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Abstract

This paper focuses on the capital structure determinants of venture capital backed firms prior to the venture capital investment event. The analyses are carried out on a matched sample of Spanish venture capital backed firms at the expansion stage and similar firms that did not receive venture funding. In the former, the results show that the structure of assets, size and growth opportunities have a positive impact on the debt ratio. Conversely, only profitability is negatively related to the leverage ratio in non venture capital backed firms. Overall, there is stronger evidence on the Pecking Order Theory for venture capital backed firms.

Keywords: Capital structure, determinants, growth opportunities, venture capital
JEL Classification: G32, G24

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1 Introduction

In the past few years many papers have addressed the issue of the better performance of Venture Capital (VC) backed firms when compared to similar, non-VC-backed firms. VC is a source of external financing that has spread all over the world since the first deals were conducted in the US in the mid forties. It implies an equity, or quasi-equity, injection in firms that have good growth prospects. Many papers have already addressed the determinants of getting VC funding, based on the human capital, the market size, and the uniqueness of the product or service.

However, there is little evidence on the study of several aspects related to the capital structure of VC-backed firms. To cover this gap, the aim of this paper is to analyse whether the determinants of capital structure are able to explain why these firms get access to VC later. In particular, this paper analyses the determinants of capital structure before the investment event and to what extent those determinants are different from those of other similar firms that do not receive VC.

The analysis is carried out on a comprehensive sample of Spanish VC-backed firms during the period 1995 to 2007. As De Clercq et al. (2008) point out, limiting the scope of analysis to one country increases the likelihood that the participants operate under similar constraints resulting from the institutional and legal environment. Additionally, this approach also reduces the heterogeneity that would arise from comparing companies that are subject to different accounting systems.

The results show that the leverage of VC-backed firms is clearly related to growth opportunities, which is not the case in similar non-VC-backed firms. We also find that the Pecking Order Theory is the basis for a better understanding of the capital structure determinants on the former firms, even though variables such as the structure of assets and size also play a significant role.

The rest of the paper is organised as follows. Section 2 provides an overview on the VC process in order to understand the functioning of this activity. Section 3 reviews the theory and existing literature on capital structure theory, which is related to VC as a source of external finance. Section 4 describes the dataset and the methodology. The results of the regression analyses are presented in Section 5. Section 6 concludes the paper and discusses the results obtained.

2 Venture capital activity

The VC process is characterized by cyclical behaviour, meaning that its stages are periodically repeated. There are three main stages: fundraising, investment in companies with high potential returns and, finally, divestment. The process starts when VC organisations raise funds. Most of the resources of this activity are destined for closed-end funds with a limited life of between eight and twelve years.

These funds are formed by general partnerships or VC organisations. As a general rule, when investors join a new fund, they sign a commitment, but they are not required to disburse the money until a given investment is approved. Additionally, investors often cannot always commit the amount of funds they would like to. This is due to the fact that VC organisations are usually reluctant to accept large sums of money, as the number of experienced investment managers often adjusts more slowly than the swings in capital (Gompers and Lerner, 2002). This first stage of the process usually takes between twelve and eighteen months.

In the second stage of the process, the VC organisation first activates a deal flow, and then starts screening investment proposals. VC organisations tend to specialise in certain industries or stages of development of the firms where they can best provide experience, managerial advice and contacts with third parties (Norton and Tenenbaum, 1993). The companies selected are then asked to provide a comprehensive business plan. In this part of the process, both parties express their preferences on the financial instruments to be used. If an agreement is reached, a letter of intention is signed. What follows is a process, known as due diligence, in which the management team carries out a detailed investigation into the company concerned. To finalize this process, the fund managers ask the investors to pay their share of the capital required. Given that companies which receive this type of finance are rarely stock market quoted, the entry process is slow usually taking between fourteen and sixteen weeks. Due to the complexity of the process, the total time required to invest the majority of the fund is often around three years.

The final stage of the process is the divestment of the shares of the companies in the portfolio. Up to this moment, the aim of the fund managers is mainly to add value to the companies in the portfolio through management support and by providing credibility to third parties. As the normal functioning of funds implies a progressive return of the proceeds from divestments to the investors, managers have to launch

new funds approximately every two or three years in order to continue with the investment activity, thus beginning the process anew.

3 The capital structure of firms and its relationship with venture capital

3.1 Theories and evidence on capital structure

The study of the factors that influence the financing of firms is one of the main topics of research in modern finance (Myers, 1984). A vast stream of literature has focused on the variables that determine the capital structure of firms (Titman and Wessels, 1988; De Miguel and Pindado, 2001; Sogorb-Mira, 2005). Although there is not yet a universally accepted theory on capital structure (Harris and Raviv, 1991), some theories have been proposed with different implications on the way firms finance their projects.[1] Since the seminal works by Modigliani and Miller (1958; 1963), a vast amount of research has been conducted on this topic.

One stream of papers considers that while debt has a positive effect on the value of firms, it also implies bankruptcy costs (Kraus and Litzenberger, 1973) as well as agency costs (Jensen and Meckling, 1976; Myers, 1977). This leads to the static or Trade-off Theory, which states that there exists a trade-off between the tax advantages of debt and financial distress costs, which leads to the existence of an optimum level of debt (Bradley et al., 1984). Myers (1984) and Myers and Majluf (1984) reconsider this theory and present an alternative one, the Pecking Order Theory,[2] based on the information asymmetries that exist between insiders (i.e., managers, who are assumed to behave in current shareholder interests) and outsiders, primarily financing suppliers. According to the latter theory, firms follow a hierarchical order when they choose from among the different instruments available for financing: first internal funds and, in the event of external funds being needed, the preferred ones are those that imply a lower level of information asymmetry, since their cost would be lower. In this way, equity should be used as the last resource.

A vast number of empirical papers have tried to provide evidence of one of these theories. In some cases the Trade-off Theory has been proved (Marsh, 1982; Bradley et al., 1984; Jalilvand and Harris, 1984; Fischer et al., 1989; Hovakimiam et

[1] Harris and Raviv (1991) distinguish among theories based on fiscal considerations, agency costs, information asymmetries, interaction between input and product markets and corporate control. After that, other theories based on how the current market situation affects capital structure have been proposed (Baker and Wurgler, 2002; Welch, 2004).

[2] Myers (1984) states that this behaviour had already been mentioned in Donaldson (1961).

al., 2001; Ozkan, 2001; Hovakimian et al., 2004; Flanery and Ragan, 2006; López-Gracia and Sogorb-Mira, 2008; among others), whereas in others the Pecking Order Theory is able to explain the debt ratios to a larger extent (Shyam-Sunder and Myers, 1999; Watson and Wilson, 2002; Sánchez-Vidal and Martín-Ugedo, 2005). Some papers also find that there are mixed effects from both theories (Fama and French, 2002; Frank and Goyal, 2003). According to Myers (2001), the disparity of results could be explained by the use of heterogeneous samples in the empirical analysis.

The first empirical papers on the topic focused on quoted or large firms. However, since the 90s, more attention has been devoted to small and medium firms because of the interest of academics and political regulators in these firms (Berger and Udell, 1998) and because they are different in many respects, including financing, to large firms (Hutchinson et al., 1998). In this way, while large firms can negotiate on more favourable terms, small firms face several constraints that prevent them from obtaining funds in favourable conditions. VC is considered as a source of long term financing that sometimes is the only alternative for growth firms. Albeit there is increasing interest in small firms, the capital structure of VC-backed firms has received little attention (Cumming, 2005). The interest in the latter firms has relied on the instruments that are most convenient for investors (Bergeman and Hedge, 1998; Cumming 2005). However, very few papers investigate the impact that VC can have on the capital structure of the firms they back. One of the few papers relevant in this area is the one by Hogan and Hudson (2007), who analyse the capital structure of VC-backed firms in the software sector and conclude that the Pecking Order Theory seems better to explain their debt ratios.

However, to the best of our knowledge, this is the first paper that empirically analyses the determinants of capital structure in VC-backed firms before the VC investment and aims to analyse whether it could have an impact on the probability of receiving VC later on. This paper tries to add evidence to the literature since, apart from analysing the determinants of the capital structure of these firms, the differences found between VC and non-VC-backed firms are also studied. In this way, the possible differences, if any, could be motivated by the specific characteristics of the firms in which venture capitalists (VCs) invest.

3.2 Determinants of the capital structure of venture capital backed firms

Regarding the study of the factors that affect the capital structure of firms, Harris and Raviv (1991) find consensus on the relevance of the following variables on the debt level: tangible fixed assets, size, probability of default, profitability, volatility, growth opportunities, tax effects, marketing expenditures, research and development expenditures and the specificity of the product. Since the analyses are carried out on a sample of unquoted firms, there is no publicly available information on marketing and research & development expenditures, nor about the specificity of the product. Therefore, we focus on the following characteristics:

- *Tangible fixed assets*

The relationship between bondholders and shareholders is subject to a problem of moral hazard, since there are situations in which shareholders attempt to increase their value at the expense of bondholders, giving rise to the existence of conflicts of interest between these two groups. One of the consequences of this problem relates to situations in which shareholders carry out high-risk investment projects, which is exacerbated by the limited liability that shareholders enjoy, since the risk is passed on to bondholders (Jensen and Meckling, 1976). The magnitude of this problem diminishes as the level of debt decreases. In this context, the tangible fixed assets of the firm may be used as collateral, thus limiting the extent of this problem. Moreover, in a context of liquidation of a firm, the tangible rather than the intangible fixed assets are the ones that preserve most of their value (Wald, 1999). In this line, the level of tangible fixed assets should have a positive relationship with the level of debt (Titman and Wessels, 1988; Mackie-Mason 1990; Prowse, 1990; Jensen et al., 1992; Smith and Watts 1992; Grier and Zychowicz, 1994; Hovakimian et al., 2001; Frank and Goyal, 2003).

In the same vein, Myers and Majluf (1984) suggest that firms may find advantageous to sell secured debt, due to the fact that the cost of this would be lower. For this reason, firms with more tangible assets that can be used as collateral may be expected to issue more debt to take advantage of this fact. This leads us to formulate the following hypothesis:

Hypothesis 1: The relationship between tangible fixed assets and the level of debt should be positive both for VC and non-VC-backed firms.

- *Size – Probability of default*

The size of the firm is negatively related to the probability of default (Titman and Wessels, 1988; Rajan and Zingales, 1995; Fama and French 2002; Frank and Goyal 2003). It is assumed that large firms are better diversified, so that their profits and cash flows are subject to lower volatility. Moreover, with lower cash flow volatility it is more likely that firms can benefit from tax deductions related to interest rate payments (Hovakimian et al., 2001). According to this evidence, a positive relationship between size and level of debt should be expected (Titman and Wessels, 1988; Hovakimian et al., 2001; Frank and Goyal, 2003). Similarly, Rajan and Zingales (1995) affirm that informational asymmetries between insiders and external investors are lower for large firms. As a result, the cost of external financing should be lower for these firms when compared with the costs that smaller firms face.

Nevertheless, size could be an irrelevant characteristic for small and medium firms since, like profitable large firms without large growth opportunities the former could finance their assets basically with internal sources. Therefore, with the caveat of this latter argument, no significant differences between VC and non-VC-backed firms are expected. This leads us to formulate the following hypothesis:

Hypothesis 2: The size of the firm is positively related to the level of debt, both for VC and non-VC-backed firms.

- *Profitability*

One of the advantages of debt is obtained through the tax deductibility of interest payments (Modigliani and Miller, 1963). In this way, the more profitable a firm is, the higher the possibility of paying lower taxes through interest payments and the lower the probability of default. Thus, profitable firms are expected to have a high level of debt. However, firms that generate high levels of internal funds should not use external funds very often according to the Pecking Order Theory (Myers, 1984; Myers and Majluf, 1984). Therefore, a negative relationship between return and level of debt should exist (Rajan and Zingales, 1995; Ozkan 2001). We assume that this latter view should be valid for both VC and non-VC-backed firms in the following hypothesis:

Hypothesis 3: The profitability of a firm is negatively related to the debt ratio in both VC and non-VC-backed firms.

- *Volatility*

Even though current profits are important, their dispersion over time is a key characteristic that creditors take into account. In this line, Titman and Wessels (1988) argue that there should be a negative relationship between volatility and debt, which is widely accepted in the literature (Harris and Raviv, 1991; Michaelas et al., 1999; Fama and French, 2002). Nevertheless, in growing firms there might be high dispersion because the profits are growing fast over time. Since capital structure determinants are tested on, supposedly, high growth firms, the reverse sign is expected, at least for VC-backed firms. Therefore, the next hypothesis would be as follows:

Hypothesis 4: The relationship between dispersion in returns and debt should be positive for VC-backed firms, whereas it should be negative for non-VC-backed firms.

- *Growth opportunities*

According to Titman and Wessels (1988) growth opportunities are represented by those assets that add value to the firm but can not be used as collateral and do not currently generate profits for the firm. Wald (1999) points out that firms with high growth opportunities have more potential to carry out future investments. However, this situation could give rise to agency conflicts whereby shareholders expropriate value from bondholders. This should lead to lower levels of debt. Moreover, low levels of debt would allow the firm not to disregard valuable investment opportunities (Myers, 1977; Ozkan, 2001). Therefore, the relationship between debt and growth opportunities should apparently be negative (Myers, 1977).

Michaelas et al. (1999) point out, however, that firms with high growth opportunities should use debt since the internal funds generated would not be enough to finance their growth. In this line, if firms estimate future financial needs, they will establish current relationships with financial providers, since this will both ease their access to the financing needed and lower the cost associated with the money provided (Cassar, 2004).

In relation with VC and non-VC-backed firms, some differences could be found, since the former are expected to have higher growth opportunities, which is one of the characteristics that VCs require when investing in a firm.

Hypothesis 5: The relationship between growth opportunities and debt should be positive and stronger for VC-backed firms.

- *Tax aspects related to capital structure*

The literature has highlighted the direct relationship between the effective corporate tax paid and debt (Graham, 1996; Michaelas et al. 1999), since firms that pay higher taxes could benefit more from tax shields. Nevertheless, since there are tax shields different from those related to interest rate payments, a different approach is to analyse their effect on the debt ratio as well. In this sense, Titman and Wessels (1988) argue that an inverse relationship between debt levels and non-debt tax shields is anticipated. However, the empirical evidence on this topic is mixed, since some papers find a direct relationship (Bathala et al., 1994; Grier and Zychowicz, 1994), while others encounter an inverse relationship (Barton et al., 1989; Prowse, 1990). In order to account for this mixed evidence, Mackie-Mason (1990) proposes breaking down the non-debt tax shields into two components: the investment tax credits, which should have a direct relationship, and the tax loss carry-forwards, with an expected inverse relationship.

Regarding VC-backed firms, since they are about to be screened by a VC institution, they are seeking finance to fund their growth opportunities. Their priority is to seek finance rather than to minimise tax payments through capital structure decisions. However, this might not be valid for non-VC-backed firms.

Hypothesis 6: The relationship between tax shields and debt level should not be important for VC-backed firms whereas it could be relevant for non-VC-backed firms.

4 Data and methodology

4.1 Data and sample selection

Our research questions are tested on a sample of Spanish VC-backed firms that were at the expansion stage at the time of the initial VC investment. The period analysed covers VC investments reported from 1995 until 2007. The source of data is the Spanish Private Equity and Venture Capital Association (ASCRI) and www.webcapitalriesgo.com, which feeds an annual database in collaboration of one of the co-authors since 1984.[3] The key advantage of using this database is that it covers all individual deals carried out in Spain, allowing us to create an unbiased sample that is close to the full population. According to Marti and Salas (2008, 2009), 2,651 private equity investments were recorded over the period 1995-2007,

[3] No other official source keeps track of VC activity in Spain, neither the Bank of Spain nor the Securities and Exchange Commission (CNMV).

including all stages, from seed to buyout, but excluding investments in financial and real estate sectors. We were able to find relevant accounting data from 2,230 of these firms and to match each VC-backed firm with a similar non-VC-backed one in 1,965 firms. Those at the expansion stage were 757 firms. The accounting data were taken from the Official Trade Registers and from the Amadeus Database. Since the aim is to analyse the capital structure determinants prior to the initial VC investment, we selected those firms for which we could track at least 3 years before the external financing event. The number of firms that fulfilled this requirement is 385. The hypotheses proposed are tested on a matched panel of 385 VC-backed firms and 385 control group firms. The latter firms were selected from the Amadeus Database by filtering one firm belonging to the same NACE code, of similar size (sales and/or employment and/or total assets), and in the same region.[4] Table 1 shows the mean of sales, headcount and total assets for both groups prior to the initial VC investment, highlighting that mean values of both groups are not statistically different. The tests are repeated by separating firms located in developed versus less developed areas.

Table 1. Mean of sales, headcount and total assets

Group	n	Sales	Employees	Assets
Sample				
VC-backed	385	16,856	163	17,139
Non-VC-backed	385	16,476	117	14,122
	p-value	0.4481	0.1489	0.1616
Developed regions				
VC-backed	227	18,776	218	17,984
Non-VC-backed	242	19,537	136	15,125
	p-value	0.4302	0.1328	0.2508
Less developed regions				
VC-backed	158	14,109	86	15,932
Non-VC-backed	143	11,303	87	12,427
	p-value	0.1807	0.4918	0.2063

*Sales in thousand constant 2001 Euro.
Source: Amadeus Database.

4.2 Model and methodology

According to the literature, capital structure can be explained by the structure of assets, the size of the firm, its profitability, volatility, growth opportunities and the tax

[4] In some cases we did not find a similar firm in the same region, so we selected a valid firm from a different Spanish region..

impact of leverage. Therefore, the general model that aims to explain the leverage of a firm could be represented as follows:

Debt ratio = F (tangibility, size, profitability, volatility, growth opportunities, tax effects)

The dependent variable (Ratio) could be defined as the quotient between long term debt and long term debt plus total equity (Rajan and Zingales, 1995; De Miguel and Pindado, 2001), or as the quotient between long term debt and total assets (Sogorb-Mira, 2005). Since the right hand-side of the equation contains several accounting variables divided by total assets as well, the first dependent variable proposed may imply fewer endogeneity concerns.

Regarding the exogenous variables, the empirical analysis includes all the variables that have proved to be relevant in the literature, such as tangibility, size, profitability, volatility, growth opportunities and tax effects. The first one aims to analyse the relationship between assets that could be used as collateral and debt, assuming that those firms with larger tangible assets could have access to larger amounts of debt. Therefore, a positive relationship is anticipated. Rajan and Zingales (1995), Hovakimian et al. (2001), Frank and Goyal (2003), Hovakimian et al. (2004) and Flanery and Ragan (2006), among others, define the weight of tangible assets as the quotient between tangible fixed assets and total assets (Tang1). An alternative measure, defined as the quotient between tangible fixed assets plus inventories and total assets (Tang2), is found in Titman and Wessels (1988) and Sogorb-Mira (2005).

The second category is related to the size of the firm, assuming that larger firms, which are more visible, would encounter fewer difficulties in raising funds from creditors. From a different perspective, larger firms are, usually, more diversified and show a lower probability of default. This variable could be defined as the natural logarithm of sales (Titman and Wessels, 1988; Rajan and Zingales, 1995; Ozkan, 2001; Baker and Wurgler, 2002; Frank and Goyal, 2003; Hovakimian et al. 2004; among others). Alternatively, it is also represented by the natural logarithm of total assets (Titman and Wessels, 1988; Hovakimian et al. 2001; Fama and French, 2002; Sogorb-Mira, 2005; Flanery and Ragan, 2006; among others). The analyses focus on this latter variable (Size).

As regards profitability, firms with higher profits may benefit from tax deductions related to interest payments to a larger extent, thus implying a positive relationship

of this variable with debt. But, conversely, those firms are also more capable of reducing the need to access external funds, according to the Pecking Order Theory. Following Titman and Wessels (1988), Hovakimian et al. (2001), Ozkan (2001) and Baker and Wurgler (2002), among others, we may define it as the quotient between earnings before interest, taxes, depreciation and amortization (EBITDA) and total assets (Prof1); or as the quotient between earnings before interest and taxes (EBIT) and total assets (Prof2) (Fama and French, 2002; Frank and Goyal, 2003; Sogorb-Mira, 2005; Flanery and Ragan, 2006). Other authors (Titman and Wessels, 1988) also cite the relationship between EBITDA and sales, but we think this latter quotient is more linked to a margin rather than to the return obtained from the assets committed to the activity.

The fourth category aims to measure volatility. There are different ways to measure it, the first one being the variation coefficient of EBIT (Michaelas et al., 1999). Other measures include the standard deviation of the change in EBIT (Titman and Wessels, 1988), or the standard deviation of the change in EBITDA (Mackie-Manson, 1990). As all these variables are time invariant, they would be excluded in a static fixed effects regression. On the other hand, since the analysis is based on an unbalanced panel, for some firms this measure would compute a large number of years while for others the number of observations would be smaller. Considering that banks usually assess a limited number of years in their screening process, the measure of volatility provided in this paper refers to a moving standard deviation computing the changes in EBITDA (Vol1), or EBIT (Vol2), of the current and the previous two years. Even though a negative sign is expected in the literature, since a greater volatility would imply a lower debt ratio, in the case of growth firms this measure could be anticipating positive changes in profits. Therefore, a positive sign, at least for VC-backed firms, is anticipated.

Growth opportunities are measured in different ways in the literature. Titman and Wessels (1988) define it as the percentage of change in total assets. Nevertheless, it could be argued that this is more a representation of past growth, as discussed by Fama and French (2002), which could or could not be related to future growth. Michaelas et al. (1999) introduce the ratio between intangible assets and total assets as an alternative measure of future growth (GO).

Finally, the tax effects are included in two ways. First, the ratio between the effective corporate tax paid and the earnings before tax (ETR) is computed, as suggested by

Kim and Sorensen (1986) and Ozkan (2000). Second, the non-debt tax shield is estimated as the quotient between depreciation and total assets (NDTS) (Titman and Wessels, 1988; Ozkan, 2001; Fama and French, 2002; Sogorb-Mira, 2005; Flanery and Ragan 2006).

Table 2. Description of variables

Variable	Description
Ratio	Quotient between long term debt and long term debt plus total equity.
Tang1	Quotient between tangible fixed assets and total assets.
Tang2	Quotient between tangible fixed assets plus inventories and total assets.
Size	Natural logarithm of total assets.
Prof1	Quotient between earnings before interest, taxes, depreciation and amortization (EBITDA) and total assets.
Prof2	Quotient between earnings before interest and taxes (EBIT) and total assets.
Vol1	Moving standard deviation of the change in EBITDA, computing the current and the two previous years.
Vol2	Moving standard deviation of the change in EBIT, computing the current and the two previous years.
GO	Ratio between intangible assets and total assets.
ETR	Quotient between the effective corporate tax paid and the earnings before tax.
NDTS	Quotient between depreciation and total assets.

Since the data refer to time series observations on a sample of firms, the panel data methodology is employed to estimate the different specifications of the model. Regarding the estimation method, the possible correlation between the exogenous variables and the individual effects is tested (Hausman, 1978) to check whether fixed effects or random effects are best suited.

4.3 Descriptive statistics

The leverage ratios of VC and non-VC-backed firms are shown in Table 3. Panel A shows that, on average, VC-backed firms show higher debt ratios prior to the entry of the VCs. Despite the fact that both groups did not show differences in size, Panel B highlights that their debt ratios are significantly different for both groups in each of the three years before the initial VC investment. This could imply that firms get access to VC so as to continue growing when they have exhausted their capacity to raise debt, thus signalling the superior explanatory capacity of the Pecking Order Theory.

A further comment should be made about the maximum and minimum leverage ratios, since values above one and below zero are found, respectively. They are related to negative equity values, due to cumulative losses that are found in some firms, mostly VC-backed. Excluding these observations could lead to a bias in the results obtained.[5]

Table 3. Descriptive statistics of the leverage ratio before the initial VC investment

Panel A. Descriptive statistics of the debt ratio

Variable	Obs	Mean	Std. Dev.	Min	Max
All firms	5086	0.3144	1.3037	-2.8689	84.9746
VC-backed	2581	0.3608	1.7244	-2.4369	84.9746
Non-VC-backed	2505	0.2667	0.6191	-2.8689	24.5818

Panel B. Debt ratio evolution prior to the initial investment

		Debt ratio		
Group / Year		t - 1	t - 2	t - 3
VC-backed		0.3983	0.3455	0.3634
Non-VC-backed		0.2365	0.2634	0.2421
	p-value	0.0000	0.0002	0.0015

t: Year of the initial VC investment.

Regarding the exogenous variables, Table 4 shows several descriptive statistics. Tangible fixed assets represent around one third of the total assets, with the ratio being greater for VC-backed firms. When inventories are added, the sum represents about half of total assets. The natural logarithm of total assets shows that both groups are similar in this respect. The ratio between EBITDA and total assets also shows similar values, which are slightly greater in non-VC-backed firms. Similarly, the range of values, as well as the standard deviation, is larger in this latter group of firms. The same applies to the ratio EBIT over total assets. Similar values are also found for the average and the standard deviation in the relationship between Depreciation and Total assets, represented by NDTS, and in the first measure of volatility (Vol1). Nevertheless, important differences are found between the two groups in the second measure of volatility (Vol2), in the relationship between intangible and total assets, which represent growth opportunities, and in the ratio between the effective corporate tax paid and the EBT. These differences may result in significant differences in the determinants of their respective capital structures.

[5] In this sense, Michaelas et al. (1999) and Hall et al. (2000) argue that excluding bankrupt firms from their sample could censor it.

Table 4. Descriptive statistics of the exogenous variables

Panel A - All firms

Variable	Obs	Mean	Std. Dev.	Min	Max
Tang1	5086	0.3068	0.2164	0.0000	0.9976
Tang2	5086	0.4568	0.2355	0.0000	0.9991
Size	5086	15.0193	1.5928	8.7124	20.3136
Prof1	5086	0.1131	0.1295	-2.2302	1.0292
Prof2	5086	0.0660	0.1282	-2.2863	1.0155
Vol1	3546	2.4359	23.9574	0.0001	691.7764
Vol2	3546	2.6230	15.8945	0.0001	349.0565
GO	5086	0.0628	0.1144	0.0000	0.9886
ETR	5086	0.2055	0.1974	0.0000	1.0000
NDTS	5086	0.0472	0.0499	0.0000	1.6065

Panel B – VC-backed firms

Variable	Obs	Mean	Std. Dev.	Min	Max
Tang1	2581	0.3283	0.2135	0.0000	0.9976
Tang2	2581	0.4807	0.2296	0.0000	0.9976
Size	2581	15.0811	1.5757	8.7124	20.3136
Prof1	2581	0.1063	0.1252	-1.5221	0.7230
Prof2	2581	0.0588	0.1252	-1.6693	0.6528
Vol1	1811	2.5198	24.5969	0.0001	691.7764
Vol2	1811	3.1261	17.9843	0.0002	349.0565
GO	2581	0.0704	0.1154	0.0000	0.9513
ETR	2581	0.1890	0.2026	0.0000	1.0000
NDTS	2581	0.0476	0.0525	0.0000	1.6065

Panel C – Non-VC-backed firms

Variable	Obs	Mean	Std. Dev.	Min	Max
Tang1	2505	0.2846	0.2170	0.0000	0.9682
Tang2	2505	0.4321	0.2390	0.0000	0.9991
Size	2505	14.9557	1.6081	9.1226	19.8560
Prof1	2505	0.1202	0.1335	-2.2302	1.0292
Prof2	2505	0.0734	0.1309	-2.2863	1.0155
Vol1	1735	2.3483	23.2778	0.0002	571.2906
Vol2	1735	2.0979	13.3543	0.0001	326.4380
GO	2505	0.0551	0.1129	0.0000	0.9886
ETR	2505	0.2224	0.1905	0.0000	1.0000
NDTS	2505	0.0468	0.0470	0.0000	0.5348

Tang1: Quotient between tangible fixed assets and total assets; Tang2: Quotient between tangible fixed assets plus inventories and total assets; Size: Natural logarithm of total assets; Prof1:Quotient between EBITDA and total assets; Prof2: Quotient between EBIT and total assets; Vol1: Moving standard deviation of the change in EBITDA, computing the current and the previous two years; Vol2: Moving standard deviation of the change in EBIT, computing the current and the two previous years; GO: Ratio between intangible assets and total assets; ETR: Quotient between the effective corporate tax paid and the earnings before tax; NDTS: Quotient between depreciation and total assets.

Pair-wise correlations among all variables are shown in Table 5. Excluding the obvious conflict between variables included under the same category, the only concern is related to NDTS, which shows a relevant correlation with tangible assets, EBITDA and growth opportunities. Since some of the variables are defined as quotients with the same denominator, namely total assets, this concern is of importance because the correlation of NDTS could have an additive effect among some of the variables. Therefore, regressions are run with and without the NDTS in order to check potential distortions due to collinearity.

Table 5. Correlation matrix

	Tang1	Tang2	Size	Prof1	Prof2	Vol1	Vol2	GO	ETR	NDTS
Tang1	1.0000									
Tang2	0.7760 0.0000	1.0000								
Size	0.1667 0.0000	0.1946 0.0000	1.0000							
Prof1	0.0298 0.7854	-0.0302 0.7615	-0.0337 0.5202	1.0000						
Prof2	-0.0619 0.0005	-0.0763 0.0000	-0.0002 1.0000	0.9252 0.0000	1.0000					
Vol1	-0.0156 1.0000	-0.0268 0.9948	-0.0443 0.3119	-0.0452 0.2759	-0.0447 0.2964	1.0000				
Vol2	0.0092 1.0000	-0.0226 0.9999	-0.0173 1.0000	-0.0626 0.0085	-0.0735 0.0005	0.3933 0.0000	1.0000			
GO	-0.0428 0.0976	-0.1336 0.0000	-0.0492 0.0200	-0.0423 0.1092	-0.1531 0.0000	-0.0024 1.0000	0.0450 0.2816	1.0000		
ETR	-0.1074 0.0000	-0.1132 0.0000	-0.0017 1.0000	0.1667 0.0000	0.1890 0.0000	-0.0485 0.1608	-0.0538 0.0595	-0.0718 0.0000	1.0000	
NDTS	0.2364 0.0000	0.1178 0.0000	-0.0870 0.0000	0.2188 0.0000	-0.1679 0.0000	-0.0050 1.0000	0.0209 1.0000	0.2837 0.0000	-0.0527 0.0076	1.0000

Tang1: Quotient between tangible fixed assets and total assets; Tang2: Quotient between tangible fixed assets plus inventories and total assets; Size: Natural logarithm of total assets; Prof1:Quotient between EBITDA and total assets; Prof2: Quotient between EBIT and total assets; Vol1: Moving standard deviation of the change in EBITDA, computing the current and the previous two years; Vol2: Moving standard deviation of the change in EBIT, computing the current and the previous two years; GO: Ratio between intangible assets and total assets; ETR: Quotient between the effective corporate tax paid and the earnings before tax; NDTS: Quotient between depreciation and total assets. P-values in small cases.

5 Results

The Hausman test was run on all specifications. The results are shown in Tables 6 and 7, with fixed effects estimation being the most suitable method for both groups of firms. In order to avoid potential collinearity problems related to the variable NDTS, all regressions are run excluding this variable. Tables 6 and 7 show the results related to the variables Tang1 and Tang2, respectively. The results in both cases are similar, which adds robustness to the results, no matter which variable of tangibility is used. The results show important differences in the determinants of the two groups analysed.

The debt ratio is significantly related to the relative importance of tangible assets for VC-backed firms. Since tangible assets could be used as collateral, firms with more tangible assets tend to have access to more long term debt. It should be noted that the coefficients are slightly lower when inventories are added to the amount of tangible fixed assets (Table 7). This finding confirms Hypothesis 1 for VC-backed firms.

A similar result is obtained for the size variable, which is positively related to leverage in VC-backed firms, thus, confirming that those companies face a lower probability of default. Conversely, in none of the specifications related to non-VC-backed firms is this coefficient significant. Therefore, Hypothesis 2 is partially confirmed, since there are, in fact, differences between both groups and only debt ratios of VC-backed firms seem to be affected by the size of the firm.

Conversely, evidence is found about the effect of profits on leverage, the sign being negative and significant only in the group of non-VC-backed firms in all specifications. Therefore, non-VC-backed firms seem to rely first on their internal resources before accessing debt, as stated by the Pecking Order Theory. On the contrary, in none of the regressions performed on VC-backed firms was a significant coefficient found. As a result, Hypothesis 3 is only partially confirmed on the group of non-VC-backed firms.

When the volatility in returns is considered, in none of the specifications regarding the VC-backed group were significant results obtained. Turning to the group of non-VC-backed firms, mixed results are found since the coefficient representing the moving standard deviation of EBITDA is not significant in all specifications but, on the contrary, the moving standard deviation of EBIT is significant. On these grounds, Hypothesis 4 can only be confirmed partially for non-VC-backed firms.

The variable representing growth opportunities is positive and significant in all regressions conducted on VC-backed firms, but no evidence is found about its effect on leverage in non-VC-backed firms. This result is in line with Hypothesis 5, confirming that firms that were later funded by VCs show a positive relation between intangible assets and debt levels. These firms, for which higher leverage ratios than those of comparable firms not accessing VC are found, seem to exhaust their debt capacity to finance growth before accessing VC. This finding is in line with the Pecking Order Theory.

Finally, results show that effective taxes paid do not have a significant effect on either VC or on non-VC-backed firms. This was to be expected in the former, according to Hypothesis 6, and not necessarily in the latter. This finding is not in line with the proposition of the Trade-off Theory.

As checks for robustness, all regressions for VC-backed firms including NDTS were run and the results remained unchanged. This variable is not significant, as expected, and the signs of the other variables do not change. Moreover, the same regressions were run including time dummies and the results do not change either.

Table 6. Regression results of the determinants of capital structure in VC and non-VC-backed firms (Tang1)

	Dependent Variable: Debt ratio							
Indep.	**First specification**		**Second specification**		**Third specification**		**Fourth specification**	
Var.	**VC**	**Non-VC**	**VC**	**Non-VC**	**VC**	**Non-VC**	**VC**	**Non-VC**
Tang1	0.3041***	0.2437	0.3152***	0.2494	0.2847***	0.2413	0.2932***	0.2470
	(0.0784)	(0.1945)	(0.0831)	(0.1946)	(0.0743)	(0.1931)	(0.0784)	(0.1930)
Size	0.0941***	0.0780	0.0925***	0.0803	0.0951***	0.0816	0.0941***	0.0842
	(0.0230)	(0.0553)	(0.0237)	(0.0550)	(0.0227)	(0.0561)	(0.0231)	(0.0559)
Prof1	-0.2875	-0.4105***	-0.3092	-0.4081***				
	(0.2829)	(0.1551)	(0.2830)	(0.1535)				
Prof2					-0.3721	-0.3652***	-0.4073	-0.3721***
					(0.3292)	(0.1403)	(0.3271)	(0.1384)
Vol1	-0.0013	-0.0004			-0.0012	-0.0004		
	(0.0011)	(0.0004)			(0.0011)	(0.0004)		
Vol2			-0.0010	-0.0014***			-0.0010	-0.0016***
			(0.0008)	(0.0005)			(0.0007)	(0.0005)
GO	0.4010***	0.2898	0.4204***	0.3015	0.3680***	0.2386	0.3844***	0.2510
	(0.1268)	(0.4734)	(0.1260)	(0.4739)	(0.1227)	(0.4834)	(0.1211)	(0.4836)
ETR	0.0868	0.0225	0.0981	0.0157	0.0926	0.0211	0.1034	0.0141
	(0.1206)	(0.0605)	(0.1176)	(0.0606)	(0.1211)	(0.0596)	(0.1177)	(0.0596)
Cons	-1.2200***	-0.9565	-1.2022***	-0.9907	-1.2376***	-1.0299	-1.2262***	-1.0673
	(0.3504)	(0.7618)	(0.3586)	(0.7573)	(0.3461)	(0.7801)	(0.3512)	(0.7763)
Firms	385	385	385	385	385	385	385	385
Obs	1811	1735	1811	1735	1811	1735	1811	1735
Hausman	35.86	25.24	29.92	25.57	29.71	24.57	24.94	24.93
p-value	0.0000	0.0003	0.0000	0.0003	0.0000	0.0004	0.0004	0.0004

Fixed effects regressions of the models. Dependent variable: Ratio between long term debt and long term debt plus total equity. Independent Variables: Tang1: Quotient between tangible fixed assets and total assets; Size: Natural logarithm of total assets; Prof1:Quotient between EBITDA and total assets; Prof2: Quotient between EBIT and total assets; Vol1: Moving standard deviation of the change in EBITDA, computing the current and the two previous years; Vol2: Moving standard deviation of the change in EBIT, computing the current and the two previous years; GO: Ratio between intangible assets and total assets; ETR: Quotient between the effective corporate tax paid and the earnings before tax.
Robust standard errors in brackets.
*** Significant at the 1% level; **Significant at the 5% level; *Significant at the 10% level.

Table 7. Regression results of the determinants capital structure in VC and non-VC-backed firms (Tang2)

	Dependent Variable: Debt ratio							
Indep.	**First specification**		**Second specification**		**Third specification**		**Fourth specification**	
Var.	**VC**	**Non-VC**	**VC**	**Non-VC**	**VC**	**Non-VC**	**VC**	**Non-VC**
Tang2	0.2904***	0.1485	0.2895***	0.1537	0.2713***	0.1487	0.2678***	0.1537
	(0.0660)	(0.1127)	(0.0667)	(0.1124)	(0.0642)	(0.1110)	(0.0645)	(0.1105)
Size	0.1049***	0.0783	0.1031***	0.0807	0.1051***	0.0819	0.1038***	0.0846
	(0.0219)	(0.0559)	(0.0226)	(0.0556)	(0.0220)	(0.0567)	(0.0225)	(0.0565)
Prof1	-0.2660	-0.4088***	-0.2873	-0.4060***				
	(0.2806)	(0.1566)	(0.2810)	(0.1549)				
Prof2					-0.3541	-0.3648***	-0.3908	-0.3712***
					(0.3288)	(0.1420)	(0.3269)	(0.1401)
Vol1	-0.0013	-0.0003			-0.0012	-0.0004		
	(0.0012)	(0.0004)			(0.0011)	(0.0004)		
Vol2			-0.0009	-0.0014***			-0.0009	-0.0016***
			(0.0007)	(0.0005)			(0.0007)	(0.0005)
GO	0.4134***	0.2635	0.4301***	0.2751	0.3808***	0.2133	0.3943***	0.2257
	(0.1263)	(0.4473)	(0.1258)	(0.4477)	(0.1223)	(0.4567)	(0.1210)	(0.4567)
ETR	0.0800	0.0196	0.0917	0.0128	0.0862	0.0182	0.0976	0.0112
	(0.1210)	(0.0616)	(0.1180)	(0.0616)	(0.1217)	(0.0606)	(0.1182)	(0.0604)
Cons	-1.4263***	-0.9538	-1.4012***	-0.9897	-1.4278***	-1.0281	-1.4073***	-1.0669
	(0.3409)	(0.7878)	(0.3503)	(0.7829)	(0.3443)	(0.8068)	(0.3509)	(0.8025)
Firms	385	385	385	385	385	385	385	385
Obs	1811	1735	1811	1735	1811	1735	1811	1735
Hausman	47.30	27.09	40.05	27.40	42.61	27.81	36.83	28.16
p-value	0.0000	0.0001	0.0000	0.0001	0.0000	0.0001	0.0000	0.0001

Fixed effects regressions of the models. Dependent variable: Ratio between long term debt and long term debt plus total equity. Independent Variables: Tang2: Quotient between tangible fixed assets plus inventories and total assets; Size: Natural logarithm of total assets; Prof1:Quotient between EBITDA and total assets; Prof2: Quotient between EBIT and total assets; Vol1: Moving standard deviation of the change in EBITDA, computing the current and the two previous years; Vol2: Moving standard deviation of the change in EBIT, computing the current and the two previous years; GO: Ratio between intangible assets and total assets; ETR: Quotient between the effective corporate tax paid and the earnings before tax.

Robust standard errors in brackets.

*** Significant at the 1% level; **Significant at the 5% level; *Significant at the 10% level.

6 Conclusions and discussion

VC is a long term source of funding for firms that cannot access stock markets to finance their start-up process and/or their growth. The literature on finance and entrepreneurship has profoundly analysed the characteristics of firms that lead to the entry of a VC firm. Nevertheless, those papers basically rely on surveys that aim to find psychological, technological or other determinants related to market issues. The aim of this paper, which is rooted on the theories about capital structure, is to identify the determinants of leverage on firms that are able to attract VC later. A matched sample of similar non-VC-backed firms is used as a control group. The

analyses are carried out on accounting data related to a sample of 385 Spanish growth firms in the years before receiving VC funding. The scope includes investments performed between 1995 and 2007.

Significant differences are found between the capital structures of the firms that received VC later and those that did not receive it. Only profitability is significant for non-VC-backed firms in all specifications and mixed results are obtained for volatility. None of the remaining determinants found in the literature proved to be significant for this group of firms. The lack of significance of tangibility and size in the non-VC-backed sample could be based on the fact that they are capable of generating enough resources internally, not needing external financing and therefore the use of collaterals.

Conversely, firms that later receive VC consistently show a significant effect on debt of tangibility, size, and growth opportunities. If we only assume the information asymmetry implications of the first two and the clear alignment of the last one, we can conclude that the explanatory capacity of the Pecking Order Theory in the VC-backed group is superior.

This paper contributes to the literature on entrepreneurial finance by providing firm evidence of the significant effect of growth opportunities to explain the greater leverage ratios found in firms that later receive VC. This finding is in line with the Pecking Order Theory, since firms seem to exhaust their debt capacity before accessing VC. VCs are better prepared to face the information asymmetries found in unquoted growth firms. On the contrary, tax effects are not important at that stage because the main goal for those firms is focused on its growth. The tax effects could become important once they have completed their growth objectives.

This paper also considers a slightly different approach to the one used in the literature on capital structure to measure volatility. This variable is included through a three-year moving standard deviation. We believe that this measure reflects the information that banks analyse before allocating loans to client firms. They usually consider a limited number of years. In the same vein, this seems more appropriate in the context of unbalanced panels, since one single standard deviation would imply computing a different number of observations for each firm.

As regards the limitations, the first one is the potential endogeneity of the models, since we are dealing with accounting variables that could not be fully exogenous. For that reason, we chose as debt ratio the long term debt divided by the long term

debt plus equity rather than the same divided by total assets. Focusing on a dynamic model could address this concern, but a considerable amount of important information regarding the years that are closer to the VC entry year would be lost.

A second limitation is the potential heterogeneity of the firms in the sample that could explain the results obtained on the non-VC group. Industry dummies could help in this respect. However, the inclusion of industry dummies would imply a high number of exogenous variables in the analysis, which could distort the results. In any case, consistent results were found in the case of the VC group.

Finally, due to unavailability of data, some variables that are sometimes included in papers based on quoted firms are not considered in our analysis. We were unable to test the impact of marketing and research & development expenditures, or other variables about the specificity of the product, on the debt ratio.

Regarding future research, a further addition would be to increase sample size in order to be able to analyse the determinants in certain sectors, relying on a homogeneous sample of firms. Finally, it could be interesting to test whether the results obtained in this sample of Spanish VC-backed firms are also found in other countries.

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