The zero-leverage phenomenon: A bivariate probit with partial observability approach

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Abstract

The empirical literature on zero leverage investigates why some firms are debt-free using standard logit and probit specifications. However, such models are not suitable to provide a direct answer to the main research question that arises in this context: is zero leverage a financial decision of the firm or an imposition raised by creditors? This paper examines the factors that affect the demand for debt and the supply of debt using bivariate probit models with partial observability in the sense of Poirier (1980), providing empirical evidence on the zero-leverage phenomenon for European listed firms during the period 2001-2016. We find that variables such as firm profitability and asset tangibility influence in opposite directions debt demand and supply. We also find that the recent European crises reduced the propensity of firms to resort to debt but did not affect significantly debt supply, and that common (civil) law systems increase (reduce) the propensity for zero leverage both via demand and supply effects.

Key-words: Zero leverage; Capital structure; Bivariate probit models; Legal system; European crisis

JEL classification: G32

1. Introduction

Firms' financing decisions are on the daily agenda of the scientific community and patricians of corporate finance field (Moradi & Paulet, 2019). That firms report average debt ratios below those of the target levels (e.g. Graham, 2000) established by the static and dynamic trade-off theories is not a recent observation. More recent is the finding that there is a considerable number of firms with a "mysterious zero leverage" (Strebulaev & Yang, 2013). Coupled with the lack of theoretical support, the zero-leverage phenomenon gained particular relevance in the scientific community by considering that these firms effectively leave a substantial amount of "money on the table" (Graham, 2000; Korteweg, 2010; Strebulaev & Yang, 2013).

Some recent studies have provided evidence of the rising trend towards zero leverage in the US. In particular, Strebulaev and Yang (2013) report that the proportion of zero-leverage firms in the US rose from 4.3% in 1980 to 19.5% in 2009. This significant rise in debt-free firms in the US over the last three decades has also come under study by Byoun and Xu (2013) and D'Mello and Gruskin (2014). In addition to its growth, Devos, Dhillon, Jagannathan, and Krishnamurthy (2012) argue that zero leverage is a persistent phenomenon by showing that in 2008 around 11.3% of firms in their US sample did not resort to debt over the preceding three consecutive years. A

substantial number of zero-leverage firms is also found in the UK (Dang, 2013; Zhang & Gregoriou, 2019), India (Ghose & Kabra, 2016), China (Huang Li, & Gao, 2017) and Japan (Takami, 2016). Using international samples spanning many countries, Bessler, Drobetz, Haller, and Meier (2013) maintain that the rising trend towards zero leverage constitutes an international reality while Ghoul, El Guedhami, Kwok, and Zheng (2018) added that this trend is taking place on a global scale with a higher prevalence in developed countries.

The majority of these studies seek to answer why firms adopt a zero-leverage policy, highlighting the motives that drive their option. However, these studies end up by providing some contrasting results (e.g. Devos et al., 2012; Strebulaev & Yang, 2013), which hinders any understanding of just what motivates these firms to keep zero-leverage levels. Nevertheless, the financial constraints approach has generated the greatest consensus in the literature (Bessler et al., 2013; Devos et al., 2012). According to this perspective, zero leverage emerges more as an imposition of creditors who do not wish to grant credit rather than a financial decision taken by the firm. On the other hand, there seems to exist a non-negligible number of debt-free firms that do not suffer from financing constraints (Bessler et al., 2013) but instead generally prefer to retain financial flexibility. In the latter case, firms deliberately opt for zero debt and thus zero leverage reflects a financial decision taken by the firm (Dang, 2013).

Empirical studies of zero leverage typically use regression models where the dependent variable holds the value of 1 if the firm presents no debt and 0 otherwise (e.g. Strebulaev & Yang, 2013). Given the binary nature of the dependent variable, the standard logit and probit specifications (Wooldridge, 2012) commonly applied in zero leverage studies seems to be a natural option. However, these models only allow to establish just which factors explain why a firm has debt or not, but do not provide insights into what really affects the decision of the firm over whether to resort to debt or not and what affects the decision of the creditor over whether to grant credit or not. This shortcoming represents an important gap in the literature on zero leverage, since firm leverage not only results from the demand for debt but also requires the supply of debt (Dang, 2013). With the existence of two decision-makers (the firm and the creditor), traditional probit or logit univariate models (binary decision of just one decision-maker) are not the most appropriate methods as they do not allow to analyse separately the two binary choices made by the two different decision makers (Poirier, 1980). In this paper, we use bivariate probit models (Poirier, 1980), which allow to partially observe the choices of two independent decision-makers and, thus, to analyse firm decisions over whether or not to resort to debt and creditor decisions over whether or not to concede debt to firms.

Thus, this study focuses on the following research questions: *What are the determinants of the decision of the firm to resort or not to debt?* (demand side) and *What are the determinants of the creditor decision to grant or not debt to the firm?* (supply side). In order to respond to these research questions and put forward empirical evidence on the phenomena surrounding zero

leverage, we use a sample of listed European firms over the period from 2001 to 2016 and consider a set of firm-level, corporate governance, macroeconomic and country-specific variables which potentially impact the demand and/or the supply of debt. The applied bivariate probit models with partial observability in the sense of Poirier (1980) have never been used, to the best of our knowledge, in the zero-leverage literature, with its application across the extensive capital structure field also remaining relatively scarce[1]. Therefore, our study is differentiated from existing literature and contributes to them by presenting a separate empirical observation of the determinants affecting supply and demand for debt, which ultimately allows us to be the first to show whether zero-leverage policies arise from firm's own decision or by creditors' imposition. It is also our aim to show the differences in the results provided by the bivariate probit models in comparison with those returned by the univariate probit models traditionally applied in the zero leverage literature. Other departure of our paper from other studies is the focus on European countries, most of which follow a civil law system increasing debt dependency, while the majority of previous studies on zero leverage have focused on countries with common law systems, which favours financing via capital markets (Demirgüç-Kunt & Levine, 1999; La Porta, Lopez-de-Silanes, Shleifer, & Vishny, 1997). Finally, the temporal scope under analysis spans the recent financial crisis (beginning in 2008) with its effects deepening in Europe due to the sovereign debt crises and that up until quite recently hindered normal growth, financing and the resumption of investment levels (European Commission, 2014; European Investment Bank, 2015; Moradi & Paulet, 2019). To investigate how such crises affected both the demand and supply of debt is another contribution of this paper.

The remainder of the paper is organised as follows. Section 2 briefly reviews the theoretical explanations of the zero-leverage phenomenon and formulates some empirical hypotheses. Section 3 describes the data and the methodology applied in the empirical analysis. Section 4 presents and discusses the main results of the paper. Finally, section 5 sets out some final considerations.

2. Literature review and empirical hypotheses

Due to the lack of a theoretical support provided by the dominant capital structure theories for the zero-leverage phenomenon, studies on this subject have adopted alternative approaches to explain extreme conservative levels of debt. The financial constraints and financial flexibility approaches are those that have received greatest attention (Dang, 2013; Huang et al., 2017). Studies carried

[1] Two examples of application of bivariate probit models with partial observability are Grilli (2005) and Heino (2006), which study the factors shaping the decisions of owners of start-ups to make recourse to loans and the factors taken into consideration by financial institutions in granting those loans.

out on US firms also considered extensively the managerial entrenchment approach (Byoun & Xu, 2013; Devos et al., 2012; Strebulaev & Yang, 2013) as a possible explanation for zero leverage, while studies on international samples typically include macroeconomic variables and country specific effects (Bessler et al., 2013; Ghoul et al., 2018). Some studies have focused either on the demand for debt or the supply of debt, while others explained their findings using indistinctly demand- and supply-side arguments in spite of the applied methodology not allowing for such distinction.

In this paper, we formulate a series of empirical hypotheses which are specific to either the demand for debt or the supply of debt. The classical pecking-order (Myers, 1984; Myers & Majluf, 1984) and trade-off (Kraus & Litzenberger, 1973) capital structure theories are used to justify some of the hypotheses for the demand analysis. However, the hypotheses for the demand for debt are based mainly on the financial flexibility and managerial entrenchment approaches (Huang et al., 2017; Strebulaev & Yang, 2013), while those for the supply analysis rely mostly on the financial constraints approach (Bessler et al., 2013; Dang, 2013). For both analyses, we also formulate hypotheses related to macroeconomic conditions and country specific effects, which are susceptible to impact, although in a different way, both the demand and supply of debt (Bessler et al., 2013; Ivashina & Scharfstein, 2010).

2.1. Demand side

Understanding how decisions regarding the capital structure taken today may hold consequences for future investment represents the departure point for a better understanding of the importance attributed to financial flexibility by firms. Specifically, the literature frequently highlights financial flexibility as determining the scope of firms to carry out investments in the future even when facing asymmetric information problems (Ferrando, Marchica, & Mura, 2017; Gamba & Triantis, 2008). Correspondingly, the argument maintains that firms avoid making recourse to debt and establish financial slack by accumulating internal liquidity, which enables to preserve borrowing capacity (de Jong, Verbeek, & Verwijmeren, 2012). This mechanism enables the mitigation of investment distortions (Marchica & Mura, 2010), namely the problem of underinvestment in which firms holding future growth opportunities, but already having excessive levels of debt, are forced to forego projects with a positive net present value (NPV) (Myers, 1977).

The results of surveys carried out in the US (Graham & Harvey, 2001) and in Europe (Bancel & Mittoo, 2004; Brounen, de Jong, & Koedijk, 2006) confirm that financial managers consider financial flexibility as a determinant role in decisions about capital structure, leading such managers to voluntarily limit credit lines so as to preserve their capacity to take on future debt. In this framework, Lotfaliei (2018) argues that firms do not lose value by remaining debt-free, as they hold the real option to lever up in the future when good investment opportunities arise.

The main conclusions of the financial flexibility approach are thus similar to those of the Pecking Order theory, which also concludes that firms prefer to use internal funds instead of debt in their financing. However, the reasoning is different. While the former points out that firms should avoid debt financing to preserve borrowing capacity to invest in future investment opportunities, the latter argues that the firm should resort to internal sources of finance to avoid the more expensive external finance.

The empirical literature on zero leverage reports that there is a small number of highly profitable firms, with high levels of cash holdings and growth opportunities, that is debt-free. Bessler et al. (2013) and Dang (2013) interpret this as an attempt of those firms to deliberately pursue zero-leverage policies as a way to increase financial flexibility. Next, we present a first set of empirical hypotheses on the decision of the firm to become debt-free.

H1: *Cash holdings have a negative effect on firm's decisions to resort to debt, increasing the propensity towards zero leverage.* Cash holdings frequently serves as a proxy for financial flexibility (Dang, 2013), since, in an attempt to avoid resorting to debt and retaining borrowing capacity, firms should create financial slack through the accumulation of cash (Myers, 1984). On the other hand, according to the Pecking Order theory, the presence of information asymmetries means that firms prefer internal sources of liquidity rather than expensive external financing (Myers & Majluf, 1984).

H2: *Growth opportunities have a negative effect on firm's decisions to resort to debt, increasing the propensity to zero leverage.* Firms with future growth opportunities have incentives to preserve their borrowing ability to be able to invest by resorting to debt when good investment opportunities arise and, thus, avoid to forego projects with a positive NPV (de Jong et al., 2012; Marchica & Mura, 2010).

H3: *Profitability has a negative effect on firm's decisions to resort to debt, increasing the propensity to zero leverage.* Firm's profitability may affect the demand for debt, since the greater the profitability of firms, the higher the amount of internally generated funds and the lower the need to resort to debt (Myers, 1984; Myers & Majluf, 1984).

According to Jensen and Meckling (1976), managerial entrenchment can be another factor affecting firm demand for debt. Under this perspective, entrenched managers choose lower levels of debt for various reasons: to reduce firm's financial risk and protect their human capital (Fama, 1980); to act in accordance with their private benefits increasing the resources under their control (Stulz, 1990); and to avoid the disciplinary power of debt (Jensen, 1986). Hence, the explanation of the zero-leverage phenomenon may lie in the agency problems affecting shareholders and managers in which the latter acts in accordance with their own interests rather than to the

shareholder rights. Firms with stronger corporate governance mechanisms are more able to constrain managerial entrenchment, increasing their propensity to use debt.

Another mechanism used by firms to control the incentives of entrenched managers to take advantage of their private benefits is the distribution of dividends to shareholders. Specifically, for zero-leverage firms, one way of avoiding managers from appropriating firm gains (the free cash-flow issue - Jensen, 1986) is to give them to shareholders in the form of dividends, which enables firms to keep low-levels of debt without such becoming perceived as an action demonstrative of its entrenchment management. Dividends and debt are thus seen as substitutes to control free cash-flow problems (Easterbrook, 1984; Fama & French, 2002).

So far, the empirical literature on zero leverage has considered the effect of managerial entrenchment mainly for the US, with Devos et al. (2012) finding no evidence that external control mechanisms of the manager's actions, proxied by ownership concentration, can explain the firm's decision to have zero leverage and Byoun and Xu (2013) reporting that the payment of dividends raises the propensity for zero leverage. Similarly to them, we analyse how these mechanisms of corporate governance affect zero leverage.

H4: *Ownership concentration has a positive effect on firm's decisions to resort to debt, reducing the propensity to zero leverage.* Theory about ownership and control tells us that the performance of managers may be subject to monitoring actions by shareholders. This argument takes on strength when dealing with the involvement of large shareholders who have strong incentives to monitor the manager's actions and decisions to ensure that their wealth is being maximized (Shleifer & Vishny, 1986), reducing the incentives for the existence of entrenched management and low-levels of leverage.

H5: *Dividend payout has a negative effect on firm's decisions to resort to debt, increasing the propensity to zero leverage.* Firms that pay higher dividends to distribute free cash-flow among shareholders have a lower need for using debt as a means to control entrenched managers (Jensen, 1986).

Static Trade-off theory advocates the existence of a target level of debt obtained through balancing the fiscal benefits of debt (Modigliani & Miller, 1963) against financial distress (Kraus & Litzenberger, 1973) and bankruptcy costs increased by debt. Within this framework, firms avoid debt when they gain few fiscal benefits from using it and to minimise the costs of financial distress and bankruptcy. Next, we formulate two empirical hypotheses resulting from this reasoning.

H6: *Non-debt tax shields has a negative effect on firm's decisions to resort to debt, increasing the propensity to zero leverage.* Tax shields obtained by sources other than debt may constitute an explanatory factor for firms to decide not to resort to debt. Specifically, firms with high levels of

non-debt tax shields display lower propensity to take advantage of debt tax shields given the potential substitution between the two sources of tax shields (DeAngelo & Masulis, 1980).

H7: *Asset tangibility has a positive effect on firm's decisions to resort to debt, reducing the propensity to zero leverage.* Firms with higher levels of tangibility have lower costs of financial distress and bankruptcy given that, in case of bankruptcy, these assets retain their value (Myers, 1977).

Demand for debt may also depend on the legal system prevailing in each country and the quality of its implementation (Djankov, McLiesh, & Shleifer, 2007; Fan, Titman, & Twite, 2012). A common law system provides better protection to external investors than a civil law system (La Porta et al., 1997), which is reflected in better access to external financing via capital markets in common law systems and a greater dependence on loans granted by the banking sector in civil law systems (Fan et al., 2012). Demirgüç-Kunt and Levine (1999) present evidence about how common law systems generate greater propensities towards market-based financial systems while civil law system presents greater propensities towards bank-based systems. The demand for bank debt thus tends to be higher in countries with civil law systems, since, on the one hand, capital markets are less attractive and, on the other hand, there are closer ties between firms and banks.

Antoniou, Guney, and Paudyal (2008) confirm that high levels of leverage are found in countries where firms keep closer relationships with banks. Bessler et al. (2013) shows that the legal system has an impact on zero leverage, specifically the propensity for firms presenting zero leverage is higher in common law systems. Therefore, we formulate the following hypothesis.

H8: *A common law system (civil law system) has a negative (positive) effect on firm's decisions to resort to debt, increasing (reducing) the propensity to zero leverage.*

Finally, macroeconomic conditions also represent a determinant factor on firm's capital structure (Cook & Tang, 2010). In periods of uncertainty and risk, asset values fall and, therefore, according to the trade-off theory, because the costs of financial distress and bankruptcy increase, the demand for debt decreases. The same effect is predicted by the pecking-order theory, since information asymmetries become more severe in crisis periods (Korajczyk & Levy, 2003). Moreover, because consumer confidence drops in periods of economic recession, firms' investment typically also falls and less financing is required.

Kahle and Stulz (2013) shows that the recent financial crisis reduced the demand for debt. Dang (2013) finds that low or negative GDP growth rates raise the likelihood of zero-leverage firms. Similar results have been presented by Ghose and Kabra (2016), which enables to conclude that zero leverage runs in counter-cycles to the prevailing macroeconomic conditions.

Our sample of listed firms from different European countries represents an opportunity to analyse the effects of the financial crisis (2008-2009) and the sovereign debt crises that then

followed (2010-2012) (European Commission, 2014; European Investment Bank, 2015) on the decisions of firms to resort to debt (Kahle & Stulz, 2013). We postulate the following hypothesis.

H9: *Crisis periods have a negative effect on firm's decisions to resort to debt, increasing the propensity to zero leverage.*

2.2. The supply side

There has already been a long discussion on the effects of financial constraints imposed by debt suppliers on firm capital structure (Diamond, 1991; Stiglitz & Weiss, 1981). The key factor for understanding their effects on firm financing decision stems from the existence of information asymmetries. Specifically, whenever creditors are unable to correctly evaluate the quality of a firm and its investments portfolio, the latter may face constraints on its access to credit, such as credit rationing (Stiglitz & Weiss, 1981). One result of this credit rationing imposed by creditors to firms without reputation is the impossibility of the latter to finance projects with a positive NPV through external funds and correspondingly forcing them to forego good investment opportunities. In the presence of adverse selection and moral hazard, access to credit becomes too expensive to firms with low reputational levels and without any favourable track record in the debt markets. Creditors therefore require compensation for the risk of granting loans to firms they do not know (Diamond, 1991), which leads such firms to make recourse to non-debt financing sources.

Many studies focus on analysing the impact of the financial constraints on zero-leverage firms, but evidence is mixed so far. Bessler et al. (2013) shows that the majority of debt-free firms experience financial constraints; Dang (2013) identifies two types of zero-leverage firms; constrained and unconstrained; and Takami (2016) reports that zero-leverage firms in their sample are not financially constrained. The literature also presents evidence that smaller (Hadlock & Pierce, 2010) and less profitable firms (Bessler et al., 2013), which pay out lower levels of dividends (Fazzari, Hubbard, & Petersen, 1988) and with lower tangibility (Benmelech & Bergman, 2009) face greater credit constraints. Next, we put forward a set of empirical hypotheses concerning firms characteristics that may make them more or less susceptible of suffering financial constraints.

H10: *Firm size has a positive effect on creditor's decisions to grant loans to firms, reducing the propensity to zero leverage.* Firm size emerges as an indicator generally accepted by the literature for measuring the willingness of creditors to grant credit to the firm (Hadlock & Pierce, 2010). In particular, due to information asymmetries, smaller firms are more likely to face financial constraints (Hadlock & Pierce, 2010), with empirical evidence demonstrating that they display a higher propensity towards zero leverage (Bessler et al., 2013; Dang, 2013).

H11: *Asset tangibility has a positive effect on creditor's decisions to grant loans to firms, reducing the propensity to zero leverage.* An important fraction of capital structure studies use asset tangibility (collateral) as a proxy for the financial constraints faced by firms (Benmelech & Bergman, 2009). Firms with less collateral are more exposed to information asymmetries and consequently more credit constrained. The empirical evidence shows that firms with lower asset tangibility display a greater propensity to present zero leverage (Devos et al., 2012).

H12*: Dividend payout has a positive effect on creditor's decisions to grant loans to firms, reducing the propensity to zero leverage.* Dividend payments are also a traditional measure to analyse creditor's willingness to grant debt to the firms (Fazzari et al., 1988), being used in many studies to classify firms according to different levels of financial constraints (Strebulaev & Yang, 2013). Firms paying dividends convey positive signals both to creditors and to investors (Gomes, 2000), facing fewer information asymmetries.

H13: *Profitability has a positive effect on creditor's decisions to grant loans to firms, reducing the propensity to zero leverage.* More profitable firms provide better guarantees of paying loans and, therefore, are expected to experience fewer credit constraints (Kaplan & Zingales, 1997; Whited & Wu, 2006).

H14: *Growth opportunities have a negative effect on creditor's decisions to grant loans to firms, increasing the propensity towards zero leverage.* According to Myers and Majluf (1984), information asymmetries tend to be more severe for companies when their value is determined mostly by growth opportunities. In the case of bankruptcy, the value of such opportunities falls away drastically (Shleifer & Vishny, 1992), giving less comfort to creditors that are not sure that in case of bankruptcy they will be refunded.

As argued in Section 2.1, the protection of external investors varies with the legal system prevailing in the country, with a greater preponderance for debt financing granted by banks in civil law systems than in common law systems. The closer ties established in civil law systems between firms and banks result in reduced information asymmetries, given that the bank knows better the value of the firm, being its main monitoring entity (Leland & Pyle, 1977). As a result, banks become more willing to grant credit under more favourable conditions to firms in civil law systems (Djankov et al., 2007; Takami, 2016). Thus, we test the following hypothesis:

H15: *A common law system (civil law system) has a negative (positive) effect on creditor's decisions to grant loans to firms, increasing (reducing) the propensity to zero leverage.*

Also as discussed in Section 2.1, macroeconomic conditions can affect firm's capital structure. Specifically, in terms of debt supply, creditors may react to the losses returned by macroeconomic shocks by promoting a contraction in credit availability to firms or requiring higher interest rates

(Brunnermeier, 2009; Santos, 2011). The existing literature confirms that the recent financial crisis did affect the supply of debt (Ivashina & Sharfstein, 2010; Santos, 2011). Therefore, we consider the following hypothesis:

H16: *Crisis periods have a negative effect on creditor's decisions to grant loans to firms, increasing the propensity to zero leverage.*

3. Data, methodology and variables

3.1. Data

The accounting, financial and governance data about listed European firms used in this paper were obtained from the Datastream database provided by Thomson Reuters. Data were collected for the period between 2001 and 2016 for 14 Western European countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and the UK). Selected countries ensure the availability of information for listed firms during the period of analysis.

Utilities and financial firms were excluded from our sample due to the regulations that these firms are subject to and the impact they have on its capital structure. Firms without an industry code were also excluded as well as any observations with missing data or obvious errors (e.g. negative sales). We allowed firms' entry and exit from the sample, in an attempt to mitigate potential survivor bias. After applying the cleaning criteria, a final sample of 7,368 listed firms were obtained, corresponding to an unbalanced panel data with 64,150 firm-year observations.

3.2. Empirical Model

Existing literature about zero leverage typically applies simple univariate logit or probit models, which fail to account for the bivariate decision process of debt. In fact, firm's leverage is the result of two decisions taken by two different decision-makers: the firm, which decides if it wants to resort to debt or not; and the creditor, which decides if it is willing to grant debt or not. Therefore, we estimate a bivariate probit model with partial observability in the sense of Poirier (1980), which allows to estimate which factors lie beneath firms' decision to seek debt (demand side) and which factors drive creditors' lending decision (supply side).

We assume that firm demand for debt is represented by a dichotomous variable y_1, which is equal to the unit if the firm wants to resort to debt and zero otherwise. For the supply side, we define the dichotomous variable y_2, which takes on the value 1 if the creditor is willing to grant debt to firms and is zero otherwise. Each dichotomous variable is determined by one latent

variable, y_1^* or y_2^*, being one when those variables are positive. In turn, the latent variables are governed according to:

$$y_1^* = \beta_1' x_1 + \varepsilon_1 \quad (1)$$

$$y_2^* = \beta_2' x_2 + \varepsilon_2$$

where x_1 (for the demand function) and x_2 (for the supply function) are vectors of explanatory variables, β_1' and β_2' represent the respective coefficients and ε_1 and ε_2 are error terms assumed to follow a bivariate normal distribution $\Phi_2(\varepsilon_1,\varepsilon_2)$, with $E(\varepsilon_1) = E(\varepsilon_2) = 0$, $Var(\varepsilon_1) = E(\varepsilon_2) = 1$ and $Cov(\varepsilon_1,\varepsilon_2) = \rho$.

The only variables that are observed by the researcher are x_1, x_2 and $y = y_1 \,.\, y_2$. Therefore, as regards the four possible decisions on leverage ("firms want to resort to debt", y_1 = 1, and "creditors want to grant debt", y_2 = 1; "firms want to resort to debt", y_1 = 1, but "creditors do not want to grant debt", y_2 = 0; "firms do not want to resort to debt", y_1 = 0, but "creditors would grant debt", y_2 = 1; and "firms do not want to resort to debt", y_1 = 0, and "creditors would not grant debt", y_2 = 0), the latter three end up indistinguishable as all we may observe is that firms are debt-free.

The probability that the *i*th firm decides to resort to debt and that the debt is actually granted by the creditor is given by:

$$\begin{aligned} Prob[y = 1] &= Prob\left[y_1^* > 0, y_2^* > 0\right] \\ &= Prob[\varepsilon_1 > -\beta_1' x_1, \varepsilon_2 > -\beta_2' x_2] \\ &= \Phi_2(\beta_1' x_1, \beta_2' x_2, \rho) \end{aligned} \quad (2)$$

Reciprocally, the probability that the *i*th firm holds no debt results from:

$$Prob[y = 0] = 1 - Prob[y_1 = 1] \quad (3)$$

As noted by Poirier (1980), in spite of not observing y_1 and y_2, estimation of the coefficients of the demand and supply functions remains feasible. The model's likelihood function is:

$$L = \prod_{y=1}[\Phi_2(\beta_1' x_1, \beta_2' x_2, \rho)] \prod_{y=0}[1 - \Phi_2(\beta_1' x_1, \beta_2' x_2, \rho)] \quad (4)$$

with the two equations being jointly estimated by maximum likelihood. For the model to be identified, it is necessary that at least one of the variables contained in x_1 does not appear in x_2, or vice versa ($x_1 \neq x_2$). Note that, unlike typical zero leverage empirical studies, we model *directly* the probability of a firm being levered, not of being debt-free.

3.3. Variables

Following previous studies on capital structure, book leverage ratio is defined as the sum of the short- and long-term debt divided by total assets (Strebulaev & Yang, 2013). Therefore, a firm is considered to adopt a zero-leverage (ZL) policy if both short-term debt and long-term debt are equal to zero in a given year. The reverse of *ZL*, i.e. *Leverage* (*y*) takes the value of 1 if in a given year the amount of debt is greater than zero and is 0 otherwise.

To appropriately identify the parameters of the demand and supply equations, the vectors of explanatory variables included in each equation need to differ in some variables. This requirement is met by our model, since, as discussed in the previous section, there are variables that we consider as relevant only for the demand for debt (Cash holdings, Non-debt tax shields, Ownership concentration) or for the supply of debt (Size). Cash holdings is the most liquid asset possessed by a firm and a traditional measure of the firm's source for financial flexibility, being considered and interpreted in the literature as a measure mostly influencing the demand for debt (e.g. Dang, 2013). On contrary, firm size represents a traditional and accepted measure of access to external finance, generally interpreted as influencing the supply of debt (Dang, 2013; Guariglia, 2008). Regarding firms' non debt tax shields and ownership concentration, these are measures commonly used to analyse internal financing decisions, being generally interpreted as influencing demand for debt rather than supply of debt (e.g. Dang, 2013; Harford, Li, & Zhao, 2008). Table 1 provides a definition of the variables considered in the econometric models.

Table 1: Definition of the variables

Variable	Definition*
Book leverage	Ratio of long- and short-term debt (03251 and 03051 or 03255) to total book assets (02999)
ZL	Dummy that equals 1 if a firm has a zero book leverage in a given year and 0 otherwise
Leverage	Dummy that equals 1 if a firm has leverage greater than zero in a given year and 0 otherwise
Cash holdings	Ratio of cash and short-term investments (02001) to book assets (02999)
Growth opportunities	Market-to-book ratio (the market value of equity (08001) plus the book value of debt (03255), divided by total assets (02999))
Profitability	Ratio of earnings before interests, taxes, and depreciation (EBITDA) (18198) to book assets (02999)
Ownership concentration	Percentage of shareholdings of 5% or more held by employees, or by individual investors (NOSHEM)
Dividend payout	Ratio of common dividends (04551) to book assets (02999)
Non-debt tax shields	Ratio of depreciation and amortizations (01151) to book assets (02999)
Tangibility	Ratio of fixed assets (02501) to book assets (02999)
Size	Logarithm of total book assets (02999)
Common law system	Dummy variable that equals 1 for countries with a common law system, and 0 for countries with a civil law system (Source: The World Factbook, CIA and Djankov et al., 2007)
Financial crisis	Equals 1 if the observation corresponds to the years of financial crisis in Europe (2008, 2009) and 0 otherwise
Sovereign crisis	Equals 1 if the observation corresponds to the years of sovereign debt crisis in Europe (the period of crisis goes from 2010 to 2011, or 2012, depending on the country being considered) and is 0 otherwise (Source: Laeven &

Valencia, 2018)[2]

* The corresponding Datastream field or code is in parentheses.

4. Empirical evidence

4.1. Descriptive analysis

Table 2 presents the distribution of observations and firms by country, highlighting the percentage of observations and firms with zero leverage.

Table 2: Sample characteristics by country

		All firms		Debt-free firms	
Country	N. firms	N. obs.	% obs.	% obs.	% firms*
Austria	114	1,026	1.60	8.87	20.18
Belgium	152	1,528	2.38	4.19	12.50
Denmark	185	1,906	2.97	8.92	22.70
Finland	181	1,925	3.00	4.05	12.15
France	1,114	10,186	15.88	2.84	9.25
Germany	995	9,248	14.42	14.10	31.86
Greece	341	3,692	5.76	6.28	21.41
Ireland	102	831	1.30	13.36	32.35
Italy	339	3,316	5.17	2.17	8.85
Netherlands	231	2,143	3.34	8.17	21.21
Portugal	78	731	1.14	1.78	3.85
Spain	194	1,846	2.88	1.57	7.73
Sweden	743	6,351	9.90	21.82	46.16
UK	2,599	19,421	30.27	19.53	38.75
Total	7,368	64,150	100.00	12.17	28.22

* Firms that present zero-leverage levels in at least one year.

Table 2 shows that more than 60% of observations come from the UK, France and Germany. A considerable number of firms adopted a zero-leverage policy between 2001 and 2016, with 12.17% of firm-year observations corresponding to zero-leverage firms. Debt-free firms are found in all countries, which is in accordance with the evidence presented by Bessler et al. (2013) that zero leverage represents an international phenomenon. However, there is a great heterogeneity in the distribution of zero-leverage firms across countries. For example, in countries such as Sweden and the UK the percentage of zero-leverage observations is around 20%, while in France, Italy, Portugal and Spain that percentage is below 3%. These results seem to indicate that the country

[2] The *Sovereign crisis* variable takes on the value 1 only for the following countries: Austria, Belgium, Greece, Ireland, Portugal and Spain for the period 2010-2012 and UK for the period 2010-2011. See Laeven and Valencia (2018).

effect plays a determinant role in firm's decision to resort to debt and/or creditor's decision to grant it.

Table 3 shows the descriptive statistics of the model continuous variables. On average, firms present a book leverage ratio of approximately 20%, a level close to that reported by Campbell and Rogers (2018) for European firms.

Table 3: Descriptive statistics

Variable	N	mean	sd	min	median	max
Book Leverage	64,150	0.2033	0.1784	0.0000	0.1758	0.9676
Cash holdings	64,067	0.1584	0.1792	0.0000	0.0941	0.9999
Growth opportunities	58,403	1.3554	1.5263	0.0081	0.9278	29.7700
Profitability	62,668	0.0536	0.2412	-3.0000	0.0935	2.9112
Ownership concentration	51,827	0.1735	0.2455	0.0000	0.0000	1.0000
Dividend payout	60,815	0.0173	0.0409	0.0000	0.0027	0.8971
Non-debt tax shields	63,729	0.0495	0.0502	0.0000	0.0389	0.9407
Tangibility	63,897	0.2304	0.2225	0.0000	0.1606	0.9968
Size	64,150	11.6573	2.3127	2.5649	11.4956	19.8069

Table 4 presents Pearson's paired correlation coefficients for the explanatory variables and the dependent variable *Leverage*. With *Leverage* being the reverse of *ZL,* displayed coefficients only change their signal when we consider the correlation with *ZL*, maintaining the significance.

Table 4: Pearson's correlation matrix and Variance Inflation Factor
The table shows the Pearson correlation coefficients between the model variables and the VIF coefficients.
** significance at 1%; * significance at 5%

Variables	Leverage	Cash holdings	Growth opportunities	Profitability	Ownership concentration	Dividend payout	Non-debt tax shields	Tangibility	Size	VIF
Leverage	1.000									
Cash holdings	-0.399**	1.000								1.30
Growth opportunities	-0.223**	0.324**	1.000							1.20
Profitability	0.120**	-0.192**	-0.125**	1.000						1.21
Ownership concentration	0.003	0.038**	-0.018**	0.016**	1.000					1.05
Dividend payout	-0.091**	0.061**	0.178**	0.254**	-0.028**	1.000				1.15
Non-debt tax shields	0.041**	-0.085**	0,005	-0.083**	-0.008	-0.035**	1.000			1.04
Tangibility	0.181**	-0.324**	-0.130**	0.116**	-0.064**	-0.017**	0.111**	1.000		1.16
Size	0.292**	-0.260**	-0.199**	0.290**	-0.179**	0.078**	-0.102**	0.245**	1.000	1.25

The correlations between the explanatory variables are not very high, with their coefficients being always below 0.5. However, to exclude the presence of multicollinearity problems, we then calculated the variance inflation factor (VIF). As shown in the last column of the table, the VIF

is always lower than 2, which seems to indicate that multicollinearity does not represent a problem.

4.2. Econometric analysis

Table 5 presents the results from the estimated regression models. The analysis of the determinants that affect firm's decisions to resort to debt and creditor's decisions to grant debt to the firm is based on the bivariate probit models with partial observability (1)-(2). For comparison purposes, the traditional univariate probit models with random effects (3)-(4) were also estimated. In all cases, the dependent variable is *Leverage*. For each explanatory variable, we report the estimated coefficient and the result of a Wald test for its individual significance in brackets.

Model (1) only considers specific firm-level explanatory variables for the demand and supply sides, respectively. Model (2) adds the proxy variables for country effects (*Common law system*) and macroeconomic effects (*Financial crisis* and *Sovereign crisis*). Finally, model (3) includes all specific firm-level explanatory variables considered in model (1), while model (4) adds country and macroeconomic effects. All models include industry dummies.

Table 5- Regression results

Table 5 presents the main results of the econometric models. The dependent variable takes the value of 1 when the firm holds debt in a given year and 0 otherwise. For each independent variable, we report the regression coefficients and the z-statistics (in parentheses).
***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

	Bivariate Probit (1)		Bivariate Probit (2)		Univariate Probit	
Explanatory variables	Demand (a)	Supply (b)	Demand (a)	Supply (b)	(3)	(4)
Cash holdings	-3.606***		-3.552***		-2.664***	-2.662***
	(-40.33)		(-40.26)		(-27.93)	(-28.04)
Growth opportunities	-0.070***	-0.022**	-0.044***	-0.031***	-0.046***	-0.045***
	(-8.03)	(-2.39)	(-4.32)	(-3.02)	(-5.01)	(-4.85)
Profitability	-0.468***	0.139***	-0.711***	0.129***	-0.224***	-0.267***
	(-4.77)	(2.77)	(-7.59)	(2.60)	(-3.92)	(-4.71)
Ownership concentration	0.267***		0.226***		0.465***	0.509***
	(4.46)		(3.57)		(5.50)	(5.97)
Dividend payout	-1.974***	-3.207***	-2.269***	-3.144***	-3.984***	-4.083***
	(-7.08)	(-10.97)	(-8.04)	(-10.52)	(-11.39)	(-11.69)
Non-debt tax shields	1.159***		0.965**		1.654***	1.506***
	(3.12)		(2.56)		(5.46)	(4.98)
Tangibility	-0.715***	2.929***	-0.265**	1.918***	1.472***	1.474***
	(-8.03)	(9.20)	(-2.25)	(7.64)	(11.11)	(11.25)
Size		0.311***		0.313***	0.456***	0.431***

		(30.09)		(28.02)	(27.21)	(25.98)
Common law system			-0.680***	-0.213***		-0.925***
			(-16.68)	(-4.84)		(-14.30)
Financial crisis			-0.092*	0.068		0.008
			(-1.88)	(1.33)		(0.21)
Sovereign crisis			-0.179***	0,064		-0.119**
			(-3.17)	(0.87)		(-2.34)
Constant	2.430***	-2.068***	2.586***	-1.909***	-2.723***	-2.139***
	(35.79)	(-19.67)	(35.68)	(-16.66)	(-14.24)	(-11.22)
Observations	48.770		48.770		48.770	48.770
Wald test for joint significance	5399.08***		5766.82***		2389.27***	2422.96***
ρ	-0.291***		-0.288***			
Log-likelihood	-12244,95		-11835,249		-8670,1563	-8559,7934

The estimate of ρ in the bivariate probit models with partial observability is significantly different from zero, which indicates that the demand and supply equations require simultaneous estimation (Mohanty, 2002). This result confirms the importance of the bivariate probit model with partial observability in analysing the factors influencing debt decisions and shows that the application of univariate decision methods such as standard probit models to study firms' zero leverage may be inefficient in dealing with the firm decision to resort to debt and the lender decision to concede debt.

Model (1) reveals that all explanatory variables included in both the demand and supply equations are statistically significant. Moreover, the results show that there are variables that impact in opposite ways the demand and supply of debt, such as *Profitability* and *Tangibility*. This simple finding clearly illustrates the main advantage of using a bivariate probit model instead of its univariate version: with the latter model it would be impossible to detect the distinct effect that those two variables have on the demand and supply of debt. We would simply conclude, see model (3), that *Profitability* decreases the probability of a firm being levered and *Tangibility* increases it.

Instead, with the bivariate probit model, we find that more profitable firms have lower tendency to resort to leverage (increasing the propensity for zero leverage by their own decision) but, whenever doing so, they experience greater creditor willingness to finance them (reducing the propensity for zero leverage by creditor-related reasons). The negative effect of profitability on firms' decisions to resort to debt are in line with the arguments of the Pecking Order theory and with the financial flexibility approach. Specifically, most profitable firms may avoid debt in order to preserve their borrowing capacity at the same time that they promote an increase in their internal liquidity (Myers, 1984; Myers & Majluf, 1984) in order to fund future good growth

opportunities (Marchica & Mura, 2010). On the other hand, the positive effect of profitability on the supply of debt is supported by the financial constraints approach, since more profitable firms give better guarantees to remunerate debt holders and, thus, creditors are more willing to grant debt to them (Kaplan & Zingales, 1997; Whited & Wu, 2006). Therefore, these results provide support to hypotheses H3 and H13.

Regarding asset tangibility, the results show that firms with greater asset tangibility have lower propensity to resort to debt (increasing the propensity for zero leverage by their own decisions), but greater creditor availability to finance them (reducing the propensity for zero leverage by creditor-related reasons). The negative effect of asset tangibility on the demand for debt contradicts the arguments of Trade-off theory and allows us to reject hypothesis H7. One possible explanation for this result stems from the financial flexibility approach, i.e. firms with higher levels of tangible assets have less need to use debt as they can liquidate their existing assets for self-financing, which enables them to keep their borrowing power for future investments (Marchica & Mura, 2010). In contrast, the positive effect of tangibility supports hypothesis H11 and confirms that firms with a higher level of tangible assets (collateral) are less credit constrained (Benmelech & Bergman, 2009).

Growth opportunities and *Dividend payout* are the other variables that appear in both the demand and supply equations in model (1). Both affect negatively the probability of holding debt in both equations and, hence, higher growth opportunities and dividend payouts increase the zero leverage propensity both by firm decision and creditor imposition. Regarding the former variable, firms with higher growth opportunities have incentives to preserve their borrowing capacity in order to be able to invest when future projects with positive NPV appear (de Jong et al., 2012; Marchica & Mura, 2010) and thus reduce their demand for debt at the present; and information asymmetries are more severe for firms with a predominance of growth opportunities, because their value falls dramatically in case of bankruptcy (Shleifer & Vishny, 1992), which makes it difficult for creditors to recover their money. On the other hand, the negative impact of dividend payments on firms' decisions to resort to debt is in line with the agency theory related with free cash-flow (Jensen, 1986): firms use dividends to distribute free cash-flow to shareholders (Easterbrook, 1984; Fama & French, 2002) and thus do not need to use debt to control managerial entrenchment. The negative impact of dividends on the supply of debt contradicts the financial constraints argument that firms with higher dividend payments suffer less from information asymmetries and are then expected to increase creditor availability to grant debt to those firms (Fazzari et al., 1988). One possible explanation for this result is that dividend payments contribute to the decapitalisation of firms leaving them less able to comply with its debt service and reducing the creditor propensity to grant debt to those firms. Overall, our results provide support to hypotheses H2, H5 and H14, but do not validate hypothesis H12.

Considering now the variables assumed to be only related to the demand for debt, we observe that C*ash holdings* have a negative effect on firm decision to use debt and, thus, a positive effect on the propensity of firms to adopt zero-leverage policies. This result is in accordance with both the financial flexibility (de Jong et al., 2012) and the Pecking Order theories (Myers, 1984; Myers & Majluf, 1984) and supports hypothesis H1. As regards the *Ownership concentration* variable, we find that the higher the concentration of the ownership, the greater the propensity of the firm to resort to debt. This is because the existence of large shareholders reduces the incentives for managerial entrenchment and for the maintenance of zero-leverage levels (Shleifer & Vishny, 1986), as stated in hypothesis H4. Finally, firms with higher non-debt tax shields demand more debt and have a lower propensity for zero leverage. This result contradicts the arguments of Trade-off theory, according to which firms with high tax benefits from sources other than debt should have lower incentives to use debt (DeAngelo & Masulis, 1980). Therefore, hypothesis H6 is rejected.

The only variable considered only in the supply side*, Size*, has a positive coefficient, which indicates that creditors are more willing to grant loans to larger firms, thereby increasing the tendency of small firms to adopt zero leverage due to creditor imposition. This result is supported by the financial constraints approach, which argues that smaller firms have lower reputations in the debt market and suffer greater information asymmetries (Diamond, 1991; Hadlock & Pierce, 2010). This finding provides support to hypothesis H10.

Model (2) adds the *Commom law system*, *Financial crisis* and *Sovereign crisis* variables. Overall, the introduction of these variables does not modify the key conclusions taken from model (1), with no changes in terms of coefficients' sign and significance for the firm-level variables. The *Common law system* variable presents a negative and significant coefficient for both the demand for debt and supply of debt, which reflects the negative (positive) effect of the common law system (civil law system) on leverage. Therefore, a country with a common law system (civil law system) increases (reduces) firm propensity to be debt-free by its own decision. Similarly, creditors in common law systems are less available to concede debt to firms than in civil law systems, which increases the propensity for zero-leverage levels by creditor imposition in the former countries. These results are in accordance with the idea that the banking sector in civil law systems gives to the bank privileged access to the firm's history (Leland & Pyle, 1977), decreasing information asymmetries. As a result, creditors become more willing to grant debt in more favourable conditions in civil law systems (Djankov et al., 2007; Takami, 2016). In short, the zero-leverage phenomenon is potentiated in common law systems both by firm decision and creditor imposition, which confirms hypotheses H8 and H15.

Regarding the variables representing recent crisis periods, *Financial crisis* and *Sovereign crisis*, we find that they are significant only in the demand equation. This means that neither the financial crisis nor the sovereign crisis impacted significantly the availability of creditors to grant

debt. In contrast, the results show that during the mentioned crises the propensity of firms to use debt decreased by firm decision. The evidence that crisis periods, particularly the period representing the financial crisis, did not affect the creditor's willingness to grant credit to the firm, does not corroborate the results presented by Ivashina and Sharfstein (2010) and Santos (2011). However, our results are close to the conclusions presented by Kahle and Stulz (2013) that reductions in firms' credit is not primarily conducted by credit supply shocks but by demand shocks. Overall, our results provide support to hypothesis H9 but not to hypothesis H16.

Table 6 summarizes the conclusions of our study.

Table 6: Tested hypotheses

Hypothesis	Validated / Rejected
H1: Cash holdings have a negative effect on firm's decisions to resort to debt.	Validated
H2: Growth opportunities have a negative effect on firm's decisions to resort to debt.	Validated
H3: Profitability has a negative effect on firm's decisions to resort to debt.	Validated
H4: Ownership concentration has a positive effect on firm's decisions to resort to debt.	Validated
H5: Dividend payout has a negative effect on firm's decisions to resort to debt.	Validated
H6: Non-debt tax shields have a negative effect on firm's decisions to resort to debt.	Rejected
H7: Asset tangibility has a positive effect on firm's decisions to resort to debt.	Rejected
H8: A common law system (civil law system) has a negative (positive) effect on firm's decisions to resort to debt.	Validated
H9: Crisis periods have a negative effect on firm's decisions to resort to debt.	Validated
H10: Firm size has a positive effect on creditor's decisions to grant loans to firms.	Validated
H11: Asset tangibility has a positive effect on creditor's decisions to grant loans to firms.	Validated
H12: Dividend payout has a positive effect on creditor's decisions to grant loans to firms.	Rejected
H13: Profitability has a positive effect on creditor's decisions to grant loans to firms.	Validated
H14: Growth opportunities have a negative effect on creditor's decisions to grant loans to firms.	Validated
H15: A common law system (civil law system) has a negative (positive) effect on creditor's decisions to grant loans to firms.	Validated
H16: Crisis periods have a negative effect on creditor's decisions to grant loans to firms.	Rejected

As discussed before, the main disadvantage of using univariate probit models is the inability of such models to separate the effects of the variables over debt demand and supply. However, in terms of the overall effect of the variables, the differences between univariate and bivariate models are less important. Indeed, whenever models (1)-(2) reveal the same type of effect (positive or negative) for the covariates that appear in both the demand and supply equations, then the corresponding univariate probit models (3)-(4) indicate the same overall effect for those variables. This suggests that previous studies of zero leverage based on standard probit models are likely to have found, in general, the correct sign for the overall effects of most explanatory variables. Nevertheless, those studies may have failed to find important relationships. For example, because the financial crisis is found in model (2) to be relevant only for debt demand,

the univariate probit model (4) that mixtures both demand and supply effects is unable to find a significant effect for *Financial crisis*. Overall, the richness of the results obtained from the bivariate probit models with partial observability is clear.

5. Conclusion

This paper analyses the zero-leverage phenomenon in a sample of listed European firms over the period between 2001 and 2016. Around 12.17% of the observations are identified as zero-leverage firms. Using bivariate probit models with partial observability in the sense of Poirier (1980), we find that some variables influence in opposite directions debt demand and supply. In particular, we provide empirical evidence that although more profitable firms and firms with greater asset tangibility have lower propensity to resort to debt by their own decision, it is to these firms that creditors are more willing to grant debt.

Another implication of our study is that the recent European crises reduced the demand for debt but did not affect their supply. We also found that common law systems, growth opportunities and dividend payments reduce both firms' decision to resort to debt and creditor willingness to grant funds, thus increasing zero leverage by firm's own decision and by creditors' imposition. As expected, firm size affects positively creditors' decision to grant loans, while the level of cash holdings, non-debt tax shields and ownership concentration influence firms' decision to resort to debt.

Because firms' leverage results from a bivariate decision-making process in which firms either want or do not want to resort to debt and creditors either want or do not want to grant it (two bivariate decisions taken by two independent decision makers), bivariate probit models emerge as the most suitable approach for analysing the determinants of zero leverage. These models are particularly useful when the same variable has opposite effects on demand and supply (*Profitability* and *Tangibility*) or when the effect is only significant in one of those equations (*Financial crisis* and *Sovereign crisis*), as our empirical study illustrates. Ours is the first study in the zero-leverage literature that uses bivariate probit models and, as such, the first one to show what motivates firms' decision to resort or not to debt and what drives the decision of the creditor to grant or not to grant debt to the firm.

Some practical implications of the study can be derived. For managers wishing to resort to debt, we empirically show that greater firm's profitability, asset tangibility and size favours greater creditor willingness to lend and that may eventually result in better credit conditions. Contrarily, higher dividend payments and growth opportunities reduce creditor propensity to grant debt, which might therefore mean worse credit conditions. Furthermore, for managers of profitable firms and with greater asset tangibility who do not wish to resort to debt, it is shown

that they can eventually obtain credit on favourable terms for the firm, considering the creditor willingness to lend them debt.

Future capital structure research based on binary dependent variables must take into consideration that the results obtained from the traditional logit and probit models might not only be ineffective but also fail to convey a clear view of decisions on leverage. Future studies should also explore the performance of debt-free firms, investigating whether the zero-leverage phenomenon when resulting from the firm's financial decisions increases its performance and when originated by lender's impositions produces a lower performance.

References

Antoniou, A., Guney, Y., & Paudyal, K. (2008). The determinants of capital structure : capital market oriented versus bank oriented institutions. *Journal of Financial and Quantitative Analysis, 43*(1), 59–92.

Bancel, F., & Mittoo, U. R. (2004). The determinants of capital structure choice : A survey of European firms. *Financial Management, 33*(4), 103–132.

Benmelech, E., & Bergman, N. K. (2009). Collateral pricing. *Journal of Financial Economics, 91*(3), 339–360.

Bessler, W., Drobetz, W., Haller, R., & Meier, I. (2013). The international zero-leverage phenomenon. *Journal of Corporate Finance*, *23*(1), 196–221.

Brounen, D., de Jong, A., & Koedijk, K. (2006). Capital structure policies in Europe: Survey evidence. *Journal of Banking and Finance, 30*(5), 1409–1442.

Brunnermeier, M. K. (2009). Deciphering the liquidity and credit crunch 2007-2008. *Journal of Economic Perspectives, 23*(1), 77–100.

Byoun, S., & Xu, Z. (2013). Why do some firms go debt free ? *Asia-Pacific Journal of Financial Studies*, *42*(1), 1–38.

Campbell, G., & Rogers, M. (2018). Capital structure volatility in Europe. *International Review of Financial Analysis, 55*(1), 128–139.

Cook, D. O., & Tang, T. (2010). Macroeconomic conditions and capital structure adjustment speed. *Journal of Corporate Finance, 16*(1), 73–87.

D'Mello, R., & Gruskin, M. (2014). Are the benefits of debt declining? The decreasing propensity of firms to be adequately levered. *Journal of Corporate Finance, 29*(1), 327–350.

Dang, V. A. (2013). An empirical analysis of zero-leverage firms : New evidence from the UK. *International Review of Financial Analysis*, *30*(1), 189–202.

de Jong, A., Verbeek, M., & Verwijmeren, P. (2012). Does financial flexibility reduce investment distortions? *Journal of Financial Research*, *35*(2), 243–259.

DeAngelo, H., & Masulis, R. W. (1980). Optimal capital structure under corporate and personal taxation. *Journal of Financial Economics, 8*(1), 3–29.

Demirgüç-Kunt, A., & Levine, R. (1999). Bank-based and market-based financial systems: Cross-country comparisons. *Police Research Working Paper*, World Bank, 1–73. https://doi.org/10.1.1.195.8349

Devos, E., Dhillon, U., Jagannathan, M., & Krishnamurthy, S. (2012). Why are firms unlevered ? *Journal of Corporate Finance*, *18*(3), 664–682.

Diamond, D. W. (1991). Monitoring and reputation: The choice between bank loans and directly placed debt. *Journal of Political Economy*, *99*(4), 689–721.

Djankov, S., McLiesh, C., & Shleifer, A. (2007). Private credit in 129 countries. *Journal of Financial Economics, 84*(2), 299–329.

Easterbrook, F. H. (1984). Two agency-cost explanations of dividends. *American Economic Review, 74*(4), 650–659.

European Commission (2014). *Helping firms grow - European competitiveness Report 2014*.

European Investment Bank (2015). *Investment and Investment Finance in Europe – Investing in Competitiveness*.

Fama, E. F. (1980). Agency problems and the theory of the firm. *Journal of Political Economy, 88*(2), 288–307.

Fama, E. F., & French, K. R. (2002). Testing Trade-off and Pecking Order predictions about dividends and debt. *The Review of Financial Studies, 15*(1), 1–33.

Fan, J. P. H., Titman, S., & Twite, G. (2012). An international comparison of capital structure and debt maturity choices. *Journal of Financial and Quantitative Analysis, 47*(1), 23–56.

Fazzari, S. M., Hubbard, G. R., & Petersen, B. C. (1988). Finance constraints and corporate investment. *Brookings Papers on Economic Activity*, *19*(1), 141–206.

Ferrando, A., Marchica, M. T., & Mura, R. (2017). Financial flexibility and investment ability across the Euro area and the UK. *European Financial Management*, *23*(1), 87–126.

Gamba, A., & Triantis, A. (2008). The value of financial flexibility. *The Journal of Finance*, *63*(5), 2263–2296.

Ghose, B., & Kabra, K. C. (2016). What determines firms' zero-leverage policy in India? *Managerial Finance*, *42*(12), 1138–1158.

Ghoul, S., El Guedhami, O., Kwok, C., & Zheng, X. (2018). Zero-leverage puzzle : An international comparison. *Review of Finance, 22*(3), 1063–1120.

Gomes, A. (2000). Going public without governance: Managerial reputation effects. *The Journal of Finance, 55*(2), 615–646.

Graham, J. R. (2000). How big are the tax benefits of debt ? *The Journal of Finance, 55*(5), 1901–1942.

Graham, J. R., & Harvey, C. R. (2001). The theory and practice of corporate finance: evidence from the field. *Journal of Financial Economics*, *60*(2–3), 187–243.

Grilli, L. (2005). Internet start-ups access to the bank loan market: Evidence from Italy. *Applied Economics, 37*(3), 293–305.

Guariglia, A. (2008). Internal financial constraints, external financial constraints, and investment choice: Evidence from a panel of UK firms. *Journal of Banking and Finance, 32*(9), 1795–1809.

Hadlock, C. J., & Pierce, J. R. (2010). New evidence on measuring financial constraints : Moving beyond the KZ index. *The Review of Financial Studies*, *23*(5), 1909–1940.

Harford, J., Li, K., & Zhao, S. (2008). Corporate boards and the leverage and debt maturity choices. *International Journal of Corporate Governance*, *1*(1), 3–27.

Heino, H. (2006). Use of borrowed start-up capital and micro enterprises in Mexico: Existence of liquidity constraints. *Portuguese Economic Journal, 5*(1), 1–30.

Huang, Z., Li, W., & Gao, W. (2017). Why do firms choose zero-leverage policy ? Evidence from China. *Applied Economics*, *49*(28), 2736–2748.

Ivashina, V., & Scharfstein, D. (2010). Bank lending during the financial crisis of 2008. *Journal of Financial Economics*, *97*(3), 319–338.

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review, 76*(2), 323–329.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics, 3*(4), 305–360.

Kahle, K. M., & Stulz, R. M. (2013). Access to capital, investment, and the financial crisis. *Journal of Financial Economics, 110*(2), 280–299.

Kaplan, S., & Zingales, L. (1997). Do investment-cash flow sensitivities provide useful measures of financing constraints ? *Quarterly Journal of Economics, 112*(1), 169–215.

Korajczyk, R. A., & Levy, A. (2003). Capital structure choice: macroeconomic conditions and financial constraints. *Journal of Financial Economics, 68*(1), 75–109.

Korteweg, A. (2010). The net benefits to leverage. *The Journal of Finance*, *65*(6), 2137–2170.

Kraus, A., & Litzenberger, R. H. (1973). A state-preference model of optimal financial leverage. *The Journal of Finance, 28*(4), 911–922.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. W. (1997). Legal determinants of external finance. *The Journal of Finance, 52*(3), 1131-1150.

Laeven, L., & Valencia, F. (2018). Systemic banking crises revisited. *IMF Working Paper*, 1–47.

Leland, H. E., & Pyle, D. H. (1977). Informational asymmetries, financial structure, and financial intermediation. *The Journal of Finance, 32*(2), 371–387.

Lotfaliei, B. (2018). Zero leverage and the value in waiting to have debt. *Journal of Banking and Finance, 97*, 335–349.

Marchica, M., & Mura, R. (2010). Financial flexibility , investment ability, and firm value : Evidence from firms with spare debt capacity. *Financial Management*, *39*(4), 1339–1365.

Modigliani, F., & Miller, M. H. (1963). Corporate income taxes and the cost of capital : A correction. *American Economic Review, 53*(3), 433–443.

Mohanty, M. S. (2002). A bivariate probit approach to the determination of employment: A study of teen employment differentials in Los Angeles county. *Applied Economics, 34*(2), 143–156.

Moradi, A., & Paulet, E. (2019). The firm-specific determinants of capital structure - An empirical analysis of firms before and during the Euro Crisis. *Research in International Business and Finance, 47*, 150-161.

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics, 5*(2), 147–175.

Myers, S. C. (1984). The capital structure puzzle. *The Journal of Finance*, *39*(3), 575–592.

Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics, 13*(2), 187–221.

Poirier, D. J. (1980). Partial observability in bivariate probit models. *Journal of Econometrics, 12*(2), 209–217.

Santos, J. (2011). Bank corporate loan pricing following the subprime crisis. *The Review of Financial Studies, 24*(6), 1916–1943.

Shleifer, A., & Vishny, R. W. (1986). Large shareholders and corporate control. *Journal of Political Economy, 94*(3), 461–488.

Shleifer, A., & Vishny, R. W. (1992). Liquidation values and debt capacity : A market equilibrium approach. *The Journal of Finance, 47*(4), 1343–1366.

Stiglitz, J. E., & Weiss, A. (1981). Credit rationing in markets with imperfect information. *The American Economic Review*, *71*(3), 393–410.

Strebulaev, I. A., & Yang, B. (2013). The mystery of zero-leverage firms. *Journal of Financial Economics*, *109*(1), 1–23.

Stulz, R. M. (1990). Managerial discretion and optimal financing policies. *Journal of Financial Economics, 26*(1), 3–27.

Takami, S. (2016). Factors inhibiting Japanese firms from zero leverage : financial constraints and bank relationships. *Asia-Pacific Journal of Accounting Economics*, *23*(2), 161–176.

Whited, T. M., & Wu, G. (2006). Financial constraints risk. *The Review of Financial Studies*, *19*(2), 531–559.

Wooldridge, J. M. (2012). *Introductory econometrics: A modern approach* (5th ed.). Mason, Ohio: South-Western Cengage Learning.

Zhang, S., & Gregoriou, A. (2019). The price behavior around initial loan announcements: Evidence from zero-leverage firms in the UK. *Research in International Business and Finance, 50*, 191-200.