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The puzzling phenomenon of zero-leverage firms: characteristics and performance of unlevered firms

Flávio Daniel Correia Morais

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Orientador: Prof. Doutora Zélia Maria da Silva Serrasqueiro
Co-orientador: Prof. Doutor Joaquim José dos Santos Ramalho

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Dedication

With love, I dedicate this work to my wife Carolina, my little son Manuel, my parents, Manuel João and Maria José, my brothers, my nephews and to my loved grandmother hoping that she receives this dedication.

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Extended abstract

Long is the discussion about firm's capital structure decisions. The pioneering study by Modigliani and Miller (1958) based on the assumption of a perfect capital market represents the common point to all theories that have been developed and still applied today to the field of capital structure decisions. Whether by bringing tax benefits (trade-off theory), by reducing information asymmetries (pecking order theory), by contributing to the reduction of agency conflicts between shareholders and managers (agency theory) or by signalling good firm's prospects and the existence of value creating projects (signalling theory), the classical theories of capital structure focus on the existence of debt and its benefits over equity financing. Also, previous empirical studies focus on the existence of debt and, overall, investigate the motives that lead companies to have higher or lower debt levels. Therefore, the central axis of this extensive field of research is Debt, the existence of debt being assumed to be something natural and until a sustainable level beneficial to firms. However, the last decade has been marked by the finding that a considerable number of firms does not hold any amount of debt in their capital structure, with an increasing trend towards the emergence of debt-free firms. This phenomenon known as the "mysterious of zero leverage" or the "zero-leverage puzzle" contradicts classical theories of capital structure, which has aroused the interest of the scientific community, being considered a fertile topic for further research. In order to explore the phenomenon of zero leverage and increase our knowledge about an unexpected and puzzling financing policy that has become a trend in recent years, this thesis is composed by 5 empirical articles that explore a sample of listed firms from 14 European countries. The main purpose of this thesis is to examine what motivates firms to be debt-free and the effects on their performance by following an extremely conservative financing policy.

The first paper included in this Ph.D. thesis (CHAPTER 3) has the title "The zero-leverage phenomenon in European listed firms: a financing decision or an imposition of the financial market?". Recognizing that zero leverage can arise from the creditor's imposition who do not wish to grant credit, as suggested by the financial constraints approach, or by firm's own financial decision, as suggested by the financial flexibility approach, this paper has as first goal to examine whether zero leverage in the European context can be explained by any of these theoretical approaches. Next, it is our intention to analyse the role played by country-specific characteristics and the 2008 global financial crisis on the zero-leverage phenomenon. Finally, it is proposed to examine whether financing flexibility and financing constraints motives for zero leverage are

dependent or not of the country and/or macroeconomic conditions. The results from several models that consider the binary nature of our dependent variable show that in the European context there are two types of zero-leverage firms: financially constrained firms that are unable to get any funding; and financially unconstrained firms, which maintain zero leverage by choice. Also, the European financial and sovereign debt crises increased the propensity for zero leverage only for market-based countries, since no significant changes occurred in bank-based countries. Finally, the relevance of the financial flexibility approach (zero leverage by firm's decision) is higher in market-based systems and that the financial constraints approach did not gain importance with the 2008 crisis.

The second paper included in this Ph.D. thesis (CHAPTER 4) has the title "The heterogeneous effect of governance mechanisms on zero-leverage phenomenon across financial systems". Recognizing that zero debt can be the consequence of opportunistic managers that aim to increase their private benefit, this paper analyses the effect of governance mechanisms on zero debt. Particularly, it is our aim to examine the effect of firm- and country-specific governance mechanisms on the propensity for firms having zero leverage. Finally, it is our intention to analyse whether their effects vary or not across different financial systems. The results show that the impact of country-specific governance mechanisms on zero leverage differs across financial systems, with stronger national governance mechanisms increasing (decreasing) the propensity for zero leverage in bank(market)-based countries. Additionally, the firm's ownership concentration only impacts significantly the zero-leverage phenomenon in bank-based countries, while board dimension and independency do not impact it.

The third paper included in this Ph.D. thesis (CHAPTER 5) has the title "The zero-leverage phenomenon: A bivariate probit with partial observability approach" and using bivariate probit models with partial observability aims to examine the factors that affect the demand for debt and the supply of debt. The regression model used allows us to provide empirical evidence on the determinants of the firm decisions on whether or not to resort to debt and creditor decisions on whether or not to concede debt to firms. Results show that some variables may influence in opposite directions debt demand and supply. For example, although more profitable firms have lower propensity to resort to debt by their own decision, it is to these firms that creditors are more willing to grant debt. Therefore, zero leverage in most profitable firms arises from firm's own decision and not by creditors imposition. Another highlight is the fact that tangibility does not affect firms' demand for debt, but creditors are more prone to grant debt to firms with greater asset tangibility, thus decreasing the propensity for zero leverage by creditor-

related reasons. Conversely, the recent European crises decrease the demand for debt but did not affect their supply, thus the recent European crises increase the propensity for zero leverage only by firms' own decision.

The fourth paper included in this Ph.D thesis (CHAPTER 6) has the title "Capital structure speed of adjustment heterogeneity across zero leverage and leveraged European firms". As established by the dynamic trade-off theory, firms actively adjust to a target level of debt, thus this paper aims to investigate whether firms classified as zero leverage adjust or not to a target debt ratio and, if they do, how fast they do it. Several comparative analyses are carried out between zero-leverage firms and leveraged firms. Overall, results show that zero-leverage firms adjust to a target level of debt but present an annual speed of adjustment significantly slower than the exhibited by leveraged firms. In addition, both zero-leverage and leveraged firms present a greater speed of adjustment in market-based financial systems. Finally, it is found that zero-leverage firms increased significantly their speed of adjustment during the 2008 financial crisis even exceeding the speed of adjustment of leveraged firms.

The fifth paper included in this Ph.D thesis (CHAPTER 7), has the title "To be or not to be debt-free, which is the optimal answer for a better firm performance?". This paper aims to examine the impact of zero-leverage policies on the firm's financial performance. Empirical results show that zero-leverage policies significantly increase the firm's performance, this effect being even stronger during the 2008 global financial crisis. The positive effect of zero debt on firm's performance is observed for both financially unconstrained and constrained firms. However, the estimated stronger positive effect of zero leverage on firm's performance during crisis periods only holds for the group of financially unconstrained firms.

Keywords

Zero leverage; Debt-free firms; Capital structure; Financial constraints; Financial flexibility; Financial system; Legal system; Financial crisis; European crises; Corporate governance; Country governance; Speed of adjustment; Firm's performance; Bivariate probit models; DPF estimator; Dynamic panel data; Propensity score methods

Resumo alargado

Longa vai a discussão sobre as decisões que afetam a estrutura de capital das empresas. O pioneiro estudo de Modigliani e Miller (1958) baseado no pressuposto de um mercado de capitais perfeito apresenta-se como o ponto comum a todas as teorias que se desenvolveram e ainda hoje se aplicam às decisões de financiamento que as empresas enfrentam. Quer seja por trazer benefícios fiscais (teoria de *trade-off*), reduzir assimetrias de informação (teoria de *pecking order*), contribuir para a diminuição dos conflitos de agência entre acionistas e gestores (teoria da agência) ou por transmitir ao mercado que a empresa possui boas perspetivas de crescimento e projetos criadores de valor (teoria dos sinais), as abordagens teóricas clássicas centram-se na existência de dívida e nos seus benefícios face ao financiamento via capital próprio. Nesse sentido também caminham os estudos empíricos existentes, que investigam os motivos que levam as empresas a ter maior ou menor montante de dívida na sua estrutura de capitais. Portanto, o eixo central desta extensa área de investigação das finanças empresarias é a Dívida, assumindo-se a existência de dívida, em maiores ou menores quantidades, como algo natural e benéfico para a empresa quando mantida a um nível sustentável. No entanto, a última década fica marcada pela descoberta de que um número considerável de empresas não apresenta qualquer montante de dívida na sua estrutura de capitais, existindo uma tendência crescente para o surgimento de empresas sem dívida. Este fenómeno, conhecido como o mistério do endividamento zero ou o puzzle do endividamento zero, contraria a teoria e tem despertado o interesse da comunidade científica, considerando-se uma área fértil para novas investigações. No sentido de explorar o fenómeno do endividamento zero e aumentar o conhecimento sobre uma inesperada política de endividamento que virou moda nos anos mais recentes, esta tese é composta por 5 artigos empíricos que exploram uma amostra de empresas cotadas de 14 países do continente Europeu. O principal objetivo desta tese passa por examinar o que motiva as empresas a não ter dívida e os efeitos na sua performance por seguir uma política de endividamento extremamente conservadora.

O primeiro artigo empírico desta tese (Capítulo 3) intitula-se "The zero-leverage phenomenon in European listed firms: a financing decision or an imposition of the financial market?". Reconhecendo que o endividamento zero pode surgir por imposição dos credores que se recusam a financiar a empresa, tal como sugerido pela abordagem dos constrangimentos financeiros, ou por decisão financeira da própria empresa, tal como sugerido pela abordagem da flexibilidade financeira, este artigo tem como primeiro propósito examinar se o endividamento zero no contexto Europeu pode ser explicado por

alguma destas abordagens teóricas. De seguida, pretende-se analisar o efeito das caraterísticas específicas do país, nomeadamente as caraterísticas do seu sistema financeiro, e o impacto da crise financeira de 2008 no endividamento zero. Finalmente, pretende-se examinar se os motivos da flexibilidade financeira e dos constrangimentos financeiros para o endividamento zero dependem ou não das caraterísticas do país ou das condições macroeconómicas. Os resultados provenientes de diversos modelos que consideram a natureza binária da variável dependente em estudo mostram que no contexto Europeu existem dois tipos de empresas sem dívida: as empresas constrangidas financeiramente e as empresas não constrangidas financeiramente que mantêm níveis de endividamento zero por decisão própria. Também a crise financeira e da dívida pública aumentou a propensão para o endividamento zero, mas este efeito apenas se revela significante em países com sistema financeiro baseado no mercado de capitais. Finalmente, a relevância da abordagem da flexibilidade financeira (dívida zero por decisão da empresa) é maior em países com sistema financeiro baseado no mercado de capitais, enquanto a abordagem dos constrangimentos financeiros não ganhou importância com o período da crise iniciada em 2008.

O segundo artigo empírico da tese (Capítulo 4) tem como título "The heterogeneous effect of governance mechanisms on zero-leverage phenomenon across financial systems". Reconhecendo que o endividamento zero surgir de decisões oportunistas dos gestores que visam aumentar o seu benefício privado, este artigo analisa o efeito dos mecanismos de governança no endividamento zero. Particularmente, pretende-se examinar o efeito dos mecanismos de governança específicos do país e da empresa no endividamento zero. Finalmente, pretende-se analisar se estes efeitos variam ou não entre diferentes sistemas financeiros. Os resultados mostram que os mecanismos de governança específicos de cada país têm um impacto significativo no endividamento zero, mas o seu efeito difere entre sistemas financeiros. Concretamente, fortes mecanismos nacionais de governança aumentam (diminuem) a propensão para o endividamento zero em sistemas financeiros baseados na banca (no mercado de capitais). Adicionalmente, a concentração da propriedade apenas impacta significativamente o endividamento zero em sistemas baseados na banca, enquanto a dimensão e independência do conselho de administração não afetam o endividamento zero.

O terceiro artigo empírico (Capítulo 5) tem como título "The zero-leverage phenomenon: A bivariate probit with partial observability approach" e utilizando modelos probit bivariados com observação parcial pretende examinar os fatores que afetam a procura por dívida e a oferta de dívida. O método econométrico utilizado permite fornecer

evidências empíricas sobre os determinantes da decisão da empresa recorrer ou não à dívida e os determinantes dos credores concederem ou não dívida à empresa. Os resultados mostram que algumas variáveis afetam em direções opostas a procura e oferta de dívida. Por exemplo, as empresas mais lucrativas têm uma menor propensão para recorrer à dívida, mas é a estas empresas que os credores estão mais dispostos a conceder crédito. Portanto, o endividamento zero nas empresas mais lucrativas é uma política com origem na sua própria decisão financeira e não por imposição dos credores. Outro destaque vai para o facto de a tangibilidade do ativo não afetar a procura por dívida, mas aumentar a propensão para os credores concederem crédito às empresas, pelo que aumenta a propensão para o endividamento zero das empresas com menor tangibilidade do ativo por imposição dos credores. Contrariamente, as recentes crises Europeias diminuem a propensão para a empresa recorrer à dívida, mas não afetam a decisão dos credores em conceder dívida, pelo que as recentes crises europeias aumentam a propensão para o endividamento zero por decisão financeira da empresa.

O quarto artigo empírico (Capítulo 6) tem como título "Capital structure speed of adjustment heterogeneity across zero leverage and leveraged European firms". Tal como estabelecido pela teoria de *trade-off* dinâmica as empresas ajustam-se ativamente a um nível alvo de endividamento. Neste contexto, este artigo tem como propósito investigar se as empresas classificadas como não tendo dívida perseguem ou não um nível alvo de endividamento e, se perseguem, a que velocidade ajustam a esse alvo. Diversas análises comparativas são desenvolvidas entre empresas classificadas como tendo endividamento zero e empresas que recorrem à dívida. Os resultados mostram que de um modo geral as empresas sem dívida também ajustam a um nível alvo, mas fazem-no a uma velocidade significativamente inferior às empresas com dívida. Adicionalmente, verifica-se que tanto empresas classificadas como tendo endividamento zero e empresas com dívida ajustam mais rapidamente ao alvo em sistemas financeiros baseados no mercado de capitais. Finalmente, descobre-se que as empresas sem dívida aumentam de forma significativa a sua velocidade de ajustamento ao alvo durante a crise iniciada em 2008, excedendo até a velocidade de ajustamento das empresas que recorrem à dívida.

O quinto artigo empírico (Capítulo 7) tem como título "To be or not to be debt-free, which is the optimal answer for a better firm performance?". Este artigo tem como propósito examinar o impacto das políticas de endividamento zero na performance financeira da empresa. Os resultados obtidos mostram que as políticas de endividamento zero aumentam de forma significativa a performance da empresa tornando-se este efeito ainda mais forte durante a crise iniciada em 2008. O efeito positivo do endividamento zero na performance das empresas é observado tanto para empresas classificadas como

constrangidas financeiramente como não constrangidas financeiramente. Todavia, o fortalecimento do impacto da política de endividamento zero na performance estimado durante o período de crise apenas é válido para o grupo de empresas sem constrangimentos financeiros.

Palavras-chave

Endividamento zero; Empresas livres da dívida; Estrutura de capitais; Constrangimentos financeiros; Flexibilidade financeira; Sistema financeiro; Sistema legal; Crise financeira; Crises Europeias; Governança corporativa; Governança nacional; Velocidade de ajustamento; Performance empresarial; Modelos probit bivariados; Estimador DPF; Dados dinâmicos em painel; Métodos de propensity scores

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CHAPTER 1

Introduction

1. Motivation and research problem

Theoretical foundations about capital structure decisions start with the irrelevance paradigm of Modigliani and Miller (1958), which under the assumptions of a perfect capital market show that the debt-equity mix does not influence the firm's market value. However, in a real-world context, market frictions are a reality. On the one hand, the existence of corporate taxes brings debt tax shields (Modigliani and Miller, 1963), while the use of debt financing also increases the likelihood of financial distress and bankruptcy risks (Kraus and Litzenberger, 1973), thus, debt costs can outweigh their benefits. Recognizing the existence of debt benefits and costs, trade-off theory advocates that there exists an optimal capital structure that maximizes the firm's value. On the other hand, the existence of information asymmetries is the theoretical support of the pecking order theory predictions (Myers, 1984; Myers and Majluf, 1984), which challenges trade-off theory by arguing that firms do not have a target capital structure on mind. On the contrary, the pecking order theory argues that firms follow a hierarchy in funding sources according to their costs, i.e., only when the capacity to raise least expensive financing sources is exhausted firms turn to more expensive funding. Recognizing that debt issuance generates lower information costs than issuing equity, debt financing is expected to have a lower cost than equity, and hence the pecking order theory postulates firm's preference for financing through debt over equity. Another classical theory of capital structure is the agency theory, which considers the existence of agency conflicts to ground their theoretical perspective over the firm's capital structure (Jensen and Meckling, 1976; Jensen, 1986). As claimed by this theory, managers are self-interested and do not always act to maximize shareholders wealth, which means that another benefit of debt is its contribution to reduce the so-called principal-agent problems by decreasing the level of free cash-flows (Jensen, 1986). In the presence of information asymmetries, debt can be also used as a way of signalling good firm's prospects and the existence of value creating projects, as well as the management commitment with the firm's investment plan, being another benefit of debt this time used by the signalling theory (Ross, 1977). Therefore, all classical capital structure theories agree that debt brings benefits to firms and that, until a sustainable level, debt

rises firm value. Since Modigliani and Miller's (1958) ground-breaking theorem six decades have passed, and firm's capital structure remains today as one of the most important and investigated topic on the corporate finance field.[1]

Despite the theoretical benefits of debt to firms, researchers have noted that a substantial number of firms have average debt ratios below the target levels (e.g. Graham, 2000) established by the static and dynamic trade-off models, not taking advantage of all debt benefits. However, this phenomenon known as the low-leverage puzzle (e.g. Strebulaev and Yang, 2013) is in part explained by an even more extreme and enigmatic financing policy that is the total absence of debt in balance sheets. Therefore, even more surprising, it is the recent finding regarding a growing number of firms does not hold any amount of debt (Bessler, Drobetz, Haller, and Meier, 2013), a phenomenon that became known as the "zero-leverage puzzle" or "mystery of zero-leverage firms" (Strebulaev and Yang, 2013). For example, firms such as Apple, Amazon and Yahoo have adopted extremely conservative levels of leverage in a given period, reaching an unexpected zero debt.[2] Some academics claim that this is an increasing and global phenomenon (Bessler et al., 2013; Ghoul, El Guedhami, Kwok, and Zheng, 2018), which includes both large, listed firms (Strebulaev and Yang, 2013) and small, unlisted firms (Ramalho and Silva, 2009). Coupled with the lack of theoretical support from classical theories of capital structure, the zero-leverage phenomenon gained relevance in the scientific community by considering that these firms effectively leave a substantial amount of "money on the table" by not levering up to catch debt benefits of debt (Graham, 2000; Korteweg, 2010; Strebulaev and Yang, 2013). The zero-leverage phenomenon is one of the most enigmatic managerial decisions about firm's capital structure. Giving the irreverence of the phenomenon, the last decade is marked by the emergence of a new line of research in corporate finance dedicated to study the zero-leverage phenomenon.

The lack of theoretical support has led academics to present alternative theoretical approaches to explain zero leverage. However, despite using similar samples in some cases, the empirical evidence of those studies is somewhat conflicting (Byoun and Xu, 2013; Devos, Dhillon, Jagannathan, and Krishnamurthy, 2012; Strebulaev and Yang, 2013), hindering the clarification of the zero-leverage phenomenon. Nevertheless,

[1] A search performed during December 2020 on Web of Science bibliographic database by papers published during 2020 that include on the title the words "capital structure" returned a total of 161 documents. The number grows substantially when we search by papers that have as one of the topics "capital structure", in which case a total of 2,145 documents is returned.

[2] See for instance the last decade annual financial reports of the firms highlighted. To access a higher number of firms with zero leverage, consult the news article posted at https://www.cnbc.com/2012/01/25/15-Companies-with-Zero-Debt.html, where 15 debt-free S&P 500 firms are presented.

previous studies agree on the existence of a significant number of debt-free firms and of a trend for their increasing importance over the years.

Specifically, Ramalho and Silva (2009) revealed that a high proportion (72.8%) of firms in their sample had no long-term debt. However, the zero-leverage phenomenon is not confined to the lack of long-term debt, but also refers to zero short-term debt. Considering both types of debt, Strebulaev and Yang (2013) showed that, between 1962 and 2009, an average of 10.2% of large listed US firms followed a zero-leverage policy. The upward trend of the phenomenon is demonstrated by D'Mello and Gruskin (2014), showing that in 1980 the percentage of zero-leverage US firms was around 6%, increasing to more than 19% in 2010. Using a similar sample, Devos et al. (2012) identified persistence of the zero-leverage phenomenon, concluding that in 2008 around 11.3% of firms in their US sample did not resort to debt in the preceding three consecutive years. Strebulaev and Yang (2013) present evidence that around 61% of firms with zero leverage continue debt-free in the following year. Despite some concentration of the phenomenon in certain industries, the studies presented above report that debt-free firms are found in most industries (Byoun and Xu, 2013; Strebulaev and Yang, 2013).

A substantial number of zero-leverage firms is also found in the UK (Dang, 2013; Zhang and Gregoriou, 2019), India (Ghose and Kabra, 2016), China (Huang Li, and Gao, 2017) and Japan (Takami, 2016). Using international samples spanning many countries, Bessler et al. (2013) and Ghoul et al. (2018) maintain that the rising trend towards zero leverage constitutes an international reality.

So significant numbers of firms with no debt, including both short- and long-term debt, have no theoretical support from classical theories of capital structure. However, this is neither an outlier nor an aberration found in the databases (Strebulaev and Yang, 2013).

2. Literature gaps and research purpose

The majority of studies dedicated to the zero-leverage phenomenon seek to answer why firms adopt a zero-leverage policy, highlighting the motives that drive their option. Assuming that classical capital structure theories are not able to explain in a unique and exclusive way zero debt, authors have proposed several alternative approaches to that purpose. The financial constraints approach has generated the greatest consensus in the literature (Bessler et al., 2013; Devos et al., 2012). According to this perspective, more than a financial decision, zero leverage is as an imposition of creditors. 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 prefer to retain financial

flexibility. Studies carried out on US firms also considered extensively the managerial entrenchment approach (Byoun and Xu, 2013; Devos et al., 2012; Strebulaev and Yang, 2013) as a possible explanation for zero leverage, while studies using international samples typically include macroeconomic variables and country-specific effects (Bessler et al., 2013; Ghoul et al., 2018). Nevertheless, despite the considerable advances made during the last decade, it is still not clear which are the theoretical approaches that best explain the zero-leverage phenomenon, as recently stressed by Saona, Vallelado and Martín (2020).

Several shortcomings are found in the literature that need to be filled to improve knowledge about the zero-leverage phenomenon. First, most studies are developed using samples of firms from market-based countries, especially the US, which favours financing through the capital market rather than through bank debt. Even studies using international samples include a high proportion of US firms (Bessler et al., 2013; Ghoul et al., 2018; Saona et al., 2020), which may indicate that their results can be strongly influenced by the considerable number of debt-free US firms. Second, the impact of the 2008 global financial crisis on zero leverage has not been analysed nor whether their effects vary across financial systems. Third, previous studies that have considered several approaches to explain zero leverage analysed them separately, estimating just a single effect of each variable on zero leverage even when different financial systems and/or time periods were used. Fourth, studies considering the managerial entrenchment and corporate governance approach on zero leverage only use firm-level governance indicators (i.e. mechanisms directly developed by the firm board and related structures or by the firm's controlling shareholders as an attempt to align principal-agent interests). However, both firm- and country-specific governance mechanisms influence monitoring forces, allowing a better or worse protection of external shareholders against managers' opportunistic decisions (Martins, Schiehll, and Terra, 2017). A final gap identified in the literature that focus on the motives explaining zero leverage is that previous studies fail to answer when zero leverage is a consequence of the firm own financing decision or it is an imposition of creditors who do not wish to grant credit to the firm. This fifth gap exists because the regression models traditionally applied to analyse the zero-leverage phenomenon (the standard logit and probit specifications) only allow to establish 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.

Beyond these shortcomings identified in the traditional literature focusing on the motives for zero leverage, we found that little is known about the targeting behaviour of

zero-leverage firms, namely whether they adjust or not to a target debt ratio and, if they do, how fast they do it. Indeed, neither the zero-leverage literature nor the specific literature focusing on the target capital structure speed of adjustment have investigated these research topics. This analysis will allow to compare the targeting behaviour of zero leverage and leveraged firms, as well as the determinants of the adjustment speed to the target of both group of firms. This analysis will help to reinforce whether zero-leverage firms present higher financial flexibility and greater debt capacity relative to leveraged firms, or whether they are more financially constrained than leveraged firms.

A final gap that we find to be critical to understand the reasoning of zero-leverage firms and solve the zero-leverage puzzle is the lack of evidence about the financial performance of these firms compared with those of leveraged firms. To the best of our knowledge, there is no study investigating the role played by zero-leverage policies as a determinant of firm's financial performance. This study will show whether zero leverage emerges as a firm's own financing decision to improve their financial performance and whether it decreases firm's performance when it is an imposition from creditors. Finally, it will be possible to show whether zero-leverage firms are better or worse prepared for negative macroeconomic shocks such as the 2008 global financial crisis.

In order to fill the previous identified gaps, this Ph.D. thesis aims to investigate the zero-leverage phenomenon in the European context. Therefore, to improve our knowledge about the zero-leverage phenomenon and raise awareness among managers, investors and governmental entities about extremely conservative financial policies, the next chapters present empirical evidence by using a sample of European listed firms collected from the *DataStream* database. The main purpose of this doctoral thesis is to examine the motives that guide a firm to be debt-free and the outcomes obtained by following such a financing policy. Particularly, it is our intention to empirically show whether this financing policy emerges as an imposition of creditors who do not wish to grant credit to the firm or it is a financial decision taken by the firm and to measure the impact of such financing policy on firm's performance. Several more specific goals are defined throughout the thesis that allows to achieve the overall purposes. These more specific goals are defined and guided by the research questions raised in each empirical chapter, which are presented and summarized below:

1) *Does zero leverage in the European context result mainly from financial constraints experienced by firms or from the desire of maintaining financial flexibility?*
2) *Is the increasing phenomenon of zero leverage observable in all European countries, irrespective of their financial systems?*

3) *Has the recent financial crises increased the phenomenon of zero leverage in Europe?*
4) *Are the answers to questions 1-3 independent or inter-related?*
5) *Does the zero-leverage phenomenon in Europe result from firm- and/or country-specific governance mechanisms?*
6) *Is the effect of governance mechanisms on zero leverage different for firms in market- and bank-based financial systems?*
7) *What are the determinants of the decision of the firm to resort or not to debt? (demand side)*
8) *What are the determinants of the creditor decision to grant or not debt to the firm? (supply side)*
9) *Do zero-leverage firms perform better than their leveraged counterparts?*
10) *Does the effect of zero leverage on firm's performance become more important during crisis periods?*
11) *Is the effect of zero-leverage policies on firm's performance similar across financially constrained and unconstrained zero-leverage firms?*

To keep consistence, all chapters use the same definition of zero leverage to classify a firm as having such a financial policy, although as can be seen throughout the thesis the use of alternative measures of debt conservatism do not change our main findings. Therefore, in a given year, a firm is classified as a zero-leverage firm if their book leverage ratio is equal to zero in that year, i.e., both short- and long-term debt are zero. In this calculation we considered only financial debt and excluded non-debt liabilities, since our focus is on firms' financing decisions (Strebulaev and Yang, 2013).

3. Structure of the thesis

The remainder of this Ph.D. thesis is organized in 7 chapters.

Chapter 2 briefly describes main theories applied to capital structure decisions and explains how the arguments of these theories are not able to explain in a unique and exclusive way the zero-leverage phenomenon. Given this lack of theoretical support we present some additional approaches that may help to explain why firms become debt-free and that will be tested throughout the empirical part of the thesis.

Chapter 3 corresponds to the first empirical paper included in this Ph.D. thesis, entitled "The zero-leverage phenomenon in European listed firms: a financing decision or an imposition of the financial market?", this paper focus on the motives that lead firms to adopt zero-leverage policies. Based on a sample of non-financial listed firms belonging

to 14 Western European countries, for the period between 1995 and 2016[3], and using models that account for the binary nature of the dependent variable, the purpose of this paper is three-fold: (1) to examine whether zero leverage in European context may be explained by the financing constraints and/or by financial flexibility perspectives; (2) to analyse the role played by country-specific characteristics and the 2008 global financial crisis on the zero-leverage phenomenon; and (3) to examine whether financing flexibility and financing constraints motives for zero leverage are dependent or not of the country and/or macroeconomic conditions.

Chapter 4 corresponds to the second empirical paper included in this Ph.D. thesis, entitled "The heterogeneous effect of governance mechanisms on zero-leverage phenomenon across financial systems", this paper also focuses on the determinants of zero leverage. Particularly, this paper analyses the effect of governance mechanisms on zero leverage. The purpose of this paper is two-fold: (1) to examine the effect of firm- and country-specific governance mechanisms on the propensity for firms having zero leverage; and (2) to analyse whether these effects vary across different financial systems.

Chapter 5 corresponds to the third empirical paper included in this Ph.D. thesis, entitled "The zero-leverage phenomenon: A bivariate probit with partial observability approach", this is the last paper examining the determinants of zero debt. In particular, this paper provides empirical evidence on the zero-leverage phenomenon using bivariate probit models with partial observability in the sense of Poirier (1980). The main purpose of the paper is to examine the factors that affect the demand for debt and the supply of debt. Particularly, it is our goal to provide empirical evidence on the determinants of the firm decision to resort or not to debt and the determinants of the creditor decision to grant or not debt to the firm.

Chapter 6 corresponds to the fourth empirical paper included in this Ph.D. thesis, entitled "Capital structure speed of adjustment heterogeneity across zero leverage and leveraged European firms". Using the dynamic panel fractional estimator to estimate the capital structure speed of adjustment, this paper investigates whether zero-leverage firms pursue or not a target level of debt and, if they pursue, how fast they adjust to that target. Specific analyses are developed throughout the chapter that allows to compare the leverage target behaviour of zero-leverage and leveraged firms, namely considering different financial systems, time periods and levels of financing constraints.

[3] Note that not all chapters use the same period. In particular, governance and ownership data are only available from 2002 and 2001, respectively. Also, the statistical method may impose a shorter panel to get more accurate estimates.

Chapter 7 corresponds to the fifth empirical paper included in this Ph.D. thesis, entitled "To be or not to be debt-free, which is the optimal answer for a better firm performance?". Using dynamic panel data regression models, specifically the system GMM estimator, and propensity score (PS) methods, this paper examines the impact of zero-leverage policies on firm's performance. To achieve this main goal, three specific goals are defined: (1) to examine whether zero-leverage firms perform better or not than their leveraged counterparts; (2) to analyse whether the effect of zero-leverage policies on firm's performance is influenced by the 2008 financial crisis; and (3) to verify whether these effects prevail for financially constrained and unconstrained zero-leverage firms.

Finally, in Chapter 8, we conclude this Ph.D. thesis by summarizing the main findings and discussing some practical implications.

4. Contributions

This thesis presents several contributions to the literature. Overall, this is the first study to use an international sample exclusively composed by European listed firms to analyse the zero-leverage phenomenon. Regarding the determinants of the zero-leverage phenomenon, this is also the first to consider the effect of the 2008 global financial crisis that in some European countries has led to sovereign debt crisis that until very recently hindered normal growth, financing and the resumption of investment levels (European Investment Bank, 2015; Laeven and Valencia, 2018).

Second, we show that (at least some of) the conflicting results found in previous studies may be due to the incorrect assumption they made of a unique, homogeneous effect of each determinant of zero leverage across different realities. For example, we find that the effect of the European financial and sovereign debt crises on zero leverage depends on the financial system prevailing in the country, namely during crisis periods the propensity for zero leverage is increased in market-based financial systems, while in bank-based systems no significant changes occur. Also, the relevance of the financial flexibility approach depends on the financial system being considered.

Third, contributing to filling the lack of studies looking at the effects of governance mechanisms on zero leverage outside the US context, we evaluate the impact of both country- and firm-level governance mechanisms on zero leverage. Different from existing literature that estimate a single effect of governance mechanisms on zero leverage, we examine whether their impact on zero leverage vary across different realities. In fact, we show that the impact of country governance mechanisms on zero leverage differs across financial systems.

Fourth, by using a regression model different from those traditionally applied in the capital structure field, this study is the first to present a separate empirical analysis of the determinants affecting the supply and the 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.

Fifth, this study is the first to investigate the capital structure target and speed of adjustment behaviour of zero-leverage and to compare them with leveraged firms. We show that debt-free firms actively adjust to a target level of debt, but at a significantly slower adjustment speed than leveraged firms. Moreover, the influence of firms' debt policy on capital structure speed of adjustment changes with different financial systems, macroeconomic conditions and financial constraints levels. This study suggests that the estimation of adjustment speeds without considering heterogeneity in firms' financing policies (zero leverage and non-zero leverage) may draw inaccurate conclusions about adjustment behaviour.

Sixth, this is the first study to examine the direct effect of zero leverage on firm's financial performance. We show that zero-debt financing policies increase firm's performance, which implies that current theories of capital structure are not enough to explain the relationship between debt and performance. Moreover, the positive impact of zero-leverage policies on firm's performance was boosted during the 2008 global crisis period for financially unconstrained zero-leverage firms, while the performance of leveraged firms deteriorated significantly during the crisis. These results suggest that the better financial performance of zero-leverage firms may be a possible reason for firms adopting such an extremely conservative financial policy.

Beyond theoretical contributions this study also contributes methodologically for the research field. First, considering that 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), 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). Therefore, chapter four (final chapter about the determinants of zero leverage) apply bivariate probit models with partial observability in the sense of Poirier (1980), a method that has 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. This method allows us to partially observe the choices of two independent decision-makers (the firm and the creditor) and, thus, to analyse firm

decisions on whether or not to resort to debt and creditor decisions on whether or not to concede debt to firms. We suggest that bivariate probit models emerge as the most suitable approach for analysing the determinants of zero leverage, being particularly useful when the same variable have opposite effects on demand and supply of debt or when the effect is only significant in one of those equations.

Second, considering that speed of adjustment estimates obtained by the most commonly used dynamic panel estimators are potentially biased due to the overlooked bounded nature (between zero and one) of debt ratios, this study used the dynamic panel fractional (DPF) estimator proposed by Elsas and Florysiak (2011; 2015) to estimate firms' speed of adjustment.

Beyond theoretical and methodological contributions to the corporate finance literature that may be of interest to academics, we anticipate that the results of this study will be of interest to firms' managers, shareholders, investors and government entities.

5. Publications and conferences presentation

The content of Chapter 3 was presented at 28th EFMA Annual Meeting, 2019:

- Morais, F., Serrasqueiro, Z., Ramalho, J.J.S. (2019). The zero-leverage phenomenon in European listed firms: a financing decision or an imposition of the financial market?. 28th Annual European Financial Management Association Meeting. June 26-29, 2019, University of Azores, Ponta Delgada, Island of S. Miguel, Portugal.
- The full content of Chapter 3 is under a peer-review process in a Journal indexed and ranked in ISI and Scopus databases.

A previous version of Chapter 4 was presented at XXI Seminário Luso-Espanhol de Economia Empresarial and was published as a book chapter:

- Morais, F., Serrasqueiro, Z., Ramalho, J.J.S. (2019). The effect of corporate governance structures on zero-leverage phenomenon. XXI Seminário Luso-Espanhol de Economia Empresarial. November 21-22, 2019, University of Évora, Portugal.
    - Young Researcher Award – "Prémio Jovem Investigador Cátedra Luís de Camões – Universidad Carlos III de Madrid – Banco de Santander – Fundacíon Ramón Areces"
- Morais, F., Serrasqueiro, Z., Ramalho, J.J.S. (2020). Zero-leverage in European firms: The role of corporate governance mechanisms on the phenomenon. In: Farinha L., Cruz A., Sebastião J. (eds.) Handbook of Research on Accounting and Financial Studies, IGI Global, 227-251. DOI:10.4018/978-1-7998-2136-6.ch011

- The content of Chapter 4 is under a peer-review process in a Journal indexed and ranked in ISI and Scopus databases.

Chapter 5 was published as a research paper:

- Morais, F., Serrasqueiro, Z., and Ramalho, J.J.S. (2020). The zero-leverage phenomenon: A bivariate probit with partial observability approach. *Research in International Business and Finance*, *53*, 1-16. DOI: https://doi.org/10.1016/j.ribaf.2020.101201

Chapter 6 was accepted for presentation at 11th Portuguese Finance Network Conference - PFN 2020 (postponed to 2021).

- Additionally, the content of Chapter 6 is under a peer-review process in a Journal indexed and ranked in ISI and Scopus databases.

The material of Chapter 7 is under a peer-review process in a Journal indexed and ranked in ISI and Scopus databases.

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CHAPTER 2

Financial theories and zero leverage

1. Classical theories of capital structure

The firm's capital structure represents the origin of financial funds that are necessary for the firm's current activities and investment opportunities. Thus, the capital structure may be defined as the mix between the different financing sources, i.e. financing through debt (short- and long-term debt) and/or equity, that the firm needs to finance its activities. The seminal work of Modigliani and Miller (1958) represents the breaking point from the traditional to the modern investigation on capital structure field. Both theoretical perspectives and empirical investigations have evolved from this central axis. The Modigliani and Miller's (1958) theorem, or the irrelevance paradigm, were based on a set of assumptions, namely the absence of taxes, transaction costs, financial distress, bankruptcy costs, agency costs and information asymmetries. Under these assumptions of a capital market that works perfectly given the absence of frictions, the authors conclude that the firm's capital structure has no influence on its value. However, a few years later Modigliani and Miller (1963) recognized that their initial model was flawed, as it did not consider the effect of corporate taxes on capital structure decisions. In particular, the presence of income taxes makes debt financing preferable over equity financing, since interest payments are tax deductible resulting in what is called as the debt tax shields. Therefore, Modigliani and Miller (1963) concluded that debt financing increases the firm's value, which suggest that 100% debt financing would maximize firm's value. These initial premises served for all the theoretical developments that followed and that we next present.

1.1. Trade-off theory

Considering that market frictions are a reality, the entirely finance of firm's assets through debt would also increase the risk of default. Thus, debt brings benefits, such fiscal benefits, but also brings costs directly related with the likelihood of bankruptcy (Kraus and Litzenberger, 1973). The higher the firm's debt ratio, the higher its bankruptcy costs. The firm is exposed to bankruptcy costs as it becomes unable to fulfil its obligations to creditors. There are two classes of costs faced by highly leveraged firms:

financial distress costs that occur before the firm's default and that are motivated by high debt ratios that increase the likelihood of a firm suffer financial difficulties that can lead to bankruptcy (loss of suppliers and customers, loss of financial flexibility and power to renegotiate debt contracts and debt covenants that reduce the power of managers and shareholders over the firm); and the direct cost of the bankruptcy process, such as legal and accounting expenses, or costs with the liquidation of firm's assets (Kraus and Litzenberger, 1973).

The recognition of the existence of debt benefits and costs are at the basis of the classic or static version of trade-off theory that advocates the existence of an optimal level of debt obtained through balancing the fiscal benefits of debt (Modigliani and Miller, 1963) against financial distress and bankruptcy costs increased by debt (Kraus and Litzenberger, 1973). Therefore, the trade-off theory points out the existence of an optimal capital structure that maximizes the firm's value, being this level reached when debt benefits equal its costs. Under this framework, a firm should raise debt, to catch its fiscal benefits, until the optimal ratio that maximise firm's value. In short, until a sustainable level, debt is seen as value creating for firms.

Considering that firm's activity is dynamic in nature it is assumed that firms can adjust their real debt ratio in relation to their optimal ratio, for example, by renegotiating debt contracts with creditors. With this assumption there is a shift from the static trade-off theory to the dynamic trade-off theory. Instead of an "optimal" capital structure, the focus is placed in a target debt ratio for which the firm can adjust over the time (Fisher, Heinkel, and Zechner, 1989). According to this theory, firms suffer costs of being off the target, known as deviation costs (e.g., financial distress and bankruptcy costs; loss of debt tax shields), which incentives firms to move closer to their targets. Nonetheless, this convergence is also a function of adjustment costs (e.g., transaction and debt agency costs) that prevent and hinder full adjustment toward the target (Fisher et al., 1989), which explains why firms may present large and persistent deviations from their target leverage and just partially adjust over time. Thus, a dynamic version of the trade-off theory states that firm's financial structure can move away from its target, with some firms adjusting more quickly or slowly than others.

As the theory postulate the use of debt as a mechanism to increase firm's value and to converge to its target debt ratio, this theory does not seem to be the most appropriate to explain the zero-leverage phenomenon (Bessler et al., 2013; Dang, 2013; Devos et al.,2012).

1.2. Pecking order theory

Contrary to the previous theory, the pecking order theory (Myers, 1984; Myers and Majluf, 1984) argues that firms do not have a target capital structure on mind that maximizes firm's value. This theory advocates that in the presence of information asymmetries firms establish a preference in their sources of financing according with their cost, choosing in a first stage internal sources of finance instead of the more expensive external financing (Myers, 1984; Myers and Majluf, 1984). Only when internal sources of financing are exhausted firms should resort to external finance, in which case firms should start by raising debt and only when the firm exhausted its borrowing capacity should resort to equity issuances. The implications of this theory are more evident in the presence of significant information asymmetries. In particular, as firm's insiders (managers) have access to more and better information about the real value of the firm's assets and growth opportunities than outsiders (creditors and investors), a firm should pay a premium to obtain external finance and cover the risk faced by creditors and investors. In the presence of adverse selection about firm value, firms prefer to issue debt over outside equity, as predicted by pecking order theory, since creditors have more guarantees of getting their capital back than external investors, which result in a lower cost of debt over equity.

Once again, debt is seen as preferable over equity issuance, this time by generating lower information costs. Therefore, also this theory seems not to be sufficient to justify in a unique and exclusive way the zero-leverage phenomenon (Dang, 2013).

1.3. Agency theory

The agency theory is based on the conflicts of interests between shareholders (the principal) and managers (the agent) to develop their predictions over the firm's capital structure (Jensen and Meckling, 1976). In order to create and maximize firm's value shareholders hire managers and delegate authority to them giving the possibility to act and make decisions on behalf of shareholders. With the contract established between the parties, equity holders are expecting that managers act according with the principal interests, maximizing the firm's value and consequently the shareholders wealth. However, as noted by Jensen and Meckling (1976) both, shareholders and managers, can act with the purpose of maximizing their own utility function. Therefore, instead of maximizing shareholders wealth, managers may act to pursue their own private benefits, taking decisions that increase their power and control over the firm, which ultimately leads to conflicts between the parties. This happens because managers know better than anyone the real value of the firm and the value of their investments, while shareholders only have information made available by the management team. Thus, in the presence of

market frictions such as adverse selection and moral hazard the presence of managers that act to increase their private control benefits rather than maximizing shareholder wealth is not easily detected.

One way that managers found to increase their power over the firm's decisions is to avoid the disciplinary pressures associated with debt (Jensen, 1986). The absence of a debt service plan means a higher level of free cash flows that increase the discretionary power of the manager over the firm's decisions and gives them the possibility to use these funds for personal benefits. Therefore, the agency theory postulates that firms should use debt to reduce agency conflicts and increase firm's real and perceived value (Jensen and Meckling, 1976; Ross, 1977). Hence, this is another theory presenting debt benefits to firms, this time by preventing the so-called principal-agent problems (Jensen, 1986). In short, the arguments of this theory seem not to be enough or to apply to zero-leverage firms since, contrary to what is postulated by the theory, this kind of firms avoid the recourse to debt. However, it could also mean that zero-leverage firms are being governed by entrenched managers, a hypothesis that next will be further explained in the next section.

1.4. Signalling theory

Considering the existence of information asymmetry between shareholders and managers in what concerns firm's future growth prospects, Ross (1977) proposed an incentive signalling model, arguing that firms can make financial information available to the market based on their capital structure decisions. The so-called signalling theory advocates that financing a project by resorting to debt conveys positive signals to the market, namely: that a firm has profitable and value creating projects in its portfolio that justify to raise debt, and that managers are not self-interested since they are willing to use debt even if this means to reduce their discretionary power over the firm investment and financing decisions. On the other hand, the financing of a project through equity issues may be interpreted by the market as an attempt of firm's owners to share firm's future losses. Therefore, also this theory seems not to be the suitable to explain the considerable and increasing numbers of firms that go debt-free.

In short, all theories advocate that debt-free firms are losing benefits by not levering up, which suggests that zero-leverage firms are losing value by keeping their conservative financing policy and eventually performing worse than their leveraged counterparts.

Considering that none of the classical theories of capital structure seem to be able to explain the increasing phenomenon of zero leverage by themselves, next we present some

alternative theoretical approaches that could help to explain the existence of debt-free firms.

2. Alternative theoretical approaches

Considering the lack of a theoretical support provided by classical capital structure theories for the zero-leverage phenomenon, studies on this field use alternative approaches as an attempt to explain extreme conservative levels of debt. The financial constraints and financial flexibility approaches have received the greatest attention (Bessler et al., 2013; Dang, 2013; Huang et al., 2017). Some other studies using samples of US firms also considered that zero leverage may be a consequence of the presence of opportunistic managers that take advantage of weak corporate governance mechanisms to adopt zero-leverage policies, i.e., the managerial entrenchment approach (Byoun and Xu, 2013; Devos et al., 2012; Strebulaev and Yang, 2013). In addition, studies using international samples typically include country-specific or macroeconomic arguments to explain the zero-leverage phenomenon (Bessler et al., 2013; Ghoul et al., 2018). Next, we briefly describe each of these approaches and the findings of the main empirical studies using these perspectives.

2.1. The financial constraints approach

According to this theoretical approach, in the presence of capital market imperfections, capital structure is not only determined by the firm's need for capital (i.e., the demand side), but also by the firm's possibility of obtaining external finance (i.e., the supply side). Therefore, the use of debt by firms is conditioned on the willingness of creditors to grant or not debt to them. In the context of this approach, the zero-leverage phenomenon is more an imposition of creditors that may refuse to grant credit to the firm than a firm's own financing decision. The implications of this perspective become more visible in the presence of information asymmetries that may prevent lenders from correctly assess the real value of a firm and the quality of their future investments (Stiglitz and Weiss, 1981). In this situation, resort to debt can become more difficult and too expensive for firms with little reputation or without a favourable past in the credit markets (Diamond, 1991). A consequence is that these firms facing constraints on its access to credit, such as credit rationing (Stiglitz and Weiss, 1981), may be forced to forego good investment opportunities (Almeida and Campello, 2007), even when these the purpose is to fund value creating projects. Thus, financial constrained firms may find in non-debt financing sources, such as equity issuances, a good possibility to keep their investment plan.

The financial constraints approach is the hypothesis most widely accepted by researchers as an explanation of the zero-leverage phenomenon. In particular, Dang (2013) and

Devos et al. (2012) show that the characteristics traditionally presented by financially constrained firms increase the propensity for zero leverage. Bessler et al. (2013) adds that zero-leverage firms are mostly classified as financially constrained firms.

2.2. The financial flexibility approach

The financial flexibility approach suggests that firms avoid debt because of their own financing decisions and not of their inability to obtain external finance. In fact, an important stream of literature argues that firms avoid debt financing today and stockpile cash to increase financial slack in an attempt to preserve borrowing capacity and assure financing for future investments (de Jong, Verbeek, and Verwijmeren, 2012; Myers, 1984; Rapp, Schmid, and Urban, 2014). Another possibility to firms maintaining their financial flexibility is to keep a low level of investments, which also allows the firm to preserve debt capacity to fund good investment opportunities when they arise (Marchica and Mura, 2010). Thus, internal liquidity and investment levels are seen as determinant factors for the constitution of financial flexibility, enabling the firm to reduce debt levels and perhaps remain debt-free. The importance of financial flexibility to firm's capital structure decisions are directly confirmed by CFOs, which acknowledge that they voluntarily limit credit lines to preserve their capacity to take on future debt (Bancel and Mittoo, 2004).

Previous empirical evidence shows that there seems to exist a non-negligible number of debt-free firms that do not suffer from financing constraints (Bessler et al., 2013) and prefer to retain financial flexibility. According with this approach firms deliberately opt for zero debt and thus this policy reflects a financial decision taken by the firm (Dang, 2013) rather than a market imposition. Huang et al. (2017) confirms that firms with a greater level of financial flexibility are, in fact, more likely to have zero leverage.

2.3. Governance mechanisms and the managerial entrenchment approach

Constructed on the basis of the agency theory, the managerial entrenchment approach suggests that probably the natural mechanism suggested by the agency theory to prevent opportunistic behaviour from managers (the use of debt) is not being followed by extremely conservative firms (Devos et al., 2012). In short, the absence of a debt service plan means a higher level of free cash flows, which makes easier for managers to adopt opportunistic actions that only increase their private control benefits without being detected. According to this approach, entrenched managers may choose low levels of debt for various reasons: to reduce the firm's risk and protect their human capital (Fama, 1980); to act in accordance with their private benefits increasing the resources under

their control (Stulz, 1990); or to avoid the disciplinary power of debt (Jensen, 1986). Thus, by not using debt, zero-leverage firms may be governed by entrenched managers that adopt extremely conservative financing to pursue their own objectives more easily. In fact, an important part of the literature argues that managerial entrenchment may be a determinant factor for firms to deviate from their target capital structure and present low debt ratios (Byoun and Xu, 2013; Devos et al., 2012; Strebulaev and Yang, 2013).

To prevent opportunistic managers to seize shareholders' wealth, governance structures act as mechanisms defining the rights and duties of managers and shareholders in a firm. The objective of these mechanisms is to monitor the manager's performance in order to ensure that there are no conflicts of interest between shareholders and managers. Thus, managerial entrenchment depends on the country and corporate governance structures, being exacerbated with weaker governance structures and reduced in the presence of stronger governance structures (Martins et al., 2017). Therefore, according to the managerial entrenchment approach, the propensity for zero leverage should be higher in countries and in firms with weaker governance mechanisms, since managers can more easily follow an opportunistic behaviour. Empirically, Strebulaev and Yang (2013) found that, as predicted, weak corporate governance mechanisms increase the propensity for zero leverage.

2.4. Country-specific effects

Decisions about capital structure are affected not only by firms' specific factors but also by their country's specific characteristics. Finance literature often evaluates how institutional development and regulatory system affects capital structure decisions. A particular focus has been given to the financial system prevailing in the country, i.e., how bank- and market-based financial systems influence firm's capital structure decisions (e.g. Antoniou Guney, and Paudyal, 2008). Theoretically, a market-based financial system presents a higher capital market development, being a more favourable place for external investors to invest and for firms looking for attractive external finance (Drobetz, Schilling, and Schröder, 2015). Overall, a wider range of available sources of financing is found in market-based financial systems, with most of these sources being found through the capital market. On the other hand, the small dimension and less development and liquidity of capital markets in bank-based financial systems hinders the firm's access to those markets. Therefore, the main source of external financing in bank-based systems comes from the bank. Hence, there exists a great dependence of firms on debt in bank-based countries, which results in closer ties and less information asymmetries between firms and banks, given that the bank knows better the value of the firm, being its main monitoring entity (Leland and Pyle, 1977). In short, while market-based systems

promote financing via capital markets providing more alternative sources to debt, in bank-based systems the dependence on bank loans is greater. Theoretically, a greater propensity for zero leverage is expected in market-based financial systems.

Capital structure decisions may also depend on the legal system prevailing in each country. Considering that common law systems generate greater propensities towards market-based financial systems while civil law systems present greater propensities towards bank-based systems (Demirgüç-Kunt and Levine, 1999), the expected effect of legal systems on zero leverage is expected to be similar to those explained previously for the financial system. In particular, a common law system provides better protection to external investors and a greater transparency and information sharing that lowers adverse selection problems than a civil law system (La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1997). Therefore, a better access to external financing via capital markets is expected in common law systems and a greater dependence on loans granted by the banking sector is expected in civil law systems (Fan, Titman, and Twite, 2012).

Empirical evidence confirms that lower levels of leverage are generally found in market-based countries (Antoniou et al., 2008). In particular, Ghoul et al. (2018) shows that the financial system has an impact on zero leverage, specifically the propensity for firms presenting zero leverage is higher in market-based financial systems and Bessler et al. (2013) also found a greater propensity for zero leverage in common law systems.

Beyond confirming the direct impact of country-specific effects (such as the financial system prevailing in the country) on firm's propensity to have zero leverage, it is important to verify whether the previous approaches and motives for zero leverage vary, for example, across different financial systems.

2.5. Macroeconomic conditions

Previous research suggests that capital structure decisions are affected not only by firm-factors but also by macroeconomic conditions (Cook and Tang, 2010; Korajczyk and Levy, 2003). Considering that in periods of economic growth the costs of adverse selection are lower, a greater volume of shares issuances is expected (Choe, Masulis, and Nanda, 1993). Reciprocally, while financing through equity issuances increases during expansionary periods, financing through debt is expected to decrease. Therefore, equity issues are considered to be pro-cyclical and debt to be counter-cyclical. However, it is also true that asset values fall in periods of macroeconomic shocks, resulting in lower collateral to debt, which reduces the overall debt levels during recessionary periods (Kiyotaki and Moore, 1997), i.e., both collateral and debt are pro-cyclical. The idea that debt is pro-cyclical is also supported by the overall drop in consumer confidence that

occurs in bad times, which decreases firms' investments and their need to raise debt (Khale and Stulz, 2013). Macroeconomic conditions are, thus, expected to play an important role in the propensity for zero leverage. Empirical evidence confirms a determinant role of macroeconomic conditions on zero leverage. In particular, Dang (2013) and Ghose and Kabra (2016) found that adverse macroeconomic conditions, represented by a low, or negative, GDP growth rate, increase the propensity toward the zero-leverage phenomenon.

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CHAPTER 3

The zero-leverage phenomenon in European listed firms: a financing decision or an imposition of the financial market?

Abstract

This paper provides empirical evidence on the zero-leverage phenomenon for a sample of European listed firms for the period 1995-2016. It is shown that there are two types of firms with zero leverage: the financially constrained firms that face obstacles in obtaining external finance, as predicted by the financial constraints hypothesis; and the financially unconstrained firms that maintain zero leverage as a consequence of a financing decision, which supports the financial flexibility hypothesis. The zero-leverage phenomenon is also influenced by the financial system that prevails in each country, being boosted (inhibited) in market-based (bank-based) financial systems, and by the country's macroeconomic conditions, with the recent financial and sovereign debt crises increasing the propensity for zero leverage in market-based countries. We also find that the financial flexibility hypothesis seems to be more important in market-based systems and that the financial constraints approach did not gain importance during the crisis period. Our results are robust to the use of alternative measures of debt conservatism, explanatory variables and econometric methods and maintain their validity when we allow for endogeneity in firm size and dividend payments.

Keywords: Zero leverage; Financial Constraints; Financial Flexibility; Financial System; Financial Crisis

JEL classification: G32

1. Introduction

A recent line of research in corporate finance investigates the phenomenon that has become known as "mysterious zero leverage", after the contemporary studies of Strebulaev and Yang (2013), which found that an important and increasing proportion

of firms had been presenting no debt over the years, and Devos et al. (2012), which showed that zero leverage is a persistent phenomenon.[4] Also intriguing is the fact that the existence of debt-free firms seems to be a global phenomenon, being present all over the world (Bessler et al., 2013) and including both large, listed firms (Strebulaev and Yang, 2013) and small, unlisted firms (Ramalho and Silva, 2009). Moreover, the zero-leverage phenomenon is not confined to the lack of long-term debt, but also refers to zero short-term debt (Strebulaev and Yang, 2013). Firms such as Apple, Amazon and Yahoo are examples of organisations that in a given period have adopted extremely conservative levels of debt, even reaching an unexpected zero leverage level.[5]

The complexity of the zero-leverage phenomenon increases inasmuch as the classical theories of capital structure, namely the trade-off, pecking order and agency theories, are not able to explain such conservative levels of debt. The lack of theoretical support has led academics to present alternative approaches to explain zero leverage, such as the financial constraints theory, where zero leverage emerges as an imposition of creditors, and the financial flexibility hypothesis, which states that firms avoid using debt in order to retain financial flexibility. Nevertheless, despite the considerable advances made during the last decade, it is still not clear which are the theoretical approaches that best explain the zero-leverage phenomenon, as recently stressed by Saona et al. (2020).

A drawback of existing studies on zero-leverage firms is their focus on countries with market-based financial systems, especially the US, which favours financing through the capital market rather than through bank debt (La Porta et al., 1997). Although studies considering other countries and financial systems do exist (Bessler et al., 2013; Ghoul et al., 2018; Saona et al., 2020), their results are likely to have been strongly influenced by the considerable number of debt-free US firms present in their samples. A more balanced context to study zero leverage is provided by European countries. Indeed, Europe is the home of the largest banking system of the world, with non-financial firms being very dependent on bank loans as the primary source of external finance (European Investment Bank, 2015), but at the same time includes a relevant proportion of firms operating in countries with market-based financial systems. Therefore, the European context seems to be the ideal for studying not only the general effect of the financial system on the zero-leverage phenomenon, as Ghoul et al. (2018) did using a sample that

[4]Strebulaev and Yang (2013) show that, between 1962 and 2009, an average of 10.2% of large listed US firms followed a zero-leverage policy, with the proportion of zero-leverage firms increasing from around 5% in the beginning of the 1980s to more than 19% in the end of 2000s. Devos et al. (2012) contributes to the discussion adding that more than 11% of the firms in their sample had no debt during three consecutive years.

[5]See for instance the annual financial reports of the firms highlighted or consult the news on 15 debt-free S&P 500 firms posted by Moreano and Toscano (2014) at https://www.cnbc.com/2012/01/25/15-Companies-with-Zero-Debt.html.

included some European countries, but also to test whether the relative importance of the financial constraints and financial flexibility hypotheses to explain zero leverage decisions varies across countries with different financial systems.

Another issue that has not been fully analysed is the impact of the financial crisis initiated in 2008 on zero leverage. In various countries, this crisis has been related to the sovereign debt crises that until very recently prevented the normal economic growth, the availability of finance and the recovery of investment levels, particularly in Western European countries (Dolz, Iborra, and Safón, 2019; European Investment Bank, 2015). Although the reduction in credit demand and supply is expected to have favoured the zero-leverage phenomenon, the economic crisis, by reducing the internal resources generated by firms, may have forced former zero-leverage firms to resort to debt after 2008 (Ramalho, Rita, and Silva, 2018). To the best of our knowledge, this is the first study considering the effect of the 2008 global crisis on the existence of zero-debt firms. Regarding the role played by the crisis on the zero-leverage phenomenon several questions need to be answered, such as whether that effect was similar across countries with different financial systems or whether the financial constraints hypothesis gained relevance during the crisis.

In an attempt to fill the previously identified gaps, this study focuses on the following research questions: 1) *Does zero leverage in the European context result mainly from financial constraints experienced by firms or from the desire of maintaining financial flexibility?*; 2) *Is the increasing phenomenon of zero leverage observable in all European countries, irrespective of their financial systems?*; 3) *Has the recent financial crises increased the phenomenon of zero leverage in Europe?* and 4) *Are the answers to questions 1-3 independent or inter-related?* To answer these questions, we use an unbalanced panel of 8,676 listed firms from 14 European countries for the 1995-2016 period. The sample, which was collected from the *DataStream* database, includes information that allows the construction of a set of proxy variables representing the financial constraints and financial flexibility approaches in order to examine whether zero leverage can be explained by both theories. It also comprises a relatively balanced number of firm-year observations between countries with market- and bank-based financial systems and covers the whole period of the most recent banking crises and sovereign debt crises in Europe, which, for some countries, according to Laeven and Valencia (2018), went until 2012.

This paper contributes in several ways to the literature. Confirming previous evidence (Bessler et al., 2013), our results show that also at the European level there are two types of zero-leverage firms: financially constrained firms that are unable to get any funding;

and financially unconstrained firms, which maintain zero leverage by choice. Also, similarly to Ghoul et al. (2018), we confirm that the financial system prevailing in the country, as well as the level of stock market development, are important determinants of zero leverage, with firms in countries with market-based systems being more prone to be unlevered. In addition, we show that the European financial and sovereign debt crises increased the propensity for zero leverage, only in market-based countries, since no significant changes occurred in bank-based countries. Another novel result uncovered by our study is the fact that the relevance of the financial flexibility hypothesis is higher in market-based systems and that, contrary to what would be expectable, the financial constraints approach did not gain importance with the 2008 crisis. Finally, we show that our conclusions are robust to the use of alternative measures of debt conservatism, explanatory variables and econometric methods, including instrumental variable models that allow for endogeneity in firm size and dividend payments. A preliminary propensity matching score analysis also provides similar results. Overall, our results show that (at least some of) the conflicting results found in previous studies may be due to the incorrect assumption they made of a unique, homogeneous effect of each determinant of zero leverage across different realities.

The remainder of the paper is organised as follows. Section 2 briefly reviews theoretical explanations of the zero-leverage phenomenon and formulates some empirical hypotheses. Section 3 describes the data and the methodology used in the empirical analysis. Section 4 presents and discusses the results obtained by both univariate and multivariate data analyses. Finally, section 5 contains some final considerations.

2. Literature review and research hypotheses

Studies on the "zero-leverage phenomenon" need to resort to explanatory approaches alternative to the main financial theories. This paper focuses on two firm-level arguments (financial constraints and financial flexibility) and on two macroeconomic factors (financial system and the global financial crisis), and on their interaction, as possible explanations for zero leverage. Next, we review the main theoretical arguments underlying each class of zero leverage determinants and formulate a set of empirical hypotheses that will be tested in Section 4.

2.1. Internal determinants of the zero-leverage phenomenon: The financial constraints and the financial flexibility approaches

The financial constraints approach is the hypothesis most widely accepted by researchers as an explanation of the zero-leverage phenomenon. According to this theory, in the presence of capital market imperfections, capital structure is not only determined by the

need for capital (i.e., the demand side), but mainly by the possibility of obtaining external finance (i.e., the supply side). Therefore, decisions about debt are not taken only by firms, but also by creditors that may be willing to grant or not debt to them. In this context, the zero-leverage phenomenon is more an imposition of creditors due to financial market imperfections than the firm's own financing decision.

Stiglitz and Weiss (1981) developed a theoretical model which shows that, in the presence of market frictions such as information asymmetries, debt can become too expensive. This prevents firms from funding projects with a positive net present value (NPV) through external finance, which may force firms to forego good investment opportunities (Almeida and Campello, 2007). Indeed, financially constrained firms face restrictions in accessing credit, because lenders are not able to assess the quality of their future investments due to information asymmetries (Stiglitz and Weiss, 1981). Furthermore, Diamond (1991) states that in the presence of adverse selection and moral hazard problems external finance becomes more difficult for firms with little reputation, i.e., firms without a favourable past in the credit market.

In terms of empirical research, Bessler et al. (2013) and Devos et al. (2012) find strong evidence that zero-leverage firms are financially constrained. The authors also conclude that such firms are smaller, present a lower asset tangibility and have not yet acquired a favourable reputation in the debt market. More recently, Huang et al. (2017) show that firms that face more frequently financial constraints are more likely to present zero leverage.

Based on the theoretical arguments and empirical evidence described, we test the following hypothesis:
H1: Financial constraints increase the firm's likelihood of having zero leverage.

Regarding the financial flexibility hypothesis, this approach suggests that firms avoid debt because of their financing decisions and not of their inability to obtain external finance. The literature relates financial flexibility to the firm's capacity to fund future investments, even in the presence of information asymmetries (Ferrando, Marchica, and Mura, 2017; Gamba and Triantis, 2008). It is considered that the capacity to answer opportunely to unexpected changes in the firm's activity is improved by its financial flexibility (Denis, 2011). Recognizing the interdependence over time between the firm's financing and investment decisions is the starting point for enhancing the importance of financial flexibility.

Survey evidence points out that financial managers consider financial flexibility as a determinant factor of firm's capital structure decisions, indicating that they voluntarily

limit credit lines to maintain firm's debt capacity to turn to credit in the future (Brounen, de Jong, and Koedijk, 2006; Campello, Graham, and Harvey, 2010). Recognizing that financial flexibility allows firms to mitigate either the underinvestment problem in situations of restricted access to external finance or financial distress costs (Rapp et al., 2014), firms have incentive to present high levels of cash holdings as well as to preserve their borrowing capacity (de Jong et al., 2012). Internal liquidity is then a determinant factor of financial flexibility (Ferrando et al., 2017). On the other hand, Marchica and Mura (2010) conclude that firms with low levels of debt try to maintain their financial flexibility through a low level of investment and turning to debt only when good investment opportunities arise.

Empirically, Bessler et al. (2013) present evidence that some debt-free firms deliberately adopt a debt conservatism policy. They conclude that such firms are typically more profitable and have a greater level of cash holdings than leveraged firms. Dang (2013) states that firms with greater levels of growth opportunities and liquidity are more likely to avoid debt, this being explained by the search for financial flexibility. He concludes also that the strategic decision to hold zero leverage prevails essentially in firms without financial constraints. Finally, Huang et al. (2017) show that firms with a greater level of financial flexibility are, in fact, more likely to have zero leverage.

Considering these arguments, we formulate the following hypothesis:
H2: Financial flexibility increases the firm's likelihood of having zero leverage.

2.2. External determinants of the zero-leverage phenomenon: The financial system and the 2008 global financial crisis

Previous research suggests that decisions regarding capital structure are affected not only by firms' specific factors but also by their country's specific characteristics. For example, Ghoul et al. (2018) report that zero leverage is more prominent in developed and high-income countries. In the case of Europe, analysing the phenomenon of extreme financial conservatism implies to highlight the importance of the banking sector. In recent decades, the European banking sector has shown strong development, presenting much stronger growth than that registered in other banking systems across the world (Langfield and Pagano, 2016). In the recent study by Takami (2016), it is argued that the reduced level of debt-free firms in Japan may be explained by the bank-based financial system that prevails in the country. Actually, although Japan is a country known for its highly developed banking system, such system has even a greater weight in Europe (Langfield and Pagano, 2016). Such a high preponderance of the bank-based financial system is reflected in the European firms' great dependence on funding from banks (Langfield and Pagano, 2016; Fernández-Méndez and González, 2019). Indeed,

European non-financial firms are more dependent on bank loans as the first source of external finance than firms in the US and Japan (European Investment Bank, 2015).

On the other hand, market-based financial systems are characterized by a generally well-functioning stock market, with greater size and liquidity (Drobetz et al., 2015), which is more attractive to external investors than bank-based financial systems. Therefore, in countries with market-based financial systems firms tend to have a wider range of available sources of financing. Taking into account the characteristics of both bank- and market-based financial systems, countries with market-oriented system are expected to have a greater proportion of debt-free firms than those with bank-oriented systems (Ghoul et al., 2018). Hence, the following research hypothesis is postulated:
H3: A financial system based on capital markets (banks) increases (decreases) the firm's likelihood of having zero leverage.

Firm's financing decisions are also determined by macroeconomic conditions. However, the effect of macroeconomic conditions on capital structure is somewhat ambiguous. Choe et al. (1993) show that in periods of economic growth, the costs of adverse selection are lower, which motivates a greater volume of share issuances. Therefore, given that firms' preference for financing through equity is higher in periods of economic growth, equity issues are considered to be pro-cyclical and debt to be counter-cyclical. Another theoretical perspective points out that asset values fall in periods of uncertainty and macroeconomic shocks, which is reflected in a lower firm's net worth and collateral (Brunnermeier and Oehmke, 2013). Therefore, in periods of economic recession, firms turn less to credit because the value of their collateral falls. In this view, both collateral and debt are pro-cyclical (Kiyotaki and Moore, 1997).

There are some studies relating macroeconomic conditions with zero leverage. Dang (2013) shows that in adverse macroeconomic conditions, represented by a low, or negative, GDP growth rate, a firm's likelihood of adopting zero leverage increases. A similar result is obtained by Ghose and Kabra (2016), and so the authors conclude that zero leverage is counter-cyclical as regards macroeconomic conditions.

In this paper, we are particularly interested in estimating the effects of the recent global financial crisis on zero leverage. Considering that the 2008 US subprime crisis was transformed into a sovereign debt crisis in 2010 in several European countries (Laeven and Valencia, 2018), preventing the availability and access to external sources of finance (European Investment Bank, 2015), it is expected that the recent crisis experienced in Europe had an important effect on zero leverage. Indeed, during periods of macroeconomic shocks, the access to external finance generally becomes more expensive

and difficult due to increasing information asymmetries and default risk. On the one hand, the uncertainty about the real value of the firm and the quality of their investments reduce the creditor willingness to grant debt (Kiyotaki and Moore, 1997; Stiglitz and Weiss, 1981). On the other hand, the substantial losses faced by financial institutions during the recent financial crisis may also have decreased their loan activities (Ivashina and Scharfstein, 2010).

Based on these arguments, we expect that one consequence of the 2008 global crisis was an increment in the proportion of zero-debt firms. Thus, the following hypothesis is formulated:

H4: The 2008 global financial crisis increased the firms' likelihood of having zero leverage.

The great dependence of firms on debt in bank-based countries results in closer ties and less information asymmetries between firms and banks, which can arguably mitigate the negative effects of the crisis on access to debt financing (Leland and Pyle, 1977). Therefore, firms from bank-based systems may benefit from their closer relationships with banks to keep access to debt at a fair condition during crisis periods, while firms from market-based systems may be forced to renounce the use of debt in such periods to avoid the aggravated costs. Hence, while it is expected that the 2008 crisis increased zero leverage in both bank- and market-based financial systems, it is also expectable that firms located in bank-based financial systems were less impacted than their peers located in market-based countries. Thus, we argue that the crisis may have had a different effect on zero leverage depending on the financial system being considered and formulate the following hypothesis:

H5: The impact of the 2008 financial crisis on firm's likelihood of having zero leverage was higher in countries with market-based financial systems.

2.3. Interactions between zero-leverage internal and external determinants

So far, the literature on zero leverage has considered independently the effects of internal and external determinants on zero leverage, assuming they are homogenous across different contexts. For example, while Bessler et al. (2013) and Ghoul et al. (2018) present evidence of a direct impact of country legal and/or financial system on zero leverage, they assume that the effects of internal determinants are identical across countries. However, there are some connections between internal and external factors that may boost or attenuate their influence on zero leverage. Therefore, we formulate two additional hypotheses that consider their joint influence in cases that we think are particularly important.

The stronger protection to minority shareholders and the higher flow of information existent in countries with well-functioning and developed capital markets increase investors' willingness to invest (La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 2002), providing firms with a wider range of alternative and attractive sources of financing than in bank-based systems, where the relationships are mainly established with banks (Leland and Pyle, 1977). In particular, the greater number of investors and the higher liquidity of capital markets in market-oriented systems give firms a better chance to replace debt by equity and remain debt-free. Therefore, it is easier for firms located in those countries to keep their financial flexibility and, hence, their borrowing capacity to future investment opportunities that may arise (de Jong et al., 2012). For example, more profitable firms, with higher levels of internal liquidity and holding future good prospects, have more chances to be debt-free in market systems than in bank systems, where, instead of building up financial flexibility, firms often have to use their operational profits and liquidity to comply with debt repayment plans. Thus, the financial flexibility approach may apply, particularly, to firms in countries with market-based systems, i.e., there is a higher propensity for those firms to adopt zero-leverage policies due to their own decision. Therefore, the following hypothesis will be tested:
H6: The expected positive effect of financial flexibility on the firm's likelihood of having zero leverage is strengthened in market-based systems.

On the other hand, the overall increase in information asymmetries and default risk during crisis periods are expected to hamper the access to external finance. In particular, the arguments put forward in Section 2.2 suggest that the recent financial and sovereign debt crises aggravated firms' financial constraints and, hence, firms' access to debt got worse due to creditors' imposition. From the debt supply side, there are some reasons that may lead creditors to aggravate the conditions to grant debt to firms during periods of crisis. As argued by the balance sheet channel perspective, asset values fall during crisis, which, together with the uncertainty about the real value of the firm, increases considerably the risk taken by creditors and consequently reduces their willingness to grant debt (Kiyotaki and Moore, 1997; Stiglitz and Weiss, 1981). Moreover, creditors may react to the substantial losses faced by financial institutions during the crisis by promoting a contraction in credit availability to firms or requiring higher interest rates (Ivashina and Sharfstein, 2010; Santos, 2011). Although this situation affects all firms, it is expectable that firms with little reputation in the credit market to be even more affected and to have even more difficulties to raise debt (Diamond, 1991). Therefore, smaller firms with low percentage of asset tangibility and low-dividend payments are expected to be more prone to have zero leverage during the crisis period due to creditors

imposition. Thus, financial constraints arguments for zero leverage may acquire more relevance during the crisis period. Hence, we hypothesize that:

H7: The expected positive effect of financial constraints on the firm's likelihood of having zero leverage was strengthened during the 2008 financial crisis.

3. Data and Methodology

The accounting, financial and market data about the listed European firms included in our sample were obtained from the *DataStream* database provided by Thomson Reuters. Data were collected for the period between 1995 and 2016 for 14 Western European countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and the UK). These countries were selected to ensure the availability of information for listed firms during the period of analysis.

As in previous studies about capital structure, utilities and financial firms were excluded from the sample due to the different regulations that these firms are subject to. Following the recent study by Sardo and Serrasqueiro (2018), we used the FTSE/Dow Jones Industry Classification Benchmark (ICB), and so firms with an industry code of 7000-7999 (Utilities) or 8000-8999 (Financials), as well as firms without industry code, were excluded from the sample. Then, we removed from the sample firm-year observations with missing information for total assets, sales or total debt. Finally, we excluded firm-year observations with invalid information or obvious errors for assets, sales and short and long-term debt. To mitigate potential survivorship bias, we allowed firms' entry and exit from the sample. After applying those cleaning and filtering criteria, the final sample contains 8,676 listed firms corresponding to an unbalanced panel data of 88,348 firm-year observations.

Table 1 provides a definition of the variables considered in the main econometric models and also of the additional variables that were used to test the robustness of our main results. The dependent variable (*ZL*) has a binary nature, being 1 if total debt is equal to zero in a given year. In this calculation we considered only financial debt and excluded non-debt liabilities, since our focus is on financing decisions (Strebulaev and Yang, 2013).

Table 1: Definition of the model variables

Note: [a] Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Portugal and Spain are considered to have bank-based financial systems, while Denmark, the Netherlands, Sweden and the UK have market-based financial systems.

[b] The group of common law countries is composed by Ireland and UK, while Austria, Belgium, Denmark, Germany, Greece, Finland, France, Italy, Netherlands, Portugal, Spain and Sweden are identified as civil law countries.

[c] The longest crisis period is considered only for the following countries: Austria, Belgium, Greece, Ireland, Portugal and Spain. For UK the crisis period is 2008-2011 and for the remaining countries only the 2008-2009 period is considered as a crisis period. See Laeven and Valencia (2018).

Variable	Definition
Panel A: Main variables	
Dependent variable	
ZL	Equals 1 if a firm has zero short-term debt and zero long-term debt in a given year and is 0 otherwise.
Proxies for financial constraints	
Size	Logarithm of total book assets (thousand Euro).
Dividend payout	Ratio of common dividend to total book assets.
Tangibility	Ratio of fixed assets to total book assets.
SA-index	The Size-Age index is constructed as (– 0.737 * Size) + (0.043 * Size^2) – (0.040 * Age), where Age is the difference between the year of the observation and the first date that the firm appears in the *DataStream* database with trading available data and Size is as defined previously (Hadlock and Pierce, 2010).
WW-index	The WW-index is constructed as –0.091*CFlow – 0.062*DIVPOS + 0.021*TLTD – 0.044*LNTA + 0.102*ISG – 0.035*SG, where CFlow = (Net income+Depreciation)/Total assets, DIVPOS is an indicator set to 1 if positive dividends, TLTD = Long term debt/Total assets, LNTA = Size, ISG is the average industry sales growth and SG is the firm's sales growth (Whited and Wu, 2006).
KZ-index	The KZ-index is constructed as –1.002*CashFlow + 0.283*Q + 3.139*Lev – 39.368*Div – 1.315*Cash, where CashFlow = (Net income + Depreciation)/lagged property, plant and equipment; Q refers to Tobin's Q (total assets minus book equity plus market capitalization, divided by total assets); Lev = Ratio of short and long-term debt to total book assets; Div = Ratio of common dividend to lagged property, plant and equipment; Cash = Ratio of cash and short-term investments to lagged property, plant and equipment (Lamont, Polk, and Saaá-Requejo, 2001).
Size_d	Equals 1 if the firm's size is in the first tercile of the variable *Size* (smaller firms) and 0 if it is in tercile 3 (larger firms). Terciles are calculated separately for each year. Firm-year observations in the first tercile are classified as financially constrained while those in tercile 3 are classified as being unconstrained.
Dividend_d	Equals 1 if the firm's dividend payments are in the first tercile of the variable *Dividend payout* (low-dividend payers) and 0 if it is in tercile 3 (high-dividend payers). Terciles are calculated separately for each year. Firm-year observations in the first tercile are classified as financially constrained while those in tercile 3 are classified as being unconstrained.
Tangibility_d	Equals 1 if the firm's asset tangibility is in the first tercile of the variable *Tangibility* (low asset tangibility) and 0 if it is in tercile 3 (high asset tangibility). Terciles are calculated separately for each year. Firm-year-observations in the first tercile are classified as financially constrained while those in tercile 3 are classified as being unconstrained.
Proxies for financial flexibility	
Cash holdings	Ratio of cash and short-term investments to book assets.
Growth opportunities	Market-to-book ratio (the market value of equity plus the book value of debt, divided by total assets).
Profitability	Ratio of earnings before interests, taxes, and depreciation (EBITDA) to total book assets.
Cash_d	Equals 1 if the firm's cash holdings are in the third tercile of the variable *Cash holdings* (higher cash ratios) and 0 if it is in tercile 1 (lower cash ratios). Terciles are calculated separately for each year. Firm-year observations in the third tercile are classified as highly financially flexible.

Growth_d	Equals 1 if the firm's growth prospects are in the third tercile of the variable *Growth opportunities* (higher growth) and 0 if it is in tercile 1 (lower growth). Terciles are calculated separately for each year. Firm-year observations in the third tercile are classified as highly financially flexible.
Profitability_d	Equals 1 if the firm's profits are in the third tercile of the variable *Profitability* (higher profitability) and 0 if it is in tercile 1 (lower profitability). Terciles are calculated separately for each year. Firm-year observations in the third tercile are classified as highly financially flexible.
Proxies for the financial system	
Market system	Equals 1 if a financial system is market-based (a higher level of stock market development relative to banking sector development), and 0 if it is bank-based (source: Demirgüç-Kunt and Levine, 2004). [a]
Stock market capitalization	Total value of listed shares in a stock market divided by GDP (source: Beck, Demirgüç-Kunt, and Levine, 2000; data were obtained from the Global Financial Development Database).
Legal system	Equals 1 for countries with a common law system and 0 for countries with a civil law system (source: Djankov, McLiesh, and Shleifer, 2007 and The World Factbook, CIA). [b]
Proxies for the 2008 financial crisis	
Crisis	Equals 1 if the observation corresponds to the years of financial and sovereign debt crises in Europe (the period of crisis goes from 2008 to 2009, 2011 or 2012, depending on the country being considered) and is 0 otherwise (source: Laeven and Valencia, 2018). [c]
Control variables	
Capital expenditures	Ratio of capital expenditures to total book assets.
Taxes	Ratio of income taxes paid to total book assets.
Non-debt tax shields	Ratio of depreciation and amortizations to total book assets.
Earnings volatility	The absolute value of the difference between firm's annual % change in EBITDA and the (time-series) average of those changes.
GDP growth rate	Annual GDP growth rate (source: World Development Indicators, The World Bank).
Panel B: Other variables	
Alternative dependent variables	
AZL	Equals 1 if the book leverage ratio is below 5% and is 0 otherwise.
ZL3	Equals 1 if a firm has a zero debt during three consecutive years and is 0 otherwise.
LTZL	Equals 1 if a firm has zero long-term debt in a given year and is 0 otherwise.
STZL	Equals 1 if a firm has zero short-term debt in a given year and is 0 otherwise.
Additional control variables	
Age	Difference between the year of the observation and the first date of trading available at *DataStream*.
Short-term liabilities	Ratio of short-term liabilities other than debt to total book assets.

As determinants of *ZL*, we consider several proxies for the factors related to the hypotheses formulated in Section 2. Regarding the financial constraints hypothesis, there is not a unique, consensual way to measure financial constraints (e.g. Almeida, Campello, and Weisbach, 2004). Therefore, various proxies for the willingness of creditors to grant credit to a firm have been used in the literature, in particular firm size (Cleary, 2006; Guariglia, 2008; Hadlock and Pierce, 2010), dividend payments (Cleary, 2006; Dang, 2013; Fazzari, Hubbard, and Petersen, 1988) and asset tangibility

(Benmelech and Bergman, 2009).[6] These firm-specific characteristics can be seen as proxies for the degree to which firms are more exposed to information asymmetries and, thus, for the difficulty in obtaining external finance (Guariglia, 2008). Specifically, firms of smaller size and firms that do not pay out dividends have generally less reputation, which makes it difficult to obtain external finance, inasmuch as lenders require greater compensation for the risk in granting credit to such firms. Simultaneously, tangible assets serve as collateral to debt, which grants creditors protection in case of firms' default, implying that firms with lower asset tangibility are more likely to face information asymmetries and consequent credit rationing (Benmelech and Bergman, 2009). Alternatively, researchers have used composite indexes of financial constraints, such as the SA-index (Hadlock and Pierce, 2010), the WW-index (Whited and Wu, 2006) and the KZ-index (Kaplan and Zingales, 1997; Lamont et al., 2001), which are constructed weighting differently several firm-specific characteristics assumed to be related to the existence of financial constraints. In the three cases, a higher (lower) value for the index suggests that greater (smaller) financial constraints are faced by firms. Another possible strategy for proxying financial constraints is to use the dummy variables defined in Table 1, which are based on the *Size*, *Dividend payout* and *Tangibility* variables, but distinguish directly financially constrained firms (firms with values in the first terciles of those variables - smaller firms, firms with a lower dividend payout or firms with less tangible assets) from the unconstrained ones (firms in the last tercile). This approach may provide additional insights, since using the continuous values of the three mentioned variables may not completely identify and differentiate firms with different levels of constraints. In order to reduce missclassification of constrained and unconstrained firms, all analyses based on the dummy variables exclude firms in the second tercile of *Size*, *Dividend payout* or *Tangibility*.

Similarly, in the literature there is no well-defined measure of financial flexibility, this being a non-observable factor that depends greatly on managers' assessment of future growth opportunities (Ferrando et al., 2017). Nevertheless, previous studies have assessed financial flexibility by resorting mostly to measures related to debt and/or internal liquidity (Arslan-Ayaydin, Florackis, and Ozkan, 2014; Ferrando et al., 2017; Gamba and Triantis, 2008; Marchica and Mura, 2010). In this paper, we consider three of those measures as proxies for financial flexibility: cash holdings, profitability and

[6] Other firm-specific indicator sometimes used in the literature as a proxy for financial constraints is firm age. However, this information was not available in the database when we drew the sample. The only related information that we could get was the first date of trading available in *DataStream*, which only allows us to obtain the number of years since that date. For this reason, and also because firm size and firm age are usually highly correlated (see the detailed analysis by Dang, 2013), we decided to consider the age variable only in the robustness section, as an additional control variable.

growth opportunities. Firms with a higher level of any of these measures are expected to have a greater ability or desire to build up financial flexibility. In addition, as in the previous case, we use dummy variables distinguishing between the most and least financially flexible firms.

To analyse the effect of the financial system, three alternative proxies are used. First, we construct a dummy variable based on an indicator developed by Demirgüç-Kunt and Levine (2004) that allows the partition of the sample into countries with a market-based financial system and countries with a bank-based financial system. Second, we use the *Stock market capitalization* variable, an indicator of the size of the stock market (Beck et al., 2000), also interpreted as a measure of stock market development (Aktas, Andries, Croci, and Ozdakak, 2019). Finally, because common law countries favour the development of market-based financial systems (Demirgüç-Kunt and Levine, 1999), we use a dummy variable based on the legal system prevailing in the country, a variable that has also been considered by Bessler et al. (2013) to explore the effect of country specificities on zero leverage.

For the crisis, we use a dummy variable based on the recent classification developed by Laeven and Valencia (2018) about banking, currency and sovereign debt crises, which recognizes that the 2008 global financial crisis affected European countries in different ways and assigns distinct final years for the crisis in each country.

Finally, the econometric models also include control variables shown in previous studies as having power in explaining capital structure decisions. These control variables are: *Capital expenditures, Taxes, Non-debt tax shields, Earnings volatility* and *GDP growth rate* (Bessler et al., 2013; Dang, 2013; Strebulaev and Yang, 2013). In order to control for non-observed specific effects, all models include dummy variables for industry (based on the 1-digit ICB code) and some models also consider country and year dummies.

We perform both univariate and multivariate analyses to investigate which firms' characteristics stimulate zero-leverage policies. In the multivariate analysis, as a consequence of the binary nature of the dependent variable, it is required the use of an econometric method appropriate for such response variable, since, for example, standard estimators such as ordinary least squares assume that the dependent variable can take on any real negative or positive value (Wooldridge, 2012). In particular, pooled logit regression models are used to estimate the impact of the explanatory variables on the likelihood of a firm having zero leverage. The logit model has the following form:

$$\Pr(ZL=1|x) = 1/[1+e^{-(x\beta)}] \quad (1)$$

where x represents the vector containing some of the explanatory variables defined in Table 1 (including also a constant term) and β represents the vector of the variable coefficients. In the robustness section other models will be considered, including probit models, random and fixed effects models and an instrumental variable approach. Propensity score matching will also be considered in a preliminary analysis.

4. Empirical results

4.1. Univariate analysis

4.1.1. Sample

We begin the empirical part of the paper by presenting a brief description of the research sample. Table 2 shows the distribution of observations and firms by country and financial system for both the full sample and the sub-sample of debt-free firms. Between 1995 and 2016 around 10.84% of firm-year observations are classified as having zero leverage, with debt-free firms being significantly present in all countries. The dimension of this result is even more noteworthy if we consider that almost 29% of firms present zero leverage levels in at least one year. Nevertheless, these values are lower than those reported in most studies developed for the US (Strebulaev and Yang, 2013) and the UK (Dang, 2013). Comparing with papers including other countries, the values reported here are also lower than those found by Bessler et al. (2013) and Ghoul et al. (2018), where about 18% and 13% of observations correspond to debt-free firms, respectively.

Table 2: Sample characterisation by country
Note: This table presents the distribution of firms across the 14 countries considered in the sample. The first 3 columns report the number of observations (N. obs.), the percentage of observations (% obs.) and the number of firms (N. firms), by country, for all firms. The last 2 columns present the percentage of both the observations (% obs.) and firms (% firms) classified as debt-free in each country.
* Firms that present zero leverage levels in at least one year.

	All firms			**Debt-free firms**	
Country	N. obs.	% obs.	N. firms	% obs.	% firms*
Bank-based countries					
Austria	1,519	1.72	137	8.16	23.36
Belgium	2,095	2.37	176	3.72	14.20
Finland	2,636	2.98	202	3.76	13.37
France	14,254	16.13	1,312	2.40	9.45
Germany	12,992	14.71	1,129	12.85	34.46
Greece	4,682	5.30	356	7.35	29.78
Ireland	1,164	1.32	117	11.08	32.48
Italy	4,297	4.86	381	2.19	9.97
Portugal	1,149	1.30	105	2.61	9.52
Spain	2,500	2.83	215	2.12	11.63
Subtotal	47,288	53.52	4,130	6.26	19.71
Market-based countries					

Denmark	2,741	3.10	227	7.30	21.15
Netherlands	3,248	3.68	292	9.21	26.37
Sweden	7,835	8.87	832	20.36	46.15
UK	27,236	30.83	3,195	16.61	37.12
Subtotal	41,060	46.48	4,546	16.12	37.29
Total	**88,348**	**100.00**	**8,676**	**10.84**	**28.92**

A more detailed analysis reveals great heterogeneity in the distribution of zero-leverage firms between countries, with Sweden (20.36%) and UK (16.61%) presenting the greatest proportions of zero-leverage observations and France, Italy, Portugal and Spain the lowest (between 2% and 3%). Since the first two countries are characterized by market-based financial systems and the last four by bank-based systems, it seems that, as conjectured, there may be a relationship between the level of development of the financial system and the zero-leverage phenomenon. The same conclusion is achieved when we compare the average percentage of observations of debt-free firms in countries with market and bank-based systems (16.12% and 6.26%, respectively).

4.1.2. Trends of zero leverage

The literature is consensual about an increasing trend towards zero leverage over the years (e.g. Bessler et al., 2013; Ghoul et al., 2018). In order to confirm a similar trend in Europe, Figure 1 shows the evolution of zero leverage over the period 1995-2016, both in global terms and by financial system. It is clear an upward trend of zero leverage for the full sample. The proportion of firms with zero leverage was 5.15% in 1995, increased fairly steady until 2006 (12.81%), stagnated during the global financial crisis (12.11%-12.87% between 2008 and 2010), peaked in 2014 (13.92%) and reached 11.94% in 2016, more than doubling during the period of analysis.

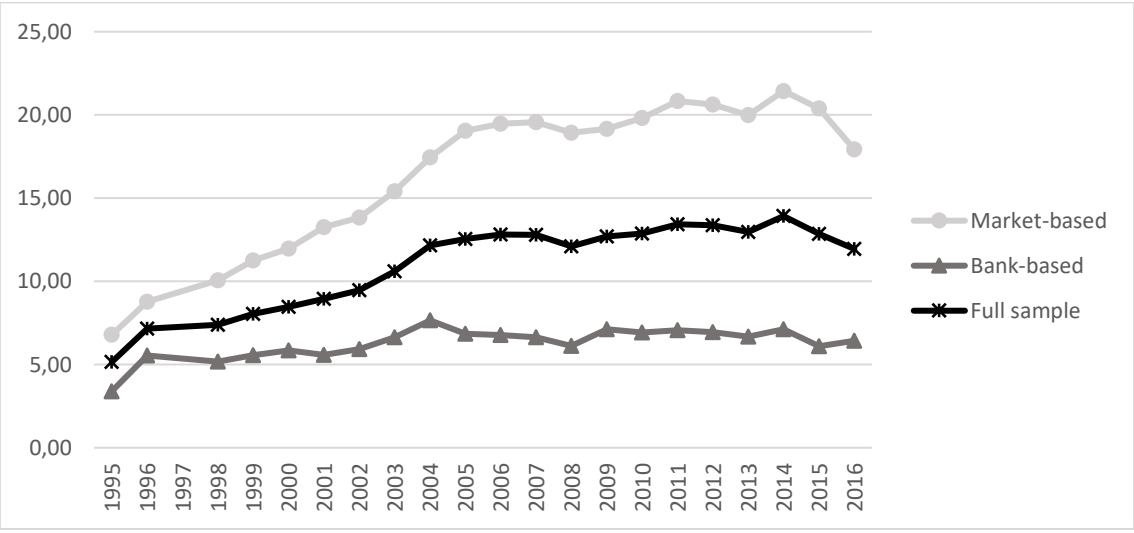

Figure 1: Evolution over time of zero-leverage levels in different financial systems and in the whole sample

Figure 1 also shows marked differences in the distribution and evolution of zero leverage between the two financial systems considered. In countries with a market-based financial system, zero leverage increased considerably over the years, with the proportion of debt-free firms almost tripling between the beginning (6.79%) and the end of the period of analysis (20.40% in 2015 and 17.93% in 2016). However, for countries with a bank-based financial system, the increase of zero leverage was much less noticeable. In fact, considering the evolution from 1996 (5.54%) to 2016 (6.42%), we find that the increase of zero leverage is residual, not even reaching 1 percentage point (pp). It increased slightly until 2004 and then fell until 2008, with the figures remaining similar until 2016.

4.1.3. Descriptive statistics

Table 3 presents descriptive statistics for the continuous variables defined in Table 1. In particular, Panel A reports several descriptive statistics for the full sample, while Panel B presents the mean values for both zero-leverage and leveraged firms and the results of t-tests for the mean differences across groups.

Table 3: Descriptive statistics and mean characteristics of zero-leverage *versus* leveraged firms
Note: *** significance at the 1% level.

	Panel A: Full sample descriptive statistics						Panel B: Mean characteristics of zero-leverage and leveraged firms		
Variable	**N. obs**	**Mean**	**s.d.**	**Min.**	**Median**	**Max.**	**ZL firms**	**Leveraged firms**	**T-test for diff. in means**
Size	88,348	11.631	2.238	2.565	11.461	19.807	9.882	11.843	-84.150***
Dividend payout	83,785	0.018	0.038	0.000	0.006	0.897	0.028	0.017	26.782***
Tangibility	88,072	0.248	0.223	0.000	0.188	0.980	0.135	0.261	-52.860***
SA-index	88,348	-3.019	0.682	-5.238	-3.150	1.759	-2.981	-3.338	49.110***
WW-index	65,394	-0.576	0.328	-17.562	-0.569	8.733	-0.508	-0.584	18.040***
KZ-index	68,999	-11.805	25.915	-149.961	-2.540	77.180	-12.301	-9.599	-70.589***
Cash holdings	88,226	0.152	0.176	0.000	0.089	0.974	0.343	0.129	120.000***
Growth opportunities	79,490	1.431	1.728	0.004	0.946	19.853	2.398	1.316	55.383***
Profitability	86,423	0.070	0.228	-2.995	0.103	2.911	-0.004	0.079	-33.145***
Stock market capitalization	81,116	0.798	0.376	0.081	0.759	2.386	0.903	0.786	26.763***
Capital expenditures	82,765	0.054	0.068	0.000	0.035	0.843	0.040	0.056	-20.163***
Taxes	81,690	0.016	0.034	-0.199	0.012	0.299	0.017	0.016	2.811***
Non-debt tax shields	87,774	0.050	0.048	0.000	0.040	0.941	0.044	0.050	-12.169***
Earnings volatility	75,774	2.167	7.870	0.000	0.459	44.765	3.093	2.064	10.818***
GDP growth rate	88,348	1.902	2.272	-9.133	2.337	25.557	1.991	1.891	4.049***

Table 3 shows that debt-free firms are smaller and have lower levels of tangible assets than leveraged firms, which agrees with the hypothesis of zero leverage arising from financial constraints (Hadlock and Pierce, 2010; Benmelech and Bergman, 2009). However, on average, debt-free firms pay out more dividends as a percentage of assets

than leveraged firms. This result is against to the financial constraints approach according to which firms paying more dividends suffer less from information asymmetries and have a better reputation and, hence, are less likely to be financially constrained (Cleary, 2006; Fazzari et al., 1988). The composite measures of financially constraints are also not completely in accordance, since two of them show that on average debt-free firms are more financially constrained while the other (*KZ-index*, the only index that considers the actual value of the dividends) shows the opposite. Additionally, the results show that firms with zero leverage, on average, present higher levels of growth opportunities and cash holdings than leveraged firms. These results are similar to those of Dang (2013) and are consistent with the argument of zero leverage being the result of a financing decision of firms, which aim at maintaining financial flexibility to preserve their debt capacity in order to fund future valuable growth opportunities (Marchica and Mura, 2010). However, unlike what the financial flexibility theory predicts, debt-free firms are less profitable than leveraged firms.

4.1.4. Propensity score matching analysis

Because the previous analysis mixes zero-leverage firms with different characteristics, we use the propensity score matching approach suggested by Rosenbaum and Rubin (1983) to further examine the effect of firm-specific variables proxying for financial constraints and financial flexibility on zero leverage. Propensity score matching analysis allows us to get a more balanced distribution of the values of the covariates across the groups of financially constrained and unconstrained firms, on the one hand, and the groups of highly and little financially flexible firms, on the other hand. To implement this method, we first use the procedure described in Table 1 to divide firms into terciles and create the 'treatment' variables *Size_d*, *Dividend_d*, *Tangibility_d*, *Cash_d*, *Growth_d* and *Profitability_d*. The first three variables are equal to 1 for financially constrained firms and to 0 otherwise, while the last three are equal to 1 when firms are classified as highly financially flexible firms and to 0 otherwise. Then, for each treatment variable, we use a logit model to estimate the corresponding propensity scores conditional on a set of other firm-specific characteristics (e.g., for *Size_d*, we consider *Dividend payout*, *Tangibility*, *Cash holdings*, *Growth opportunities* and *Profitability*). Next, using nearest-neighbour matching, we match each constrained or highly financially flexible firm with the unconstrained or little financially flexible firms that display the closest predicted propensity scores, and vice-versa.[7] Finally, we estimate the differences

[7] Each firm in one group is matched with at least one firm in the other group and all observations are potential matches regardless of how dissimilar they are.

between the predicted probabilities of being a zero-leverage firm for each match and average those differences for the whole sample.

Table 4 reports the results obtained. In the first row we present the 'treatment effect', which in this case may be interpreted as the average difference in the predicted probability of being debt-free between financially constrained and unconstrained firms (columns 1-3) and between highly and little financially flexible firms (columns 4-6). In the other rows we present, both for the original and matched sample, a summary of two diagnostic measures for the balance of the distribution of the covariate values for each group of firms. A perfect matching would imply a standardized mean difference of zero across groups and a variance ratio of one. As can be seen, the level of balance between the groups improves substantially in the matched sample in five out of the six cases analysed, the exception being the groups of financial flexible firms defined by the variable *Growth_d*. Nevertheless, because the matching is never perfect, the following conclusions should be seen as preliminary and must be confirmed by the multivariate regression analysis that we undertake in Section 4.2.

Table 4: Propensity score matching estimates
Note: Robust standard errors, based on the correction by Abadie and Imbens (2016), are reported in parenthesis. The two balance diagnostic measures presented are the averages of the absolute value of the standardized mean differences and variance ratios calculated independently for each independent variable considered in the estimation of the propensity scores.
*** significance at the 1% level.

	Size_d (1)	Dividend_d (2)	Tangibility_d (3)	Cash_d (4)	Growth_d (5)	Profitability_d (6)
ZL	0.123***	-0.035***	0.039***	0.138***	0.032***	-0.021***
	(0.006)	(0.007)	(0.005)	(0.004)	(0.004)	(0.004)
Standardized mean differences						
- Raw sample	0.456	0.503	0.540	0.406	2.599	0.429
- Matched sample	0.072	0.032	0.081	0.027	2.491	0.073
Variance ratios						
- Raw sample	4.654	2.355	3.121	2.661	0.875	0.740
- Matched sample	1.079	1.200	0.916	0.962	1.087	0.653
N. observations	48,552	57,124	49,441	49,360	49,735	49,416

Overall, the results of Table 4 lead to conclusions similar to those of Table 3. The probability of being debt-free is higher by 12.3pp for small firms and 3.9pp for the firms with the lowest proportion of tangible assets, and lower by 3.5pp for firms with the lowest dividend payouts. Thus, as before, the two first effects conform with the financial constraints theory, while the third is in contradiction. On the other hand, firms with the highest cash holdings and growth opportunities have a higher probability of having zero leverage, while the most profitable ones are less likely to be debt-free, the average

difference in probability being 13.8pp, 3.2pp and -2.1pp, respectively. Again, the two first results are in accordance with the financial flexibility theory, while the third is in conflict.

4.1.5. Correlation analysis

Table 5 presents the Pearson pairwise correlation coefficients between the continuous independent variables.[8] The results show that the correlations between the explanatory and control variables are not particularly high, being higher than 0.5 only for the pair (*Size*, *SA-index*), an expected result given that the composite measure is based on firm's size. As shown in the last column, the variance inflation factor is always under 4, suggesting that even in that case multicollinearity is not a problem.

[8] Table 5 does not include the dependent variable and the dummy explanatory variables, because the Pearson coefficient is not appropriate to measure correlations involving categorical variables. Nevertheless, we calculated the Pearson pairwise correlation coefficient between the dependent variable and each one the continuous explanatory variables and in all cases we found a significant correlation at the 1% level.

Table 5: Pearson correlation matrix and Variance Inflation Factor (VIF)
Note: The table shows the Pearson correlation coefficients between the variables of the study, and the coefficients associated with the VIF. ** significance at 1%; * significance at 5%

Variables	Size	Dividend payout	Tangibility	SA-index	WW-index	KZ-index	Cash holdings	Growth opportunities	Profitability	Stock market cap	Capital expenditures	Taxes	Non-debt tax shields	Earnings volatility	GDP growth rate	VIF
Size	1.00															3.14
Dividend payout	0.06**	1.00														1.23
Tangibility	0.23**	-0.01**	1.00													1.44
SA-index	0.71**	-0.00	-0.10**	1.00												2.77
WW-index	-0.03**	-0.00	-0.00	0.03**	1.00											1.00
KZ-index	0.02**	-0.08**	0.06**	-0.01*	0,03**	1.00										1.02
Cash holdings	-0.24**	0.06**	-0.33**	0.09**	0.01	-0.06**	1.00									1.31
Growth opportunities	-0.19**	0.15**	-0.13**	0.02**	0.00	-0.03**	0.32**	1.00								1.25
Profitability	0.25**	0.26**	0.12**	-0.10**	-0.01**	-0.03**	-0.19**	-0.09**	1.00							1.52
Stock market capitalization	-0.11**	0.06**	-0.00	0.12**	0.00	-0.00	0.07**	0.16**	-0.08**	1.00						1.20
Capital exp.	0.02**	0.01	0.43**	-0.06**	-0.00	0.03**	-0.11**	0.05**	0.07**	0.02**	1.00					1.35
Taxes	0.12**	0.36**	-0.00	-0.06**	-0.01	-0.03**	0.01**	0.13**	0.47**	0.02**	0.06**	1.00				1.52
Non-debt tax shields	-0.08**	-0.03**	0.13**	0.01**	0.07	0.04**	-0.09**	-0.00	-0.06**	-0.03**	0.22**	-0.07**	1.00			1.10
Earnings volatility	-0.10**	-0.06**	0.04**	-0.08**	-0.01**	-0.01	0.04**	-0.01	-0.12**	-0.01**	-0.03**	0.08**	0.03**	1.00		1.02
GDP growth rate	-0.03**	0.03**	0.03**	-0.01*	-0.00	-0.00	0.02**	0.12**	0.05**	0.31**	0.09**	0.08**	0.00	0.00	1.00	1.17

4.2. Multivariate analysis

4.2.1. Results for the internal determinants of zero leverage

Table 6 presents the results of the models that allow us to test the hypotheses concerning the internal determinants of zero leverage. The eight estimated logit regression models differ only on the set of independent variables considered. For each independent variable, we report the estimated coefficient and the result of a Wald test for its individual significance in brackets. The Wald test uses robust standard errors that are adjusted for heteroscedasticity and clustered by firm to mitigate concerns about within-firm correlation. Given that the value of the regression coefficients is not directly interpretable in nonlinear models, below we also comment on the estimated (average) partial effect for the main independent variables, but these results are not presented in the table to save space.[9]

We focus on columns (1)-(5) to test hypothesis H1 about the role played by financial constraints on zero leverage and on columns (1) and (6)-(8) to test hypothesis H2 about the role played by financial flexibility. The specification in column (1) is used as our baseline model and incorporates the firm's specific explanatory variables representing the financial constraints and financial flexibility approaches, the control variables defined in Panel A of Table 1, as well as industry, year and country dummies to mitigate concerns about omitted variables. The model in column (2) adds the composite measures of financial constraints, namely the SA-index of Hadlock and Pierce (2010), the WW-index of Whited and Wu (2006) and the KZ-index of Kaplan and Zingales (1997). Columns (3)-(5) report the results for the models that use the dummy variables *Size_d*, *Dividend_d* and *Tangibility_d*, respectively, to distinguish between groups of financially constrained (dummy variable = 1) and unconstrained firms. Finally, the models in columns (6)-(8) use the dummy variables *Cash_d*, *Growth_d* and *Profitability_d*, respectively, to separate highly (dummy variable = 1) and little financially flexible firms. We consider the dummy variables one at a time in order to avoid a substantial loss of observations, since firms in the middle tercile of each variable are dropped from the sample, as explained before.

Table 6: Internal determinants of zero leverage

[9] The calculated partial effects measure the variation in the probability of following a *ZL* policy due to a one standard deviation increase in a continuous explanatory variable (xj) or a change from 0 to 1 in a dummy variable (Wooldridge, 2012). For continuous covariates, we first calculate for each firm the derivative of Pr(ZL=1|x), see equation (1), in order to x_j, which is given by $PE = \beta_j \exp(x\beta) / [1 + \exp(x\beta)]^2$. Then, we calculate the average of the individual *PE*'s and multiply it by one standard deviation of xj. For dummy variables, we first compute the value of equation (1) for each firm setting xj = 1 (and evaluating the other variables at their sample values) and then repeat that calculation considering xj = 0. Finally, we compute the average of the differences between the two values obtained for each firm.

Note: The table presents the results of eight logit regression models for the dependent variable *ZL*, which takes the value of 1 if the firm has no debt in a given year and 0 otherwise. The models differ on the set of independent variables considered: column (1) uses traditional firm-specific indicators of financial constraints and flexibility; Column (2) adds the composite measures of financial constraints proxied by the variables *SA-index*, *WW-index* and the *KZ-index*; Columns (3)-(8) instead add the dummy variables *Size_d*, *Dividend_d*, *Tangibility_d*, *Cash_d*, *Growth_d* or *Profitability_d*, respectively. All models include year, industry and country dummies as well as the control variables defined in Panel A of Table 1. For each independent variable we report the regression coefficients and the z-statistics (in brackets). Robust standard errors are adjusted for heteroscedasticity and clustered by firm.
***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Size	-0.428***	-0.344***		-0.439***	-0.415***	-0.420***	-0.397***	-0.397***
	(-21.05)	(-13.55)		(-20.21)	(-18.52)	(-19.46)	(-18.37)	(-19.34)
Dividend payout	5.392***	5.201***	4.681***		6.193***	4.937***	4.807***	4.998***
	(8.36)	(7.69)	(6.91)		(7.78)	(7.01)	(7.05)	(7.94)
Tangibility	-0.903***	-0.963***	-1.110***	-0.986***		-1.541***	-0.832***	-0.924***
	(-3.82)	(-3.96)	(-3.52)	(-3.93)		(-5.61)	(-3.17)	(-3.47)
Cash holdings	4.338***	4.467***	4.018***	4.398***	4.201***		4.200***	4.075***
	(28.00)	(27.39)	(22.41)	(27.62)	(24.48)		(25.28)	(26.07)
Growth opportunities	0.044***	0.050***	0.071***	0.054***	0.043***	0.063***		0.033**
	(2.85)	(3.12)	(4.03)	(3.52)	(2.70)	(4.49)		(2.15)
Profitability	0.356***	0.226**	0.011	0.298***	0.453***	0.060	0.331***	
	(3.59)	(2.27)	(0.12)	(3.00)	(4.13)	(0.62)	(3.11)	
SA-index		0.520***						
		(5.44)						
WW-index		0.008*						
		(1.67)						
KZ-index		-0.000						
		(-0.67)						
Size_d			2.026***					
			(16.97)					
Dividends_d				-0.711***				
				(-9.79)				
Tangibility_d					0.589***			
					(5.53)			
Cash_d						2.183***		
						(25.58)		
Growth_d							0.235***	
							(3.14)	
Profitability_d								0.322***
								(4.71)
Wald test for joint significance	2454.25***	2273.11***	1681.78***	2179.35***	2156.97***	1901.06***	1989.10***	2141.40***
Pseudo R2	0.3295	0.3317	0.3582	0.3085	0.3434	0.3364	0.3213	0.3136
Correct classification	91.45%	91.38%	91.39%	89.49%	90.50%	89.01%	90.02%	89.37%
N. observations	64,017	59,487	41,157	48,198	41,669	41,579	42,030	41,469

The applied econometric tests and criteria confirm the suitability of the estimated logit regression models. The Wald tests for the individual and joint significance of the

explanatory variables confirm their ability to explain *ZL*. The Pseudo R-squared is always above 30%. The percentage of values of *ZL* being correctly predicted by the model are always around to 90%.

Analysing first the variables proxying the financial constraints approach, column (1) shows that both *Size* and *Tangibility* present a negative and statistically significant effect on zero leverage. *Ceteris paribus*, the increase of one standard deviation in each variable corresponds to a fall of, respectively, 2.6pp or 5.5pp in the firm's likelihood of having *ZL*.[10] Consequently, the results suggest that smaller firms and firms with less collateral to debt are more likely to face information asymmetries and the consequent credit rationing (Hadlock and Pierce, 2010; Stiglitz and Weiss, 1988; Benmelech and Bergman, 2009), which is in accordance with the financial constraints hypothesis. In contrast, dividend payments present a positive and statistically significant effect on *ZL*, with a positive change of one standard deviation in the dividend payment ratio, *ceteris paribus*, increasing the likelihood of *ZL* by 33pp. This result, although similar to those obtained by Bessler et al. (2013) and Byoun and Xu (2013), disagrees with the arguments of the financial constraints approach, whereby firms paying lower dividends are more likely to adopt zero leverage due to higher costs of information asymmetry.

When we add to the model the composite indexes of financial constraints, see column (2), the previous conclusions are reinforced.[11] On the one hand, the sign and significance of the *Size* and *Tangibility* variables do not change and the positive and significant coefficients of the *SA-index* and the *WW-index* variables are also in accordance with the financial constraints hypothesis. On the other hand, the effect of *Dividend payout* is again the opposite of that predicted by the financial constraints theory and the non-significant coefficient of the *KZ-index* also does not corroborate that theory. Similarly, the positive coefficients of the variables *Size_d* and *Tangibility_d* on columns (3) and (5), respectively, and the negative coefficient of the variable *Dividend_d* on column (4), confirm that smaller firms, firms with lower asset tangibility and firms paying more dividends have greater propensity to have zero leverage.

Overall, in spite of the contradictory results found, we conclude that there is some support to hypothesis H1. Indeed, given that the univariate analysis in Section 4.1. had already shown that zero-leverage firms display on average smaller values for the *KZ-index*, and that this index is the only one that considers the actual value of dividend

[10] The absolute variation of the independent variable that corresponds to a one standard deviation may be found in Table 3. In the case of *Size*, which is a logged variable, one standard deviation corresponds to a change of 9,375 Euro in total assets.
[11] The inclusion of these indexes one at a time does not change our findings.

payments in its calculation, we think that our results suggest that both *Dividend payout* and *KZ_index* may not be the best proxies for financial constraints. The unexpected, but systematic, positive effect of dividends on zero leverage seems to indicate that, more than a proxy of the financial constraints experienced by zero-leverage firms, dividends may act mainly as a mechanism controlling for managerial entrenchment arising from excessive free cash-flows, and therefore as a substitute for debt for that purpose (Easterbrook, 1984) or as a way to establish a good reputation with shareholders to obtain financing via equity issuances and therefore avoid raising debt (Byoun and Xu, 2013). On the other hand, there is an active debate about the ability of composite measures of financial constraints to effectively identify financial constraints (Farre-Mensa and Ljungqvist, 2016). Our results seem to confirm the doubts cast by Hadlock and Pierce (2010) and Whited and Wu (2006) regarding the use of the KZ-index as a measure of financial constraints, since, for example, this index tends to classify large and overinvested firms as constrained firms (Whited and Wu, 2006). Moreover, as debt loads the KZ-index positively and higher values of the index mean higher financial constraints, zero-leverage firms have more chances to be classified as financially unconstrained.

Concerning the variables representing the financial flexibility approach, i.e., *Cash holdings*, *Growth opportunities* and *Profitability*, column (1) shows that they have, as predicted by that theory, positive and statistically significant effects on the firm's likelihood of having zero leverage. Specifically, the increase of one standard deviation in the level of cash holdings, with the other variables remaining constant, increases by around 26.5pp a firm's likelihood of having zero leverage, while a similar change in the *Growth opportunities* and *Profitability* variables present a lower economic impact (approximately 0.3pp and 2.2pp respectively). These results are in accordance with the arguments of the financial flexibility theory, whereby firms with high internal liquidity, represented by high cash holdings and profitability and valuable growth opportunities, choose zero leverage to hold on debt capacity, in order to fund future good growth opportunities (Marchica and Mura, 2010; Rapp et al., 2014).

Columns (6)-(8) show that results are quite similar when we use only extreme terciles of financial flexibility measures. The positive coefficients of the variables *Cash_d*, *Growth opportunities* and *Profitability_d* confirm that cash-rich firms, with greater future prospects and profitability, are more likely to adopt zero-leverage policies. Thus, highly financially flexible firms, namely those in the top tercile of each proxy of financial flexibility, show a greater propensy to be debt-free. Hence, on the basis of these results, hypothesis H2 is validated.

4.2.2. Results for the external determinants of zero leverage

The results for the models including external determinants of zero leverage are reported in Table 7. Using the first model in Table 6 as baseline, the model in column (1) incorporates the *Market system* dummy variable to control the specific effect of the financial system on zero leverage (hypothesis H3) and the *Crisis* variable to capture the specific effect of the recent crisis on zero leverage (hypothesis H4). The model in column (2) adds the interaction variable *Market*Crisis*, which allows testing whether the effects of the crisis depend on the financial system of the country (hypothesis H5). In columns (3)-(4), the *Market system* variable is replaced by other variables also characterizing or affecting the functioning of the financial system of each country: column (3) considers the *Stock market capitalization* variable and column (4) the *Legal system* variable. All models discussed in this section use proxies for countries specificities or for the crisis period and, therefore, country and year dummies are excluded from the regression analysis.

Table 7: External determinants of zero leverage
Note: The table presents the results of four logit regression models for the dependent variable *ZL*, which takes the value of 1 if the firm has no debt in a given year and 0 otherwise. Using the first model in Table 6 as baseline, Column (1) adds the variables *Market system* and *Crisis*; Column (2) adds the interaction variable *Market*Crisis*; and Column (3) and (4) replaces the *Market system* variable by the *Stock market capitalization* and the *Legal system* variables, respectively. All models include industry dummies as well as the control variables defined in Panel A of Table 1. For each independent variable we report the regression coefficients and the z-statistics (in brackets). Robust standard errors are adjusted for heteroscedasticity and clustered by firm.
***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

Independent variables	**(1)**	**(2)**	**(3)**	**(4)**
Size	-0.428***	-0.427***	-0.475***	-0.451***
	(-21.55)	(-21.52)	(-21.92)	(-22.09)
Dividend payout	5.552***	5.570***	5.455***	5.930***
	(9.10)	(9.16)	(8.33)	(9.38)
Tangibility	-0.984***	-0.971***	-0.722***	-1.037***
	(-4.19)	(-4.13)	(-2.96)	(-4.42)
Cash holdings	4.272***	4.276***	4.208***	4.128***
	(28.75)	(28.78)	(26.79)	(28.12)
Growth opportunities	0.042***	0.042***	0.046***	0.056***
	(2.91)	(2.93)	(2.90)	(3.79)
Profitability	0.347***	0.346***	0.206**	0.347***
	(3.51)	(3.50)	(2.01)	(3.50)
Market system	1.014***	0.968***		
	(12.68)	(11.99)		
Crisis	0.239***	0.037	-0.510**	-0.104
	(3,42)	(0.34)	(-2.46)	(-1.17)
Market*Crisis		0.275**		
		(2.43)		
			0.424***	

Stock market capitalization			(4.06)	
Crisis*Stock market capitalization			1.087*** (5.34)	
Legal system				0.707*** (9.89)
Crisis*Legal system				0.477*** (4.71)
Wald test for joint significance	2414.53***	2444.96***	2184.49***	2439.03***
Pseudo R2	0,2990	0.2992	0.2846	0.2926
Correct classification	91.27%	91.28%	91.69%	91.20%
N. observations	64,017	64,017	58,259	64,017

Focusing on column (1) we confirm the importance of the financial system's development on zero leverage. The *Market system* dummy variable has a positive and statistically significant coefficient, implying that a firm located in a European market-based financial system is more likely to have zero leverage, as also found by Ghoul et al. (2018). Specifically, belonging to a market-based financial system rather than to a bank-based one, *ceteris paribus*, increases by around 6.4pp the firm's probability of having zero leverage. The results validate hypothesis H3, confirming that firms' greater dependence on bank finance in bank-based financial systems, as is mostly the case in Europe (Langfield and Pagano, 2016), implies that the likelihood of a firm having zero leverage is lower than in market-based financial systems.

The results on the *Crisis* dummy variable reveal that, overall, the 2008 financial crisis and recent sovereign debt crises had a positive and statistically significant effect in explaining zero leverage, and that, during this period, the likelihood of firms adopting zero leverage increased by around 1.5pp. This validates hypothesis H4 and suggests that the recent crises had an impact on decisions related to firms' capital structure in the European context, implying a greater trend towards zero leverage during this period.

Regarding the joint effects of financial system and financial crisis, see column (2), we find that the coefficient of *Market*Crisis* is positive and significant. This means that the 2008 crisis had a higher impact on the zero-leverage phenomenon in countries with market-based systems, as postulated by hypothesis H5. Interestingly, the variable *Crisis* is no longer significant, which implies that zero leverage propensity was not affected by the 2008 crisis in countries with bank-based systems. In contrast, because the sum of the coefficients associated to the variables *Crisis* and *Market*Crisis* is positive (0.312) and significant (p-value = 0.000), the 2008 crisis increased the propensity for zero leverage in countries with market-based systems. Therefore, while we cannot reject that

the 2008 financial crisis increased the overall propensity for zero leverage, see column (1), we find that such effect is only significant in market-based oriented systems. A possible explanation for these findings is the closer ties between firms and banks that tend to be established in countries with bank-based systems (Leland and Pyle, 1977). Instead of being forced to renounce the use of debt, these firms may benefit from their good relation and partnership with banks to renegotiate credit lines.

Columns (3) and (4) show that using alternative proxies for the country's specificities do not change our main findings. Column (3) shows that more developed stock markets potentiate the zero-leverage phenomenon and column (4) reveals that firms located in common law countries are more likely to have zero leverage. Because common law countries favour the development of market-based financial systems (Demirgüç-Kunt and Levine, 1999) and having a more developed stock market is a characteristic of such financial systems, these results confirm that European firms located in countries with market-based financial systems are more likely to have zero leverage.

The models in columns (3) and (4) also confirm that the crisis period increased the propensity for zero leverage in countries with market-based systems. In column (3) that effect depends on the sign and significance of the sum of the coefficient of *Crisis* with the product of the coefficient of *Crisis*Stock market capitalization* by the variable *Stock market capitalization*. This sum is only positive and significant for values of *Stock market capitalization* higher than 0.616 (10% significance level), 0.639 (5%) or 0.680 (1%) and is negative and significant for values lower than 0.218 (10%), 0.146 (5%) or -0.040 (1%). During the crisis period all four market-based countries in our sample displayed a value higher than 0.616 for that variable, implying that the propensity for zero leverage was significantly higher in those years; for most bank-based countries the value of *Stock market capitalization* was between 0.218 and 0.616 and thus the impact of the global crisis was not statistically relevant; and for Greece the effect of the global crisis even decreased significantly (10% level) the propensity for zero leverage in 2011 and 2012. Regarding the effect of the legal system, see column (4), while the coefficient of *Crisis* is not significant, the sum of the coefficients associated to the variables *Crisis* and *Crisis*Legal system* is positive (0.373) and significant (p-value = 0.000), implying that the probability of observing the zero-leverage phenomenon increased significantly during the crisis period in countries with common law systems, but not in those with civil law systems.

4.2.3. Interactions between external and internal zero-leverage determinants

In this section we allow the effect of internal and external determinants of zero leverage to be interrelated. For this purpose, we use as baseline the second model of Table 7, which incorporates all variables relevant for the hypotheses H1-H5 already tested, and add interaction terms between firm's internal and external determinants of zero leverage. Table 8 displays the results obtained. The model in column (1) includes the interaction variables *Market*Cash holdings*, *Market*Growth opportunities* and *Market*Profitability*, in order to test the joint effects on zero leverage of financial system and financial flexibility (hypothesis H6). To test the joint effects of the 2008 crisis and financial constraints (hypothesis H7), the model in column (2) includes the interaction variables *Crisis*Size*, *Crisis*Dividend Payout* and *Crisis*Tangibility*.

Table 8: Interactions between firm's internal and external determinants of zero leverage
Note: The table presents the results of two logit regression models for the dependent variable ZL, which takes the value of 1 if the firm has no debt in a given year and 0 otherwise. Using the second model in Table 7 as baseline, Column (1) adds the interaction variables Market*Cash holdings, Market*Growth opportunities and Market*Profitability, while Column (2) adds the interaction variables Crisis*Size, Crisis*Dividend Payout and Crisis*Tangibility. All models include industry dummies as well as the control variables defined in Panel A of Table 1. For each independent variable we report the regression coefficients and the z-statistics (in brackets). Robust standard errors are adjusted for heteroscedasticity and clustered by firm.
***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

Independent variables	(1)	(2)
Size	-0.428***	-0.435***
	(-21.44)	(-21.15)
Dividend payout	5.597***	5.437***
	(9.21)	(9.18)
Tangibility	-0.968***	-0.988***
	(-4.11)	(-4.05)
Cash holdings	3.942***	4.271***
	(15.27)	(28.81)
Growth opportunities	0.070**	0.042***
	(2.34)	(2.92)
Profitability	-0.193	0.346***
	(-0.84)	(3.48)
Market system	0.815***	0.964***
	(7.20)	(11.91)
Crisis	0.033	-0.427
	(0.29)	(-1.28)
Market*Crisis	0.295***	0.309***
	(2.58)	(2.68)
Market*Cash holdings	0.475*	
	(1.67)	
Market*Growth	-0.015	
opportunities	(-0.57)	
Market*Profitability	0.645**	
	(2.55)	

Crisis*Size		0.038
		(1.29)
Crisis*Dividend		0.946
payout		(0.59)
Crisis*Tangibility		0.095
		(0.31)
Wald test for joint		
significance	2488.93***	2451.01***
Pseudo R2	0.3000	0,2993
Correct classification	91.28%	91.27%
N. observations	64,017	64,017

According to column (1), we find some evidence supporting hypothesis H6, since only the effect of *Growth opportunities* is similar in bank- and market-based financial systems. Indeed, the positive and significant coefficient of interaction term *Market*Cash holdings* shows that firm's cash ratios have a stronger effect on zero leverage in market- than in bank-based systems. Moreover, *Profitability* is no longer significant but its interaction with *Market system* is, which implies that firm profitability has a significant and positive effect on the probability of a firm having zero leverage (sum of the coefficients = 0.452, p-value = 0.0000) only in market-based systems. Therefore, as conjectured, firms located in market-based financial systems, by having a wider range of alternative funding sources, are more prone to use their profits and internal liquidity to preserve debt capacity to fund future investments.

In contrast, in column (2) we find that none of the coefficients relative to the interaction variables where *Crisis* is present is significant, which means that the effects of the variables proxying financial constraints were similar in crisis and non-crisis periods. This suggests that eventual increases in the likelihood of zero leverage during the crisis period were not the consequence of additional restrictions imposed by creditors to grant debt to more constrained firms, but probably firms' own decision, which corroborates previous findings by Kahle and Stulz (2013) that the 2008 crisis reduced firm's debt levels primarily by demand and not by supply-side reasons. Thus, hypothesis H7 is rejected.

4.2.4. Robustness tests

This section considers several departures from the model reported in the second column of Table 7 to evaluate the robustness of our results.[12] First, alternative dependent variables are used. Second, alternative econometric models (probit, random effects, fixed

[12] Using the models of Table 8 as baseline for the regression checks does not change our findings but would make it difficult to accommodate all results in the presented tables.

effects) are estimated. Third, models appropriate to deal with potential omitted variable bias and endogeneity issues are considered.

Table 9 presents the results for the models that use alternative dependent variables to *ZL* for debt conservatism. The models in columns (1) and (2) replace *ZL* by, respectively, the *AZL* and *ZL3* variables defined in Table 1. These alternative measures of financial conservatism allow us to examine the determinants of, respectively, low debt levels (Strebulaev and Yang, 2013) and persistent zero-leverage policies (Devos et al., 2012). Columns (3) and (4) consider only long-term debt and short-term debt, respectively, to classify a firm as having zero leverage, instead of total debt as in the base model. In all cases, the results are quite similar to those found before for the base case.

Table 9: Robustness tests using alternative dependent variables
Note: This table presents the results of four logit regression models. Using as baseline model the second column of Table 7, each model uses an alternative dependent variable to *ZL*: Column (1) uses the *AZL* variable; Column (2) the *ZL3* variable; Column (3) the *Long-term ZL* variable; and Column (4) the *Short-term ZL* variable. All variables are defined on Panel B of Table 1. All models include industry dummies as well as the control variables defined in Panel A of Table 1. For each independent variable we report the regression coefficients and the z-statistics (in brackets). Robust standard errors are adjusted for heteroscedasticity and clustered by firm.
***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

Independent variables	AZL (1)	ZL3 (2)	Long-term ZL (3)	Short-term ZL (4)
Size	-0.310***	-0.371***	-0.464***	-0.375***
	(-21.41)	(-15.18)	(-30.14)	(-22.98)
Dividend payout	6.323***	5.588***	5.859***	5.085***
	(9.49)	(9.56)	(9.24)	(8.96)
Tangibility	-1.325***	-0.984***	-1.168***	-0.529***
	(-8.17)	(-2.96)	(-6.86)	(-2.85)
Cash holdings	5.611***	3.780***	3.181***	3.787***
	(36.41)	(23.55)	(24.05)	(28.10)
Growth opportunities	0.032**	0.033**	0.027**	0.057***
	(2.30)	(2.11)	(2.08)	(3.94)
Profitability	0.148*	0.484***	-0.036	0.189**
	(1.75)	(3.91)	(-0.43)	(2.17)
Market system	0.495***	0.873***	0.609***	0.836***
	(9.24)	(8.38)	(10.30)	(12.97)
Crisis	-0.080	0.132	-0.066	-0.116
	(-1.14)	(0.94)	(-0.84)	(-1.23)
Market*Crisis	0.246***	0.346**	0.269***	0.363***
	(3.17)	(2.44)	(3.21)	(3.76)
Wald test for joint significance	2954.50***	1946.87***	2605.15***	2561.14***
Pseudo R2	0.2735	0.2641	0.2448	0.2485
Correct classification	82.36%	94.39%	84.75%	88.44%
N. observations	64,017	64,017	64,017	64,017

Table 10 presents results from four alternative econometric methods. Column (1), (2), (3) and (4) are estimated using, respectively, Random-effects Logit, Fixed-effects Logit, Pooled Probit and Random-effects Probit methods.[13] Again, our main findings are robust to the estimation method applied, since the only explanatory variable that lost significance (in two out of the four models) was *Growth opportunities* and the other two proxies for financial flexibility kept theirs.

Table 10: Robustness tests using alternative econometric methods
Note: This table re-estimates the baseline model presented on the second column of Table 7, using alternative econometric methods: Column (1) uses Random-effects Logit; Column (2) Fixed-effects Logit; Column (3) Pooled Probit; and Column (4) Random-effects Probit methods. All models include industry dummies as well as the control variables defined in Panel A of Table 1. For each independent variable we report the regression coefficients and the z-statistics (in brackets). Robust standard errors are adjusted for heteroscedasticity and clustered by firm.
***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

Independent variables	Random-effects Logit (1)	Fixed-effects Logit (2)	Pooled Probit (3)	Random-effects Probit (4)
Size	-0.731***	-0.639***	-0.224***	-0.387***
	(-27.27)	(-15.97)	(-21.87)	(-27.32)
Dividend payout	7.203***	6.624***	3.016***	3.868***
	(12.83)	(9.87)	(9.94)	(13.07)
Tangibility	-2.527***	-3.207***	-0.413***	-1.315***
	(-10.92)	(-10.36)	(-3.78)	(-10.85)
Cash holdings	5.173***	3.627***	2.424***	2.812***
	(32.14)	(20.76)	(30.12)	(33.07)
Growth opportunities	0.022	-0.007	0.029***	0.014*
	(1.61)	(-0.47)	(3.63)	(1.94)
Profitability	0.359***	0.372***	0.156***	0.189***
	(3.39)	(3.33)	(3.01)	(3.33)
Market system	1.741***		0.479***	0.914***
	(15.23)		(11.83)	(15.24)
Crisis	-0.022	0.057	-0.006	-0.037
	(-0.17)	(0.74)	(-0.11)	(-0.53)
Market*Crisis	0.225*		0.179***	0.146**
	(1.71)		(3.10)	(2.03)
Wald test for joint significance	2745.08***	1455.43***	2541.75***	2975.12***
Pseudo R2			0.3038	
Correct classification			91.25%	
N. observations	64,017	14,203	64,017	64,017

Finally, recognizing that endogeneity is a real problem in corporate empirical finance due to omitted variables and reverse causality, we consider, in Table 11, four further

[13] Fixed-effects estimators are available only for logit models and promote a considerable loss of observations, since observations without within group variance are omitted. Thus, firms with *ZL* equal to zero or one in all years of the period analysed are excluded from the model. Also, all time-constant dummy variables are dropped.

models that try to mitigate the effects of potential endogeneity issues. First, in Panel A we consider models with additional control variables, which have not been considered in our main models because they have been rarely used in zero-leverage studies (*Short-term liabilities* other than debt and lagged *ZL*) or we could not get good measures of it (firm's *Age* - see footnote 5). The model in column (1), which adds the *Short-term liabilies* and *Age* variables in order to control for the influence of firm's non-interest liabilities and maturity on its overall debt demand and capacity, does not change our main findings. The model in column (2), which accounts for the persistence of zero-leverage policies, also produces similar conclusions.

Table 11: Robustness tests controlling for endogeneity problems
Note: Using the second column of Table 7 as baseline model, Panel A considers several additional control variables: Column (1) adds *Age* and *Short-term liabilities;* and Column (2) adds the lagged dependent variable $ZL_{(t-1)}$. All variables are defined in Table 1. In Panel B, Column (3) re-estimates the model on the second column of Table 7 with all independent variables lagged by one year, while Column (4) uses a probit model with continuous endogenous covariates as regression method. All models include industry dummies as well as the control variables defined in Panel A of Table 1. For each independent variable we report the regression coefficients and the z-statistics (in brackets). Robust standard errors are adjusted for heteroscedasticity and clustered by firm.
***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

	Panel A: Omitted controls		Panel B: Endogeneity issues	
Independent variables	Other liabilities and age (1)	Lagged dependent variable (2)	Lagged independent variables (3)	Instrumental variables (4)
Size	-0.502***	-0.303***	-0.424***	-0.233***
	(-22.19)	(-18.84)	(-20.55)	(-39.24)
Dividend payout	5.362***	2.801***	4.999***	6.860***
	(8.50)	(6.30)	(8.31)	(16.29)
Tangibility	-1.001***	-0.281*	-0.829***	-0.485***
	(-4.21)	(-1.66)	(-3.42)	(-8.15)
Cash holdings	4.283***	3.618***	4.143***	2.489***
	(26.10)	(27.40)	(26.41)	(47.39)
Growth opportunities	0.044***	0.021	0.008	0.024**
	(2.80)	(1.62)	(0.51)	(4.21)
Profitability	0.223***	0.365***	0.178*	0.099**
	(2.67)	(3.44)	(1.65)	(2.19)
Market system	0.886***	0.611***	0.988***	0.487***
	(10.19)	(9.76)	(11.62)	(21.94)
Crisis	0.069	-0.046	-0.075	-0.031
	(0.57)	(-0.43)	(-0.77)	(-0.66)
Market*Crisis	0.155*	0.201*	0.275**	0.174***
	(1.66)	(1.76)	(2.32)	(3.41)
First-stage F statistics				
- Size				316584.24***
- Dividend payout				1707.65***
Wald test for joint significance	2226.00***	9688.94***	2153.63***	7488.92***
Pseudo R2	0.3073	0.5763	0.2850	

Correct classification	92.11%	95.54%	91.30%	
N. observations	60,733	64,017	56,513	54,947

In panel B, column (3), similar to previous empirical studies on debt conservatism that deal with endogeneity concerns, we lag all independent variables by one year (e.g. Bessler et al., 2013; Ghoul et al., 2018). Alternatively, in column (4) we consider an instrumental variable approach to deal with possible reverse causality between debt and firm size and dividend payments. Indeed, debt-free firms may be foregoing the opportunity to finance their investment opportunities at a lower cost and hence may invest less and present lower size; and firms with debt contracts may face covenants requiring low or no dividend payments and hence zero-leverage firms may be more prone to pay higher dividends. Considering the binary nature of the dependent variable, the model in column (4) is based on the probit model with continuous endogenous covariates proposed by Newey (1987). It assumes *Size* and *Dividend payout* to be endogenous and uses the first lag of the remaining firm-specific variables as instruments.

Again, the only explanatory variable that loses significance, and only in one case, is *Growth opportunities* and hence our main findings are not changed.

5. Conclusion

This paper analyses the zero-leverage phenomenon in Europe, a continent greatly dominated by bank-based financial systems. During the 1995-2016 period, 10.84% of the observations in our sample of listed firms corresponded to debt-free firms. This figure is slightly lower than that reported in most previous studies, but it hides a great heterogeneity among countries. Indeed, we find that the financial system has a great relevance for the distribution of debt-free firms: while, on average, around 16% of the observations recorded in market-based financial systems correspond to debt-free firms, the corresponding figure recorded in bank-based financial systems is only about 6%. Moreover, while in market-based financial systems zero leverage presents a clear upward trend, in bank-based financial systems the percentage of debt-free firms increased less than 1pp between 1996 and 2016.

The importance of the financial system for the explanation of the zero-leverage phenomenon is reinforced by the results of our econometric analysis. After controlling for many other factors, we find that firms located in countries with market-based systems have a significant higher probability of being debt-free. We also find that the recent European financial and sovereign crises potentiated firm's zero leverage by significantly increasing the probability of a firm being debt-free, both in terms of short- and long-term

debt, but this effect seems to have been limited to countries with a market-based system. Finally, we found some support that the financial flexibility hypothesis, which argues that firms may be debt-free by their own choice, seems to be a more relevant explanation for zero leverage in market-based systems, probably due to the wider range of funding options that are available in countries with that system.

An active research topic in the zero-leverage literature is whether it results mainly from frictions and impositions created by the financial market or from firms' own financing decisions. We found that debt-free firms in Europe tend to be smaller and less profitable and to have fewer tangible assets. However, they display higher levels of cash holdings and growth opportunities and pay more dividends than leveraged firms. This shows that neither the financial flexibility nor the financial constraints approaches can explain entirely the zero-leverage phenomenon, with both of them being useful to explain the zero-leverage policies of particular groups of firms. We also found that the financial constraints approach did not gain importance during the crisis period.

In addition to contributing to the scientific literature on zero leverage, our paper also has some interesting implications for practitioners, managers and government entities. For example, given that for some firms zero leverage is an imposition of the financial market, it would be important for firms located in countries with market-based systems to develop closer ties with banks and/or to focus on the constitution of a financial slack that could prepare them better for periods of uncertainty. Both measures would result in a greater willingness of creditors to make credit available, in better conditions, to those firms, allowing them to keep their investment plans through periods of deteriorated credit conditions. Interesting topics for future research are, *inter alia*, the comparison of the performance of debt-free and leveraged firms and investigating the existence, or not, of target debt ratios for both groups of firms.

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CHAPTER 4

The heterogeneous effect of governance mechanisms on zero-leverage phenomenon across financial systems

Abstract

Purpose: The purpose of this paper is to investigate whether the effect of country and corporate governance mechanisms on zero leverage is heterogenous or not across market- and bank-based financial systems. **Design/methodology/approach**: Using a sample of listed firms from 14 Western European countries for the 2002-2016 period, this study uses logit regression methods to examine the propensity of firms having zero leverage in different financial systems. **Findings**: Country governance mechanisms have a heterogeneous effect on zero leverage across financial systems, with higher quality mechanisms increasing zero-leverage propensity in bank-based countries and decreasing it in market-based countries. Regarding corporate governance mechanisms, ownership concentration impacts zero leverage only in bank-based countries, while board dimension and independency do not impact it. **Practical implications**: For managers this study suggests that stronger national governance difficult (favours) zero-leverage policies in market(bank)-based countries. Moreover, in bank-based countries the presence of shareholders that own a large stake difficult the adoption of zero-leverage policies. Therefore, for small shareholders, from bank-based countries, wondering to protect their wealth from opportunistic managers, we suggest that investing in firms with a concentrated ownership, assures a lower propensity for zero-leverage policies taken by entrenched reasons. **Originality/value**: To the best of the authors' knowledge, this is the first study considering simultaneously the effect of both country- and firm-level governance mechanisms on zero leverage. It is also the first study showing that the effects of governance mechanisms vary across financial systems.

Keywords: Zero leverage; Financial system; Country governance; Corporate governance

JEL classification: G32

1. Introduction

There is a long debate about the effect of governance structures on firm's financing decisions (Elmagrhi, Ntim, Malagila, Fosu, and Tunyi, 2018; Sheikh and Wang, 2012), but little is known about how these mechanisms influence the adoption of financial conservative policies. Financial conservatism is a topic that has acquired particular attention from corporate finance researchers and practitioners in the last two decades, driven by the stylized fact that a growing number of firms carry out substantially less debt than the optimal level predicted by dominant capital structure theories (Strebulaev and Yang, 2013). In particular, the trade-off theory claims that there is an optimal level of debt that maximizes firms' value and may be reached by balancing the benefits and the costs of debt (Kraus and Litzenberger, 1973). Therefore, firms below their target level are leaving a substantial amount of money on the table by not levering up to obtain debt tax shields. While this reality is already a challenge for the capital structure literature, the findings that a growing number of firms do not have any amount of debt (Bessler et al., 2013) is even more puzzling. Particularly, Strebulaev and Yang (2013) show that, between 1962 and 2009, an average of 10.2% of large listed US firms followed a zero-leverage policy, with a growing trend that rose from 4.3% in 1980 to 19.5% in 2009. See also Devos et al. (2012), Bigelli, Martín-Ugedo and Sánchez-Vidal (2014), Dang (2013), Haddad and Lotfaliei (2019), Huang et al. (2017) and Ramalho et al. (2018) for more evidence on the existence and persistence of zero-leverage policies. However, even after all these (and other) studies, the answer to why firms have no debt is far from being reached, as recently recognized by Saona et al. (2020). The zero-leverage phenomenon remains thus as one of the most enigmatic managerial decisions about firm's capital structure.

Among others, managerial entrenchment has been considered as a possible explanation for zero leverage. However, results have not been consensual, with studies using similar samples providing opposite findings (Devos et al., 2012; Strebulaev and Yang, 2013). Moreover, governance mechanisms have been studied only at the firm-level (i.e. mechanisms directly developed by the firm board and related structures or by the firm's controlling shareholders as an attempt to align principal-agent interests), ignoring the country-level governance quality. However, both firm- and country-specific governance mechanisms influence monitoring forces, allowing a better or worse protection of external shareholders against managers' opportunistic decisions (Martins et al., 2017). Therefore, the validation of the arguments that zero-leverage policies are driven by entrenched managers, which are potentiated by weaker governance mechanisms, should consider both corporate and country governance mechanisms. Furthermore, considering

that the zero-leverage phenomenon strongly depends on the financial system prevailing in each country (Bessler et al., 2013; Ghoul et al., 2018), it is crucial to analyse whether the effect of governance mechanisms on zero leverage also differs across financial systems and if those mechanisms help to explain the effect of financial systems on zero leverage.

In order to fill the identified gaps, this study focuses on the following research questions: *Does the zero-leverage phenomenon in Europe result from firm- and/or country-specific governance mechanisms?* and *Is the effect of governance mechanisms on zero leverage different for firms in market- and bank-based financial systems?* To answer to these research questions, we examine the effect of governance mechanisms on zero leverage across financial systems using firm-specific data from the *DataStream* database. In particular, we consider an unbalanced panel of 7,019 listed firms from 14 Western European countries for the 2002-2016 period. To examine the role of corporate governance mechanisms on zero leverage we consider firm's board and ownership indicators. Country governance quality is assessed through the *Worldwide Governance Indicators* (WGI). Because European non-financial firms are more dependent on bank loans as a primary source of financing (Langfield and Pagano, 2016), but at the same time there are European countries with a great predominance and development of capital markets, our sample allows us to investigate the potential heterogenous effects of governance mechanisms on zero leverage across different financial systems.

This study contributes to the literature in several ways. First, we show that to evaluate the impact of governance mechanisms on zero leverage both country- and firm-level governance mechanisms should be considered and not only one source of governance indicators. Second, different from existing literature that estimate a single effect for the determinants of zero leverage across different contexts, we prove that the factors explaining this financing policy are dependent on the context being considered. Particularly, we show that the determinants of zero leverage are not the same across financial systems. Third, we find that the effect of country governance mechanisms on zero leverage differs across financial systems, with stronger national governance mechanisms increasing (decreasing) the propensity for zero leverage in bank(market)-based countries. Fourth, we show that the firm's ownership concentration only impacts significantly the zero-leverage phenomenon in bank-based countries. In particular, the presence of shareholders that own large stakes reduce the propensity for zero-leverage policies taken by entrenched reasons only in bank-based countries. Finally, our study uses a comprehensive sample of European firms, contributing to filling the lack of studies looking at the effects of governance mechanisms on zero leverage outside the US context.

The remainder of the paper is organised as follows. Section 2 presents theoretical perspectives explaining the zero-leverage phenomenon and formulates some empirical hypotheses. Section 3 describes the data and the methodology used in the empirical analysis. Section 4 presents and discusses the results. Finally, section 5 presents some final considerations.

2. Literature review and research hypotheses

We start this section by briefly reviewing the literature studying the relationship between the country financial system and zero leverage and how the former may also impact governance mechanisms. Then, we present the expected effect of governance measures on zero leverage.

2.1. Zero leverage, financial systems and governance mechanisms

Europe presents a great diversity on the development of the financial system across countries. On the one hand, the European banking system presents a stronger growth and a greater weight than in other developed banking systems, making Europe the home of the largest bank financial system of the world (Langfield and Pagano, 2016). On the other hand, some European countries, such as the UK, present one of the most developed market-based financial system (Antoniou et al., 2008). The existence of such different financial systems may arguably affect the zero-leverage distribution and the motives for this conservative policy.

The characteristics and development of financial institutions and capital markets influence both the demand and supply of debt. A market-based financial system is generally characterized as a well-functioning market with greater size and liquidity (Drobetz et al., 2015), being a more favourable place for firms looking for attractive external finance. Overall, a wider range of available sources of financing is found in market-based financial systems. Reciprocally, the small dimension and less development and liquidity of capital markets in bank-based financial systems hinders the firm's access to those markets. Therefore, while market-based systems promote financing via capital markets, in bank-based systems the dependence on bank loans is greater. Therefore, from a theoretical point of view, a greater propensity for zero-leverage policies is expected in market-based financial systems. Empirical evidence confirms that lower levels of leverage are generally found in market-based countries (Antoniou et al., 2008). Ghoul et al. (2018) also found a greater propensity for zero leverage in market-based countries.

Given that the propensity for zero leverage may vary across financial systems, also their determinants can change. In particular, country governance mechanisms are different between financial systems, with market-based countries expectedly exhibiting better national governance mechanisms that ensure a stronger legal protection of external investors' interests, which gives them more confidence to invest and leads to a greater number of investors in the market (La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1998). Also, the corporate governance characteristics vary across market- and bank-based systems. For example, the stronger protection of minority shareholders' interests in market-based countries increase the number of external investors acting in the market and that are willing to invest. Therefore, a consequence is a firms' ownership structure that is dispersed by a large number of small shareholders in market-based countries, while the lower number of investors in countries favouring the bank-lending relationship result in firms' ownership structure that is more concentrated in few shareholders that own large stakes (La Porta et al., 2002).

2.2. The role of governance structures on zero leverage

According to the agency theory (Jensen and Meckling, 1976), entrenched managers prefer to increase their private control benefits rather than maximizing shareholder wealth, originating the so-called principal-agent problems. This opportunistic action is more easily taken in the presence of free-cash flows (Jensen, 1986), since it increases the managers' discretionary power over the firms' investments and financing decisions. A way of managers to preserve free-cash flows is to avoid the disciplinary pressures of debt (Jensen, 1986). Therefore, financial conservative firms may be the consequence of entrenched managers, maximizing their own personal benefits.

A real problem for firm's owners is that in the presence of adverse selection and moral hazards frictions, opportunistic managers are not easily detected, and so they can effectively expropriate shareholders' wealth. Managerial entrenchment depends on the country and firm governance structures, being exacerbated with weaker governance structures and reduced in the presence of stronger governance structures (Martins et al., 2017). Particularly, stronger governance structures ensure greater protection to the shareholder's rights and allows to monitor manager's decisions in a more effective way, decreasing the tendency for the adoption of decisions that only increase manager's private benefits and control over the firm.

Next, we discuss how country and corporate governance structures may influence managerial entrenchment and consequently how they influence zero leverage.

2.2.1. The role of country governance structures on zero leverage

Following the exhaustive research of Kaufmann, Kraay and Mastruzz (2011), country governance indicators reflect the traditions and institutions by which authority in a country is exercised. In particular, the quality of country-specific governance structures shapes the national legal environment and the strength of firms' monitoring forces, being a good indicator of the country's legal and regulatory system (Saona et al., 2020). Stronger country governance structures provide generally better protection and information to external investors, which contributes to reduce the adverse selection problems (Djankov et al., 2007). External investors have access to a more detailed information about the firm (i.e. their real value and the value of their investments), improving the scrutiny of managers' actions and decisions, which decreases the tendency for managerial entrenchment. Therefore, according to the agency perspective, countries with a higher quality of national governance mechanisms are expected to decrease the propensity for zero-leverage policies taken by opportunistic managers.

Notwithstanding the above arguments, the opposite effect can also be observed. Particularly, considering the better protection of the investors' interests and the availability of a higher flow of information in countries with a good quality governance structures, it is expected that investors are more willing to invest, providing more alternative sources of financing to debt (La Porta et al., 1998) and contributing to a higher liquidity of the capital markets. Following this argument, firms have better access to equity financing in countries with strong national governance structures, which allows them to replace debt by equity and remain debt-free.

Recognizing that market-based countries increase the propensity for zero leverage (Ghoul et al., 2018) and that these countries have better national governance indicators is naturally expected that good country governance structures increase the firm's propensity to have zero leverage (Saona et al., 2020). However, more important than confirm this is to verify whether the effect of country governance indicators on zero leverage differs across financial systems. Theoretically, as countries with market-based financial systems have capital markets that are attractive for firms and investors, it might be expected that a higher quality of national governance to raise even more the propensity for zero-leverage policies, since investors may feel even more comfortable and protected to invest giving more chances to firms replace debt by equity. On the other hand, an improvement in the quality of weaker national governance mechanisms of bank-based countries it might be expected to decrease even more the propensity for zero leverage. Indeed, investors may use the increment of protection to scrutiny managers and to avoid decisions that may be taken only by entrenchment reasons, rather than investing even more in low attractive capital markets. These theoretical arguments give

rise to the following hypotheses that will be tested in the empirical component of the paper:

H1: Country governance mechanisms have a heterogeneous effect on zero leverage across financial systems.

H1a: Higher quality of country governance mechanisms increase the firm's propensity toward zero leverage in market-based systems.

H1b: Higher quality of country governance mechanisms decrease the firm's propensity toward zero leverage in bank-based systems.

2.2.2. The role of corporate governance structures on zero leverage

Corporate governance structures act as mechanisms defining the rights and duties of managers and shareholders within the company, having as main objective to monitor the manager's performance to ensure that there are no conflicts of interest between the principal and the agent. Corporate governance mechanisms are generally split into two categories, internal and external mechanisms (Ferreira, Ferreira, and Raposo, 2011; Weir, Laing, and Mcknight, 2002).[14] Similar to Devos et al. (2012), in this paper we analyse the effect of both types of corporate governance mechanisms on zero leverage.

In terms of internal mechanisms, a key element of corporate governance structure is the size and composition of the board of directors, since their main function is to monitor manager actions and decisions (Liu, Miletkov, Wei, and Yang, 2015; Uribe-Bohorquez, Martínez-Ferrero, and García-Sánchez, 2018). Overall, a board with small size (Cheng, 2008) and less independent members (Boone, Field, Karpoff, and Raheja, 2007) is seen from an agency perspective as a more favourable board for the manager, decreasing the board's potential to monitor effectively the firm management and increasing the propensity of manager's opportunistic behaviour and the consequent adoption of zero-leverage policies by firms. Hence, from the agency theory viewpoint a smaller and less independent board are representative of weaker internal corporate governance mechanisms (Zaid, Wang, Abuhijleh, Issa, Saleh, and Ali, 2020).

Empirical evidence on the role of corporate governance mechanisms on zero leverage is not conclusive. On the one hand, Strebulaev and Yang (2013) found that as predicted by theory weak corporate governance mechanisms increase the propensity for zero leverage. On the other hand, Devos et al. (2012), using a set of board measures as proxy for internal governance mechanisms, found no significant effect of board measures on zero leverage.

[14] Internal corporate governance mechanisms are typically assigned to internal organisational bodies that supervise manager's behaviour, while external mechanisms are those developed by the market itself, with investors end up supervising the managers' decisions (Weir et al., 2002).

More interesting than testing the overall effect of internal corporate governance mechanisms on zero leverage, it is to verify whether their effect vary across financial systems. Particularly, as in market-based financial systems investors have access to a substantial flow of information about firms, it is expected that weaker internal corporate governance mechanisms may contribute to decrease the propensity for zero-leverage policies, since an opportunistic manager may be more easily detected by external investors. On the other hand, as in bank-based countries the protection of investors' interests and information about firms is lower it is expected that weaker internal corporate governance mechanisms to increase the propensity for zero leverage, given that opportunistic manager's decisions may not be easily detected. To test the existence of a heterogeneous effect of the internal mechanisms of corporate governance on zero leverage, the following research hypotheses are established:

H2: Corporate governance mechanisms have a heterogeneous effect on zero leverage across financial systems.

H2a: Weaker corporate governance mechanisms decrease the firm's propensity toward zero leverage in market-based systems.

H2b: Weaker corporate governance mechanisms increase the firm's propensity toward zero leverage in bank-based systems.

As highlighted by Devos et al. (2012), other mechanism to monitor the manager may be developed by external investors. Indeed, it is often argued that the presence of shareholders that own a large stake may result in strong incentives to monitoring manager's actions and ensure that they act to maximize the firm's value (Miravitlles, Mora, and Achcaoucaou, 2018; Shleifer and Vishny, 1986). These incentives are typically not shared with small investors, since the wealth they invested in the firm may not justify the development of costly monitoring activities. Therefore, the presence of large shareholders, represented by a greater ownership concentration, decreases the propensity for managerial entrenchment, which may result in a lower propensity for zero-leverage policies.

Empirically, Devos et al. (2012), using a sample of US listed firms, failed to find evidence that the existence of blockholders, used as a proxy for large shareholders, affects zero leverage. However, more interesting than examining the overall effect of the presence of large shareholders on zero leverage it is to examine whether this effect differs across financial systems. The presence of large shareholders with strong incentives to monitoring manager's actions is particularly valuable in bank-based countries, since in market-based countries investors' interests are more protected allowing small

shareholders to be protected from opportunistic managers. Therefore, while in bank-based countries the existence of shareholders that own a large stake may contribute to decrease zero-leverage policies taken by entrenched managers, in market-based countries this effect may not be observed. As managers already are strongly scrutinized, the presence of large shareholders in market-based countries may even contribute to the use of zero-leverage policies, when this financing policy is taken to improve the firm's financial flexibility. To validate these arguments the following hypotheses are postulated:
H3: The effect of ownership concentration on zero leverage is heterogeneous across financial systems.

H3a: Ownership concentration increase the firm's propensity toward zero leverage in market-based systems.

H3b: Ownership concentration decrease the firm's propensity toward zero leverage in bank-based systems.

3. Methodology

3.1. Data and variables

We use the *DataStream* database, provided by Thomson Reuters, to obtain financial, accounting and governance data for all listed firms from 14 Western European countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and the UK). Country governance data is obtained through the WGI.[15] Firms' and countries' data are collected for the period between 2002 and 2016. Firms without industry code, utilities and financial firms (industry codes 7000-7999 and 8000-8999 of FTSE/Dow Jones Industry Classification Benchmark - ICB) and firm-year observations with nonpositive values for sales, assets and equity or other erroneous information for the variables included in our analysis are dropped from the final dataset. To mitigate potential survivor bias, we allowed firms' entry and exit from the sample. The final sample contains 7,019 listed firms corresponding to an unbalanced panel data of 59,771 firm-year observations.

A firm is considered as adopting a zero-leverage policy (*ZL*) if it has zero outstanding debt in a given year, i.e. both short and long-term debt equal zero. To develop our study and to examine the heterogeneity of zero leverage determinants across financial systems, we use the *Financial system* dummy variable. This categorical variable is based on the

[15] The WGI reports aggregate and individual governance indicators for over 200 countries and is available at www.info.worldbank.org/governance/wgi/.

indicator provided by Demirgüç-Kunt and Levine (2004) and allows us to discriminate between bank- and market-based countries.[16]

To examine the specific effect of the country governance structures on zero leverage across financial systems, we use the *Country governance* variable. We compute the variable as the average of the six broad dimensions of governance considered by Kaufmann et al. (2011), to build up an aggregated indicator able to capture the overall quality of national governance for the countries included in our sample. The six governance dimensions are Voice and Accountability, Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption (refer to Kauffman et al. (2011) for an explanation of each dimension). Each one of these indicators range from −2.5 to +2.5, with higher values indicating stronger country governance. Following Denis and McConnell (2003) and Devos et al. (2012) regarding corporate governance mechanisms we use *Board size* and *Independent directors* as board measures and *Ownership concentration* as proxy for the presence of large shareholders. The first two variables are obtained through the total number of board members and the proportion of independent directors serving on board, respectively. We measure *Ownership concentration* as the percentage of shares of 5% or more held by individual investors.

The econometric models include also a set of traditional control variables such as *Size*, *Tangibility*, *Dividend payouts*, *Cash holdings*, *Profitability*, *Growth opportunities*, *Capital expenditures* and *Non-debt tax shields*, which are usually found in the literature as determinants of firms' capital structure and zero-leverage policies (Bessler et al., 2013; Frank and Goyal, 2009). To control for macroeconomic effects, the variable *GDP growth rate* is also included in all models. Dummy variables for industry are also introduced to control for non-observed specific effects. Table 1 provides a definition of the variables used in the main econometric models.

Table 1: Definition of the variables
Note: * The corresponding *DataStream* field or code is in parentheses.

Variable	Definition*
ZL	Dummy that equals 1 if a firm has a zero-book leverage in a given year and 0 otherwise
Country governance	The average of the six broad dimensions of governance considered by Kaufmann et al. (2011), the aggregated indicator ranges from −2.5 to +2.5, with higher values indicating strong country governance quality
Board size	Logarithm of total number of board members at the end of the fiscal year (CGBSDP060)

[16] According to Demirgüç-Kunt and Levine (2004), Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Portugal and Spain belong to bank-based financial systems, while Denmark, the Netherlands, Sweden and the UK belong to market-based financial systems.

Independent directors	Proportion of independent board members as reported by the firm (CGBSO07V)
Ownership concentration	Percentage of shareholdings of 5% or more held by individual investors (NOSHEM)
Size	Logarithm of total book assets (02999)
Tangibility	Ratio of fixed assets (02501) to book assets (02999)
Dividend payout	Ratio of common dividends (04551) to book assets (02999)
Cash holdings	Ratio of cash and short-term investments (02001) to book assets (02999)
Profitability	Ratio of earnings before interests, taxes, and depreciation (EBITDA) (18198) 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))
Capital expenditures	Ratio of capital expenditures (04601) to total book assets (02999)
Non-debt tax shields	Ratio of depreciation and amortizations (01151) to book assets (02999)
GDP growth rate	Annual GDP growth rate (source: World Development Indicators, The World Bank)
Categorical variable	
Financial system	A country is classified as having a Market system if it has a market-based financial system (a higher level of stock market development relative to banking sector development), otherwise is considered as having a Bank system (source: Demirgüç-Kunt and Levine, 2004)

3.2. The model

In the econometric models, the dependent variable (*ZL*) holds the value of 1 if the firm presents no debt and 0 otherwise. This binary nature of *ZL* implies that linear regression models, which assume that the dependent variable can take any positive or negative value, cannot be used in this context, since they will produce biased results (Hosmer, Lemeshow, and Sturdivant, 2013; Wooldridge, 2012). Instead, we need to use non-linear regression methods accounting for the binary nature of the dependent variable, such as logit specifications (Wooldridge, 2012). In fact, logit regression is a widely used statistical approach, being the most widely used method to examine the zero-leverage phenomenon (Strebulaev and Yang, 2013).

In a binary response model, interest lies primarily in the response probability:

$$P(y = 1|x) = P(y = 1|x_1,x_2,...,x_k) \quad (1)$$

where we use x to denote the full set of explanatory variables and P to denote the probability that the dependent variable takes the value 1. Here, we use pooled logit regression models to estimate the impact of the explanatory variables on the likelihood of a firm having zero leverage. The logit model has the following form:

$$P(ZL=1|x) = 1/[1+e^{-(\alpha+x\beta)}] \quad (2)$$

where x represents the vector of the explanatory variables defined previously in Table 1, β represents the vector of the variable coefficients and α is the constant of the model.

4. Empirical evidence

We start the empirical component of the paper by presenting a brief description of our sample and variables. After that, the main results obtained through the econometric methods are presented and discussed.

4.1. Sample composition and descriptive analysis

Table 2 shows the distribution of our firms and observations by country and financial system.

Table 2: Sample distribution by country and financial system
Note: This table presents the distribution of firms across the 14 countries considered in the sample. The first 3 columns report the number of observations (N. obs.), the percentage of observations (% obs.) and the number of firms (N. firms), by country, for all firms. The last 2 columns present the percentage of both the observations (% obs.) and firms (% firms) classified as debt-free in each country.
* Firms that present zero leverage levels in at least one year.

	All firms			Debt-free firms	
Country	N. obs.	% obs.	N. firms	% obs.	% firms*
Bank-based countries					
Austria	940	1.57	101	9.04	20.79
Belgium	1,431	2.39	147	4.40	12.93
Finland	1,797	3.01	179	3.95	12.29
France	9,449	15.81	1,042	2.95	9.31
Germany	8,556	14.31	917	14.45	32.50
Greece	3,417	5.72	330	5.99	19.09
Ireland	773	1.29	98	13.71	30.61
Italy	3,119	5.22	331	2.08	8.76
Portugal	667	1.12	70	1.50	2.86
Spain	1,726	2.89	185	1.51	7.57
Subtotal	31,875	53.33	3,400	6.73	17.50
Market-based countries					
Denmark	1,779	2.98	181	9.11	22.65
Netherlands	1,979	3.31	221	7.93	20.81
Sweden	6,056	10.13	732	21.91	45.63
UK	18,082	30.25	2,485	20.03	38.95
Subtotal	27,896	46.67	3,619	18.88	38.38
Total	**59,771**	**100**	**7,019**	**12.40**	**28.27**

Table 2 shows that both the number of observations and firms are quite similar across financial systems, with 53.33% corresponding to bank-based countries and 46.67% to market-based countries. Such equilibrium between bank- and market-based observations reveal the adequacy of the sample to our purposes of analysing the influence of financial system on zero leverage determinants. On average, between 2002 and 2016, 12.40% of firm-year observations are classified as zero leverage observations and almost 30% of the firms adopt a zero-leverage policy in at least one year. The proportion of zero-leverage firms in our sample is slightly lower than those obtained in other studies using

international samples that include US firms (Bessler et al., 2013; Ghoul et al., 2018; Saona et al., 2020).

Zero-leverage firms are presented in all sampled European countries, confirming the international nature of the phenomenon (Bessler *et al.*, 2013). We also cannot ignore the great heterogeneity on the distribution of debt-free firms across countries. Particularly, in seven out of the ten identified bank-based countries, the proportion of zero-leverage firms do not reach 6%, with the lowest percentage being observable in Western European countries such France, Italy, Portugal and Spain (below 3%). A different figure is analysed in market-based countries, where the proportion of debt-free firms is higher than 7% in all countries, with Sweden (21.91%) and UK (20.03%) presenting the greatest proportion. Such a difference reinforces the pertinence of studying heterogeneity on zero leverage determinants across bank- and market-based systems.

Table 3 presents descriptive statistics for all model variables. Panel A shows descriptive statistics for the full sample, while Panel B and C exhibit them for market- and bank-based financial systems, respectively.

Table 3: Descriptive statistics

	Panel A: Full sample			Panel B: Market system			Panel C: Bank system		
Variable	N	mean	sd	N	mean	sd	N	mean	sd
ZL	59,771	0.1240	0.3296	27,896	0.1888	0.3914	31,875	0.0673	0.2506
Country governance	59,771	1.3629	0.3515	27,896	1.5542	0.1603	31,875	1.1955	0.3862
Board size	8,280	2.3035	0.3566	4,618	2.1825	0.2771	3,662	2.4561	0.3860
Independent directors	7,571	0.4976	0.2528	4,368	0.5473	0.2006	3,203	0.4296	0.2970
Ownership concentration	49,451	0.1742	0.2456	22,409	0.1408	0.2043	27,042	0.2019	0.2721
Size	59,771	11.6548	2.3297	27,896	11.3039	2.4185	31,875	11.9619	2.2037
Tangibility	59,521	0.2281	0.2224	27,722	0.2186	0.2341	31,799	0.2364	0.2113
Dividend payout	56,578	0.0174	0.0416	27,128	0.0189	0.0429	29,450	0.0160	0.0402
Cash holdings	59,694	0.1591	0.1786	27,865	0.1692	0.1945	31,829	0.1502	0.1629
Profitability	58,399	0.0544	0.2388	27,351	0.0244	0.2948	31,048	0.0808	0.1709
Growth opportunities	54,265	1.3606	1.5377	25,122	1.5945	1.8374	29,143	1.1589	1.1853
Capital expenditures	56,528	0.0460	0.0627	27,084	0.0452	0.0666	29,444	0.0468	0.0590
Non-debt tax shields	59,380	0.0486	0.0487	27,714	0.0488	0.0500	31,666	0.0485	0.0475
GDP growth rate	59,771	1.3619	2.4485	27,896	1.7502	2.0571	31,875	1.0221	2.7003

Panel B and C show, once again, substantial differences across financial systems in the distribution of zero-leverage firms. Only 6.73% of the observations on bank-based countries correspond to debt-free firms, while in the market-based systems, the proportion is almost 19%. Using a simple t-test for mean differences between the two groups of countries, we find that the percentage of zero-leverage firms from market-based countries (18.88%) is significantly higher than those from bank-based systems

(6.73%) (t-statistic for no differences in mean=45.74; p-value: 0.0000), which confirms the expected lower dependence on bank debt in market-based countries.

Regarding the explanatory variables, higher quality country governance is found in market-based systems. This finding seems to indicate that zero-leverage firms are more common in countries with stronger national governance. Panel A also highlights that almost half of the board of directors is composed, on average, by outside or independent directors. Simultaneously, Panels B and C show that larger boards are found in bank-based countries with those of market-based countries having a higher percentage of independent directors. Finally, on average, more than 17% of the firms' ownership is concentrated on individual shareholders with large stakes. More important, Panels B and C show that the ownership is substantially more concentrated in bank-based countries, where, on average, around 20% of the ownership is concentrated on blockholders, while in market-based systems the percentage of ownership concentration is only 14%. These findings corroborate the arguments of the traditional literature, pointing out that, on the one hand, more developed capital markets, with greater liquidity, attract a greater number of private external investors, resulting in a higher dispersed ownership (La Porta et al., 1997; 2002); and, on the other hand, systems favouring bank-lending relationship, with less developed capital markets, result in a greater ownership concentration on a few shareholders.

Table 4 reports Pearson's paired correlation coefficients and the variance inflation factor (VIF) for the model explanatory variables to investigate whether multicollinearity may be an issue in the econometric models. The results show that the correlations between the explanatory variables are not particularly high, being generally lower than 0.5, and the VIF is below 1.8 for all variables, which suggests that multicollinearity is not a problem.

Table 4: Pearson correlation matrix and Variance Inflation Factor (VIF)
Note: The table shows the Pearson correlation coefficients between the variables of the study, and the coefficients associated with the VIF. ** significance at 1%; * significance at 5%

Variables	Country governance	Board size	Independent directors	Ownership concentration	Size	Tangibility	Dividend payout	Cash holdings	Profitability	Growth Opportunities	Capital expenditures	Non-debt tax shields	GDP growth rate	VIF
Country governance	1.00													1.24
Board size	-0.25**	1.00												1.73
Independent directors	0.19**	-0.27**	1.00											1.18
Ownership concentration	-0.15**	0.02*	-0.16**	1.00										1.10
Size	-0.10**	0.54**	0.01	-0.18**	1.00									1.66
Tangibility	-0.10**	0.04**	-0.03**	-0.06**	0.25**	1.00								1.61
Dividend payout	0.06**	-0.06**	0.01	-0.03**	0.08**	-0.02**	1.00							1.35
Cash holdings	0.10**	-0.09**	0.02	0.03**	-0.26**	-0.32**	0.07**	1.00						1.16
Profitability	-0.04**	-0.05**	-0.02	0.02**	0.29**	0.11**	0.26**	-0.18**	1.00					1.55
Growth opportunities	0.13**	-0.14**	-0.03*	-0.02**	-0.20**	-0.13**	0.18**	0.33**	-0.13**	1.00				1.72
Capital expenditures	0.02**	-0.01	-0.02*	-0.02**	0.04**	0.44**	0.01	-0.11**	0.06**	0.04**	1.00			1.69
Non-debt tax shields	0.07**	0.02	-0.05**	-0.01	-0.10**	0.12**	-0.03**	-0.09**	-0.06**	0.01*	0.18**	1.00		1.21
GDP growth rate	0.27**	-0.04**	-0.01	-0.06**	-0.03**	-0.03**	0.03**	0.05**	0.02**	0.12**	0.03**	0.01	1.00	1.08

4.2. Regression results

First, we present the results from the regressions modelling the propensity of firms to have zero-leverage policies and after that, a set of checks are performed to test the robustness of the main results.

4.2.1. Main findings

Table 5 presents the results from the logit regression models. To provide an answer to our research questions three different specifications of equation (2) were adopted for each financial system, corresponding each specification to a different model. We report the estimated coefficient for each independent variable, as well as the result of a Wald test for its individual significance in brackets and its (average) partial effect. Partial effects reported here, measure the probability of a change in *ZL* policy due to a one standard deviation change in a continuous explanatory variable (Wooldridge, 2012). Despite logit models automatically account for heteroscedasticity by applying the maximum likelihood estimations (Wooldridge, 2012), the Wald test use robust standard errors that are adjusted for heteroscedasticity and clustered by firm to mitigate concerns about within-firm correlation.

Model (1), intending to capture the specific effect of the country governance mechanisms on zero leverage in both financial systems, introduces the *Country governance* variable to the standard firm-level variables and industry dummies. The introduction of board data in the analysis reduces substantially the number of observations. Hence, like Devos *et al.* (2012), we analyse board and ownership data separately. Therefore, Model (2) adds board data with the introduction of the *Board size* and *Independent directors* variables. Finally, Model (3) incorporates the *Ownership concentration* variable.

Table 5: Regression results
Note: Table 5 presents the main results of the econometric models. For each independent variable, we report the regression coefficients, the z-statistics (in brackets) and marginal effects (average partial effects). Robust standard errors are adjusted for heteroscedasticity and clustered by firm.
***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

	Country governance (1)		Board variables (2)		Ownership concentration (3)	
Independent variables	Market system	Bank system	Market system	Bank system	Market system	Bank system
Country governance	-1.219***	1.060***				
	(-4.38)	(4.48)				
	0.126	0.045				
Board size			0.416	-0.639		
			(0.61)	(-0.98)		
			0.018	-0.004		
Independent directors			0.432	-0.325		
			(0.65)	(-0.30)		

			0.018	-0.002		
Ownership concentration					-0.014	-1.418***
					(-0.07)	(-5.08)
					-0.001	-0.057
Size	-0.370***	-0.487***	-0.863***	-0.979**	-0.400***	-0.512***
	(-17.08)	(-11.06)	(-4.77)	(-2.35)	(-15.89)	(-11.02)
	-0.038	-0.021	-0.037	-0.006	-0.040	-0.021
Tangibility	-1.154***	-0.483	0.632	0.408	-1.134***	-0.906*
	(-4.06)	(-1.01)	(0.64)	(0.17)	(-3.69)	(-1.77)
	-0.119	-0.020	0.027	0.003	-0.113	-0.036
Dividend payout	7.474***	4.238***	3.516**	-0.235	8.324***	4.248***
	(7.56)	(4.67)	(2.20)	(-0.10)	(7.21)	(4.77)
	0.771	0.179	0.151	-0.002	0.829	0.171
Cash holdings	4.197***	4.132***	5.566***	12.371***	4.486***	4.399***
	(22.90)	(13.31)	(5.00)	(4.63)	(21.58)	(13.65)
	0.433	0.174	0.238	0.081	0.447	0.177
Profitability	0.550***	0.004	3.702***	-0.049	0.541***	-0.033
	(5.08)	(0.02)	(3.10)	(-0.04)	(4.48)	(-0.12)
	0.057	0.000	0.158	-0.000	0.054	-0.001
Growth opportunities	0.047***	0.066**	-0.058	0.051	0.039*	0.099***
	(2.61)	(2.00)	(-0.68)	(0.36)	(1.77)	(2.59)
	0.005	0.003	-0.002	0.000	0.004	0.004
Capital expenditures	-0.110	-1.466	-1.262	8.020***	0.176	-0.483
	(-0.18)	(-1.49)	(-0.60)	(2.60)	(0.27)	(-0.46)
	-0.011	-0.062	-0.054	0.053	0.018	-0.019
Non-debt tax shields	-1.791**	-3.358**	5.504	7.625	-1.952**	-2.830**
	(-2.55)	(-2.52)	(1.22)	(1.58)	(-2.39)	(-2.26)
	-0.185	-0.142	0.236	0.050	-0.194	-0.114
GDP growth rate	-0.009	-0.004	0.031	0.019	-0.017	0.015
	(-0.84)	(-0.23)	(0.73)	(0.30)	(-1.59)	(0.85)
	-0.001	-0.000	0.001	0.000	-0.002	0.001
Constant	3.524***	0.450	6.268***	6.831	1.988***	1.567**
	(6.13)	(0.61)	(2.98)	(1.14)	(4.15)	(2.25)
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23,973	26,161	4,310	3,139	21,472	24,423
Wald test for joint significance	1349.67***	634.11***	137.73***	165.43***	1204.98***	622.68***
Pseudo R2	0.2781	0.2645	0.2968	0.6040	0.2886	0.2749
Correct classification	84.96%	94.50%	94.13%	98.85%	85.58%	94.71%
AIC	16302.65	8324.30	1401.34	186.74	14187.96	7458.66
BIC	16448.17	8471.40	1477.76	259.36	14331.50	7604.52

Overall, the Wald tests for the individual and joint significance of the explanatory variables confirm their ability to explain *ZL*. Additionally, the Pseudo R-squared here reported are generally in line with those of the previous studies analysing the impact of corporate governance mechanisms on zero leverage (Devos et al., 2012; Strebulaev and

Yang, 2013). Furthermore, the percentage of *ZL* values correctly predicted by the model are always above 80%, which simultaneously with Akaike information criterion (AIC) and Bayesian information criterion (BIC) shows that the different models fit well our data. Therefore, econometric tests confirm the suitability of the estimated logit regression models.

Model (1) shows that country-level governance mechanisms have a heterogeneous effect on zero leverage, depending on the type of financial system considered. However, contrary to what has been hypothesized, *Country governance* variable has a positive and significant effect on *ZL* in bank-based financial systems, with a positive change of one standard deviation on the variable increasing the firm's likelihood of having zero leverage by around 4.5 percentage points (pp). While in market-based systems the variable has a negative effect on *ZL*, with the increase of one standard deviation on the quality of country governance, *ceteris paribus*, corresponding to a fall of approximately 12.6pp in the firm's likelihood of having zero leverage.

On the one hand, the higher (lower) propensity for zero leverage in bank-based countries with stronger (weaker) national governance mechanisms agrees with the arguments that a better protection of investors' interests increases their willingness to invest, allowing the firm to replace debt financing by a more attractive and diverse equity financing (La Porta et al., 1998). On the other hand, the lower (higher) propensity for zero-leverage firms in market-based systems with stronger (weaker) governance mechanisms is supported by the agency perspective. According to their arguments, stronger governance mechanisms reduce the adverse selection problems and the tendency for managerial entrenchment (Djankov et al., 2007), decreasing the propensity for zero-leverage policies taken by opportunistic reasons.

The unexpected effect of national governance on zero leverage across financial systems seems to indicate that when the country-level governance mechanisms are weaker, an improvement on their quality raises the willingness of investors to invest, more than increase their concerns about managerial entrenchment, which is reflected on a great propensity for firms to have zero leverage in a country that favours the bank-lending relationship. On the other hand, in market-based countries as investors already have stronger country governance mechanisms protecting their interests and a financial system promoting the financing via capital markets, an increase on the quality of national governance raises the concerns about managerial entrenchment, more than increase the willingness of investors to invest, thus decreasing the propensity for firms having zero leverage.

Results confirming that the effect of country governance on zero leverage is heterogeneous across financial systems, however with this effect being different of what we might initially think. Therefore, although our findings reject hypothesis H1a and H1b they confirm the general hypothesis H1.

Regarding the effect of corporate governance mechanisms on zero leverage across financial systems, Model (2) shows that board related variables, *Board size* and *Independent directors*, do not significantly explain zero leverage, neither in market- nor in bank-based countries. Results that do not allow us to support the entrenchment argument that more favourable boards for the management team, namely those with smaller size and less independency (Boone et al., 2007; Cheng, 2008), explain the adoption of zero-leverage policies. Our results contrasts those of Strebulaev and Yang (2013) but are similar to those of Devos et al. (2012), who shows that firms' board characteristics do not influence zero leverage in US. Therefore, we reinforce their conclusions that zero leverage seem not to be driven by opportunistic managers taking advantage of weaker internal corporate governance mechanisms. More important, there is no evidence that the effect of internal mechanisms of corporate governance on zero leverage differs across financial systems. Thus, using board variables as a proxy for corporate governance mechanisms, allow us to reject our hypothesis H2 and the specific hypotheses H2a and H2b.

Regarding the role played by the ownership structure on zero leverage, Model (3) shows that the *Ownership concentration* has a heterogeneous effect on *ZL* across financial systems. Whether in bank-based financial systems the *Ownership concentration* variable has a negative and statistically significant coefficient, indicating that a firm with higher ownership concentration has less propensity to adopt a zero-leverage policy, in market-based systems the variable has not a significant effect on zero leverage. Particularly, the increase of one standard deviation in the level of ownership concentration in bank-based systems, *ceteris paribus*, correspond to a fall of approximately 5.7pp in the firm's likelihood of having *ZL*.

Therefore, the managerial entrenchment argument, stating that large shareholders have strong incentives to monitor managers (Shleifer and Vishny, 1986), reducing the propensity toward zero-leverage policies adopted by managerial opportunistic reasons, may be applied in bank- but not in market-based systems. The different role played by the ownership concentration on zero leverage may be explained by the different characteristics of the ownership structures across financial systems. Traditionally, bank(market)-based systems are characterised by the presence of a small (large) number of shareholders, which represents a more concentrated (dispersed) ownership structure

(La Porta et al., 1997; 2002). The presence of large shareholders in bank-based systems, also visible in our descriptive results, leads them to have strong incentives to monitor manager's actions and ensure that they act to maximize the firm's value (Shleifer and Vishny, 1986). The intensive monitoring actions may arguably decrease the propensity for the manager's opportunistic decisions, such the adoption of zero-leverage policies.

Our empirical findings for market-based countries corroborates the study of Devos et al. (2012) that, using a sample of US listed firms, found that the existence of blockholders has not a significant effect on zero-leverage propensity. Furthermore, we extend their analysis by showing that in bank-based countries, the higher the ownership concentration, the lower the propensity for zero leverage. Findings that allow us to confirm the heterogeneous effect of ownership concentration on zero leverage across financial systems and the corresponding hypothesis H3. Regarding the specific hypotheses our results allows to validate hypothesis H3b and to reject hypothesis H3a.

4.2.2. Robustness tests

In this section, using different specifications of models (1)-(3) we perform some robustness checks. First, we use an alternative dependent variable and second, an alternative categorical variable. Because at this stage we are only interested in the sign and significance of the coefficients, to save space we omit from the tables the estimated partial effects for each variable.

Table 6 presents the results from logit regression models, using an alternative proxy for debt conservatism. The dependent variable *ZL* is replaced in model (1a), (2a) and (3a) by the *ZL3* variable, which considers a zero-leverage firm only if the firm has no debt in its capital structure during three consecutive years (Devos et al., 2012). Our initial dependent variable classifies as debt-free those firms that have at least once debt ratios equal zero, which implies that all zero-leverage firms are considered, even if their policy is only temporary. The new dependent variable implies that only firms adopting a persistent zero-leverage policy are considered debt-free. To save space, the regression coefficients and the z-statistics for the 9 control variables used in the models are not reported (results available upon request), but they are similar to those presented in Table 5.

Table 6: Robustness tests using an alternative dependent variable
Note: Table 6 presents robustness tests using the alternative dependent variable *ZL3*, which equals 1 if a firm has a zero debt during three consecutive years and is 0 otherwise. For each independent variable we report the regression coefficients and the z-statistics (in brackets). Robust standard errors are adjusted for heteroscedasticity and clustered by firm.
***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

	Country governance (1a)	Board variables (2a)	Ownership concentration (3a)

Independent variables	Market system	Bank system	Market system	Bank system	Market system	Bank system
Country governance	-0.960***	1.137***				
	(-2.87)	(3.55)				
Board size			0.392	-1.352*		
			(0.47)	(-1.94)		
Independent directors			0.307	-0.466		
			(0.36)	(-0.47)		
Ownership concentration					-0.055	-1.375***
					(-0.24)	(-3.64)
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23,973	26,161	4,310	3,139	21,472	24,423
Wald test for joint significance	1021.96***	511.87***	139.64***	143.35***	962.27***	497.22***
Pseudo R2	0.2273	0.2341	0.2624	0.6596	0.2466	0.2507
Correct classification	89.38%	96.72%	96.06%	99.30%	89.54%	96.76%
AIC	12626.68	5694.80	1018.58	136.12	11127.21	5165.86
BIC	12772.21	5841.89	1095.00	208.74	11270.75	5311.72

Overall, main results are quite similar to those of the reference models (1), (2) and (3). Model (1a) shows that the heterogeneous effect of national governance on zero leverage across financial systems is also found for persistent zero-leverage policies. Model (2a) shows that board related variables, *Board size* and *Independent directors,* have also a low explanatory power of persistent zero-leverage levels in both financial systems. Nevertheless, the *Board size* variable has now a small negative significant effect on persistent zero-leverage polices, only in bank-based countries.

Finally, Model (3a) shows that the higher the ownership concentration, the lower the propensity for persistent zero-leverage policies, with this impact being statistically significant, once again, only in bank-based countries. Therefore, we complement the study of Devos *et al.* (2012), by showing that the existence of large shareholders in bank-based countries decrease the propensity for zero leverage, irrespective the criteria used to classify a zero-leverage firm. Overall, the differences observed on the determinants of zero leverage across financial systems is observed when zero leverage is based on only one year or when only persistent zero-leverage policies are considered.

Table 7 presents an alternative categorical variable replacing the *Financial system* to divide our sample across countries. Therefore, models (1b), (2b) and (3b) are estimated for the sub-samples generated accordingly with the variable *Legal system*, a dummy variable that equals 1 for countries with a common law system, and 0 for countries with

a civil law system.[17] The choice of this variable is explained by the tendency of common law countries to favour the development of market-based financial systems (Demirgüç-Kunt and Levine, 1999), which is ideal to validate our initial results.

Table 7: Robustness tests using an alternative categorical variable
Note: Table 7 presents robustness tests using the alternative categorical variable *Legal system*, which equals 1 for countries with a common law system, and 0 for countries with a civil law system. For each independent variable we report the regression coefficients and the z-statistics (in brackets). Robust standard errors are adjusted for heteroscedasticity and clustered by firm.
***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

	Country governance (1b)		Board variables (2b)		Ownership concentration (3b)	
Independent variables	Common law system	Civil law system	Common law system	Civil law system	Common law system	Civil law system
Country governance	-2.451***	1.371***				
	(-5.21)	(7.03)				
Board size			0.497	-0.948		
			(0.72)	(-1.41)		
Independent directors			1.125	0.168		
			(1.31)	(0.23)		
Ownership concentration					-0.119	-1.390***
					(-0.52)	(-6.02)
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,732	33,402	3,334	4,115	15,342	30,553
Wald test for joint significance	957.75***	1073.34***	118.80***	146.98***	869.16***	954.73***
Pseudo R2	0.2652	0.3086	0.3057	0.4018	0.2742	0.3083
Correct classification	83.94%	93.01%	93.16%	98.57%	84.34%	93.45%
AIC	12011.06	12549.23	1239.59	357.78	10851.75	10818.19
BIC	12150.11	12700.73	1312.93	433.65	10989.24	10968.08

Again, Models (1b), (2b) and (3b) show that the results are quite similar to those obtained when *Financial system* dummy is used as categorical variable. In particular, the specific effect of explanatory variables representative of country governance, board characteristics and ownership concentration on zero leverage is the same. Model (1b) shows that stronger country governance mechanisms increase (decrease) significantly the likelihood of firms having zero leverage in civil (common) law systems. Model (2b) shows that board-related variables do not have a significant influence on zero leverage in both legal systems. Finally, Model (3b) shows that the higher the ownership concentration is, then the lower is the propensity for zero leverage but only in civil law systems.

[17] Source: The World Factbook, CIA (https://www.cia.gov/library/publications/resources/the-world-factbook/fields/308.html) and Djankov *et al.* (2007). The group of common law countries is composed by Ireland and UK, while Austria, Belgium, Denmark, Germany, Greece, Finland, France, Italy, Netherlands, Portugal, Spain and Sweden are identified as civil law countries.

5. Conclusion

This study analyses the heterogeneous effects of country- and firm-level governance mechanisms on zero leverage across different financial systems. During the period of analysis, on average, 12.40% of the observations are classified as zero-leverage firms, a figure that hides a considerable heterogeneity on the distribution of zero-leverage firms across countries. Particularly, whether in bank-based countries the percentage of zero-leverage observations not even reach 7%, in market-based countries these percentage is close to 19%.

We find that country governance mechanisms have a heterogeneous effect on zero leverage. While higher quality mechanisms increase the propensity for zero leverage in bank-based countries, in market-based countries the propensity is reduced. Additionally, great ownership concentration, indicating the presence of large shareholders, decreases the propensity for zero leverage only in bank-based countries. Finally, corporate governance mechanisms related to the board characteristics, namely board size and independency do not significantly influence zero leverage, irrespective the financial system prevailing in the country. Findings that are valid to zero leverage persistent or "temporary" policies.

This set of findings contributes to the growing research on zero leverage through the analysis of the effect of governance mechanisms on zero leverage, which contributes directly to the scarce literature investigating this relation. More important, we extend these studies (Devos et al., 2012; Strebulaev and Yang, 2013) and found that to evaluate the impact of governance mechanisms on zero leverage should be considered both country- and firm-level governance mechanisms and not only one source of governance indicators. Furthermore, the heterogeneous effects of country and some corporate governance mechanisms, let us conclude that the motives for zero leverage vary across financial and legal systems. Thus, conclusions about whether zero leverage is, or is not, driven by entrenched managers attempting to avoid the disciplinary pressures of debt should consider that it depends on the governance indicators and on the financial/legal systems analysed. Our study also contributes to those that using international samples (Bessler et al., 2013; Ghoul et al., 2018; Saona et al., 2020), estimated a single effect for zero-leverage determinants in bank- and market-based financial systems. Finally, we contribute to Devos et al. (2012) and Strebulaev and Yang (2013) by showing that our conclusions are valid for persistent and "temporary" zero-leverage policies, while on these studies only one of these methods are used to classify a firm as zero leverage.

Implications for practitioners can also be derived from this study. For example, managers deserving to deploy a zero-leverage policy, will find it easier to implement it in

market-based countries with weaker country governance indicators than in those with stronger governance. Perhaps because investors will be more alert and better informed for opportunistic managers' decisions in the latter case. Regarding managers in bank-based countries they should find it easier to implement conservative leverage policies when country governance is stronger. Perhaps investors take advantage of some lower adverse selection costs to invest, making equity financing more attractive to firms than when country governance is weaker in this financial system. Moreover, managers of firms from bank-based systems will find it difficult to adopt a zero-leverage policy in the presence of large shareholders, which have strong incentives to control manager's actions, preventing them to adopt opportunistic actions. For small shareholders, from bank-based countries, wondering to protect the wealth invested in a firm, we suggest that the investment in firms with a concentrated ownership assures a lower propensity for the firm's manager to adopt zero-leverage policies by entrenched reasons.

Future research should consider further sources of heterogeneity on the zero-leverage phenomenon, comparing the motives for firms adopt a financial conservative policy across different realities. Another avenue for future research is to consider whether zero-leverage firms have a target debt level and actively adjust to that target and more important to explore if firms present a different adjustment behaviour across different financial systems.

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CHAPTER 5

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

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 some variables influence in opposite directions debt demand and supply, or affect significantly only of them. In particular, firms' profitability affects negatively debt demand but positively debt supply; asset tangibility increases the willingness of creditors to grant debt but does not influence debt demand; and the recent European crises reduced the propensity of firms to resort to debt but did not affect debt supply. We also find that firms in countries with common law systems, market-based financial systems and stronger protection to investors' and creditors' rights are more prone to have zero leverage due to both demand and supply effects.

Keywords: 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 and 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 and 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; Strebulaev and 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 et al. (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 and Gregoriou, 2019), India (Ghose and Kabra, 2016), China (Huang et al., 2017) and Japan (Takami, 2016). Using international samples spanning many countries, Bessler et al. (2013) maintain that the rising trend towards zero leverage constitutes an international reality, while Ghoul et al. (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 and 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 and 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[18]. Therefore, our study is differentiated from existing literature and contributes to it 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 and Levine, 1999; La Porta et al., 1997). Finally, the

[18] 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.

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 Investment Bank, 2015; Moradi and Paulet, 2019). To investigate how such crises affected both the demand and supply of debt is another contribution of this paper.

The main results of the paper are the following. We find that more profitable firms have a higher tendency to be debt-free by their own decision. However, at the same time, it is precisely to these firms that creditors are more willing to grant debt, which implies that such firms are less prone to have zero debt due to creditor-related reasons. We also find that asset tangibility increases the supply of debt but does not affect its demand, decreasing the propensity for zero leverage by creditor-related reasons, since they are more willing to grant debt to firms with more asset tangibility. On the other hand, the recent European crises reduced the demand for debt but did not affect their supply, increasing the tendency for zero leverage only by firms' own decision. Finally, we find that a firm from a country with a common law system has a greater propensity to adopt zero-leverage policies, by both its own financial decision and creditor imposition. The importance of country-specific effects on zero-debt decisions is confirmed by other country-specific characteristics, with firms in countries with a market-based financial system and a stronger protection to investors' and creditors' rights being more likely to be debt-free. Overall, because some variables influence in opposite directions debt demand and supply, or affect significantly only one of them, bivariate probit models emerge as the most suitable approach for analysing the determinants of zero leverage.

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 out on US firms also considered extensively the managerial entrenchment approach (Byoun and Xu, 2013; Devos et al., 2012; Strebulaev and 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 and Majluf, 1984) and trade-off (Kraus and 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 and 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 and 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 et al., 2017). 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 et al., 2012). This mechanism enables the mitigation of investment distortions (Marchica and 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 and Harvey, 2001) and in Europe (Bancel and Mittoo, 2004; Brounen et al., 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 and 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 and 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 and 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 and 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 and 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 and Miller, 1963) against financial distress (Kraus and 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 have 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 and 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 et al., 2007; Fan et al., 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 systems present 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 et al. (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 and 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 and 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 Investment Bank, 2015) on the decisions of firms to resort to debt (Kahle and 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 and 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 and 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 firms that are smaller (Hadlock and Pierce, 2010), less profitable (Bessler et al., 2013), pay out lower levels of dividends (Fazzari et al., 1988) and have lower

tangibility (Benmelech and 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 and Pierce, 2010). In particular, due to information asymmetries, smaller firms are more likely to face financial constraints (Hadlock and 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 and 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 and 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 and Zingales, 1997; Whited and 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 and 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 and 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 (Santos, 2011). The existing literature suggests that the recent financial crisis did affect the supply of debt (Ivashina and 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 and years ensure the availability of information for listed firms during the period of analysis. In particular, the information about firm's ownership structure is scarce before 2001 and the chosen period allows us to have a similar distribution of observations across the years. More important, with this time frame we are able to analyse the effect of financial and sovereign debt crises on the demand and supply of debt.

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 5,837 listed firms were obtained, corresponding to an unbalanced panel data with 48,770 firm-year observations.

3.2. Empirical model

Existing literature about zero leverage typically applies simple univariate probit (or logit) 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. In this context, by using a simple probit model to find the determinants of leverage, researchers are implicitly assuming that all firms' requests for debt are successful, although some of the relationships found are then justified using creditor-related arguments. Therefore, a bivariate probit model, taking into account both decision processes, should be employed. However, because we cannot observe the result of each decision but only the joint outcome, a problem of partial observability arises and a more complex econometric model needs to be used.

In this paper, 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:

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

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

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 $E(\varepsilon_1) = E(\varepsilon_2) = 0, Var(\varepsilon_1) = Var(\varepsilon_2) = 1$ 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. Figure 1 presents the partial observability problem associated with debt-related decisions.

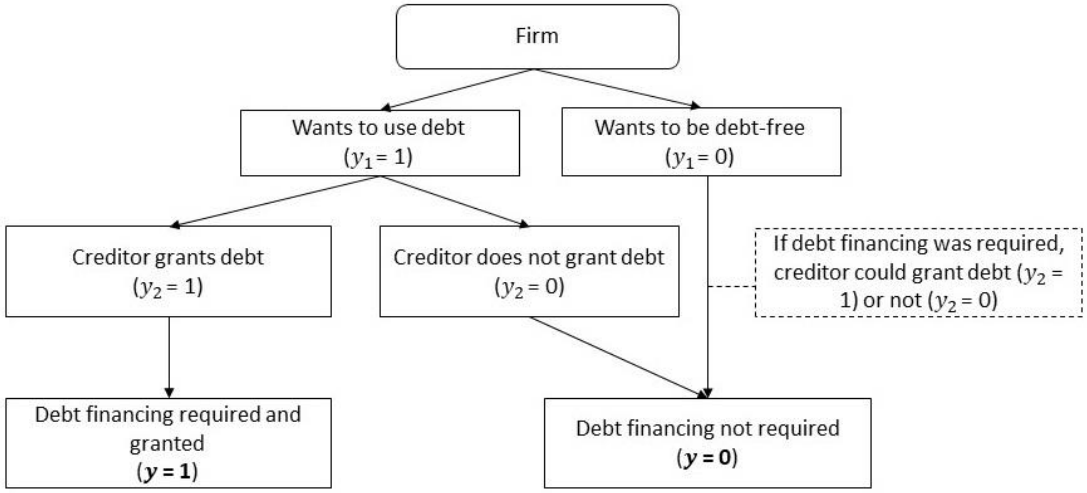

Figure 1. Partial observability problem

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:

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

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

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

Note that, unlike typical zero leverage empirical studies, we (have to) model *directly* the probability of a firm being levered, not of being debt-free.[19]

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:

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

[19] Suppose that y_1 and y_2 were defined in the opposite way, i.e. they were set to one in case no debt was required or granted. Then, a zero-leverage firm would be observed if $(y_1 = 1, y_2 = 0)$, $(y_1 = 0, y_2 = 1)$ or $(y_1 = 1, y_2 = 1)$. However, using equation (2), with the bivariate probit model with partial observability we would be able to estimate directly only the probability of observing zero-leverage firms of the last type, $Prob[y = 1] = Prob[(y_1 = 1, y_2 = 1)]$, not being possible to distinguish the other two types of zero-leverage firms from a levered firm $(y_1 = 0, y_2 = 0)$.

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 ($x_1 \neq x_2$).

To the best of our knowledge, the bivariate probit model with partial observability has been rarely used in empirical work. In addition to the studies of Grilli (2005) and Heino (2006) already referred in Footnote 1, examples of the use of this model in other fields are: Heywood and Mohanty (1994) and Mohanty (2002), who studied the determinants of the decision of individuals to seek employment and of employers in granting that job; and Wang, Winton and Yu (2010), Cline and Posylnaya (2019) and Ghafoor, Zainudin and Mahdzan (2019), who estimated the propensity of firms to commit fraud and the likelihood of their respective detection.

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 and 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, and Zhao, 2008). Table 1 provides a definition of the variables considered in the econometric models.

Table 1: Definition of the variables
Note: This table defines the main variables used in the study. [a] The corresponding *DataStream* field or code is in parentheses.

[b] 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).

Variable	Definition[a]
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 and Valencia, 2018)[b]

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
This table presents the distribution of firms across the 14 countries considered in the sample. The first 3 columns report the number of observations (N. obs.), the percentage of observations (% obs.) and the number of firms (N. firms), by country, for all firms. The last 2 columns present the percentage of both the observations (% obs.) and firms (% firms) classified as debt-free in each country.
* Refers to firms that present zero-leverage levels in at least one year.

	All firms			**Debt-free firms**	
Country	N. obs.	% obs.	N. firms	% obs.	% firms*
Austria	834	1.71	81	8.15	17.28
Belgium	1,168	2.39	122	4.28	10.66
Denmark	1,482	3.04	140	7.02	18.57
Finland	1,640	3.36	150	3.90	12.00
France	7,495	15.37	862	2.05	6.73
Germany	7,031	14.42	781	11.71	27.66
Greece	2,873	5.89	298	4.32	15.44

Ireland	643	1.32	82	11.98	25.61
Italy	2,588	5.31	285	1.58	6.32
Netherlands	1,715	3.52	193	7.29	19.17
Portugal	611	1.25	60	1.96	3.33
Spain	1,394	2.86	163	0.93	4.29
Sweden	3,945	8.09	464	19.29	40.95
UK	15,351	31.48	2,156	18.96	36.32
Total	**48,770**	**100.00**	**5,837**	**10.92**	**24.82**

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 10.92% 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 19%, while in France, Italy, Portugal and Spain that percentage is below 2.5%. These results seem to indicate that the country 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
This table shows the number of observations (N), the mean, the standard deviation (sd), the median, the minimum (min) and the maximum (max) values of each continuous variable defined in Table 1.

Variable	N	mean	sd	min	median	max
Book Leverage	48,770	0.2060	0.1729	0.0000	0.1848	0.9555
Cash holdings	48,770	0.1506	0.1674	0.0000	0.0929	0.9699
Growth opportunities	48,770	1.2916	1.3189	0.0265	0.9140	15.8132
Profitability	48,770	0.0610	0.2200	-2.9830	0.0948	2.9112
Ownership concentration	48,770	0.1732	0.2432	0.0000	0.0000	1.0000
Dividend payout	48,770	0.0177	0.0376	0.0000	0.0060	0.8971
Non-debt tax shields	48,770	0.0486	0.0472	0.0000	0.0389	0.9407
Tangibility	48,770	0.2370	0.2205	0.0000	0.1730	0.9780
Size	48,770	12.0171	2.1932	4.4998	11.8115	19.8069

Table 4 presents Pearson's paired correlation coefficients between the continuous explanatory variables. In all cases, the correlations are below 0.5. To confirm the absence of multicollinearity problems, we calculated the variance inflation factor (VIF). As shown

in the last column of the table, the VIF is always lower than 2, which suggests that multicollinearity does not represent a problem.

Table 4: Pearson's correlation matrix and Variance Inflation Factor
The table shows the Pearson correlation coefficients between the continuous explanatory variables, as well as the VIF coefficients associated to each variable. ** significance at 1%; * significance at 5%

Variables	Cash holdings	Growth opportunities	Profitability	Ownership concentration	Dividend payout	Non-debt tax shields	Tangibility	Size	VIF
Cash holdings	1.000								1.31
Growth opportunities	0.349**	1.000							1.22
Profitability	-0.198**	-0.090**	1.000						1.21
Ownership concentration	0.042**	-0.018**	0.015**	1.000					1.05
Dividend payout	0.065**	0.224**	0.258**	-0.030**	1.000				1.15
Non-debt tax shields	-0.074**	0,010*	-0.057**	-0.007	-0.032**	1.000			1.04
Tangibility	-0.322**	-0.128**	0.118**	-0.065**	-0.017**	0.117**	1.000		1.16
Size	-0.258**	-0.168**	0.298**	-0.184**	0.096**	-0.101**	0.218**	1.000	1.25

4.2. Econometric analysis

Table 5 presents the results from the main 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 model with partial observability (1). For comparison purposes, the traditional univariate probit models with random effects (2) was also estimated. In both cases, the dependent variable is *Leverage* and the explanatory variables include, in addition to those defined in Table 1, industry dummies. For each explanatory variable, we report the estimated coefficient and the result of a Wald test for its individual significance in brackets. The Wald test uses robust standard errors.

Table 5: Regression results
Table 5 presents the main results of the econometric models. Model 1 apply bivariate probit models with partial observability to analyse the determinants of both demand and supply of debt, while model 2 apply traditional univariate probit models with random effects. Models 1 and 2 considers firm-level explanatory variables and proxy variables for country- and macroeconomic-specific effects (*Common law system*, *Financial crisis* and *Sovereign crisis*). 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 regression coefficients and robust z-statistics (in parentheses).
***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

	Bivariate Probit (1)		Univariate Probit
Explanatory variables	Demand (a)	Supply (b)	(2)
Cash holdings	-3.552***		-2.662***
	(-43.82)		(-18.43)
Growth opportunities	-0.044***	-0.031**	-0.045***

	(-3.32)	(-2.58)	(-3.46)
Profitability	-0.711***	0.129**	-0.267***
	(-5.97)	(2.27)	(-3.67)
Ownership concentration	0.226***		0.509***
	(3.43)		(4.66)
Dividend payout	-2.269***	-3.144***	-4.083***
	(-8.20)	(-10.27)	(-8.78)
Non-debt tax shields	0.965**		1.506***
	(2.57)		(3.46)
Tangibility	-0.265	1.918***	1.474***
	(-1.19)	(3.11)	(7.69)
Size		0.313***	0.431***
		(26.29)	(20.14)
Common law system	-0.680***	-0.213***	-0.925***
	(-12.98)	(-3.89)	(-14.67)
Financial crisis	-0.092*	0.068	0.008
	(-1.95)	(1.37)	(0.18)
Sovereign crisis	-0.179***	0,064	-0.119**
	(-3.30)	(0.91)	(-2.05)
Constant	2.586***	-1.909***	-2.139***
	(30.30)	(-18.87)	(-8.88)
Observations	48.770		48.770
Wald test for joint significance	8452.26***		2422.96***
ρ	-0.288***		
Log-likelihood	-11835,249		-8559,7934

The estimate of ρ in the bivariate probit models with partial observability is significantly different from zero, which means that the error terms of the latent equations (1) are indeed related. Hence, even if y_1^* and y_2^* were observed, a bivariate probit model (with full observability) would still be preferable to separate, standard probit estimation of the demand and supply equations, since it would allow efficiency gains (Meng and Schmidt, 1985). This result confirms the importance of the bivariate probit model (with partial or full 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) shows that there is a variable, *Profitability*, that impacts in opposite ways the demand and supply of debt. 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 this variable has on the demand and supply of debt. We would simply conclude, see model (2), that *Profitability* decreases the probability of a firm being levered.

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 and Majluf, 1984) in order to fund future good growth opportunities (Marchica and 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 and Zingales, 1997; Whited and Wu, 2006). Therefore, these results provide support to hypotheses H3 and H13.

The results show that the coefficient of *Tangibility* is significant only in the supply equation. Therefore, contrary to our expectations, asset tangibility does not influence firms' decisions to resort to debt, which allows us to reject hypothesis H7. In contrast, the positive effect of *Tangibility* does not allow us to reject hypothesis H11 and confirms that firms with a higher level of tangible assets (collateral) are less credit constrained (Benmelech and Bergman, 2009), since such firms face greater creditor availability to finance them (reducing the propensity for zero leverage by creditor-related reasons). Therefore, the negative effect of asset tangibility on the probability of a firm being debt-free found in most of the literature (e.g. Devos et al., 2012) seems to be driven by creditors' imposition and not by firms' own decisions.

Growth opportunities and *Dividend payout* are the other firm-specific 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 and 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 and 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 and 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, the results do not allow us to reject hypotheses H2, H5 and H14, but reject hypothesis H12.

Considering now the firm-specific 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 and Majluf, 1984) and does not allow us to reject 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 and 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 and Masulis, 1980). The unexpected sign for the coefficient of non-debt tax shields is sometimes observable in the literature (Dang, 2013) and is probably related to the proxy considered in the model. Indeed, as Dang (2013), we used the ratio of depreciation and amortizations to book assets as proxy for non-debt tax shields, but leveraged firms have more tangible assets and consequently higher depreciation, making it difficult to isolate the effects of non-debt tax shields and fixed assets. 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 and Pierce, 2010). This finding provides support to hypothesis H10.

Regarding country-specific effects, they are controlled for in model (1) by the *Commom law system* variable. This 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 and 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 and therefore hypotheses H8 and H15 are not rejected.

Finally, the variables representing recent crisis periods, *Financial crisis* and *Sovereign crisis*, 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, the results provide support to hypothesis H9 but hypothesis H16 is rejected.

Table 6 summarizes the conclusions of our study.

Table 6: Tested hypotheses
This table summarizes the conclusions of the study, indicating whether research hypotheses are rejected or not.

Hypothesis	Not rejected / Rejected
H1: Cash holdings have a negative effect on firm's decisions to resort to debt.	Not rejected
H2: Growth opportunities have a negative effect on firm's decisions to resort to debt.	Not rejected
H3: Profitability has a negative effect on firm's decisions to resort to debt.	Not rejected
H4: Ownership concentration has a positive effect on firm's decisions to resort to debt.	Not rejected
H5: Dividend payout has a negative effect on firm's decisions to resort to debt.	Not rejected
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.	Not rejected
H9: Crisis periods have a negative effect on firm's decisions to resort to debt.	Not rejected
H10: Firm size has a positive effect on creditor's decisions to grant loans to firms.	Not rejected
H11: Asset tangibility has a positive effect on creditor's decisions to grant loans to firms.	Not rejected
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.	Not rejected
H14: Growth opportunities have a negative effect on creditor's decisions to grant loans to firms.	Not rejected
H15: A common law system (civil law system) has a negative (positive) effect on creditor's decisions to grant loans to firms.	Not rejected
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 model (1) reveals 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 (2) 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 (1) to be relevant only for debt demand, the univariate probit model (2) 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.

4.3. Robustness tests

This section presents two sets of additional tests to evaluate the robustness of our findings. First, we perform a comprehensive sensitivity analysis considering alternative

combinations of the variables that appear in the demand and supply equations of the estimated bivariate probit models with partial observability. Second, additional country-specific characteristics are considered to account for the differences across countries.

For the bivariate probit model with partial observability to be identified, it is necessary that at least one variable that appears in the demand equation does not appear in the supply equation, or vice-versa. Using theoretical arguments, we excluded three variables from the latter equation and one from the former. However, because there is a large overlap of the variables in the demand and supply functions and other arguments could lead to different exclusion restrictions, it is important to check whether our main results hold when the variables in the two equations are changed. In this sensitivity analysis, we dropped/added arbitrarily one variable at a time from/to the demand or the supply equations, considering multiple combinations of variable overlap and excluded/added variables.

For brevity, in Table 7 we report only the results of four experiments, which concern the four firm-specific variables that in model (1) appeared in both the demand and supply equations: *Growth opportunities*, *Profitability*, *Dividend payout* and *Tangibility*.[20] In models (1.1-1.4) we dropped each variable, one at a time, from one of the equations, keeping it only on the demand (supply) equation when the finance literature presents mostly demand (supply)-related theoretical arguments to justify its effect on debt. For example, *Profitability* is identified in the literature as the main indicator of a pecking order style of financing (e.g. Dang, 2013), influencing mainly the firms' demand for debt, while *Tangibility* is in general used to analyse creditor's willingness to grant debt to the firms (Devos et al., 2012; Strebulaev and Yang, 2013). As Table 7 shows, the results are very similar to those already discussed in the previous section. In particular, the sign and statistical significance of the explanatory variables do not change across models, with a single exception: in model 1.2 the effect of *Tangibility* on debt demand becomes statistically significant. However, our previous conclusions do not change, since the effect found for *Tangibility* is negative and hence hypothesis H7 continues to be rejected. One possible explanation for this unexpected 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 and Mura, 2010).

Table 7: Alternative variables for the demand and supply equations of the bivariate probit model
This table presents robustness tests using alternative specifications of model (1). Model (1.1) considers *Profitability* only on the demand equation. Model (1.2) considers *Growth opportunities* only in the demand equation. Model (1.3) considers *Tangibility* only on the supply equation and model (1.4) considers the

[20] Full results are available upon request.

variable *Dividend payout* only on the supply equation. All models apply bivariate probit methods with partial observability to analyse the determinants of demand and supply of debt. 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 regression coefficients and robust z-statistics (in parentheses).
***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

	Model (1.1)		Model (1.2)		Model (1.3)		Model (1.4)	
Independent variables	Demand (a)	Supply (b)	Demand (a)	Supply (b)	Demand (a)	Supply (b)	Demand (a)	Supply (b)
Cash holdings	-3.556***		-3.487***		-3.486***		-3.596***	
	(-43.10)		(-44.29)		(-43.89)		(-43.79)	
Growth opportunities	-0.041***	-0.036***	-0.062***		-0.041***	-0.032***	-0.058***	-0.025**
	(-3.00)	(-3.15)	(-6.96)		(-3.32)	(-2.72)	(-4.77)	(-2.37)
Profitability	-0.588***		-0.649***	0.153***	-0.726***	0.136**	-0.899***	0.151***
	(-5.57)		(-4.74)	(2.66)	(-6.42)	(2.37)	(-7.50)	(2.78)
Ownership concentration	0.228***		0.220***		0.227***		0.266***	
	(3.41)		(3.61)		(3.41)		(3.89)	
Dividend payout	-2.353***	-3.105***	-2.224***	-3.245***	-2.286***	-3.104***		-4.051***
	(-8.50)	(-10.57)	(-7.95)	(-9.92)	(-8.26)	(-10.25)		(-12.24)
Non-debt tax shields	0.918**		0.901**		0.892**		1.004***	
	(2.44)		(2.40)		(2.45)		(2.59)	
Tangibility	-0.282	1.932***	-0.424**	2.780**		1.542***	-0.295	1.827***
	(-1.26)	(3.10)	(-2.52)	(2.43)		(6.08)	(-1.51)	(3.91)
Size		0.318***		0.315***		0.320***		0.306***
		(26.94)		(22.13)		(34.93)		(30.08)
Common law system	-0.679***	-0.221***	-0.649***	-0.221***	-0.695***	-0.195***	-0.657***	-0.246***
	(-12.57)	(-3.94)	(-13.61)	(-4.23)	(-13.57)	(-3.45)	(-13.11)	(-4.98)
Financial crisis	-0.089*	0.061	-0.088**	0.074	-0.089*	0.068	-0.094*	0.061
	(-1.86)	(1.23)	(-1.96)	(1.48)	(-1.85)	(1.34)	(-1.89)	(1.27)
Sovereign crisis	-0.187***	0.075	-0.169***	0.067	-0.179***	0.071	-0.181***	0.060
	(-3.45)	(1.04)	(-3.24)	(0.86)	(-3.29)	(1.00)	(-3.24)	(0.89)
Constant	2.584***	-1.956***	2.593***	-2.016***	2.518***	-1.931***	2.624***	-1.855***
	(29.81)	(-19.14)	(38.17)	(-18.51)	(38.13)	(-18.14)	(31.09)	(-18.97)
Observations	48,770		48,770		48,770		48,770	
Wald test for joint significance	8188.05***		7252.14***		8611.03***		8544.34***	
ρ	-0.271***		-0.315***		-0.289***		-0.352***	
Log-likelihood	-11838.456		-11837.653		-11837.516		-11862.405	

In the previous section we used the *Common law system* to control for differences across countries. There are other alternatives that can be considered for the same effect, such as more direct measures of the development of the financial system and of the protection provided to external investors (Acharya, Amihud, and Litov, 2011; Antoniou et al., 2008; La Porta et al., 1997). As argued in sections 2.1 and 2.2, a well-developed capital market and a strong level of protection to minority shareholders are expectable to decrease both demand and supply of debt (La Porta et al., 2002). Another country-specific measure that can be considered is the level of protection provided to creditors. It is expectable that a stronger protection of creditor rights makes managers more concerned with the

loss of control in case of financial distress, making them more risk averse and more likely to avoid using debt (Acharya et al., 2011). Thus, Table 8 considers three alternative county-specific variables to the *Common law system* variable. In particular, model (1.5) uses a proxy for the financial system development, the *Financial system* variable, which indicates the type of financial system prevailing in the country (Demirgüç-Kunt and Levine, 2004): is equal to 1 if it is market-based (a more developed capital market) and 0 if it is bank-based (a more developed banking sector).[21] Model (1.6) uses the Djankov, La Porta, Lopez-de-Silanes and Shleifer's (2008) *Anti-director rights index*, a variable already considered by Ghoul et al. (2018) to capture the extent to which the interests of outside shareholders are protected in the country.[22] A higher score represents a higher legal protection of minority shareholders. Finally, model (1.7) uses the *Creditor rights index* from Djankov et al. (2007), an index also considered by Bessler et al. (2013) which aggregates secured creditors' scores on four types of legal rights in case of bankruptcy.[23] The *Creditor rights index* ranges from 0, a weak creditor rights, to 4, which represents strong creditor rights.

Table 8: Bivariate probit models with alternative country-specific variables
This table presents robustness tests using alternative country-specific variables to the *Common law system* variable. Model (1.5) considers the variable *Financial system*, a dummy taking a value of 1 if the country has a market-based financial system and 0 if it is a bank-based. Model (1.6) uses the variable *Anti-director rights index*, a variable that measures the level of protection provided to minority shareholders (Source: Djankov et al., 2008), a higher score representing strong protection of shareholders rights. Model (1.7) uses the variable *Creditor rights index*, a variable that measures the protection provided to creditors (Source: Djankov et al., 2007), where a higher score represents strong protection of creditors rights. All models apply bivariate probit methods with partial observability to analyse the determinants of demand and supply of debt. 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 regression coefficients and robust z-statistics (in parentheses). ***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

	Model (1.5)		Model (1.6)		Model (1.7)	
Independent variables	Demand (a)	Supply (b)	Demand (a)	Supply (b)	Demand (a)	Supply (b)
Cash holdings	-3.673***		-3.547***		-3.617***	
	(-41.52)		(-41.23)		(-45.02)	
Growth opportunities	-0.029**	-0.029**	-0.051***	-0.026**	-0.056***	-0.028***
	(-2.00)	(-2.31)	(-4.06)	(-2.35)	(-5.06)	(-2.70)
Profitability	-0.769***	0.154***	-0.662***	0.134**	-0.609***	0.081*
	(-6.77)	(2.75)	(-5.60)	(2.42)	(-4.55)	(1.79)
	0.081		0.258***		0.180***	

[21] According to Demirgüç-Kunt and Levine (2004), Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Portugal and Spain belong to bank-based financial systems, while Denmark, the Netherlands, Sweden and the UK belong to market-based financial systems.
[22] The index aggregates scores on the following six aspects of corporate law: (1) vote by mail; (2) shares not deposited; (3) cumulative voting; (4) oppressed minority; (5) pre-emptive rights; and (6) capital to call a meeting. (Source: Djankov et al., 2008).
[23] The four rights of creditors in case of bankruptcy considered by the index are: (1) there are restrictions imposed by creditors, for debtors to file for reorganisation; (2) secured creditors are able to seize their collateral; (3) the proceeds of liquidating a bankrupt firm are used to pay in a first place the secured creditor instead of government or workers; and (4) if management does not retain administration of its property pending the resolution of the reorganisation. When the previous rights are defined on the country's laws and regulations a value of 1 is added to the score (Source: Djankov et al., 2007).

Ownership concentration	(1.18)		(3.89)		(2.76)	
Dividend payout	-2.134***	-2.720***	-2.083***	-3.108***	-2.185***	-3.372***
	(-7.76)	(-9.29)	(-7.62)	(-10.06)	(-7.57)	(-10.59)
Non-debt tax shields	0.986**		1.080***		1.292***	
	(2.40)		(2.83)		(3.23)	
Tangibility	-0.129	1.398***	-0.369	1.891***	-0.537***	2.749***
	(-0.42)	(2.60)	(-1.49)	(2.97)	(-4.52)	(4.44)
Size		0.297***		0.307***		0.304***
		(29.77)		(24.87)		(28.36)
Financial crisis	-0.119**	0.073	-0.099**	0.058	-0.087*	0.062
	(-2.45)	(1.43)	(-2.06)	(1.18)	(-1.85)	(1.33)
Sovereign crisis	-0.283***	0.016	-0.220***	-0.013	-0.258***	0.112
	(-4.53)	(0.21)	(-3.84)	(-0.19)	(-4.77)	(1.47)
Financial system	-0.704***	-0.343***				
	(-10.49)	(-6.07)				
Anti-director rights index			-0.276***	-0.122***		
			(-7.44)	(-3.49)		
Creditor rights index					-0.233***	-0.145***
					(-15.58)	(-12.40)
Constant	2.722***	-1.588***	3.444***	-1.457***	3.081***	-1.675***
	(30.07)	(-15.77)	(23.61)	(-8.22)	(34.97)	(-17.20)
Observations	48,770		48,770		48,770	
Wald test for joint significance	8657.13***		8966.90***		8683.74***	
ρ	-0.336***		-0.318***		-0.252***	
Log-likelihood	-11734.614		-11954.695		-11710.052	

Model (1.5), as expected, shows that the *Financial system* variable has a negative coefficient for both demand and supply of debt, indicating that firms located in market(bank)-based financial systems have higher (lower) propensity to be debt-free by its own decision and by creditors' imposition. This result corroborates our initial findings for the effect of the legal system on debt and the arguments of Demirgüç-Kunt and Levine (1999) that common law countries favour the development of market-based financial systems. Model (1.6) confirms that a strong protection of minority shareholders decreases both demand and supply of debt (La Porta et al., 2002), increasing the propensity for zero leverage by firm own decision and by creditors' imposition. Model (1.7) shows that a strong protection to creditors' rights decreases both demand and supply of debt. The propensity for zero leverage is increased, thus, by firms' decisions and creditors' impositions, a result corroborating the study of Bessler et al. (2013), who founds a positive influence of creditors' protection on zero leverage. Overall, our evidence shows that both demand and supply of debt tends to be lower (higher) in common (civil) law systems, in market (bank)-based systems, in countries with stronger (weaker)

protection of minority shareholders and in countries with stronger (weaker) protection to creditors' rights, increasing (decreasing) the propensity for zero leverage.

5. Conclusion

This paper analyses the zero-leverage phenomenon in a sample of listed European firms over the period between 2001 and 2016. Around 10.92% 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 one variable influences in opposite directions debt demand and supply. In particular, we provide empirical evidence that although more profitable firms have lower propensity to resort to debt by their own decision, it is to these firms that creditors are more willing to grant debt. In addition, there are firm- and country-specific characteristics that are important to explain firms' demand but not supply of debt, and vice-versa. Tangibility does not affect firms' demand for debt, but creditors are more prone to grant debt to firms with greater asset tangibility. The recent European crises reduced the demand for debt but did not affect their supply.

We also found that country-specific effects play a determinant role on debt decisions. In particular, we found that common law systems and alterative country-specific indicators, such market-based financial systems and stronger protection of the rights of minority shareholders and creditors, 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. Additional findings show that 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*) or when the effect is only significant in one of those equations (*Financial crisis, Sovereign crisis* and *Tangibility*), 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 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.

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CHAPTER 6

Capital structure speed of adjustment heterogeneity across zero leverage and leveraged European firms

Abstract

This paper investigates whether zero-leverage firms pursue or not a target level of debt and, if they pursue, how fast they adjust to that target. Using the dynamic panel fractional estimator to estimate the speed of adjustment (SOA) in a sample of European listed firms for the 1995-2016 period, we find that both zero-leverage and leveraged firms adjust to a target debt ratio, with the former group adjusting at an annual SOA of 22.1%, a significantly slower adjustment speed than the 27.6% exhibit by leveraged firms. However, we also find that the influence of firms' debt policy on capital structure SOA changes with different financial systems, macroeconomic conditions and financial constraints levels. The difference in SOA estimates between zero-leverage and leveraged firms is only significant when firms are financially unconstrained. Both groups of firms present a greater SOA in market-based financial systems. Zero-leverage firms adjusted faster during the 2008 financial crisis, both relative to other non-crisis periods and leveraged firms.

Keywords: Zero leverage; Speed of adjustment; Financial system; European crises; DPF estimator

JEL classification: G32

1. Introduction

This paper focuses on two important topics on firms' capital structure, namely target capital structure speed of adjustment (hereafter SOA) and the so-called zero-leverage phenomenon (Drobetz et al., 2015; Wang, Xu, and Yang, 2018). Recognizing that debt brings tax shields (Modigliani and Miller, 1963) and simultaneously financial distress

and bankruptcy costs (Kraus and Litzenberger, 1973), the static trade-off theory advocates that there exists an optimal capital structure that maximizes the firm's value. However, a dynamic version of the trade-off theory states that firm's financial structure can move away from its target. According to this theory, firms suffer costs of being off the target, known as deviation costs (e.g. financial distress and bankruptcy costs; loss of debt tax shields), which incentives firms to move closer to their targets. Nonetheless, this convergence is also a function of adjustment costs (e.g. transaction and debt agency costs) that prevent and hinder full adjustment toward the target (Fisher et al., 1989), which explains why firms may present large and persistent deviations from their target leverage and just partially adjust over time. Thus, these two classes of costs, deviation costs and adjustment costs, affect capital structure SOA: the more the former costs exceed the latter, the faster firms move to their target debt ratio.

In empirical studies, a nonzero value estimated for the SOA is interpreted as evidence of the existence of a target leverage ratio, while a null SOA reveals that there is no target leverage and leverage changes are explained according to the financing deficit theory (Myers and Majluf, 1984).[24] Previous empirical evidence is almost unanimous in concluding that firms actively adjust to a target leverage (Drobetz et al., 2015; Fitzgerald and Ryan, 2019), with survey evidence presented by Graham and Harvey (2001) showing that more than 80% of firms pursue a target capital structure. However, a growing number of firms report permanent average debt ratios below the estimated target levels (e.g. Graham, 2000), with a recent branch of the literature finding that there is a considerable number of firms with a "mysterious zero leverage" (Strebulaev and Yang, 2013) and that these firms effectively leave a substantial amount of "money on the table" (Graham, 2000; Strebulaev and Yang, 2013) by not levering up until their target. Therefore, debt-free firms are, on average, substantially under-leveraged (e.g. Dang, 2013).

Given the novelty of this phenomenon, little is known about the targeting behaviour of zero-leverage firms, namely whether they adjust or not to a target debt ratio and, if they do, how fast they do it. Indeed, neither the zero-leverage literature nor the SOA specific literature have investigated these research topics. On the one hand, the literature dealing with the zero-leverage phenomenon is mainly dedicated to study the reasons for firms adopting such extremely conservative policy in specific years. On the other hand, the literature about capital structure SOA has not considered the leverage target behaviour of zero-leverage firms. In fact, most studies in this area continue to consider zero-

[24] This last result is generally coincident with the arguments of the pecking order theory (Myers, 1984; Myers and Majluf, 1984) that firms do not have a target level, their financing decisions following a hierarchical sequence that allows to minimize financing costs.

leverage firms as outliers, removing them from the analysis (e.g. Chauhan and Huseynov, 2018). However, contemporaneous literature shows that zero-leverage firms are an international and growing phenomenon (Bessler et al., 2013) and should not be interpreted as outliers or errors existent in databases.

This paper is the first to investigate the capital structure target and SOA behaviour of zero-leverage firms, focussing on the following research question: 1) *If zero-leverage firms pursue target leverage ratios, how quickly do they adjust back to their target?* To allow a deep analysis of their behaviour, we compare them with leveraged firms. Therefore, another research question that this paper tries to answer is the following: 2) *Is the SOA of zero-leverage firms significantly different from that exhibited by leveraged firms?* Finally, in line with the existing literature that investigates sources of heterogeneity on SOA (e.g. Drobetz et al., 2015), it is our purpose to answer the following research question: 3) *How the SOA of zero leverage and leveraged firms is influenced by the different financial constraints they may face and by their country's financial system and macroeconomic context?* Indeed, previous research has considered country-specific factors (Bessler et al., 2013; Drobetz et al., 2015), macroeconomic factors (Dang, 2013; Halling, Yu, and Zechner, 2016) and firm-specific factors affecting the level of financial constraints felt by firms (Devos et al., 2012; Fitzgerald and Ryan, 2019) as important determinants of both zero leverage and capital structure SOA.

To answer these questions and provide empirical evidence about the SOA of zero-leverage firms, and its comparison with leveraged firms, we use an unbalanced panel of 7,046 listed firms from 14 European countries for the 1995-2016 period. The panel comprises both zero-leverage (firms that reported a null leverage ratio in at least one year of the period in analysis) and leveraged firms (remaining firms). Because Europe is the home of the largest banking system of the world, with non-financial firms being very dependent on bank loans as the primary source of external finance (European Investment Bank, 2015), but also includes countries with strong market-based financial systems, our panel is particularly suited to study the effect of the financial system on the SOA. Moreover, it also allows to study the effects of the 2008 financial crisis and subsequent sovereign debt crises that until recently prevented normal economic growth, availability of finance and recovery of investment levels in some European countries (European Investment Bank, 2015).

This work contributes to the literature in several ways. First, in our empirical analysis, we take into account the concerns of Chang and Dasgupta (2009) that SOA estimates obtained by the most commonly used dynamic panel estimators are potentially biased due to the overlooked bounded nature (between zero and one) of debt ratios and use the

dynamic panel fractional (DPF) estimator proposed by Elsas and Florysiak (2011; 2015) to estimate firms' SOA. Second, we contribute for financial conservatism and capital structure SOA, by showing that debt-free firms actively adjust to a target level of debt, but at a significantly slower adjustment speed than leveraged firms. To explain this result, we argue that zero-leverage firms face lower deviation costs than leveraged firms, since they should possess a larger debt capacity, which allows them to hold the real option to lever up in the future and thus compensate the opportunity cost of not taking in the present full advantage of debt tax shields. This reasoning is supported by another important result that we obtain: when firms are divided into financially constrained and unconstrained firms, only in the latter case the SOA differences between zero-leverage and leveraged firms remain significant. Indeed, only when firms are debt-free by their own choice, and not due to market restrictions, can we argue that zero-leverage firms have a larger debt capacity. We also contribute to the literature focusing on the role played by the financial system on firm's financing decisions. We find that both zero-leverage and leveraged firms present a greater SOA in market-based financial systems, a result that seems to conform with the existing literature (Drobetz et al., 2015). However, reinforcing the importance of the SOA differences between the two groups of firms, our results show that zero-leverage firms from market-based countries adjust more slowly than leveraged firms from bank-based countries. Finally, we contribute to the literature dedicated to the effect of the 2008 financial crisis on firm's capital structure. Particularly, in contrast to previous evidence claiming that firms adjust more slowly during recessions (Dang, Kim, and Shin, 2014), our results reveal that zero-leverage firms increased significantly their SOA during the 2008 financial crisis, which even exceeded, and by a large margin, the SOA of leveraged firms. Again, this distinct behaviour of zero-leverage firms may be explained by their higher financial flexibility and greater debt capacity relative to leveraged firms, which gives them the possibility to adjust faster to a target leverage in bad times, where deviation costs become more important.

The remainder of the paper is organised as follows. Section 2 briefly reviews the literature on SOA and establishes some research hypotheses. Section 3 describes the most commonly applied model to study SOA, discusses some methodological issues that renders the standard dynamic estimators unsuitable to this analysis and presents the estimator adopted in this study. Section 4 briefly describes the data. Section 5 presents and discusses the main results of the paper. Finally, section 6 sets out some final considerations.

2. Literature review and empirical hypotheses

2.1. Empirical evidence on SOA

The extensive discussion about SOA to a target leverage ratio was driven by Fisher et al. (1989) finding that even small adjustment costs lead to wide swings in a firm's debt ratio over time. The authors used dynamic models in their analysis, which have since then acquired particular relevance on the investigation of whether firms adjust to a target debt ratio and the respective SOA. De Miguel and Pindado (2001), Ozkan (2001) and Gaud, Jani, Hoesli and Bender (2005), for Europe, Flannery and Rangan (2006), Huang and Ritter (2009) and Lemmon, Roberts and Zender (2008), for the USA, and Antoniou et al. (2008), for G5 countries, are examples of the first studies using dynamic panel data models in this context, all of them confirming that firms actively adjust to a target, although at different rates.

Recognizing that financing decisions are unlikely to be homogenous across firms, time and countries, research about possible sources of heterogeneity in adjustment and deviation costs that ultimately impact on the SOA has been increasing. Most studies examine firm-level heterogeneity in SOA. Recently, Fitzgerald and Ryan (2019) found that smaller firms and low-dividend payers adjust faster than their counterparts, while Wojewodzki, Poon and Shen (2018) found that firms with a poorer credit rating adjust more rapidly to a target capital structure. Evidences that financially constrained firms display a faster SOA than unconstrained ones. Using alternative proxies for financial constraints, also Dang et al. (2014), Drobetz et al. (2015) and Elsas and Florisiak (2011) reach the same conclusion. On the contrary, Öztekin and Flannery (2012), using dividend payments as proxy, find that unconstrained firms present higher SOA, while Faulkender, Flannery, Hankins and Smith (2012), using firm size and dummies for being a dividend payer and having a bond rating as proxies, show that constrained firms may adjust more slowly or more quickly depending on whether they are above or below the target level.

Firm's financing decisions are also determined by the country's specific characteristics, with another stream of the literature investigating whether differences in SOA can be explained by variations in countries' legal, institutional and financial environments (e.g. Antoniou et al. 2008). Öztekin and Flannery (2012), resorting to a sample of 37 countries, and Drobetz et al. (2015), using a sample of G7 countries, found that firms in countries with market-based financial systems, or with more developed financial systems, adjust faster due to lower transaction costs.

Other important strand of literature relates SOA to macroeconomic conditions. According to the model proposed by Hackbarth, Miao and Morellec (2006), macroeconomic conditions determine both the rhythm and the size of capital structure changes, being predicted that firms change their capital structure more often in

expansionary than in recessionary periods, which has been empirically corroborated by several studies (Cook and Tang, 2010; Drobetz and Wanzenried, 2006). More recently, also Drobetz et al. (2015) and Halling et al. (2016) conclude that the SOA is lower during recessive than in boom periods, while Dang et al. (2014) estimate a slower SOA during the recent global financial crisis.

Despite extensive research, with many recent contributions increasing our knowledge about the target leverage behaviour of firms, estimating the SOA "is perhaps the most important issue in capital structure research today" (Huang and Ritter, 2009, p. 239). This sentence remains pertinent, since currently little is known about the SOA of zero-leverage firms. Filling this gap is the main aim of this paper. Next, we formulate the research hypotheses to be tested in the empirical part of the paper.

2.2. Research hypotheses

2.2.1. Zero leverage and SOA

The literature about zero leverage has focused on the causes for such an extremely financially conservative policy (e.g. Bessler et al., 2013; Ghoul et al., 2018; Huang et al., 2017). Dang (2013) finds that zero leverage is the result of a persistent financial policy, with firms that in one year are debt-free having a 61% chance of remaining in that situation in the following year (Strebulaev and Yang, 2013). DeAngelo and Roll (2015) observe that capital structure stability, although an infrequent phenomenon, occurs primarily at low-leverage levels. Dang (2013) shows that zero-leverage firms are under-leveraged most of the time, with an average 5.8 percentage points (pp) deviation from their target.[25] The author adds that zero-leverage firms lever up in the following years to reduce the deviation from the target leverage. In a similar vein, Devos et al. (2012) find that debt-free firms have a mean predicted leverage of 13.3%.

Theoretically, a firm deviating from its target leverage faces deviation costs, varying the characteristics of such costs with the sign of the deviation (above or below the target). An over-leveraged firm faces higher bankruptcy and financial distress costs than it should according to the trade-off theory, while an under-leveraged firm does not take full advantage of debt tax shields. While in both cases firms have incentives to adjust to the target, a stronger incentive is verified when firms are highly leveraged. In particular, such firms have as ultimate cost the total loss of value of its shares, while the main cost of firms with low levels of debt is the opportunity cost of leaving money on the table

[25] Note that zero-debt firms are not under-leveraged by definition, since in most studies, including ours, it is enough for a firm to be classified as being zero-leverage to report a null leverage ratio in just one year throughout the period in analysis. Therefore, as any other firm, in some years zero-leverage firms may be over-leveraged and in other years under-leveraged.

(Mukherjee and Wang, 2013). Therefore, it is expected that the more leveraged the firm is, the greater is the managers' incentive to adjust back to the target, which implies a faster SOA for over-leveraged firms. Existing literature supports these arguments, with Byoun (2008), Faulkender et al. (2012) and Mukherjee and Wang (2013) providing evidence that the SOA is lower for under-leveraged firms.

Given that zero-leverage firms, when having a target leverage, are often under-leveraged (Dang, 2013), it is expected that on average these firms adjust at a slower speed than leveraged firms, which are more likely to be over-leveraged. Moreover, the deviation costs faced by zero-leverage firms might be balanced by a larger debt capacity allowing the firm to hold the real option to lever up in the future (Lotfaliei, 2018). In accordance with these arguments, in the empirical component of this paper, the following hypothesis will be tested:

H1: Zero-leverage firms adjust slower than leveraged firms.

2.2.2. SOA and financial systems

The firm's financing decisions are also determined by the country's specific characteristics. On the one hand, the financial system prevailing in the country has impact on zero leverage. In particular, market-based financial systems, by providing a greater number of alternative financing sources to debt, increase the propensity for the presence of debt-free firms (Ghoul et al., 2018). On the other hand, the financial system may also influence the firm's SOA. For example, if institutional environment and financial market development makes it expensive to resort to external finance, it is expected that firms adjust more slowly given the higher adjustment costs suffered. Otherwise, if country characteristics impose higher deviation costs that outweigh adjustment costs, the benefits of being closer to the target are higher and it is expected that firms present higher adjustment speeds.

Finance literature often evaluates how bank- and market-based financial systems influence firm's capital structure decisions (e.g. Antoniou et al., 2008). A market-based financial system is generally characterized as a well-functioning market with greater size and liquidity (Drobetz et al., 2015). Market-based financial systems are predominant in common law systems, which promote a better external investors' protection and a greater transparency and information sharing that lowers adverse selection problems (Djankov et al., 2007). Reciprocally, the small dimension and less development and liquidity of capital markets in bank-based financial systems result in higher adjustment costs, hindering the firm's access to those markets. Thus, issuing (or retiring) debt or equity is more difficult and costly in countries with bank-based financial systems. Therefore,

lower adjustment costs are expected in market-based than in bank-based countries, resulting in a faster SOA in the former.

Another argument supporting a slower SOA in bank-based systems is that deviation costs are lower than in market-based systems. Particularly, the greater dependence on debt financing granted by banks in bank-based systems results in closer ties established between firms and banks, which reduces information asymmetries given that banks act as main monitoring entity (Leland and Pyle, 1977). Therefore, creditors are more willing to negotiate deviations from the target leverage instead of punishing the firm immediately as occurs often by investors in the market (Antoniou et al. 2008).

Öztekin and Flannery (2012) and more recently Drobetz et al. (2015) provide empirical evidence showing that firms in market-based financial systems present indeed a higher SOA. However, they did not discriminate between zero-leverage and leveraged firms. According to the arguments presented and previous empirical evidence, we expect that both types of firms adjust faster to their target leverage when located in countries with market-based financial systems. Therefore, the following research hypotheses are postulated:

H2a: Zero-leverage firms adjust more quickly (slowly) in market-based systems (bank-based systems).

H2b: Leveraged firms adjust more quickly (slowly) in market-based systems (bank-based systems).

2.2.3. SOA and macroeconomic conditions: the recent European crises

Economic cycles are important determinants of firm's default risk, which in turn affects the cost of raising capital (Cook and Tang, 2010). The balance sheet channel perspective argues that asset values fall in periods of uncertainty, which results in lower firm's net worth and collaterals and increases financial distress and bankruptcy costs. Additionally, the drop in consumer confidence that occurs in most financial and economic crises, such as the recent global crisis, promotes a fall in firms' investment, decreasing firms' need to raise debt (Khale and Stulz, 2013). Hence, both collateral and debt are pro-cyclical (Kiyotaki and Moore, 1997). Also, from a supply side perspective debt is considered to be pro-cyclical, since creditors may react to the losses returned by macroeconomic shocks promoting a contraction in credit availability or requiring higher interest rates and collaterals (Ivashina and Scharfstein, 2010).

Macroeconomic conditions also affect the SOA toward target leverage. From a theoretical perspective, considering the greatest default risk and information asymmetries during

adverse macroeconomic shocks, raising (or paying) external finance becomes more expensive, which will lead to an increase in firms' adjustment costs and slow down firms' SOA. Similarly, creditors' may decrease their loan activities and simultaneously increase interest rates and require more collaterals, which also contributes to increasing adjustment costs. Overall, these arguments suggest that the SOA is slower in adverse macroeconomic cycles. In line with these arguments, Hackbarth's et al. (2006) theoretical model shows that firms rebalance their leverage ratios more frequently in expansionary economic cycles than in periods of recession. Empirically, Drobetz and Wanzenried (2006), Cook and Tang (2010), Dang et al. (2014), Drobetz et al. (2015) and Halling et al. (2016) confirm the theoretical prediction of a lower SOA during economic recessions.

According to theoretical arguments and empirical findings, it is expected that during the recent financial crisis, all types of firms moved more slowly toward their target debt ratio. Therefore, the following hypotheses are formulated:
H3a: Zero-leverage firms adjusted more slowly during the recent financial crisis.
H3b: Leveraged firms adjusted more slowly during the recent financial crisis.

2.2.4. SOA and financial constraints

Some firms may face greater restrictions and tightening conditions in accessing external finance than others. A reason for this is the presence of adverse selection and moral hazard problems, which makes more difficult to obtain external finance for firms with little reputation (Stiglitz and Weiss, 1981), i.e., firms without a favourable past in the credit market. This is a traditional and generally accepted argument to justify the zero-leverage phenomenon. According to financing constraints arguments, rather than a financing decision, zero leverage emerges as an imposition raised by creditors (Bessler et al., 2013; Dang, 2013). Furthermore, the distinction between financially constrained and unconstrained firms may be also explored as a source for different adjustment and deviation costs, giving rise to different SOA across firms (Fitzgerald and Ryan, 2019).

Theoretically, it can be argued that financially constrained firms suffer higher adjustment costs, since issuing or retiring debt and/or equity become more expensive due to the higher interest rate demanded by creditors and/or investors, which ultimately should result in a slower SOA. However, it is also true that financially constrained firms face higher distress and bankruptcy costs, meaning higher deviation costs and a greater benefit to adjust faster toward the target. The empirical evidence is also mixed, with Dang et al. (2014), Drobetz et al. (2015), Elsas and Florisiak (2011) and Fitzgerald and Ryan (2019) finding that firms that are financially constrained, displaying higher bankruptcy

and liquidation costs, exhibit a faster SOA, while Öztekin and Flannery (2012) find a faster adjustment speed for unconstrained firms.

Based on the most common conclusions of empirical studies, the following hypotheses are formulated:

H4a: Zero-leverage financial constrained firms adjust faster toward target leverage.

H4b: Leveraged financial constrained firms adjust faster toward target leverage.

3. SOA – The model

We start this section by presenting the dynamic partial adjustment model considered throughout the paper. Next, we discuss the inability of the most commonly applied estimators in the SOA literature to deal with the fractional nature of leverage ratios. Finally, we describe the Elsas and Florisiak's (2011; 2015) doubly-censored Tobit - or DPF - estimator that we use in our analysis.

3.1. Capital structure adjustments – Dynamic partial adjustment model

In accordance with the dynamic trade-off theory, target leverage may be time-varying and firms can deviate from their target. While firms have incentives to adjust toward the target, the existence of adjustment costs may prevent full adjustments. Therefore, dynamic partial adjustment models have been used to estimate SOA, which assume that a firm has a unique target leverage ratio in a given time period and actively adjusts its leverage ratio in each time period. These assumptions can be econometrically expressed as:

$$LEV_{i,t} - LEV_{i,t-1} = \lambda\left(LEV_{i,t}^{*} - LEV_{i,t-1}\right) + \omega_{i,t} \quad (1)$$

where $LEV_{i,t}$ represents the leverage ratio in the current time period and $LEV_{i,t} - LEV_{i,t-1}$ is the change in the actual leverage ratio from period t-1 to period t. This change depends on the SOA, λ, and on the distance between the (time-varying) target leverage $LEV_{i,t}^{*}$ and the lagged leverage ratio. $\omega_{i,t}$ is the error term. If $\lambda = 0$, then the SOA is 0, which means that there is no adjustment toward a target leverage (there are only random movements of leverage). On the other hand, $\lambda = 1$ implies an immediate adjustment and a full correction of the deviation.

Firm's target leverage ratio is unobservable and recent studies model it as a function of a vector of the observable firm characteristics $X_{i,t}$ (Drobetz et al., 2015):

$$LEV_{i,t}^{*} = \theta X_{i,t} + \varphi_i + \varphi_t + \upsilon_{i,t} \quad (2)$$

where θ is the coefficient vector (including a constant term), φ_i and φ_t are respectively a firm and a time fixed effect and $v_{i,t}$ is a generic error term. Replacing $LEV_{i,t}^{*}$ in (1) by this target definition, we have:

$$LEV_{i,t} = (1-\lambda)LEV_{i,t-1} + \beta X_{i,t} + \eta_i + \eta_t + \varepsilon_{i,t} \quad (3)$$

which represents the general equation of a dynamic partial adjustment model, where 1 minus the coefficient of the lagged dependent variable is interpreted as the average SOA exhibited by firms.

3.2. Methodological issues

Estimating SOA represents a real econometric puzzle. There is no consensus in the literature on which estimation method should be used and very different estimates of the SOA have been obtained when applying different methods, even for the same dataset (Drobetz et al., 2015; Elsas and Florisiak, 2015). One example concerns the USA case, where we may find in the literature studies with SOA estimates of (not significantly different from) 0% (Welch, 2004), 7% to 18% (Fama and French, 2002; Kayhan and Titman, 2007), about 25% (Lemmon et al., 2008; Huang and Ritter, 2009) and above 30% (Flannery and Rangan, 2006) per year.

Most of the techniques commonly applied to estimate the SOA have recently been criticized because they fail to account for particular characteristics of corporate financial data and leverage ratios, providing estimates that are severely biased (Dang et al., 2015; Drobetz et al., 2015; Elsas and Florysiak, 2015; Flannery and Hankins, 2013). The bias arises from not dealing in an appropriate way with: (i) the unbalanced nature of the available panel data; (ii) the inclusion of the lagged dependent variable as a regressor; (iii) the presence of unobserved heterogeneity; and (iv) the fractional nature of the dependent variable, which is bounded between zero and one. For example, pooled OLS estimators ignore issues (ii)-(iv); standard fixed-effects panel data estimators ignore the fractional nature of leverage ratios and the correlation between the lagged dependent variable and the regression error term; and even more advancing techniques such as dynamic IV (Anderson and Hsiao, 1981) and GMM difference (Arellano and Bond, 1991) and systems estimators (Blundell and Bond, 1998), the LD estimator of Hahn, Hausman, and Kuersteiner (2007) and the bias-corrected LSDVC estimator of Kiviet (1995) adapted for unbalanced panel data (Bruno, 2005) do not account for the fractional nature of debt ratios (Loudermilk, 2007). A consequence is that most standard estimators are subject to the problem of "mechanical mean reversion" (Chang and Dasgupta, 2009), providing a positive SOA estimate even when debt ratio changes are due to random factors. Therefore, they have low power to reject the null hypothesis of no capital structure

adjustment. Finally, standard estimators have non-monotonic bias curves, producing the same estimates for the SOA in cases where the underlying true SOA is different (Elsas and Florysiak, 2015).

To avoid all these problems, Elsas and Florysiak (2011; 2015) extend the model of Loudermilk (2007) and propose a doubly-censored (bounded between zero and one) Tobit estimator for unbalanced panel data with a lagged dependent variable, accounting both for the presence of fractional dependent variables and for unobserved heterogeneity. As demonstrated by simulation by Elsas and Florysiak (2015), the so-called DPF estimator detects "mechanical mean reversion" and provides unique estimates of SOA for different true underlying SOA, being thus ideal for investigating their heterogeneity. Using empirical data, Drobetz et al. (2015) and Elsas and Florysiak (2015) confirm the biased estimates provided by commonly used estimators and show that the DPF estimator is either unbiased or the least-biased estimator available for dealing with unbalanced panel data with fractional dependent variables and unobserved heterogeneity.

3.3. The DPF estimator

According to Elsas and Florysiak (2015), by using a latent variable specification, the DPF estimator is able to deal with the fractional nature of leverage ratios. The unobserved latent variable $LEV_{i,t}^{\#}$ is assumed to evolve according to the dynamic model expressed in (3):

$$LEV_{i,t}^{\#} = (1-\lambda)LEV_{i,t-1} + \beta X_{i,t} + \eta_i + \eta_t + \varepsilon_{i,t} \tag{4}$$

Correspondingly, the observed doubly censored dependent variable $LEV_{i,t}$ assume values between two possible extreme outcomes and is expressed as follows:

$$LEV_{i,t} = \begin{cases} 0, \ if \quad LEV_{i,t}^{\#} \leq 0 \\ LEV_{i,t}^{\#}, \ if \quad 0 < LEV_{i,t}^{\#} < 1 \\ 1, \ if \quad LEV_{i,t}^{\#} \geq 1 \end{cases} \tag{5}$$

A possible economic interpretation for the unobserved latent variable is firm's debt capacity (Elsas and Florysiak, 2015). While authors argue that debt capacity may go outside the unit range, the observed debt ratio is bounded between zero and one.

The DPF estimator requires the specification of the conditional distribution of the firm fixed effects η_i. It is assumed that η_i depends on the mean of the firm specific variables, $E(X_i)$, and on the leverage ratio in the initial period, $LEV_{i,0}$:

$$\eta_i = \alpha_0 + \alpha_1 LEV_{i,0} + \alpha_2 E(X_i) + a_i \tag{6}$$

with error term $a_i \sim N(0, \sigma_a^2)$. The distribution of the fixed effects η_i, adopted by Elsas and Florysiak (2015), allows a correlation structure between the regressors of the model and the fixed effect. Estimation of the model described by equations (4)-(6) is performed using the maximum likelihood method.

There are only a few recent empirical studies using the DPF estimator in SOA analyses, such as Elsas and Florysiak (2011, 2015) for a sample of US listed firms, Drobetz et al. (2015) for G7 listed firms and Fitzgerald and Ryan (2019) for UK listed firms. Considering our goal of studying the SOA of zero-leverage firms (firms with corner observations at 0), applying the DPF estimator on a partial adjustment model makes even more sense.

4. Data

4.1. Dataset selection and variables

The data set was taken from the *DataStream* database provided by Thomson Reuters. Accounting, financial and market data was collected for listed firms from 14 Western European countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and the UK) for the period between 1995 and 2016. Using such a large European sample including various countries with different financial systems, represents an opportunity to analyse the influence of such systems on SOA. Moreover, the period of analysis (1995-2016) allows us to examine the impact of the recent European financial and sovereign debt crises on the capital structure dynamics.

Utilities and financial firms (industry code 7000-7999 and 8000-8999 of FTSE/Dow Jones Industry Classification Benchmark-ICB) were excluded from our analysis, because they face different regulations and hence their capital structure decisions may be driven by special factors. Firms without an industry code were also excluded. Firm-year observations with obvious errors for sales, assets or equity (e.g. non-positive sales, assets or equity) or missing data in any model variable were also discarded. Finally, only firms with a minimum of three years of consecutive data were included in the sample. For all firms, we allowed entry and exit from the sample, in an attempt to mitigate potential survivor bias. After applying these filtering and cleaning criteria, we ended up with a sample of 7,046 listed firms, corresponding to an unbalanced panel data with 74,384 firm-year observations.

Table 1 provides a definition of the variables considered in our empirical analysis, namely the dependent variable, the control variables and the categorical variables used to divide

the sample in groups that allows us to study SOA heterogeneity and thus test our research questions. We choose book leverage ratio as dependent variable, since, as argued by Huang and Ritter (2009), firms' market leverage ratios are affected by equity market shocks. The lack of control of firms on such shocks may, potentially, lead to spurious inferences on the SOA, resulting in an overestimate of their value (Huang and Ritter, 2009).

As suggested by the influential study of Frank and Goyal (2009), we modelled firms' target ratio as a function of reliable important determinants of leverage, namely: firm size, growth opportunities, asset tangibility, profitability, non-debt tax-shields and annual industry median leverage. Following previous capital structure research (DeAngelo and Masulis, 1980; Drobetz et al., 2015; Frank and Goyal, 2009; Rajan and Zingales, 1995; Titman and Wessels, 1988), we expect leverage to be inversely related to profitability, market-to-book ratio and non-debt tax shields, but positively associated with firm size, asset tangibility and the industry median of leverage.

Table 1: Definition of the variables
Note: [a] The corresponding *DataStream* field or code is in parentheses.
[b] To check the robustness of the results, later zero-leverage firms will be redefined as firms reporting zero debt in at least 3 consecutive years.
[c] According to Demirgüç-Kunt and Levine (2004), Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Portugal and Spain belong to bank-based financial systems, while Denmark, the Netherlands, Sweden and the UK belong to market-based financial systems.
[d] The longest crisis period is considered only for the following countries: Austria, Belgium, Greece, Ireland, Portugal and Spain. For UK the crisis period is 2008-2011 and for the remaining countries only the 2008-2009 period is considered as a crisis period. See Laeven and Valencia (2018).

Variable	Definition[a]
Dependent variable	
Leverage	Ratio of long- and short-term debt (03251 and 03051 or 03255) to total book assets (02999)
Control variables	
Size	Logarithm of total 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))
Tangibility	Ratio of fixed assets (02501) to book assets (02999)
Profitability	Ratio of earnings before interests, taxes, and depreciation (EBITDA) (18198) to book assets (02999)
Non-debt tax shields	Ratio of depreciation and amortizations (01151) to book assets (02999)
Industry leverage	Industry median book leverage in a given year for *DataStream* industry classification, the FTSE/Dow Jones Industry Classification Benchmark-ICB (ICBIC)
Categorical variables	
Zero leverage	A firm is classified as being Zero leverage if has at least a zero-book leverage ratio in one year[b], otherwise the firm is considered a Leveraged firm
Financial system	A country is classified as having a Market system if it has a market-based financial system (a higher level of stock market development relative to banking sector development), otherwise is considered as having a Bank system (source: Demirgüç-Kunt and Levine, 2004)[c]

Crisis	A firm-year observation is classified as Crisis for the years of financial and sovereign debt crises in Europe (the period of crisis goes from 2008 to 2009, 2011 or 2012, depending on the country being considered), otherwise is considered a non-crisis period (source: Laeven and Valencia, 2018)[d]
SA-index	The Size-Age index is constructed as (– 0.737 * Size) + (0.043 * Size^2) – (0.040 * Age), where Age is the difference between the year of the observation and the first date that the firm appears in the *DataStream* database with trading available data and Size is as defined previously (Hadlock and Pierce, 2010). A higher (lower) value for the index suggests that greater (smaller) financial constraints are faced by firms.

Regarding categorical variables, firstly we consider the *Zero leverage* variable to analyse differences on SOA between zero-leverage and leveraged firms. To make this analysis possible, we divide our sample in two groups, one composed by zero-leverage firms and the other by leveraged firms. Following most of the literature (e.g. Strebulaev and Yang, 2013), a firm is included in the group of zero-leverage firms if it has a debt ratio equal to zero in at least one year, otherwise the firm is placed in the group of leveraged firms.

Secondly, to study the effects of the financial system on the SOA we use the *Financial system* variable. Contrary to Öztekin and Flannery (2012) and Drobetz et al. (2015) that adopted a set of country-level indexes or scores to study SOA between different financial systems, we follow Demirgüç-Kunt and Levine (2004) and use an indicator which allows the partition of our sample into countries with a market-based financial system (a more developed capital market) and countries with a bank-based financial system (a more developed banking sector).[26]

Thirdly, to examine the effects of macroeconomic conditions on SOA, we use the *Crisis* variable. Similar to Dang et al. (2014), we are particularly interested in estimating the effects of the recent global financial crisis on the SOA, but additionally we consider its extension to a sovereign debt crisis in 2010 in several European countries (Laeven and Valencia, 2018). Therefore, we define the crisis period by using the recent classification developed by Laeven and Valencia (2018) about banking, currency and sovereign debt crises, which recognizes that the 2008 global financial crisis affected European countries in different ways, being longer in some countries than in others.

Finally, to examine the effects of different levels of financial constraints on SOA, we follow recent studies (e.g. Dang et al., 2014) and use the so-called Size-Age index of Hadlock and Pierce (2010) to divide the groups of zero-leverage and leveraged firms into sub-groups of financially constrained and unconstrained firms. As shown by Hadlock and Pierce (2010), the Size-Age index is a more appropriate measure to classify

[26] As noted by Drobetz et al. (2015), their main findings related with cross-country heterogeneity on SOA are congruent with a classification into countries with bank-based or market-based financial systems.

financially constrained and unconstrained firms than other common composite measures such as the WW- (Whited and Wu, 2006) and KZ-indexes (Kaplan and Zingales, 1997). To create the categorical variable *SA-index*, we use a similar procedure to those of Bessler et al. (2013). Hence, first we calculate quintiles of the cross-sectional distribution in each year and assign all firm-year observations to one of those quintiles. In a second step, we compute the (rounded) average quintile of a firm over time and assign all its observations to this average quintile. This procedure leads to five groups of firms. A higher (lower) value for the index suggests that greater (smaller) financial constraints are faced by firms, thus firms on quintile 4 and 5 (1 and 2) are classified as financially constrained (unconstrained) firms. In order to avoid misclassification, all firms in the quintile 3 are excluded from the analysis.

4.2. Sample characterisation and descriptive analysis

Table 2 presents the distribution of observations and firms by country and leveraged-based groups.

Table 2: Sample characterisation by country and leverage policy
This table presents the distribution of firms across the 14 countries considered in the sample. The first 3 columns report the number of observations (N. obs.), the percentage of observations (% obs.) and the number of firms (N. firms), by country, for all firms. The next 4 columns present the number of observations (N. obs.) and the number of firms (N. firms) for firms classified as zero leverage and for firms classified as leveraged.

	All firms			Zero-leverage firms		Leveraged firms	
Country	N. obs.	% obs.	N. firms	N. obs.	N. firms	N. obs.	N. firms
Bank-based countries							
Austria	1,343	1.81	118	255	22	1,088	96
Belgium	1,801	2.42	154	208	17	1,593	137
Finland	2,318	3.12	170	297	20	2,021	150
France	11,481	15.43	1,058	801	76	10,680	982
Germany	10,895	14.65	959	3,522	298	7,373	661
Greece	4,249	5.71	334	1,121	84	3,128	250
Ireland	976	1.31	93	266	25	710	68
Italy	3,544	4.76	311	339	27	3,205	284
Portugal	1,016	1.37	91	91	8	925	83
Spain	2,138	2.87	184	138	15	2,000	169
Subtotal	39,761	53.45	3,472	7,038	592	32,723	2,880
Market-based countries							
Denmark	2,409	3.24	198	433	36	1,976	162
Netherlands	2,739	3.68	248	695	59	2,044	189
Sweden	6,109	8.21	614	2,737	274	3,372	340
UK	23,366	31.41	2,514	9,122	892	14,244	1,622
Subtotal	34,623	46.54	3,574	12,987	1,261	21,636	2,313
Total	**74,384**	**100**	**7,046**	**20,025**	**1,853**	**54,359**	**5,193**

More than 60% of observations come from the UK, France and Germany. We observe that about 26% of the firms (1,853 out of 7,046) are assigned to the zero-leverage group, indicating that these firms present zero-leverage levels in at least one year. A high proportion of zero-leverage firms have also been reported by Dang (2013), which found that almost 35% of his sample of UK listed firms were debt-free. Table 2 also shows that zero-leverage firms are present in all European countries in our sample, which confirms the international nature of the phenomenon. However, the zero-leverage phenomenon seems to be more prevalent in market-based countries, where 1,261 out of 3,574 firms (35.3%) are assigned to the zero-leverage group against only 17.1% (592 out of 3,472) in bank-based countries. The results show that more than 68% of zero-leverage firms are found in market-based countries.

Table 3 reports descriptive statistics for the variables that will be used in the model. On average, firms present a book leverage ratio of approximately 20%, a level close to that reported by recent European studies. However, mean debt levels vary considerably between zero-leverage and leveraged firms. Particularly, firms classified as being zero-leverage have on average debt ratios of around 8.7%, which are significantly smaller than those presented by leveraged firms (almost 25%).[27]

Table 3: Descriptive statistics

	Full sample			Zero-leverage firms			Leveraged firms		
Variable	N	mean	sd	N	mean	sd	N	mean	sd
Leverage	74,384	0.2033	0.1692	20,025	0.0865	0.1334	54,359	0.2464	0.1605
Size	74,384	11.8461	2.1442	20,025	10.5724	1.6767	54,359	12.3154	2.1067
Growth Opportunities	74,384	1.3796	1.6162	20,025	1.8488	2.2603	54,359	1.2067	1.2575
Tangibility	74,384	0.2568	0.2233	20,025	0.1856	0.2119	54,359	0.2831	0.2216
Profitability	74,384	0.0740	0.2066	20,025	0.0222	0.3017	54,359	0.0931	0.1533
Non-debt tax shields	74,384	0.0496	0.0459	20,025	0.0490	0.0556	54,359	0.0498	0.0418
Industry leverage	74,384	0.1831	0.0546	20,025	0.1658	0.0625	54,359	0.1894	0.0499

Table 4 presents the average debt ratio of zero-leverage and leveraged firms for the sub-samples constructed using the categorical variables *Financial system*, *Crisis* and *SA-index* defined in Table 1. To verify whether there are significant differences on mean debt ratios, within and between groups, a two-sample t-test is used.

Table 4: Mean debt ratio of zero-leverage and leveraged firms
Note: This table compares the mean debt ratio between and within our groups of zero-leverage and leveraged firms across different financial systems, macroeconomic states and levels of constraints. T-tests are presented for differences in means between and within groups.
*** indicates statistical significance at 1%.

[27] Using a simple t-test for mean differences between the two groups of firms, we find that this difference is statistically significant (t-statistic for no differences in the mean: 125.88; p-value: 0.0000).

	Leveraged firms	Zero-leverage firms	*T-test for mean differences Between groups*
	Financial system		
Market system	0.2328	0.0796	96.14***
Bank system	0.2554	0.0992	73.69***
T-test for mean differences Within groups	-16.12***	-9.93***	
	Macroeconomic conditions		
Non-crisis period	0.2423	0.0854	53.42***
Crisis period	0.2723	0.0919	114.60***
T-test for mean differences Within groups	-15.03***	-2.60***	
	Financial constraints		
Small SA-index	0.2663	0.1031	78.45***
High SA-index	0.2201	0.0841	55.42***
T-test for mean differences Within groups	30.04***	7.11***	

The results reveal that the group of leveraged firms present systematically higher debt ratios than zero-leverage firms, being the difference always statistically significant, irrespective of the financial system, the period and the level of financial constraints being considered. More interesting, within each group the mean debt ratio significantly differs across the different realities considered. In particular, both zero-leverage and leveraged firms have, on average, a significantly higher debt ratio: (i) in bank-based systems than in market systems; (ii) in crisis periods than in non-crisis years; (iii) when they are classified as being financially unconstrained (small SA-index). Overall, debt ratios significantly differ across zero-leverage and leveraged firms, varying also significantly in different sub-samples, which reinforces our expectations that the SOA of zero-leverage and leveraged firms may vary across different financial systems, macroeconomic conditions and levels of financial constraints.

Table 5 presents Pearson's paired correlation coefficients for the explanatory variables. The correlations between the explanatory variables does not seem to be particularly high, always presenting coefficients below 0.4, which, conjugated with the low values of the variance inflation factor (always below 1.5), suggests that multicollinearity is not a problem.

Table 5: Pearson correlation matrix and Variance Inflation Factor (VIF)
Note: The table shows the Pearson correlation coefficients between the variables of the study, and the coefficients associated with the VIF. ** significance at 1%.

Variables	Size	Growth Opportunities	Tangibility	Profitability	Non-debt tax shields	Industry leverage	VIF

Size	1.0000						1.16
Growth Opportunities	-0.1694**	1.0000					1.06
Tangibility	0.2009**	-0.1214**	1.0000				1.15
Profitability	0.2652**	-0.0634**	0.1315**	1.0000			1.09
Non-debt tax shields	-0.0924**	0.0034	0.1329**	-0.0590**	1.0000		1.04
Industry leverage	0.1985**	-0.1731**	0.2747**	0.1154**	-0.0449**	1.0000	1.13

5. Empirical results

5.1. Leverage policy as a source of SOA heterogeneity

Table 6 presents the DPF estimates for the dynamic partial adjustment model (3). To examine SOA heterogeneity, we consider three different sets of observations in the estimation of equation (3): the full sample; the group of zero-leverage firms; and the group of leveraged firms. For each independent variable, we report the estimated coefficient and the respective standard error and an indicator of its statistical significance. We also report the difference in SOA between sub-samples and apply a simple two-tailed z-test to assess if the difference is statistically significant.[28]

Table 6: SOA estimates for full sample and across sub-samples of leverage policy
Note: Table 6 presents the estimates of SOA from the partial adjustment model in (3) using the DPF estimator for the full sample and the sub-samples of zero-leverage and leveraged firms. For each independent variable we report the regression coefficients and standard errors (in brackets).
***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

Independent variables	Full sample	Leveraged firms	Zero-leverage firms
$Leverage_{t-1}$	0.7270***	0.7239***	0.7795***
	(0.0037)	(0.0044)	(0.0089)
Size	0.0285***	0.0239***	0.0364***
	(0.0007)	(0.0008)	(0.0016)
Growth opportunities	0.0006*	0.0026***	-0.0005
	(0.0003)	(0.0004)	(0.0006)
Tangibility	0.1290***	0.0988***	0.2021***
	(0.0041)	(0.0045)	(0.0094)
Profitability	-0.1021***	-0.1585***	-0.0646***
	(0.0023)	(0.0032)	(0.0041)
Non-debt tax shields	0.0208**	0.0400***	0.0158
	(0.0104)	(0.0132)	(0.0196)
Industry leverage	0.1471***	0.1063***	0.1944***
	(0.0225)	(0.0244)	(0.0558)
% SOA	27.30***	27.61***	22.05***
SOA difference (pp)		5.56***	
Observations	66,716	48,810	17,906

[28] The z test applied throughout the paper to test the difference between SOA of different groups is not the ideal test to use, but, given the complexity of our econometric model, it is the best available option in the sense that it provides a good approximation to the true result. See *inter alia* Clogg, Petkova and Haritou (1995), Paternoster, Brame, Mazerole and Piquero (1998) and Fitzgerald and Ryan (2019).

Year Dummies	Yes	Yes	Yes
Wald test for joint significance	82059.83***	60642.48***	12139.75***

The Wald test for the joint significance of the explanatory variables in each model confirm their ability to explain the leverage behaviour of sample firms. Also individually all variables are statistically significant, except *Growth Opportunities* and *Non-debt tax shields* for the specific case of zero-leverage firms. As expected, size, tangibility and the median industry leverage exhibit a positive effect on leverage, while profitability presents a negative effect on firms' leverage (e.g. Frank and Goyal, 2009). While the first results are consistent with the trade-off theory, the negative effect of profitability on leverage is consistent with the predictions of the pecking order theory, since more profitable firms generate more internal funds. The positive effect of growth opportunities for leveraged firms is also consistent with the arguments of the pecking order theory that firms with more future investment opportunities should accumulate more debt over time. The unexpected sign for the coefficient of non-debt tax shields for leveraged firms is sometimes observable in the literature (e.g. Fitzgerald and Ryan, 2019) and may be explained by the proxy used, which relies on depreciation and amortizations of fixed assets, making difficult to isolate the effects of non-debt tax shields and fixed assets.

In all models the coefficient of the lagged book leverage ratio $(1 - \lambda)$ is significantly different from one, which implies that the estimated SOA (λ) is significantly different from zero and hence firms exhibit leverage targeting behaviour, irrespective of their leverage policy. Considering our full sample, on average, firms adjust to their target leverage at an annual rate of $1 - 0.727 \approx 27.3\%$, which implies that firms take approximately 2 years to close half the gap between actual and target capital structure.[29] Similar estimates of SOA have been obtained by Drobetz et al. (2015) and Öztekin and Flannery (2012), with the former authors reporting a SOA of approximately 25%.

For the group of zero-leverage firms, the estimated SOA is approximately 22.1%, while the group of leveraged firms presents a SOA of about 27.6%, being the difference of 5.5pp statistically significant. This suggests that the group of zero-leverage firms needs almost 3 years to close half the gap between observed and target leverage, while leveraged firms just need about 2 years. The finding that zero-leverage firms adjust significantly slower than leveraged ones are supported by the arguments that a zero-leverage firm faces lower deviation costs than leveraged firms, since they arguably possess a larger debt capacity, which allows them to hold the real option to lever up in the future and thus compensate

[29] The half-life of leverage adjustment is calculated as $ln(0.5)/ln(1 - \lambda)$, where $\lambda \approx 0.273$.

the opportunity cost of not taking in the present full advantage of debt tax shields (Lotfaliei, 2018). Moreover, in line with previous empirical evidence of Dang (2013) that zero-leverage firms are on average under-leveraged, our result can also be interpreted in light of existing studies, confirming that such firms have less incentives to adjust back to the target, since their ultimate cost of being off the target is only the loss of debt tax benefits. On the basis of the results obtained, hypothesis H1 is corroborated. However, in the next section we show that there is a particular case where this hypothesis does not hold.

5.2. Sources of SOA heterogeneity within and between zero-leverage and leveraged firms

After finding significant differences between zero-leverage and leveraged firms in their target leverage behaviour, in this section we study more deeply the possible sources of heterogeneity between and within both groups of firms. In particular, we investigate, on the one hand, whether those differences remain significant for specific sub-samples of zero-leverage and leveraged firms (between-group differences) and, on the other hand, how the factors appearing in hypotheses 2-4 affect the target debt behaviour of each group of firms (within-group differences). Therefore, Table 7 presents the estimated SOA for zero-leverage and leveraged firms for the sub-samples defined by the categorical variables *Financial system*, *Crisis* and *SA-index* defined in Table 1. To save space, the regression coefficients of the 12 models that we needed to estimate to obtain the SOA estimates are not reported, but they are similar, in terms of sign and significance, to those presented in Table 6.

Table 7: SOA heterogeneity across different sub-samples of zero-leverage and leveraged firms
Note: Table 7 presents estimates of SOA from the partial adjustment model in (3) using the DPF-estimator for sub-samples of zero-leverage and leveraged firms across different financial systems, macroeconomic states and levels of constraints. We present the % of SOA obtained for each model and the difference within and between leveraged and zero-leverage firms. To assess whether the differences are statistically significant we apply a simple two-tailed z-test.
*** and ** indicates statistical significance at 1% and 5% respectively.

	Leveraged firms		Zero-leverage firms		*Between*
	N	%SOA	N	%SOA	*difference (pp)*
		Financial system			
Market system	19,213	31.48***	11,577	23.73***	7.75***
Bank system	29,597	25.47***	6,329	20.05***	5.42***
Within difference		6.01***		3.68**	
		Macroeconomic conditions			
Non-crisis period	41,655	26.94***	14,695	21.55***	5.39***
Crisis period	7,155	25.64***	3,211	46.78***	-21.14***
Within difference		1.30		-25.23***	
		Financial constraints			
Small SA-index	23,157	26.45***	10,718	21.04***	5.41***

High SA-index	16,063	27.84***	2,895	24.65***	3.19
Within difference		-1.39		-3.61	

We start by analysing cross-country differences on SOA, focusing on the role played by the financial system prevailing in the country. Table 7 shows that firms adjust significantly faster in market- than in bank-based financial systems, irrespective of being a zero-leverage or a leveraged firm. Zero-leverage firms adjust to the target leverage at an estimated speed of approximately 23.7% in market-based systems and around 20.0% in bank-based systems, while leveraged firms present a SOA of about 31.5% in the former system and of around 25.5% in the latter. These results are supported by the arguments that lower (higher) adjustment costs and higher (lower) deviation costs occur in market-based (bank-based) financial systems, leading to higher (lower) adjustment benefits. Specifically, the greater liquidity and development of capital markets in market-based systems imply lower adjustment costs, allowing an easier access to external finance. On the other hand, the closer ties established between firms and banks in bank-based systems implies that creditors are more willing to negotiate deviations from the target leverage, lowering the deviation costs faced by firms and the need to quickly adjust to their target (Antoniou et al. 2008; Leland and Pile, 1977). Thus, these results corroborate hypotheses H2a and H2b and are in accordance with previous empirical evidence (Drobetz et al., 2015; Öztekin and Flannery, 2012) that firms located in market-based financial systems exhibit a greater SOA than firms in bank-based systems.

Regarding the differences between zero-leverage and leveraged firms, once again we observe that zero-leverage firms present a slower SOA than leveraged firms, in both market- and bank-based financial systems. The difference between zero-leverage and leveraged firms of more than 7pp in market-based systems and 5pp in bank-based systems are both statistically significant. Moreover, it is worth to emphasize that even zero-leverage firms from market-based systems adjust slower than leveraged firms from bank-based countries. As a consequence, our findings show that previous existing evidence that firms from market-based systems adjust faster than firms from bank-based systems (Drobetz et al., 2015; Öztekin and Flannery, 2012) may not be completely true, since extremely financial conservative firms, even if located in market-based systems, adjust slower than leveraged firms located in bank-based systems. Therefore, previous empirical evidence should be interpreted with caution and a deeper analysis to the firm's debt policy is needed to correctly evaluate heterogeneity in SOA in different financial systems.

Regarding the effect of different macroeconomic conditions on SOA, Table 7 shows a substantial different behaviour between zero-leverage and leveraged firms. In particular, while leveraged firms did not change significantly their average adjustment rate towards a target leverage ratio during the recent crisis, zero-leverage firms adjusted significantly faster during this period. For the group of leveraged firms, the SOA ranges between 25.6% during the crisis period and around 26.9% in the non-crisis years. A very different pattern is observed for zero-leverage firms, which exhibit a SOA of almost 47% during the crisis period and of approximately 21.6% in non-crisis years. This implies that these firms just needed approximately 1 year to close half the gap between actual and target leverage ratios during the crisis period, but required 3 years outside that period. Therefore, both hypotheses H3a and H3b are rejected. Furthermore, because we find that zero-leverage firms adjusted faster than their leveraged counterparts during the 2008 financial crisis, our previous evidence about the validity of hypothesis H1 does not seem to hold during crisis periods.

The arguments that firms rebalance their capital structure at a slower speed during crisis periods due to greater adjustment costs (Ivashina and Scharfstein, 2010) is hence not supported for both leveraged and zero-leverage firms. Since one of the reasons for firms to adopt zero-leverage policies is to build up financial flexibility and keep their borrowing capacity (Bessler et al., 2013) to have a better financial position to face future unexpected events, these firms hold the real option to lever up in periods of uncertainty (Lotfaliei, 2018). Therefore, zero-leverage firms, by facing smaller adjustment costs, can adjust their capital structure at more favourable conditions in crisis periods than their leveraged counterparts, which explains why the former group adjusted faster during the crisis period than the latter. On the other hand, because deviation costs tend to increase substantially during adverse macroeconomic shocks, higher deviation costs may explain the greater SOA exhibited by zero-leverage firms during the crisis years in comparison to other periods. In contrast, in the crisis period, leveraged firms suffer from both higher deviation costs and higher adjustment costs, which seem to compensate each other and hence their SOA does not change significantly.

Overall, our findings reveal that previous empirical evidence that firms adjust more slowly in periods of recession (Dang et al., 2014; Drobetz et al., 2015; Halling et al., 2016) should be interpreted with caution, since firms with extremely conservative leverage policies, which are often excluded from empirical studies, may adjust faster in periods of adverse macroeconomic shocks.

Finally, to analyse the SOA for firms with different levels of financial constraints, zero-leverage and leveraged firms are divided into financially constrained and unconstrained

firms, according with the categorical variables *SA-index*.[30] Table 7 shows that financially constrained firms (firms with higher *SA-index*, quintiles 4 and 5 of the composite measure) present a higher SOA toward the target than unconstrained firms, irrespective of being zero-leverage or not. However, unlike most of the empirical studies that found a significant difference between the SOA of constrained and unconstrained firms (Dang et al., 2014; Drobetz et al., 2015; Fitzgerald and Ryan, 2019), the SOA differences that we obtained are not statistically significant. Therefore, our findings imply the rejection of hypotheses H4a and H4b.

Regarding the differences between zero-leverage and leveraged firms, we find that the former group only present a significant slower SOA than leveraged firms for the case of unconstrained firms. If both types of firms face high financial constraints, then their SOA is similar. This reinforces the idea that the average SOA of zero-leverage firms is lower due to their greater financial flexibility and debt capacity, since this explanation implicitly assumes that firms are debt-free by their own choice.

The statistically significance of the SOA estimated in all models confirms that European firms exhibit leverage targeting behaviour, irrespective of the leverage policy adopted by the firms, the financial system that prevails in the country, the economic cycle and the different levels of constraints felt by firms. Similar results were obtained when zero-leverage firms were redefined as firms reporting zero debt in at least 3 consecutive years.[31] These findings support the relevance of the dynamic trade-off theory to explain European firms' capital structure decisions.

6. Conclusion

This paper analyses two classic and puzzling subjects on corporate finance that have been on the daily agenda of the scientific community. In particular, we investigate sources of heterogeneity in SOA towards a target debt ratio for zero-leverage firms and compare it with that of traditionally leveraged firms. To perform this research, we used a sample of 7,046 European listed firms over the period between 1995 and 2016, where more than 26% of the firms are classified as zero-leverage firms. On average, the group of zero-leverage firms presents a book debt ratio of around 8.7%, which is significantly lower than that exhibited by the group of leveraged firms (24.6%). Additionally, the zero-leverage phenomenon is more prevalent in market- than bank-based financial systems, with the proportion of debt-free firms in the former system being twice larger.

[30] The total number of observations is not equal to those reported previously for leveraged and zero-leveraged firms, because firms on quintile 3 of the categorical variable *SA-index* were dropped to avoid misclassification.
[31] Results available upon request.

Using dynamic partial adjustment models and the unbiased DPF-estimator suggested by Elsas and Florysiak (2015), we find that European firms exhibit leverage targeting behaviour by adjusting toward their target at an annual rate of approximately 27.3%. More importantly, we show that the firm's financial policy is an important source of SOA heterogeneity. In particular, zero-leverage firms present an annual SOA of 22.1%, which is a significantly slower adjustment speed than the 27.6% exhibit by leveraged firms. While the former firms need almost 3 years to close half the gap between observed and target leverage, leveraged firms just need about 2 years.

We also found that the influence of the debt policy adopted by the firm on SOA heterogeneity changes with different financial systems, macroeconomic conditions and financial constraints levels. Our results show that adjustment speeds estimated without considering heterogeneity in firms' financing policies and institutional context may draw inaccurate conclusions about adjustment behaviour. One example is the effect of the financial system on firms' SOA. We show that both zero-leverage and leveraged firms present a greater SOA in market-based financial systems, extending the work of Drobetz et al. (2015). In addition, we find, however, that not all firms from market-based systems adjust faster than firms from bank-based systems, since zero-leverage firms from the former countries adjust more slowly than leveraged firms from bank-based countries.

Another example of the importance of taking into account firms' debt policies when estimating their SOA towards target debt ratios is given by the finding that financially constrained and unconstrained firms display similar adjustment rates when the analysis is performed separately for zero-leverage and leveraged firms. Moreover, zero-leverage firms adjust at a slower pace than leveraged firms only for the case of financially unconstrained firms, which shows that the key point in this analysis is whether zero leverage is a choice of the firm or an imposition of the market. Indeed, only in the former case zero-leverage firms are likely to have a greater financial slack and debt capacity than leveraged firms and the option to lever up in the future, which motivates them to have a lower SOA in the present.

A further important result of the paper is that zero-leverage firms adjusted faster during the 2008 financial crisis, relative to both other time periods and leveraged firms. This unexpected result may be explained, on the one hand, by a substantial increase in deviation costs during the crisis period and, hence, in the benefits of adjusting toward the target; and, on the other hand, by the smaller adjustment costs faced by zero-leverage firms relative to leveraged firms during the crisis, since the financial slack build by zero-leverage firms enables them to lever up in a better financial position when facing unexpected events. Our findings thus complement and contrast the recent literature that

shows that firms adjust more slowly during bad times, namely the recent financial crisis (Dang et al., 2014).

Beyond theoretical contributions, the paper has also some practical implications. For financial managers, we show that firms adopting financial conservative policies adjust more slowly to a desirable target debt ratio, which may indicate a lower adjustment benefit to these firms. Further, financial conservatism allows a greater SOA during recessions, indicating that policies that preserve firms' debt capacity allows to quickly adjust to target debt ratios when deviation costs turn to be more aggressive. Together, these results convey signals that conservative debt policies may better prepare firms for periods of crisis, since they are able to obtain more favourable conditions from creditors than leveraged firms.

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CHAPTER 7

To be or not to be debt-free, which is the optimal answer for a better firm performance?

Abstract

The debate on the zero-leverage phenomenon has increased considerable in the last few years, with the focus being placed on the motives for firms presenting such an extreme conservative financing policy. Typically, researchers try to explain such policy by looking at its determinants without regard for its consequences. In this paper, we adopt the opposite perspective and investigate whether one the reasons for firms adopting a zero-leverage policy is the consequent better financial performance. Using a sample of European listed firms for the 2002-2016 period, dynamic panel data regression models and propensity score (PS) methods, we find that zero-leverage policies increase firm's performance of both financially unconstrained and constrained firms. We also find that during the 2008 global financial crisis the positive effect of zero-debt policies became even stronger for the former group, remaining similar for the latter. In quantitative terms, the positive effect of zero leverage on firm's performance was predicted to be 2.7-4.2 percentage points (pp) when considering the whole period analysed and 5.9-7.9 during the 2008 crisis.

Keywords: Zero leverage; Firm's performance; Financial crisis; Financial constraints; Dynamic panel data; Propensity score methods

JEL classification: G32

1. Introduction

How financing decisions impact firm's financial performance is one of the most puzzling questions faced by finance researchers and financial managers (Le and Phan, 2017; Sánchez-Vidal, Hernández-Robles, and Mínguez-Vera, 2020). Theoretical foundations about the effect of capital structure on firm's performance start with the irrelevance

paradigm of Modigliani and Miller (1958), which under the assumption of a perfect capital market show that the debt-equity mix does not influence firm's value. However, in a real-world context debt brings tax shields (Modigliani and Miller, 1963) and, if held at a (too) high level, financial distress and bankruptcy costs (Kraus and Litzenberger, 1973), implying, as argued by the trade-off theory, the existence of an optimal debt level that maximizes the firm's value. Moreover, as claimed by the agency theory (Jensen and Meckling, 1976; Jensen, 1986), managers are self-interested and do not always act to maximize shareholders wealth, which means that another benefit of debt is its contribution to reduce the so-called principal-agent problems. Finally, because debt issuance generates lower information costs than issuing equity, debt financing is expected to have a lower cost than equity, and hence the pecking order theory (Myers, 1984; Myers and Majluf, 1984) postulates firm's preference for financing through debt over equity. Therefore, all classical capital structure theories argue that, until a sustainable level, debt rises firm performance.

Despite the theoretical benefits of debt to firm's performance, during the last decade researchers have noted that a growing number of firms does not hold any amount of debt. Strebulaev and Yang (2013) and D'Mello and Gruskin (2014) found that almost 20% of US listed firms were debt-free in the beginning of the 2010s. Devos et al. (2012), Bessler et al. (2013), Ghoul et al. (2018) and Saona et al. (2020) showed that this so-called mystery of zero-leverage firms is a persistent and global phenomenon, with firms from of all over the world remaining debt free for several years. Since this zero-leverage phenomenon cannot be accommodated by classical capital structure theories, new explanations for that behavior emerged. According to the most popular zero-leverage theories, for some firms zero leverage is mainly the consequence of financial constraints, i.e. creditors do not wish to grant credit to the firm (Bessler et al., 2013). For others, zero leverage is the result of their own financial decisions, i.e. firms deliberately opt for zero-debt policies to build up financial flexibility and preserve borrowing capacity (Dang, 2013). Notwithstanding the considerable advances done in the last decade to understand zero-leverage firms' motivations (Dang, 2013; Haddad and Lotfaliei, 2019; Huang et al., 2017; Ramalho et al., 2018; Takami, 2016), little is known about the effect of such a conservative policy on firm's financial performance. There are some studies focusing on the long-run stock performance of zero-leverage firms (Lee and Moon, 2011; Moon, Lee, and Waggle, 2015), but they do not examine the role of zero-debt policies as a determinant of firm's financial performance, namely its profitability.

Firms that are debt-free due to creditors imposition may be forced to bypass good investment opportunities, which may negatively affect their financial performance. On

contrary, firms that opt for zero leverage due to its own decision hold the real option to lever up in the future when good investment opportunities arise, which suggests that they do not lose value by remaining debt-free for some time. Actually, it may even contribute for a superior financial performance during crises and negative macroeconomic shocks, since these firms may use their financial slack to invest or their borrowing capacity to access debt (to invest or simply to survive) at favourable conditions. In contrast, during crisis periods the costs of external financing tends to raise substantially for firms already highly dependent on bank debt, increasing their financial distress and bankruptcy risk. See Arslan-Ayaidin et al. (2014) for some empirical evidence on the better performance of financially flexible firms during macroeconomic shocks.

To the best of our knowledge, there is no study investigating the role played by zero-leverage policies as a determinant of firm's financial performance. In order to fill this gap, this study focuses on the following research question: 1) *Does zero-leverage firms perfom better than their leveraged counterparts?* We conjecture that the impact of zero leverage on firm's financial performance may be particularly relevant during macroeconomic shocks, which justifies our second research question: *2) Does the effect of zero leverage on firm's performance become more important during crisis periods?* Finally, as some zero-leverage firms adopt this financing policy by their own decision and others by creditor's imposition, it is important to examine whether the potential superior performance of zero-leverage firms is restricted to the former group. Thus, the third research question is the following: *3) Is the effect of zero-leverage policies on firm's performance similar across financially constrained and unconstrained zero-leverage firms?*

To answer these questions and provide empirical evidence about the effects of zero leverage policies on firm's performance, we use an unbalanced panel of 4,502 listed firms from 14 European countries for the 2002-2016 period. The impact of zero-leverage policies on firm's performance is estimated using dynamic panel data methods, namely the system GMM estimator (Blundell and Bond, 1998), which accounts for firm's performance dynamics, unobservable individual heterogeneity, endogeneity and reverse causality concerns. In addition, we also use PS methods, which account for sample selection effects and allow a direct comparison of the performance of zero-leverage and leveraged firms. We use Return on Assets as a measure of firm's performance and consider both the WW-index (Whited and Wu, 2006) and the SA-index (Hadlock and Pierce, 2010) to decide if a firm should be classified as being financially constrained or unconstrained. As macroeconomic shock, we consider the 2008 financial crisis, which is covered in full by our sample.

By being the first to examine the effect of zero leverage on firm's financial performance, our paper makes several contributions to the financial literature. First of all, we show that zero-debt financing policies increase firm's performance, which implies that current theories of capital structure are not enough to explain the relationship between debt and performance. Second, we show that the positive effects of those policies are valid for both financially unconstrained and constrained firms and for both crisis and non-crisis periods. Third, we find that the positive impact of zero-leverage policies on firm's performance was boosted during the 2008 global crisis period for financially unconstrained zero-leverage firms. Actually, while the performance of leveraged firms deteriorated significantly during the crisis, most of our estimated models suggest that the same did not happen with debt-free firms, which managed to keep a similar performance. Overall, our results suggest that the better financial performance of zero-leverage firms may be a possible reason for firms adopting such an extremely conservative financial policy.

The remainder of the paper is organised as follows. Section 2 briefly reviews the empirical literature relating capital structure and firm's financial performance and formulate some empirical hypotheses. Section 3 describes the data, variables and the applied methodology. Section 4 presents and discusses the main results of the paper. Finally, section 5 concludes.

2. Capital structure and financial performance: evidence and hypotheses

2.1. Empirical evidence on the effect of capital structure on financial performance

Corporate finance researchers have intensively studied how financing decisions impact firm's performance, discussing their results at the light of existing theories. As discussed in the Introduction, classical capital structure theories defend a positive effect of debt on firm performance due to tax shields, reduction of principal-agent problems and/or lower issuance costs. This conjecture is also supported by several empirical studies. Particularly, Berger and di Patti (2006), using data on US banking industry, find that a higher debt ratio is associated with a higher performance, even for high levels of debt. In another influential study, Margaritis and Psillaki (2007) found the same impact of leverage on firm's performance for their sample of New Zealand firms. Using a sample of German non-financial listed firms, Abdullah and Tursoy (2019) found that a 1 percentage point (pp) increase in total debt ratio leads to an increase in return on assets (ROA) of approximately 3.6pp. A number of other studies using samples of firms from a series of

other developed or developing economies empirically show that capital structure has a positive impact on firm's performance (e.g. Davydov, 2016; Fosu, 2013; Jouida, 2018; Kyereboah-Coleman, 2007).

Beyond benefits, debt can also bring costs. Financial distress and bankruptcy costs increase with leverage (Kraus and Litzenberger, 1973), being more relevant for higher debt levels, where the mentioned costs increase more rapidly than the tax benefit of debt. Furthermore, while at a low level of leverage an increase in debt reduces agency conflicts between shareholders and managers, at higher levels it can cause agency conflicts between shareholders and creditors, which may prevent the firm to invest in projects with positive net present value (NPV), originating the so-called underinvestment problem (Jensen and Meckling, 1976; Myers, 1977). Thus, a negative effect of debt on firm profitability can be also explained by theory and in fact was observed in several empirical studies (e.g. Dawar, 2014; Le and Phan, 2017; Vithessonthi and Tongurai, 2015; Vo and Ellis, 2017), making difficult to reach consensus on the effect of debt on firm performance.

In order to accommodate both the negative and positive effects of debt on firm performance predicted by theory, Margaritis and Psillaki (2010) specify a regression model including both the debt ratio and its square as explanatory variables. However, using a sample of French firms, they found that leverage has a positive impact on firm's over the entire relevant range of leverage values. From these results, and the underlying theories, we should infer that adopting a zero-leverage policy should decrease firm's performance. Next, we argue that may not be the case and formulate some research hypotheses to be tested in the empirical part of the paper.

2.2. Research hypotheses

2.2.1. Zero leverage and firm's performance

Since classical theories of capital structure are not able to explain the zero-leverage phenomenon, new theories have been formulated to describe it. One of those theories is the financial flexibility approach, according to which firms may deliberately adopt zero-leverage policies to build up a financial slack and keep their borrowing capacity to invest when good investment opportunities arrive or to answer opportunely to unexpected changes on the firm's activity (Bessler et al., 2013; Dang, 2013). Survey evidence confirms the prominent role that financial managers attribute to financial flexibility in their decisions related to firm's capital structure (Bancel and Mittoo, 2004; Brounen et al., 2006), revealing for example that credit lines are reduced to maintain firm's debt capacity to turn to credit only when entirely necessary.

Since zero-leverage firms keep the real option to lever up in the future, Lotfaliei (2018) argues that firms do not lose value by remaining debt-free, quite the contrary. Another sign of the possible positive effect of zero leverage on firm's performance is given by studies analysing the stock returns of zero-leverage firms. For example, Zaher (2010) shows that investing in portfolios of debt-free firms tends to generate higher returns for investors and Lee and Moon (2011) and Moon et al. (2015) find that zero-leverage firms generate positive abnormal returns in the long run regardless of the level of debt capacity.

Based on these arguments, we hypothesise that, as implicitly suggested by the financial flexibility theory, firm's financial performance may be positively influenced by zero-debt policies. Hence, we formulate the following hypothesis:
H1: Zero leverage increases firm's financial performance.

2.2.2. Zero leverage and firm's performance during the 2008 global financial crisis

Economic cycles are an important determinant of both firm's financial performance and default risk (Cook and Tang, 2010), which also affects the firm's capital structure (Azofra, Rodríguez-Sanz, and Velasco, 2020). Recessionary periods such as the 2008 global financial and economic crisis reduce consumer confidence and the levels of consumption, eventually resulting in firm's losses (Ivashina and Scharfstein, 2010) and higher financial distress levels and bankruptcy risks (Kahle and Stulz, 2013). Due to the greatest default risk and information asymmetries observed during adverse macroeconomic shocks, raising (or paying) external finance becomes more expensive (Hackbarth et al., 2006). Thus, firms that were already dependent on debt are expected to be particularly affected by the increased interest rates demanded by creditors and may be forced to forego investment opportunities, which contributes to decrease their financial performance during crisis periods.

Conversely, the performance of zero-leverage firms is expected to be less affected by macroeconomic shocks. On the one hand, even if they needed to resort to external financing during the crisis period, zero-leverage firms would start in a much better position to raise debt. On the other hand, as implied by the financial flexibility theory, the financial slack of debt-free firms may allow them to invest during recessions using only internal sources of financing. Supporting this conjecture that zero-leverage firms perform better than their leveraged counterparts during periods of macroeconomic uncertainty, Arslan-Ayaydin et al. (2014) shows that firms that created a financial slack in pre-crisis periods were less affected by crises; and Sanchéz-Vidal et al. (2020) found that financial conservatism fosters job creation during economic crises.

Overall, we think that the positive effect described in hypothesis H1 will be stronger during crisis periods. Thus, we formulate the following hypothesis:

H2: The positive effect of zero leverage on firm's financial performance was stronger during the 2008 financial crisis.

2.2.3. Zero leverage and firm's performance under financial constraints

The previous research hypotheses implicitly assume that firms are debt-free by their own choice. However, sometimes, more than a financial decision of the firm, zero leverage may be the result of an imposition of the lenders, which refuse or impose severe conditions to grant debt to the firm (Diamond, 1991; Stiglitz and Weiss, 1981). This is the main idea of the financial constraints approach, another theory that has emerged as one of the most popular explanations of zero leverage. According to this theory, in the presence of adverse selection and moral hazard problems, obtaining external finance becomes difficult for firms with little reputation or without a favourable past in the credit market, since lenders are not able to properly assess the quality of their assets (Stiglitz and Weiss, 1981). Hence, debt becomes too expensive for those firms, which may have no other choice than remaining debt-free. See *inter alia* Bessler et al. (2013) and Dang (2013) for some empirical evidence on the existence of financially constrained zero-leverage firms.

Unlike financially flexible firms, financially constrained firms are not expected to have a substantial financial slack. Therefore, they may be prevented to invest in projects with positive NPV and forced to bypass good investment opportunities, which will negatively impact their performance (Almeida and Campello, 2007). Thus, we conjecture that the previously hypothesized positive effect of zero leverage on firm's financial performance is not valid when the firm is debt-free due to financial constraints. Hence, we formulate the following hypothesis:

H3: The positive effect of zero leverage on firm's financial performance does not apply to financially constrained firms.

3. Data and methodology

3.1. Sample

To test our hypotheses, we use as main source of information the *DataStream* database, which provides firm's annual reports and other financial and market information relevant to perform the study. Data were collected for listed firms from 14 Western European countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and the UK) over the period ranging

from 2002 to 2016. Using the FTSE/Dow Jones Industry Classification Benchmark (ICB), we excluded firms with an industry code ranging from 7000 to 7999 (Utilities) or 8000 to 8999 (Financials), because those firms face different regulations that affect their capital structure decisions. Firms without an industry code have been also excluded from the sample. We also removed from the sample firm/year observations with missing information for total assets or sales, as well as observations with obvious errors (e.g. non-positive sales or assets) or missing data for any variable used in the econometric models. To be able to test for the absence of second-order serial correlation, an assumption of the method used for estimating the dynamic regression model considered in our analysis, we kept in the sample only firms with at least four consecutive years of complete data (Pindado, Requejo, and de la Torre, 2011). Finally, we allowed firms' entry and exit from the sample to avoid the possible survivorship bias that could arise from considering only successful firms (Munjal, Requejo, and Kundu, 2019).

Our final sample is represented by an unbalanced panel data with 44,995 firm-year observations, corresponding to 4,502 firms.[32] Table 1 presents the distribution of observations and firms and the percentage of debt-free observations by country. Approximately 60% of the observations are relative to France, Germany or UK. Between 2002 and 2016 around 10.9% of firm-year observations are classified as having zero leverage, with debt-free firms being present in all countries, although in an unbalanced way. Indeed, the percentage of zero-leverage firms ranges from 0.46% in Spain to 19.39% in Sweden.

Table 1: Sample characterisation by country
Note: This table summarizes the distribution of firms by country highlighting the number of firms and firm/year observations (#), the correspondent percentage of firm/year observations (%) and the percentage of observations corresponding to zero-leverage firms (% zero-leverage). A firm is classified as zero-leverage if it has no long-term and short-term debt in a given year.

Country	Firms	Firm/year observations		
	#	#	%	% zero-leverage
Austria	72	771	1.71	7.65
Belgium	101	1,114	2.48	4.22
Denmark	125	1,409	3.13	7.31
Finland	128	1,531	3.40	3.72
France	643	6,719	14.93	1.95
Germany	636	6,638	14.75	11.65
Greece	248	2,403	5.34	3.50
Ireland	65	608	1.35	12.50
Italy	228	2,416	5.37	1.37
Netherlands	156	1,583	3.52	6.89
Portugal	48	537	1.19	1.49
Spain	122	1,303	2.90	0.46

[32] Note that because some of the variables used in the right-hand side of the main models use lags, not all observations could be used in model estimation.

Sweden	425	4,075	9.06	19.39
UK	1,505	13,888	30.87	18.79
Total	**4,502**	**44,995**	**100**	**10.86**

3.2 Variables

Table 2 provides a definition of the variables considered in our empirical analysis, namely the dependent, explanatory and control variables used in the main regression models, the categorical variables used to divide the sample in groups of financially constrained and unconstrained firms and the alternative explanatory variables considered in the robustness tests. Following most previous studies investigating the determinants of firm's financial performance, our dependent variable is the firm's Return on Assets (*ROA*) (Davydov, 2016; Le and Phan, 2017; Lindemanis, Loze, and Pajuste, 2020; Munjal et al., 2019). *ROA* is an accounting-based performance measure that, contrary to the also common Return on Equity (*ROE*), is not directly influenced by firm's leverage and hence is a better measure for firm's operational profitability when the aim is to examine the effect of debt on firm's performance.

Table 2: Variables definition
Note: a The longest crisis period is considered only for the following countries: Austria, Belgium, Greece, Ireland, Portugal and Spain. For UK the crisis period is 2008-2011 and for the remaining countries only the 2008-2009 period is considered as a crisis period. See Laeven and Valencia (2018).

Variable	Definition
Dependent variable	
ROA	Ratio of net income to total book assets
Explanatory variables	
ZL	Equals 1 if a firm has both zero short-term debt and zero long-term debt in a given year and is 0 otherwise
Crisis	Equals 1 if the observation corresponds to the years of financial and sovereign debt crises in Europe (the period of crisis goes from 2008 to 2009, 2011 or 2012, depending on the country being considered) and is 0 otherwise (source: Laeven and Valencia, 2018)[a]
Control variables	
Size	Logarithm of total book assets
Tangibility	Ratio of fixed assets to total book assets
Dividend payout	Ratio of common dividend to total book assets
Cash holdings	Ratio of cash and short-term investments to book assets
Sales growth	Sales in t minus sales in t–1 divided by sales in t–1
Capital expenditures	Ratio of capital expenditures to total book assets
Firm risk	The absolute value of the difference between the annual % change in EBITDA and the (time-series) average of this change
Categorical variables	
WW-index	The WW-index is constructed as -0.091*CFlow - 0.062*DIVPOS + 0.021*TLTD - 0.044*LNTA + 0.102*ISG – 0.035*SG, where CFlow=(Net income+Depreciation)/Total assets, DIVPOS is an indicator set to 1 if the firm pays dividends, TLTD=Long term debt/Total assets, LNTA=Size, ISG

	is the average industry sales growth and SG is the firm's sales growth (source: Whited and Wu, 2006). Firms in quintiles 4 and 5 are classified as financially constrained, while those in quintiles 1 and 2 are classified as being unconstrained. To avoid misclassification all firms sorted in quintile 3 are excluded.
SA-index	The Size-Age index is constructed as (– 0.737 * Size) + (0.043 * Size^2) – (0.040 * Age), where Age is the difference between the year of the observation and the first date that the firm appears in the *DataStream* database with trading available data and Size is as defined previously (Hadlock and Pierce, 2010). Firms in quintiles 4 and 5 are classified as financially constrained, while those in quintiles 1 and 2 are classified as being unconstrained. To avoid misclassification all firms sorted in quintile 3 are excluded.
Alternative explanatory variables	
ZL3	Equals 1 if a firm has a zero debt during three consecutive years and is 0 otherwise
AZL	Equals 1 if the book leverage ratio is below 5% and is 0 otherwise

Regarding the explanatory variables, to test the effect of firm's debt policy on its performance we consider the dummy variable (*ZL*), which is equal to 1 when the firm's book leverage ratio is zero, i.e. a firm is considered to adopt a zero-leverage policy if both short- and long-term debt are equal to zero in a given year (Strebulaev and Yang, 2013). To examine the moderating role of the 2008 financial crisis on the effect of *ZL* on *ROA*, we use the *Crisis* dummy variable. Recognizing that this crisis in some European countries gave rise to sovereign debt crises, with their effects on economic growth, finance and investment being felt until recently (European Investment Bank, 2015), our definition of *Crisis* considers that the crisis period was extended beyond 2009 in several European countries. Therefore, following the recent classification of Laeven and Valencia (2018) about crises, we assign distinct final years for the crisis in each country (2009, 2011 or 2012).

To examine whether the effects of zero leverage on firm's financial performance are different for financially constrained and unconstrained firms, we divide the sample into two groups of firms using two different indicators of financial constraints: the widely used *WW-index* (Whited and Wu, 2006); and the size and age index *SA-index* (Hadlock and Pierce, 2010).[33] Both indexes are composite measures of financial constraints that aggregate a comprehensive set of firm- and industry-specific characteristics, with a higher (lower) value indicating greater (smaller) financial constraints. To identify the groups of constrained and unconstrained firms, we first calculate quintiles of the cross-sectional distributions of each variable in each year, being the firm assigned to the correspondent quintile. Then, we compute the (rounded) average quintile of a firm over

[33] There are several measures used to separate firms that are suffering from financial constraints from those that are not, but the best measure it is still a matter of debate. We chose two aggregate indexes commonly used in corporate finance literature (Baños-Caballero, García-Teruel, and Martínez-Solano, 2014).

time and assign all its observations to this average quintile. This procedure leads to five groups of firms, but to avoid misclassification firms in quintile 3 are excluded. Firms placed in quintiles 4 and 5 of *WW-index* and *SA-index* are classified as constrained and those in quintiles 1 and 2 as unconstrained.

The econometric models used in this paper also include a set of standard firm-specific control variables commonly found in the literature to be important for explaining firm's financial performance, such as *Size*, *Tangibility*, *Dividend payout*, *Cash holdings*, *Sales growth*, *Capital expenditures* and *Firm risk* (Davydov, 2016; Jadiyappa, Hickman, Jyothi, Vunyale, and Sireesha, 2020; Le and Phan, 2017; Munjal et al., 2019).

Table 3 presents some descriptive statistics for the dependent and firm-specific explanatory and control variables. During 2002-2016, on average, firms exhibited a ROA of approximately 2.2%, a figure slightly higher than that recently reported (1.06%) by Sardo and Serrasqueiro (2017) also for European countries.

Table 3: Descriptive statistics

Variable	N.obs.	Mean	s.d.	Min.	Median	Max.
ROA	44,995	0.022	0.222	-3.254	0.053	2.466
ZL	44,995	0.109	0.311	0.000	0.000	1.000
Size	44,995	12.036	2.213	4.727	11.839	19.807
Tangibility	44,995	0.237	0.221	0.000	0.173	0.969
Dividend payout	44,995	0.018	0.038	0.000	0.006	0.877
Cash holdings	44,995	0.149	0.164	0.000	0.094	0.959
Sales growth	40,292	0.149	0.741	-1.000	0.048	9.952
Capital expenditures	44,995	0.045	0.056	0.000	0.028	0.757
Firm risk	40,286	1.836	4.988	0.000	0.442	43.850

3.3. Dynamic panel data model specification

The baseline empirical specification of the dynamic panel data model used to test the overall effect of zero leverage on firm's financial performance (hypothesis H1) is the following:

$$ROA_{i,t} = \beta_1 ROA_{i,t-1} + \beta_2 ZL_{i,t} + \phi X_{i,t} + \varepsilon_{i,t} \quad (1)$$

where *i* and *t* index, respectively, the firm and the year, $ROA_{i,t}$ and $ZL_{i,t}$ were defined in Table 1, $X_{i,t}$ is the set of control variables, β and ϕ are the variable coefficients and $\varepsilon_{i,t}$ is the error term. This last term may be split in three components: a time-invariant effect (η_i), a time-specific effect (d_t) and a random disturbance ($\upsilon_{i,t}$).

This baseline model is then extended by adding the dummy variable *Crisis* and the interaction term between *ZL* and *Crisis* to examine whether the effect of zero leverage on firm's financial performance changed during the 2008 crisis (hypothesis H2):

$$ROA_{i,t} = \beta_1 ROA_{i,t-1} + \beta_2 ZL_{i,t} + \beta_3 Crisis_t + \beta_4 ZL_{i,t} * Crisis_t + \phi X_{i,t} + \varepsilon_{i,t} \qquad (2)$$

By estimating model (2) separately for financially constrained and unconstrained firms, we use this specification to also assess whether the effects of zero leverage on firm's performance, both during crisis and non-crisis years, depend on the level of financial constraints faced by firms (hypothesis H3).

All models are estimated using the two-step system GMM (SYS-GMM) estimator (Blundell and Bond, 1998; Roodman, 2009). Similarly to the most common fixed-effects estimators, to avoid biased estimation due to unobserved heterogeneity, the SYS-GMM estimator accounts for time-invariant, individual-specific factors (η_i) that may also explain firm's performance and financing policy but are unobservable to the researcher, including firm (*e.g.* strategy, culture), industry and country-specific characteristics (Pindado et al., 2011). It also accounts for time-variant heterogeneity by adding a set of year dummies to the model, which allows the time-specific effects d_t to be estimated. In addition, and this is its major advantage over standard fixed-effects estimators, SYS-GMM also allows to control for endogeneity and reverse causality concerns, i.e. correlation between the explanatory/control variables and the remaining component of the error term ($v_{i,t}$). To do that, SYS-GMM uses lags of the model endogenous variables as instruments for their value in the current time period. There are other estimators that work in a similar way, but using different combinations of instruments, such as the dynamic IV estimators of Anderson and Hsiao (1981) and the difference GMM estimator of Arellano and Bond (1991), but they often suffer from a weak instruments problem. Here, to avoid endogeneity concerns, we use all firm-specific right hand-side variables in the models lagged from t−1 to t−4 as instruments.

To check for the validity of the models, we first apply Hansen's *J* statistic of overidentifying restrictions to assess whether instruments are valid or not. Then, we use the m_2 statistic (Arellano and Bond, 1991) to test for lack of second order serial correlation, another crucial assumption of the SYS-GMM estimator. Only if the null hypothesis of correct specification is not rejected in both cases can we conclude that SYS-GMM produces valid estimates.

3.4. Propensity score matching

As a robustness test for the effects of zero leverage on firm's financial performance, we use PS methods (Rosenbaum and Rubin, 1983). In our study, zero-leverage firms are the 'treatment' group and leveraged firms the control group and, hence, the PS is the estimated probability of a firm being debt-free. We use a logit model, with *ZL* as dependent variable, to estimate the PS conditional on a set of other firm-specific characteristics, namely the control variables defined in Table 2. Then, two alternative PS methods are considered: matching and use of PS as an additional covariate in the models described in the previous section. Using the first method, we first match each zero-leverage firm with the leveraged firm(s) that display the closest predicted PS(s), and vice-versa. Next, we estimate the performance difference for each match. Finally, we estimate the effect of zero leverage on firm's financial performance by averaging those differences for the whole sample. The second PS method simply adds the estimated PS as an additional covariate in the dynamic panel data regression models.

4. Empirical findings

4.1. The overall effect of zero leverage on firm's performance

Table 4 presents SYS-GMM estimates for the models (1) and (2) described in Section 3.3. For each independent variable, we report the estimated coefficient and the respective heteroscedasticity-robust standard error. Hansen's *J* and the m_2 statistics are presented at the bottom of the table. In both cases, and for both models, the null hypothesis cannot be rejected, suggesting that SYS-GMM produces suitable estimates for both specifications. In addition, all Wald tests of the individual and joint significance of the reported coefficients confirm the ability of the models to explain firm's financial performance. Another sign of the good specification of the models is that the coefficients of all control variables have the expected signs.

Table 4: Effect of zero leverage on firm's performance
Note: The dynamic panel data models are estimated using the system GMM estimator. The dependent variable *ROA* proxies for firm's performance. The list of independent variables is detailed in Table 2. For each independent variable we report the regression coefficients and, in brackets, heteroskedasticity-robust standard errors. m2 is a test for second order serial correlation, asymptotically distributed as N(0,1) under the null of no serial correlation; and Hansen's J is a test of over-identifying restrictions, asymptotically distributed as $\chi 2$ under the null of no correlation between the instruments and the error term (degrees of freedom in parentheses).
***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

Independent variables	(1)	(2)
$ROA_{i,t-1}$	0.266***	0.266***
	(0.0063)	(0.0061)
ZL	0.027***	0.015**
	(0.0082)	(0.0073)
Crisis		-0.031***
		(0.0107)

ZL*Crisis		0.044***
		(0.0121)
Size	0.044***	0.047***
	(0.0024)	(0.0021)
Tangibility	0.050**	0.050**
	(0.0247)	(0.0251)
Dividend payout	0.825***	0.843***
	(0.0482)	(0.0496)
Cash holdings	0.204***	0.207***
	(0.0064)	(0.0064)
Sales growth	0.036***	0.036***
	(0.0019)	(0.0020)
Capital expenditures	0.245***	0.255***
	(0.0268)	(0.0283)
Firm risk	-0.003***	-0.003***
	(0.0005)	(0.0005)
Observations	40,286	40,286
m_2 statistic	1.15	1.21
Hansen's J statistic	267.02 (248)	262.49 (246)
Wald test for joint significance	39413.49***	34532.11***

Column (1) of Table 4 shows that zero-leverage policies have a significant, positive impact on *ROA*, providing empirical support to hypothesis H1. In particular, by adopting a zero-debt policy, *ceteris paribus*, a firm will increase its financial performance by around 2.7pp. This finding confirms that classical theories of capital structure are not appropriate to explain the zero-leverage phenomenon, since *e.g.* zero-debt firms are not losing value by not levering up as postulated by the trade-off theory. This result also does not corroborate empirical studies on firm's performance that show an overall positive effect of debt on firm's performance (Abdullah and Tursoy, 2019; Berger and di Patti, 2006; Margaritis and Psillaki, 2007). In contrast, it validates the arguments of Lotfaliei (2018) that zero-leverage firms do not lose value by remaining debt-free, since they increase their debt capacity and keep the real option to lever up in the future. Our findings also show that the positive abnormal returns in the long run obtained by zero-leverage firms (Lee and Moon 2011; Moon et al., 2015) are supported by a direct, positive effect of zero leverage on firm's financial performance.

To examine whether the effect of zero leverage on firm's financial performance changed during the 2008 financial crisis and test hypothesis H2, the second column of Table 4 reports the results obtained for model (2), which adds the variable *Crisis* and the interaction term *ZL*Crisis*. The results show that the positive effect of zero leverage on firm's performance was stronger in 4.4pp during the crisis period. In fact, *ceteris*

paribus, while outside the crisis period adopting a zero-leverage policy increases performance in 1.5 pp, during the crisis years the performance of zero-leverage firms was superior in 5.9pp relative to their leveraged counterparts[34]. This is a direct consequence of the fact that during the 2008 crisis the performance of leveraged firms deteriorated in 3.1pp, while that of zero-leverage firms did not change significantly[35]. Therefore, as conjectured in Section 2.2.2, the 2008 financial crisis seems to have been more severe for firms dependent on debt, most likely due to the increased interest rates demanded by creditors during this period, which may also have forced them to forego good investment opportunities (Santos, 2011). In contrast, also as hypothesized in Section 2.2.2, the zero-leverage strategy pursued by debt-free firms allowed them to face the unexpected 2008 crisis in a better financial position, since it seems that they were able to use their financial slack and/or borrowing capacity to continue their investment plans. Overall, our findings support Arslan-Ayaydin et al. (2014) claims that firms exhibiting financial flexibility in pre-crisis periods are less affected by crises. It also validates hypothesis H2.

4.2. The role played by financial constraints on the effect of zero leverage on firm's performance

The results for the models that consider only financially constrained zero-leverage and leveraged firms, on the one hand, and unconstrained zero-leverage and leveraged firms, on the other hand, are reported in Table 5. These models are based on partitions of the original sample according with the *WW-index* and the *SA-index*, as explained in Section 3.2. Again, both Hansen's *J* and the m_2 statistics do not detect any sign of misspecification in any of the four estimated models.

Table 5: Effect of zero leverage on firm's performance across different levels of financial constraints
Note: The dynamic panel data models are estimated using the system GMM estimator. The dependent variable *ROA* proxies for firm's performance. Groups of financially constrained and unconstrained firms are created according with the categorical variables WW-index and SA-index defined in Table 2. See Table 4 for the rest of the information needed to read this table.
***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

Independent variables	WW-index		SA-index	
	Constrained firms	Unconstrained firms	Constrained firms	Unconstrained firms
$ROA_{i,t-1}$	0.243***	0.325***	0.233***	0.265***
	(0.0063)	(0.0105)	(0.0159)	(0.0057)
ZL	0.067***	0.019**	0.042***	0.058***
	(0.0057)	(0.0095)	(0.0146)	(0.0069)
Crisis	-0.005	-0.023***	-0.020***	-0.062***
	(0.0189)	(0.0018)	(0.0023)	(0.0045)

[34] The last figure is the sum of the coefficients of the variables *ZL* and *ZL*Crisis*, which is statistically significant at the 1% level.
[35] In the crisis period the performance of zero-leverage firms increased in 1.3pp (sum of the coefficients of the variables *Crisis* and *ZL*Crisis*), but this result is not statistically significant.

ZL*Crisis	-0.001	0.032***	0.049	0.041***
	(0.0188)	(0.0072)	(0.0509)	(0.0070)
Size	0.117***	-0.032***	-0.047***	0.120***
	(0.0064)	(0.0032)	(0.0045)	(0.0017)
Tangibility	-0.050*	-0.072***	-0.186***	-0.187***
	(0.0261)	(0.0204)	(0.0233)	(0.0309)
Dividend payout	0.234***	0.749***	0.905***	0.529***
	(0.0325)	(0.0807)	(0.1174)	(0.0451)
Cash holdings	0.212***	0.038**	-0.042	0.311***
	(0.0113)	(0.0186)	(0.0309)	(0.0057)
Sales growth	0.042***	0.064***	0.051***	0.022***
	(0.0039)	(0.0041)	(0.0036)	(0.0010)
Capital expenditures	0.299***	0.170***	0.407***	-0.122***
	(0.0455)	(0.0369)	(0.0662)	(0.0269)
Firm risk	-0.002***	-0.002***	-0.003***	-0.002***
	(0.0003)	(0.0003)	(0.0007)	(0.0001)
Observations	9,323	14,412	15,896	16,010
m_2 statistic	0.18	0.83	0.93	0.44
Hansen's J statistic	183.83 (232)	252.88 (269)	200.58 (233)	198.11 (242)
Wald test for joint significance	158384.66***	260506.00***	47391.07***	856386.99***

For all models in Table 5, the coefficient of the *ZL* dummy variable is again positive and significant, reinforcing the findings of the previous models and additionally showing that zero leverage positively impacts firm's performance irrespective of whether it faces financial constraints or not, unlike what we conjectured in hypothesis H3. Therefore, it does not matter if zero leverage is the consequence of a financial decision taken by unconstrained firms to build up financial flexibility (Dang, 2013) or it is an imposition of creditors that refuse to grant credit to the firm (Bessler et al., 2013): in both cases the financial performance of the firm is increased by the adopted zero-debt financing policy. Thus, when facing financing constraints, it seems to be more profitable for a firm to pursue a zero-leverage policy than resorting to debt, avoiding the greater compensation and higher interest rates imposed by lenders to offset the risk of granting credit to riskier firms. On the basis of these results, hypothesis H3 is rejected.

Table 5 also shows that, nevertheless, the existence or not of financial constraints is an important factor to take into account when evaluating the effect of zero leverage policies on firm's performance, namely during crisis periods. Indeed, the coefficient of the interaction term *ZL*Crisis* is only significant for the group of unconstrained firms. This means that the previously found stronger positive effect of zero leverage policies during the 2008 global financial is only valid for financially flexible firms. When firms are financially constrained, then the difference in terms of performance between zero-

leverage and leveraged firms is similar across the years and does not change with macroeconomic shocks.

4.3. Alternative measures of financial conservatism

This section examines whether the previous results are robust to the use of alternative measures of financial conservatism. To this end, we re-estimate model (2) of Table 4 and all models of Table 5 using alternative proxies to classify a firm as being financial conservative. First, by replacing *ZL* by the *ZL3* variable, we narrow down the definition of zero-leverage firms to those that have zero debt in at least three consecutive years and investigate the effect of persistent zero-leverage policies (Devos et al., 2012). Then, we do the opposite and use a less stringent definition of financial conservatism than the one implied by *ZL*. In particular, we consider the *AZL* variable and examine whether low-debt levels, not necessarily zero (Strebulaev and Yang, 2013), influence firm's financial performance in the same way as found before. See Table 2 for a full description on the new variables.

Table 6 shows that the overall effect of *ZL3* on firm's financial performance is quite similar to that of the *ZL* variable. As before, we find that (persistent) zero-leverage policies positively impact firm's performance and that this effect was stronger during the crisis period. Moreover, we find again that while the former effect is valid irrespective of the level of financial constraints felt by firms, the latter is observed only for unconstrained firms.

Table 6: Effect of persistent zero-leverage policies on firm's performance
Note: The dynamic panel data models are estimated using the system GMM estimator. The dependent variable *ROA* proxies for firm's performance. The alternative explanatory variable *ZL3* is defined in Table 2. See Table 4 and Table 5 for the rest of the information needed to read this table.
***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

Independent variables	All firms	WW-index		SA-index	
		Constrained firms	Unconstrained firms	Constrained firms	Unconstrained firms
$ROA_{i,t-1}$	0.240***	0.214***	0.345***	0.219***	0.299***
	(0.0065)	(0.0058)	(0.0183)	(0.0176)	(0.0021)
ZL3	0.011**	0.049***	0.071***	0.041**	0.014***
	(0.0052)	(0.0049)	(0.0132)	(0.0152)	(0.0016)
Crisis	-0.030***	-0.007	-0.023***	-0.021***	-0.014***
	(0.0098)	(0.0120)	(0.0054)	(0.0023)	(0.0012)
ZL3*Crisis	0.089***	-0.021	0.029*	0.080	0.068***
	(0.0192)	(0.0352)	(0.0322)	(0.0948)	(0.0032)
Size	0.043***	0.149***	-0.029***	-0.515***	0.071***
	(0.0027)	(0.0074)	(0.0081)	(0.0043)	(0.0004)
Tangibility	0.030	-0.068***	-0.098**	-0.206***	0.021**
	(0.0299)	(0.0240)	(0.0432)	(0.0231)	(0.0100)
Dividend payout	0.806***	-0.417***	0.892***	0.962***	0.222***

	(0.0468)	(0.0850)	(0.0560)	(0.1066)	(0.0159)
Cash holdings	0.242**	0.278***	0.012	-0.034	0.256***
	(0.0082)	(0.0131)	(0.0285)	(0.0319)	(0.0032)
Sales growth	0.025***	0.019***	0.043***	0.053***	0.059***
	(0.0017)	(0.0023)	(0.0049)	(0.0046)	(0.0005)
Capital expenditures	0.269***	0.294***	0.297***	0.436***	-0.106***
	(0.0190)	(0.0214)	(0.0662)	(0.0717)	(0.0080)
Firm risk	-0.003***	-0.002***	-0.003***	0.000	-0.004***
	(0.0005)	(0.0004)	(0.0003)	(0.0005)	(0.0001)
Observations	40,286	9,323	14,412	15,896	16,010
m_2 statistic	0.72	0.22	0.58	1.55	0.53
Hansen's J statistic	249.14 (246)	185.20 (232)	178.38 (224)	194.42 (229)	186.68 (227)
Wald test for joint significance	52762.04***	4842.78***	4522.00***	112744.25***	22959.36***

The results on Table 7 show that our previous findings are also robust to the inclusion of firms with low, but not zero, leverage in the definition of financial conservatism.

Table 7: Effect of low leverage on firm's performance
Note: The dynamic panel data models are estimated using the system GMM estimator. The dependent variable *ROA* proxies for firm's performance. The alternative explanatory variable *AZL* is defined in Table 2. Refer to Table 4 and 5 for the rest of the information needed to read this table.
***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

Independent variables	All firms	WW-index		SA-index	
		Constrained firms	Unconstrained firms	Constrained firms	Unconstrained firms
$ROA_{i,t-1}$	0.255***	0.219***	0.302***	0.250***	0.252***
	(0.0062)	(0.0057)	(0.0128)	(0.0165)	(0.0060)
AZL	0.026***	0.087***	0.018***	0.043***	0.015***
	(0.0038)	(0.0138)	(0.0057)	(0.0072)	(0.0038)
Crisis	-0.034***	-0.018	-0.026***	-0.028***	-0.059***
	(0.0102)	(0.0151)	(0.0020)	(0.0079)	(0.0045)
AZL*Crisis	0.043***	0.003	0.026***	-0.003	0.077***
	(0.0090)	(0.0074)	(0.0091)	(0.0115)	(0.0063)
Size	0.050***	0.148***	-0.034***	-0.031***	0.110***
	(0.0026)	(0.0068)	(0.0033)	(0.0068)	(0.0012)
Tangibility	-0.026	-0.077***	-0.142***	0.020	-0.214***
	(0.0224)	(0.0224)	(0.0234)	(0.0251)	(0.0280)
Dividend payout	0.818***	-0.293***	0.649***	0.802***	-0.046
	(0.0616)	(0.1032)	(0.0858)	(0.1436)	(0.0645)
Cash holdings	0.195***	0.240***	0.017	0.096***	0.297***
	(0.0058)	(0.0216)	(0.0207)	(0.0218)	(0.0076)
Sales growth	0.033***	0.003	0.060***	0.011***	0.023***
	(0.0017)	(0.0042)	(0.0040)	(0.0035)	(0.0013)
Capital expenditures	0.409***	0.253***	0.303***	0.204***	-0.131***
	(0.0328)	(0.0420)	(0.0585)	(0.0710)	(0.0248)
Firm risk	-0.004***	-0.004***	-0.002***	-0.003***	-0.003***
	(0.0006)	(0.0006)	(0.0003)	(0.0009)	(0.0003)
Observations	40,286	9,323	14,412	15,896	16,010

m_2 statistic	0.78	0.08	0.58	1.42	0.55
Hansen's J statistic	244.42 (247)	176.38 (232)	245.13 (242)	181.22 (220)	200.33 (230)
Wald test for joint significance	79283.51***	5053.56***	186435.33***	3009.24***	494701.20***

4.4. Propensity score analysis

In addition to the panel data regression models that we used to estimate the effects of zero leverage on firm's performance, we also applied PS methods, which have the advantage of accounting for sample selection effects. As described in Section 3.4, we considered two alternative techniques: a dynamic panel data regression model with the PS added as additional control variable; and PS matching. Because the latter method does not involve the estimation of any regression coefficient, giving direct predictions for the effect of zero leverage, in Table 8 we report only those predictions for both models. We compute effects separately for all firms, financially constrained firms and financially unconstrained firms; and for the whole period in analysis, the crisis years and the non-crisis years. For comparison purposes, Table 8 also reports the results obtained for the standard dynamic panel data models estimated in the previous sections, which were presented in, or can be calculated from, Table 4 and Table 5. For example, when considering all firms, the effect of zero leverage on firm's performance is given by; for the whole period, the coefficient of the *ZL* variable in column (1) of Table 4; for the non-crisis years, the coefficient of the same variable in column (2) of Table 4; and for the crisis years, the sum of the coefficients of the *ZL* and *ZL*Crisis* variables in column (2) of Table 4. A similar reasoning can be applied to the case of financially constrained and unconstrained firms (based on the results in Table 5) and also to compute the effects for the regression model where the PS is added as an additional control variable.

Table 8: Effect of zero leverage on firm's performance: propensity score estimates
Note: The results of dynamic panel data models are those estimated in the previous sections and are used for comparison purposes. The dynamic panel data model with PS as added variable includes the PS score as explanatory variable. In both cases the system GMM estimator was used. PS matching uses robust standard errors based on the correction by Abadie and Imbens (2016) and are reported in parenthesis. The dependent variable *ROA* proxies for firm's performance. Refer to Table 4 and 5 for the rest of the information needed to read this table.
***,**,* indicates statistical significance at 1%, 5% and 10% respectively.

Dynamic	All firms	WW-index		SA-index	
		Constrained firms	Unconstrained firms	Constrained firms	Unconstrained firms
Panel A: All years					
Dynamic panel data model	0.027***	0.063***	0.039***	0.020**	0.059***
	(0.0082)	(0.0059)	(0.0060)	(0.0099)	(0.0043)
Dynamic panel data model with PS as added variable	0.038***	0.071***	0.034**	0.054**	0.065***
	(0.0088)	(0.0069)	(0.0147)	(0.0220)	(0.0050)
PS matching	0.042***	0.034***	0.051***	0.045***	0.036***

	(0.0059)	(0.0088)	(0.0100)	(0.0123)	(0.0067)
Panel B: Non-crisis years					
Dynamic panel data model	0.015**	0.067***	0.019**	0.042***	0.058***
	(0.0073)	(0.0057)	(0.0095)	(0.0146)	(0.0069)
Dynamic panel data model with PS as added variable	0.024***	0.067***	0.032***	0.050***	0.047***
	(0.0082)	(0.0066)	(0.0105)	(0.0165)	(0.0069)
PS matching	0.040***	0.026**	0.056***	0.042***	0.034***
	(0.0087)	(0.0120)	(0.0098)	(0.0102)	(0.0077)
Panel C: Crisis years					
Dynamic panel data model	0.059***	0.066***	0.051***	0.091*	0.099***
	(0.0142)	(0.0181)	(0.0131)	(0.0514)	(0.0098)
Dynamic panel data model with PS as added variable	0.079***	0.078***	0.074***	0.069	0.094***
	(0.0147)	(0.0173)	(0.0132)	(0.0582)	(0.0106)
PS matching	0.061***	0.044**	0.039**	0.059**	0.067***
	(0.0170)	(0.0179)	(0.0166)	(0.0275)	(0.0127)

Table 8 shows that the effects of zero leverage on firm's performance are positive and statistically significant in 44 out of the 45 estimated models. Thus, clearly, our previous findings on that relationship are validated by the PS analysis. On average, considering all years, the positive effect of zero leverage on firm's performance is predicted to be between 2.7 and 4.2 percentage points (pp). For financially unconstrained firms the estimated effect is in the range 3.4-6.5pp, while for constrained firms is between 2.0-7.1pp. Hence, once again, hypothesis H1 is validated and hypothesis H3 refuted.

Regarding hypothesis H2, considering all firms, it is predicted that zero leverage increased significantly firm's performance in 1.5-4.0pp in the non-crisis years and 5.9-7.9pp during the 2008 crisis. Thus, it seems that, as found before, the positive effect of zero leverage on firm's performance was stronger during the crisis period, as conjectured by hypothesis H2.

The predictions for the non-crisis and crisis years for financially unconstrained firms are 1.9-5.8pp and 3.9-9.9pp, respectively; and for constrained firms 2.6-6.7pp and 4.4-9.1pp, respectively. Unlike the case of the full sample, now it is not so clear how the 2008 crisis impacted the effect of zero leverage on firm's performance. In particular, we need to examine whether the differences found for each group across periods are statistically significant. To this end, in Figure 1 and 2 we plot 95% confidence intervals for the predicted effects, in order to check if the intervals estimated for one period include the point estimates of the other, and vice-versa. If not, then we may conclude that the differences are significant.[36]

[36] For simplicity, only the results based on the SA-index are plotted, but considering the WW-index would lead to similar conclusions.

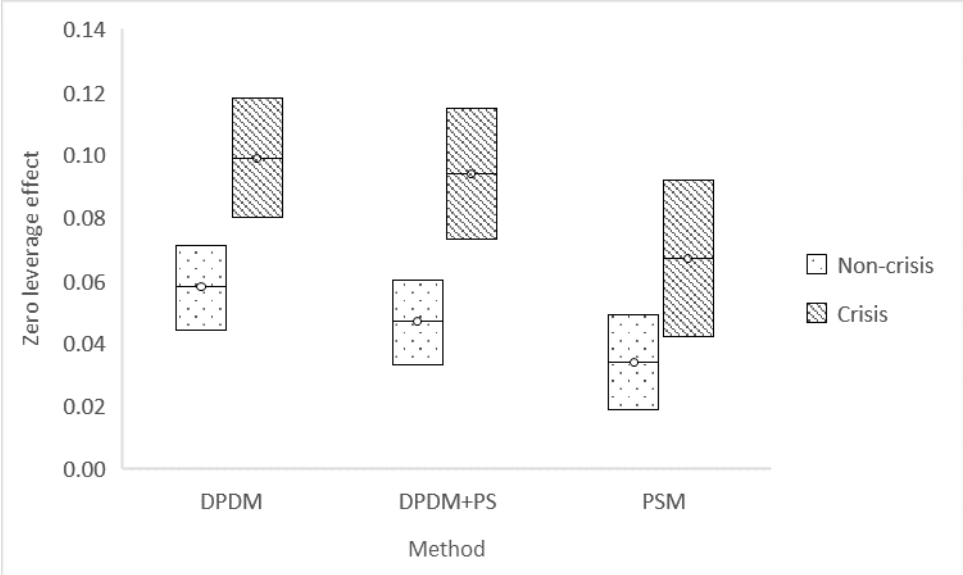

Figure 1: Effect of zero leverage on firm's performance (point estimates and 95% confidence intervals) – Financially unconstrained firms based on the SA-index

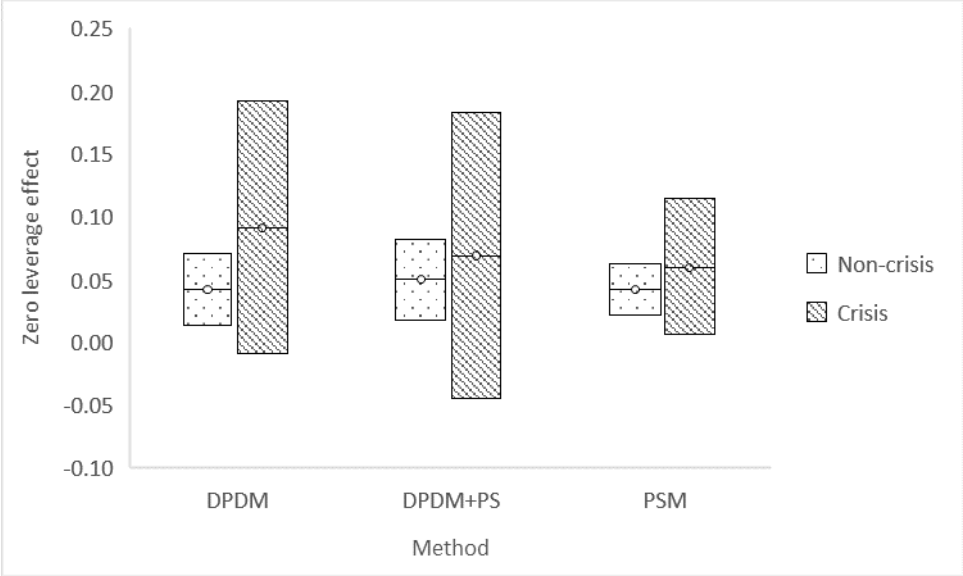

Figure 2: Effect of zero leverage on firm's performance (point estimates and 95% confidence intervals) – Financially constrained firms based on the SA-index

Figure 1 shows clearly that for financially unconstrained firms the effect of zero leverage on firm's performance was significantly higher during the 2008 crisis, since in no case the point estimate of the effect produced by one method for one the periods is covered by the confidence interval estimated for the other period. The opposite happens with financially constrained firms (in 5 out of 6 cases), as shown by Figure 2, which confirms our previous findings that for these firms the difference in terms of performance between zero-leverage and leveraged firms does not change with macroeconomic shocks.

5. Conclusion

This paper examines the financial performance of zero-leverage firms, discussing how extremely conservative financing policies affect firm's performance. To perform this research, we used a sample of 4,502 European listed firms over the period between 2002 and 2016, where more than 10% of the observations correspond to debt-free firms. Using dynamic panel data models and PS methods, we found that zero-leverage policies significantly increase the firm's financial performance and that this effect was stronger during the 2008 global financial crisis. Overall, the performance of zero-leverage firms is predicted to be 2.7 and 4.2pp superior to that of leveraged firms. During the crisis period, using zero-debt policies increased the firm's performance in 5.9-7.9pp, while in other years the positive effect of zero leverage was estimated to be between 1.5 and 4.0pp.

Zero leverage may be a financial decision taken by the firm or an imposition of creditors that refuse to grant credit to the firm. We found that the positive impact of zero debt on firm's performance is valid for both financially unconstrained and constrained firms. However, the estimated stronger positive effect of zero leverage on firm's performance during crisis periods only holds for the former group of firms, with the performance gap between zero-leverage and leveraged financially constrained firms being similar over the whole sample period.

Our findings contradict the most established capital structure theories, which claim that, given its benefits, debt rises firm performance. Thus, such theories do not seem suitable to explain the performance of zero-leverage firms. However, there are many possible explanations for the superior performance of zero-leverage firms. By remaining debt-free due to their own decisions, financially flexible firms are able to keep their borrowing capacity to invest when good investment opportunities arise. They will be also better prepared to answer opportunely to unexpected changes on their activity and to face negative economic cycles. Moreover, when firms are financially constrained, remaining debt free, and because of that possibly being forced to bypass some investment opportunities, seems to be a better option than paying the greater compensations demanded by lenders to accept granting credit to them. Therefore, in a sense, a financially constrained firm is often a zero-leverage firm also by choice. Overall, our results implicitly suggest that one of the main reasons for firms adopting a zero-leverage policy may be the consequent expected better financial performance, a hypothesis that has not been considered previously in the capital structure literature, to the best of our knowledge.

Beyond the theoretical contributions, our paper also has some interesting implications for practitioners, managers and government entities. The high dependence on external

financing of European firms led to the harmful consequences of the financial crisis that emerged in 2008, which triggered a wave of bankruptcies that originated high unemployment rates, especially in peripheral countries where firms are most dependent on debt such as Greece, Italy, Portugal and Spain. By showing that debt-free firms can overcome macroeconomic shocks in a better financial position than firms relying on debt, our results suggest that governmental entities should actively delineate policies and incentives to reduce the dependence of firms on external financing. They also clearly show to managers that they will be more likely to keep investments and the competitiveness of their firms if they opt for low-leverage policies.

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CHAPTER 8

Conclusions and practical implications

1. Conclusion

This Ph.D. thesis examined the zero-leverage phenomenon, analysing the motives that guide a firm to be debt-free and the outcomes obtained by following such a financing policy. Zero leverage is a financing policy followed by many firms, with the number of debt-free firms increasing over the years. Despite debt-free firms being present in all European countries composing our sample, their prevalence and growing trend is very heterogeneous among countries. Using countries' financial system to represent this heterogeneity, it is shown that the presence of debt-free firms and the upward trend for firms following these extremely conservative financing policies is much more relevant in market-based countries.

According to the results of the first empirical paper (CHAPTER 3), we find that there are two types of zero-leverage firms: financially constrained firms that are unable to get any funding; and financially unconstrained firms, which maintain zero leverage by choice. Also, the European financial and sovereign debt crises increased the propensity for firms having zero leverage only in market-based countries, since no significant changes occurred in bank-based countries. Moreover, the relevance of the financial flexibility hypothesis for firms having zero leverage is higher in market-based systems and, contrary to what would be expectable, the financial constraints approach did not gain importance with the 2008 crisis.

Results from the second empirical paper (CHAPTER 4) reveal that the impact of country governance mechanisms on zero-leverage firms differs across financial systems, with stronger national governance mechanisms increasing (decreasing) the propensity for firms having zero leverage in bank(market)-based countries. Additionally, the firm's ownership concentration only impacts significantly the zero-leverage phenomenon in bank-based countries, while board dimension and independency do not impact it.

Findings from the third empirical paper (CHAPTER 5) show that some variables may influence in opposite directions debt demand and supply. For example, although more

profitable firms have lower propensity to resort to debt by their own decision, it is to these firms that creditors are more willing to grant debt. Therefore, more profitable firms have a higher tendency to be debt-free by their own decision. In addition, there are firm-specific characteristics and time periods that are important to explain firms' demand but not supply of debt, and vice-versa. Tangibility does not affect firms' demand for debt, but creditors are more prone to grant debt to firms with greater asset tangibility, thus decreasing the propensity for zero leverage by creditor-related reasons. The recent European crises reduced the demand for debt but did not affect their supply, increasing the tendency for zero leverage only by firms' own decision. Moreover, firms from a country with a common law system have a greater propensity to adopt zero-leverage policies, by both its own financial decision and creditor imposition.

Regarding the fourth empirical paper (CHAPTER 6), we find that the firm's financial policy is an important source of speed of adjustment heterogeneity. In particular, zero-leverage firms adjust to a target level of debt but present an annual speed of adjustment significantly slower than the exhibited by leveraged firms, which confirms that both group of firms follow the predictions of dynamic trade-off theory. Additionally, we find that the influence of firms' debt policy on capital structure speed of adjustment changes with different financial systems, macroeconomic conditions and financial constraints levels. For example, the difference in speed of adjustment estimates between zero-leverage and leveraged firms is only significant when firms are financially unconstrained, which shows that the key point in this analysis is whether zero leverage is a choice of the firm or an imposition of the market. Moreover, both zero-leverage and leveraged firms present a greater speed of adjustment in market-based financial systems, however, not all firms from market-based systems adjust faster than firms from bank-based systems, since zero-leverage firms from the former countries adjust more slowly than leveraged firms from bank-based countries. Finally, this study reveals that zero-leverage firms increased significantly their speed of adjustment during the 2008 financial crisis, which even exceeded, and by a large margin, the speed of adjustment of leveraged firms.

According to the results of the fifth empirical paper (CHAPTER 7), zero-leverage policies significantly increase the firm's financial performance, and this effect was stronger during the 2008 global financial crisis. Overall, the performance of zero-leverage firms is predicted to be 2.7 and 4.2pp superior to that of leveraged firms. During the crisis period, using zero-debt policies increased the firm's performance in 5.9-7.9pp, while in other years the positive effect of zero leverage was estimated to be between 1.5 and 4.0pp. Furthermore, the positive impact of zero debt on firm's performance is valid for both financially unconstrained and constrained firms. However, the estimated stronger

positive effect of zero leverage on firm's performance during crisis periods only holds for the group of financially unconstrained firms.

2. Practical implications

Several practical implications of results from this Ph.D. thesis can be derived. For managers we present evidence that the extremely conservative financing policy that more and more firms have adopted during the most recent years can ultimately be used to improve firm's financial performance. This policy may be the result of creditors' impositions or a firm's own financing decision. For managers wishing to adopt zero-leverage policies we show that firm-specific characteristics such as higher profitability and liquidity, good growth prospects and high dividend payouts enables them to follow such a financing policy. Moreover, the presence of the firm in market-based countries, with a more developed capital market and a strong level of protection to minority shareholders, smooth the adoption of zero leverage by manager's decision. Also, negative macroeconomic shocks, such the 2008 global financial crisis, favour the firm's managers to follow zero-leverage policies. However, when this policy is not a financing decision, but instead it is a consequence of creditor's that do not want to grant credit to the firm, it is important for firms to develop closer ties with banks and/or to focus on the constitution of a financial slack that could prepare them better for periods of uncertainty and would result in a greater willingness of creditors to make credit available in better conditions.

Furthermore, the use of zero-leverage policies allows firms' managers to quickly adjust to target debt ratios when deviation costs turn to be more aggressive, such in periods of uncertainty as the 2008 global financial crisis. These results convey signals that conservative debt policies may better prepare firms for periods of crisis. This assertion is confirmed by the positive impact of zero-leverage policies on firm's performance, being this impact boosted during the recent 2008 global financial crisis.

As zero-leverage policies may also be a consequence of entrenched managers, for small investors, particularly those from bank-based countries, this study suggests that investing in firms with a concentrated ownership assures a lower propensity for the firm's manager to adopt zero-leverage policies by entrenched reasons.

By showing that debt-free firms can overcome macroeconomic shocks in a better financial position than firms relying on debt, for governmental entities this study suggests that they should actively delineate policies and incentives to reduce the dependence of firms on external financing. Such a decision would help to smooth the harmful consequences of the financial crisis that emerged in 2008, which triggered a

wave of bankruptcies that originated high unemployment rates, especially in peripheral countries where firms are mostly dependent on debt such as Greece, Italy, Portugal and Spain.