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Board of directors' composition and capital structure

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Abstract

The present study empirically analyses the association between board of directors' composition and capital structure. Particularly, the fraction of independent directors on the board, the fraction of female directors, the board size, and whether the Chief Executive Officer (CEO) is also the chairman of the board are analysed. Consistent with the pecking order theory of Myers (1984) and Myers and Majluf (1984) the results provide strong evidence that firms with a larger fraction of independent directors on the board have a capital structure composed with more external capital when compared with retained earnings; have more short term debt in relation with retained earnings; have more long term debt compared with short term debt; and have more external equity than long term debt. The results also provide some evidence that a more gender diversified board of directors and where the chairman is non-executive (i.e. the CEO is a different person from that of the chairman) can improve the board of directors' independence and efficiency and therefore lead the firm to have a capital structure composed with more long term sources of financing.

Keywords: board of directors; independent directors; corporate governance; capital structure.

JEL Codes: G32; G38

1. Introduction

Since the Modigliani and Miller (1958) seminal paper that many studies attempt to explain the capital structure used by corporations to finance their investments. One prominent line of research is the pecking order theory of Myers (1984) and Myers and Majluf (1984). This theory argues that because of adverse selection costs, firms have an order of preference in the use of their financing sources. The theory predicts that firms prefer to use retained earnings over debt, short-term debt over long-term debt and debt over equity. This pecking order arises from information asymmetries between managers and outside investors.

This study builds on the pecking order theory and analyses the effect of the board of directors' composition on the structure of the firm's financing sources. We conjecture that a more independent and effective board of directors increases the quality and quantity of information provided by insiders to the public and therefore reduce the adverse selection costs considered by the pecking order theory. To test this hypothesis we analyse the effect of the board of directors' features on the structure of the different sources of financing. That is, the research question here addressed asks whether the board of directors' composition has an influence on the structure of financing sources.

Given that less information asymmetry leads to less use of retained earnings, the impact of having a more independent board on the use of equity can be difficult to assess, since retained earnings is part of the firm's equity. To address this problem the present study analyses the effect of board composition on external equity and internal generated equity (i.e. retained earnings). Further, since the pecking order predicts that if debt capital is needed firms should use short term debt rather than long term we segregate the firm sources of financing into retained earnings, short term debt and long

term debt. We then analyse the association between board of directors' composition and the structure of each one of these financing sources.

After controlling for a wide set of control variables, the results of the empirical investigation support the proposed hypotheses. Particularly, it is found that the fraction of independent directors on the board is positively associated with the fraction of external financing. Moreover, the board of directors' independence is also positively associated with a debt structure composed with more long term debt than short term debt. Furthermore, firms with more independent directors have a capital structure composed with more external equity than long term debt. The results also provide some evidence that a more gender-diversified board of directors and where the chairman is non-executive can lead the firm to have a capital structure composed with more long term sources of financing. These results are robust to a number of specifications and robustness tests.

This study extends the empirical work on the effect of corporate governance on capital structure in three main ways. First, the present study focus on particular attributes of the board of directors structure, namely the total number of independent directors, the fraction of female directors, the board size and if the Chief Executive Officer (CEO) is also the chairman of the board of directors. This focused analysis is important because many of the aggregated indices may include governance devices that are both beneficial to shareholders and to the bondholders as is the case of the antitakeover devices (Bradley and Chen, 2011). Second, since the pecking order theory have different empirical implications in regard to different types of financing sources, this study analyses the effect of board structure on the fraction of retained earnings, external equity, short-term debt and long-term debt. Finally, this study provides new

insights on the determinants of capital structure and adds to the discussion over capital structure theories.

The remaining of the paper is organized as follows. In the next section the capital structure literature and the literature addressing the effect of board composition on capital structure is reviewed and the main hypotheses developed. In section 3 the data and the methodology is presented. The results are presented and discussed in section 4 and section 5 concludes with policy implications of the findings.

2. Literature review and hypotheses development

In this section we briefly review the main theoretical theories and previous empirical studies relating to capital structure and corporate governance. These theoretical and empirical studies will then be used to frame the hypotheses stated subsequently.

2.1. Literature review

Capital structure theory can be divided in two main lines of thought: (1) the trade-off theory and the (2) pecking-order theory. Although not contrasting, these theories can predict different management behaviours in relation to financing choices, particularly, in relation to the effect of board of directors' composition on those choices. Since these theories are commonly discussed in the corporate finance literature, we will be brief on the exposition. For a thorough and relative recent theoretical and empirical discussion of both the trade-off and the pecking order theories refer to Myers (2003) and Frank and Goyal (2008).

2.1.1. Trade-off theory

The trade-off theory suggests that firms will target for an optimal level of mix between equity and debt that maximizes the difference between the benefits and costs of issuing debt. The benefit of debt is the tax advantage of interest payments to debt holders (Modigliani and Miller, 1963; Miller, 1977). Since interest is tax deductible, firms have incentives to use more debt. The costs of debt are generally described as financial distressed costs. These costs include the costs of bankruptcy (Kraus and Litzenberger, 1973) and agency costs of financial distress (Jensen and Meckling, 1976).

The costs of bankruptcy include the direct costs (e.g. legal and administrative expenses) and the indirect costs of bankruptcy. These indirect costs are characterized by the reduction in value of the firm assets over the bankruptcy process (e.g. loss of business with clients that demand guaranties of business continuity from their suppliers). Beyond these bankruptcy costs, the costs that arise from the conflicts of interest between equity holders and debt holders must also be taken into account in this trade-off theory. As Jensen and Meckling (1976) show, managers can change the riskiness of their investments after issuing debt. Motivated by the fact that equity can be viewed as a call option, in which its value appreciates as the risk of the underlying asset increases (Merton, 1973), managers acting on the interest of equity holders can be tempted to shift the risk of their operations at the cost of the creditors. This behaviour is often labelled as “the asset substitution problem”. Notwithstanding, rational debt holders are aware of that possibility and therefore, write debt contracts (including monitoring devices) to prevent managers to shift the firms’ assets risk and/or demand higher premiums for buying debt. In either case, as shown by Jensen and Meckling (1976), the entire costs are incurred by the shareholders and the more debt the firm uses the higher the likelihood of incurring financial distress costs. The trade-off theory then

argues that firms will aim at some target level leverage so that the firm value is maximized (i.e. where the marginal costs of debt use match the marginal benefits).

2.1.2. Pecking order theory

The pecking order theory of Myers and Majluf (1984) and Myers (1984) argue that because of adverse selection costs, firms have an order of preference in the use of their financing sources. The theory builds on asymmetric information problems between managers and outside investors. Since managers know more about the company prospects than outside investors, when facing new valuable investment opportunities managers may pass them up if external financing is needed. The rational for this behaviour is that investors (who have less information than managers) infer the true value of the firm from the manager willingness to issue equity. Investors interpret a new equity issue rationally and read it as bad news and only accept to buy new equity at a discount price. Because issuing new equity at lower prices might transfer value from current shareholders to new shareholders managers do not issue new equity and pass up an investment opportunity that would increase the firm value.

In this scope (where internal agents know more about the firm than do outsiders) internal financing sources allow managers to always go ahead with new valuable investment opportunities. Further, if debt is available and risk free, than it can also be used. If debt is available and risky, then Myers (1984) argues intuitively that it is preferable to equity, since it is less sensible to adverse selection costs. In other words, the adverse selection premium demanded by investors is lower for less risky securities. Therefore, because of these information asymmetries, the pecking order theory predicts that if capital is needed for new investment opportunities firms prefer to use retained earnings over debt, short-term debt over long-term debt and debt over equity.

One key difference between the pecking order theory and the trade-off theory is that in the most extreme interpretation of the pecking order theory managers do not have a well-defined target leverage ratio, while in the trade-off theory it is predicted that management will issue debt or equity towards a target leverage ratio (Myers, 1984). A critique that is often pointed to the pecking order theory is that in its most extreme interpretation companies should never issue equity, provided that it is always possible to issue debt. Pecking order advocates then argue that because firms have some limit debt capacity, the debt capacity serves to limit the amount of debt within the pecking order and in fact allows for the use of equity (Lemmon and Zender, 2010). Although, neither the trade-off theory or the pecking order theory can explain all the stylized facts encountered in the real life (Frank and Goyal, 2008, 2009), empirical literature has frequently documented that managers behave like the pecking order theory predicts, even if they have in mind some sort of flexible target leverage ratio (e.g. Pinegar and Wilbricht (1989); Shyam-Sunder and Myers, 1999; Fama and French, 2002; Brounen et al., 2006; Lemmon and Zender, 2010).

2.1.3. Other capital structure theories

Although the trade-off and the pecking order are the main theories explaining how firms choose their financing structures, other forces can influence that structure. Jensen (1986) posits that the use of debt can mitigate the agency costs that arise from conflicts of interest between managers and shareholders. The intuition is that managers of firms that generate substantial cash-flows are more likely to be entrenched, tempted to overinvest and consume perquisites. The use of debt ties managers to pay out future cash flows, reducing the cash flow available for spending at their discretion and increases organizational efficiency. As such, in line with the trade-off theory, debt has this additional benefit: reducing agency costs between managers and equity holders. In a

different line, Baker and Wurgler (2002) argue that firms decide whether to issue equity or repurchase it depending on equity market values, creating what it is commonly labelled as the market timing hypothesis. Alti (2006) tested this market timing hypothesis and found that the negative effect of timing equity issues on financial leverage quickly reverses. This reversion happens because it is likely that when issuing overvalued equity it is also likely that debt is also overvalued and firms issue more debt.

2.1.4. Institutional environment and capital structure

There are several strands in the corporate finance literature that relates institutional factors to capital structure. One major line of research focuses on the institutional aspects of governance and capital structure (e.g. La Porta et al., 1997, 1998; Aggarwal Goodell 2010, 2011, 2014a,b; Antonczyk and Salzmann, 2014; Arosa et al., 2014; Baxamusa and Jalal, 2014). La Porta et al. (1997, 1998) strongly suggest that legal environment plays a decisive role in the development of capital markets, shareholders' rights, and creditors' rights and therefore firms' financing choices are largely affected by this environment. Aggarwal and Goodell (2010) empirically investigate how cultural characteristics of a country affect many aspects of financial market development and thus firm financing preferences. These authors analyse 19 countries in Europe and find that institutional and cultural features, such as power distance, lower levels of uncertainty avoidance, higher concentration in equity markets, and the adoption of the euro are associated with a greater predilection for market financing. Within this institutional framework, Aggarwal and Goodell (2010, 2011) suggest that demand for equity is higher in countries with better control of corruption and higher regulatory quality. Other countries' cultural dimensions, such as uncertainty avoidance and power distance, also play a role in the capital structure debate (Aggarwal and Goodell 2014b; Arosa et al., 2014; Antonczyk and Salzmann, 2014). Gungoraydinoglu and Oztekin

(2011) argue that the capital structure of a firm is not only the outcome of its own characteristics but also the result of its environment and traditions in which it operates. In the same line of reasoning, Fan et al. (2012) and Alves and Francisco (2015) conclude that country specific variables related with the economic environment, financial development and business environment are important determinants of firms' capital structure. Antoniou et al. (2008) analyse how firms' capital structure differ in capital market oriented economies (the United Kingdom and the United States) and bank oriented economies (France, Germany and Japan) and find that the impact of firm specific factors on firm's leverage ratio is influenced by corporate governance practices, tax systems, the role of capital markets, corporate and banking relations and investor protection of the country in which the firm operates. In a similar scope, De Jong et al. (2008), also find that institutional differences in countries affect the relationship between firm-specific factors and firm's capital structure.

More related to the present study, Aggarwal and Goodell (2014a) provide strong evidence that access to financing is positively associated with better investor protection and argue that firms' choice of financing will reflect actual and perceived transactions costs of resolving asymmetric information. Along the same line of thought, O'Connor (2012) argues that transparent and well-governed firms get the greatest gains from financial liberalization and therefore should have a higher "investable premium".

Another line of research has focused on the relation between firm specific corporate governance metrics and the use of total equity versus total debt. John and Litov (2010) and Jiraporn et al. (2012) are two examples of this approach. These two studies find that firms whose managers are more entrenched (with poor governance mechanisms) are significantly more leveraged. These authors then argue that debt and governance play the same role and may substitute for each other. Contrasting with these

results, Harford and Zhao (2008), using an index of board directors characteristics find that 'stronger' boards (more independent boards) will force the firm to hold more debt and more short-term. Berger et al. (1997) find that firms' leverage levels are lower when CEOs do not face pressure from either ownership and compensation incentives or active monitoring. These authors argue that managers will not issue the optimal amount of debt without pressure from a disciplining force, such as efficient governance mechanisms. Consistent with this argument, Ortiz-Molina (2007) documents that CEO pay-performance sensitivity decreases in firm leverage, suggesting that entrenched managers tend to issue less debt. Mehran (1992) finds that percentage of executives' total compensation in incentive plans, percentage of equity owned by managers, percentage of investment bankers on the board of directors, and percentage of equity owned by large individual investors is associated with higher leverage ratios. Additionally, Ghosh et al. (2011) find that firms with entrenched CEOs use less leverage and shorter maturity debt. They argue that managers acting for their own self-interest / acting on their own behalf will choose lower leverage to reduce liquidity risk and use short maturity debt to preserve their ability to enhance their compensation and reputations by empire building.

A related stream of work analyses the relationship between equity ownership and firms' capital structure. The study of Brailsford et al. (2002) is an example of this approach. These authors document a positive relation between equity blockholders and leverage. Similarly, King and Santor (2008) find that family firms are more leveraged. Céspedes et al. (2010) argues that this relationship may be due to the fact that ownership-concentrated firms avoid issuing equity because they do not want to share control rights. In a similar approach, Setia-Atmaja et al. (2009) analyse family controlled firms and find that these firms have higher debt levels and lower levels of

board independence compared to non-family firms, suggesting that debt is a substitute for independent directors.

Another related stream of literature analyses how corporate governance mechanisms affect firms' debt. Klock et al. (2005), Bradley and Chen (2011), Lorca et al. (2011) and Fields et al. (2012) are some examples of this line of research. Klock et al. (2005) find that antitakeover governance provisions (that provides strongest management rights) lower the cost of debt financing. In other words, there is a positive association between governance quality and the cost of capital. Consistent with this result, Bradley and Chen (2011) argue that managerial self-serving behaviour (entrenchment) may not be detrimental to bondholders as they adopt low-risk, self-serving operating strategies, which coincidentally redound to the benefit of corporate bondholders. Conversely, Lorca et al. (2011) and Fields et al. (2012) find that firms that have higher quality boards (with a greater advisory presence) contribute to a reduction in the agency cost of debt financing. They argue that the board of directors monitoring role leads to a decrease in the opportunistic behaviour of managers and information asymmetry, with the consequent reduction of creditors' perception of likelihood of default in loan repayments, which results in a lower cost of debt. These two contrasting results may be originated from the fact that antitakeover provisions affect the cost of debt in an opposing way to the board of directors' independence and effectiveness effect. Antitakeover provisions are detrimental to equity but beneficial to bond holders (due to the to the coinsurance effect associated with acquisitions (Bradley and Chen, 2011)), whereas board of directors' independence is beneficial to both equity and bondholders (since it reduces information asymmetry (Fields et al. (2012)). Aman and Nguyen, P. (2013), analyse credit ratings of Japanese firms and show that good governance is associated with higher credit ratings suggesting that firms are expected to

benefit from better governance by being able to access funding at a lower cost and in larger amounts. Garvey and Hanka (1999) find that firms protected by antitakeover laws substantially reduce their use of debt, and that unprotected firms do the reverse.

Overall, the literature suggests that capital structure models that ignore governance features are incomplete. We take a step further and analyse the relationship between firm's board of directors' composition and capital structure.

2.2. Hypotheses

Following the pecking order theory it is clear that information asymmetry problems between the firm and capital providers are important determinants of financing choices. Since different funds providers have different access to relevant information about the firm and different ability to monitor firm behaviour, firms care about who provides the funds (MacKie-Mason, 1990). Because information asymmetry between managers and investors increases the difficulty of issuing securities, particularly public equity and debt securities, it creates a natural preference for managers to use internal over external financing.

The pecking order theory predicts that the lower the information asymmetry between management and public investors the less costly is to issue securities. Firms within which information asymmetry is great should use more internal generated funds and if needed issue the less risky securities, such as short-term debt to avoid issuing securities at higher discount, such as long-term debt and/or equity. Among the external financing sources managers would prefer less risky securities, since high risk securities (such as new equity and long term debt), are more sensitive to information asymmetries than the low risk ones such as short-term debt (Myers and Majluf, 1984).

One governance feature that has received major attention from researchers is the board of directors' independence, or in other words, the percentage of directors considered to be outside directors or not related with internal managers (executives) and its effect on reducing agency costs between agents (executive managers) and shareholders (Fama, 1980; Fama and Jensen, 1983; Hermalin and Weisbach, 1998, 2003). Within this scope, several research studies have found that firms with better corporate governance devices have better information disclosures and less information asymmetry problems (e.g. Vafeas, 2000; Klein, 2002; Beekes et al., 2004; Ajinkya et al., 2005; Karamanou and Vafeas, 2005; Cheng and Courtenay, 2006; Petra, 2007; Kanagaretnam et al., 2007; Dimitropoulos and Asteriou, 2010). For example, Ajinkya (2005) finds that firms with more outside directors' issue forecast earnings more frequently, more specific, accurate and less optimistically biased. Similarly, Kanagaretnam et al (2007) report that firms with more independent boards of directors have lower information asymmetry around quarterly earnings announcements. The intuition is that the board of directors is responsible for monitoring the quality of the information contained in financial reports and provided to the shareholders and, therefore boards that do a more effective job of monitoring management enhance the quality and the frequency of public information released by the executive management.

Given these arguments, a more independent and diversified board of directors is expected to decrease information asymmetries between managers and investors and therefore should make it easier to issue external securities and risky securities. The reason is that outside financing requires managers to explain to outside investors the need for the funds and therefore expose themselves to investor monitoring if they want to get best price for the securities. Entrenched and self-serving managers dislike this process and would prefer retained earnings over external financing (Frank and Goyal,

2008). A board of directors composed in such a way that it reduces information asymmetries between managers and potential investors should make it easier to issue external finance, and within this type the more risky securities. In other words, one should see a shift between internal and external financing choices, and from less risky securities (e.g. short-term debt) to more risky securities (e.g. long-term debt and new equity) when the board of directors can act as a mechanism of reducing information asymmetries between insiders and external investors. We therefore expect a positive relationship between the fraction of outsiders and the use of more risky securities in its financing structure.

H1: The greater the firm's proportion of independent directors on its board, the greater the proportion of risky securities on its' capital structure.

There are also several studies that address the effect of gender diversity on the corporate boards' efficiency. Carter et al. (2003, 2010) suggest that board diversity can improve its monitoring efficiency. In a similar view, Kang et al. (2010) find a positive reaction from investors to women director appointments. Adams and Ferreira (2009) document that female directors attend more to the board meetings, which is the primary way by which important monitoring information is gathered, suggesting that gender-diverse boards allocate more effort to monitor the executive directors. Francoeur et al. (2008) suggest that "women (like external shareholders, ethnic minorities, and foreigners) often have a fresh perspective regarding complex issues, and this can help correct informational biases". Also, a recent Finnish study reports that female board members are, compared to their male counterparts, more likely to take active roles on their boards (Virtanen, 2012). Other works indicate that women are more likely to ask questions and debate issues (Bilimoria and Wheeler, 2000; Ingley and Van der Walt, 2003). Furthermore, there is evidence that boards with more women have greater levels

of public disclosure and better oversight of management reporting that enhances earnings quality (Gul et al., 2011; Srindhi et al., 2011). Based on these arguments we expect a more gender diversified board of directors to be more efficient and to contribute to lower information asymmetries and increase the firm proportion of risky securities on its' capital structure.

H2: The greater the firm's proportion of female directors on its board, the greater the proportion of risky securities on its' capital structure.

With respect to board size, its effect on information asymmetry can be ambiguous. Yermack (1996) claim that larger boards are less efficient in monitoring management, arguing that coordination, communication and decision making can be more burdensome in large boards, thus, making the monitoring role of the board less effective. Consistent with this view, Vafeas (2000) and Ahmed et al. (2006) research document that earnings of firms with smaller boards are perceived by investors as being more informative. However, more recently, Coles et al. (2008) provide evidence that complex firms, which have greater advising requirements than simple firms, have larger boards and for these firms board effectiveness is positively associated with its size. Results from Peasnell et al. (2005) reveal that firms with larger boards are less likely to be associated with earnings management measured by abnormal accruals. These authors suggest that larger boards contribute towards the integrity of financial statements. Further, Cheng and Courtenay (2006) provide evidence that board of directors' size is positively associated with the level of firm voluntary disclosure. Moreover, a larger board can also reflect dispersed ownership of the firm (as opposed with family controlled firms) which in turn can positively affect the quantity and quality of information provided to the public (Chau and Gray, 2002). However, Dimitropoulos and Asteriou (2010) find that board size is irrelative to the value relevance of annual

accounting earnings. Therefore, whether board size increases or decreases information asymmetries between managers and the public is an empirical question. Hence, we are not able to predict a sign for the association between board size and the firm financing choices.

H3a: The greater the size of the board of directors, the greater the proportion of risky securities on its' capital structure.

H3b: The greater the size of the board of directors, the smaller the proportion of risky securities on its' capital structure.

Turning now to the role of the board Chairman, particularly the Chair/CEO duality function, Klein (2002) suggests that boards structured to be more independent of the CEO are more effective in monitoring the corporate financial accounting process. In this sense, a board of directors where the chairman of the board is also the CEO should be less independent because of high concentration of power and adverse conditions for outsiders to effectively monitor the executive members (Coles et al., 2008; Duchin et al., 2010). Consistent with this view, Gul and Leung (2004) show that CEO duality is associated with lower voluntary disclosures firms. As such, firms with a chairman of the board that is simultaneously the CEO should face larger information asymmetries and we expect these firms to use less risky sources of financing.

H4: Firms, wherein the chair of the board of directors is someone other than the CEO have a greater proportion of risky securities on its' capital structure.

3. Data and methodology

This study builds on a sample of firms extracted from Bloomberg data base. This data vendor provides market, accounting and corporate governance data from a wide set of listed firms across the world. The initial data sample consists of all nonfinancial firms with both financial and corporate governance data available between 2006 and 2010. We select this time period because this data vendor only provides corporate governance data for a wide set of firms from 2006 onwards. Selecting a longer time window would significantly reduce the total number of firms in the initial sample. Financial firms are excluded because they are subject to specific capital requirement regulations that can potentially influence their financing choices (Alves and Ferreira, 2011). The initial sample results in 2,427 firms (12,135 observations) from 33 countries. Column (1) and (2) of table 1 provides a description of sample data over the various countries. Similar to other capital structure studies (e.g. Alves and Ferreira, 2011) our sample is composed with roughly 50% of firms from the US and Japan. Table 1 shows that the capital structure is quite heterogeneous across countries. The whole sample firms have a capital structure comprised of circa 60% of equity. In Australia, companies have a capital structure comprised of 70% external while in Japan is only 24%. Although these indicators on capital structure are not directly comparable with other studies on this topic, in general we can say that the results are in line with the literature on international capital structure (e.g. Alves and Ferreira, 2011; Arosa, et al., 2014)

«insert Table 1 approximately here»

3.1. Dependent Variables

This paper hypotheses posit that a firm board of directors' composition affects the mix of financing sources. Particularly, it is argued that a board composed in such a way that

reduces information asymmetries between management and investors makes it more likely for the firm to use external sources of funds and, among these, the more risky ones. To test these hypotheses we segregate the firm financing sources into four different levels according to the predicted hierarchy of the pecking order. First, following Myers (1984), we segregate equity into internal and external, one at the top of the pecking order and one at the bottom. Further, in a similar way of Baker and Wurgler (2002) we define internal equity as the book value of retained earnings (RE) and book external equity (BEE) as the total book value of equity minus retained earnings. Finally, we segregate the firm debt into short-term-debt (STD) and long-term debt (LTD), where STD is the book value of current liabilities due within one year minus accounts payable and LTD is defined as the total book value of non-current liabilities (liabilities not due to be paid within the next year). Each of these four types of financing sources is then scaled by the total book value of capital employed (*book capital*), which is defined as the book value of assets less accounts payable as in Rajan and Zingales (1995). By this means the total book capital is segregated in four types of financing sources and they sum up to one: (1) *Book EE*, defined as BEE divided by *book capital*; (2) *Book RE*, defined as RE divided by *book capital*; (3) *Book STD*, defined as STD divided by *book capital*; (4) *Book LTD* defined as LTD divided by *book capital*.

In addition, each of the four abovementioned types of financing is also computed as quasi-market values. To be consistent with the book measures, the market value of external equity (MEE) is defined as the market value of equity minus the book value of retained earnings. The other three measures (RE, STD and LTD) are computed the same way. Then, each one is divided by the quasi market value of capital (*market capital*), which is computed as the book value of total capital less the book value of equity plus the market value of equity. As with the book values of financing sources, these quasi

market values also sum up to one. (1) *Market EE*, defined as MEE divided by *market capital*; (2) *Market RE*, defined as RE divided by *market capital*; (3) *Market STD*, defined as STD divided by *market capital*; and (4) *Market LTD*, defined as LTD divided *market capital*. In sum, we end up with eight measures of financing sources, four measures computed as book values and other four measures valued as quasi market values (where the book value of equity is replaced by the market value of equity): Finally, we have winsorised each of these measures, using the bottom and the top 1% of the variables distribution tails in order to avoid potential erroneous data. Columns (3) to (6) of table 1 present these four quasi market-value financing sources for the various countries in the sample. Overall, the fraction of market external equity yields up to 43.2% which represents the highest fraction of all financing sources. The second most used source of finance is long term debt, followed by short-term debt and then by retained earnings. This ranking varies widely across countries. For instance, in Japan retained earnings is the most representative financing source and represent on average 32.3% of total capital. On the other hand, in Australia external equity represents 71.8% of the total capital and retained earnings are negative, probably revealing that Australian firms in this sample pay out most of its positive profits and when capital is needed (e.g. when having negative profits) they issue external equity.

3.2. Independent variables

Following the proposed hypotheses the independent variables considered in this study are: (i) the percentage of outside independent directors, measured as the ratio between the number of independent directors as reported by the company and number of directors on the firm's board (% independent). If the company has supervisory and management boards (two-tier board), this is the percentage of independent members in the supervisory board as provided by Bloomberg; (ii) the percentage of female directors

measured as the ratio between the number of women and number of directors on the firm's board (% women); (iii) the board size which is the logarithm of the total number of directors on the firm's board (Log(board size)). If the company has supervisory and management boards, this is the total members of the supervisory board; (iv) a dummy variable that takes the value of one if the CEO is also the chairman of the board or supervisory board (CEO/Chair duality).

3.3. Control variables

We include several control variables that are shown in prior studies to have significant impact on financing choices (e.g. Titman and Wessel, 1988; Harris and Raviv, 1991; Rajan and Zingales, 1995). First, we control for growth opportunities, because of the asset the substitution problem described by Jensen and Meckling (1976) and the underinvestment problem identified by Myers (1977). Firms with higher opportunities to growth are more able to shift the risk of their assets and benefit shareholders at the cost of bondholders. In a similar way, firms with new valuable investment opportunities may pass them up if it leads to a reduction on the risk of assets that would benefit bondholders. The asset substitution and underinvestment problems can have influence on the firm financing choices, particularly for firms with higher growth opportunities and highly leveraged (Brounen et al., 2006; Alves and Ferreira, 2011).

We use two proxies for growth opportunities; the first is the average growth rate of the firm sales (Sales growth) as in Mande et al. (2010). The second is the value of investment in research and development (R&D) scaled by the firm total assets (R&D to assets) as in Johnson (2003) and Brown et al. (2009). We use these proxies for growth opportunities as opposed to the market-to-book ratio for three reasons. First, the market-

to-book indicator measures not only growth opportunities but also the degree of information asymmetry between management and investors. In fact a firm with a high value of market-to-book may indicate that it has valuable growth opportunities but also that have less agency problems. This is important for this study because this lower level of information asymmetry may steam from a more independent board of directors. Including market-to-book as a control variable could result in collinearity between this variable and the board structure variables. Secondly, the relation between market-to-book ratio and financing sources may reflect the fact that managers time their equity issues (Baker and Wurgler, 2002). This is also important in the present study because managers may time their equity issues when their shares are overvalued, and this overvaluation may also reflect the effect of having a more independent board. Finally, as explained in Baker and Wurgler (2002) and Johnson (2003) the relation between market-to-book and market measures of leverage can be mechanical, rather than reflecting the effect of growth opportunities on financing choices. For example, when regressing market leverage (measured as the book value of debt over the market value of capital) on market-to-book ratio, the market value of the firm is on the numerator of the dependent variable and also on the denominator of the independent variable.

Tax-shields are also important determinants of firms' capital structure (Modigliani and Miller, 1963). Many studies on the determinants of capital structure have recognized their importance in explaining financing choices (e.g. Huang and Song, 2006; Brounen et al., 2006). The effective tax rate (Tax rate) measured as the total of corporate income taxes paid divided by the pre-tax profit is then used as a control variable. Effective tax rate is censored to be between zero and one.

Firm size has also been identified by capital structure literature as one of the main determinants of financing mix (e.g. Frank and Goyal, 2009). Larger firms are

more likely to be diversified and thus less likely to default on their debt provisions. Accordingly, larger firms may issue more debt than smaller firms. Therefore, we expect size to be positively related to leverage. Further, although larger firms tend to issue more information, they can be more complex and relevant information more difficult to read by investor. We therefore include the logarithm of sales (Log(Sales)) as a proxy for firm size as an additional control variable.

DeAngelo and Masulis (1980) emphasize that non-debt related corporate tax shields like tax deductions for depreciation and investment tax credits may affect leverage. Such non-debt tax shields are substitutes for the tax benefits of debt. To address this determinant we follow Huang and Song (2006) and use depreciation and amortization over assets as a control variable to measure this kind of non-debt tax shield (Depreciation to assets).

In Williamson (1988), assets redeployability is a determinant of capital structure choices. In his scope, the assets specificity of firms determines the best type of financing sources to be employed. For firms where asset specificity is great (and less redeployable) equity financing should be used, since equity enables management oversight by the board of directors and, if financed with debt, debt holders would bear higher risks (less protection in case of liquidation) and demand higher rates of return. On the other hand, for firms with highly redeployable assets, debt financing should be the preferred source of finance since it limits management discretion to a more bounded behaviour. Further, Williamson (1988) argues that although not identical, tangibility and redeployability are highly correlated. Campello and Giambona (2013), and Alves and Ferreira (2011) empirically observe a strong positive relationship between tangibility and firm leverage, corroborating Williamson (1988) predictions. As such, the present

study also employs a control variable for assets tangibility, measured as the ratio of fixed assets over total assets (Tangibility).

Operating profitability, measured as the ratio of earnings before interest, taxes, depreciation and amortization (EBITDA) to book value of total assets (Return on assets (ROA)) is also included as a control variable. If firms prefer internal generate funds to finance their investment needs, firms with higher levels of profitability can have potentially higher levels of retained earnings, despite of the information asymmetry problems. Moreover, firms with a more independent board of directors can also be more profitable. Thus, profitability is included as a control variable to extract any of these potential confounding effects. Additionally, we also include operating earnings volatility as an additional control variable, since firms with higher operating income volatility have higher operating risk and more likely to default (Frank and Goyal, 2009). This measure is computed for each firm as the standard deviation of its operating profit over the sample period (Sigma (ROA)).

Country specific control variables are also included in the analysis. Following Kayo and Kimura (2011) we use the market capitalization to GDP ratio as a proxy to stock markets level of development (Log(Market cap to GDP)). Following Alves and Ferreira (2011) we also include a proxy for creditor rights measured as an index that ranges from 0 to 10, with higher scores indicating that these countries bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending (legal rights indicator). Both indicators were obtained from World Bank data base. Several of the variables used were logarithmized to account for skewness in the data.

Table 2 presents descriptive statistics on the variables used in this study. With respect to capital structure variables it is found that firms have on average a book capital

structure composed with 29.1% of external equity; 21.4% of retained earnings; 20.8% of short term debt and 28.4% of long term debt. Considering equity market values the data sample reveals an average capital structure composed with 43.2% of external equity; 17.9% of retained earnings; 16.3% of short term debt; and 22.3% of long term debt. A larger fraction of external equity was expected when computed with market values of equity, because observed market-to-book values are typically greater than one over the sample period. These differences are also observed in other capital structure studies (e.g. Campello and Giambona, 2013; Alves and Ferreira, 2011; Alves and Francisco, 2015). The main independent variables analysed in this study are the board of directors' related variables. The average fraction of independent directors is 0.439 and the average fraction of women directors is 0.065. The average board size is 9.745 and 39.2 percent of the firms/years have a CEO that is also the chairman of the board. These statistics are comparable to those in other studies (e.g. Carter et al. 2003, 2011; Terjesen et al., 2015; Ferreira et al., 2011). In general the descriptive results of the control variables are in line with other empirical studies on capital structure (e.g. Campello and Giambona, 2013; Alves and Ferreira, 2011).

«insert Table 2 approximately here»

3.4. Methodology

To test the effect of board of directors' composition on capital structure, we employ a panel data model of the following baseline form:

$$\begin{aligned}\left(capital\ structure\right)_{i,t} = \beta_0 + \beta_1\left(\%\ independent\right)_{i,t} + \beta_2\left(\%\ \text{women}\right)_{i,t} + \beta_3\left(board\ size\right)_{i,t} \\ + \beta_4\left(CEO\ duality\right)_{i,t} + \sum_j \beta_j\left(control\ \text{variable}_j\right)_{i,t} + u_{i,t}\end{aligned} \quad (1)$$

where the index *i* denotes a firm, *t* denotes a year, *capital structure* is one of the eight measures of capital structure used by firms, *% of independent* is the ratio between the number of independent directors and number of directors on the firm's board (board size), as reported by the company. If the company has supervisory and management boards (two-tier board), this is the percentage of independent members in the supervisory board. *% female* is the fraction of female directors on the board of directors, *board size* is the logarithm of the total number of directors on the board, *CEO/Duality* is a dummy variable that takes the value of one, if the chairman of the board (or supervisory board) is also de CEO, and *control variable* is the set of control variables defined above.

This baseline specification includes year- and industry-fixed effects. The industry effects are captured using Global Industry Classification Standard (GICS) sectors developed by and Standard & Poor's. We include industry fixed effects as opposed to firm fixed effects for two reasons. First, including firm fixed effects requires variation within firms across time in the variables of interest, which here are the fraction of independent and female directors, the board size and a dummy for the CEO/Chairman duality. Although these variables are not strictly constant over time for all firms, they are in fact time invariant for the majority of firms. Over the sample period (2006 to 2010) many firms may have constant fractions of independent and female directors and even more likely to have a constant dummy for the dummy variable CEO/Chairman duality. By estimating the parameters of equation (1) with firm fixed effects, the effects associated with the variables that are time invariant for those specific firms are not taken into account. As stressed by Wooldridge (2002, pg. 286) when key independent variables do not vary much over time, firm fixed effects (and in fact first differencing methods as well) can lead to imprecise estimates. John and Litov

(2010) and Ghosh et al. (2011) also stress their inability to use firm fixed effects in this scope. Second, the capital structure literature has often documented that the firm industry is a major determinant of financing practices. For example, Frank and Goyal (2009) find evidence that firms in industries in which the median leverage is high tend to have higher leverage, and that this is a core factor explaining leverage practices across firms.

One potential problem of using industry rather than firm fixed effects or first differencing models is that it assumes exogeneity from independent variables (i.e. the error term in equation (1) is uncorrelated with the independent variables). We believe, however, that the board of directors' composition variables and the financing sources variables are unlikely to be endogenously determined. Jiraporn et al. (2012) (following the arguments of Berger et al. (1997), Garvey and Hanka (1999), John and Litov (2009), among others), claim that there is no theoretical model in the literature suggesting the capital structure shocks cause changes in governance devices. Further, they argue that while capital structure decisions are defined by (executive) managers it is rather difficult for these managers to modify the firm's corporate governance devices. Therefore, our baseline model is estimated assuming exogeneity. Nevertheless, we relax this assumption in the robustness section of the results.

Although the baseline model incorporates industry and time effects, a further improvement would be to also include country fixed effects. Within this scope, the proposed relationships would not suffer from any confounding effects that might emerge from omitted institutional/country effects. However, because the variables of interest (% independent; % women; board size and CEO/Chair duality) are generally clustered by country if we include country fixed effects, the model would eliminate the effects that these variables have on capital structure throughout country specific

contexts. For example the variable "% independents" is strongly influenced by each country institutional framework (e.g. corporate governance codes which are applicable to all firms in each country). Within this scope, the percentage of independent directors is quite homogeneous within each country and potentially largely heterogeneous across countries. If country fixed effects are included, we disregard the cross country heterogeneity and the effect that the variable "% independents" has on the structure of capital throughout institutional effects (e.g. governance codes around the world). For this reason we have opted to present the baseline model without country fixed effects. Still, in the robustness section we present the results when country fixed effects are included.

To account for possible heteroskedasticity and autocorrelation in error term, all coefficients *t* statistics are estimated with heteroskedasticity-consistent errors clustered by firm (Petersen, 2009). As a robustness check we also estimated *t* statistics based errors clustered by industry and country. The results remain qualitatively similar.

4. Empirical Results

The main results of our investigation are presented in table 3. In this table we show the results for 8 regressions, one for each of the independent variables considered in the baseline model. In column (1) and (2) the independent variables are Market EE and Book EE respectively. The variable % of independent reveals a positive and highly statistically significant coefficient, meaning that a board composed with a higher fraction of independent directors is associated with a higher fraction of external equity in their capital composition. This relation is economically relevant since the results estimates that an increase of 10% on the number of independent director is associated

with an increase of 3.22% (2.14%) of the fraction of market (book) external equity financing. In columns (3) and (4) we present the regression results when the dependent variable is the Market RE and Book RE. Contrary to the results of external equity, retained earnings are now negatively associated with a higher fraction of independent directors in the board of directors and the coefficient is also highly statistically significant. This relation is also economically relevant since an increase of 10% on the number of independent directors is associated with a decrease of 2.94% (3.15%) of the fraction of retained earnings scaled by total market (book) capital. Together, the results from specifications (1) to (4) provide evidence in support of our prediction in H1 that a more independent board of directors facilitates the use of external equity as compared with internal equity. In specification (5) and (6) the dependent variables are now the market and book STD and in specification (7) and (8) the market and book values of LTD. According to the pecking order theory these sources of financing are between internal and external equity, being the STD preferable to LTD. Our prediction in H1 is that a more independent board should be associated with less STD and more LTD. The results for the percentage of independent directors' variable are consistent with our prediction. A more independent board is negatively associated with the fraction of short-term debt and positively associated with the fraction of long-term debt. These relations are still highly statistical significant. Further, an increase of 10% on the number of independent directors would reduce short term debt scaled by market capital by 0.65% and increase long term debt over market capital by 1.67%. Overall the results provide supporting evidence that a more independent board leads to a rise over the order of financing choices proposed by Myers and Majluf (1984). Particularly, a more independent board of directors is positively associated with the use of external equity

and long term debt (at the bottom of the pecking order) and negatively associated with the use of retained earnings and short term debt (at the top of the pecking order).

With respect to the effect of gender composition of the board of directors (H2), the results do not provide strong statistically results, since the coefficients are only statistically significant for two of the specifications. One potential problem is that the percentage of women directors is highly correlated with the percentage of independent directors, leading to collinearity problems in the estimation results. Nevertheless, consistent with our prediction the results show that a more gender diversified board of directors is positively associated with a higher use of market external equity (specification 1) and negatively associated with the short term debt use (specification 5). Although these results have lower *t* statistic values they provide some support that a more gender diversified board can lead firms to use more external equity and less retained earnings. With respect to STD and LTD the results are not consistent when using book or market values, since we obtain opposite and non-statistical significant signs.

The effect of board size on the different types of financing is only statistical significant for specifications (5) to (8) where the dependent variables are market and book values of STD and LTD. The results support H3a, i.e. firms with larger boards have more long term debt and less short term debt. These results may mean that a large board of directors reduces information asymmetries trough more disclosure (Cheng and Courtenay, 2006) which in turn facilitate firms to use more long-term debt. Nevertheless, we find no evidence that larger boards lead firms to have more external equity and less retained earnings.

When the CEO is also the chairman of the board one should suspect of a less efficient board of directors and higher levels of information asymmetries (H4). We therefore predict that for this kind of boards firms should use more internal equity and less external equity. The results of table 3 provide evidence in support of this prediction, that is, when the CEO is also the chairman the firm has lower levels of external equity and has a higher fraction of retained earnings. The coefficients of this dummy variable have the expected signs and are statistically significant for the market value of external equity and for both the market and book retained earnings. The association between this variable and the fraction of STD is negative. Following the results of the % of independent directors' variable (where the relation found is negative), we expected to see a positive relation between this variable and the use of STD but the results are negative. Notwithstanding, the results for the market and the book values of LTD show the predicted sign and are highly statistical significant. Firms with a CEO that is also the chairman of the board use much less LTD. Putting together all results we find that the dummy CEO Chairman Duality is positively associated with retained earnings and negatively associated with the remaining sources of financing, which is also consistent with the prediction that firms with a more independent board have more risky sources of financing in their capital structures.

«insert Table 3 approximately here»

Turning now to the analysis of control variables, our proxies for growth opportunities (sales growth and R&D) are positively related with external equity financing and negatively related with the other sources of financing. These results are consistent with prior literature. Firms with higher growth opportunities are more likely to face asset substitution and underinvestment problems. Therefore, these firms use more external equity as compared with debt. The negative relationship between growth

opportunities and retained earnings may come from the fact that these firms are still in growing phase and for that reason have few positive earnings to retain. Additionally, in order to finance their new investment opportunities with external equity these firms might need to pay-out a large fraction of dividends as predicted by the signalling effect of dividends (Williams, 1988) to provide financial markets with a signal of the return on assets they invest and to reduce agency costs of equity (Easterbrook, 1984). With respect to the tax rate the results show a positive relation between this variable and the fraction of short term debt and a negative relationship with retained earnings, which is consistent with the tax shield hypothesis. Surprisingly, it seems that firms that pay higher tax rates use more external equity. One possible justification for this result is that firms that have higher tax rates are also more valuable firms, which in turn are more likely to issue more equity. Nevertheless, more research is needed to further explain this relationship. We further find no evidence as to whether tax rate has an influence of long term debt usage. With respect to firm dimension (measured as the log of sales), table 3 results are also consistent with prior empirical literature, since it provides new evidence that larger firms are more likely to use debt as a preferred source of finance. The effect of depreciation on the different sources of finance is also consistent with prior empirical literature (e.g. DeAngelo and Masulis, 1980) in the sense that firms with higher levels of assets depreciation use less debt financing sources and more external equity. Further, as expected the results show that firms with more depreciations also have less retained earnings, since depreciation are usually considered non-cash expenses and a part of the internal generated funds (Brown et al., 2009). As expected, tangibility is positively and highly statistically associated with the use of long term debt and negatively associated with external equity and short term debt (Bevan and Danbolt, 2002). Profitability, measured by return on assets is naturally positively associated with the fraction of

retained. Further, in line with the pecking order theory and previous capital structure empirical studies (e.g. Frank and Goyal, 2009), the results show that profitable firms are less likely to use long term debt. With respect to operating risk, measured as the standard deviation of ROA, the results show that firms with higher operating risk are less likely to issue debt (both short term and long term), and retained earnings. As expected firms with higher earnings volatility make more use of external equity. Finally, with respect to country level variables it is found that firms in countries with more developed stock markets rely more on external equity and less on long term debt. Moreover, as expected, firms based in countries where laws are more likely to protect the rights of borrowers and lenders have higher fractions of long term debt (Alves and Ferreira, 2011).

So far we have provided evidence that board composition has influence on the firm capital structure. Particularly, firms where the board has more independent directors have more external equity and long term debt and less retained earnings and short-term debt which is consistent with our hypotheses. We are however unable to provide evidence as to whether firms with a more independent board of directors is more likely to have a capital structure composed with more debt or external equity; long-term debt or external equity; and more retained earnings or short-term debt. In table 4 we provide further insights as to the trade-off between each of the four types of financing sources.

«insert Table 4 approximately here»

In table 4 (specification 1) we consider an independent variable which relates the total debt (STD plus LTD) to total quasi market value of external financing (total debt plus market value of external equity). Following previous capital structure empirical

literature (e.g. Alves and Ferreira, 2011; Cronqvist et al., 2012), we focus on the quasi market values of financing sources to account for the possibility that managers think in terms of market values instead of book values (this is consistent with the hypothesis that managers time their equity issues as predicted by the market timing stylized facts). Nevertheless, results using book values show qualitative similar results. We then logarithmize this variable since data show some skewness and it provides better model adjustment. This variable is then regressed against the same independent variables considered in table 3. The results of column (1) of table 4 show a negative relationship between the fraction of debt over total external financing and percentage of independent directors in the board, providing support that a more independent board is positively associated with external equity (the more risky securities) as predicted in H1. Moreover, a board with a higher fraction of female directors is associated with less debt financing as compared with external equity financing, therefore consistent with the view that gender diversity in the board room improves its efficiency H2. With respect to board size it seems that larger boards are associated with less debt and more external equity, supporting the view that larger boards reduces information asymmetries H3a. Finally, results from specification (1) provide some support (although with a small *t* statistic) that when the CEO is also the chairman of the board the firm is more likely to use debt over external equity financing. These results are consistent with those of Jiraporn and Gleason (2007) in which they find an inverse relationship between leverage and shareholder rights, suggesting that firms adopt higher debt ratios where shareholder rights are more restricted consistent with agency theory, which predicts that leverage helps alleviate agency problems Jensen (1984). With respect to control variables, the results from table 4 are generally in line with those of columns (5) to (8) of table 3.

Following the same methodological strategy of specification (1), in specification (2) of table 4 we provide results from regressing a dependent variable that relates short term debt with retained earnings against board composition variables. Particularly, the dependent variable is defined as the fraction between retained earnings divided by short term debt plus retained earnings. We choose this fraction as opposed to short term debt in the numerator because this fraction reveals a better adjustment of the data (based on the R^2 measure). The results remain consistent with the hypotheses H1 and H2 that a firm where its board is composed with more independent members and more gender diversified has a capital structure composed with more short term debt when compared with retained earnings. The results show that the percentage of independent and female directors are positively and statistically significant related with a higher fraction of short term debt as compared with retained earnings. Results from specification (2) also show that firms with a board of directors with many members use more retained earnings than short-term debt, which is not consistent with the results from table 4, where the results support the view that a larger board contributes to facilitate the use of more risky financing sources. On plausible justification for this result is that a larger board can in fact reduce information asymmetries (by issuing more information) and therefore make it easier to issue external equity over total debt. But, at the same time, a larger board can also be less effective in monitoring executive management. In this scope internal agents might be tempted to rely more on internal generated funds rather than on short term debt. One other possible justification for this effect is that board size may affect both board effectiveness and information asymmetries in a non-linear way. To check this possibility we re-estimated specification (2) from table 4 including a new variable defined as the square of Log(Board Size). The results then show that the Log(Board Size) size is positively related with the use of short-term debt and the square of

Log(Board Size) is negatively related with short term debt. Both coefficients are statistically significant at 10% level. This could mean that board size can be related to capital structure in complex ways and further research is needed to explore those complexities. With respect to the coefficient of the CEO/Chair duality dummy variable is negative and statistically significant which is consistent with the view that a more independent board (where the chairman is a different person from that of the CEO) leads to an increase of short term debt in relation to retained earnings. With respect to the control variables the results show that our proxies for growth opportunities have different signs. The variable *sales growth* reveals to be positively associated with the use of short-term debt where we should expect to see a negative relationship. A plausible reason for this result is that firms that have high growth in their revenues rely much on short term debt to finance their increasing working capital needs. The variable R&D is negatively associated with the short term debt, which is consistent with the hypothesis that growth opportunities lead to less use debt. The results from the tax rate variable reveal that firms with higher effective tax rates use much more short term debt than retained earnings which is consistent with the tax benefit of debt and this relationship is highly statistically significant in all five specifications. Consistent with the previous results the level of firm revenues is positively associated with the use short term debt when compared with retained earnings. The level of depreciations is positively associated with the fraction of short term debt over short term debt plus retained earnings. This result can simply mean that firms with higher levels of depreciations retained fewer earnings, since deprecation is a non-cash expense that serves as internal generated funds for investment purposes. Results from table 5 reveal that firms with more tangible assets use less short term debt when compared with retained earnings. This finding is consistent with Bevan and Danbolt (2002) results.

These authors argue that firms match their assets maturity with financing sources maturities. As such, *ceteris paribus* firms with more tangible assets have less current assets and thus less short term debt. Finally, the variables that measure profitability, operating risk, stock market development and lenders rights have coefficients with similar signs of those of specification 1.

In specification (3) of table 4 the dependent variable considered relates the use of long term debt with short term debt. This variable is defined as the ratio between the long term debt divided by total debt. The results reveal that the percentage of independent directors in the board is positively and statistically significant related with the use of long term in comparison with short term debt. Therefore, these results are consistent with the proposed H1: firms with a more independent board are more likely to use more risky securities. The effect of gender diversity (H2) is not clear, since the results show a negative relation when we expected a positive sign. One reason for this is that the percentage of independent directors is highly correlated with the fraction of women directors (Pearson correlation yields up to 0.51). Therefore the negative sign can only be interpreted when the board has few independent directors. In fact, women directors cannot enhance board independence if it has no independent directors. For robustness reasons we run a new regression (not reported) without the variable "% independent" and the results reveal a positive and statistical significant coefficient (t=2.240). This result provide some (limited) evidence that a more gender diversified board of directors is positively associated with more long term debt in comparison with short term debt (H2). With respect to board size the relation is also limited since t statistic is quite low (t=2.113). Yet it is found a positive relation between board size and the use of long term debt (H3a) supporting the view that bigger boards lower information asymmetry problems. Notwithstanding, as stated above, further research is

needed to provide better perceptions concerning the relation between board size and financing sources. Finally, the results for the dummy variable CEO/duality (H4) are also not clear, since the association is not statistically different from zero. As such we are unable to provide supporting evidence as to whether a more independent chairman leads to a shift from short term debt to long term debt. With respect to the control variables, the results from specification (3) of table 4 are generally in line with those of columns (7) and (8) of table 3. An exception worth noting is the coefficient of the variable depreciation which in table 4 is found to be positively related with the fraction of long term debt over total debt. This result may lie in the fact that firms with higher levels of depreciation also have long lived assets, which in turn leads to the use of more long term debt in order to match the assets maturity with the financing sources maturity (Bevan and Danbolt, 2002).

In specification (4) of table 4, the dependent variable considered is the fraction between long term debt and external equity plus long term debt. Again, the results provide strong support that a board of directors composed with more independent directors and more gender diversified uses more external equity when compared with long term debt (H1 and H2). Also, although not statistically significant, the size of the board is found to be negatively related with the use debt versus external equity (H3a). Moreover, when the board of directors has an independent chairman the firm has a higher fraction of external equity in comparison with long term debt (H4). These results provide new insights, since that in table 3 we find that board composition features leads the firm to use both more external equity and long term debt.

Overall the results of tables 4 support the idea that a board composed in such a way that increases its independence and efficiency makes it easier for firms to have more risky securities in their capital structures. Particularly, it is found that a board

composed with more independent members have a capital structure composed with: more external financing and less retained earnings; more short term debt and less retained earnings; more long term than short term debt; and more equity than long term debt.

5. Robustness checks

The results provided so far assume that the independent variables of interest, i.e. board of directors' composition are exogenous and therefore unrelated with the error term. One potential source of endogeneity may come from reverse causality between financing sources and board of directors' variables. If this is the case the coefficients estimates provided in tables 3 and 4 can be biased. To address this potential reverse causality problem we re-estimated table 4 using the same variables but with the lagged values of the independent variables. In table 5, the regression results provided in Panel A replicate the regressions of column (1) to (4) from table 4 considering one lag between the dependent variables and independent variables. In Panel B we replicate the same regressions using the maximum number lags available in the data (i.e. 4 years). The results are generally preserved. Particularly, coefficients of the variable percentage of independent directors remain highly statistically significant and maintain the expected signs. The percentage of women directors also reveal the expected signs, except in specification (3) and (7) where the independent variable considered is long term debt over total debt. As in the results from table 4 also in this case we encounter collinearity problems among the percentage of female directors and other explanatory variables. In fact, when we re-estimate specification (3) and (7) dropping other board variables the coefficients turn positive. The results for the size of the board remain mixed. As discussed above this variable may relate to financing sources in complex ways and therefore we are unable to provide consistent evidence as to whether a larger

board leads firms to scale up in the pecking order. With respect to role of the chairman of the board the results provide some evidence that a non-executive chairman may increase the board independence and lead the firm to rely more on risky financing sources. Overall the results support the view that the direction of causality goes from board of directors' variables to financing sources and not the other way around.

«insert Table 5 approximately here»

To further control for possible endogeneity problems we re-estimated our models using an instrumental variable framework. Particularly, we rely on 2SLS regressions. This estimation technique directly addresses endogeneity problems of any kind (reverse causality, measurement errors in the regressors and omitted-variable bias). In this scope, the variables that we suspect to be endogenous are instrumented with the other independent variables as well as other variables not in the model (instruments). These instruments should be related to the variables instrumented (considered to endogenous) and should not be correlated with the error term. In table 6 we provide the second stage results of a 2SLS regression where the dependent variables are the same as those of table 5 and the variable percentage of independent directors on the board is treated as endogenous and therefore instrumented. The selected instruments are the lag values of this variable. The results are identical to those of tables 4 and 5 and the coefficients of the variable percentage of independent directors do not have only the expected signs but are also highly statistical significant. To determine whether the variables of interest should be treated as endogenous variables, we use the Wooldridge's (1995) robust score test (see bottom lines of table 6). If the test statistic is significant, then the variables being tested should be treated as endogenous. As can be seen this test is not rejected at any usual level of significance. As such we do not reject the hypothesis that the variable percentage of independent directors is exogenous. In other words, we

confirm the validity of the previous results that treated this variable as exogenous. Further, also in the bottom of table 6 we provide results for the assessment of the instruments validity. The Sargan's (1958) χ^2 test of overidentifying restrictions is employed to this end. A statistically significant test statistic always indicates that the instruments may not be valid. The results obtained for this test are not rejected at any typical level of significance. Further, the partial R^2 which measures the level of correlation between the instrumented variable and the instruments is also presented and in all specification their value is very high. In sum, the results suggest that instruments are valid. In this analysis we have focused on the independent directors' variable in order to avoid collienarity problems. Nevertheless, we have conducted the same analysis considering the percentage of women directors instead of the percentage of independent directors and results reveal the same signs of those presented here including high values of the *z* statistics. The results for the size of the board and CEO/Chair duality are similar to those of table 5.

«insert Table 6 approximately here»

In table 7 we analyse the results in a cross section framework for each year in the sample period. By these means one can check whether the results are consistent over the period considered. The results are relatively similar to those presented in Table 6. Particularly, for every year the coefficient of the variable percentage of independent directors is the same as in table 6 and statistical significant for all years except in Panel A and D for the 2008 year. This lack of statistical significance may be related to the subprime crisis where stock prices significantly dropped and since we are measuring debt as book values this price drop is not seen in the value of debt which should be probably seen if debt market values where available.

«insert Table 7 approximately here»

In all previous models, we have included industry dummies and country level control variables, but it can still be argued that firm capital structure within a country is exposed to common factors beyond those variables. In order to capture country/institutional effects, we re-estimated the models presented in table 4 considering country fixed effects. The results are provided in table 8. Generally, the results are qualitatively similar. Particularly, the board of directors related variables present the same signs as those of table 4. However, as expected the *t* statistics are significantly lower than in the baseline model. One plausible reason for this decrease in the statistical significance of the coefficients is that the corporate governance variables are highly homogenous within countries and highly heterogeneous across countries. Nevertheless, the results still provide robust evidence that firms with a more independent board are more likely to have a capital structure composed with more risky securities as predicted by H1. Particularly, firms with more independent directors have a capital structure composed with more external equity and less retained earnings, and have a debt structure composed with more long term debt and less short term debt.

«insert Table 8 approximately here»

We have also subjected our results to battery of additional sensitiveness tests. Following Alves and Ferreira (2011) we re-estimated the results of table 4 excluding utilities, since some of these firms are regulated in a number of countries and therefore can be subject to specific forces that drive its financing choices. Further, we also have excluded firms from the United States and then the firms from Japan. We also have substituted the proxies of growth opportunities with the lag value of the market to book ratio (in order to minimize the mechanical relationship between this variable and the

market based financing sources measures), defined as the market value of equity plus the book value of total debt divided by the book value of assets. The results are qualitatively similar to those reported above. We have also re-estimated the results of table 3 and 4 excluding countries with less than 20 firms in the original sample and results remain identical. These robustness tests are not reported in the present paper to conserve space but available from the authors upon request.

6. Conclusion

This article investigates empirically how the board of directors' composition affects the mix of financing sources used by firms. The investigation is conducted using a panel data of 2,427 firms from 33 countries over the period of 2006 to 2010. After controlling for a wide set of capital structure determinants the results show that firms with a board of directors composed with more independent directors are more likely to have higher fractions of riskier financing sources in their capital structures. Particularly, the results provide strong evidence that firms with a larger fraction of independent directors on the board: (1) have more external financing sources when compared with retained earnings; (2) have more short term debt in relation with retained earnings; (3) have more long term debt compared with short term debt; and (4) have more external equity than long term debt. These results are consistent with our hypothesis which conjectures that a more independent board should lead firms to reduce information asymmetries between managers and outside investors and by that means reduce the cost of issuing more risky sources of financing as predicted by the pecking order theory of Myers (1984) and Myers and Majluf (1984). The results also provide some evidence that a more gender diversified board of directors and where the chairman is non-executive (i.e. the CEO is a

different person from that of the chairman) can improve the board of directors' independence and efficiency and therefore lead the firm to rely more on long term sources of financing. The effect of board size on financing choices is mixed, since larger boards can be more or less effective depending on the complexity of the firm.

With respect to policy implications the present study provides new insights into the way firms can have more external sources of finance. The result that a firm with a more independent board of directors have more long term debt and external equity suggests that it can match more easily (i.e. less costly) the maturity of their assets with the maturity of their financing sources (Hall et al., 2000). The results also provide important implications to securities regulators, since the investigation suggests that firms with more independent directors are more likely to issue long term debt and external equity. If that is the case, then regulators could promote the inclusion of independent directors in the board of directors of listed firms in order to develop their financial markets. Lastly, the results also add to the discussion over the capital structure theories. If the trade-off theory is to hold stand alone and the pecking order theory is not then one should not see such strong effect between the board of directors' structure and the use of different financing sources. In fact the present study results suggest that managers pick financing sources taking into account the level of information asymmetry. Further, the results suggest that board independence is not only important to align the manager interest with those of the owners but is also important to other financing suppliers, such as bondholders.

The results presented are consistent with a number of empirical findings previously documented in the literature. For example, our results are consistent with the findings of Cronqvist et al. (2012) where firms with strong governance devices are less likely to reveal corporate leverage practices that arise from the CEO personal

preferences. The results are also consistent with the literature that argue that governance mechanisms can substitute the effect of debt in reducing the free cash flow agency problems (e.g. Berger et al. 1997 and Jiraporn et al. 2012), since we find that firms with a more independent board of directors relies more heavily on external equity when compared with total debt and long term debt. Finally, the results are also consistent with previous empirical work that finds a negative relation between corporate governance devices and the cost of debt (e.g. Fields et al. 2012).

This study has several limitations that should be stressed. First, the financing sources are measured using book values and quasi market values. Given that long term debt market values can be much lower than book values during the sample period here considered the results are not as robust as would be if market values were considered. Further, the study do not do not segregate public from private debt. Information asymmetries costs are potentially lower for private debt since creditors can monitor more closely executive management. Additionally, the sample data analysed has a small time span (5 years) and a large cross section. Therefore, the results presented are more likely to characterize different financing policies across firms than across time. Finally, the present study does not control for firm ownership heterogeneity. Firms with diverse ownership structures may have different information asymmetry levels. As such, this study's findings would benefit from further research that considers these limitations. Future research could exploit these limitations and further provide new evidence as to whether other corporate governance devices could change firm financing choices, for example ownership structure.

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Table 1 – Country statistics.

Country	Firms (1)	N (2)	Market EE (3)	Market RE (4)	Market STD (5)	Market LTD (6)
Australia	180	900	0.718	-0.013	0.103	0.194
Austria	7	35	0.377	0.181	0.127	0.315
Belgium	7	35	0.498	0.177	0.097	0.219
Brazil	14	70	0.545	0.085	0.121	0.247
Canada	92	460	0.652	0.049	0.054	0.245
China	56	280	0.634	0.099	0.192	0.074
Denmark	13	65	0.490	0.219	0.136	0.154
Finland	25	125	0.385	0.228	0.183	0.203
France	43	215	0.459	0.089	0.179	0.263
Germany	9	45	0.512	0.065	0.172	0.234
Greece	4	20	0.435	0.147	0.150	0.269
Hong Kong	22	110	0.513	0.191	0.107	0.186
India	289	1,445	0.253	0.240	0.221	0.264
Ireland	14	70	0.598	0.042	0.113	0.251
Israel	3	15	0.630	0.105	0.147	0.119
Italy	18	90	0.325	0.193	0.170	0.311
Japan	722	3,610	0.239	0.323	0.230	0.207
Luxembourg	5	25	0.469	0.171	0.146	0.204
Malaysia	7	35	0.524	0.182	0.093	0.201
Netherlands	21	105	0.466	0.133	0.183	0.215
New Zealand	8	40	0.430	0.294	0.070	0.205
Norway	6	30	0.306	0.166	0.172	0.356
Portugal	3	15	0.461	0.147	0.103	0.289
Russia	7	35	0.386	0.387	0.092	0.132
Singapore	17	85	0.475	0.185	0.181	0.158
South Africa	27	135	0.522	0.187	0.126	0.165
Spain	15	75	0.417	0.128	0.122	0.325
Sweden	23	115	0.460	0.202	0.156	0.182
Switzerland	27	135	0.533	0.177	0.108	0.181
Thailand	2	10	0.472	0.248	0.087	0.193
Turkey	5	25	0.347	0.234	0.278	0.141
United Kingdom	197	985	0.471	0.156	0.152	0.223
United States	539	2,695	0.596	0.065	0.094	0.246
Full Sample	2,427	12,135	0.432	0.179	0.163	0.223

Note: This table reports per country firms, observation and means of the market financing sources. Market EE is defined as market external equity (MEE) divided by market capital. MEE is computed as the market value of equity minus the book value of retained earnings. Market capital is defined as book capital less the book value of equity plus the market value of equity. Book capital is defined as the book value of assets less accounts payable. Market RE is defined as book value of retained earnings (RE) divided by market capital. Market STD is defined as book value of current liabilities due within one year (STD) minus accounts payable divided by market capital. Market LTD is defined as total book value of non-current liabilities (LTD) divided by market capital.

Table 2 - Description and descriptive statistics of the variables used in the analysis.

Variable	*Description*	*No. of Obs.*	*Mean*	*Std. Dev.*	*25th Perc.*	*75th Perc.*
Panel A: Capital Structure Variables						
Book EE	Defined as book external equity (BEE) divided by book capital. BEE is computed as the book value of equity minus the book value of retained earnings. Book capital is defined as the book value of assets less accounts payable.	12,135	0.291	0.389	0.122	0.349
Book RE	Defined as book value of retained earnings (RE) divided by book capital. Book capital is defined as the book value of assets less accounts payable.	12,135	0.214	0.405	0.096	0.401
Book STD	Defined as book value of current liabilities due within one year (STD) minus accounts payable divided by book capital. Book capital is defined as the book value of assets less accounts payable.	12,135	0.208	0.135	0.110	0.275
Book LTD	Defined as total book value of non-current liabilities (LTD) divided by book capital. Book capital is defined as the book value of assets less accounts payable.	12,135	0.284	0.196	0.129	0.405
Market EE	Defined as market external equity (MEE) divided by market capital. MEE is computed as the market value of equity minus the book value of retained earnings. Market capital is defined as book capital less the book value of equity plus the market value of equity. Book capital is defined as the book value of assets less accounts payable.	12,135	0.432	0.373	0.212	0.645
Market RE	Defined as book value of retained earnings (RE) divided by market capital. Market capital is defined as book capital less the book value of equity plus the market value of equity. Book capital is defined as the book value of assets less accounts payable.	12,135	0.179	0.313	0.063	0.291
Market STD	Defined as book value of current liabilities due within one year (STD) minus accounts payable divided by market capital. Market capital is defined as book capital less the book value of equity plus the market value of equity. Book capital is defined as the book value of assets less accounts payable.	12,135	0.163	0.130	0.068	0.224
Market LTD	Defined as total book value of non-current liabilities (LTD) divided by market capital. Market capital is defined as book capital less the book value of equity plus the market value of equity. Book capital is defined as the book value of assets less accounts payable.	12,135	0.223	0.170	0.086	0.324
Panel B: Board composition variables						
% independent	Ratio between the number of independent directors and number of directors on the firm's board (board size), as reported by the company. Independence is defined according to the company's own criteria.	12,135	0.439	0.281	0.200	0.692
% women	Ratio between the number of women and number of directors on the firm's board (board size), as reported by the company.	12,135	0.065	0.088	0.000	0.111
Board size	The total number of directors on the firm's board. If the company has supervisory and management boards, this is the total members of the supervisory board.	12,135	9.745	3.247	8.000	12.000
CEO/chair duality	Dummy variable that takes the value of 1 if the company's Chief Executive Officer is also Chairman of the Board and 0	12,135	0.392	0.488	0.000	1.000

duality	otherwise.					
Panel C: Firm Specific control variables						
Sales growth	Average growth rate of firm's operating revenues during the sample period (between 2006 and 2010).	12,135	0.122	0.188	0.034	0.146
R&D to assets	Value of firm's investment in research and development (R&D) scaled by book value of assets.	12,135	0.016	0.039	0.000	0.018
Tax rate	Total of corporate income taxes paid divided by the pre-tax profit is then used as a control variable. Censored to be between zero and one.	12,135	0.341	0.245	0.214	0.398
Log(Sales)	Logarithm of the total value of firm's operating revenues, sales or turnover, as reported by the firm as of the end of fiscal year.	12,135	7.418	2.132	6.335	8.820
Depreciation to assets	Value of firm's reported depreciation and amortization divided by book value of assets.	12,135	0.039	0.026	0.023	0.049
Tangibility	Book value of fixed assets as reported by the firm (such as machinery, buildings and land) divided by book value of assets.	12,135	0.334	0.220	0.155	0.475
Return on assets (ROA)	Ratio of earnings before interest, taxes, depreciation and amortization (EBITDA) to book value of total assets.	12,135	0.091	0.104	0.041	0.129
Sigma (ROA)	Standard deviation of ROA (%) over the sample period (from 2006 to 2010).	12,135	3.874	4.654	1.326	4.690
Panel D: Country Specific						
Log(Market cap to GDP ratio)	Logarithm of the per capita gross domestic product (USD) of the country where the firm is based.	12,135	4.594	0.451	4.312	4.922
Legal rights indicator	Index that ranges from 0 to 10, with higher scores indicating that these countries bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending.	12,135	7.802	1.484	7.000	9.000

Notes: This table reports descriptive statistics of the variables used in the study. All of the data were obtained from Bloomberg, except for the country-specific variables, which were gathered from the World Bank's website. All of the values are presented in USD unless otherwise specified.

Table 3 - Industry- and year-fixed effects regression of capital structure.

Explanatory variables	*Market EE* (1)	*Book EE* (2)	*Market RE* (3)	*Book RE* (4)	*Market STD* (5)	*Book STD* (6)	*Market LTD* (7)	*Book LTD* (8)
% independent	0.322***	0.214***	-0.294***	-0.315***	-0.102***	-0.065***	0.074***	0.167***
	(13.121)	(8.304)	(13.217)	(11.240)	(11.774)	(6.564)	(6.656)	(12.363)
% women	0.160**	-0.022	-0.101	-0.082	-0.040*	0.047	-0.030	0.039
	(2.146)	(0.268)	(1.503)	(0.958)	(1.854)	(1.600)	(0.868)	(0.921)
Log(Board size)	0.023	-0.006	-0.009	-0.005	-0.039***	-0.029***	0.018**	0.035***
	(1.313)	(0.345)	(0.526)	(0.224)	(5.174)	(3.391)	(2.034)	(3.201)
CEO/Chair duality	-0.032***	-0.008	0.044***	0.043***	-0.000	-0.020***	-0.012***	-0.016***
	(3.221)	(0.803)	(4.672)	(3.847)	(0.129)	(4.574)	(2.586)	(2.882)
Sales growth	0.210***	0.141***	-0.146***	-0.125***	-0.051***	-0.020	-0.013	0.002
	(4.967)	(3.195)	(4.132)	(2.868)	(4.614)	(1.633)	(0.707)	(0.079)
R&D to assets	1.235***	2.782***	-0.532*	-2.389**	-0.223***	-0.048	-0.483***	-0.338***
	(3.605)	(3.130)	(1.718)	(2.505)	(5.077)	(0.701)	(6.228)	(3.371)
Tax rate	0.061**	0.118***	-0.093***	-0.133***	0.031***	0.015**	0.009	0.010
	(2.481)	(4.704)	(4.117)	(5.141)	(4.625)	(2.161)	(1.053)	(1.062)
Log(Sales)	-0.021***	-0.039***	0.003	0.017***	0.007***	0.007***	0.013***	0.016***
	(4.262)	(8.085)	(0.856)	(3.662)	(4.709)	(4.706)	(7.645)	(8.969)
Depreciation to assets	1.179***	0.381	-0.788***	-0.525	-0.231***	-0.046	-0.121	0.211
	(3.708)	(0.923)	(2.679)	(1.238)	(3.503)	(0.577)	(1.039)	(1.263)
Tangibility	-0.217***	-0.115***	0.037	-0.007	-0.065***	-0.127***	0.258***	0.266***
	(6.509)	(3.065)	(1.292)	(0.167)	(6.164)	(10.309)	(14.642)	(13.644)
Return on assets (ROA)	0.240**	-1.176***	0.460***	1.418***	-0.232***	0.042*	-0.469***	-0.266***
	(2.312)	(9.199)	(5.240)	(9.912)	(9.703)	(1.650)	(13.827)	(6.787)
Sigma (ROA)	0.013***	0.014***	-0.006***	-0.009***	-0.003***	-0.002***	-0.004***	-0.003***
	(7.276)	(5.966)	(3.562)	(3.339)	(6.172)	(3.375)	(6.828)	(4.256)
Log(Market cap to GDP)	0.109***	0.051***	-0.036***	-0.003	-0.019***	0.000	-0.053***	-0.049***
	(7.779)	(3.148)	(3.145)	(0.140)	(4.587)	(0.031)	(7.890)	(6.035)

Legal rights indicator	-0.002	0.002	-0.004	-0.010**	-0.007***	-0.012***	0.014***	0.021***
	(0.521)	(0.461)	(1.163)	(2.024)	(4.704)	(5.208)	(6.904)	(8.120)
Constant	-0.114	0.264***	0.499***	0.281***	0.434***	0.395***	0.164***	0.042
	(1.632)	(4.062)	(8.240)	(3.626)	(16.926)	(12.996)	(4.620)	(0.992)
Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,135	12,135	12,135	12,135	12,135	12,135	12,135	12,135
R^2	0.304	0.358	0.164	0.288	0.302	0.150	0.374	0.335
F Statistic	138.282	16.798	26.170	21.272	73.291	30.654	119.707	77.052
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Notes: Standard errors are adjusted for clusters in firms and heteroskedastic robust variance estimators. *t* statistics in parentheses. *, ** and *** refer to significance at 10%, 5% and 1% levels respectively. Refer to table 2 for variables definition.

Table 4 – Panel data regressions results of capital structure.

Explanatory variables	*TD/(EE+TD)* (1)	*STD/(RE+STD)* (2)	*LTD/TD* (3)	*LTD/(EE+LTD)* (4)
% independent	-0.468***	0.274***	0.480***	-0.231**
	(7.727)	(4.210)	(8.472)	(2.352)
% women	-0.285*	0.337*	-0.283*	-0.669**
	(1.750)	(1.835)	(1.691)	(2.439)
Log(Board size)	-0.120***	-0.110**	0.091**	-0.068
	(2.610)	(2.261)	(2.113)	(0.918)
CEO/Chair duality	0.031	-0.065**	0.016	0.070*
	(1.271)	(2.344)	(0.717)	(1.748)
Sales Growth	-0.454***	0.342***	-0.045	-0.641***
	(3.964)	(3.315)	(0.480)	(3.559)
R&D to assets	-2.984***	-0.687	-1.045***	-4.303***
	(6.066)	(1.472)	(2.790)	(5.522)
Tax rate	-0.102*	0.254***	0.051	-0.016
	(1.894)	(5.237)	(1.411)	(0.210)
Log(Sales)	0.105***	0.032***	0.078***	0.187***
	(7.377)	(3.434)	(8.917)	(9.050)
Depreciation to assets	-0.849*	1.258**	1.530***	0.180
	(1.695)	(2.159)	(2.970)	(0.210)
Tangibility	0.665***	-0.430***	0.993***	1.493***
	(7.067)	(4.831)	(13.859)	(10.359)
Return on assets (ROA)	-1.991***	-1.392***	-1.109***	-3.445***
	(7.040)	(6.739)	(5.658)	(7.854)
Sigma (ROA)	-0.040***	-0.016***	-0.015***	-0.060***
	(7.756)	(3.022)	(3.564)	(7.287)
Log(Market cap to GDP ratio)	-0.334***	-0.063	-0.189***	-0.561***
	(10.058)	(1.530)	(4.148)	(8.353)
Legal rights indicator	0.033***	0.001	0.104***	0.119***
	(2.864)	(0.046)	(6.147)	(4.887)
Constant	0.129	-0.465**	-1.983***	-1.032***
	(0.751)	(2.224)	(9.565)	(3.274)
Industry Effects	Yes	Yes	Yes	Yes
Year Effects	Yes	Yes	Yes	Yes
Observations	12,018	11,364	12,135	11,827
R^2	0.360	0.089	0.241	0.347
F Statistic	124.425	12.382	43.064	92.336
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)

Notes: TD/(EE+TD) is defined as total debt divided by external equity plus total debt. Total debt is the sum of short term debt and long term debt. External equity is defined as market value of equity less retained earnings. STD/(RE+STD) is defined as short term debt divided by retained earnings plus short term debt. LTD/TD is the ratio of long term debt divided by total debt. LTD/(EE+LTD) is defined as long term debt divided by external equity plus long term debt. The variables are logarithmized to account for skewness in the data. Refer to table 2 for description of independent variables. Standard errors are adjusted for clusters in firms and heteroskedastic robust variance estimators. *t* statistics in parentheses. *, ** and *** refer to significance at 10%, 5% and 1% levels respectively.

Table 5 – Panel data regressions results of capital structure with lagged dependent variables.

	Panel A: *(endogenous variable)* $_{t+1}$				***Panel B:*** *(endogenous variable)* $_{t+4}$			
	TD/(EE+TD) (1)	*STD/(RE+STD)* (2)	*LTD/TD* (3)	*LTD/(EE+LTD)* (4)	*TD/(EE+TD)* (5)	*STD/(RE+STD)* (6)	*LTD/TD* (7)	*LTD/(EE+LTD)* (8)
% independent	-0.532***	0.290***	0.509***	-0.282***	-0.713***	0.224***	0.452***	-0.490***
	(8.365)	(4.267)	(8.537)	(2.728)	(8.664)	(2.791)	(6.346)	(3.929)
% women	-0.313*	0.322*	-0.278	-0.716**	-0.139	0.441**	-0.415**	-0.689**
	(1.819)	(1.684)	(1.635)	(2.503)	(0.686)	(1.983)	(2.026)	(1.994)
Log(Board size)	-0.126***	-0.108**	0.065	-0.104	-0.054	-0.091	0.025	-0.082
	(2.652)	(2.111)	(1.389)	(1.308)	(0.922)	(1.553)	(0.470)	(0.891)
CEO/Chair duality	0.040	-0.081***	0.019	0.081*	0.089***	-0.060*	0.030	0.128***
	(1.563)	(2.839)	(0.789)	(1.897)	(2.894)	(1.759)	(1.071)	(2.663)
Sales Growth	-0.467***	0.310***	-0.004	-0.632***	-0.277*	0.198	-0.076	-0.419*
	(3.868)	(2.870)	(0.042)	(3.296)	(1.884)	(1.433)	(0.513)	(1.653)
R&D to assets	-2.558***	-0.497	-0.533	-3.266***	-1.734**	-0.024	0.397	-1.484*
	(5.025)	(1.064)	(1.297)	(4.098)	(2.427)	(0.059)	(1.073)	(1.698)
Tax rate	-0.082	0.239***	0.069*	0.027	-0.192*	0.036	-0.149*	-0.286*
	(1.473)	(4.754)	(1.680)	(0.326)	(1.712)	(0.307)	(1.678)	(1.704)
Log(Sales)	0.106***	0.035***	0.078***	0.190***	0.120***	0.047***	0.083***	0.213***
	(7.450)	(3.515)	(8.756)	(9.219)	(7.658)	(3.805)	(7.527)	(9.411)
Depreciation to assets	-1.259**	1.243*	1.123**	-0.775	-2.055***	-0.945	1.122	-1.886
	(2.540)	(1.813)	(2.351)	(0.970)	(2.987)	(0.867)	(1.433)	(1.341)
Tangibility	0.675***	-0.473***	0.980***	1.496***	0.678***	-0.249**	0.766***	1.330***
	(6.893)	(5.138)	(13.947)	(10.292)	(6.007)	(2.174)	(9.184)	(7.780)
Return on assets (ROA)	-1.424***	-1.517***	-0.909***	-2.599***	-0.745**	-1.536***	-0.693***	-1.642***
	(5.053)	(6.830)	(4.544)	(6.007)	(2.312)	(5.363)	(2.950)	(3.322)
Sigma (ROA)	-0.038***	-0.014**	-0.013***	-0.056***	-0.034***	-0.002	-0.010	-0.049***
	(7.414)	(2.393)	(2.641)	(6.437)	(6.227)	(0.198)	(1.493)	(4.796)

Log(Market cap to GDP ratio)	-0.240*** (7.324)	-0.060 (1.409)	-0.184*** (3.813)	-0.434*** (6.261)	-0.570*** (7.465)	-0.134* (1.680)	-0.123 (1.594)	-0.804*** (6.628)
Legal rights indicator	0.018 (1.518)	-0.004 (0.314)	0.097*** (5.940)	0.094*** (3.796)	0.044** (2.567)	0.009 (0.566)	0.066*** (4.137)	0.101*** (3.675)
Constant	-0.165 (0.942)	-0.452** (2.072)	-1.925*** (8.668)	-1.355*** (4.057)	1.103*** (3.619)	-0.266 (0.784)	-1.737*** (5.043)	0.478 (0.915)
Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,603	9,090	9,708	9,423	2,396	2,275	2,427	2,352
R^2	0.318	0.096	0.233	0.306	0.297	0.091	0.203	0.282
F Statistic (p-value)	104.515 (0.000)	12.616 (0.000)	41.551 (0.000)	77.924 (0.000)	44.259 (0.000)	8.757 (0.000)	34.688 (0.000)	32.021 (0.000)

Notes: TD/(EE+TD) is defined as total debt divided by external equity plus total debt. Total debt is the sum of short term debt and long term debt. External equity is defined as market value of equity less retained earnings. STD/(RE+STD) is defined as short term debt divided by retained earnings plus short term debt. LTD/TD is the ratio of long term debt divided by total debt. LTD/(EE+LTD) is defined as long term debt divided by external equity plus long term debt. The variables are logarithmized to account for skewness in the data. Refer to table 2 for description of independent variables. Standard errors are adjusted for clusters in firms and heteroskedastic robust variance estimators. *t* statistics in parentheses. *, ** and *** refer to significance at 10%, 5% and 1% levels respectively.

Table 6 – 2sls regression results of capital structure.

Explanatory variables	*TD/(EE+TD)* (1)	*STD/(RE+STD)* (2)	*LTD/TD* (3)	*LTD/(EE+LTD)* (4)
% independent[a]	-0.520***	0.410***	0.505***	-0.290***
	(13.227)	(7.209)	(10.971)	(4.665)
Sales Growth	-0.342***	0.397***	-0.037	-0.464***
	(4.738)	(4.559)	(0.453)	(3.894)
R&D to assets	-3.075***	-0.711	-1.211***	-4.368***
	(9.573)	(1.498)	(3.638)	(8.574)
Tax rate	-0.079*	0.205***	0.069*	0.008
	(1.944)	(3.381)	(1.676)	(0.128)
Log(Sales)	0.087***	0.024***	0.089***	0.172***
	(10.160)	(3.078)	(12.644)	(13.971)
Depreciation to assets	-0.451	2.216***	2.282***	1.149*
	(1.147)	(4.004)	(5.113)	(1.876)
Tangibility	0.596***	-0.462***	0.957***	1.376***
	(8.889)	(6.258)	(15.622)	(13.887)
Return on assets (ROA)	-1.960***	-1.984***	-1.401***	-3.602***
	(8.930)	(9.352)	(6.535)	(10.254)
Sigma (ROA)	-0.037***	-0.018***	-0.014***	-0.058***
	(10.749)	(3.804)	(3.637)	(10.124)
Log(Market cap to GDP ratio)	-0.305***	-0.043	-0.139***	-0.487***
	(14.203)	(1.137)	(4.005)	(11.777)
Legal rights indicator	0.034***	-0.002	0.080***	0.103***
	(4.281)	(0.229)	(6.456)	(6.567)
Constant	0.145	-0.794***	-1.956***	-1.026***
	(1.362)	(5.231)	(12.881)	(5.497)
Industry Effects	Yes	Yes	Yes	Yes
Year Effects	Yes	Yes	Yes	Yes
Observations	7,189	4,535	4,854	7,032
χ^2	3230.558	409.059	1552.785	2333.000
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)
Wooldridge's χ^2	1.08575	2.4408	0.001933	0.00157
(p-value)	(0.2974)	(0.1182)	(0.9649)	(0.9684)
Sargan χ^2	0.044796	0.00042	0.955277	0.100666
(p-value)	(0.8324)	(0.9837)	(0.3284)	(0.7510)
Partial R^2	0.9243	0.8881	0.8855	0.9236

Notes: TD/(EE+TD) is defined as total debt divided by external equity plus total debt. Total debt is the sum of short term debt and long term debt. External equity is defined as market value of equity less retained earnings. STD/(RE+STD) is defined as short term debt divided by retained earnings plus short term debt. LTD/TD is the ratio of long term debt divided by total debt. LTD/(EE+LTD) is defined as long term debt divided by external equity plus long term debt. The variables are logarithmized to account for skewness in the data. Refer to table 2 for description of independent variables. Standard errors are adjusted for clusters in firms and heteroskedastic robust variance estimators. *z* statistics in parentheses. *, ** and *** refer to significance at 10%, 5% and 1% levels respectively. [a]instrumented with the lagged values.

Table 7 – Cross section regressions results of capital structure.

Year	% ind.	Growth	R&D	TAX	Sales	DEP	TANG	ROA	Sigma (ROA)	MC to GDP	LR	Const.	R^2
Panel A: Regression results of the fraction between total debt and total debt plus equity [TD/(EE+TD)]													
2006	-0.397***	-0.879***	-4.638**	-0.128	0.188***	-1.440	1.624***	-2.967***	-0.071***	-0.812***	0.149***	-0.141	0.353
	(3.754)	(3.556)	(2.257)	(0.779)	(8.947)	(1.265)	(9.527)	(5.408)	(5.731)	(5.469)	(4.391)	(0.258)	
2007	-0.374***	-0.806***	-4.707***	0.064	0.182***	-0.607	1.632***	-3.674***	-0.060***	-0.801***	0.154***	-0.108	0.366
	(3.772)	(3.418)	(4.185)	(0.416)	(8.872)	(0.372)	(9.454)	(7.120)	(5.640)	(6.964)	(5.529)	(0.232)	
2008	-0.137	-0.462**	-3.571***	0.022	0.152***	0.152***	1.315***	-2.834***	-0.050***	-0.420***	0.103***	-1.306***	0.265
	(1.308)	(2.151)	(3.604)	(0.223)	(7.602)	(7.602)	(8.367)	(4.934)	(4.672)	(5.179)	(3.616)	(3.831)	
2009	-0.308***	-0.500***	-4.626***	0.034	0.160***	-0.125	1.448***	-3.942***	-0.066***	-0.487***	0.104***	-0.996***	0.324
	(2.930)	(2.779)	(5.223)	(0.317)	(7.342)	(0.120)	(8.056)	(5.931)	(7.060)	(6.929)	(3.772)	(3.164)	
2010	-0.406***	-0.412*	-5.284***	-0.022	0.203***	1.937	1.323***	-4.458***	-0.057***	-0.448***	0.085***	-1.285***	0.349
	(4.006)	(1.908)	(6.063)	(0.167)	(8.941)	(1.586)	(7.372)	(7.536)	(6.472)	(7.083)	(3.423)	(3.935)	
Panel B: Regression results of the fraction between short term debt and retained earnings plus short term debt [STD/(RE+STD)]													
2006	0.311***	0.321**	-0.738*	0.219**	0.009	0.511	-0.367***	-1.336***	-0.008	-0.128*	0.018	-0.428	0.079
	(4.527)	(2.236)	(1.751)	(2.052)	(0.868)	(0.875)	(3.390)	(4.769)	(1.052)	(1.797)	(1.212)	(1.439)	
2007	0.179***	0.496***	-0.185	0.353***	0.023**	0.533	-0.500***	-0.845***	-0.020***	0.089	-0.004	-1.403***	0.078
	(2.627)	(3.347)	(0.306)	(3.789)	(2.099)	(0.614)	(4.641)	(3.270)	(3.125)	(1.468)	(0.350)	(4.867)	
2008	0.444***	0.166	-1.405**	0.297***	0.041***	1.387*	-0.492***	-1.167***	-0.018**	-0.153***	0.005	-0.554***	0.101
	(5.837)	(0.912)	(2.374)	(4.043)	(3.743)	(1.798)	(4.333)	(3.391)	(2.183)	(2.640)	(0.371)	(2.595)	
2009	0.454***	0.371***	-0.595	0.160**	0.015	2.276***	-0.532***	-1.845***	-0.024***	-0.075	-0.007	-0.524**	0.102
	(5.970)	(3.196)	(0.878)	(2.054)	(1.339)	(3.044)	(5.098)	(6.754)	(3.257)	(1.317)	(0.494)	(2.357)	
2010	0.310***	0.417***	-0.829	0.262***	0.034***	2.164***	-0.396***	-2.141***	-0.013**	-0.075	0.005	-1.082***	0.102
	(4.104)	(3.268)	(1.244)	(2.697)	(3.178)	(2.631)	(3.778)	(6.530)	(2.019)	(1.317)	(0.346)	(5.298)	
Panel C: Regression results of the fraction between long term debt and total debt [LTD/TD]													
2006	0.242***	-0.194	-1.611	-0.011	0.086***	0.558	1.024***	-0.822***	-0.019***	-0.208**	0.114***	-1.669***	0.217
	(3.772)	(1.406)	(1.422)	(0.136)	(8.009)	(0.558)	(9.352)	(3.645)	(3.681)	(2.137)	(4.430)	(4.726)	
2007	0.519***	-0.000	-0.974	0.040	0.074***	0.514	1.093***	-1.093***	-0.013**	-0.379***	0.127***	-1.030***	0.261
	(8.978)	(0.001)	(1.512)	(0.511)	(7.327)	(0.385)	(10.953)	(4.357)	(2.256)	(4.905)	(6.458)	(3.464)	

2008	0.441***	0.056	-0.760	0.060	0.082***	1.645***	1.006***	-1.071***	-0.018***	-0.172***	0.106***	-2.046***	0.235
	(7.091)	(0.502)	(1.394)	(1.099)	(8.402)	(3.060)	(12.000)	(3.254)	(3.394)	(3.099)	(5.248)	(9.946)	
2009	0.506***	0.039	-1.257***	0.119**	0.085***	1.896***	0.991***	-1.415***	-0.013***	-0.136***	0.088***	-2.033***	0.251
	(8.419)	(0.389)	(2.745)	(2.228)	(9.464)	(3.473)	(11.161)	(5.023)	(2.612)	(2.799)	(4.667)	(10.323)	
2010	0.507***	-0.117	-1.174**	0.001	0.092***	2.844***	0.916***	-1.393***	-0.015***	-0.143***	0.072***	-1.860***	0.262
	(8.103)	(0.903)	(2.546)	(0.021)	(8.534)	(3.831)	(10.874)	(4.353)	(2.584)	(2.929)	(4.552)	(7.996)	
Panel D: Regression results of the fraction between long term debt and external equity plus long term debt [LTD/(EE+LTD)]													
2006	-0.397***	-0.879***	-4.638**	-0.128	0.188***	-1.440	1.624***	-2.967***	-0.071***	-0.812***	0.149***	-0.141	0.353
	(3.754)	(3.556)	(2.257)	(0.779)	(8.947)	(1.265)	(9.527)	(5.408)	(5.731)	(5.469)	(4.391)	(0.258)	
2007	-0.374***	-0.806***	-4.707***	0.064	0.182***	-0.607	1.632***	-3.674***	-0.060***	-0.801***	0.154***	-0.108	0.366
	(3.772)	(3.418)	(4.185)	(0.416)	(8.872)	(0.372)	(9.454)	(7.120)	(5.640)	(6.964)	(5.529)	(0.232)	
2008	-0.137	-0.462**	-3.571***	0.022	0.152***	1.965**	1.315***	-2.834***	-0.050***	-0.420***	0.103***	-1.306***	0.265
	(1.308)	(2.151)	(3.604)	(0.223)	(7.602)	(2.146)	(8.367)	(4.934)	(4.672)	(5.179)	(3.616)	(3.831)	
2009	-0.308***	-0.500***	-4.626***	0.034	0.160***	-0.125	1.448***	-3.942***	-0.066***	-0.487***	0.104***	-0.996***	0.324
	(2.930)	(2.779)	(5.223)	(0.317)	(7.342)	(0.120)	(8.056)	(5.931)	(7.060)	(6.929)	(3.772)	(3.164)	
2010	-0.406***	-0.412*	-5.284***	-0.022	0.203***	1.937	1.323***	-4.458***	-0.057***	-0.448***	0.085***	-1.285***	0.349
	(4.006)	(1.908)	(6.063)	(0.167)	(8.941)	(1.586)	(7.372)	(7.536)	(6.472)	(7.083)	(3.423)	(3.935)	

Notes: TD/(EE+TD) is defined as total debt divided by external equity plus total debt. Total debt is the sum of short term debt and long term debt. External equity is defined as market value of equity less retained earnings. STD/(RE+STD) is defined as short term debt divided by retained earnings plus short term debt. LTD/TD is the ratio of long term debt divided by total debt. LTD/(EE+LTD) is defined as long term debt divided by external equity plus long term debt. Refer to table 2 for description of independent variables. The variables are logarithmized to account for skewness in the data. Heteroskedastic robust *t* statistics in parentheses. *, ** and *** refer to significance at 10%, 5% and 1% levels respectively.

Table 8 – Panel data regressions results of capital structure including country fixed effects.

Explanatory variables	*TD/(EE+TD)* (1)	*STD/(RE+STD)* (2)	*LTD/TD* (3)	*LTD/(EE+LTD)* (4)
% independent	-0.501**	0.257**	0.483***	-0.385**
	(-2.716)	(2.384)	(5.083)	(-2.027)
% women	-0.286	0.382	-0.347*	-0.703**
	(-1.535)	(1.403)	(-1.800)	(-2.211)
Log(Board size)	-0.150*	-0.109	0.088*	-0.051
	(-1.811)	(-1.686)	(1.975)	(-0.552)
CEO/Chair duality	0.027	-0.059	0.010	0.069
	(0.894)	(-1.246)	(0.399)	(1.429)
Sales Growth	-0.444	0.348***	-0.044	-0.640
	(-1.645)	(2.899)	(-0.252)	(-1.455)
R&D to assets	-2.970**	-0.670	-1.353***	-4.406***
	(-2.730)	(-0.937)	(-2.795)	(-2.836)
Tax rate	-0.110	0.252***	0.055	-0.010
	(-0.778)	(5.786)	(0.632)	(-0.095)
Log(Sales)	0.102*	0.021	0.085***	0.184**
	(1.881)	(1.232)	(5.821)	(2.466)
Depreciation to assets	-0.732	1.352	1.805***	0.104
	(-1.433)	(1.683)	(2.850)	(0.245)
Tangibility	0.744***	-0.530*	1.021***	1.705***
	(2.822)	(-1.715)	(5.213)	(4.219)
Return on assets (ROA)	-1.560**	-1.265***	-1.125***	-3.326**
	(-2.197)	(-3.205)	(-2.816)	(-2.492)
Sigma (ROA)	-0.042***	-0.015***	-0.015***	-0.061***
	(-7.410)	(-4.192)	(-3.747)	(-6.809)
Log(Market cap to GDP ratio)	-0.430***	-0.042	-0.155*	-0.672***
	(-3.458)	(-0.781)	(-1.722)	(-2.926)
Legal rights indicator	0.023	0.000	0.096	0.135
	(0.898)	(0.015)	(1.467)	(1.202)
Constant	0.452	-0.450	-1.380***	-1.185
	(0.222)	(-1.315)	(-7.936)	(-1.301)
Industry Effects	Yes	Yes	Yes	Yes
Year Effects	Yes	Yes	Yes	Yes
Country Effects	Yes	Yes	Yes	Yes
Observations	12,018	11,364	12,135	11,827
R^2	0.431	0.133	0.306	0.408
F Statistic (p-value)	156.140 (0.000)	29.890 (0.000)	91.591 (0.000)	139.523 (0.000)

Notes: TD/(EE+TD) is defined as total debt divided by external equity plus total debt. Total debt is the sum of short term debt and long term debt. External equity is defined as market value of equity less retained earnings. STD/(RE+STD) is defined as short term debt divided by retained earnings plus short term debt. LTD/TD is the ratio of long term debt divided by total debt. LTD/(EE+LTD) is defined as long term debt divided by external equity plus long term debt. The variables are logarithmized to account for skewness in the data. Refer to table 2 for description of independent variables. Standard errors are adjusted for clusters in firms and heteroskedastic robust variance estimators. *t* statistics in parentheses. *, ** and *** refer to significance at 10%, 5% and 1% levels respectively.

Highlights:

- We analyse the relationship between Board of directors' composition and capital structure in a multi-country sample.
- Firms with more independent directors have a capital structure composed with more external equity.
- Firms with gender diversified boards and where the chairman is non-executive have a capital structure composed with more long term sources of financing.

***Graphical Abstract**