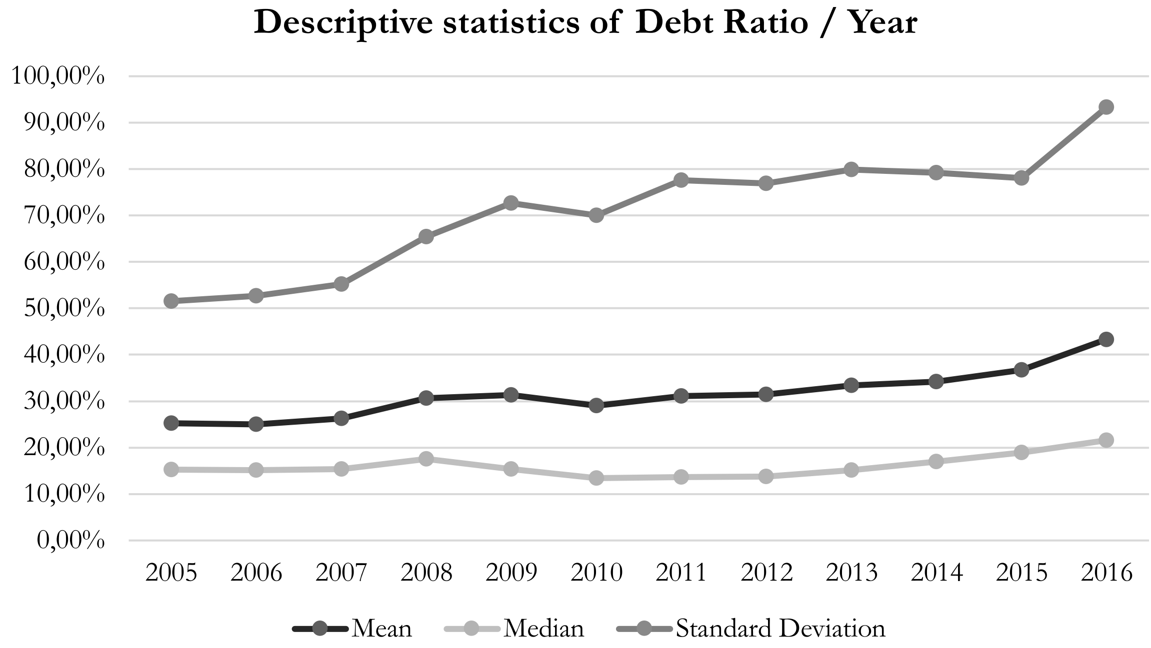
The results of this table show different behaviours of debt ratio across different industries. Companies that belongs to the category "Chemicals", "Telecom", "Others", "Energy", "Healthcare" and "Utilities" tend to have, on average, more percentage of debt than the remaining industry categories.

Additionally, companies that belong to "Energy", "Chemicals", "Business Equipment", "Telecom", "Healthcare" and "Others" tend to have values of debt ratio with more standard deviation across the years and across companies in the same industry category, meaning that the values tend to be more dispersed over the industry mean.

Now, in the graph 1, it can be seen the main descriptive statistics of debt ratio over the years of the sample (2005 until 2016).

[2] Others dummy includes sectors like Mining, Construction, Transportation, Hotels, Business Services and Entertainment.

Graph 1 - *Descriptive statistics of debt ratio across the years*



This graph shows the evolution of the Mean, Median and Standard Deviation of Debt Ratio of the data over the sample period of 2005 until 2016.

As it can be seen, since 2005, both mean, median and standard deviation have registered an increasing, with an exception between the year of 2009 and 2010 where it registered a small decrease of the mean and standard deviation (also between 2011 and 2013 in the case of standard deviation). In terms of mean, this implies that, on average, the companies are taking more debt into their capital structure since 2005 until 2016. Regarding the standard deviation, this indicates that the discrepancies between the companies have also increased, generating more dispersion over the mean value.

5. Results

5.1. Estimation of the results

5.1.1. Estimation of the model

The Table 4 shows the results estimation of the variables according to the data used.

Table 4 - *Estimation of the results of equation [1]*

*This table summarized the OLS estimation of the equation [1] with Standard Errors robust to heteroscedasticity and autocorrelation. *, ** and *** means that the variables are statistical significant at 10%, 5% and 1%, respectively. Below the value of coefficient is presented the t-statistic between "( )". N corresponds to the total number of unbalanced observations.*

Variables	Expected Signal	SPREAD Only	RF only	Interest Rates Only	Interest Rates not included	Full Model
SPREAD	-	3.5761*** (8.1362)		4.4824*** (10.1432)		-1.9008*** (-5.2608)
RF	-		-3.8186*** (-7.2728)	-5.1354*** (-9.7755)		-0.8965** (-2.0805)
PROF	-				-0.2960*** (-62.1074)	-0.2952*** (-61.9437)
LSIZE	+/-				-0.0069*** (-4.3858)	-0.0086*** (-5.3485)
GROWTH	-				-0.5876*** (-11.4671)	-0.5790*** (-11.2999)
TANG	+				0.2214*** (15.1114)	0.2231*** (15.2289)
NDTS	-				1.7008*** (16.6220)	1.7427*** (16.9566)
VOL	+/-				0.0705*** (22.6640)	0.0705*** (22.6551)
STK	-				-0.0116** (-2.4368)	-0.0135*** (-2.8171)
C		0.2716*** (35.0619)	0.4583*** (22.5846)	0.4441*** (21.6874)	0.2729*** (8.4859)	0.3620*** (9.7162)
N		27300	27300	27300	27300	27300
Adjusted R^2		0.0024	0.0016	0.0052	0.3822	0.3830
F-statistic *(p-value)*		67.5648*** (0.0000)	46.2419*** (0.0000)	73.6722 (0.0000)	2413.692*** (0.0000)	1884.055*** (0.0000)

Based on the results, all independent variables analysed in this study are statistical significant at 1%, except Risk Free Rate (*RF*) variable (only at 5%). Additionally, according to F-statistic, the model is statistical significant at 1% also. The correlation matrix of this model can be found in attachment [2].

In terms of debt market timing, the variables Industry Spread (*SPREAD*) and Risk-Free Rate (*RF*) are both statistical significant and are negative related with debt ratio. The intuition of this negative relation is the fact that higher interest rates increase the costs of holding debt, becoming debt deals less attractive. In terms of estimation coefficient, both variables have a much higher estimated coefficient compared with Stock Returns variable. This suggests that, in a scenario of equivalent variance of these three variables, the risk-free rate and industry spread will have a much higher impact on capital structure than equity returns.

When compared with the estimation without *RF* and *SPREAD*, the representativeness of the model is around 38.22%. Including the variables, this value goes up to 38.30%. Both variables are statistical significant, and these two variables were enough to increase the representativeness of the model (adjusted R^2), but with a small impact on it.

Still regarding Interest Rates, when these variables are isolated from the remain variables, the *RF* (Risk Free rate) has the same behaviour, presenting the same negative relation with leverage. However, the same does not happen with *SPREAD* variable. When it is considered alone or with *RF*, it assumes a positive relation with leverage. This might indicate a possible problem with endogeneity with the variable Debt. This because, when companies tend to have more debt, the cost of debt also tend to raise also since it is implying more risk to invest. However, the correlation matrix available in attachment [2] suggests that there are no issues regarding *SPREAD* with or any other variable.

Regarding the independent variable Profitability (*PROF*), the results show a negative relation between profitability and leverage. This result is the same as expected with the literature which predicts a negative relation between profitability and leverage. The justification of this negative relation, according to *Pecking Order Theory*, could be related with the fact that profitable companies are the ones that have available more internal resources, which means that they do not have the necessity of external financing due to internal resources availability. Additionally, profitable companies are also the ones that had the opportunity to accumulate more past results.

Regarding the Firm Size (*LSIZE*), according to the literature, this variable could have positive or negative relation with leverage. However, in this study, the estimation shows a negative relation between size and debt, which support the *Pecking Order Theory*. According to this theory, Firm Size can have a negative relation with leverage since big firms tends to be the ones that have more time in the market and they already have chance to accumulate more earnings from the long past, becoming the external financing less likely. However, the estimation coefficient of this variable is only -0.0085, which indicate a low impact of size in debt ratios of the companies, regardless of its statistical significance.

In terms of Growth (*GROWTH*), the result is what was expected, presenting also a negative relation with debt. This relation is aligned with *Trade-Off Theory*, *Market Timing* and *Agency Costs Theory*. Due to growth companies having lots of opportunities and flexibility to choose their future investments, this originates more financing costs since these "growth opportunities cannot be used as a collateral" and also generate conflict of interests with debtholders. Additionally, growth companies tend to be the ones that have market value of assets much higher that book value of assets, leading to issues of equity by the managers.

Tangibility (*TANG*), as expected, has a negative relation with leverage. A firm that has lots of tangible assets, according with *Trade-Off Theory*, can use these assets as a collateral in debt contracts and achieving better deals. In the same side, *Agency Costs Theory* also suggests that tangible assets are more difficult to be changed, generating less conflict of interests with debtholders. So, since tangibility tends to bring better debt deals, companies take advantage of these and get financing through debt, increasing the weight of debt in their companies.

The only variable that did not get the expected results was Non-Debt Tax Shield (*NDTS*). This variable was expected to have a negative relation with leverage. However, according to this study, the relation with leverage is positive, suggesting that, when companies have lots of non-debt tax shield, these does not act as a substitute but, as Bradley et al. (1984) stated, these non-debt tax shield could be interpreted as securability, which can be used to obtain better debt deal, resulting in more leverage.

Regarding Risk (*VOL*) variable, it can have positive or negative effects on companies' leverage according to the literature. However, the results of this study support a positive and statistical significance relation with debt ratio. This also supports the *Pecking Order Theory* that says companies with volatile cash flows might need a constant and periodic necessity of external financing and, due to adverse selection problems, debt is taken in the first place compared with equity.

Considering now the stock returns and equity market timing (*STK*), this variable presents an expected negative relation with debt ratio. This is explained by *Market Timing Theory* that says managers timing equity markets in the moment to issue equity. The preferred timing to issue equity is when they can sell share at higher prices. So, in the moment of high prices, equity will be raised, and debt will lose space in capital structure.

5.1.2. Estimation of the results with industry dummies

After the analysis of the independent variables under study and the influence on the dependent variable, the Table 5 shows the results when we also consider the dummy variables of the industry.

Table 5 *- Estimation of the results of equation [2] with additive dummies*

*This table summarized the OLS estimation of the equation [2], including additive dummies of the industries identified in the attachment [5]and with Standard Errors robust to heteroscedasticity and autocorrelation. *, ** and *** means that the variables are statistical significant at 10%, 5% and 1%, respectively. Below the value of coefficient is presented the t-statistic between "( )". N corresponds to the total number of unbalanced observations.*

Variables	Expected Signal	Without SPREAD	Without RF	Without Interest Rates	Full Model
SPREAD	-		-0.6709* (-1.8027)		-0.3919 (-1.0358)
RF	-	-1.4852*** (-3.5123)			-1.3693*** (-3.1904)
PROF	-	-0.2899*** (-60.4467)	-0.2905*** (-60.6054)	-0.2905*** (-60.5940)	-0.2900*** (-60.458)
LSIZE	+/-	-0.0137*** (-8.3162)	-0.0137*** (-8.2963)	-0.0135*** (-8.1631)	-0.0139*** (-8.3740)
GROWTH	-	-0.5597*** (-10.9524)	-0.5575*** (-10.9058)	-0.5591*** (-10.9380)	-0.5587*** (-10.9317)
TANG	+	0.2198*** (13.5204)	0.2195*** (13.4984)	0.2192*** (13.4816)	0.2199*** (13.5271)
NDTS	-	2.0716*** (18.8782)	2.0784*** (18.9416)	2.0783*** (18.9385)	2.0722*** (18.8837)
VOL	+/-	0.0703*** (22.6244)	0.0705*** (22.6792)	0.0705*** (22.6808)	0.0703*** (22.6272)
STK	-	-0.0089* (-1.8644)	-0.0077 (-1.6259)	-0.0073*** (-1.5298)	-0.0090* (-1.8938)
D1		-0.0081 (-0.4215)	-0.0101 (-0.5234)	-0.0089 (-0.4604)	-0.0089 (-0.4612)
D2		-0.0321 (-1.3031)	-0.0335 (-1.3591)	-0.0331 (-1.3425)	-0.0324 (-1.3158)
D3		-0.0261* (-1.7653)	-0.0282* (-1.9109)	-0.0268* (-1.8126)	-0.0270* (-1.8250)
D4		-0.1496*** (-7.4331)	-0.1470*** (-7.2829)	-0.1500*** (-7.4501)	-0.1479*** (-7.3275)
D5		0.1374*** (5.7725)	0.1354*** (5.6845)	0.1366*** (5.7390)	0.1366*** (5.736647)
D6		-0.0596*** (-4.5395)	-0.0595*** (-4.5287)	-0.0605*** (-4.6033)	-0.0591*** (-4.4995)
D7		0.0800*** (2.8874)	0.0790*** (2.8502)	0.0795*** (2.8681)	0.0797*** (2.8753)
D8		0.0519** (2.1409)	0.0500** (2.0636)	0.0507** (2.0934)	0.0513** (2.1196)
D9		-0.0005 (-0.0349)	-0.0017 (-0.1124)	-0.0010 (-0.0675)	-0.0009 (-0.0636)
D10		-0.0753*** (-5.1764)	-0.0730*** (-5.0018)	-0.0753*** (-5.1776)	-0.0739*** (-5.0658)
D11		0.0689*** (5.4406)	0.0642*** (4.9759)	0.0683*** (5.3922)	0.0665*** (5.1480)
C		0.4524*** (11.7823)	0.4088*** (11.5889)	0.3935*** (11.4930)	0.4567*** (11.7881)
N		27300	27300	27300	27300
Adjusted R^2		0.3885	0.3883	0.3882	0.3885
F-statistic (p-value)		913.8586*** (0.0000)	913.1769*** (0.0000)	963.6415*** (0.0000)	868.2213*** (0.0000)

The option to exclude the industry spread in the regressions was not only the non-statistical significance in the model that include all variables and dummy variables but also industry spread is, indirectly, a representation of the industry, which could lead to a duplication of industry specifications represented in the model. However, the results of the two last regressions (with and without *SPREAD*) are very similar in terms of signals, coefficients and statistical significance.

The correlation matrix that shows the correlation between the *SPREAD* and *RF* with the additive dummies can be found in attachment [3].

The main conclusion in this table is that, for some industries, its features are relevant for the definitions of debt levels. Industries like Manufacturing (*D3*), Energy (*D4*), Business Equipment (*D6*) and Healthcare (*D10*) are statistical significant for the definition of companies' leverage and, according to the results, they have a negative relation with debt ratio. In other hand, industries such as Chemicals (*D5*), Telecom (*D7*), Utilities (*D8*) and Finance (*D11*) are statistical significance for the definition of companies' leverage but they present a positive relation with debt ratio. Lastly, the following industries are not statistical significant for the definitions of their companies leverage: Consumer Nondurables (*D1*), Consumer Durables (*D2*) and Shops (*D9*).

Comparing the estimated results with descriptive statistics, the five industries that have higher debt ratios (except Others) are the following: Telecom, Chemicals, Energy, Healthcare and Utilities. From the 5, only three of the dummy variables has positive relation with debt. Energy and Healthcare industry, although the high debt ration mean, the industry dummy variable has a negative relation with debt suggesting negative effects even in industries with high levels of leverage.

In this case, when both interest rates (risk free and industry spread) and industry dummies are included, the representativeness of the model goes up to 38.85%. Compared with the model without any of these three variables (*RF*, *SPREAD* and Industry classification), the adjusted R^2 only represents 38.22% (38.30% when it is considered only the interest rates). This shows an improvement of the representativeness of the model and supports the idea of industry effect and interest rates timings.

5.1.3. Estimation of the results with multiplicate dummies

An additional test was made in order to see how the simultaneous combination of industry classification and risk-free rates can influence or not the definition of capital structure by the companies. The Table 6 shows the estimation of the equation [3].

Table 6 *- Estimation of the results of equation [3] with multiplicative dummies*

*This table summarized the OLS estimation of the equation [3] with Standard Errors robust to heteroscedasticity and autocorrelation. *, ** and *** means that the variables are statistical significant at 10%, 5% and 1%, respectively. Below the value of coefficient is presented the t-statistic between "( )". N corresponds to the total number of unbalanced observations.*

Variables	Expected Signal	Without SPREAD	Without RF	Without Interest Rates	Full Model
SPREAD	-		-0.5686 (-1.5464)		-0.3488 (-0.9208)
RF	-	-1.3817*** (-2.7181)			-1.2659** (-2.4174)
PROF	-	-0.2898*** (-61.8545)	-0.2904*** (-62.0453)	-0.2904*** (-62.0429)	-0.2898*** (-61.8609)
LSIZE	+/-	-0.0138*** (-8.4198)	-0.0137*** (-8.3444)	-0.0135*** (-8.2314)	-0.0140*** (-8.4671)
GROWTH	-	-0.5619*** (-11.0929)	-0.5614*** (-11.0799)	-0.5632*** (-11.1176)	-0.5609*** (-11.0710)
TANG	+	0.2198*** (13.6734)	0.2183*** (13.5889)	0.2178*** (13.5640)	0.2199*** (13.6792)
NDTS	-	2.0730*** (19.2273)	2.0681*** (19.1843)	2.0663*** (19.1678)	2.0736*** (19.2323)
VOL	+/-	0.0703*** (23.2648)	0.0703*** (23.2724)	0.0703*** (23.2706)	0.0703*** (23.2661)
STK	-	-0.0086* (-1.7864)	-0.0078 (-1.6296)	-0.0074 (-1.5530)	-0.0087* (-1.8135)
D1 × RF		-0.2967 (-0.5649)	-0.6482 (-1.2779)	-0.6695 (-1.3203)	-0.3149 (-0.5991)
D2 × RF		-0.8918 (-1.3358)	-1.2311* (-1.8840)	-1.2719* (-1.9481)	-0.8986 (-1.3459)
D3 × RF		-0.6326 (-1.5767)	-0.9888*** (-2.6217)	-1.0059*** (-2.6680)	-0.6534 (-1.6260)
D4 × RF		-4.1732*** (-7.6311)	-4.4057*** (-8.2054)	-4.5146*** (-8.4811)	-4.1351*** (-7.5397)
D5 × RF		3.7886*** (5.8756)	3.4367*** (5.4525)	3.4167*** (5.4217)	3.7697*** (5.8434)
D6 × RF		-1.6528*** (-4.6407)	-1.9558*** (-5.8964)	-2.0272*** (-6.1716)	-1.6404*** (-4.6025)
D7 × RF		2.1235*** (2.8175)	1.8069** (2.4328)	1.7681** (2.3819)	2.1175*** (2.8095)
D8 × RF		1.5109** (2.3155)	1.1669* (1.8290)	1.1340* (1.7783)	1.4995** (2.2976)
D9 × RF		0.0250 (0.0591)	-0.3107 (-0.7722)	-0.3447 (-0.8579)	0.0149 (0.0351)
D10 × RF		-2.0826*** (-5.2655)	-2.3450*** (-6.2032)	-2.4420*** (-6.5503)	-2.0532*** (-5.1745)
D11 × RF		1.9382*** (5.6523)	1.5028*** (4.8022)	1.5486*** (4.9707)	1.8775*** (5.3766)
C		0.4498*** (11.9036)	0.4170*** (11.9539)	0.4052*** (11.9037)	0.4533*** (11.9360)
N		27300	27300	27300	27300
Adjusted R^2		0.3888	0.3887	0.3887	0.3888
F-statistic *(p-value)*		915.1745*** (0.0000)	914.7440*** (0.0000)	965.3810*** (0.0000)	869.4533*** (0.0000)

Once again, the variable spread was not considered in one of the estimations due to duplicated effects of *SPREAD* variable and the industry dummies. The same happens with the variable *RF* since it is part of the multiplicative dummy. Now, the industry dummies are multiplied by the Risk-Free rate, generating a combined effect of the interest rates and industry classification into a single variable. This allow to conclude the different influences of *RF* variable across the industries. The correlation matrix of this regression can be found in attachment [4].

Even with *RF* variable in the full model, its coefficient is statistical significant with negative relation with leverage. However, the same does not happen with the variable *SPREAD* where, like the results of equation [2], the variable is not statistical significant due to the industry dummies.

Regarding the interest rates effect on the different industries, it can be seen differences in terms of relation between leverage and interest rates.

The dummies *D1×RF* (Consumer Nondurables) and *D9×RF* (Shops) are the only multiplicative dummies that are not statistical significant in the model that exclude interest rates (also *D2×RF* (Consumer Durables) and *D3×RF* (Manufacturing) when is analysed the full model). The *D1* and *D9* are two of the variables that, in equation 2, does not have a statistical significant effect on companies leverage which suggests a nonlinear effect.

About the statistical significant multiplicative dummies, it can be seen two difference behaviours of RF (Risk Free rate) on companies leverage. Companies that belong to *D5* (Chemicals), *D7* (Telecom), *D8* (Utilities) and *D11* (Finance), the coefficient of the dummy times *RF* has a positive relation with leverage. This means that these companies tend to raise their levels of leverage when interest rates are higher. A possible reason could be related with, even times of high interest rates, these companies still recognize that required rate of returns for debt contracts are lower compared to the required rate of returns of equity. So, they still prefer debt over equity even when interest rates are higher.

On the other hand, companies like D2 (Consumer Durables), D3 (Manufacturing), D4 (Energy), D6 (Business Equipment), D9 (Shops) and D10 (Healthcare), the multiplicative dummy with *RF* has a negative signal. This suggests that these companies react negatively to the increasing of interest rates, decreasing the levels of leverage. For them, they time the market to get more debt in times of cheap debt and decrease their leverage in times of high interest rates.

In terms of sensitivity to variations of Risk Free rates, companies like D4 (Energy), D5 (Chemicals), D6 (Business Equipment) and D10 (Healthcare) are the ones that have higher coefficients, which indicate that leverage is more affected by the variations of Risk Free rates than the remaining industries.

5.2. Robustness test

An additional test was made in order to test the robustness of the variables Interest Rates on capital structure. For this, instead of using the interest rates' values, it will be used two types of dummy variables: (1) when the values of interest rates are above the average of the year and (2) when the values of interest rates are above the average of the whole sample period. This will try to avoid possible problems with endogeneity between the variables since now, for the interest rate variables, it is only take into consideration if the values are above the mean or not.

- **Yearly average**

The variable $D_{spread\ ymean_i}$ will assume the value of 1 when the spread values of the companies are above the yearly average of all the spreads; and otherwise, it will be 0.

- **Period average**

Regarding $D_{spread\ pmean_i}$ will assume the value of 1 when the spread values of the companies are above the 12years average of all the spreads; and otherwise, it will be 0.

Lastly, $D_{RF\ pmean_i}$ will assume the value of 1 when the spread values of the companies are above the 12years average of all the spreads; and otherwise, it will be 0.

The risk free dummy variable was not taken into consideration in the yearly average since risk free rate variables are equal across all companies. The only variation of risk free ratio is across the time (in the case of spread, the values changes across the time and across the industries).

To test these dummy variables, it was used the following two equations:

- Yearly average

[4] $$DEBT_{i,t} = \beta_1 + \beta_2 D_{spread\ ymean_{i,t}} + \beta_3 PROF_{i,t} + \beta_4 LSIZE_{i,t} + \beta_5 GROWTH_{i,t} + \beta_6 TANG_{i,t} + \beta_7 NDTS_{i,t} + \beta_8 VOL_{i,t} + \beta_9 STK_{i,t} + u_{i,t}$$

- Period average

[5] $$DEBT_{i,t} = \beta_1 + \beta_2 D_{spread\ pmean_{i,t}} + \beta_3 D_{RF\ pmean_t} + \beta_4 PROF_{i,t} + \beta_5 LSIZE_{i,t} + \beta_6 GROWTH_{i,t} + \beta_7 TANG_{i,t} + \beta_8 NDTS_{i,t} + \beta_9 VOL_{i,t} + \beta_{10} STK_{i,t} + u_{i,t}$$

The Table 7 shows the output of equation [4] (yearly dummy) and the Table 8 represents the estimation of equation [5] (period average).

Table 7 *- Estimation of the results of equation [4] – Yearly average*

*This table summarized the OLS estimation of the equation [1] and [4] with Standard Errors robust to heteroscedasticity and autocorrelation. *, ** and *** means that the variables are statistical significant at 10%, 5% and 1%, respectively. Below the value of coefficient is presented the t-statistic between "()". N corresponds to the total number of unbalanced observations.*

Variables	Expected Signal	Estimation of Equation 4 (only Dummy)	Estimation of Equation 4	Initial Estimation of Equation 1
$D_{spread\ ymean_i}/SPREAD$	-	0.0744*** (8.2791)	-0.0584*** (-7.9423)	-1.9008*** (-5.2607)
RF	-			-0.8965** (-2.0804)
PROF	-		-0.2953*** (-62.0223)	-0.2952*** (-61.9437)
LSIZE	+/-		-0.0093*** (-5.8058)	-0.0085*** (-5.3485)
GROWTH	-		-0.5762*** (-11.254)	-0.5789*** (-11.2999)
TANG	+		0.2240*** (15.3070)	0.2230*** (15.2289)
NDTS	-		1.7528*** (17.1018)	1.7427*** (16.9566)
VOL	+/-		0.0709*** (22.8190)	0.0704*** (22.6551)
STK	-		-0.0107** (-2.2474)	-0.0135*** (-2.8170)
C		0.2916*** (49.564)	0.3400*** (10.2206)	0.3619*** (9.7162)
N		27300	27300	27300
Adjusted R^2		0.0023	0.3835	0.3830
F-statistic *(p-value)*		66.3879 (0.0000)	2124.445*** (0.0000)	1884.055*** (0.0000)

The Table 7 shows that dummy variable that represent if the spread is above the yearly average, it is statistical significant. This means that, when it is only considered if interest rates are above the mean or not, this has a statistical impact on corporate capital structure. So, when spread is above the mean, by other words, spread is higher, this has a negative influence on companies leverage, which has the same effect and significance of the initial variable *SPREAD*.

Table 8 - *Estimation of the results of equation [5] – Period average*

*This table summarized the OLS estimation of the equation [1] and [5] with Standard Errors robust to heteroscedasticity and autocorrelation. *, ** and *** means that the variables are statistical significant at 10%, 5% and 1%, respectively. Below the value of coefficient is presented the t-statistic between "( )". N corresponds to the total number of unbalanced observations.*

Variables	Expected Signal	Estimation of Equation 5 (Only SPREAD Dum.)	Estimation of Equation 5 (Only RF Dum.)	Estimation of Equation 5 (Only Dum.)	Estimation of Equation 5	Initial Estimation of Equation 1
$D_{spread\ pmean_i}/SPREAD$	-	0.0431*** (4.8569)		0.0691*** (7.5714)	-0.0380*** (-5.1262)	-1.9008*** (-5.2607)
$D_{RF\ pmean_i}/RF$	-		-0.0610*** (-6.9336)	-0.0827*** (-9.141207)	-0.0149** (-2.0499)	-0.8965** (-2.0804)
PROF	-				-0.2952*** (-61.9469)	-0.2952*** (-61.9437)
LSIZE	+/-				-0.0082*** (-5.1924)	-0.0085*** (-5.3485)
GROWTH	-				-0.5825*** (-11.3736)	-0.5789*** (-11.2999)
TANG	+				0.2229*** (15.2270)	0.2230*** (15.2289)
NDTS	-				1.7229*** (16.8089)	1.7427*** (16.9566)
VOL	+/-				0.0704*** (22.6578)	0.0704*** (22.6551)
STK	-				-0.0139*** (-2.9022)	-0.0135*** (-2.8170)
C		0.3016*** (48.5006)	0.3486*** (53.4246)	0.327733*** (45.1898)	0.3225*** (9.7167)	0.3619*** (9.7162)
N		27300	27300	27300	27300	27300
Adjusted R^2		0.0008	0.0016	0.0035	0.3830	0.3830
F-statistic *(p-value)*		23.1277 (0.0000)	46.5177 (0.0000)	50.1092*** (0.0000)	1884.289*** (0.0000)	1884.055*** (0.0000)

When it considered the average of whole sample period, it can be calculated also the average for the variable *RF*. The Table 8 shows the same conclusions of the yearly average where both statistical significance and has a negative effect on the level of debt on companies' capital structure. Which means that, in the times of spread is above the sample average, these high spreads have a negative impact of the companies. The same happens when we consider periods of high risk-free rates (above the average of sample period).

An additional conclusion about the two models (4 and 5) is that, when it is considered only the dummy of *SPREAD* (or dummy of *SPREAD* and *RF*), both equations gives a positive relation of *SPREAD* with the companies leverage. As stated before, this could be related with the fact that higher debt ratios could lead to higher cost of debts. Since the variable *SPREAD* is related with the spread of the industry and the debt ratio is related to single companies, the leverage ratio could be correlated with the debt ratio of the industry. Even when the data only includes companies that has a small influence on the industry.

Using the dummy variables for *SPREAD* and *RF*, this will reduce any possible endogeneity of these two variables. The results confirm the initial results of equation [1], which suggest a robust result of for these two variables because, even changing the formula to calculate the variables, the results keep the same. However, this could not fully avoid the problem of endogeneity since, when it is only included the *SPREAD* dummy, the signal becomes positive (rather than negative).

6. Conclusion

The main goal of this work is to provide new insights about capital structure in variables that are, somehow, neglected in the literature. Interest rates timings are one of these variables since the literature tends to focus the market timing on the equity market, which means that the cost of debt is not taken into consideration in the decision to have more or less debt. Additionally, industry can have impact on capital structure since it can include omitted variables that are specifically from the industry Hovakimian et al. (2004).

The results have confirmed that there is not any universal theory regarding capital structure. It was analysed the four main theories regarding capital structure: *Trade-Off*, *Pecking Order*, *Market Timing* and *Agency Costs*. All of them were useful to conduct this study, however, the results did not confirm that any theory can fully fit the capital structure.

The traditional determinants of capital structure, like Profitability, Size, Growth, NDTS, Tangibility, Risk and Stock Returns are statistical significant according to the model used, which supports the literature and confirm that these indicators can justify why some companies have more leverage than others. However, this can only justify 38.22% of the capital structure. To try to improve the representativeness of the variables, it was study the effect of interest rates and industry on capital structure.

Regarding interest rates, both risk free rates and industry spread are statistical significant with a negative impact on firm's capital structure. This means that managers timing not only the equity market but debt market. So, when interest rates are higher, the cost of holding debt increases, and debt becomes less likely due to the increasing of its costs.

In relation to industry effect, using the additive dummy method, the static classification of the industry is statistical significant for majority of the industries, which suggests that industry can define the level of debt of their companies. This could be justified by industries' specifications that are omitted in the model and the dummies capture these missing variables.

Additionally, it was analysed the multiplicative dummy combining industry classification and risk-free rates. This allowed to conclude that Risk Free rates have different behaviours in different industries, where can be seen a positive effect of risk free rates on companies leverage in industries like *D5* (Chemicals), *D7* (Telecom), *D8* (Utilities) and *D11* (Finance). This suggests that certain companies still prefer debt even in times of higher interest rates since they might recognize that, even with high cost of debt, it is still lower that cost of equity.

References

Adam, T., & Goyal, V. K. (2008). The Investment Opportunity Set And Its Proxy Variables. *Journal of Financial Research, 31*(1), 41-63. doi:10.1111/j.1475-6803.2008.00231.x

Almazan, A., & Molina, C. A. (2005). Intra-Industry Capital Structure Dispersion. *Journal of Economics & Management Strategy, 14*(2), 263-297. doi:10.1111/j.1530-9134.2005.00042.x

Baker, M., & Wurgler, J. (2002). Market Timing and Capital Structure. *The Journal of Finance, 57*(1), 1-32. doi:10.1111/1540-6261.00414

Barry, C. B., Mann, S. C., Mihov, V. T., & Rodríguez, M. (2008). Corporate Debt Issuance and the Historical Level of Interest Rates. *Financial Management, 37*(3), 413-430. doi:10.1111/j.1755-053X.2008.00019.x

Bradley, M., Jarrell, G. A., & Kim, E. H. (1984). On the Existence of an Optimal Capital Structure: Theory and Evidence. *The Journal of Finance, 39*(3), 857-878. doi:10.1111/j.1540-6261.1984.tb03680.x

Choe, H., Masulis, R. W., & Nanda, V. (1993). Common stock offerings across the business cycle: Theory and evidence. *Journal of Empirical Finance, 1*(1), 3-31. doi:https://doi.org/10.1016/0927-5398(93)90003-A

DeAngelo, H., & Masulis, R. W. (1980). Optimal capital structure under corporate and personal taxation. *Journal of Financial Economics, 8*(1), 3-29. doi:https://doi.org/10.1016/0304-405X(80)90019-7

Fama, E. F., & French, K. R. (1997). Industry costs of equity. *Journal of Financial Economics, 43*(2), 153-193. doi:https://doi.org/10.1016/S0304-405X(96)00896-3

Ferri, M. G., & Jones, W. H. (1979). Determinants of Financial Structure: a New Methodological Approach. *The Journal of Finance, 34*(3), 631-644. doi:10.1111/j.1540-6261.1979.tb02130.x

Flannery, M. J., & Rangan, K. P. (2006). Partial adjustment toward target capital structures. *Journal of Financial Economics, 79*(3), 469-506. doi:10.1016/j.jfineco.2005.03.004

Frank, M. Z., & Goyal, V. K. (2007). Trade-Off and Pecking Order Theories of Debt. In *Handbook of Empirical Corporate Finance SET* (Vol. 1, pp. 135-202).

Frank, M. Z., & Goyal, V. K. (2009). Capital Structure Decisions: Which Factors Are Reliably Important? *Financial Management, 38*(1), 1-37. doi:10.1111/j.1755-053X.2009.01026.x

Gilson, S. C. (1997). Transactions Costs and Capital Structure Choice: Evidence from Financially Distressed Firms. *The Journal of Finance, 52*(1), 161-196. doi:10.1111/j.1540-6261.1997.tb03812.x

Graham, J. R., & Harvey, C. R. (2001). The theory and practice of corporate finance: evidence from the field. *Journal of Financial Economics, 60*(2), 187-243. doi:https://doi.org/10.1016/S0304-405X(01)00044-7

Grinblatt, M., & Titman, S. (2002). *Financial markets and corporate strategy*: McGraw-Hill Irwin.

Heaton, J. B. (2002). Managerial optimism and corporate finance. *Financial Management, 31*(2), 33-45.

Hirshleifer, J. (1966). Investment Decision under Uncertainty: Applications of the State-Preference Approach. *The Quarterly Journal of Economics, 80*(2), 252-277. doi:10.2307/1880692

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. doi:https://doi.org/10.1016/S0304-405X(03)00181-8

Hovakimian, A., Opler, T., & Titman, S. (2001). The Debt-Equity Choice. *The Journal of Financial and Quantitative Analysis, 36*(1), 1-24. doi:10.2307/2676195

Jensen, M. C. (1986). Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers. *The American Economic Review, 76*(2), 323-329.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics, 3*(4), 305-360. doi:https://doi.org/10.1016/0304-405X(76)90026-X

Johnson, S. A. (1997). An Empirical Analysis of the Determinants of Corporate Debt Ownership Structure. *The Journal of Financial and Quantitative Analysis, 32*(1), 47-69. doi:10.2307/2331316

Kayhan, A., & Titman, S. (2007). Firms' histories and their capital structures. *Journal of Financial Economics, 83*(1), 1-32. doi:https://doi.org/10.1016/j.jfineco.2005.10.007

Kim, E. H. (1978). A Mean-Variance Theory Of Optimal Capital Structure And Corporate Debt Capacity. *The Journal of Finance, 33*(1), 45-63. doi:10.1111/j.1540-6261.1978.tb03388.x

Kraus, A., & Litzenberger, R. H. (1973). A State-Preference Model of Optimal Financial Leverage. *The Journal of Finance, 28*(4), 911-922. doi:10.2307/2978343

La Porta, R. (1996). *Expectations and the Cross-Section of Stock Returns* (Vol. 51).

Lucas, D. J., & McDonald, R. L. (1990). Equity Issues and Stock Price Dynamics. *The Journal of Finance, 45*(4), 1019-1043. doi:10.1111/j.1540-6261.1990.tb02425.x

Miller, M. H. (1962). [Credit Risk and Credit Rationing]: Further Comment*. *The Quarterly Journal of Economics, 76*(3), 480-488. doi:10.2307/1879634

Modigliani, F., & Miller, M. H. (1958). The Cost of Capital, Corporation Finance and the Theory of Investment. *The American Economic Review, 48*(3), 261-297.

Modigliani, F., & Miller, M. H. (1963). Corporate Income Taxes and the Cost of Capital: A Correction. *The American Economic Review, 53*(3), 433-443.

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics, 5*(2), 147-175. doi:https://doi.org/10.1016/0304-405X(77)90015-0

Myers, S. C. (1984). The Capital Structure Puzzle. *The Journal of Finance, 39*(3), 574-592. doi:10.1111/j.1540-6261.1984.tb03646.x

Myers, S. C. (2001). Capital Structure. *The Journal of Economic Perspectives, 15*(2), 81-102.

Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics, 13*(2), 187-221. doi:https://doi.org/10.1016/0304-405X(84)90023-0

Rajan, R. G., & Zingales, L. (1995). What Do We Know about Capital Structure? Some Evidence from International Data. *The Journal of Finance, 50*(5), 1421-1460. doi:10.1111/j.1540-6261.1995.tb05184.x

Robichek, A. A., & Myers, S. C. (1965). *Optimal financing decisions*. Englewood Cliffs, N.J.: Prentice-Hall.

Strebulaev, I. A. (2007). Do Tests of Capital Structure Theory Mean What They Say? *The Journal of Finance, 62*(4), 1747-1787. doi:10.1111/j.1540-6261.2007.01256.x

Stulz, R. (1990). Managerial discretion and optimal financing policies. *Journal of Financial Economics, 26*(1), 3-27. doi:https://doi.org/10.1016/0304-405X(90)90011-N

Titman, S. (1984). The effect of capital structure on a firm's liquidation decision. *Journal of Financial Economics, 13*(1), 137-151. doi:https://doi.org/10.1016/0304-405X(84)90035-7

Titman, S., & Wessels, R. (1988). The Determinants of Capital Structure Choice. *The Journal of Finance, 43*(1), 1-19. doi:10.1111/j.1540-6261.1988.tb02585.x

Welch, I. (2004). Capital Structure and Stock Returns. *Journal of Political Economy, 112*(1), 106-132. doi:10.1086/379933

Attachments

Attachment 1 *- Relation between determinants and companies' leverage*

This table shows the relation between leverage and each determinant according to each theory analysed. In the last column (Expected Signal), it shows a resume of expected relations with leverage stated in chapter 3.

Predictors	Trade-Off theory	Pecking Order theory	Market Timing	Agency Costs	Expected Signal
Profitability	Positive	Negative	-	Positive	Negative
Firm Size	Positive	Negative	-	-	?
Growth	Negative	Positive	Negative	Negative	Negative
Nature of Assets	Positive	Negative/Positive	-	Positive	Positive
NDTS	Negative	-	-	-	Negative
Risk	Negative	Positive	-	-	?
Stock Market Conditions	Positive	-	Negative	-	Negative
Industry Effect	-	-	-	-	?
Debt Market Timing	-	-	Negative	-	Negative

Attachment 2 *- Correlation matrix of the variables in equation [1]*

This table represents the correlation matrix of the variables analysed in the equation [1] presented in the chapter 4 and estimated in chapter 5.

Variables	DEBT	PROF	LSIZE	GROWTH	TANG	NDTS	VOL	STK	SPREAD	RF
DEBT	1	-0.5885	-0.3288	-0.1467	0.0875	0.2756	0.4814	-0.0323	0.0497	-0.0411
PROF	-0.5885	1	0.4974	0.1538	0.0382	-0.2736	-0.6776	0.0365	-0.0987	0.0439
LSIZE	-0.3288	0.4974	1	0.0418	0.1095	-0.2504	-0.4432	-0.0185	-0.2125	-0.0105
GROWTH	-0.1467	0.1538	0.0418	1	-0.0187	-0.0451	-0.1016	0.0714	0.0213	-0.0027
TANG	0.0875	0.0382	0.1095	-0.0187	1	0.3556	-0.0389	-0.0012	0.0281	0.0018
NDTS	0.2756	-0.2736	-0.2504	-0.0451	0.3556	1	0.1704	-0.0041	0.1432	-0.0226
VOL	0.4814	-0.6776	-0.4432	-0.1016	-0.0389	0.1704	1	-0.0041	0.0877	-0.0389
STK	-0.0323	0.0365	-0.0185	0.0714	-0.0012	-0.0041	-0.0041	1	-0.0259	-0.0976
SPREAD	0.0497	-0.0987	-0.2125	0.0213	0.0281	0.1432	0.0877	-0.0259	1	0.2277
RF	-0.0411	0.0439	-0.0105	-0.0027	0.0018	-0.0226	-0.0389	-0.0976	0.2277	1

Attachment 3 *- Correlation matrix between interest rates and additive dummies*

	SPREAD	RF	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12
SPREAD	1	0.2277	-0.0124	0.0090	-0.0342	0.1171	-0.0107	0.1235	0.0072	-0.0090	-0.0010	0.1781	-0.3049	0.0572
RF	0.2277	1	0.0052	0.0062	0.0055	-0.0066	0.0011	0.0108	-0.0059	0.0086	-0.0007	-0.0137	0.0078	-0.0171
D1	-0.0124	0.0052	1	-0.0325	-0.0681	-0.0441	-0.0341	-0.0916	-0.0289	-0.0352	-0.0620	-0.0733	-0.1182	-0.0844
D2	0.0090	0.0062	-0.0325	1	-0.0500	-0.0324	-0.0250	-0.0673	-0.0212	-0.0259	-0.0455	-0.0538	-0.0868	-0.0620
D3	-0.0342	0.0055	-0.0681	-0.0500	1	-0.0678	-0.0525	-0.1410	-0.0444	-0.0542	-0.0954	-0.1128	-0.1819	-0.1299
D4	0.1171	-0.0066	-0.0441	-0.0324	-0.0678	1	-0.0340	-0.0912	-0.0287	-0.0351	-0.0618	-0.0730	-0.1177	-0.0841
D5	-0.0107	0.0011	-0.0341	-0.0250	-0.0525	-0.0340	1	-0.0706	-0.0222	-0.0271	-0.0478	-0.0565	-0.0911	-0.0650
D6	0.1235	0.0108	-0.0916	-0.0673	-0.1410	-0.0912	-0.0706	1	-0.0597	-0.0729	-0.1284	-0.1517	-0.2446	-0.1747
D7	0.0072	-0.0059	-0.0289	-0.0212	-0.0444	-0.0287	-0.0222	-0.0597	1	-0.0230	-0.0404	-0.0478	-0.0770	-0.0550
D8	-0.0090	0.0086	-0.0352	-0.0259	-0.0542	-0.0351	-0.0271	-0.0729	-0.0230	1	-0.0493	-0.0583	-0.0940	-0.0672
D9	-0.0010	-0.0007	-0.0620	-0.0455	-0.0954	-0.0618	-0.0478	-0.1284	-0.0404	-0.0493	1	-0.1027	-0.1656	-0.1183
D10	0.1781	-0.0137	-0.0733	-0.0538	-0.1128	-0.0730	-0.0565	-0.1517	-0.0478	-0.0583	-0.1027	1	-0.1956	-0.1397
D11	-0.3049	0.0078	-0.1182	-0.0868	-0.1819	-0.1177	-0.0911	-0.2446	-0.0770	-0.0940	-0.1656	-0.1956	1	-0.2254
D12	0.0572	-0.0171	-0.0844	-0.0620	-0.1299	-0.0841	-0.0650	-0.1747	-0.0550	-0.0672	-0.1183	-0.1397	-0.2254	1

This table represents the correlation matrix of the variables SPREAD (Industry Spread) and RF (Risk Free Rate) and the additive dummies used in the equation [2].

Attachment 4 - *Correlation matrix between interest rates and multiplicative dummies*

	SPREAD	RF	D1 × RF	D2 × RF	D3 × RF	D4 × RF	D5 × RF	D6 × RF	D7 × RF	D8 × RF	D9 × RF	D10 × RF	D11 × RF	D12 × RF
SPREAD	1	0.2277	-0.0002	0.0186	-0.0122	0.1215	-0.0021	0.1513	0.0172	0.0012	0.0164	0.1836	-0.2782	0.0771
RF	0.2277	1	0.0509	0.0398	0.0755	0.0382	0.0358	0.1045	0.0230	0.0450	0.0626	0.0601	0.1288	0.0677
D1 × RF	-0.0002	0.0509	1	-0.0309	-0.0647	-0.0419	-0.0325	-0.0869	-0.0275	-0.0335	-0.0590	-0.0696	-0.1117	-0.0801
D2 × RF	0.0186	0.0398	-0.0309	1	-0.0475	-0.0308	-0.0238	-0.0638	-0.0202	-0.0246	-0.0433	-0.0511	-0.0821	-0.0589
D3 × RF	-0.0122	0.0755	-0.0647	-0.0475	1	-0.0645	-0.0499	-0.1335	-0.0422	-0.0515	-0.0906	-0.1070	-0.1717	-0.1231
D4 × RF	0.1215	0.0382	-0.0419	-0.0308	-0.0645	1	-0.0323	-0.0865	-0.0274	-0.0334	-0.0587	-0.0693	-0.1113	-0.0798
D5 × RF	-0.0021	0.0358	-0.0325	-0.0238	-0.0499	-0.0323	1	-0.0670	-0.0212	-0.0258	-0.0455	-0.0537	-0.0861	-0.0618
D6 × RF	0.1513	0.1045	-0.0869	-0.0638	-0.1335	-0.0865	-0.0670	1	-0.0567	-0.0692	-0.1216	-0.1436	-0.2305	-0.1653
D7 × RF	0.0172	0.0230	-0.0275	-0.0202	-0.0422	-0.0274	-0.0212	-0.0567	1	-0.0219	-0.0385	-0.0454	-0.0729	-0.0523
D8 × RF	0.0012	0.0450	-0.0335	-0.0246	-0.0515	-0.0334	-0.0258	-0.0692	-0.0219	1	-0.0469	-0.0554	-0.0889	-0.0638
D9 × RF	0.0164	0.0626	-0.0590	-0.0433	-0.0906	-0.0587	-0.0455	-0.1216	-0.0385	-0.0469	1	-0.0975	-0.1564	-0.1122
D10 × RF	0.1836	0.0601	-0.0696	-0.0511	-0.1070	-0.0693	-0.0537	-0.1436	-0.0454	-0.0554	-0.0975	1	-0.1847	-0.1325
D11 × RF	-0.2782	0.1288	-0.1117	-0.0821	-0.1717	-0.1113	-0.0861	-0.2305	-0.0729	-0.0889	-0.1564	-0.1847	1	-0.2126
D12 × RF	0.0771	0.0677	-0.0801	-0.0589	-0.1231	-0.0798	-0.0618	-0.1653	-0.0523	-0.0638	-0.1122	-0.1325	-0.2126	1

This table represents the correlation matrix of the variables SPREAD (Industry Spread) and RF (Risk Free Rate) and the multiplicative dummies used in the equation [3].

Attachment 5 - *Fama's and French's 12 industry classification description*

This table shows more information about the type of companies each Industry dummy variables contains. This desegregation is the Fama's and French's 12 industry classification in Fama and French (1997).

Dummy	Dummy Name	Description	Sic Codes
D1	Consumer Nondurables	Food, Tobacco, Textiles, Apparel, Leather, Toys	0100-0999; 2000-2399; 2700-2749; 2770-2799; 3100-3199; 3940-3989
D2	Consumer Durables	Cars, TV's, Furniture, Household Appliances	2500-2519; 2590-2599; 3630-3659; 3710-3711; 3714-3714; 3716-3716; 3750-3751; 3792-3792; 3900-3939; 3990-3999
D3	Manufacturing	Machinery, Trucks, Planes, Off Furn, Paper, Com Printing	2520-2589; 2600-2699; 2750-2769; 3000-3099; 3200-3569; 3580-3629; 3700-3709; 3712-3713; 3715-3715; 3717-3749; 3752-3791; 3793-3799; 3830-3839; 3860-3899
D4	Energy	Oil, Gas, and Coal Extraction and Products	1200-1399; 2900-2999
D5	Chemicals	Chemicals and Allied Products	2800-2829; 2840-2899
D6	Business Equipment	Computers, Software, and Electronic Equipment	3570-3579; 3660-3692; 3694-3699; 3810-3829; 7370-7379
D7	Telecom	Telephone and Television Transmission	4800-4899
D8	Utilities	Utilities	4900-4949
D9	Shops	Wholesale, Retail, and Some Services (Laundries, Repair Shops)	5000-5999; 7200-7299; 7600-7699
D10	Healthcare	Healthcare, Medical Equipment, and Drugs	2830-2839; 3693-3693; 3840-3859; 8000-8099
D11	Finance	Finance	6000-6999
D12	Other	Mines, Constr, BldMt, Trans, Hotels, Bus Serv, Entertainment	

Attachment 6 *- Resume of the main statistical inferences of this study*

This table aggregate the main statistical inferences performed during this study. Regarding the dummy variables, additive dummies must be considered in the equation [2] (i.e. D1) and, in the case of multiplicative dummy, it must be considered in equation [3] (i.e. D1×SPREAD).

Variables	Expected Signal	Interest Rates Only	Equation 1 Without Interest Rates	Equation 1 With Interest Rates	Equation 2 Without Interest Rates	Equation 2 With Interest Rates	Equation 3 Without Interest Rates	Equation 3 With Interest Rates
SPREAD	-	4.4824*** (10.1432)		-1.9008*** (-5.2608)		-0.3919 (-1.0358)		-0.3488 (-0.9208)
RF	-	-5.1354*** (-9.7755)		-0.8965** (-2.0805)		-1.3693*** (-3.1904)		-1.2659** (-2.4174)
PROF	-		-0.2960*** (-62.1074)	-0.2952*** (-61.9437)	-0.2905*** (-60.5940)	-0.2900*** (-60.458)	-0.2904*** (-62.0429)	-0.2898*** (-61.8609)
LSIZE	+/-		-0.0069*** (-4.3858)	-0.0086*** (-5.3485)	-0.0135*** (-8.1631)	-0.0139*** (-8.3740)	-0.0135*** (-8.2314)	-0.0140*** (-8.4671)
GROWTH	-		-0.5876*** (-11.4671)	-0.5790*** (-11.2999)	-0.5591*** (-10.9380)	-0.5587*** (-10.9317)	-0.5632*** (-11.1176)	-0.5609*** (-11.0710)
TANG	+		0.2214*** (15.1114)	0.2231*** (15.2289)	0.2192*** (13.4816)	0.2199*** (13.5271)	0.2178*** (13.5640)	0.2199*** (13.6792)
NDTS	-		1.7008*** (16.6220)	1.7427*** (16.9566)	2.0783*** (18.9385)	2.0722*** (18.8837)	2.0663*** (19.1678)	2.0736*** (19.2323)
VOL	+/-		0.0705*** (22.6640)	0.0705*** (22.6551)	0.0705*** (22.6808)	0.0703*** (22.6272)	0.0703*** (23.2706)	0.0703*** (23.2661)
STK	-		-0.0116** (-2.4368)	-0.0135*** (-2.8171)	-0.0073*** (-1.5298)	-0.0090* (-1.8938)	-0.0074 (-1.5530)	-0.0087* (-1.8135)
D1 or D1 × RF					-0.0089 (-0.4604)	-0.0089 (-0.4612)	-0.6695 (-1.3203)	-0.3149 (-0.5991)
D2 or D2 × RF					-0.0331 (-1.3425)	-0.0324 (-1.3158)	-1.2719* (-1.9481)	-0.8986 (-1.3459)
D3 or D3 × RF					-0.0268* (-1.8126)	-0.0270* (-1.8250)	-1.0059*** (-2.6680)	-0.6534 (-1.6260)
D4 or D4 × RF					-0.1500*** (-7.4501)	-0.1479*** (-7.3275)	-4.5146*** (-8.4811)	-4.1351*** (-7.5397)
D5 or D5 × RF					0.1366*** (5.7390)	0.1366*** (5.736647)	3.4167*** (5.4217)	3.7697*** (5.8434)
D6 or D6 × RF					-0.0605*** (-4.6033)	-0.0591*** (-4.499523)	-2.0272*** (-6.1716)	-1.6404*** (-4.6025)
D7 or D7 × RF					0.0795*** (2.8681)	0.0797*** (2.8753)	1.7681** (2.3819)	2.1175*** (2.8095)
D8 or D8 × RF					0.0507** (2.0934)	0.0513** (2.1196)	1.1340* (1.7783)	1.4995** (2.2976)
D9 or D9 × RF					-0.0010 (-0.0675)	-0.0009 (-0.0636)	-0.3447 (-0.8579)	0.0149 (0.0351)
D10 or D10 × RF					-0.0753*** (-5.1776)	-0.0739*** (-5.0658)	-2.4420*** (-6.5503)	-2.0532*** (-5.1745)
D11 or D11 × RF					0.0683*** (5.3922)	0.0665*** (5.1480)	1.5486*** (4.9707)	1.8775*** (5.3766)
C		0.2716*** (35.0619)	0.2729*** (8.4859)	0.3620*** (9.7162)	0.393536*** (11.4930)	0.4567*** (11.7881)	0.4052*** (11.9037)	0.4533*** (11.9360)
N		27300	27300	27300	27300	27300	27300	27300
Adjusted R^2		0.002432	0.382206	0.3830	0.3882	0.3885	0.3887	0.3888
F-statistic (p-value)		67.56487*** (0.0000)	2413.692*** (0.0000)	1884.055*** (0.0000)	963.6415*** (0.0000)	868.2213*** (0.0000)	965.3810*** (0.0000)	869.4533*** (0.0000)