



**DETERMINANTS OF CORPORATE DEBT MATURITY STRUCTURE:
A STUDY IN EURO ZONE COUNTRIES**

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II. Abstract

The main objective of the dissertation is to understand the determinants related with the choice of corporate debt maturity. In general, some countries were affected by the financial crisis of 2008 and different measures were applied in order to overcome the situation. This fact affected their decisions of debt maturity, reason because it will be analyzed whether these choices are, in accordance with the existing theories proposed by the financial literature.

The present study involves a sample with 3.618.795 listed and unlisted firms during the period from 2007 to 2015. The methodology is the panel data and we decided to use different regression techniques, such as OLS and Fixed Effects, evaluating the changes in the determinants of debt maturity of each model. The variables implicit in our analysis are divided in variables that have an impact on firms and countries.

We found that, considering the empirical studies present in the literature review, the firm variables have a significant contribution to the debt maturity. Only taxes, in one of the models presented different values from those expected and, although significant, they are low. For the country variables, we verified that they have a small impact on the maturity of the debt in the period of analysis, such as the inflation rate and the size of the country's banking system. It should be noted because of the financial crisis occurred in 2008, in some variables there was an impact on the fluctuation of the values.

In this way, taking into account the results obtained, it can be verified that the maturity of the firms' debt is determined both by the characteristics of the firms and of each country.

JEL Classifications: G01, G30.

Keywords: Maturity of debt, Determinants, European Union, Financial Crisis.

III. Resumo

O principal objetivo da dissertação consiste em entender quais os determinantes relativamente à escolha da maturidade da dívida das empresas. De um modo geral, alguns países foram afetados pela crise financeira de 2008, tendo sido aplicadas diferentes medidas de forma a ultrapassar a situação instalada. Tal facto afetou as suas decisões no que respeita à maturidade da dívida, razão pela qual será analisado se de facto estas escolhas estão de acordo com as teorias existentes, propostas pela literatura financeira.

O presente estudo engloba uma amostra de 3.618.795 empresas cotadas e não cotadas no principal mercado bolsista, durante o período de 2007 a 2015. No que respeita à metodologia, utilizou-se dados em painel e diferentes técnicas de regressão, como OLS e Fixed Effects, avaliando a alteração dos determinantes da maturidade da dívida. As variáveis implícitas na nossa análise estão divididas em variáveis com impacto nas empresas e nos países.

Constatámos que, tendo em conta os estudos empíricos presentes na revisão da literatura, as variáveis referentes às empresas têm um contributo significativo para a maturidade da dívida. Apenas os impostos, num dos modelos apresentou valores diferentes dos esperados e apesar de significativos, baixos. No que respeita às variáveis dos países, verificámos que não têm tanto impacto na maturidade da dívida, no período em análise, nomeadamente a taxa de inflação e a dimensão do sistema bancário do país. Importa referir que o facto de ter ocorrido a crise financeira em 2008, em algumas variáveis houve um impacto na oscilação dos valores.

Desta forma, tendo em conta os resultados que obtivemos, pode-se constatar que a maturidade da dívida das empresas é determinada tanto pelas características das empresas, como de cada país.

Classificações JEL: G01, G30.

Palavras-chave: Maturity of debt, Determinants, Union European, Financial Crisis.

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1. Introduction

The financial decisions of the firms are related not just with the profit, but also with their level of indebtedness of them. The firms should take in account in their decisions their debt and its maturity, they have to choose an adequate maturity to develop their activity and business in the best way.

Some financial theories have started to be studied since the decade of 50's, from which the authors Modigliani and Miller (1958) developed their theories in this area. During the following periods their theories were being explored and formulated several hypotheses of debt determinants' choices of the firms. In these hypotheses were considered some factors, like the costs of agency and bankruptcy, asymmetry of information, growth opportunities and taxation.

There are several theories that try to explain the key factors that drive firms to make their decisions regarding with debt maturity. The theories studied, although quite different from each other and not considering all the possible hypotheses in financial theory, concluded that there is no single specific theory for the capital structure of a firm, but several separated theories. In this way, "there is no universal theory of the debt-equity choice, and no reason to expect one" (Myers, 2001: 81)

At the academic level, the discussion on this topic focuses on the factors that influence the capital structure of a firm, such as debt and equity. In addition, the most recent studies have been mostly related to the analysis of determinants that influence the choice of corporate debt maturity, being englobed in these factors are the agency costs (Myers, 1977; Barnea *et al.*, 1980; Guney and Ozkan, 2005), firm liquidity (Diamond, 1991), asset suitability, indebtedness level, information asymmetry and tax quality (Brick and Ravid, 1985; Kane *et al.*, 1985). More recently, studies have been debated with the fact that there are also external factors associated with the firms, related to the countries that affect their decisions. In this way, we can consider factors related to the legal and financial system of a country, macroeconomic factors (Fan *et al.*, 2012), and factors associated with the national culture of the country itself (Zhenf *et al.*, 2012). According to Terra (2001), as there is no universal theory regarding capital structure, there is also no general theory of equilibrium associated with the maturity of debt. There are some diversified partial explanations that have not been universally classified into a single theory.

In this sense, the present work will be based on and will start with the presentation of the various theories studied and that have been developed according to debt maturity. After presenting these same theories, will be presented the sample and methodology used and the analysis of the final

results. All of this work will finish with the presentation of the main conclusions obtained, comparing the results verified with the theories discussed in the next chapter.

2. Literature Review

The studies about the main factors that influence the capital structure of firms and the impact on their value, emerged mainly after the publication elaborated by Modigliani and Miller (1958). This was based on the thematic of the capital structure of the firms, involving a controversy because of the propositions assumed by the author.

Modigliani and Miller (1958) in their first proposition, under the inexistence of taxes, affirmed that the financing structure of a firm doesn't affect its own value. In this sense, since some authors have disagreed, several studies about the determinants of the capital structure of firms have been developed over the last decades, including capital and debt. However, it's equally important to study the analysis of corporate indebtedness, such as the maturity of debt, because the decision of finance firms is not restricted to the choice of equity and debt.

Thus, to understand how the main theories and hypotheses studied affect the choice of financing firms, in this chapter both will be presented, being divided into firm impacts and country impacts.

2.1 Firm Impacts

2.1.1 Agency Costs

The agency theory emerged after the work of several economists, such as Wilson (1968) and Arrow (1971), who explored the risk of sharing between groups and individuals, when different entities have different attitudes towards this risk. According to Jensen and Meckling (1976) and Ross (1973), the theory of agency costs is related with this problem, being the goal minimizes costs between shareholders and creditors of the firms.

Based on the definition of Jensen and Meckling (1976), the influence of agency cost theory on debt maturity reflects the level of conflict of interest between shareholders and managers, associated with the size of the firm, the problems of under-investment and risk-shifting.

Firm size

According to some authors, there is a relationship between the theory of agency costs and the size of the firms, with an impact on the debt maturity choice.

Studies developed by Smith and Warner (1979) proved that smaller firms have more agency problems between shareholders and creditors. According to Stulz and Johnson (1985) and Rajan and Zingales (1995), one way to reduce these conflicts between is to introduce guarantees for debt, which can be overcome by financing short-term debt (Barnea *et al.*, 1980).

To justify the relation between the size of the firms and the maturity of the debt, there are associated transaction costs that allow to conclude that short-term debt mainly finances small firms, because of the high transaction costs they face when used long-term debt (Titman and Wessels, 1988).

The public debt market is associated with long maturities, reason because there is a relationship between access to debt and debt maturity (Barclay and Smith, 1995). According to the same authors, smaller firms have limited access to the public debt market. This is due to the existence of an associated fixed costs to generate information for the issuance of public debt, which is why they choose to use private debt (Johnson and Houston, 1997; James, 1996). In this way, smaller firms will choose to finance themselves through private debt, in a larger proportion of short-term debt and at a lower cost, due to lower associated fixed costs.

According to Krishnaswami *et al.* (1999), large firms that are financed from large debt issues will have a smaller amount of private debt and a larger amount of public debt. Larger firms gain economies of scale by issuing public securities, according to studies by Houston and James (1996), Johnson (1997), Colla, Ippolito and Li (2013), thus preferring the issuance of public and private titles. This is also because, for large issues of debt, the fixed costs associated with public debt are reduced by the lower rates in the public debt market (Carey, et al., 1993). Thus, as a function of the size of the issue, firms with access to the public and private debt market will, *ceteris paribus*, make their decisions regarding debt financing.

According to Ozkan (2000), larger firms have a lower agency cost because they have better access to the stock market, and the size of the firm and its level of risk can be considered as important factors for the agency problem. The small firms' limited access to long-term debt is because they have a smaller proportion of marketable assets in view of their growth opportunities (Whited, 1992). For Yi (2005), firms with greater future investment opportunities tend to have a smaller size, "agency costs suggest that risk takers in risky businesses have an incentive to lower agency costs through issuance of Debts with lower maturity".

Antoniou *et al.* (2006) also consider that there is a positive relationship between firm size and debt maturity, based in study for United Kingdom. However, they didn't find statistical significance for Germany and France.

Several studies developed by Silva and Valle (2008) and Fan *et al.* (2012) present a positive sign between firm size and long-term debt too. However, there are another studies realized by Scherr and Hulburt (2001), Highfield (2008), García-Teruel and Martínez-Solano (2010) that represent opposite conclusions.

In this context, we will study the following hypothesis:

Hypothesis 1: the maturity of debt and the dimension of a firm have a positive correlation.

Under-investment and risk-shifting problems

The agency costs influence the maturity of the debt, as a consequence of two problems of investment incentive to the shareholders: under-investment and risk-shifting problems (Pettit and Singer (1985), Smith and Warner (1979), Ravid (1996)).

According to Myers (1977), debt financing can affect business growth opportunities, leading to a disincentive of investors - under-investment problem. This is because, when firms are financed through debt, the income generated by their projects is divided between shareholders and creditors. In firms with good opportunities for growth, the creditors get most of the income from the projects, causing shareholders not to invest in projects with positive NPV (net present value). With more growth options in the firm's investment opportunity, the conflict between stockholders and bondholders over the exercise of these options is greater (Stohs and Mauer, 1996).

Additionally, according to the risk-shifting problem, associated to a conflict of interest between equity holders and debt holders, the firms can opt for high-risk projects. The shareholders can extract wealth from debt holders by switching from safer to riskier investments (Barnea et al., 1980), with the objective of generating high rewards to equity holders – who face little additional downside risk but may garner significant extra return.

Myers (1977) argues that there are different ways for firms to mitigate these problems, such as reducing the maturity of their debt, reducing the value of debt or introducing contractual clauses of debt.

According to the author, a firm by reducing the maturity of its debt using short-term debt financing with maturity prior to the exercise of investment options, reduces the under-investment problem. Thus, firms that have higher growth potential should opt for short term debt, and in their capital structure will have less long-term debt (Myers, 1977). In the same sense, studies by Barnea *et al.* (1980) allow to emphasize that reducing debt maturity allow to control the under-investment problem, as well as to mitigate the conflict of interests between shareholders and creditors.

According to an investigation developed by Johnson (2003), it was verified that there is a relationship between indebtedness, liquidity risk and growth opportunities, regarding the maturity of the debt. The short-term debt contributes to reducing the under-investment problem advocated by Myers (1977) and is associated with a higher liquidity risk. In the issuance of

short-term debt, firms do a trade-off between the costs associated with the under-investment problem and the costs associated with liquidity risk. Stulz and Johnson (1985), Ho and Singer (1982) have proved that there are advantages of short-term debt to reduce the under-investment problem and that the firms may opt to retain the ability to issue fixed claims with high priority claims. According to Stulz and Johnson (1985), new investment projects with high-priority claims can limit transfers from stockholders to creditors and thus reduce the incentives for stockholders to renounce these projects. On the other hand, in case of insolvency, these claims have priority (Ho and Singer, 1982). Barclay and Smith (1995), Guedes and Opler (1996) and Ozkan (2000) also found that there is a positive relationship between a firm's growth opportunities and short-term debt.

On the other hand, Smith and Warner (1979) argue that another way of alleviating the under-investment problem is introduce and perfect debt financing contracts, for example through the introduction of covenants. They proved that with covenants firms with a high risk profile, could reduce the problems related to moral hazard and benefit in its capital structure.

In this way, according to the studies mentioned previously by the various authors, firms with good growth opportunities have a tendency to use more short debt and the maturity of debt it's getting smaller, the higher the agency costs.

According with this studies, the next hypothesis will be studied:

Hypothesis 2: Higher growth opportunities, reduce the maturity of debt.

2.1.2 Impacts of Signaling and Asymmetric Information

The asymmetric information and signaling theories are other hypotheses that allow us to explain firm's debt maturity.

According with Myers (1977), when in a transaction one part has better information than the other, we are in a situation with asymmetric information, being able to influence the choice of debt maturity. The signaling theory is useful for describing behavior when two parties have access to different information, but in other way. Typically, one party (the sender) must choose whether and how to communicate and signal the information and the other party (the receiver) must choose how to interpret it. In this context, there are several studies proving that the sign of quality of the firm will affect the choice of the debt maturity and information asymmetry, being able to convey insider information about firm quality.

Following these theories, Flannery (1986) created a model that allows analyzing the quality signaling of a firm, through the choice of debt, having an impact on its maturity. The model

starts from the proposition that long-term debt eliminates interest rate uncertainty, whereas short-term debt requires an interest rate that will reflect the firms's conditions at this time.

The model developed demonstrate that if in the moment 0 investors cannot have information about the quality of the firm and distinguish between high or low quality firms in the market, they have asymmetric information and investors will force firms to pay high rates to finance their projects, undervaluing high quality firms. The managers of good quality firms always know that investors will claim high risk premium (credit risk), still higher in the long-term debt, and good firms prefer to issue short term debt. In this way, since the long-term debt price is more sensitive to changes in the value of the firm, if a firm fails to calculate the prices of short- and long-term debt, the impact of long-term debt will be higher. Thus, if the bond market cannot distinguish the quality of the firms, undervalued firms will choose to issue short-term debt that is less undervalued.

In moment 1, firms can renegotiate their debt structure at a reduced cost. On the other hand, overvalued firms will issue overstated long-term debt (Flannery, 1986). However, if investors know the distribution of the firms in the market, information about the quality of the firms and the definition of the coupon rate to require, according to the maturity of debt, the investors are in an efficient capital markets. In this way, the investors will try to infer insider information from firm's financing strategies.

Flannery (1986) argues that firms with large potential information asymmetries are likely to issue short-term debt because of the larger information costs associated with long-term debt. Firms with small potential information asymmetries, will be less concerned about the signaling effects of their debt maturity choice, and are more likely to issue long term debt. The same author argues that for an existence of a Signaling Equilibrium, since those firms with lower quality projects cannot mimic other firms, as the costs of refinancing short-term debt are higher than the overvaluation of their projects, they opt for long-term debt. Additionally, higher quality firms signal their quality, issuing short term debt.

The author also argues that it's possible to define two types of equilibrium in the model, depending on the existence or not of debt issuance costs. If there are debt issuance costs, good quality firms it's possible develop a short-term debt issuance strategy that will differentiate them from bad firms, correctly signaling the market on their quality (separating equilibrium). If there is no emission debt costs, the market will undervalue good firms and overvalue more firms (pooling equilibrium). However, Kale and Noe (1990), argues that in the absence of transaction costs, low quality firms always have incentives to mimic high quality firms, which results in another possibility of a pooling equilibrium, contrary to the other by Flannery (1986).

The same authors proved that it is possible good firms distinguish themselves from bad ones, even in the presence of transactions costs, maintaining a separating equilibrium.

In the same context, Titman (1992) introduced the uncertainty of interest rates and costs of insolvency in the Flannery (1986) model and evaluated how the debt maturity choice can be influenced by the use of interest rate swaps. The author agrees that pooling equilibrium can be obtained and noticed that uncertainty of interest rates and costs of insolvency are the key factors for high quality firms.

Subsequently, Diamond (1991, 1993) researched about the relation between asymmetric information, credit ratings and choice of debt maturity. The author argues that firms with favorable private information about future profitability will prefer to issue short-term debt. The lenders are reluctant to refinance the debt if bad news arrives. So, in Diamond's analysis, there are two types of short-term borrowers: those with very good credit ratings and others with poor credit ratings; firms in between are more likely to issue long-term debt. Firms with the highest credit ratings issue short-term debt because of the refinancing risk. Firms with lower credit ratings prefer long-term debt to reduce this refinancing risk and firms with very poor credit ratings, however, are unable to borrow long-term because of the extreme adverse-selection costs. Diamond (1991) also proved that when there is asymmetric information between firms and lenders, the latter would choose short-term debt in order to control better the firms. For the author monitoring is important for reducing information asymmetries and is facilitated by a shorter debt maturity, through which lenders can refuse to renew the loan or modify the terms of supply in order to reduce adverse selection and avoid some incentive problems. When asymmetric information decreases, lenders have less need to monitor their borrowers and can increase debt maturity.

So, in this way, to study the relation between the asymmetric information and signaling theories and the firm's debt maturity we have the following hypothesis:

Hypothesis 3: firms that have positive information will opt for short-term debt to finance their projects. The firms signal their quality issuing short-term debt.

2.1.3 Impacts of Liquidity and Credit Risk

According to credit risk and liquidity risk, Diamond (1991) studied how both can affect a choice of debt maturity. The author provides a model to explain why risky firms with long-term projects might use short-term debt under the existence of asymmetric information.

Diamond (1991) refers to liquidity risk as the risk of a borrower being forced into an inefficient contract, since refinancing is not available. Even if this outcome is not achieved, short-term

debt can still cause a loss of project leases, if it has to be refinanced at an excessively high interest rate because of credit market imperfections (Froot, Scharfstein and Stein, 1993). Short-term debt creates liquidity risk, because sometimes the borrower is unable to refinance and the lender liquidates when the borrower would not choose whether he was the sole owner of the firm. On the other hand liquidity risk from short-term debt arises from the borrower's loss of control rents in the case that lenders are unwilling to refinance when bad news arrives. Sharpe (1991), Diamond (1991) and Titman (1992), argue that bad news about a borrower may arrive at the refinancing date, causing investors not to extend credit or to raise the default premium on new debt.

Firms may face some costs of financial disadvantage, when they lose access to credit at attractive prices. While liquidity risk gives to some firms an incentive to borrow long-term loans, they cannot do it because of the rate of return required to compensate investors for hearing to long-term credit risk, may induce substitution in risky projects of low quality (Stiglitz and Weiss, 1981). Thus, low-quality firms can be excluded from the long-term market, and only high-quality credit firms (for example large firms) may end up trying to borrow in the long-term credit market.

Diamond (1991) analyzed how the choice of debt maturity by firms is affected by their rating. According to the author, this choice is made by the trade-off between the preference of the firms for the short-term debt, when they have private information about the future credit rating and liquidity risk. Diamond (1991), in contrast to Flannery (1986) that classified firms according to their quality (good and bad), classifies firms according to their rating into three categories: low, medium and high.

According to Diamond (1991), good firms with private information about future performance and low-risk (high credit ratings) estimate low liquidity costs and choose short-term debt, at relatively low interest rates.

In the same context, Titman (1992) suggests that firms with expectations that the quality of their credit rating improves prefer short-term debt, using swaps to hedge the interest rate risk. The demand for variable rate fixed rate swaps increases in the presence of information asymmetry, while the demand for fixed rate variable rate swaps is smaller in firms with greater information asymmetries. According to the author, these results are consistent with the hypothesis that firms that exchange fixed rate bonds for variable rate bonds are riskier than those that exchange fixed rate variable rates. The analysis suggests that lower-rated firms with expectations of future improvement in their credit ratings prefer to finance themselves in the short term and switch to floating rate fixed rate bonds, firms to increase their value.

On the other hand, firms with favorable private information and intermediate risk may choose long-term debt at a higher rate to reduce and avoid their greater liquidity risk of being unable to refinance the debt if they choose short-term debt.

Firms with high-risk (low credit ratings) will prefer long-term debt to reduce their refinancing risk. The author also proved that firms in a stable situation may opt for long-term debt, because they faced major liquidity challenges compared to high-quality firms.

Moreover, assuming a constant level of indebtedness, the Diamond (1991) model refers to the existence of two types of firms: (i) those that are financed by short-term debt, with a very high rating, because they cannot access long-term debt due to the fact that the costs related to adverse selection are very high; (ii) those that are financed in the long term and have a very low rating. However, very low-rated firms may have no choice and are forced by creditors to finance themselves with low maturity debt.

According to the same author, in order to avoid future refinancing difficulties and liquidity risk, firms with higher level of indebtedness may prefer debt with greater maturity.

So, from a certain minimum rating level, the costs associated with liquidity risk outweigh the benefits if the firms finance themselves in the short term, and they prefer the long-term debt. However, when the rating is very low, firms may don't have choice and lenders lead them to finance themselves with lower debt maturity. In this way, the author concludes that there is a non-monotonous function between choosing the maturity of the debt and the credit rating of the firm.

In line with Diamond's (1991), there are some studies that also proved that there is a non-monotonic relationship between debt maturity and credit ratings (Barclay and Smith, 1995).

Jun and Jen (2003) also developed a model proving that according to debt maturity, firms compare refinancing and interest rate costs with short-term debt benefits. The authors determined that interest rate risk in debt renewal increases with short-term debt, increasing the risk of bankruptcy. In the same connection, the authors found that firms that finance themselves in the short term are more exposed to the risk of refinancing and bankruptcy, to the same level of indebtedness since they are more vulnerable to macro and microeconomic conditions.

In other wise, Berger *et al.* (2005) also agree to the studies of Diamond's (1991) for low-risk firms. However, their evidence for high-risk firms it's different comparing with the evidence from Diamond's model. Berger argues that high-risk firms don't present significantly different maturities to intermediate-risk firms.

Antoniou *et al.* (2006) and Ozkan (2002) carried out studies in countries such as the United Kingdom, France and Germany regarding the maturity of the debt, concluding that it is not

related to the quality of the firms. Also the authors Stohs and Mauer (1996) and García-Teruel and Martínez-Solano (2010) demonstrated the non-monotonous relationship between debt maturity structure and firm quality. Other studies developed by Highfield (2008) have demonstrated a positive relationship between debt maturity and firm quality, with firms at higher risk not having access to long-term debt markets. The author didn't find conclusions that firms with very high rating and very low rating use more short-term debt compared to firms with intermediate rating.

Hypothesis 4: firms with high liquidity present debt with lower maturity.

2.1.4 Impacts of taxes

Regarding with taxes, since the existence of studies developed by Modigliani and Miller, several authors of the financial literature have shown that they have an impact on the choice of debts maturity.

Modigliani and Miller (1958) studied whether taxes actually influence the capital structure of a firm, proving that in the existence of a perfect capital market, the absence of taxes in the capital structure has no influence on it. The authors justify this fact with the inexistence of a tax relation in the market value of the firm and based on several assumptions, such as, costs of financial distress, agency costs, asymmetric information in an efficient Market and absence of taxes. With the existence of taxes, firms can maximize their value, since there is an incentive for firms to use debt rather than equity as a financing method, if debt costs are deductible and dividends are not (Modigliani and Miller, (1963)). When firms are incurring debt, they have associated interest which results in a tax benefit, when deducted from the results on which the charges are payable by them.

Later on, new studies emerged proving that there is a disincentive by firms in use the debt, also due to the existence of high tax rates on private investors (Miler, 1977).

In the same context, other authors referred a trade-off theory in which managers can optimize the value of the firm, through an optimum target among the advantages of tax purposes that debt provides and the costs of financial distress that it causes (Kraus and Litzenberger, 1973; Brennan and Schwartz, 1978; Kim, 1978 and Scott, 1976).

For Stiglitz (1974), according to the studies of Modigliani and Miller, assuming the inexistence of bankruptcy costs, perfect markets for all bond maturities, investment decisions as a given and the existence of a general equilibrium, there is an irrelevance not only of capital structure, but also of the structure of debt maturity in firm value. Another studies realized by Brennan and Schwartz (1978) demonstrated that with taxes, firms

should opt for short-term debt, because there is not taxable income to deduct the interest on their funding, coming into default.

However, reformulating the model carried out by Brennan and Schwartz (1978), Brick and Ravid (1985) demonstrated that if interest rates present a positive development, firms should opt for long-term debt, because it allows an increase in present value of tax benefits of a firm. The authors developed a theoretical model that relates the implications of taxes in the choice of debt maturity. Assuming an increasing temporal structure of interest rates, given the existence of tax benefits related to the payment of interest and reflecting an increasing risk of default associated with debt maturity, the authors argue that firms prefer to finance themselves with long-term debt, since it allows to increase its value. This is due to the fact that the tax benefits arising from long-term debt are greater than the benefits obtained from the alternative of using short-term debt in the first years of financing.

In the same sense, Brick and Ravid (1985, 1991) argue that when the term structure of interest rates is not flat, the expected value of tax benefits depends on the maturity of debt. If the yield curve is upward sloping, firms increase their value by increasing the amount of long-term debt. A term structure of interest rates with a positive slope implies that, under the unbiased expectations theory, the interest expense from issuing long-term debt is greater than the expected interest expense from rolling short-term debt in early years, and will be lower in later years. For that reason, the benefits of debt are accelerated using long-term debt. Likewise, short-term debt increases the firm's value if the yield curve has a negative slope. Consequently, a positive relationship can be expected between the term structure of interest rates and the proportion of long-term debt according to the tax explanation of debt maturity. In this way, issuing long-term debt reduces the firm's expected tax liability and consequently increases the firm's current market value. Conversely, if the term structure is downward sloping, issuing short-term debt increases firm value. Thus, the tax hypothesis implies that firms employ more long-term debt when the term structure has a positive slope.

Conversely, Kane *et al.* (1985) developed a model that determined the optimal structure of debt maturity, considering taxes, bankruptcy costs and debt issuance costs. The model shown that optimal debt maturity increases as fiscal debt advantages decrease, issuance costs increase and the volatility of the firm's value decreases.

On the other hand, Lewis (1990) argues that the taxes don't affect the maturity of debt. The model developed by Brick and Ravid (1985) assumes that firms determine their level of indebtedness before maturity, but according to Lewis (1999), if the level of indebtedness and its maturity have been determined at the same time, the choice of maturity of the debt will be

irrelevant. Stohs and Mauer (1996) studied the effects of tax benefits arising from indebtedness on debt maturity, proving a negative relationship between the effective tax rate and its maturity. In this way, the effective tax rate and the volatility of the value of the firm's assets are negatively correlated with the maturity of the debt, but the coefficients obtained are not economically significant. On the other hand, the author didn't find the correlation between debt maturity and interest rates.

On the other hand, García-Teruel and Martínez-Solano (2010) found a positive correlation between the tax rate and debt maturity, justifying this result with the argument of Emery (2001), which says that firms use short-term debt to avoid the long-term debt maturity, but they don't care about the fiscal effect on debt maturity.

Antoniou *et al.* (2006) studied that the relationship between debt maturity and fiscal issues like effective tax rate, temporal structure of interest rates and interest rate volatility, depends of the period and the country.

However, a study about the fiscal impact on the structure of debt maturity of Spanish SMEs, Lopez-Gracia and Mestre-Barberá (2011) concluded, that the effective tax rate is strongly correlated with debt maturity. The authors also confirmed the positive and statistically significant influence of interest rate volatility and the temporal structure of interest rates on debt maturity.

The authors Fan *et al.* (2012) concluded that firms, in which the tax benefit of debt is higher, tend to use more debt.

However, there are some authors that found no evidence for the negative tax relation, such as Barclay and Smith (1995), Guedes and Opler (1996) and Ozkan (2000 and 2002).

Hypothesis 5: the maturity of debt will increase when the effective tax rate decreases.

Hypothesis 6: The maturity of debt and the volatility of the firm's value are negatively correlated.

2.1.5 Impacts of Assets Maturity / Matching

The maturity of corporate debt can be synchronized with the lifetime of their assets (Morris, 1976). When the useful life of the assets of the firms ends, it is necessary to new investments, however, it can happen in a period that their debts are not yet finished.

Morris (1976) presented a theoretical model and assumed that firms opt for short term and long term debt. The long-term maturity of debt policy implies matching the maturity of the debt with the maturity of the assets, avoiding the existence of liquidity problems associated with debt service. Failure to combine the maturity of the debt with the maturity of the assets will lead to

an increase in the risk of debt default. If the debt matures after the useful life of the asset, there may be no returns to pay the debt service, on the other hand, if the debt is due before the useful life of the final assets, the firms may not have sufficient liquidity to pay their obligations. In order to minimize exposure to liquidity risk, firms must synchronize the term of their assets and liabilities.

Following Morris's (1976), Stohs and Mauer (1996) studies, firms may run the risk of not having sufficient liquidity to service the debt, if their maturity is less than the maturity of the assets due to the insufficiency of the cash flows generated; or vice versa, if the maturity of the debt is lower than the maturity of the assets, as a consequence of the end of the associated cash flows.

Myers (1977) added that the synchronization of the term of assets and liabilities reduces the costs of agency between shareholders and creditors. According to the author, the problem of underinvestment is due to the agency conflict between shareholders and debt creditors, and can be reduced by the maturity of the assets and liabilities of the firms, guaranteeing that the payment of the debts will be programmed to correspond to the decline of the value of assets.

In the same sense, Chan and Kanatas (1985) argue that collaterals can reduce the conflict when borrowers and lenders disagree about the true value of a project. According to authors, it is usually uncertain about the value of collateral than the expected return of a project that has not been undertaken. If collateral is pledged, lenders will feel more confident and will charge lower interest rates with longer maturities.

The authors Hart et Moore (1994) also confirm the matching between debt maturity and asset maturity, controlling the risks and costs of bankruptcy and verifying that slower depreciations of assets correspond to longer debt maturities.

The importance of the synchronization of the maturities of assets and liabilities was also studied and confirmed by several authors: Stohs and Mauer (1996), Guedes and Opler (1996), Ozkan (2000 and 2002), Graham and Harvey (2001), Antoniou *et al.* (2006), Körner (2007) and Teruel and Solano (2010). The authors argue that the greater the maturity of a firm's assets, the greater the maturity of its debt. However, contrary to this, García-Teruel and Martínez-Solano (2010) did not find evidence that asset maturity influences decisions about debt maturity (coefficients present positive and significant values, however close to zero).

However, according with the majority of the studies realized there is a positive relation between the maturity of debt and maturity of the assets that will be tested by the following hypothesis:

Hypothesis 7: the maturity of debt is higher with the maturity of the assets.

2.1.6 Impacts of Indebtedness

The levels of corporate indebtedness have a significant impact on their short and long-term financing. According to studies developed by Morris (1992), firms that tend to finance themselves in the long term, have high levels of indebtedness, in order to try to reduce their exposure to the risk of bankruptcy. Similarly, Diamond (1993), Leland and Toft (1996) also consider that firms with a high level of indebtedness use the long-term debt, in order to reduce the frequency with which they are indebted. The authors Leland and Toft (1996) based on a developed theoretical model, proved that the maturity of the debt influences the optimal point of indebtedness of the firms. The model relates the risk of bankruptcy and the optimum capital structure to the maturity of the debt, allowing to conclude that when firms are financed using long-term debt, the level of indebtedness of the firm is greater, whereas if they resort to short-term debt the optimal debt position is lower.

The authors Stohs and Mauer (1996) confirm the evidence proved by the authors mentioned above, adding that since the increase in the use of long-term debt is expected to be more closely monitored, there is an automatic positive relationship between the maturity of debt and corporate indebtedness. Stohs and Mauer (1996) argue that this correlation is automatic because a high amount of long-term debt leads to a higher corporate debt ratio.

In the same context, Johnson (2003) argues that, in order to firms reduce the problem of underinvestment, they reduce debt maturity and their level of indebtedness, minimizing the liquidity risk associated with short-term debt.

There are other authors, such as Scherr and Hulburt (2001), García-Teruel and Martínez-Solano (2010), Antoniou *et al.* (2006), Teruel and Solano (2010) who concluded that the most indebted firms use more long-term debt. According to authors Kirch and Terra (2012), kmindebtedness has been considered as an endogenous variable, since the level of indebtedness and debt maturity are jointly determined, with respect to the definition of the overall financing structure of the firm.

To test the relation between the level of indebtedness and the maturity of debt, we will use the following hypothesis:

Hypothesis 8: the higher is the level of indebtedness, the higher is the maturity of debt.

2.2 Country impacts

The choice of debt maturity is not only influenced by the variables previously developed according to the firms, but also influenced by variables associated with the institutional environment in which they are involved.

According to certain authors who will be referred below in this part, sometimes the information available to investors, the choice of the capital structure of the firm and the maturity of the debt depend on external factors firms, such as, the legal and financial system of a country, its culture and some macroeconomic variables.

In this sense, in this part of the dissertation will be presented the theories and hypothesis studied by some authors, that can also influence the choice of debt maturity.

2.2.1 Impacts of Financial System

According to some authors, there are several factors related to the financial system of a country that influence the choice of the debt maturity of a firms, such as the development and size of the banking system, stock market development and the preference of capital.

Financial institutions have a competitive advantage compared to investors, once they manage to control them (Fama, 1985). Financial institutions increase their competitive advantage by reducing the maturity of corporate debt, achieving greater control over corporate financing, maintaining strong bargaining power, and influencing corporate investment strategies.

When a country's banking sector is developed, short-term financing can be increased, according to studies by the authors Demirgüç-Kunt and Maksimovic (1999). The authors justify this with the advantage that financial institutions can more easily monitor short-term debt, rather than long-term debt, reducing borrowers and lenders. Also according to the author Fan *et al.* (2012), countries with more developed banking sectors finance firms have a shorter duration of debt, given the competitive advantage of financial institutions in controlling firms. This competitive advantage results by reducing the maturity of corporate debt, gaining greater control over corporate finance, maintaining strong bargaining power, and influencing their investment strategies.

According to the study by Fan *et al.* (2012), firms in countries with more developed banking sectors have lower debt maturity, although the ratio between financing choices and the size of the insurance industry is weak.

Nevertheless, there are authors that argue that monitoring can provide loans with longer maturities and that debt maturity is positively associated with the size of a country's banking sector. According to the author Diamond (1984), when assessing credit histories and the risk associated with corporate loans, financial institutions can grant credit for longer duration given the monitoring performed. Demirgug-Kunt and Masimovic (1999) also argue that because of

the financial institutions that gain competitive advantage and economies of scale, with greater monitoring and control of covenants, it is possible to grant long-term loans.

Also in the context of the development of a country's financial system, some authors argue that it does not have a relevant influence on the choice of debt maturity. Kirch and Terra (2012) argue that, given the arguments and previous studies, the results seem to be contradictory, as is the case with the authors Demirgüç-Kunt and Maksimovic (1999) and, financial system of a country, simple indicators are used instead of compound indices to measure the development of a financial system

On the other hand, the size and development of the stock market also influences the choice of debt maturity. According to Dermirguc-Kant and Maksimovic (1999), a developed stock market leads to the transmission of important information not for the financial institutions, as for the creditors and for the fact that there is more information about the risk of the listed and lesser firms. However, given the further development of the bond market, there are more opportunities for investors to diversify, with firms eventually choosing to use equity rather than debt.

The studies developed by Demirguc-Kunt and Maksimovic (1999), proved that the size and development of the banking system and stock market were associated with the size of the firm and had an impact on the choice of debt maturity. In small firms, it's the size of the banking sector that influences the choices of debt maturity, that is, in countries with larger banking sectors, small firms have lower short-term debt. Regard to large firms, the most influence of their choices is the development and size of the stock market. In countries with more developed capital markets, large firms use more debt maturity. However, the level of activity in the shareholder market dimension has no influence on the choices of small firms.

Finally, another financial factor that also influences the choice of the maturity of corporate debt is associated with the preference of capital providers, according to studies by Fan *et al.* (2012), focused on banks, insurance firms and pension funds. The author compared the choice of maturity of the debt of 39 countries, concluding that the choice of maturity of the debt of these countries is directly related to the maturity of the liabilities of the firm. It has been found that in countries with large insurers and pension funds, they tend to have liabilities with a longer maturity and are mostly funded in the long term. In countries with a large banking system, firms tend to have lower maturity liabilities, with banks preferring to lend in the short term.

Hypothesis 9: in countries with larger banking system, firms tend to have lower debt maturity.

Hypothesis 10: the maturity of corporate debt is high in countries with larger stock markets.

Hypothesis 11: the maturity of corporate debt is high in countries with larger and more active stock markets.

2.2.2 Impacts of Legal System

The legal system is based on a set of rules and legal norms for the functioning of firms, state and society of a given country, which allow reducing and mitigating possible conflicts between them, being associated with sanctions in case of non-compliance. According to some authors, the choice of debt maturity is related to factors associated with the legal system of a country.

The first studies in this sense were developed by Diamond (1991, 1993) and Rajan (1992), arguing that if a country presents a legal system characterized as inefficient and the costs of using it are high, firms tend to finance themselves through short-term debt. The fact that firms finance themselves with a lower maturity, leads to a small capacity for creditors to be deceived, since the financing period is short and there is more accurate monitoring. On the other hand, the authors also argue that the existence of an efficient legal system is very important for the assets of firms that depreciate during their life.

In the same sense, according to the authors Demirguc-Kunt and Maksimovic (1999) firms use more long-term debt when they operate in countries with legal systems classified as more effective, since their assets also have a greater maturity. According to the same authors, as referred in the chapter about agency costs discussed earlier, there are conflicts of interest between managers and external investors, which affect the choice of debt maturity. Fan *et al.* (2012) consider that the quality of a country's legal system can lead to a decrease in the agency problems between shareholders and external investors, which has an impact on corporate financing choices. This is justified by the existence of rules concerning contracts between firms and investors, by the relevant and appropriate choice of financial assets for the firm and by the control of investors, as regards the exercise of their legal rights.

On the other hand, Fan *et al.* (2012) also argue that in countries where there is greater corruption and the legal system is less effective, with laws that are difficult to apply or weak, firms tend to be financed through short-term debt.

According to several authors, the legal system can be evaluated based on two types of law: civil-law and common-law (La Porta, Lopez-de-Silanes, Andrei Shleifer and Robert Vishny, 1998). The authors argue that developed countries, with more effective laws and common-law, have a greater protection of the rights of creditors. On the other hand, the high efficiency of a country's legal system is positively correlated with debt maturity (Demirgüç-Kunt and Maksimovic, 1999).

Another relevant factor in a country's legal system that affects the maturity of debt is related to the compliance with contracts for firms and creditors. If, there are firms not financed by the financing contracts of the division, for example, because of bankruptcy, the legal system allows a guarantee for the granting of credits and the recovery of the flows invested by creditors (Bae and Goyal, 2009). In this way, compliance with the contracts by the firms, leads to a greater availability to credit.

In this way, to test the relation between the legal system and maturity of debt we have the following hypothesis:

Hypothesis 12: the maturity of debt will be higher, if the legal system of a country is higher too.

Hypothesis 13: the type of legal system (common law and civil law) has an impact in the maturity of debt.

2.2.3 Impacts of Macro-Economic Variables

As there are microeconomic variables that influence the choice of debt maturity, macroeconomic variables also have an impact on debt maturity (Zhang and Sorge, 2010). According with some authors, the rate of inflation and its volatility, as well as the level of development of a country's economy, are macroeconomic variables that influence the choice of the maturity of a firm's debt.

Demirguc-Kunt and Maksimovic (1999) and Zhang and Sorge (2010) affirmed the rate of inflation influences the value of the currency and the long-term debt interest rate. The higher the rate of inflation, lower the maturity of the debt. On the other hand, if the uncertainty of the inflation rate is higher, lower is the credibility of creditors in grant long-term credits, because financial institutions do not make so much money available. Miller (1997) proved that countries with political instability have a greater tendency to increase the uncertainty of inflation and, consequently, the existence of a greater number of firms that resort to short-term financing.

Regard to the interest rate volatility, Kirch, Terra and Fan *et al.* (2012) argued that there is a positive relation between the volatility of the rate of inflation and the short-term debt. According to the authors, higher uncertainty of the rate of inflation in the future, leads the creditors to resort short-term debt, reducing the availability of long-term financing.

Another important macroeconomic variable is related to the level of development of the economy of a country. According to the authors Demirguc-Kunt and Maksimovic (1999) and Fan *et al.* (2004), firms located in a developing country have a higher debt maturity than firms operating in developed countries. On the other hand, Myers (1977) and Barne *et al.* (1980)

demonstrated the relationship between growth opportunities and the level of development of a country's economy with debt maturity. They argue that firms turn to short-term financing when they have great growth opportunities that depend on the wealth of the economy where they operate.

Hypothesis 14: The higher the rate of inflation, the lower the maturity of the debt.

Hypothesis 15: The lower the volatility of the inflation rate, the higher the maturity of debt.

Hypothesis 16: Firms located in a developing country have a higher debt maturity than firms operating in developed countries.

3. Sample description and variables

3.1 Sample

To development this study we selected listed and unlisted firms from 16 countries of the European Union. We excluded from our sample the other countries from European Union, because it was just considered the countries with the minimum of the same number of observations per year, to avoid the missing values. The period for this sample refers to the years from 2007 to 2015 and includes 3.618.795 observations.

The data obtained about the characteristics of the firms were collected from the Amadeus database and, in order to determine all the variables, includes the net income, equity, depreciations, total assets, current assets, current liabilities, income after and before taxes, tangible fixed assets and operational cash flow.

About the information for each country, a number of sources have been used, such as the International Monetary Fund, World Federation of Exchanges database, World Bank, the European Central Bank, the OECD, Transparency International and International Financial Statistics and data files.

Table 1 – Number of firms analyzed for each country.

Countries	Number of firms
Austria	6.992
Belgium	1.073.056
Bulgaria	49.553
Croatia	97.573
France	799.981
Germany	126.920
Greece	33.439
Italy	153.134
Luxembourg	5.079
Malta	103
Netherlands	3.377
Poland	50.425
Portugal	123.169
Slovakia	129.598
Slovenia	39.239
Spain	927.157
TOTAL	3.618.795

3.2 Variables

3.2.1 Dependent Variable

The dependent variable defined to develop the model is the maturity of the debt: MATDEBT. According with some authors, debt maturity is measured by the debt maturity of a given maturity over total debt. However, depending on the author, the maturity of debt differs because there are some definitions.

Based on the accounting and several empirical studies, Barclay and Smith (1995) refer to long-term debt when the maturity has more than three years, while Ozkan (2000 and 2002) defines the long-term debt with a maturity of more than five years. The authors Stohs and Mauer (1996) consider the weighted average of all debt and Scherr and Hulburt (2001), Barclay *et al.* (2003), Antoniou, Guney and Paudyal (2006), Stephan *et al.* (2011) and Fan *et al.* (2012) measured long-term debt considering the minimum of one year. In another approach, Guedes and Opler (1986) use the maturity of the bonds issued to measure the long term debt. In this specific case, the approach used is the long-term debt as the proportion of debt that matures after one year, from the Amadeus Databasis:

$$MATDEBT_{it} = \frac{\text{Long – term debt (> 1 year)}}{\text{Total debt}} \quad (3.1)$$

3.2.2 Independent Variables

In this section will be presented all of the independent variables (variables of firm impacts and country impacts), to be included in the empirical models and how they will be used to explain the choices of debt maturity.

3.2.2.1 Variables of firm impacts

Firm size

According with the literature and some empirical studies, there are several indicators to represent the firm size variable.

Opler (1996), Scherr and Hulburt (2001), Ozkan (2000 and 2002), Antoniou *et al.* (2006), Körner (2007) and Kirch and Terra (2012) proved that is possible use the logarithm of sells as a measure of the size of firm. Stohs and Mauer (1996) and García-Teruel and Martíney Solano (2010) use as indicator the market value of a firm logarithm and Antoniou *et al.* (2006) and Fan *et al.* (2012) use the ln of book value of the assets.

In our study, to measure and verify the positive relationship between the maturity of debt and size of the firms referred in the literature, it will be used the book market of assets logarithm.

$$SIZE = \ln(\text{book value of assets}) \quad (3.2)$$

Growth opportunities

Myers (1977) studied that it is possible minimize the problem of sub-investment, issuing short-term debt, this is beneficial for the firms with more opportunities of investments. In this sense, there is a negative relation between the opportunities of investment and the maturity of debt and, according with some empirical studies, there are indicators to measure it.

Often, the authors use the ratio market-to-book to measure the investment opportunities of the firms, such as Guedes and Opler (1996), Stohs and Mauer (1996), Ozkan (2000 and 2002), Scherr and Hulburt (2001), Fan *et al.* (2012).

Scherr e Hulburt (2001) proved that there are other variables to measure the growth opportunities: the ratio measured by the proportion of the number of employers in a firm related

with the investigation and development of activities, to measure the investment in intangible assets; the tax of the historical growth of sells; the investment in fixed tangible assets, measured by the ratio between depreciations and total asset.

Heyman *et al.* (2008) also uses the ratio of the growth historical of the **asset tax**, assuming that the firms that grew are the firms with more opportunities of growth in the future.

According with Körner (2007), there is other measure to test the potential growth of the firms, the ratio between the annual expense of depreciation and the book value of the asset.

In our study, to verify the assumption that the maturity of debt has a positive correlation with the growth opportunities, we will use the ratio between the depreciation and the book value of the asset, by Körner (2007):

$$GROP = \frac{\text{depreciations}}{\text{book value of the asset}} \quad (3.3)$$

Asymmetric information and quality of the firm

There is a relationship between firm quality and debt maturity, since in equilibrium higher quality firms issue more debt in the short term and, on the other hand, lower quality firms issue more debt in the long term (Flannery, 1986). According to the author, in the presence of debt issue costs, firms can signal the market correctly. In this sense, good firms can develop a strategy of issuing short-term debt, which will differentiate them from bad firms in the market. In order to measure the relationship between debt maturity and firm quality, several indicators have been studied by some authors. Stohs and Mauer (1996) and Cai *et al.* (2008) used as an indicator the ratio between the change in earnings per share in period t and t + 1 and the share price in period t. Cai *et al.* (2008) also use the profitability of the asset as an indicator (EBIT / asset).

Ozkan (2000 and 2002), as an indicator of firm quality, uses the ratio between the difference of the results in period t + 1 and period t, with the results in period t. Antoniou *et al.* (2006) use two indicators: the ratio between net debt and share capital and the ratio of the sum of net results to depreciation (net free assets) and the net debt of the firm.

More recently, Stephan *et al.* (2011) used to measure the quality of the firm, the rotation of the asset (sales / total assets). In these case, we are considering the return on equity ratio (ROE):

$$QUALI = \frac{\text{Net income}}{\text{Total equity}} \quad (3.4)$$

Liquidity

According to the author Diamond (1991) firms with better quality should prefer the short term financing. In fact, it may happen that cash flows generated by firms are not sufficient to meet their obligations, and these can have problems if they resort to short-term debt. In this way, there are ratios that allow calculation of liquidity, such as the current ratio:

$$LIQ = \frac{\text{Current assets}}{\text{Current liabilities}} \quad (3.5)$$

Effective tax rate

When the effective tax rate is low, firms issue long-term debt (Brick and Ravid, 1985). However, according to the literature and empirical studies performed by other authors, a mix of results was verified.

There are several indicators that allow us to study the correlation between the effective corporate tax rate and the maturity of the debt. Stohs and Mauer (1996), Ozkan (2000 and 2002), Antoniou *et al.* (2006) and Cai *et al.* (2008) use the ratio between actual taxes paid and pre-tax income as an indicator. López-Gracia and Mestre-Barberá (2011) also use this indicator, but to do not include firms with negative results in the sample to avoid errors in conclusions about the effective tax rate. In addition, the authors also use the ratio between profit tax and operational cash-flow.

Thus, following most authors, we will use the ratio between taxes paid and pre-tax income to measure the relationship between the effective tax rate and the maturity of debt.

$$TAX = \frac{\text{Income taxes}}{\text{Income before taxes}} \quad (3.6)$$

Volatility of firm's value

According with some studies, firms that present greater volatilities in their value, tend to have higher costs and risks of going bankrupt in the future.

Kane *et al.* (1985) considers that if firms use short-term debt and have frequent changes in their capital structure, they are able to reduce restructuring and bankruptcy costs. In this way, the author establishes a negative relation between the maturity of the debt and the volatility of the value of the firm.

To analyze this measure, Ozkan (2002) and Cai *et al.* (2008) used the standard deviation of the ratio between the annual variation of EBITDA and the mean of the assets value. However, according with Mestre-Barberá and López-Gracia (2011) opted for the ratio between the standard deviation of the operational cash-flows of the firm and the mean of the total asset during the period of study.

In the presente study, it is considered the approach used by the authors Mestre-Barberá and López-Gracia (2011), such as:

$$VOL = \frac{\sqrt{\text{operational cash flows}}}{\text{Average of total assets}} \quad (3.7)$$

Asset Maturity

According with Morris (1976), Stochs and Mauer (1996) firms tend to match the maturity of the assets with the maturity of liabilities in order to reduce the agency costs of debt.

According to the principle of the synchronization between the maturity of assets and the maturity of the liabilities (immunization hypothesis), a positive relation between the variables is expected to occur.

The empirical literature has essentially focused on two indicators of asset maturity: the maturity of non-current assets, i.e. the ratio between net tangible fixed assets (land, buildings and equipment) and depreciation of the year (Antoniou *et al.*, 2006 and Ozkan, 2002), and the weighted average maturity of the various subgroups of assets (García-Teruel and Martínez-Solano, 2010). However, the lack of information available for the variable depreciations for a large part of the observations, limited the possibility of using those indicators. Thus, the indicator of the asset maturity variable that we use to test the hypothesis of immunization of asset maturity and debt is the ratio of tangible fixed assets to the total value of the asset.

$$AMAT = \frac{\text{Tangible fixed assets}}{\text{Total assets}} \quad (3.8)$$

Level of Indebtedness

The existence of a positive relationship between the level of indebtedness and the maturity of the debt was developed by some authors and there are several indicators that allow measure it. According with Morris (1992) and Diamond (1993), in order to delay the exposure to bankruptcy risk, there is a tendency for firms to issue long-term debt.

On the other hand, Stohs and Mauer (1996) argue that there is an automatic correlation between debt maturity and level of indebtedness, because a high long-term debt inevitably leads to an inevitable accompaniment of the increase of indebtedness.

The most commonly used indicators are the debt-to-total ratio (Antoniou et al., 2006; García-Teruel and Martínez Solano, 2010; Cai et al., 2008; Scherr and Hulburt, 2001; Stephan et al, 2011); the ratio between total debt and the firm's market value (Stohs and Mauer, 1996 and Kirch and Terra, 2012). Antoniou *et al.* (2006) also used the ratio between net debt and total assets in a study, and concluded that the results obtained with the different measures of the level of indebtedness are similar.

In this particular study, to test the hypothesis of the positive relationship between indebtedness and debt maturity, we will use the following indicator referred to above:

$$INDEB = \frac{\text{Total debt}}{\text{Total asset}} \quad (3.9)$$

3.2.2.1 Variables of country impacts

Financial System

According to some authors, there are several factors related to the financial system of a country that influence the choice of the debt maturity of firms. To evaluate this influence we used three variables: the dimension of bank's system (BSD), the dimension of shareholders' market (SMD) and the shareholders' market activity (SMA), all provided by the World Bank Data.

According with Zheng *et al.* (2012), to measure the dimension of the bank system (BSD), we will use the ration between the domestic credit provided by bank and the GDP of the country:

$$BSD = \frac{\text{Domestic credit provided by bank}}{\text{GDP}} \quad (3.10)$$

Related with the shareholders market dimension (DMA), we will use the ration of the market capitalization by the PIB of the country:

$$SMD = \frac{\text{Market capitalization}}{\text{GDP}} \quad (3.11)$$

To finish, the shareholders market activity (MA), according with Demirgüç-Kunt e Maksimovic (1999), will be measured by the ratio of the activity between the shares value per year and market capitalization.

$$SMA = \frac{\text{Shares value per year}}{\text{Market capitalization}} \quad (3.12)$$

Legal System

According with Demirgüç-Kunt and Maksimovic (1999) and Fan *et al.* (2012), in order to reduce agency problems between managers and external investors, should be considered the quality of a country's legal system and the type of legal system implemented.

In order to measure the quality of the efficiency legal system of a country, Demirgüç-Kunt and Maksimovic (1999) and Zheng *et al.* (2012) use the Law and Order index, produced by the International Country Risk Guide (ICR). More specifically, this measure makes possible to assess the confidence of the citizens of a country, in the firms to create and implement the laws and to measure possible existing conflicts.

However, the authors Zhang and Sorge (2010) and Fan, *et al.* (2012) use the level of corruption to determine the efficiency of the country's legal system. This index is estimated based on the Corruption Perceptions Index, prepared by Transparency International and it presents sectional and temporal data (unlike the Law and Order index that doesn't have comparable historical data).

In the same context, another important measure is the protection of property rights. This measure is produced by the Global Competitiveness Report and allow us understand if property rights including over financial assets are well protected by law and the ability to enforce claims in the event of default.

In this study, to verify the impact of the efficiency and quality of a country's legal system in the maturity of debt choices, it will be used the variable efficiency of legal system (ELS) based on the Property Rights of a country.

To study the type of legal system (TLS), it will be used a dummy variable (1, if the legal system of the country is of the customary type and 0, otherwise), according with La Porta, Lopez-de-Silanes *et al.* (2008).

Macroeconomic variables

According with the literature review, there are some macroeconomic variables that influence the choice of the maturity of debt. In order to analyze this relation we have three variables, such

as the as the inflation rate (IR), the volatility of inflation rate (VIR) and the development of the economy of a country (GDP).

We defined that the impact of the inflation rate variable is measured by the annual variation consumer price index, provided by the World Bank Group. According with the same source, the volatility of inflation variable is measured by the standard deviation of the inflation rate, between the period t-4 and t. For the last variable, related with the development of the economy of a country, we defined the GDP per capita as a measure, expressed in current US dollars, by the World Bank.

4. Methodology

After selected the whole sample for the present study and defined the variables that will allow to explain it, we defined a methodology. All the analyses will be elaborated based in panel data methodology, with the support of the STATA program, that allows the data treatment.

This methodology is based on a sectional sample of 3.618.795 firms, observed between the years 2007 and 2015. The panel data allow a more realistic study to obtain better estimators and to measure effects that may not be observed in other studies, such as sectional and temporal studies (Hsiao, 2007). In addition, according to the same author, this method allows to increase degrees of freedom and considers a greater number of observations. Another advantage of using this methodology is that unobserved or omitted factors can be controlled, since all the time can be constant factors that affect the dependent variable (Woldridge, 2009). On the other hand, it is also possible to control the possible heterogeneity present in firms' observations (Gujarati, 2004).

Normally, to study panel data, several regression models can be used, such as Pooled Ordinary Least of Squares (OLS) regression, the Fixed Effects regression and the Random Effects regression (Gujarati 2004; Asteriou and Hall, 2007; Pais and Gama 2015). In the present study it was decided to do the following models:

Model 1 – OLS linear pooled regression

The first model corresponds to OLS, it is the common model used to study variables and one of the models suggest by Antoniou *et al.*(2006). This model allow us to see what is the impact of our independent variables in the maturity of debt and is defined as:

$$\begin{aligned}
 MATDEBT_{i,t} = & \alpha + \beta_2 SIZE_{i,t} + \beta_3 QUALI_{i,t} + \beta_4 TAX_{i,t} + \beta_5 LIQ_{i,t} + \beta_6 AMAT_{i,t} + \\
 & \beta_7 INDEB_{i,t} + \beta_8 BSD_{i,t} + \beta_9 SMD_{i,t} + \beta_{10} SMA_{i,t} + \beta_{11} ELS_{i,t} + \beta_{12} TLS_{i,t} + \beta_{13,i} IR_{i,t} + \\
 & \beta_{14} VIR_{i,t} + \beta_{15} GDP_{i,t} + \beta_{16} VOL + \beta_{17} GRO P + \varepsilon_{i,t}
 \end{aligned}
 \tag{4.1}$$

Where,

- $SIZE_{i,t}, QUALI_{i,t}, TAX_{i,t}, LIQ_{i,t}, AMAT_{i,t}, INDEB_{i,t}, BSD_{i,t}, SMD_{i,t}, SMA_{i,t}, ELS_{i,t}, TLS_{i,t}, IR_{i,t}, VIR_{i,t}, GDP_{i,t}, VOL_{i,t}, GRO P_{i,t}$ are the independent variables (determinants), with i =firm and j =time;
- $\varepsilon_{i,t}$ is the error term;
- β_k is the coefficient of the independent variables.

Model 2 – Firm fixed effect regression

The second model is to control the unobserved effects, that are constant across time and differ among firms. With this model we can estimate firm characteristics that have impact in the maturity of debt, creating a dummy for each firm. The model is defined as:

$$\begin{aligned}
 MATDEBT_{i,t} = & \beta_0 + \beta_1 SIZE_{i,t} + \beta_2 QUALI_{i,t} + \beta_3 TAX_{i,t} + \beta_4 LIQ_{i,t} + \beta_5 AMAT_{i,t} + \\
 & \beta_6 INDEB_{i,t} + \beta_7 BSD_{i,t} + \beta_8 SMD_{i,t} + \beta_9 SMA_{i,t} + \beta_{10} ELS_{i,t} + \beta_{11} IR_{i,t} + \beta_{12} VIR_{i,t} + \\
 & \beta_{13} GDP_{i,t} + \beta_{14,i} VOL + \beta_{15,i} GRO P + \omega_i + \varepsilon_{i,t}
 \end{aligned}
 \tag{4.2}$$

Where,

- $SIZE_{i,t}, QUALI_{i,t}, TAX_{i,t}, LIQ_{i,t}, AMAT_{i,t}, INDEB_{i,t}, BSD_{i,t}, SMD_{i,t}, SMA_{i,t}, ELS_{i,t}, TLS_{i,t}, IR_{i,t}, VIR_{i,t}, GDP_{i,t}, VOL_{i,t}, GRO P_{i,t}$ are the independent variables (determinants), with i =firm and j =time;
- $\varepsilon_{i,t}$ is the error term;
- ω_i measures the unique characteristic for each firm for unobservable heterogeneity;
- β_k is the coefficient of the independent variables.

Model 3 and Model 4 – Country and Industry effect linear regressions, respectively.

This two models allow to generate some coefficients assuming individual country and industry characteristics. We use the follow regressions for each models 3 and 4, respectively:

$$\begin{aligned}
 MATDEBT_{i,t} = & \beta_1 + \beta_{2,i} SIZE_{i,t} + \beta_3 QUALI_{i,t} + \beta_4 TAX_{i,t} + \beta_5 LIQ_{i,t} + \beta_6 AMAT_{i,t} + \\
 & \beta_7 INDEB_{i,t} + \beta_8 BSD_{i,t} + \beta_9 SMD_{i,t} + \beta_{10} SMA_{i,t} + \beta_{11} ELS_{i,t} + \beta_{12} TLS_{i,t} + \beta_{13} IR_{i,t} + \\
 & \beta_{14} VIR_{i,t} + \beta_{15} GDP_{i,t} + \beta_{16} VOL_{i,t} + \beta_{17} GROU + \beta_{18} DUMMYCOUNTRY + \varepsilon_{i,t} \quad (4.3)
 \end{aligned}$$

$$\begin{aligned}
 MATDEBT_{i,t} = & \beta_1 + \beta_2 SIZE_{i,t} + \beta_3 QUALI_{i,t} + \beta_4 TAX_{i,t} + \beta_5 LIQ_{i,t} + \beta_6 AMAT_{i,t} + \\
 & \beta_7 INDEB_{i,t} + \beta_8 BSD_{i,t} + \beta_9 SMD_{i,t} + \beta_{10} SMA_{i,t} + \beta_{11} ELS_{i,t} + \beta_{12} TLS_{i,t} + \beta_{13} IR_{i,t} + \\
 & \beta_{14} VIR_{i,t} + \beta_{15} GDP_{i,t} + \beta_{16} VOL_{i,t} + \beta_{17} GROU + \beta_{18} DUMMYINDUSTRY + \varepsilon_{i,t} \quad (4.4)
 \end{aligned}$$

Where,

- $SIZE_{i,t}, QUALI_{i,t}, TAX_{i,t}, LIQ_{i,t}, AMAT_{i,t}, INDEB_{i,t}, BSD_{i,t}, SMD_{i,t}, SMA_{i,t}, ELS_{i,t}, TLS_{i,t}, IR_{i,t}, VIR_{i,t}, GDP_{i,t}, VOL_{i,t}, GROU_{i,t}$ are the independent variables (determinants), with i =firm and j =time;
- $DUMMYINDUSTRY$ and $DUMMYINDUSTRY$ are the factors that are controlled.
- $\varepsilon_{i,t}$ is the error term;
- β_k is the coefficient of the independent variables.

In this work the coefficients matrix and some descriptive statistics will be developed to have better conclusions and understand the relationship between all the variables present in the models.

5. Empirical Results

5.1 Descriptive Statistics Analysis

According with the table 2 presented, we can observe the descriptive statistics for all the variables included in the present study, dependent and independent, for the period from 2007 to 2015. During the referred period, it is possible to observe that on average, firms have 23.79% of their debt maturing after one year. The N refers to the number of firms that were observed in the sample. We can also observe that the median value corresponds to 12.40%.

Table 2 - Descriptive statistics for all the sample (firms and country specific variables).

Period of 2007 -2015					
Variables	N	Mean	Std.Dev.	Median	Max
Debt maturity (DEBTMAT)	3618795	0.2379	0.2735	0.1240	0.8882
Size (SIZE)	3618791	6.6259	1.5645	6.5206	10.4209
Growth opportunities (GROP)	3618795	0.0515	0.0488	0.0364	0.2091
Quality (QUALI)	3618795	0.1642	0.1824	0.1514	0.9785
Liquidity (LIQ)	3618795	2.8989	4.0379	1.5733	4.2585
Effective tax rate (TAX)	3618795	0.7943	0.2291	0.7895	1.286
Volatility of the firm value (VOL)	3618795	0.0163	0.0173	0.0104	0.0816
Asset maturity (AMAT)	3618795	0.3043	0.2801	0.2147	0.9428
Level of indebtedness (INDEB)	3618795	0.5565	0.2544	0.5802	0.9645
Bank system dimension (BSD)	3618795	0.0003	0.0005	0.0002	0.0248
Shareholder market dimension (SMD)	3618795	78.36	42.25	71.32	327.79
Shareholder market activity (SMA)	3618795	145.92	51.32	116.97	271.68
Protection of property rights (ELS)	3618795	5.2345	0.7621	5	7
Type of legal system (TLS)	3618795	0,0193	0.0013	0	1
Annual consumer price index (IR)	3618795	1.8373	4.7120	2.0310	11.1230
Volatility of inflation rate (VIR)	3618795	0.9794	0.6069	0.9212	3.317
GDP per capita (GDP)	3618795	36941.93	10570.54	40838	117508

Maturity of debt

According with table 3, we can observe the evolution of some statistics during the period between 2007 and 2015.

It is possible observe that the number of observations is similar all the years, excluding the year 2007 and 2015, that we had less number of observations in the sample. Looking to the mean values, we can verify that during these years, for our sample, the debt maturity ration increased from 26.59% in 2007 to 32.25% in 2015. It is important refer that we can also observe that during the financial crises the mean of debt maturity decreased a little. The average of debt maturity in 2010 was 22.73% and decreased to 22.45% in 2011. The standard deviation presents similar results for the period analyzed.

Analyzing the debt maturity mean by country present in the table 4, we can observe that in our sample in the countries Spain and Netherlands the firms have higher maturity of debt average. In Luxembourg and Slovakia we can observe the opposite.

Table 3 - Debt maturity evolution for the whole sample.

Year	N	Mean	Std. Dev.	Median
2007	348010	0.2659	0.2798	0.1722
2008	469468	0.2365	0.2711	0.1245
2009	452352	0.2454	0.2752	0.1369
2010	482556	0.2273	0.2712	0.1052
2011	482866	0.2245	0.2701	0.1006
2012	439111	0.2290	0.2722	0.1069
2013	427932	0.2257	0.2699	0.1038
2014	394398	0.2321	0.2704	0.1169
2015	122102	0.3225	0.2852	0.2591
Total	3618795	0.2379	0.2735	0.1240

Table 4 - Debt maturity mean by country.

Country	Mean
Austria	0.1471
Belgium	0.2606
Bulgaria	0.1347
Croatia	0.1841
France	0.1353
Germany	0.2406
Greece	0.1597
Italy	0.1192
Luxembourg	0.0643
Malta	0.1513
Netherlands	0.3190
Poland	0.1367
Portugal	0.3429
Slovakia	0.0465
Slovenia	0.2921
Spain	0.3516

Variables of firm impacts

According with the presented table 5 and 6, we can observe the median of all the variables related with firm impacts in our study and its evolution during the years 2007 to 2015, respectively.

Related with the dimension of the firms, Austria and Netherlands have the firms with bigger size and Croatia and Slovakia have the firms with smaller size. Between the period 2007 and 2015, the median of size of the firms increased every year.

The countries with firms that have more growth opportunities are Belgium and Slovakia, with a similar value of median. However, Malta and France have the firms with less growth opportunities in our sample. Analyzing the evolution of the median for all the countries in our sample, the growth opportunities median decreased from 4% in 2007 to 2% in 2015, suggesting that financial crisis had an impact in the growth opportunities of the firms.

Analyzing the level of indebtedness in our sample, that in this study consists in the ratio between

total debt and total assets of the firms, according with the results the firms have in general high level of indebtedness. The country that has firms with more debt is Malta, with the ratio of approximately 75% and Bulgaria is the country with a small level of indebtedness (51%), but this level is high too. However, between 2007 and 2015, the level of indebtedness in the countries has been decreasing. According with the median, in 2015 the ration verified a value of 54%.

The firms with higher maturity of assets are located in Netherlands and Slovenia. Taking in account that this measure results the ratio between fixed tangible assets and total assets, in these two countries 34% and 41% are fixed tangible assets, respectively. Luxembourg is the country where the firms have less assets maturity, with the median value of 8%. For our sample, between 2007 and 2015 this variable doesn't have a specific trend.

In terms of taxes, it is possible observe that the firms pay a high value of their pretax income. This measure is based on the ratio between incomes before taxes and after taxes, and it is possible observe that the countries that has the highest tax are Bulgaria and Slovenia. In the opposite way Italy is the country with firms that are paying with a lower tax.

Table 5 – Median of each variable of firm impacts, by country.

Country	SIZE	GROP	QUALI	LIQ	TAX	VOL	AMAT	INDEB
Austria	9.8849	.0341	0.1237	1.355	0.7902	0.0021	0.215	0.6538
Belgium	6.1203	.0561	0.2311	1.565	0.7955	0.0147	0.309	0.5714
Bulgaria	6.8068	.0376	0.3125	1.862	0.9	0.0113	0.2691	0.5124
Croatia	5.4467	.0534	0.2625	1.515	0.7931	0.0217	0.2406	0.5963
France	6.4692	.0261	0.2625	1.588	0.8421	0.0119	0.0811	0.5467
Germany	9.2092	.0370	0.2225	1.9	0.7186	0.0029	0.229	0.6357
Greece	8.0252	.0298	0.0925	1.411	0.7713	0.0044	0.2298	0.5834
Italy	6.2785	.0196	0.0915	1.524	0.6364	0.0081	0.1663	0.6858
Luxembourg	8.6181	.0284	0.2242	2.129	0.7895	0.0039	0.0783	0.5683
Malta	8.9493	.0235	0.2258	1.152	0.6557	0.0034	0.1346	0.7478
Netherlands	9.3379	.0438	0.2217	1.493	0.7634	0.0028	0.3454	0.6500
Poland	8.0980	.0333	0.1213	1.538	0.8052	0.0053	0.3129	0.5178
Portugal	5.9610	.0374	0.1113	2.031	0.7667	0.0122	0.2207	0.6245
Slovakia	5.5529	.0593	0.3324	1.344	0.8085	0.0217	0.2686	0.6060
Slovenia	6.4232	.0493	0.0965	1.376	0.8957	0.0111	0.4160	0.6333
Spain	6.9451	.0274	0.0922	1.533	0.7544	0.0069	0.2781	0.5954

Notes: SIZE – measures the size of the firms; GROP – growth opportunities of a firm; QUALI – quality of firm; LIQ - liquidity; TAX – effective tax rate; VOL – volatility of firms' value; AMAT - ; INDEB – level of indebtedness

Table 6 - Median of each variable of firm impacts, by year.

GROP		LIQ		TAX		AMAT	
Year	Median	Year	Median	Year	Median	Year	Median
2007	0.0437	2007	1.4166	2007	0.7647	2007	0.2768
2008	0.0390	2008	1.4933	2008	0.7777	2008	0.2175
2009	0.0381	2009	1.5625	2009	0.7919	2009	0.2133
2010	0.0372	2010	1.5722	2010	0.8	2010	0.2066
2011	0.0365	2011	1.5806	2011	0.8	2011	0.2061
2012	0.0355	2012	1.6150	2012	0.7962	2012	0.2039
2013	0.0343	2013	1.626	2013	0.7974	2013	0.1993
2014	0.0319	2014	1.7045	2014	0.8	2014	0.1918
2015	0.0241	2015	1.7127	2015	0.7586	2015	0.2642

SIZE		QUALI		INDEB		VOL	
Year	Median	Year	Median	Year	Median	Year	Median
2007	6.4134	2007	0.3185	2007	0.6478	2007	.0119
2008	6.4361	2008	0.3120	2008	0.6115	2008	.0117
2009	6.4754	2009	0.2569	2009	0.5901	2009	.0109
2010	6.4630	2010	0.2314	2010	0.5829	2010	.0109
2011	6.4876	2011	0.2215	2011	0.5764	2011	.0106
2012	6.5337	2012	0.1235	2012	0.5632	2012	.0099
2013	6.5439	2013	0.1122	2013	0.5557	2013	.0098
2014	6.6133	2014	0.0965	2014	0.5305	2014	.0094
2015	7.2744	2015	0.0921	2015	0.5378	2015	.0056

Notes: SIZE – measures the size of the firms; GROP – growth opportunities of a firm; QUALI – quality of firm; LIQ - liquidity; TAX – effective tax rate; VOL – volatility of firms' value; AMAT - ; INDEB – level of indebtedness

Variables of country impacts

To analyze the country impacts on debt maturity we selected the legal system as measure. Looking to the table 8, we can observe some statistics by country of this measure.

As referred in the literature review, the legal system is based on the index of property rights, from Global Competitiveness report, that measures the ability to enforce claims if some default happen and measures if property rights are well protected by the law. Taking in account that this measure score is between 0 and 10, looking to the table8, we can observe that the maximum score in our sample is 7, in Germany and the minimum is 3 in Bulgaria.

Table 7 – Index of property rights by country.

Country	Min.	Median	Max.
Austria	6	6	6
Belgium	5	6	6
Bulgaria	3	3	4
Croatia	4	4	4
France	6	6	6
Germany	6	6	7
Greece	4	5	5
Italy	4	4	5
Luxembourg	6	6	6
Malta	5	5	5
Netherlands	6	6	6
Poland	4	4	4
Portugal	5	5	5
Slovakia	4	4	5
Slovenia	4	4	5
Spain	4	5	5

Table 8 - Evolution of GDP per capita.

Country	GDP per capita			
	Mean	Median	Min	Máx
Austria	48568.7	48334	43637	51386
Belgium	46042.8	44881	44383	48425
Bulgaria	6957.63	6956	5933	7814
Croatia	14343.5	14157	13509	15894
France	42549.7	42571	40706	45413
Germany	44235.6	44065	41178	47903
Greece	27825.1	28827	22243	31997
Italy	37044.5	36977	34814	40640
Luxembourg	108548	106248	99718	117508
Malta	22029.7	21929	19376	25125
Netherlands	51767.3	51900	49475	56929
Poland	13021.5	13145	11260	14342
Portugal	22478.1	22540	20577	24816
Slovakia	17538.2	18186	16058	18650
Slovenia	23488.7	23841	20729	27502
Spain	30836.1	30738	25685	35579

5.2 Correlation Analysis

In order to analyze the relationship between the variables of the model and to see if they have a strong or weak relationship, in the same or opposite direction, it was generated the Pearson correlation matrix, based on a significance level of 1%, 5% and 10%.

The Table 9 show us that there are no correlations close to 1, in none of the variables, for the period between 2007 to 2015.

According to the matrix, it is also verified that the greatest correlation exists between the variables of efficiency of legal system and GDP per capita, being 0.7276. On the other hand, the variables that represents the volatility and the firm size have a moderate negative correlation (0.7418), being the variables that have less negative correlation in the model.

Analyzing other correlations present in the matrix, we also can observe the positive correlation between the variable asset maturity and the dependent variable that corresponds to the value of 0.4484. This last referred variable is the most related with the dependent variable. The variable that is less related with the dependent variable is the volatility of firm's value. Consistent with matching maturity theory, there is a positive relationship between the size variable and the maturity of debt, which means that if debt maturity increases, the larger the size of the firm. The maturity of the assets also shows a positive relation with the growth opportunities of the firm (0.3409).

It is also observed that there is a positive relation between the dependent variable and the dimension of the shareholders market; a negative relationship between the dependent variable and volatility of the inflation rate and the size of a country's banking system. This relations are confirmed by some studies referred in the literature review of this study.

Table 9 – Correlation matrix of the variables included in the study.

Variables	Period of 2007 - 2015																	
	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10	v11	v12	v13	v14	v15	v16	v17	
Debt maturity	v1	1																
Inflation Rate	v2	0.0056***	1															
GDP per capita	v3	-0.0275***	0.0247***	1														
Efficiency of legal system	v4	-0.0506***	-0.2394***	0.7276***	1													
Bank system dimension	v5	-0.0135***	-0.0801***	-0.4560***	-0.4381***	1												
Shareholders market dimension	v6	0.1333***	-0.1713***	0.2466***	0.2522***	-0.3065***	1											
Shareholders market activity	v7	0.1222***	-0.3137***	-0.2176***	-0.1903***	0.3516***	-0.2231***	1										
Volatility of inflation rate	v8	-0.0997***	-0.3343***	0.1130***	0.0493***	0.2243***	-0.2130***	0.3098 ***	1									
Growth opportunities	v9	0.1036***	-0.0577***	0.0503***	0.0190***	0.1202***	-0.0850***	0.0696***	0.1343***	1								
Liquidity	v10	0.0667***	0.0521***	-0.0043***	-0.0371***	0.0197*	-0.0390***	0.0334***	-0.0091***	-0.1354***	1							
Taxes	v11	0.0253***	0.0093***	-0.0043***	0.0385***	0.0204***	0.0288***	-0.0309***	0.0028***	0.0243***	0.0077***	1						
Asset maturity	v12	0.4484***	-0.0015***	-0.0356***	-0.1264***	0.0708***	-0.0389***	0.1097***	0.0287***	0.3409***	-0.1492***	0.0510***	1					
Size	v13	0.0869***	0.0365***	-0.0200***	0.0085***	-0.0945***	0.0532***	-0.0358 ***	-0.0645***	-0.3078***	0.0242***	-0.0409***	0.0318***	1				
Quality	v14	-0.1222***	-0.0939***	0.0207***	0.0678***	0.0395***	-0.0470***	-0.0263***	0.1340***	-0.0032***	-0.0759***	-0.0202***	-0.1629***	-0.1234***	1			
Level of indebtedness	v15	0.1883***	-0.0765***	-0.0139***	0.0032***	0.0116***	0.0032***	0.0349***	0.0225***	0.0891***	-0.5059***	-0.0171***	0.1065***	0.0025***	0.1630 ***	1		
Volatility of the company's value	v16	-0.1321***	-0.0668***	0.0153***	0.0165***	0.1322***	-0.1080***	0.0122 ***	0.1369***	0.4632***	0.0063***	0.0215***	-0.0467***	-0.7418***	0.3900***	-0.1060***	1	
Type of legal system	v17	-0.0005*	-0.0027***	0.0015***	0.0014***	-0.0008*	0.0020***	-0.0008*	0.0017***	-0.0007*	-0.0003*	-0.0002*	-0.0008*	0.0028***	0.0005 *	-0.0003*	-0.0011**	1

Notes: *Significance at 10% level; **Significance at 5% level; ***Significance at 1% level.

5.3 Regression Analysis

In this chapter we are presenting the results obtained and the interpretation of the coefficients of all the regression models, comparing them.

The presented table 10 shows all the results of the four models, explained in the chapter 4 of this work, for all the variables and the respective expected sign, according with the literature review.

Table 10 – Regression coefficients and its statistical significance for the models used.

Variables	Expected Sign	Model 1	Model 2	Model 3	Model 4
		OLS	Firm Effect	Country effect	Industry effect
Debt maturity (DEBTMAT)					
Size (SIZE)	+	0.0061217*** (0.000)	-0.0054439*** (0.000)	0.00556247*** (0.000)	0.005582*** (0.000)
Growth opportunities (GROP)	-	-0.081*** (0.000)	0.037392*** (0.000)	-0.0413162*** (0.000)	-0.0475609*** (0.000)
Quality (QUAL)	-	-0.0005167*** (0.000)	-0.000445*** (0.000)	-0.0005187*** (0.000)	-0.000498*** (0.000)
Liquidity (LIQ)	-	-0.004951*** (0.000)	-0.0000718*** (0.000)	-0.005154*** (0.000)	-0.0003397*** (0.000)
Taxes (TAX)	+/-	-0.0007619*** (0.000)	0.001286*** (0.000)	-0.0023337*** (0.000)	-0.0013123*** (0.000)
Volatility of firm's value (VOL)	-	2.028014*** (0.000)	1.472768*** (0.000)	1.954336*** (0.000)	1.941083*** (0.000)
Asset Maturity (AMAT)	+	0.0534733*** (0.000)	0.0485141*** (0.000)	0.0500591*** (0.000)	0.0550405*** (0.000)
Level of indebtedness (INDEB)	+	0.029039*** (0.000)	0.0259312*** (0.000)	0.0297337*** (0.000)	0.0271265*** (0.000)
Bank system dimension (BSM)	+	6.300822*** (0.000)	-4.913231*** (0.000)	-2.194995*** (0.000)	5.511937*** (0.000)
Shareholders market dimension (SMD)	-	-0.000001*** (0.000)	-0.000001*** (0.000)	-0.000001*** (0.000)	-0.000001*** (0.000)
Shareholders market activity (SMA)	+	0.0000164*** (0.000)	0.000052*** (0.000)	0.0000253*** (0.000)	0.0000473*** (0.000)
Efficiency of legal system (ELS)	+	0.0034589*** (0.000)	0.002389*** (0.000)	0.0028401*** (0.000)	0.0021942*** (0.000)
Type of legal system (TLS)	+	-0.0090629 (0.162)	-	-0.011317* (0.000)	-0.0031868 (0.383)
Inflation rate (IR)	-	0.0000561*** (0.000)	-0.0001364*** (0.000)	-0.0001472*** (0.000)	-0.000069*** (0.000)
GDP per capita (GDP)	+	0.000001*** (0.000)	0.000001*** (0.000)	0.000001*** (0.000)	0.000001*** (0.000)
Volatility of inflation rate (VIR)	-	0.0034988*** (0.000)	0.0003919*** (0.000)	0.0002662*** (0.000)	0.0035286*** (0.000)
Observations		3,618,791	3,618,791	3,618,791	3,618,791
R-squared		0.416	0.242	0.430	0.456

Notes: *Significance at 10% level; **Significance at 5% level; ***Significance at 1% level; P-values for each variable are in parentheses.

According with the results, it is possible observe that in the four models, the adjusted coefficient of determination (R-squared) has a variation between 24.2% and 45.6%. The Model 3 and

Model 4 are the models that explain more the variability of the dependent variable, because the Model 1 explains 41.6% and the Model 4 explain 45.6% of the variable maturity of debt. The other two models, firm fixed effects and country effect explain 24.2% and 43%, respectively, of the dependent variable debt maturity.

5.3.1 Firm impacts on debt maturity

5.3.1.1 Agency costs

The influence of the agency costs was introduced in our models by the variables related with the firm size and growth opportunities, measured by the logarithm of assets book value and the ratio between depreciations and total assets, respectively.

Firm size

The firm size variable present in our models, presents a statistically significant coefficient at 1% level ($p\text{-value} < 0.01$), as we can see looking to the p values present in our table. However, the positive relation between this variable and the maturity of debt is verified in all the Models, except in the Model 2. In the Model 1, 3 e 4 the positive relation is explained by the coefficients of 0,006, approximately and in Model 2 the coefficient value is -0.005.

In general, this fact is consistent and according with expected of the literature review that considers a positive relation between the maturity of debt and the dimension of a firm and that small firms tend to have short-term debt in their maturity structure, because of the high levels of agency problems and asymmetry levels.

Firm growth opportunities

This variable presents a negative relation and statistical significance at 1% level in all the models, except again the Model 2. In this Model 2, referred to the firm fixed effects, looking to the coefficient value of 0.037, is possible a firm that in average, an increasing in firm's growth opportunities ratio of 1%, leads to a increase of 0.037 p.p. in debt maturity ratio.

Analyzing the coefficients of the other models, it is possible to see a stronger coefficient in Model 1, meaning that in average, an increasing in firm's growth opportunities ratio of 1% leads to a decrease of 0.081 p.p. in debt maturity variable. In the Models 2 and 3 the negative coefficients value are not so different, 0.041 and 0.048, respectively. This is according with the literature review, some authors verified a negative relation between the growth opportunities and the maturity of debt. Myers (1977) considers a negative relation between this variable

analyzed and the maturity of debt. The author considers that firms with a higher potential of growth opportunities should have short-term debt, since the under-investment problem can be mitigated.

5.3.1.2 Firm Quality

Observing the firm quality variable, considering a significance level of 1%, the variable is statistically significant in all the Models.

The coefficients are similar in the different Models (0.0005 and 0.0004, approximately) and all of them show a negative relation between the variable and maturity of debt. This coefficient means that, on average, an increasing of firms quality ratio of 1%, leads to a decrease of 0.005 in the maturity of debt ratio. These results are according with the expected and verified in the literature review, according with Flannery (1986), it is possible verify that firms with positive information will opt for short-term debt to finance their projects. The firms that signalize their quality issuing short-term debt.

5.3.1.3 Firm Liquidity

In this variable, with a significance level of 1%, the variable is statistically significant in all the Models, too.

As expected from the literature review, all the coefficients in the different models show a negative relation between the variable and maturity of debt. The strongest coefficient is present in the Model 3 and the meaning is, in average, an increase of 1% in the liquidity ratio, leads to a decrease of 0.005 p.p. in debt maturity ration. This relation is according with the liquidity risk theory developed by Diamond (1991), where the author defends that there is a trade off between the preference of the borrowers for short-term debt, because of the private information about the future credit rating and liquidity risk.

5.3.1.4 Taxes

The influence of taxes was introduced in our models by the variables related with the effective tax rate and volatility of the firms' value, measured by the ratio of income after and before taxes and the ratio between the std. dev. Of operation cash flows and total assets value, respectively.

Effective tax rate

According with the results, it is possible observe that with a significance level of 1% the effective corporate tax rate is statistically significant in all the models. However, observing the

value of the coefficients, the association between the variable and the maturity of debt is negative in the Models 1 (0.0007), Model 3 (0.002), Model 4 (0.001) and positive in the Model 2 (0.001).

According with the literature review, some authors consider that there is a negative relation between the effective tax rate and the maturity of debt, so the maturity of debt will decrease when the effective tax rate increase (Kane et al., 1985). However, there are another studies in our literature that prove the opposite or found no evidence for the negative tax relation, such as Barclay and Smith, (1995) and Ozkan (2000, 2002).

Volatility of the firms' value

This variable presents a positive relation and the coefficient values are all statistically significant at a significant level of 1% in all the models. This result are not according with the main studies of our literature review. Kane *et al.* (1985) and Stohs and Mauer (1996) there is a negative relation between the volatility of firm's value and the maturity of debt, however in the study developed by the authors Stohs and Mauer (1996) the coefficients obtained by the authors are not statistically significant.

5.3.1.5 Firm assets maturity

As expected from our hypothesis 7 of our literature review, the matching maturity of assets theory has a positive association with the maturity of debt. In all the four models, with a 1% of significance level, the coefficients are all statistically significant and similar in all the models. The strongest coefficient is present in the industry effect model, with a value of 0.055 that means in average, an increase of 1% of the asset maturity ratio, there is an increase of 0.055 p.p. of the debt maturity ratio.

This results confirm the studies developed by Morris (1976) and Myers (1977), that consider the importance of the firms in synchronize the maturity of debt of their assets, in order to reduce the agency costs.

5.3.1.6 Firm level of indebtedness

The obtained results are according with the hypothesis assumed in our literature review, the higher the level of indebtedness, the higher the maturity of debt. The coefficient values of the variable are all positive and statistically significant, independently of the models. In the country effect model there is a strong correlation between the level of indebtedness and the maturity of debt with a coefficient of 0.03.

Stohs and Mouer (1996), Johnson (2003) Antoniou *et al.* (2006) and García-Teruel and Marínez-Solano (2010) are some authors that also concluded that firms with more debt, use more long term debt.

5.3.2 Country impacts on debt maturity

5.3.2.1 Financial system

The influence of the financial system was introduced in our models by the variables related with the bank system dimension, shareholders market dimension and shareholders market activity. This variables are measured by domestic credit provided by banks in % of GDP, market capitalization in % of GDP and shares value per year and market capitalization ratio, respectively.

According with the main studies referred in the literature review, countries with more developed banking sectors finance firms have a shorter duration of debt, given the competitive advantage of financial institutions in controlling firms. This competitive advantage results by reducing the maturity of corporate debt, gaining greater control over corporate finance, maintaining strong bargaining power, and influencing their investment strategies (Fan *et al.*, 2012). According with our results, we can verify this negative relation in all of our models, where the coefficients are around of 0.000001 and all statistically significant al level of 1%. In all the models the coefficients have low values that means that an increase of 1% of the bank system dimension ration will not change so much the debt maturity ration.

Related with the shareholders market dimension and market activity variables, the relation assumed in our hyphotesis 10 and 11 present in the literature review for this variable says that the maturity of debt is higher in countries with larger shareholders market (Demirguc-Kunt and Maskimovic, 1999). As we can see in the presented table 10, we can verify these hypoteses in all the models because all the coefficients are with positive signal. However, as verified in the bank system dimension variable analized anterioly, we also have low values for the coefficients.

5.3.2.2 Legal system

The influence of legal system was introduced in our models by the variables related with the efficiency of legal system and type of legal system, measured by the protection of property rights index and the classification of the Central Intelligency Agency (CIA) of the type of legal system of each country, respectively.

Additionally, the table 10 shows a positive and significant relation between the efficiency of legal system and the maturity of debt. This is consistent with Rajan (1992) and Demirguc-Kunt and Maksimovic (1999) studies. The authors proved that if a country presents a legal system characterized as inefficient and the costs of using it are high, the firms tend to finance themselves through short-term debt.

In terms of type of legal system, according to several authors such as La Porta, Lopez-de-Silanes, Andrei Shleifer and Robert Vishny (1998), the legal system can be evaluated based on two types of law: civil-law and common-law. So, they proved that developed countries with more effective laws and common-law, have a greater protection of the rights of creditors. In our study, looking to the table 10 it is possible observe that the conclusions of the authors are not verified. In all the models the coefficients have a negative relation with the maturity of debt and are not statistically significant at any level in Model 1 and 4. So, we do not observe any relation between this variable and debt maturity, we suggest that the type of legal system don't have impact in the maturity of debt choices, during this period.

5.3.2.3 Macroeconomic variables

The influence of the macroeconomic variables was introduced in our models by the variables related with the inflation rate, volatility of inflation and GDP per capita. This variables are measured by the annual consumer price index, the std. dev. of the inflation rate and the GDP per capita in current US dollars, respectively.

Turning our focus to the macroeconomic variables that we used in our study, it is possible observe that all of them are statistically significant for our model at significance level of 1%.

According with the variable inflation rate, looking to the table 10 we can see that there is a negative and significant relation between this variables and the maturity of debt, in all the models except in the Model 1. Previous studies proved that debt maturity decreases with the increase of the inflation (Miller, 1992; Demirguc-Kunt and Maksimovic, 1999). So, this variable in our study is not according with our hypothesis of the literature review.

The GDP per capita results show that there is a positive relation with the maturity of debt, because in all the models presented the coefficients have positive values. These results are according with the authors Demirguc-Kunt and Maksimovic (1999) and Fan *et al.* (2004), they proved that firms located in a developing country have a higher debt maturity than firms operating in developed countries.

To finish, the volatility of the inflation rate in our results show a positive impact in the maturity of debt choices. All the coefficients are statistically significant at a significant level of 10% and

all of them are positive. However, as happened with the inflation rate variable, according with previous studies referred in the literature, the lower the volatility of the inflation rate, the higher the maturity of debt (Kirch, Terra and Fan et al., 2012). So, this variable is not according with our assumed hypothesis too.

6. Conclusions

Throughout this study, we determined which factors influenced the choice of debt maturity for 3,618,795 firms, located in the 16 countries of the European Union, during the period from 2007 to 2015.

For the analysis of the selected sample, we used the data panel methodology that allow to better understand the complexity of the firms, allowing to test more realistic models that can measure effects not observed in temporal or seccional studies (Hsiao, 2007). In addition, this methodology allows to control the impact of variables that are not observed or are omitted.

Based on some empirical studies developed in previous years, by several authors, in this study we have tested, in line with this literature, the influence of variables related with firms (size, growth ooportunities, liquidity, quality, effective tax rates, volatility of firms' value , asset maturity and level of indebtedness) and variables related with countries (legal system, financial system and macroeconomic variables)

According to the results obtained, it is possible conclude that the characteristics of the firms that are part of our study, influence the choice of debt maturity of the selected firms, located in the European Union. The results obtained are in general according with the literature review and empirical studies. We only found an exception related with the taxes, since in one of the applied models the results had some differences comparing with the studies reported in the literature. The taxes and the quality of the firms presented weak values, so it means that it does not explain the maturity of the debt choices with the increase of them, however, they are significant in all the applied models.

Contradictorily, we observed in the variables of the firms effects, the variables of the countries presented some differences comparing to our expectation based on the empirical studies of the literature. We verified that the inflation and its volatility presented values with a different sign than expected, as well as the financial variable referring to the size of the banking system of a country.

This study is a good contribution to the finance literature, because it allows to understanding not only the impact of firm effects in the maturity of debt, but also the impact of contry effects. In other hand, this study allow to observe the evolution of debt maturity in this countries, before, during and after the crisis period, where we can observe some differences in the values obtained. Normally that in this work there are some limitations in the data that is based in accounting values and formulas. We used some proxies that can change the results in other studies, such as in the firm quality was measured by the ROE or the debt maturity ratio was measured as the

proportion of debt that measure after one year. It is also important refer that the use of different variables, assumptions and methodologies could lead to different conclusions.

In the future, can be interesting study the possible existence of optimal structure of debt maturity for the firms and try to figure a solution to help the firms how to finance themselves. Another relevant study in the future can be a comparison of the variables' results between listed firms and non-listed firms.

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8. Appendixes

Appendix 1 – Description of variables.

Variable	Description
<i>MATDEBT_{it}</i>	Maturity of debt of firm i, in year t
<i>SIZE_{it}</i>	Size of the firm I, in year t
<i>GROP_{it}</i>	Growth opportunity of firm I, in year t
<i>INDEB_{it}</i>	Level of indebtedness of firm I, in year t
<i>LIQ_{it}</i>	Liquidity of the firm I, in year t
<i>TAX_{it}</i>	Effective tax rate of firm i, in year t
<i>VOL_{it}</i>	Volatility of the firm's i value, in year t
<i>AMAT_{it}</i>	Assets maturity of firm I, in year t
<i>QUALI_{it}</i>	Quality of the firm i, in year t
<i>BSD_{yt}</i>	Dimension of bank system of the country y, in year t
<i>SMD_{yt}</i>	Shareholders market dimension of the country y, in year t
<i>SMA_{yt}</i>	Shareholders market activity of the country y, in year t
<i>TLS_{yt}</i>	Type of legal system of the country y, in year t
<i>ELS_{yt}</i>	Efficiency of legal system of the country y, in year t
<i>VIR_{yt}</i>	Inflation rate volatility of country the y, in year t
<i>IR_{yt}</i>	Inflation rate of the country y, in year t
<i>GDP_{yt}</i>	Development of the economy of the country y, in year t

Appendix 2 – Empirical hypothesis, expected signal and respective source.

Hypotheses	Variables	Expected Signal	Source
Hypothesis 1 The maturity of debt and the dimension of a firm have a positive correlation.	Firm size (SIZE)	+	(1)
Hypothesis 2 Higher the growth opportunities, lower the maturity of debt.	Growth opportunities (GROP)	-	(1)
Hypothesis 3 Firms that have positive information will opt for short-term debt to finance their projects. The firms signalize their quality issuing short-term debt.	Firm Quality (QUALI)	-	(1)
Hypothesis 4 Firms with high liquidity present debt with lower maturity.	Firm Liquidity (LIQ)	-	(1)
Hypothesis 5 The maturity of debt will increase when the effective tax rate decreases.	Effective tax rate (TAX)	+/-	(1)
Hypothesis 6 The maturity of debt and the volatility of the firms' value are negative correlated.	Volatility of the firm value (VOL)	-	(1)
Hypothesis 7 The maturity of debt is higher with the maturity of the assets.	Asset maturity (AMAT)	+	(1)
Hypothesis 8 Higher the level of indebtedness, higher the (maturity of debt).	Level of indebtedness (INDEB)	+	(1)

<p>Hypothesis 9</p> <p>In countries with larger banking system the firms tend to have lower maturity.</p>	<p>Dimenson of bank system (BSD)</p>	<p>+/-</p>	<p>(2)</p>
<p>Hypothesis 10</p> <p>The maturity of corporate debt is higher in countries with larger shareholder markets.</p>	<p>Shareholders market dimension (SMD)</p>	<p>+</p>	<p>(3)</p>
<p>Hypothesis 11</p> <p>The maturity of corporate debt is higher in countries with larger and more active shareholder markets.</p>	<p>Shareholders market activity (SMA)</p>	<p>+</p>	<p>(3)</p>
<p>Hypothesis 12:</p> <p>The maturity of debt will be higher, if the legal system of a country is higher too.</p>	<p>Efficiency of legal system (ELS)</p>	<p>+</p>	<p>(4)</p>
<p>Hypothesis 13</p> <p>The type of legal system has an impact in the maturity of debt.</p>	<p>Type of legal system (TLS)</p>	<p>+</p>	<p>(5)</p>
<p>Hypothesis 14</p> <p>The higher the rate of inflation, the lower the maturity of the debt.</p>	<p>Inflation rate (IR)</p>	<p>-</p>	<p>(2)</p>
<p>Hypothesis 15</p> <p>Lower the volatility of inflation rate, higher the maturity of debt.</p>	<p>Inflation rate volatility (VIR)</p>	<p>-</p>	<p>(2)</p>
<p>Hypothesis 16</p> <p>Firms located in a developing country have a higher debt maturity than firms operating in developed countries.</p>	<p>Economic development (GDP)</p>	<p>+</p>	<p>(2)</p>

Notes:

- (1) Amadeus Data Basis.
- (2) International monetary Fund, International Financial Statistics and data files, World Bank and OECD GDP estimates.
- (3) World Federation of Exchanges database.
- (4) Global competitiveness report.
- (5) Central Intelligence Agency (CIA).

Appendix 3 – List of ISO codes of the countries used in our study.

ISO code	Country name
AT	AUSTRIA
BE	BELGIUM
BG	BULGARIA
DE	GERMANY
ES	SPAIN
FR	FRANCE
GR	GREECE
HR	CROATIA
IT	ITALY
LU	LUXEMBOURG
MT	MALTA
NL	NETHERLANDS
PL	POLAND
PT	PORTUGAL
SI	SLOVENIA
SK	SLOVAKIA

Note: ISO codes by the RIPE Network Coordination Centre, in coordination with the ISO 3166 Maintenance Agency, Berlin).

Appendix 4 – List of activity sectors used in our study.

Number of identification	Sectors of activity
1	A. Agriculture, forestry and fishing
2	B. Mining and quarrying
3	C. Manufacturing
4	D. Electricity, gas, steam and air conditioning supply
5	E. Water supply; sewerage, waste management and remediation activities
6	F. Construction
7	G. Wholesale and retail trade; repair of motor vehicles and motorcycles
8	H. Transportation and storage
9	I. Accommodation and food service activities
10	J. Information and communication
11	L. Real estate activities
12	M. Professional, scientific and technical activities
13	N. Administrative and support service activities
14	P. Education
15	Q. Human health and social work activities
16	R. Arts, entertainment and recreation
17	S. Other service activities
18	U. Activities of extraterritorial organizations and bodies