UNIVERSIDAD COMPLUTENSE DE MADRID

FACULTAD DE CIENCIAS ECONÓMICAS Y EMPRESARIALES

TESIS DOCTORAL

Effects of venture capital and private equity on investment-cash flow sesitivity of Spanish firms

MEMORIA PARA OPTAR AL GRADO DE DOCTOR

PRESENTADA POR

María Alejandra Ferrer

Directores:

José Martí Pellón
Fabio Bertoni

Madrid, 2011

ISBN: 978-84-694-6509-7

UNIVERSIDAD COMPLUTENSE DE MADRID
UNIVERSIDAD AUTÓNOMA DE MADRID
PROGRAMA DE DOCTORADO INTERUNIVERSITARIO EN FINANZAS DE EMPRESA

EFFECTS OF VENTURE CAPITAL AND PRIVATE EQUITY ON INVESTMENT-CASH FLOW SENSITIVITY OF SPANISH FIRMS

PhD THESIS
DOCTORAL DEGREE IN 'FINANZAS DE EMPRESA'

María Alejandra Ferrer
(Universidad del Zulia)

Director:
José Martí Pellón
(Universidad Complutense de Madrid)

Co-Director:
Fabio Bertoni
(Politecnico di Milano)

Madrid, May 2010

EFFECTS OF VENTURE CAPITAL AND PRIVATE EQUITY ON INVESTMENT-CASH FLOW SENSITIVITY OF SPANISH FIRMS

A mi madre y a mi tía,

a quienes debo todo lo que soy

ACKNOWLEDGEMENTS

This PhD thesis is not solely my effort. It has benefited greatly from the help of a large number of people who have provided support and guidance directly or indirectly. My deepest gratitude is for you all.

For their guidance and encouragement, I would especially like to thank Professor José Martí Pellón from the Universidad Complutense de Madrid (Spain) and Professor Fabio Bertoni from the Politecnico di Milano (Italy). They shared with me a lot of their expertise and research insight. Their very helpful assistance improved the quality of this PhD thesis. I am indebted to both of you.

For his advice, I thank Teodosio Pérez-Amaral from Universidad Complutense de Madrid (Spain).

For the support in the data collection process for this PhD thesis, I would like to thank the whole team of research assistants of Professor José Martí Pellón.

For listening to my doubts and worries, I thank my friends Adriana Cely and Walesska Schlesinger. Nevertheless, I am especially indebted to Álvaro Tresierra Tanaka, who always had an open ear for my 'little big' worries over and over again.

For the support received, I am also grateful to the Universidad del Zulia (Venezuela). Its scholarship programme gave me the opportunity to participate in this Doctoral Programme, giving me economic support and time off during such a long period.

For receiving me with open arms, I want to thank all of the people who I had the fortune to meet in these last five years. Thanks a lot for everything. You were all so patient with me.

Finally, and most importantly, I would like to thank my mother and my aunt. This experience would not be possible without their extraordinary support. There are no words that can express how grateful I am. They played a significant role in my life. Thanks for these wonderful five years.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 3
INVESTMENT-CASH FLOW SENSITIVITY IN SMALL AND MEDIUM-SIZED ENTERPRISES AT THE EXPANSION STAGE

CHAPTER 4
FINANCIAL MARKET IMPERFECTIONS, CONTROL AVERSION AND VENTURE CAPITAL IN SPANISH SMALL AND MEDIUM-SIZED ENTERPRISES

CHAPTER 5
VENTURE CAPITAL, PRIVATE EQUITY AND INVESTEE FIRM'S INVESTMENT SENSITIVITY TO CASH FLOW

INTRODUCTION

In general, Small and Medium-Sized Enterprises (SMEs, hereafter) are characterised by the lack or low level of collateral and the lack of any history or financial track record. As a result, the problems stemming from information asymmetries seem to be more acute in this group of firms and access to the stock and debt markets is more difficult, or even impossible, to achieve. Without external financing, investment decisions related to growth opportunities are then conditioned to the available internally generated funds.

Nevertheless, when SMEs cannot carry out investments to take advantage of growth opportunities, they search for financial intermediaries able to alleviate and manage information asymmetries. Their ambitions to grow as well as their needs to look for financial intermediaries change their attitude towards accessing external stakeholders.

In this framework, Venture Capital (VC, hereafter) represents an alternative source to finance investment opportunities for newly-created firms with a high growth potential. These specialised investors can deal effectively with adverse selection and moral hazard problems, and alleviate the problems stemming from information asymmetries between SMEs and investors. In addition to the funds supplied, venture capitalists provide non-financial services which add value to investee firms and increase their credibility in their relation with the stakeholders, namely potential shareholders, creditors, customers and suppliers. The latter make it easier for SMEs to access additional financial resources, thus alleviating the investment dependency on internally generated funds.

The main aim of this research is to fill the gap in the literature about the role played by venture capitalists in the reduction of the natural dependency of SMEs on internally generated funds to finance their growth opportunities. Most of the studies about VC financing on SMEs focus on the determinants of the firm's access to the financial resources provided for these investors as well as on the facts that determine the entry of venture capitalists. More recently, few papers focus on the investment sensitivity to cash flow in VC-backed firms and they obtain mixed results concerning the impact of VC funding due to methodological and sample selection issues.

We conduct our analysis on a representative sample of unlisted Spanish SMEs that were subject to a VC deal. Even though we will also consider mature firms, the main focus of attention will be firms at the expansion stage, for which growth is an important variable and data on both the pre and post-investment period are available.

Two empirical exercises are carried out to test our central research question. First, we test if the investment-cash flow sensitivity in firms that later receive VC funds differs from firms without VC involvement in the period prior to the investor's joining the SME. And second, we study to what extent venture capitalists reduce the investment dependency on cash flow of SMEs when that relationship in the pre and post-investment period is compared.

In both empirical works the results confirm the existence of the investment dependency on cash flow in the period prior to the entry of the venture capitalists. Nevertheless, this investment sensitivity becomes less

significant in the post-investment period. These results are consistent with the idea that VC does reduce SME's investment dependency on internally generated funds.

Additionally, we study whether the role played by VC investors in the investment sensitivity depends on the stage of the investee firm at the time of the funding. With a different methodological approach, we test our hypothesis on a sample of unlisted Spanish firms that were invested in at the expansion or later stages. The positive and significant relationship between investments and cash flows found in firms at the expansion stage before the investment event is significantly reduced in the post-investment period. As in previous empirical works, these results suggest that venture capitalists do reduce firm's sensitivity of investments to the internally generated cash flows. Conversely, investee firms at the late stage, namely buyout, did not exhibit any significant investment dependency before the Private Equity (PE, hereafter) deal whereas it becomes positive and significant after the firms are acquired by PE investors.

The empirical demonstration of the investment-cash flow sensitivity in unlisted SMEs, as well as its reduction after the VC investment, are the main contributions to the literature. These findings are robust to different settings, and methodologies. As alternative financial intermediaries, the financial and non-financial services provided by venture capitalists exert a positive effect on the investment-cash flow sensitivity of SMEs.

This PhD thesis is organised as follows. Chapter 1 presents a review of

literature outlining the financial problems found in SMEs as well as in mature firms, and the impact of VC and PE involvement on those groups of firms. In chapter 2, we describe the existing empirical framework related to the investment-cash flow sensitivity and the different methodological approaches to analyse this relationship. Chapters 3, 4 and 5 present the empirical results of our study. Chapter 3 provides evidence of the investment sensitivity to cash flow in firms belonging to the manufacturing sector prior to the entry of the venture capitalist. Chapter 4 illustrates the positive role played by VC on investee firms by testing the relationship between investments and cash flows on a sample of firms belonging to the technology, media and telecommunications (TMT), manufacturing and service sectors between the pre and post-investment period. In chapter 5, we apply a different methodology in order to identify the different role played by VC and PE investors. We analyse the investment-cash flow sensitivity in investee firms operating in low and medium technology firms, before and after the investment event. Finally, a discussion of the main findings and the main contributions to the literature are compiled in the last chapter. We also examine the limitations and implications of our work as well as our ideas for conducting further research on this topic. The process to build the dataset is described in the Annex. The samples of firms used in the three empirical works are based on that dataset.

CHAPTER 1
THE IMPACT OF VENTURE CAPITAL AND PRIVATE EQUITY INVOLVEMENT

1.1. INTRODUCTION

The problems stemming from information asymmetries make it difficult, or even impossible, for Small and Medium-Sized Enterprises (SMEs, hereafter) to access the capital markets. As a result, most SMEs must rely on their owners' wealth plus the internally generated resources to fund their operations. Nevertheless, the latter may not be sufficient to cover the investment required to develop their growth opportunities. An alternative financial source, such as Venture Capital (VC, hereafter), plays a critical role for SMEs, which would otherwise base their growth on short term debt or, else, forgo their growth opportunities.

But VC represents more than a financial source for entrepreneurs (Hsu, 2004; Chemmanur et al., 2009), with the VC institutions also providing many value-added services to investee firms, such as monitoring, advisory services and reputational capital (Sahlman, 1990; Gompers and Lerner, 1998). As specialised investors (Barry, 1994; Wright and Robbie, 1998; Gompers and Lerner, 2001; Tykvová, 2007), venture capitalists tend to closely follow the technology and market developments in their area of expertise. Accordingly, unlike traditional financial intermediaries, VC investors are actively involved in the investee firm (Sahlman, 1990; Gompers and Lerner, 1998; Wright and Robbie, 1998; Hellmann and Puri, 2000).

The origins of VC can be traced back to the US in the mid 1940s (Bygrave and Timmons, 1992). Its introduction in Europe occurred almost four decades later and with mixed success. First, most investments performed at the early

stages turned out not to be as profitable as they had been in the US. Second, the existence of less developed stock markets in Europe gave rise to a substantial flow of deals in unlisted mature firms, mostly related to low and medium technology sectors. In most cases the purpose was to provide an exit for the existing shareholders, who were no longer experiencing high growth rates but had stable cash flows to pay back debt. In such deals the high returns realised were based on a combination of high leverage, an active asset management and a substantial strategic shakeout after having acquired a majority stake. The importance of these deals resulted in the emergence of a market in Europe dominated by Private Equity (PE, hereafter), rather than VC, investors.

Notably, VC and PE play substantially different roles in investee firms. VC, which focuses on early stage growing firms, provides additional financing, alongside coaching and mentoring. PE, instead, does not usually inject additional funding in investee companies but, on the contrary, contributes to increasing their leverage.

Building on Jensen and Meckling (1976), Stiglitz and Weiss (1981), Myers and Majluf (1984) and Jensen (1986), the aim of the chapter is to describe the financial problems in SMEs as well as in mature firms, and the impact of VC and PE involvement on both groups of firms. The rest of the chapter is organised as follows. The following one focuses on the finance of SMEs and the value-added by VC institutions in addition to the financial resources. The third section describes the governance issues in mature corporations and the role played by PE institutions in this group of firms.

1.2. SMALL AND MEDIUM-SIZED ENTERPRISES AND VENTURE CAPITAL

1.2.1. THE FINANCING OF SMALL AND MEDIUM-SIZED ENTERPRISES

The unique characteristics of SMEs, which are not considered in the modeling of the mature firm paradigm, could generate a different set of financial problems. Those different characteristics may also explain why SMEs could find themselves faced by the same set of financial problems that mature firms address, but from a different angle (Ang, 1991). Unlike mature firms, SMEs are characterised by the lack or limited reliability of their financial track record (Ang, 1991; Chittenden et al., 1996; Berger and Udell, 1998). Therefore, SMEs are more affected by information asymmetries in their relationship with external sources of capital. These problems become more acute due to the lack or low level of tangible assets to pledge as collateral (Ang, 1991; Chittenden et al., 1996; Berger and Udell, 1998).

The problems stemming from information asymmetries, described by Jensen and Meckling (1976) and Myers and Majluf (1984) for the equity market and by Stiglitz and Weiss (1981) for the credit market, among others, imply that stakeholders do not have the same access to information. The lack of sufficient information to assess the quality of different investment projects in the firm[1] (adverse selection problems), or to ensure that the funds will not be diverted (moral hazard problems), determines the level of risk that creditors and/or equity investors face. A higher level of risk is then reflected by a high cost of external capital. Thus, information asymmetries between

[1] Each interest group has its own evaluation criteria (Cassar and Holmes, 2003).

stakeholders and entrepreneurs condition the choice of financing between outside sources and internally generated funds, and, regarding external financing, the choice between debt and equity. Jensen and Meckling (1976), Myers and Majluf (1984), and Stiglitz and Weiss (1981) affirm that information asymmetries may lead to the rejection of positive net present value investment opportunities in order to avoid the excessive cost of external financial resources. Regarding SMEs, this implies that they face additional difficulties to carry out investments to expand or, even, maintain their stake in the market.

According to Myers (1984) and Myers and Majluf (1984), there is a hierarchy in the use of funds, which is based on information asymmetry, when additional financing is required to take advantage of growth opportunities. This preference reflects the relative costs of the various sources of finance. Initially, funding firm investments should be covered by internally generated funds, which are not affected by adverse selection problems. If these were not enough, debt would be the next option and, finally, a stock issue would be the last choice. In this framework, firms with high levels of internally generated funds may carry out their investment opportunities with no need to seek external finance.

Since problems stemming from adverse selection and moral hazard may well be greater for SMEs (Carpenter and Petersen, 2002a; Frank and Goyal, 2003), their ability to attract funding from traditional external sources is limited. In addition to highly variable returns (Carpenter and Petersen, 2002b), the evaluation of the quality of the assets and the assessment of the

feasibility of investment opportunities may be difficult for suppliers of external funds (Fazzari et al., 1988). As a result, fast-growing SMEs usually do not follow the previously described hierarchy in access to external funds. Berger and Udell (2002) suggest that debt might be the first choice to finance expansion in firms where adverse selection problems dominate. Conversely, they argue that an external equity issue should be the first option in firms that are most affected by moral hazard problems. Hovakimian et al. (2001) consider that firms should finance growth opportunities with more equity than debt, and the latter more than the former should be used to finance assets.

The access of fast-growing SMEs to bank loans (Gregory et al., 2005) results in high costs (Berger and Udell, 1998; Titman and Wessels, 1988; Wald, 1999), complex contracts (Berger and Udell, 1998; Carpenter and Petersen, 2002a), and the risk of credit rationing (Stiglitz and Weiss, 1981; Carpenter and Petersen, 2002a and 2002b). The credit contract may allow banks to renegotiate the terms of the covenants. So firms face the risk of the bank reducing the funds provided or, even, asking for an anticipated return. Additionally, even for creditworthy SMEs, firms may be discouraged from applying for credit in the first place if they are not confident about the outcome of the process or, even, about the time required to receive an answer (Levenson and Willard, 2000). Based on the previous ideas, the extensive use of debt may not be appropriate for SMEs (Carpenter and Petersen, 2002a), and then they might be forced to turn down an investment project because the expected return is wiped out by a high cost of capital.

If long term debt is not available, fast-growing SMEs are compelled to

rely on short term debt (Chittenden et al., 1996; Weston and Brigham, 1991). However, the firm's financial position would be compromised by not being able to match the maturities of accounts receivable and accounts payable. Similarly, short term bank loans are a relatively accessible source of funds for fast-growing SMEs but their high cost may be impossible for entrepreneurs to take on. Therefore, this type of funding has a significant effect on the liquidity level of these firms but places its financial stability in jeopardy. Additionally, bank lines of credit, also known as revolving credit facilities, represent an alternative short term source (Riddiough and Wu, 2009) whereby banks closely monitor the financial situation of the firm. Conditional on that credit capacity, the firm chooses to invest when opportunities are available (Riddiough and Wu, 2009). Nevertheless, covenant violation may involve a restriction in the availability of credit, or even the inability to access unused credit (Sufi, 2009).[2]

In parallel, regarding outside equity, the stock market does not constitute an alternative for the financing of fast-growing SMEs, since it is relatively expensive and, even, out of the reach of smaller firms (Ang, 1991 and 1992; Kadapakkam et al., 1998) outside the US. With the exception of the UK, SMEs cannot easily raise equity capital in Europe (Weber and Posner, 2000). In the US, where the equity market is more developed, high-growth entrepreneurial firms can raise equity finance effectively through the NASDAQ. Nevertheless, the cost of a new share issue involving low volumes, including underwriting costs, registration fees and taxes, as well as selling and administrative

[2] On a sample of US firms, Sufi (2009) finds that a covenant violation is associated with a 15 to 25 per cent drop in the availability of both total and unused lines of credit.

expenses, can be unbearable (Fazzari et al., 1988).

Due to the difficult access to the traditional, most established sources of external funding, the only alternative to the internally generated funds for financing SMEs' investment opportunities is private placements of shares subscribed by business angels and venture capitalists. Nevertheless, most entrepreneurs are against dilution of ownership and loss of management control (Holmes and Kent, 1991; Chittenden et al., 1996). Based on the evolution over time of entrepreneurial attitudes towards control, Cressy (1995) identifies two groups of entrepreneurs: *Stayers* and *Movers*. *Stayers* are conservative entrepreneurs who prefer to maintain independence at the expense of abandoning growth opportunities. They generally experience low levels of external financing. On the other hand, *Movers'* preferences towards control evolve over time. They seem to display a strong ambition to grow, which in turn leads to a greater need for capital. These entrepreneurs are more active in searching for alternatives for financing their expansion process (Olofsson, 1994). As control aversion diminishes, they will progressively borrow to finance expansion. This group of entrepreneurs tends to exhibit high levels of external financing.

Entrepreneurs with a more open attitude tend to search for financial intermediaries able to deal effectively with adverse selection and moral hazard problems (Gompers, 1995), and to alleviate the problems of information asymmetries between SMEs and investors (Wright and Robbie, 1998; Gompers and Lerner, 2001; Hsu, 2004). Hogan and Hutson (2005) and Paul et al. (2007) find evidence of SME stock issues being the main source of external

financing, rather than debt, when equity capital was supplied earlier by specialised investors such as venture capitalists.

1.2.2. VENTURE CAPITAL INSTITUTIONS AS FINANCIAL INTERMEDIARIES

VC is a form of equity financing that is currently best suited to address the capital market imperfections inherent in the financing of firms' growth (Carpenter and Petersen, 2002b).[3] In some cases, it represents the only potential source of financing for high-risk firms, with significant intangible assets, expected years of negative earnings, and uncertain prospects (Gompers and Lerner, 1998; Scholtens, 1999).

In order to select the most promising firms, VC investors spend a significant amount of time and effort collecting private information during the pre-investment screening (Rajan, 1992; Admati and Pfleiderer, 1994; Reid, 1996; Kaplan and Strömberg, 2003). Fried and Hisrich (1994) find evidence that venture capitalists spend, on average, three weeks of full-time effort in the process of evaluation and closing of the deal, and that nearly 100 days are required to complete the whole investment process. The lack or insufficiency of information forces VC investors to base their evaluation on the personality of the entrepreneur, the uniqueness of the idea, or the structure of the market (Tykvová, 2007).

[3] In general, equity financing does not require collateralisable assets nor does it increase the probability of financial distress (Carpenter and Petersen, 2002a and 2002b; Brown et al., 2009); and it does not face the moral hazard problems associated with leverage (Carpenter and Petersen, 2002a and 2002b).

During the screening process, venture capitalists carefully review the firm's business plan and design contracts that minimise potential agency costs (Gompers, 1995). In this analysis, VC investors consider the attractiveness of the opportunity, the risk factors, the management team, and the contract terms (Gorman and Sahlman, 1989). At the same time, they identify areas in which they could add value through monitoring and support (Kaplan and Strömberg, 2003). Kaplan and Strömberg (2003) provide evidence that VC investors explicitly consider the attractiveness and the risks associated with the opportunity (market, strategy, technology, customer adoption, competition, and management). They highlight management risk as one of the most common sources of uncertainty identified by venture capitalists. Nevertheless, Kaplan and Strömberg (2003) find that VC investors are less concerned about undesirable characteristics of the entrepreneurs and about the management team being incomplete in some sense.

When making an investment, VC investors structure the deal and set appropriate incentive and compensation systems (Sahlman, 1990; Kaplan and Strömberg, 2003). Based on the screening, venture capitalists adjust the allocations of control rights, and the staging of the funds committed (Kaplan and Strömberg, 2003).

As a long term financing source, VC investors usually supply funds in the form of equity, or quasi-equity, instruments that involve holding minority stakes in growing SMEs (Sahlman, 1990; Kaplan and Strömberg, 2009). Additionally, venture capitalists do not aim to become permanent shareholders in the investee firms. As temporary investors, they aspire to help the entrepreneurs

develop their growth plans and, then, implement a successful exit.

Considering that venture capitalists invest in high risk ventures, they tend to limit investment to specific areas or stages of development (Barry, 1994), or to a limited technology, product and market range (Tyebjee and Bruno, 1984), with which they are familiar.

VC activity includes a wide range of activities in firms at different stages of development. Although Sahlman (1990), based on Plummer (1987), describe eight stages of VC investing, Jeng and Wells (2000), the European Private Equity and Venture Capital Association (EVCA),[4] The National Venture Capital Association (NVCA),[5] among others, only describe three stages: seed, start-up, and expansion. Firms at the seed stage usually apply the funds received to finance initial product research and development and to assess the commercial potential of ideas. They are still at a pre-manufacturing stage. In the case of firms at the start-up stage, they are bringing together a management team, refining the business plan, and preparing to manufacture, distribute, and sell their products. Usually these firms need more cash than the amount they generate.[6] Firms at the expansion stage already have their products in the marketplace, although they sometimes might still be unprofitable and need additional funds to finance the growth of their manufacturing and distribution capacity, as well as further Research and

[4] Established in 1983, the European Private Equity and Venture Capital Association (EVCA) represents the European Private Equity and Venture Capital sector and promotes the asset class both within Europe and through out the world (EVCA, 2007).
[5] The National Venture Capital Association (NVCA) is the leading trade association that represents the U.S. Venture Capital industry.
[6] Investments at either seed or start-up stage are also referred to as early stage investments (Jeng and Wells, 2000).

Development (R&D).

1.2.3. NON-FINANCIAL SERVICES PROVIDED BY VENTURE CAPITAL INSTITUTIONS

Throughout the investment process, venture capitalists provide a variety of non-financial services (Hellmann and Puri, 2000), which may considerably increase the probability of success of VC-backed firms (Chemmanur et al., 2009). In this way, VC investors differ from traditional intermediaries, who limit their involvement to providing financial resources.

In the investment process, venture capitalists face some industry-specific agency problems (Kaplan and Strömberg, 2004). Eventually, entrepreneurs and venture capitalists' interests may not be perfectly aligned[7] and the monitoring is costly if performed continuously (Gompers, 1995; Wright and Robbie, 1998). Thus, investors structure financial contracts to provide incentives for entrepreneurs to behave optimally (Kaplan and Strömberg, 2003 and 2004).

In addition to tailor-made contracts, venture capitalists employ some mechanisms to exercise more control over the management. Sahlman (1990) argues that the most common mechanisms are: the use of convertible securities, syndication of investment with other venture capitalists, and staging of capital infusions rather than a completing one-off injection of funds (Wright and Robbie, 1998). Many VC investments are made as purchases of

[7] The conflict between VC investors and entrepreneurs arises because entrepreneurs have information that VC investors do not have and because entrepreneurs make choices that are not fully known by VC investors (Barry, 1994).

convertible preferred stock (Sahlman, 1990), which is a more flexible instrument to allocate incentives to venture capitalist and entrepreneurs (Cumming, 2006). Nevertheless, Kaplan and Strömberg (2003) provide evidence of venture capitalists using combinations of multiple classes of common stock and straight preferred stock. Additionally, VC investors use 'participating preferred' stock (Sahlman, 1990; Kaplan and Strömberg, 2003), which is a combination of preferred stock and common stock. It guarantees the stakeholder a predetermined sum of cash if the firm is sold or makes an Initial Public Offering (IPO) (EVCA, 2007). This variant of convertible preferred stock is better categorised as a position of straight preferred stock and common stock than as a position of convertible preferred stock (Kaplan and Strömberg, 2003).

Regarding syndication, it represents more than a control mechanism. It allows the lead venture capitalist to share the investment risks with syndicate partners (Lerner, 1994; Wright and Robbie, 1998). As a consequence of the information shared by syndicate partners, Lerner (1994), Gompers and Lerner (2001) and Tykvová (2007) agree that syndication also helps to reduce uncertainty during the selection process and improve the selection of high quality projects. As Lerner (1994) argues, venture capitalists are more comfortable with a deal when other VC investors of similar experience are willing to invest as well. At the same time, when many high-profile co-investors constitute syndication, the alliance benefits from the reputation of the members of the group (De Clercq et al., 2008). Therefore, multifirm alliances imply greater market power for VC institutions and significant certification value to the

investee firms which the latter helps in accessing new customers, as well as other financial sources and enhance the chances of securing high-reputation underwriters (De Clercq et al., 2006; Stuart et al., 1999).

Even though use of convertible securities and syndication of investment is a strong control mechanism, Sahlman (1990) considers that staging capital infusions is the most powerful control mechanism that VC investors can employ to prevent an inefficient use of the funding provided. The capital invested at each point should be sufficient to push the firm to the next stage of its development (Tykvová, 2007). Staging capital infusions allows venture capitalists to provide incentives to entrepreneurs, and at the same time, to discipline and apply strong sanctions. Gompers and Lerner (1998) and Gompers (1995) examine the staging of investments and find evidence to support the view that venture capitalists provide more financing and a greater number of rounds of financing in the most successful transactions and cut off new financing if the information about future returns is negative. Thus, staging provides venture capitalists with an option to wait and not pre-commit funds. It also allows for the opportunity to renegotiate the terms of the agreement if the performance of the firm is not as expected (Gompers, 1995; Kaplan and Strömberg, 2003).

Another central feature of the financial contracts is the allocation of control rights between the VC investors and the entrepreneurs. Frequently, control rights are usually separated from VC investors' ownership rights and are contingent on firm performance (Tykvová, 2007). If the firm performs poorly, board rights, voting rights, and liquidation rights leave full control to

the VC investors. As performance improves, the entrepreneur retains/obtains more control rights. If the firm performs very well, the VCs retain their cash flow rights, but relinquish most of their control and liquidation rights (Kaplan and Strömberg, 2003).

After investment, the VC investors spend effort and time interacting with the investee firm (De Clercq et al., 2008). Post-investment VC actions include monitoring management, finding management, raising additional financing, offering strategic assistance, and providing advice (Gorman and Sahlman, 1989; Wright and Robbie, 1998; Kaplan and Strömberg, 2003).

Usually, the role of advisor played by venture capitalists implies that the investor takes seats on the firm's board of directors (Gompers and Lerner, 1998 and 2001). Lerner (1995) finds that VC investors are more likely to join or be added to the boards of private firms in periods when the CEO changes and when the need for monitoring is greater.

The information collection process continues after the initial investment. As Gompers (1995) argues, the monitoring activities depend on different characteristics of the firm: the lower the asset tangibility, the higher the growth options, or the greater the asset specificity of a firm, the closer the monitoring required by venture capitalists.

In addition to the monitoring role, VC investors provide support for building up the internal organization (Gorman and Sahlman, 1989; Bygrave and Timmons, 1992; Hellmann and Puri, 2002). They frequently replace the original founder as CEO (Hellmann, 1998), and assist firms in recruiting senior

managers (Gorman and Sahlman, 1989; Bygrave and Timmons, 1992; Chemmanur et al., 2009). Thus, the experience of VC investors in managerial activities implies that they may collaborate in the establishing of the optimal structure of the firm and participate in organizational, financial, strategic, and other decisions (Tykvová, 2007).

The continuous monitoring helps venture capitalists to reduce the information asymmetries as well as to provide certification to outside stakeholders (Sahlman, 1990). Venture capitalists also contribute with a network of contacts with suppliers, customers, financiers and or industry specialists with technical expertise (Tyebee and Bruno, 1984; Sahlman, 1990; Bygrave and Timmons, 1992; Barry, 1994; Gompers and Lerner, 1998; Chemmanur et al., 2009, among others), which help the investee firm create strategic alliances (Stuart et al., 1999) and access to additional finance (Sahlman, 1990; Admati and Pfleiderer, 1994; Wright and Robbie, 1998; Gompers and Lerner, 2001, Tykvová, 2007). This ability to raise additional long term funds increases the level of liquidity of fast-growing SMEs and releases their investment dependency on internally generated funds far beyond what was expected from the direct investment made by the VC firm.

The value-added by VC investors is positively perceived by both the entrepreneurs (Hsu, 2004) and the financial markets (signalling effect, e.g., Megginson and Weiss, 1991; Stuart et al., 1999). As Hsu (2004) argues, when the quality of a firm cannot be directly observed, firm outsiders rely on the quality of firm's affiliates as a signal of the firm's own quality. Thus, the amount of capital that a firm can raise could be less important than the quality

of the VC investor (Bygrave and Timmons, 1992; Sahlman, 1990) and the certification that the former can provide.[8]

1.3. PRIVATE EQUITY AND LATE STAGE INVESTMENTS

1.3.1. GOVERNANCE ISSUES IN MATURE CORPORATIONS

To a large extent financing problems exhibited by SMEs are not usually found in mature firms. Since this latter group of firms is less informationally opaque and less risky than SMEs, the capital structure decision between equity and debt is subject to different determinants in both groups (Berger and Udell, 1998; Cassar and Holmes, 2003). The relative transparency of mature firms (Berger and Udell, 1998) implies that they have an easier access to external finance than SMEs do (Berger and Udell, 2002). While SMEs only have access to VC, business angels and short term debt, whenever possible, mature firms also have access to public markets (Berger and Udell, 1998) and long term debt. As Cassar and Holmes (2003) point out, financing opportunities are naturally available for mature, more established firms, due to their longevity and more demanding reporting abilities. Along with a relatively longer operating history (Jelic et al., 2005), it is also easier to get day-to-day information from them than from SMEs (Kadapakkam et al., 1998).

Mature firms are usually more diversified and have less volatile profits. Therefore, they bear less risk and exhibit lower probability of default (Eriotis et

[8] In a sample of entrepreneurial start-ups with multiple financing offers, Hsu (2004) finds that entrepreneurs are willing to forego offers with higher valuations in order to affiliate with more reputable VC investors.

al., 2007). With stable cash flows (Jensen, 1986; Wright et al., 2001; Jelic et al., 2005), mature firms in a given industry easily attract financial suppliers and face lower transactions costs than SMEs do (Cressy, 1995; Kadapakkam et al., 1998).

When the ownership of mature firms is separated from control, the agency theory suggests that managers may pursue pecuniary and non-pecuniary maximising behaviours to the detriment of shareholders. In the presence of high free cash flow[9] and few attractive investment opportunities, the agency problems are more severe in this group of firms (Wright et al., 2001). This situation may affect investment and financing decisions (Wright and Robbie, 1998). Since payouts to shareholders reduce the funds under managers' control, as well as their power and, in some cases, managers' compensation (Jensen, 1986 and 1989), managers tend to retain cash flow in excess rather than distributing it to shareholders (Jensen, 1989). Managers are tempted to invest large amounts of free cash flow in low-return investment projects and expand firm size beyond that which maximises shareholder wealth (Jensen, 1986). A larger size of the firm enhances the social prominence, public prestige, and political power of managers (Jensen, 1986). These investments in firm growth tend to build 'empires' (Aggarwal and Samwick, 2006) that are more likely to destroy, rather than to create, value (over-investment problems).

This situation cannot be easily perceived by stakeholders when managers

[9] Jensen (1986 and 1989) defines free cash flow as cash flow in excess of what is required to fund all investment projects with positive net present values.

finance firm projects with internally generated funds (Jensen, 1986). If the ownership is so broadly dispersed across large numbers of shareholders, they experience a loss of control over the financial resources and cannot properly supervise managerial performance (Demsetz, 1983). When the conflicts described are especially severe, a financial restructuring might disgorge cash to stakeholders and resolve incentive and control problems through the introduction of new ownership and governance structures (Scholes et al., 2009).

On the other hand, ownership and control issues do not represent an important source of conflicts in owner-managed corporations. This ownership structure is typically found in family businesses in which ownership and management are assumed by a concentrated group of family members (Scholes et al., 2009). Nevertheless, closely-held firms without succession alternatives seek outside intermediaries for subsequent stages of organizational growth (Wright et al., 2001). Frequently, the owner wants his or her firm to remain independent but has not identified a top management successor (Wright et al., 2001). The founders of this group of firms may become overly conservative over time with the aim of preserving the wealth created, even though the firm may have attractive growth opportunities (Wright et al., 2001). That excessive conservatism could be based on owners' fear of losing control over the firm (Cressy, 1995) and may lead to under-investment problems. In some cases founders may be successful at starting a business but lack the required skills to manage a larger and more complex firm (Wright et al., 2001).

While stakeholders of mature firms with wide ownership-control separation demand a financial intermediary able to deal with the agency problems, owners of closely-held corporations want their firms to achieve growth by obtaining access to more professional managers. In both situations, PE investors represent an efficient alternative to mitigate the destruction or the downside of firm value as well as to survive over time.

1.3.2. PRIVATE EQUITY INSTITUTIONS AND MATURE FIRMS

The introduction of VC institutions in Europe did not lead to similar results to those found in the US. By the end of the 1980s most of the amount invested was allocated to mature, well established firms belonging to low and medium technology sectors (EVCA, 1993). As a result, the use of a new term, namely Private Equity (PE) soon became common, representing the new activities performed by those specialised investors.

PE are 'active investors' focused on value creation, as VC firms are, but they concentrate on asset, cash and leverage management in consolidated firms. Since value creation cannot be based on fast growth, because target investee firms are mature, it is based on asset management in highly-levered transactions performed in firms with stable cash flows. As mentioned in the previous section, mature firms can be affected by agency problems, when shareholders are dispersed, or by excessive conservatism, in closely-held firms. Both situations lead to sub-optimal asset allocation and capital structure decisions. Over-investment problems in corporations with acute agency

problems as well as under-investment problems in owner-managed firms may have negative effects on the shareholders' wealth. These problems may decrease the market value of the firm as well as the return to shareholders.

After a process of negotiation among three parties, namely PE investors, the management team and the incumbent owner, a firm is acquired by using a relatively small portion of equity and a relatively large amount of debt (Jensen, 1986; Kaplan, 1989; Wright et al., 2001; Kaplan and Strömberg, 2009). In a PE deal, known as buyout, the PE funds are committed to purchase the existing shares of a firm, with its price showing a significant increase (Jensen, 1986). The acquisition is carried out through an investment vehicle known as Newco, where the limited equity to be used in the acquisition is allocated. Since not all assets could be used as collateral, part of the debt used is unsecured, with subordinated debt being one of the most common financial instruments found. After the acquisition the Newco and the target firm will merge, usually retaining the original name of the target firm.

Since the PE firm buys a majority stake of an existing or mature firm (Kaplan and Strömberg, 2009), the substitution of debt for equity in the capital structure also enables greater concentration in the ownership structure (Thompson et al., 1992; Thompson and Wright, 1995; Wright et al., 2001). At the same time, PE investors retain the control of the board of directors and monitor managers with detailed contractual restrictions (Wright et al., 2009). Thus, they become 'active investors' involved in governance of the investee firm (Kaplan and Strömberg, 2009), with access to comprehensive and timely information (Wright et al., 2009).

Once the acquisition is completed, PE actions include sitting on the board of directors, monitoring and dismissing management (whenever necessary). As 'active investors', PE managers are also involved in the long term strategy of investee firms and, sometimes, manage the firms themselves (Jensen, 1986 and 1989).

The presence of a high level of debt represents a governance and control device (Wright et al., 2001). After a buyout deal, the 'overleveraging' approach might have a desirable and effective economic sense for investee firms (Jensen, 1989) since debt restrains managers from wasting resources on low-return investment projects (Jensen, 1986). Their actions focus on analysing the assets needed to support the core business and the basic sources of cash flow. The firm is forced to sell off parts of the business, refocuses its energies on a few core operations, and rethinks its entire strategy and structure in order to meet the debt service payments (Jensen, 1989; Thompson and Wright, 1995; Wright et al., 2009). Non-core assets are then sold to raise additional cash and reduce debt exposure. The proceeds of the assets sold help reduce debt to more sustainable, normal or permanent levels, and, at the same time, to create a more efficient and competitive firm (Jensen, 1986 and 1989).

PE deals provide a mean to improve managerial and employee incentives to unlock dormant firm resources that may have been blocked by prior ownership arrangements (Wright et al., 2001). The scheme of incentives of managers becomes a relevant issue for PE investors since they require meaningful investments that maximise the value of the investee firm

(Thompson and Wright, 1995; Kaplan and Strömberg, 2009; Wright et al., 2009). These decisions are reinforced by the pressure of interest and principal payments created by leverage (Kaplan and Strömberg, 2009), where asset management generates the needed cash (Jensen, 1986) and stimulates strategic change (Wright et al., 2001).

After a buyout deal, decision rights over strategic and operating choices are controlled by managers (Wright et al., 2001), who frequently receive 15-20 per cent of the equity (Jensen, 1986). The latter play an important role in structuring the debt to finance the buyout and in monitoring management in the post-buyout firm (Cotter and Peck, 2001).

As is common in VC funds, PE funds have a limited life span, therefore, they are committed to sell the firms they acquire and return the money to the limited number of partners (Norbäck et al., 2010). As a consequence, PE acquisitions are organised to complete the restructuring and value creation process in about three to five years. Then PE managers would ideally find an exit though an IPO or a trade sale, which could be made to another PE firm.

1.4. REFERENCES

Admati, A.R. and Pfleiderer, P. (1994) 'Robust financial contracting and the role of venture capitalists', The Journal of Finance, 49(2): 371–402.

Aggarwal, R.K. and Samwick, A.A. (2006) 'Empire-builders and shirkers: Investment, firm performance, and managerial incentives', Journal of

Corporate Finance, 12(3): 489-515.

Ang, J.S. (1991) 'Small business uniqueness and the theory of financial management', The Journal of Small Business Finance, 1(1): 1–13.

Ang, J.S. (1992) 'On the theory of finance for privately held firms', The Journal of Small Business Finance, 1(3): 185–203.

Barry, C.B. (1994) 'New directions in research on Venture Capital Finance', Financial Management, 23(3): 3-15.

Berger, A.N. and Udell, G.F. (1998) 'The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle', Journal of Banking & Finance, 22(6-8): 613-673.

Berger, A.N. and Udell, G.F. (2002) 'Small business credit availability and relationship lending: The importance of bank organisational structure', Economic Journal, 112(477): F32-F53.

Brown, J.R.; Fazzari, S.M. and Petersen, B.C. (2009) 'Finanging innovation and growth: Cash flow, external equity, and the 1990s R&D boom', The Journal of Finance', 44(1): 151-185.

Bygrave, W.D. and Timmons, J.A. (1992) 'Venture Capital at the crossroads', Boston (Massachusetts): Harvard Business School Press.

Carpenter, R.E. and Petersen, B.C. (2002a) 'Is the growth of small firms constrained by internal finance?', Review of Economics and Statistics, 84(2): 298–309.

Carpenter, R.E. and Petersen, B.C. (2002b) 'Capital market imperfections, high–tech investment, and new equity financing', Economic Journal, 112(477): F54–F72.

Cassar, G. and Holmes, S. (2003) 'Capital structure and financing of SMEs: Australian evidence', Journal of Accounting and Finance, 43(2): 123-147.

Chemmanur, T.J.; Krishnan, K. and Nandy, D. (2009) 'How does Venture Capital financing improve efficiency in private firms? A look beneath the Surface', URL (consulted March, 2010): http://ssrn.com/abstract=1025322.

Chittenden, F.; Hall, G. and Hutchinson, P. (1996) 'Small firm growth, access to capital markets and financial structure: Review of issues and an empirical investigation', Small Business Economics, 8(1): 59-67.

Cotter, J.F. and Peck, S.W. (2001) 'The structure of debt and active equity investors: The case of the buyout specialist', Journal of Financial Economics, 59(1): 101-147.

Cressy, R. (1995) 'Business borrowing and control: A theory of entrepreneurial types', Small Business Economics, 7(4): 291–300.

Cumming, D. (2006) 'The determinants of Venture Capital portfolio size: Empirical evidence', Journal of Business, 79(3): 1083-1126.

De Clercq, D.; Fried, V.H.; Lehtonen, O. and Sapienza, H.J. (2006) 'An entrepreneur's guide to the Venture Capital galaxy', Academy of Management Perspectives, 20(3): 90–112.

De Clercq, D.; Sapienza, H.J. and Zaheer, A. (2008) 'Firm and group influences on Venture Capital firms' involvement in new ventures', Journal of Management Studies, 45(7): 1169-1194.

Demsetz, H. (1983) 'The structure of ownership and the theory of the firm', Journal of Law and Economics, 26(2): 375-390.

Eriotis, N.; Vasiliou, D. and Ventoura-Neokosmidi, Z. (2007) 'How firm characteristics affect capital structure: an empirical study', Managerial Finance, 33(5): 321-331.

EVCA (1993) EVCA 1993 Yearbook. Zaventem (Belgium).

EVCA (2007) 'Guide on Private Equity and Venture Capital for entrepreneurs: An EVCA special paper' (November 2007). URL (consulted March, 2010): http://www.cvca.cz/miranda2/export/sites/www.cvca.cz/cs/sys/galerie-download/Guide_on_PEandVC_for_Entrepreneurs.pdf.

Fazzari, S.M.; Hubbard, R.G. and Petersen, B.C. (1988) 'Financing constraints and corporate investment', Brooking Papers on Economic Activity, 1998(1): 141–206.

Frank, M. and Goyal, V. (2003) 'Testing the Pecking Order theory of capital structure', Journal of Financial Economics, 67(2): 217-248.

Fried, V.H. and Hisrich, R.D. (1994) 'Towards a model of Venture Capital investment decision making'. Financial Management, 36 (3): 28–37.

Gompers, P.A. (1995) 'Optimal investment, monitoring, and the staging of

Venture Capital', The Journal of Finance, 50(5): 1461–1489.

Gompers, P.A. and Lerner, J. (1998) 'What drives Venture Capital fundraising?', Brookings Papers on Economic Activity. Microeconomics, 1998(1998): 149–192.

Gompers, P.A. and Lerner, J. (2001) 'The Venture Capital revolution', Journal of Economic Perspectives, 15(2): 145-168.

Gorman, M. and Sahlman, W.A. (1989) 'What do venture capitalists do?', Journal of Business Venturing, 4(4): 231-248.

Gregory, B.T.; Rutherford, M.W.; Oswald, S. and Gardiner, L. (2005) 'An empirical investigation of the growth cycle theory of small firm financing', Journal of Small Business Management, 43(4): 382-392.

Hellmann, T. (1998) 'The allocation of control rights in Venture Capital contracts', Rand Journal of Economics, 29(1): 57–76.

Hellmann, T. and Puri, M. (2000) 'The interaction between product market and financing strategy: The role of Venture Capital', The Review of Financial Studies, 13(4): 959-984.

Hellmann, T. and Puri, M. (2002) 'Venture Capital and the professionalization of start-up firms: Empirical evidence', The Journal of Finance, LVII(1): 169-197.

Hogan, T. and Hutson, E. (2005) 'Capital structure in new technology-based firms: Evidence from the Irish software sector', Global Finance Journal, 15(3): 369-387.

Holmes, S. and Kent, P. (1991) 'An empirical analysis of the financial structure of the small and large Australian manufacturing enterprises', Journal of Small Business Finance, 1(2): 141–154.

Hovakimian, A.; Opler, T. and Titman, S. (2001) 'The debt-equity choice', The Journal of Financial and Quantitative Analysis, 36(1): 1-24.

Hsu, D.H. (2004) 'What do entrepreneurs pay for Venture Capital affiliation?', The Journal of Finance, LIX(4): 1805-1844.

Jeng, L.A. and Wells, P.C. (2000) 'The determinants of venture capital funding: Evidence across countries', Journal of Corporate Finance, 6(3): 241-289

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

Jensen, M.C. (1989) 'Eclipse of the public corporation', Harvard Business Review, 67(5), 61-74.

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

Kadapakkam, P., Kumar, P. and Riddick, L.A. (1998) 'The impact of cash flows and firm size on investment: The international evidence', Journal of Banking & Finance, 22(3): 293-320.

Kaplan, S.N. (1989) 'Management buyouts: Evidence on taxes as a source of

value', The Journal of Finance, 44(3): 611-632.

Kaplan, S.N. and Strömberg, P. (2003) 'Financial contracting theory meets the real world: An empirical analysis of Venture Capital contracts', The Review of Economic Studies, 70(2): 281-315.

Kaplan, S.N. and Strömberg, P. (2004) 'Characteristics, contracts, and actions: Evidence from Venture Capitalist analyses', The Journal of Finance, 59(5): 2177-2210.

Kaplan, S.N. and Strömberg, P. (2009) 'Leveraged buyouts and Private Equity', Journal of Economic Perspectives, 23(1): 121-146.

Lerner, J. (1994) 'The syndication of Venture Capital investments', The Journal of the Financial Management Association, 23(3): 16-27.

Lerner, J. (1995) 'Venture Capitalists and the oversight of private firms', The Journal of Finance, 50(1): 301-318.

Levenson, A. and Willard, K. (2000) 'Do firms get the financing they want? Measuring credit rationing experienced by small business in the U.S.', Small Business Economics, 14(2): 83-94.

Megginson, W.L. and Weiss, K.A. (1991) 'Venture capitalist certification in initial public offerings', The Journal of Finance, 46(3): 879-903.

Myers, S.C. (1984) 'The capital structure puzzle', The Journal of Finance, 39(3): 575-592.

Myers, S.C. and Majluf, N.S. (1984) 'Corporate financing and investment

decisions when firms have information that investors do not have', Journal of Financial Economics, 13(2): 187-221.

Norbäck, P.-J.; Persson, L. and Tåg, J. (2010) 'Buying to sell: A theory of buyouts', (January 2, 2010), IFN Working Paper No. 817. URL (consulted April, 2010): http://ssrn.com/abstract=1532757.

Olofsson, Ch. (1994) 'Små och medelstora företags finansiella villkor – en enkätstudie' ('Financial conditions for SMEs – A survey') in Näringsdepartementet (Ministry for Trade and Commerce) (Ed.) Småföretagens riskkapitalförsörjning ('Risk capital supply for SMEs'), Stockholm.

Paul, S.; Whittam, G. and Wyper, J. (2007) 'The Pecking Order hypothesis: does it apply to start–up firms?', Journal of Small Business and Enterprise Development, 14(1): 8–21.

Plummer, J. (1987) QED report on venture capital financial analysis. Palo Alto (California): QED Research, Inc.

Rajan, R. (1992) 'Insiders and outsiders: The choice between informed and arm's length debt', The Journal of finance, 47(4):1367-1400.

Reid, G.C. (1996) 'Fast growing small entrepreneurial firms and their Venture Capital backers: An applied principal-agent analysis', Small Business Economics, 8(3): 235-248.

Riddiough, T. and Wu, Z. (2009) 'Financial constraints, liquidity management

and investment', Real Estate Economics, 37(3): 447-481.

Sahlman, W.A. (1990) 'The structure and governance of Venture Capital organizations', Journal of Financial Economics, 27(2): 473–521.

Scholes, L.; Wright, M.; Westhead, P.; Bruining, H. and Kloeckner, O. (2009) 'Family-firm buyouts, Private Equity, and strategic change', The Journal of Private Equity, 12(2): 7-18.

Scholtens, B. (1999) 'Analytical issues in external financing alternatives for SBEs', Small Business Economics, 12(2): 137–148.

Stiglitz, J.E. and Weiss, A. (1981) 'Credit rationing in markets with imperfect information', The American Economic Review, 71(3): 393-410.

Stuart, T.E.; Hoang, H. and Hybels, R. (1999) 'Interorganizational endorsements and the performance of entrepreneurial ventures', Administrative Science Quarterly, 44(1): 315–349.

Sufi, A. (2009) 'Bank lines of credit in corporate finance: An empirical analysis', Review of Financial Studies, 22(3): 1057-1088.

Thompson, R.; Wright, M. and Robbie, K. (1992) 'Management equity ownership, debt and performance: Some evidence from UK management buyouts', Scottish Journal of Political Economy, 39(4): 413-430.

Thompson, S. and Wright, M. (1995) 'Corporate governance: The role of restructuring transactions', Economic Journal, 105(430): 690-703.

Titman, S. and Wessels, R. (1988) 'The determinants of capital structure

choice', The Journal of Finance, 43(1): 1-19.

Tyebjee, T. and Bruno, A. (2003) 'A model of venture capitalist investment activity', in Venture Capital, Volume 1, Cheltenham (UK) and Northampton (Massachusetts): Elgar Reference Collection.

Tykvová, T. (2007) 'What do economists tell us about Venture Capital contracts?', Journal of Economic Surveys, 21(1): 65–89.

Wald, J.K. (1999) 'How firm characteristics affect capital structure: an international comparison', Journal of Financial Research, 22(2): 161-187.

Weber, S. and Posner, E. (2000) 'Creating a pan-European equity market: The origins of EASDAQ', Review of International Political Economy, 7(4): 529-573.

Weston, J.F. and Brigham, E.F. (1991) Managerial Finance (7th ed.) Tokyo (Japan): The Dryden Press.

Wright, M. and Robbie, K. (1998) 'Venture Capital and Private Equity: A review and synthesis', Journal of Business Finance & Accounting, 25(5/6): 521–570.

Wright, M.; Gilligan, J. and Amess, K. (2009) 'The economic impact of Private Equity: What we know and what we would like to know', Venture Capital, 11(1): 1-21.

Wright, M.; Hoskisson, R.E.; Busenitz, L.W. and Dial, J. (2001) 'Finance and management buyouts: Agency versus entrepreneurship perspectives', Venture Capital, 3(3): 239-261.

CHAPTER 2
AN OVERVIEW OF THE SENSITIVITY OF INVESTMENT TO CASH FLOW

2.1. INTRODUCTION

As discussed in the previous chapter, the level of information asymmetries faced by a firm determines its access to external funds and, at the same time, conditions investment decisions. As a consequence, the more informational opaque a firm is and the lesser the existence of tangible assets it has, the more difficult the access to external financial resources becomes. As a result, investment decisions basically rely on internally generated funds. In this framework, the available cash flows help explain investment decisions (Bond et al., 2003).

The investment-cash flow relationship, as well as an adequate and reliable measure to quantify it, has been the focus of many empirical works. A heated debate has taken place about the interpretation of the correlation between investment and cash flow. On the one hand, firms who are pushed to rely mainly on their internally generated funds are believed to be financially constrained by the available cash flow (Bond et al., 2003), leading to a positive relationship between investment and cash flow. Conversely, in some empirical counterexamples provided by other studies, a positive investment-cash flow has been exhibited by firms supposedly unconstrained. On the other hand, a positive relationship between investment and cash flow is observed in firms in which opportunist managers invest the excess of cash flow on unprofitable projects.

2.2. INFORMATION ASYMMETRIES AS EXPLANATION OF INVESTMENT SENSITIVITY TO CASH FLOW

In the literature, Fazzari et al. (1988) were the first to test the link between investment and cash flow, as a proxy of internally generated funds, in a sample of listed manufacturing US firms. They consider that the investment of a firm would be more sensitive to fluctuations in their cash flows if it nearly exhausted all the internal funds. Under their assumptions, one would expect cash flow to play a stronger role in the investment of firms (Vogt, 1994) that are more likely to face financial constraints (Carpenter and Guariglia, 2008). Based on the long-term dividend payout ratio as a proxy for financial constraints, Fazzari et al. (1988) classify firms into three categories: firms that have a dividend payout ratio below 0.1 for at least ten years, firms that exhibit a payout ratio below 0.2 but over 0.1 for at least ten years, and the rest of firms. Firms exhibiting low payout ratios will be more likely to suffer from capital market imperfections and, thus, to display investment dependency on cash flow. After controlling for growth opportunities using Tobin's q, their results provide evidence of a significantly and positive investment-cash flow relationship, which is greater in firms with low dividend payout ratios. The authors conclude that the strong positive effect of internal funds on investment is caused by the liquidity constraints. Holding constant the investment opportunities, a reduction in internally generated funds would reduce capital expenditures in firms facing information asymmetry costs (Ascioglu et al., 2008). The investment-cash flow sensitivity reflects the difficulties of accessing external financing when compared with internal

financing (Hovakimian, 2009), and firms must use internally generated funds to finance their investments rather than paying out dividends (Moyen, 2004).

Since the seminal work by Fazzari et al. (1988), the existence of investment-cash flow sensitivity has been tested as evidence of financial constraints in a number of subsequent empirical studies.[10] Because the level of financial constraints faced by firms is not observable, these studies apply an ex-ante classification according to different characteristics (dividend payout ratio, size, age, ownership structure, debt rating, Kaplan and Zingales (1997) index, affiliation with industrial groups, and others). These criteria can be seen as proxies of the extent to which firms are affected by information asymmetry problems, which lead to difficulties in obtaining external funds (Guariglia, 2008).

In Hoshi et al. (1991) the sorting criterion is the membership in a bank-centred industrial group, which is unlikely to be correlated with growth potential. They find that the investment-cash flow sensitivity is lower for member firms, which have easier access to financing due to their close ties to a major bank.

Whited (1992) and Bond and Meghir (1994) extend the Fazzari et al. (1988) approach. Whited (1992) studies a sample of US manufacturing firms facing debt financing constraints because of financial distress. She finds evidence of a strong relationship between cash flow and investment spending for firms with a high debt ratio or without rated debt. Focussing on a sample

[10] For a comprehensive survey, see Hubbard (1998).

of UK manufacturing firms, Bond and Meghir (1994) find that the current firms' investment is positively related to lagged cash flow.

Gilchrist and Himmelberg (1995) find no excess investment dependency on cash flow for firms with easy access to publicly traded debt, as measured by the existence of either a debt or commercial paper rating. When small firms are compared to large firms, small firms displayed higher investment-cash flow sensitivity.

High investment-cash flow sensitivity is also studied by Shin and Kim (2002) on a sample of US manufacturing firms. In this case, they observe the changes in patterns of quarterly capital expenditures. Their results provide evidence that the investment dependency on cash flow is more evident for small standalone firms with small cash holdings than for diversified large firms with large cash holdings. Similar results are obtained by Carpenter and Guariglia (2008) on a sample of UK firms. They distinguish firms into more and less likely to face financial constraints using employees as a measure of size. They also find that small firms exhibit a positive relationship between investment and cash flow.

As Fazzari et al. (1988), Alti (2003) use the dividend payout ratio to classify firms as financial constrained or not. His findings are also consistent with the results by Fazzari et al. (1988). After controlling for growth opportunities, the investment is sensitive to cash flow. This dependency is particularly higher for newly created, small firms with high growth rates and low dividend payout ratios.

Whited and Wu (2006) construct a new index of financial constraints using Generalised Method of Moments (GMM) estimation of an Euler equation of investment. The index includes firm characteristics associated with external finance constraints, such as size, investment opportunities, asymmetries information, debt capacity, and financial health.[11] They provide evidence that firms labelled as financially constrained exhibit characteristics typically associated with the exposure to external finance constraints. These firms are usually small, have low coverage by analysts, and do not have bond ratings.

Guariglia (2008) studies, both jointly and separately, the effects of 'internal' financial constraints (availability of internal funds) and 'external' financial constraints (access to external finance) on firms' investment. The large panel of financial data on UK firms, of which over 99 per cent are not listed in the stock market, covers the period 1993-2003. Internal financial constraints are measured by firms' cash flow and coverage ratio, and external financial constraints are measured by firms' size and age. Their results suggest that the sensitivity is particularly large when external constraints are strong and internal constraints are weak. Thus, investment by successful recently established, small firms may be significantly constrained by the access to external finance.

More direct measures of information asymmetries from the microstructure literature are used by Ascioglu et al. (2008) to assess the

[11] In addition to the natural logarithm of assets, as a measure of firm's size, Whited and Wu (2006) include sales growth and industry sales growth in the index as proxies of investment opportunities, analyst coverage as indicator of asymmetric information, both the firm-level and industry-level debt to assets ratios, and other four variables of financial health (ratio of cash flow to total assets, positive-dividend indicator, ratio of liquid assets to total assets, and Fama and French (2002) factors on market, size and book-to-market).

sensitivity of investment to cash flow. The first reference, relative effective spread, is a simple measure of information asymmetries, whereas the price impact of a trade and the probability of informed trading are more refined measures. Using these measures of informational problems, listed US firms of the sample are classified into three categories: definitely constrained, possibly constrained, and not constrained. The results suggest that firms with high information asymmetries have greater investment dependency on cash flow, especially when they use the probability of informed trade to classify firms as constrained.

Hovakimian and Hovakimian (2009) explore the differences in the dynamics of investment and financing methods of US firms across periods of high and low cash flows. The firm's investment-cash flow sensitivity is calculated as the difference between the cash flow-weighted time-series average investment of a firm and its simple arithmetic time-series average investment. Their results provide evidence of investment-cash flow sensitivity in firms that face financial constraints, but the severity of these constraints varies across the cash flow cycle. Firms whose investments are sensitive to cash flow invest less in low cash flow years, while they invest more in high cash flow years. The constraints are binding in low cash flow periods when the shortage of internally generated funds is exacerbated by lower availability of external capital.

The study of investment dependency to cash flow has been extended to different areas. Himmelberg and Petersen (1994) analyse Research and Development (R&D) investment sensitivity to cash flow. Their findings provide

evidence of a significant relationship between R&D expenditures and internal finance. As a consequence of information asymmetries, which are more likely to exist in this type of investment, firms face a difficult access to external finance. Therefore, cash flow represents an important determinant of investments in both tangible and intangible assets.

Finally, Carpenter and Petersen (2002) analyse if the growth of firms is often constrained by the quantity of internal finance in a panel of small manufacturing firms. They find evidence that most small firms that retain all of their income and raise relatively little external finance exhibit a strong relationship between growth[12] and internal finance. These results suggest that the growth of most small firms is constrained by internal finance, together with a small leverage effect. In contrast, the small fraction of firms that makes heavy use of new share issues exhibit growth rates far above what can be supported by internal finance. The relationship between growth and internal finance is weak in these firms, suggesting a relaxation of the internal finance constraints.

Contrary to the findings by Fazzari et al. (1988), and subsequent studies, Kaplan and Zingales (1997) consider that sensitivity of investment to cash flow should not be taken as evidence of financial constraints. They disagree on the interpretation of low dividend payout ratios as being a signal of financial

[12] Unlike Fazzari et al. (1988) and most of the subsequent literature, in the Carpenter and Petersen (2002) regression the dependent variable is the growth rate of the firm, and not the fixed investment ratio commonly used. Firm growth is measured by the log change in total assets. By examining the growth of total assets, the authors pretend to capture a broad range of activities undertaken by the firm: As firms grow, they expand not only their physical capital, but also gross working capital (such as inventories, cash and equivalents, and accounts receivable).

constraints. They argue that the firm's dividend policy is a choice of managers since they could choose to pay low dividends or not. From a subset of firms in the sample used by Fazzari et al. (1988), Kaplan and Zingales (1997) pre-classify firms as financially constrained or not using both quantitative and qualitative information and then test the sensitivity between investment and cash flow. They find that investments in firms with lower financial constraints exhibit more sensitivity to changes in cash flow. They argue that the investment dependency on cash flow might not increase monotonically with the level of cash flow, making an average sensitivity difficult to interpret. Kaplan and Zingales (2000) later argue that investment-cash flow sensitivity can (at least partially) be caused by an excessive conservatism of managers.[13] The contributions by Kadapakkam et al. (1998), Cleary (1999, 2006), and Hovakimian (2009) support the findings of Kaplan and Zingales (1997).

Kadapakkam et al. (1998) examine the degree to which the relationship between investment and cash flow is affected by size in six OECD countries (Canada, France, Germany, Great Britain, Japan and the United States). They examine firms in each country and find that internally generated resources affect firm investment in all six countries, as argued by Fazzari et al. (1988). Nevertheless, when the sample is sorted using three measures of firm size, the investment-cash flow sensitivity is generally highest in the large firm size group and smallest in the small firm size group.

Cleary (1999) finds results that are similar to those found in Kaplan and

[13] Fazzari et al. (1997) consider that the Kaplan and Zingales (1997) approach is inconsistent because the small sample is not heterogeneous enough and firms are classified as financially constrained or not using a fairly subjective set of criteria.

Zingales (1997) in a diversified sample of US firms. He classifies the firms based on an index that estimates the strength of a firm's financial position. This index combined a number of financial variables strongly related to firms' internal funds. His results suggest that the investment decisions of firms with a stronger financial position are much more sensitive to the availability of cash flow than those that are less creditworthy. Later, Cleary (2006) provides new findings on an international framework that also support the approach by Kaplan and Zingales (1997). The sample includes firms from Australia, Canada, France, Germany, Japan, the UK, and the US. His results suggest that firms with stronger financial positions are more investment-cash flow sensitive even after controlling for size and dividend payout. In addition, after controlling for size and financial strength, higher payout firms exhibit much more investment dependency to cash flow than lower payout firms.

Without relying on an ex-ante classification of the sample into constrained and unconstrained groups, Hovakimian (2009) examines the determinants of investment-cash flow sensitivity on a sample of US manufacturing firms. She uses firm-level estimates of investment-cash flow sensitivity to classify firms into groups with high, low, and negative cash flow sensitivity.[14] The results suggest that firms classified as negative cash flow sensitive have the lowest cash flows, highest growth opportunities, and appear as the most financially constrained. Otherwise, cash flow insensitive firms have the highest cash flows, lowest growth opportunities, and appear the least

[14] A set of characteristics that reflect the severity of the firms' financial constraints, their internal liquidity, growth opportunities, and their investment and financing behaviour is examined for each investment-cash flow sensitivity category.

financially constrained.

Based on listed US firms, the empirical results of Cleary et al. (2007) are consistent with both Fazzari et al. (1988) and Kaplan and Zingales (1997) approaches. They demonstrate that the measures used to classify firms as constrained or not are relevant to test the investment dependency to cash flow. When firms are classified based on information asymmetries indexes, the degree of information asymmetries increases the investment-cash flow sensitivity. On the other hand, when firms are classified based on their internal funds, firms with negative or low cash flow exhibit negative investment sensitivity to cash flow.

2.3. DIFFERENT METHODOLOGICAL APPROACHES TO ANALYSE THE INVESTMENT-CASH FLOW SENSITIVITY

The standard approach to test the investment dependency on cash flow is based on the traditional model of investment for firms suffering from capital market imperfections. This idea is expressed through the Q model of investment. This investment model includes both Tobin's q, as a proxy for the availability of investment opportunities, and cash flow, as a measure of internally generated funds.

The Q model of investment requires assumptions under which the unobserved shadow value of capital is simply related to the observed firm's market value or Tobin's q (Bond and Van Reenen, 2007). Thus, this approach

is based on the idea that market valuation of firm's assets is an important determinant of investment. The model allows relating the influence of expectations on current investment decisions (Bond and Van Reenen, 2007). The typical specification of the Q model of investment is:

$$\left(\frac{I}{K}\right)_{i,t} = \beta_0 + \beta_1 \left(\frac{CF}{K}\right)_{i,t} + \beta_2 \, Q_{i,t} + \varepsilon_{i,t} \qquad (2.1)$$

where $I_{i,t}$ measures the level of investments of firm i in period t; $K_{i,t}$ is the end-of-period-t net value of firm i's invested assets; $CF_{i,t}$ is firm i's cash flow in period t; $Q_{i,t}$ represents the value of Tobin's q at the beginning of the period and is defined as the market value of equity and debt less the value of inventories divided by the replacement cost of capital stock, adjusted for corporate and personal tax considerations. In addition to the conventional fixed-effects, within-group estimator, the Q model of investment is estimated using lagged Tobin's q as an instrument for Tobin's q, and using first differences and second differences to address measurement-error problems (Fazzari et al., 1988). The conceptual advantage of this framework in modelling the effects of internal finance on investment is that Tobin's q controls for the market's evaluation of the firm's investment opportunities (Fazzari et al., 1988). Since marginal investment opportunities are hard to measure, investment-cash flow sensitivity may be observed even in frictionless markets for reasons other than financial constraints (Hovakimian and Hovakimian, 2009).

Since the market value of firms is difficult to estimate (Bertoni et al., 2008), the Q model of investment is applicable only to listed firms. In the case

of unlisted firms, growth opportunities are measured in different ways in the literature. As Titman and Wessels (1988) point out, the percentage change in total assets is used as an indicator of growth. The growth in assets is a direct measure of current investment and, if investment is persistent, it is also a proxy for expected investment (Fama and French, 2002). Nevertheless, this measure is could be more representative of past growth. Another indicator of the growth opportunities is the ratio of R&D to total assets (Fama and French, 2002).[15] Since R&D expenditures generate future investment, this ratio is considered as a proxy for expected investment (Titman and Wessels, 1988; Fama and French, 2002). Based on the previous ideas, Michaelas et al. (1999) and Manigart et al. (2003) include intangible assets ratio as measure of growth opportunities.

Since Tobin's q is also affected by measurement errors (Erickson and Whited, 2000),[16] Abel and Blanchard (1988) introduced the sales accelerator model.[17] This model is based on the traditional acceleration principle, which links the demand for capital goods to the level or change in a firm's output or sales (Fazzari et al., 1988). In this model it is assumed that investment grows along with total sales, with the latter being a measure of a firm's output (Manigart et al., 2003). Thus, sales are a proxy for growth in product demand and future profitability (Kadapakkam et al., 1998). The accelerator effect comes from contemporary and lagged values for sales included in the model:

[15] Titman and Wessels (1998) defined the R&D ratio as quotient between R&D expenditures and sales.
[16] Even in the absence of financing frictions, Alti (2003) and Moyen (2004) provide evidence of the measurement errors and identification problems, which lead to significant investment-cash flow sensitivity.
[17] This approach is also analyzed by Fazzari et al. (1988) in their seminal work.

$$\frac{I_{i,t}}{K_{i,t-1}} = \alpha_i + \beta_1\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right) + \beta_2\Delta S_{i,t} + \beta_3\Delta S_{i,t-1} + \beta_4\left(\frac{CF_{i,t}}{K_{i,t-1}}\right) + \varepsilon_{i.t} \quad (2.2)$$

where $I_{i,t}$ measures the level of investments of firm *i* in period *t*, $K_{i,t}$ is the end-of-period-*t* net value of firm *i*'s invested assets, $\Delta S_{i,t}$ ($\Delta S_{i,t-1}$) is the current (lagged) one-year change of the logarithm of sales , and $CF_{i,t}$ is firm *i*'s cash flow in period *t*.

The sales accelerator model is estimated using the first-difference GMM estimator proposed by Arellano and Bond (1991). This technique takes unobserved firm heterogeneity into account by estimating the equation in first-differences, and controls for possible endogeneity problems by using variables lagged two or more periods as instruments (Manigart et al., 2003; Guariglia, 2008). In this estimation procedure, explanatory variables could be treated as strictly exogenous, predetermined or endogenous (Engel and Stiebale, 2009): the explanatory variables are uncorrelated with all realizations of the error term, only correlated with past realizations of the error term or, correlated with present shocks, respectively.

The sales accelerator model has been applied by Manigart et al. (2003), Guariglia (2008), and Engel and Stiebale (2009). Manigart et al. (2003) use it to test the investment-cash flow sensitivity in a panel of unlisted Belgian firms. More recently, the model estimated by Guariglia (2008) to study the investment-cash flow sensitivity of UK firms[18] includes both present and lagged logarithms of real sales as regressors. Similarly, the empirical model is applied by Engel and Stiebale (2009) in a panel of French and British firms at

[18] Over 99 per cent of sample firm are unlisted on the stock market.

the expansion and buyout stages. The accelerator effect on investment is also considerer by Hoshi et al. (1991). The regressions estimated include lagged production[19] to reflect an output accelerator effect on investment.

Some studies combine the Tobin's q and sales accelerator models in order to control for the effect of sales growth on investment expenditures. This technique has been applied by Kadapakkam et al. (1998), Shin and Kim (2002), Cleary et al. (2007) and Wei and Zhang (2008). In those cases, they regress investment on lagged sales, among other control variables.

The sales accelerator model has the advantage of allowing to explicitly separate the specification of long run determinants of investment from short run adjustment and expectation lags (Mairesse et al., 1999). However, the model does not incorporate the relative price of capital or capital services in the empirical specification (Fazzari et al., 1988).

As in the sales accelerator model, the Euler investment equation approach (Bond and Meghir, 1994) does not rely on the Tobin's q to estimate growth opportunities. In this model, the level of investment is considered as a function of the discounted expected future investment adjusted for the impact of the expected changes in the input prices and net marginal output (Manigart et al., 2003). The model is represented by the following equation:

$$\frac{I_{i,t}}{K_{i,t-1}} = \alpha_i + \beta_1\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right) + \beta_2\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right)^2 + \beta_3\left(\frac{CF_{i,t}}{K_{i,t-1}}\right) + \beta_4\left(\frac{S_{i,t}}{K_{i,t-1}}\right) + \beta_5\left(\frac{D_{i,t}}{K_{i,t-1}}\right)^2 + \varepsilon_{i.t} \quad (2.3)$$

where $I_{i,t}$ measures the level of investments of firm i in period t, $K_{i,t}$ is the end-

[19] Hoshi et al. (1991) define production as sales plus the change in final goods inventories.

of-period-t net value of firm i's invested assets, $CF_{i,t}$ is firm i's cash flow in period t, $S_{i,t}$ is firm i's sales during period t and $D_{i,t}$ is firm i's end-of-period-t total debts. The Euler equation approach is applied by Whited (1992), Bond and Meghir (1994), Alti (2003), Whited and Wu (2006), and Bertoni et al. (2008), among others.

The Euler equation approach governs the firm's decision on how much to invest today relative to investment tomorrow (Whited and Wu, 2006). Additionally, this approach has the advantage of allowing an assessment of the effects of debt (Whited, 1992). However, since the Euler equation approach is restricted period-to-period (Gilchrist and Himmelberg, 1995), the model is unable to detect constraints when firms are as constrained today as they are in the future (Gilchrist and Himmelberg, 1995; Almeida and Campello, 2007).

The most widely-used technique to estimate the Euler as well as the Sales Accelerator equations is GMM estimation. The use of GMM estimation allows us to explicitly model endogeneity between covariates and the investment rate (Bertoni et al., 2008). There are two alternative approaches, namely two step System-GMM (Arellano and Bover, 1995; Blundell and Bond, 1998) and Difference-GMM (Arellano and Bond, 1991). The System-GMM estimator is more efficient and less affected by weak instruments, especially when the dependent variable displays high persistence (Bertoni et al., 2008; Engel and Stiebale, 2009). Therefore, our empirical analyses will be based on that approach.

2.4. AN ALTERNATIVE EXPLANATION:

AGENCY PROBLEMS AND JENSEN'S (1986) FREE CASH FLOW THEORY

A positive relationship between investment and cash flow could arise in the presence of agency conflicts between shareholders and managers. In the case of managers' interests not being perfectly aligned with the interests of shareholders, Jensen's free cash flow hypothesis (1986) maintains that the existence of substantial free cash flow could be an incentive for managers to increase the firm's size beyond the optimal. Managers tend to invest the excess of internally generated funds in unprofitable investment opportunities rather than paying out those funds in the form of dividends (Vogt, 1994). The opportunistic behaviour by managers could be explained by pecuniary and non-pecuniary benefits of an increase in firm size. Based on the manager/shareholder agency problems, Kadapakkam et al. (1998) explain their empirical results. They affirm that managers of large firms tend to expand firm's size whenever internal funds are available.

Using a sample of US manufacturing firms, Vogt (1994) tests whether the investment-cash flow sensitivity is caused by information asymmetries or, else, by managerial overinvestment of free cash flow. Their results suggest that the investment behaviour of large firms is consistent with Jensen's (1986) free cash flow hypothesis. These firms exhibit low Tobin's q values and follow low-dividend-payout policies. In the case of small firms, the low investment level could be explained by information asymmetries. They exhibit high Tobin q values and maintain low-dividend-payout policies.

Additional support of the free cash flow hypothesis is provided by Pawlina and Renneboog (2005), who analyse a large sample of UK-listed firms. Their findings support the Jensen's free cash hypothesis as the main source of the firm investment dependency on cash flow. They conclude that this magnitude depends on insider ownership in a non-monotonic way.

The empirical results of Wei and Zhang (2008), which are based on East Asian emerging markets before the Asian financial crisis, are also in line with the free cash flow hypothesis. They find that the sensitivity of a firm's capital investment to its cash flow decreases as the cash flow rights of its largest shareholders increase. At the same time, this sensitivity is positively associated with the divergence between the control rights and cash flow rights of the firm's largest shareholders, particularly among firms with lower returns on assets.

In conclusion, either if it is caused by information asymmetries or by agency problems, as Pawlina and Renneboog (2005) argue, the existence of a positive firm investment dependency on internally generated funds is confirmed in the literature. It remains to be determined under which circumstances it is related the liquidity constraints.

2.5. EMPIRICAL EVIDENCE OF INVESTMENT-CASH FLOW SENSITIVITY AFTER VENTURE CAPITAL AND PRIVATE EQUITY FINANCING

There are few empirical works that assess the role of Venture Capital

(VC, hereafter) and Private Equity (PE, hereafter) financing in the investment dependency on cash flow of investee firms. The controversy found in the finance literature is also present in the VC and PE field because the results found are mixed.

Manigart et al. (2003) empirically test the role that VC investors play alleviating the investment sensitivity to cash flow in newly established and mature, Belgian unlisted firms. The sample includes VC-backed firms, which received VC funds between 1987 and 1997, and a comparable group of non-VC-backed firms. Using an unbalanced panel data, the relationship is tested with a modified sales accelerator model that is estimated using the first-difference GMM methodology. Manigart et al. (2003) find that the investment-cash flow sensitivity in Belgian unlisted firms is not reduced, but it rather increases, when firms received VC funds. This dependency is higher for VC-backed firms than for their non-VC-backed counterparts, particularly in recently created VC-backed firms. Their results are not in line with the expected role played by VC, which would relieve investee firms from their previous investment dependency on cash flow. Nevertheless, there are two possible explanations for the unexpected outcome of their study. First, most of their post-investment observations are concentrated on a period when most firms were suffering from financial constraints due to the economic crisis that started in the early nineties. Second, the investments performed in Europe are far more diverse across stages of development than those found in the US. Therefore, the mixed results found could be explained by the differential situations of firms at different stages of development.

Bertoni et al. (2008) assess whether VC financing influences the investment dependency on cash flow in Italian new-technology-base firms, also analysing if this effect depends on the type of VC investor involved. Two types of investors are considered: independent VC funds and corporate VC investors. The sample includes unlisted Italian firms, both VC- and non-VC-backed, over the 10-year period starting from 1994 (or since their founding) to 2003. They estimate an Euler equation and apply a two-step System-GMM. After receiving VC financing, Bertoni et al. (2008) observe that firms exhibit low and statistically not significant investment-cash flow sensitivity. They also find an increase in the level of investment when the investor involved is an independent VC firm. Conversely, in firms backed by a corporate VC institution investment remains sensitive to shocks in cash flow, indicating that investment sensitivity to cash flow is not removed. For non-VC-backed firms, the findings provide evidence of a significant investment dependency on cash flow, particularly for the smaller ones.

More recently, Engel and Stiebale (2009) study the impact of VC and PE investors on investment-cash flow sensitivity in British and French firms over the period 1998-2007. They rely on a sales accelerator model that is estimated by Difference-GMM techniques using lagged levels of the regressors as instruments. Engel and Stiebale (2009) provide evidence that British and French investee firms display higher investment levels and a lower dependence on internal funds after expansion financing. Nevertheless, they also find that buyouts financed by PE firms are neither associated with a decrease in investment spending nor with an increase in the dependence on

cash flow. While investments and sensitivity in buyout firms are not significantly different from those of non-PE-financed firms in France, in the UK the results are similar to those found in firms at the expansion stage, with PE-buyouts showing greater investment rates and lower dependency on cash flows. The authors argue that the difference between France and the UK depends on the different targets of buyouts and on supply-side conditions. Certain characteristics like financial soundness, growth opportunities and attitudes of the owners or the management can be different in both countries. Additionally, size and structure of PE markets in France and UK differ. Particularly, the UK history of financing buyouts is remarkably longer than that of the French market.

The findings of Bertoni et al. (2008) and Engel and Stiebale (2009) on investment-cash flow sensitivity before VC/PE financing are in line with those of Gilchrist and Himmelberg (1995), Shin and Kim (2002), Carpenter and Petersen (2002), Whited and Wu (2006), Carpenter and Guariglia (2008), and Hovakimian (2009), among others. The impact of cash flow on investment spending is greater for smaller firms, where the problems of information asymmetry become more acute. On the other hand, mature, large firms with high level of cash flow, and lower growth opportunities exhibit no significant dependence between investments and cash flows.

In the following chapters we aim to test that dependency before and after VC/PE involvement in Spanish firms over the period 1995-2007. We will also consider a one-by-one matched sample of firms that did not attract VC/PE investors as a control group.

2.6. REFERENCES

Abel, A. and Blanchard, O. (1988) 'Investment and sales: Some empirical evidence', in Barnett, W.A.; Berndt, E.R. and White, H. (Ed.), Dynamic econometric modelling, Cambridge University Press, Cambridge (UK).

Almeida, H. and Campello, M. (2007) 'Financial constraints, asset tangibility, and corporate investment', Review of Financial Studies, 20(5): 1429–1460.

Alti, A. (2003) 'How sensitive is investment to cash flow when financing is frictionless?', The Journal of Finance, 58(2): 707-722.

Arellano, M. and Bond, S. (1991) 'Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations', Review of Economic Studies, 58(2): 277-297.

Arellano, M. and Bover, O. (1995) 'Another look at the instrumental variables estimation of error-components models', Journal of Econometrics, 68(1): 29–51.

Ascioglu, A.; Hegde, S.P. and McDermott, J.B. (2008) 'Information asymmetry and investment-cash flow sensitivity', Journal of Banking and Finance, 32(6): 1036-1048.

Bertoni, F.; Colombo, M. G. and Croce, A. (2008) 'The effect of Venture Capital financing on the sensitivity to cash flow of firm's investments', European Financial Management, forthcoming.

Blundell, R. and Bond, S.R. (1998) 'Initial conditions and moment restrictions in dynamic panel data models', Journal of Econometrics, 87(1): 115–143.

Bond, S.; Elston, J.A.; Mairesse, J. and Mulkay, B. (2003) 'Financial factors and investment in Belgium, France, Germany, and the United Kingdom: A comparison using company panel data', Review of Economics and Statistics, 85(1): 153-165.

Bond, S.R. and Meghir, C. (1994) 'Dynamic investment models and the firm's financial policy', The Review of Economic Studies, 61(2): 197–222.

Bond, S.R. and Van Reenen, J. (2007) 'Microeconometric models of investment and employment', in Heckman, J.J. and Leamer, E.E. (Ed.) Handbook of econometrics, Volume 6, Elsevier, Amsterdam.

Carpenter, R. and Guariglia, A. (2008) 'Cash flow, investment, and investment opportunities: New tests using UK panel data', Journal of Banking and Finance, 32(9): 1894-1906.

Carpenter, R.E. and Petersen, B.C. (2002) 'Is the growth of small firms constrained by internal finance?', Review of Economics and Statistics, 84(2): 298–309.

Cleary, S. (1999) 'The relationship between firm investments and financial status', The Journal of Finance, 54(2): 673–692.

Cleary, S. (2006) 'International corporate investment and the relationships between financial constraint measures', Journal of Banking & Finance, 30(5): 1559–1580.

Cleary, S.; Povel, P. and Raith, M. (2007) 'The U-shaped investment curve:

Theory and evidence', Journal of Financial and Quantitative Analysis, 42(1): 1-39.

Engel, D. and Stiebale, J. (2009) 'Private Equity, investment and financial constraints: Firm–level evidence for France and the United Kingdom' (July 23, 2009). Ruhr Economic Paper No. 126. URL (consulted January, 2010): http://ssrn.com/abstract=1438037.

Erickson, T. and Whited, T. (2000) 'Measurement error and the relationship between investment and q', Journal of Political Economy, 108(5): 1027-1057.

Fama, E.F. and French, K. (2002) 'Testing Trade–Off and Pecking Order predictions about dividends and debt', The Review of Financial Studies, 15(1): 1–33.

Fazzari, S.M.; Hubbard, R.G. and Petersen, B.C. (1988) 'Financing constraints and corporate investment', Brooking Papers on Economic Activity, 1998(1): 141–206.

Gilchrist, S. and Himmelberg, C. (1995) 'Evidence on the role of cash flow for investment', Journal of Monetary Economics, 36(3): 541-572.

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

Himmelberg, C.P. and Petersen, B.C. (1994) 'R&D and internal finance: A panel study of small firms in high-tech industries', The Review of

Economics and Statistics, 76(1): 38-51.

Hoshi, T.; Kashyap, A. and Scharfstein, D. (1991) 'Corporate structure, liquidity, and investment: Evidence from Japanese industrial groups', The Quarterly Journal of Economics, 106(1): 33-60.

Hovakimian, A. and Hovakimian, G. (2009) 'Cash flow sensitivity of investment', European Financial Management, 15(1): 47-65.

Hovakimian, G. (2009) 'Determinants of investment cash flow sensitivity', Financial Management, 38(1): 161–183.

Hubbard, R.G. (1998) 'Capital-market imperfections and investment', Journal of Economic Literature, 36(1): 193-225.

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

Kadapakkam, P., Kumar, P. and Riddick, L.A. (1998) 'The impact of cash flows and firm size on investment: The international evidence', Journal of Banking & Finance, 22(3): 293-320.

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

Kaplan, S. and Zingales, L. (2000) 'Investment-cash flow sensitivities are not valid measures of financing constraints', Quarterly Journal of Economics, 115(2): 707-712.

Mairesse, J.; Hall, B.H. and Mulkay, B. (1999) 'Firm-level investment in France and the United States: An exploration of what we have learned in twenty years', Annales d'Économie et de Statistique, (55/56): 27-67.

Manigart, S.; Baeyens, K. and Verschueren, I. (2003) 'Financing and investment interdependencies in unquoted Belgian firms: The role of Venture Capital', in Butzen, P. and Fuss, C. (Ed.) Firms' investment and finance decision, Edward Elgar, Cheltenham (UK).

Michaelas, N.; Chittenden, F. and Poutziouris, P. (1999) 'Financial policy and capital structure choice in U.K. SMEs: Empirical evidence from firm panel data', Small Business Economics, 12(2): 113–130.

Moyen, N. (2004) 'Investment-cash flow sensitivities: Constrained versus unconstrained firms', Journal of Finance, 59(5), 2061-2092.

Pawlina, G. and Renneboog, L. (2005) 'Is investment-cash flow sensitivity caused by agency costs or asymmetric information? Evidence from the UK', European Financial Management, 11(4): 483–513.

Shin, H. and Kim, Y.H. (2002) 'Agency costs and efficiency of business capital investment: Evidence from quarterly capital expenditures', Journal of Corporate Finance, 8(2): 139-158.

Titman, S. and Wessels, R. (1988) 'The determinants of capital structure choice', The Journal of Finance, 43(1): 1–19.

Vogt, S. (1994) 'The cash flow/investment relationship: Evidence from U.S.

manufacturing firms', Financial Management, 23(2): 3-20.

Wei, K. and Zhang, Y. (2008) 'Ownership structure, cash flow, and capital investment: Evidence from East Asian economies before the financial crisis', Journal of Corporate Finance, 14(2): 118-132.

Whited, T.M. (1992) 'Debt, liquidity constraints, and corporate investment: Evidence from panel data', The Journal of Finance, 47(4): 1425-1460.

Whited, T.M. and Wu, G. (2006) 'Financial constraints risk', Review of Financial Studies, 19(2): 531-559.

CHAPTER 3
INVESTMENT-CASH FLOW SENSITIVITY IN SMALL AND MEDIUM-SIZED ENTERPRISES AT THE EXPANSION STAGE*

* A first version of this work was presented in the '9th Global Conference on Business & Economics 2009' (Cambridge-UK, October 2009) and in the 'I Jornadas de Investigación sobre la Pequeña y Mediana Empresa e Iniciativa Empresarial' (Madrid, December 2009), in which it was awarded the 'Quality Mention'. We would like to thank Pedro Martínez-Solano (Universidad de Murcia) and Rukhsana Kalim (University of Management and Technology) for their helpful comments and Álvaro Tresierra Tanaka for his research assistance (Universidad de Piura).

3.1. INTRODUCTION

Given that access to external funding of a firm depends upon a greater or lesser presence of the problems stemming from asymmetrical information, it is to be expected that mature firms with a long financial history and a significant amount of fixed assets will not experience restraints in obtaining funding. The characteristics of this group of firms, as far as size and the availability of information are concerned, make it easier for them to access funds provided by capital markets. Small and Medium-Sized Enterprises (SMEs, hereafter), on the contrary, suffer constraints when attempting to obtain financial resources to fund growth because public information concerning their history and financial track record is lacking, as are assets to put on the table as collateral.

With no access to the stock market, SMEs attempt to obtain funding from debt markets to finance growth opportunities. Nevertheless, debt markets provide resources at a high cost (Berger and Udell, 1998; Titman and Wessels, 1988; Wald, 1999), demand a fair amount of assets as collateral, and require complex contracts (Berger and Udell, 1998; Carpenter and Petersen, 2002a) which in some cases are difficult, or even impossible, for SMEs to take on.

As a consequence, constraints in obtaining financial resources force SMEs to fund their expansion through funds coming from people surrounding the entrepreneurs, such as family and friends (Ang, 1991), and internally generated resources (Paul et al., 2007). Nonetheless, the latter may not be sufficient, thus highlighting their problems in financing growth opportunities.

As regards those limitations faced by SMEs, venture capitalists may play

a critical role in funding their expansion. Their financial limitations are lessened not just by the resources directly supplied by the venture capitalist. The presence of these specialised investors also adds value to the firm, which may materialise in different ways (Sahlman, 1990; Hellmann and Puri, 2002; Chemmanur et al., 2009; among others), and is positively assessed by entrepreneurs (Hsu, 2004). For the purposes of this chapter, a key contribution of venture capitalists is the increased credibility of SMEs in their relation with third parties, such as potential shareholders, creditors, customers and suppliers, making it easier for them to negotiate financial terms and conditions.

In this context, the period prior to the venture capitalist's joining the firm is characterised by investment decisions being conditioned to the available resources, basically represented by internally generated funds. The relationship between investment and cash flow, as a proxy for internally generated funds, is interpreted by Fazzari et al. (1988) and later studies as evidence of the presence of financial constraints. However, Kaplan and Zingales (1997) raised the discussion about investment sensitivity to cash flow being a signal of financial constraints in firms which, due to their characteristics, have easy access to external finance. The controversial aspect of these contributions focuses on the discussion regarding the pre-classification of firms as financially constrained or not, when all firms considered in both articles were listed.

This pre-classification issue is addressed in this chapter by selecting a sample of unlisted SMEs at the expansion stage that were subject to a Venture

Capital (VC, hereafter) deal and a one-by-one matched sample of similar non-VC-backed firms. We aim to measure the sensitivity between investment and cash flow in those firms prior to the entry of the venture capitalist. In this way, the aim is also to compare whether what was suggested by Fazzari et al. (1988) is true or not; or whether, on the contrary, the relationship they establish is not important in explaining the existence of financial constraints.

We conduct our analysis on a representative sample of unlisted Spanish SMEs belonging to the manufacturing sector. Firms that received VC between 1995 and 2007 are analysed, tracing them back to at least three years before the entry of the investor.

The results confirm that the existence of financial constraints in firms from the sample is linked with the investment-cash flow sensitivity. In the same direction, an increase in long term debt has a positive effect on investment. This circumstance, also detected in firms without VC involvement, albeit with lower coefficients, stresses the justification for searching for other external sources of funds, such as VC, to continue taking advantage of growth opportunities.

The main contribution of this study to the literature is the empirical demonstration of the financial constraints suffered by SMEs as a determining factor in the quest for an alternative source of external funding, such as VC. Secondly, from a sample of firms which are presumably subject to financial constraints, new evidence is provided on the sensitivity of investment to changes in cash flow, as hypothesised by Fazzari et al. (1988). Similarly, it

must be stressed that it is the first work about this issue carried out in firms before receiving VC, and we are aware that only Manigart et al. (2003), Bertoni et al. (2008), Guariglia (2008), and Engel and Stiebale (2009) have ventured forth into this analysis for unlisted firms, albeit with a different approach.

The rest of the chapter is organised as follows. Section 3.2 focuses on the problems on the financing of SMEs and on the debate about the interpretation of the correlation between investment and cash flow and presents our hypotheses. Section 3.3 includes the description of the sampling process and the methodology used, whilst the results are presented in the fourth section. Finally, the main findings are highlighted and discussed in the fifth section.

3.2. LITERATURE REVIEW AND RESEARCH HYPOTHESES

3.2.1. FINANCIAL CONSTRAINTS FACED BY SMALL AND MEDIUM-SIZED ENTERPRISES

The problems stemming from information asymmetries, described by Jensen and Meckling (1976), Myers and Majluf (1984) and Stiglitz and Weiss (1981), among others, imply that interest groups in the firm do not have the same access to information. The lack of sufficient information to assess the quality of different investment projects in the firm as well as the quality of management in making investment decisions determines the level of risk that creditors and/or equity investors face. The level of risk is then reflected by a high cost of capital, plus the requirement of additional collateral and/or the

limitation of the amounts supplied.

According to Myers (1984) and Myers and Majluf (1984), when additional financing is required there is a hierarchy in the use of funds which is based on information asymmetry. Whenever possible, funding a firm should be covered by internally generated funds, which are not affected by adverse selection problems. If these were not enough, debt would be the next option, with stock issues something to be avoided, since the risk associated with the latter is greater than that of debt. Thus, firms with high levels of internally generated funds will not have such a strong need to seek external finance. This occurs in the presence of considerable financial slack (Myers and Majluf, 1984). The availability of cash and/or liquid assets enables the firm to take advantage of growth opportunities with no need to access external funds.

In the particular case of SMEs, problems stemming from information asymmetries are acute (Ang, 1991; Carpenter and Petersen, 2002a). Beyond the shareholders' motivation of avoiding ownership becoming diluted and their desire to keep control of the business, the growth and survival of SMEs are affected by various issues. Among others we could highlight the following (Ang, 1991; Chittenden et al., 1996; Berger and Udell, 1998): hidden information, the lack or low level of collateral and the lack of any history or financial track record to characterise them. The evaluation of the quality of assets and investment opportunities by suppliers of external funds may be difficult (Fazzari et al., 1988), so obtaining resources to finance SMEs growth is limited to certain funding sources. From the entrepreneur's point of view, if stock issues are compared with debt, the original stockholders will tend to

prefer the latter, since they are against dilution of ownership and loss of management control (Holmes and Kent, 1991; Chittenden et al., 1996; López-Gracia and Aybar-Arias, 2000). Additionally, the stock market does not constitute an alternative for SME financing, since it is relatively expensive and, even out of reach for smaller firms (Ang, 1991 and 1992; Kadapakkam et al., 1998).

On the other hand, information asymmetry problems in the SMEs' access to bank loans (Gregory et al., 2005) and the lack of collateral (Chittenden et al., 1996) result in high costs (Berger and Udell, 1998; Titman and Wessels, 1988; Wald, 1999) and complex contracts (Berger and Udell, 1998). The firm could then be forced to turn down an investment project because the expected return is wiped out by a high cost of capital. The latter could make firm growth dependent on the internally generated funds available.

Since long term debt is, generally, out of reach for SMEs, short term debt becomes the only feasible alternative (Chittenden et al., 1996). Regarding commercial credit, SMEs must find a proper matching between the maturity of the cash conversion period and the maturity of accounts payable. On the other hand, short term bank loans could also be accessed by SMEs, albeit at a high cost. Additionally, SMEs' future viability would be conditioned by the bank's willingness to renew short term credit lines over time. As a result, funding growth basically with short term debt increases the likelihood of the firm suffering most from any external shock in the economy or in the financial system.

In spite of the ideas of Myers and Majluf (1984), Hogan and Hutson (2005) and Paul et al. (2007) find evidence of SMEs' main source of external financing being stock issues rather than debt when equity capital is supplied by specialised investors such as venture capitalists. Unlike other financial intermediaries, venture capitalists can alleviate the problems of information asymmetries and provide funds that the SMEs cannot obtain from other sources (Gompers and Lerner, 2001). At the same time they add value to the firms they are investing in (Sahlman, 1990; Gompers and Lerner, 1998; Jain, 2001; Hellmann and Puri, 2002; Chemmanur et al., 2009; among others). The likelihood of losing independence and control of the firm is offset by the benefits provided by external funding (Paul et al., 2007). Opportunities for growth are favoured not only by the arrival of financial resources, since choosing a good investor adds value to the firm (Hsu, 2004). Additionally, this source of finance would not require collateral.

3.2.2. THE SENSITIVITY OF INVESTMENT TO CASH FLOW AS A MEASURE OF FINANCIAL CONSTRAINTS

When the access to external funds to attain further firm growth is difficult then the firm's future development is limited to internally generated funds. In this line, Fazzari et al. (1988) argue that a positive relationship between investment and internally generated funds signals the existence of financial constraints. They analyse the relationship on a sample of US listed firms, which are classified as financially constrained or not on the basis of the

dividend payout ratio. Their work is based on a model relating investment to available cash flow, with Tobin's q being a proxy of the firm's growth opportunities. Their results show that investment in firms with low dividends shows greater sensitivity to available cash flow.

To test the existence of investment-cash flow sensitivity as evidence of financial constraints, a number of subsequent empirical studies follow the work of Fazzari et al. (1988). Because the level of financial constraints is not observable, these studies categorised firms according to characteristics such as dividend payout (Moyen, 2004), size or age (Vogt, 1994; Gilchrist and Himmelberg, 1995), availability of debt rating (Whited, 1992), ownership structure (Pawlina and Renneboog, 2005), affiliation with industrial groups (Hoshi et al., 1991), cross-country comparison (Kadapakkam et al., 1998; Bond et al., 2003), and other firm characteristics.

Higher investment-cash flow sensitivity is also observed in firms that are new or small (Shin and Kim, 2002; Carpenter and Petersen, 2002a; Carpenter and Guariglia, 2008; Hovakimian and Hovakimian, 2009); independent firms, as opposed to firms affiliated with industrial groups (Hoshi et al., 1991; Shin and Park, 1999); firms with high growth rates and low dividend pay-out ratios (Alti, 2003); firms with high debt ratio or a high interest coverage ratio, or without rated ratio (Whited, 1992); firms with low probability of informed trading (Ascioglu et al., 2008); and firms in high-tech sectors (Carpenter and Petersen, 2002b).[20]

[20] For a comprehensive survey, see Hubbard (1998).

Contrary to the findings of Fazzari et al. (1988), and subsequent studies, Kaplan and Zingales (1997) consider that sensitivity of investment to cash flow should not be taken as evidence of financial constraints, and a firm's dividend policy is a choice variable since firms could choose to pay low dividends or to pay out more. From a subset of firms in the sample used by Fazzari et al. (1988), Kaplan and Zingales (1997) pre-classify firms as financially constrained or not using both quantitative and qualitative information and then test the sensitivity between investment and cash flow. They find that investments in firms with lower financial constraints exhibit more sensitivity to changes in cash flow. They argue that investment dependency on cash flow might not increase monotonically with the level of cash flow, making an aggregate sensitivity difficult to interpret. Kaplan and Zingales (2000) argue that investment-cash flow sensitivity could (at least partially) be caused by excessive conservatism on the part of managers.[21] The contributions of Devereux and Schiantarelli (1990), Kadapakkam et al. (1998), Cleary (1999 and 2006), Almeida and Campello (2007), and Hovakimian (2009) support the findings of Kaplan and Zingales (1997).

In spite of the controversy regarding the validity of the approach by Fazzari et al. (1988), it is still accepted in the literature as a valid way of analysing financial constraints (Pawlina and Renneboog, 2005).

Given the information asymmetries that external investors face when deciding about the funding of SMEs, we anticipate a positive and significant

[21] Fazzari et al. (1997) argue that the approach of Kaplan and Zingales (1997) is inconsistent because the small sample is not heterogeneous enough to support meaningful conclusions, and, furthermore, firms are classified as financially constrained or not using a fairly subjective set of criteria.

relationship between investment and internally generated cash flows in those firms. Accordingly, our first hypothesis would stand as:

Hypothesis 3.1: SMEs exhibit a positive relationship between cash flow and investment.

Since VC firms are able to reduce the information asymmetries in SMEs, we anticipate that those suffering most from the inability to obtain external funding would then approach VC. In this line, we also anticipate that the investment-cash flow sensitivity should be greater in firms that later receive VC in the period prior to the entry of the venture capitalist. Therefore, our second hypothesis would be as follows.

Hypothesis 3.2: SMEs that later receive VC show a greater investment dependency on cash flow than similar firms that do not profit from that source of external equity.

The empirical evidence on investment-cash flow sensitivity in VC-backed firms is limited. Manigart et al. (2003) study the investment dependency on cash flow in unlisted Belgian VC-backed firms and a matched sample of non-VC-backed firms. They do not find a significant reduction in the investment-cash flow sensitivity in the group of VC-backed firms. Their results could be affected, however, by the lack of distinction of firms across stages of development. Another factor influencing the results could be the concentration of post-investment observations in a period after the economic downturn of the early nineties, when banks were more reluctant to grant credit to SMEs.

Bertoni et al. (2008) analyse the investment-cash flow sensitivity in unlisted Italian new-technology-based firms. They find that both VC- and non-VC-backed technology-based firms exhibit a positive relationship between investment and cash flow, which is reduced in the former due to VC involvement. More recently, Engel and Stiebale (2009) also find that VC contributes to the reduction in investment sensitivity to cash flow in a sample of UK and French firms at the expansion stage.

Nevertheless, to the best of our knowledge, our work is the first to test whether the dependency of investment to cash flow before the VC investment event is greater in firms that later receive VC than in similar growing firms that do not have access to that source of funding.

3.3. DATA AND METHODOLOGY

3.3.1. THE SAMPLING PROCESS

The presence of investment-cash flow sensitivity in SMEs that were later financed by venture capitalists is tested on a sample of Spanish manufacturing SMEs[22] at the expansion stage. The period of analysis includes VC investments performed between 1995 and 2007.

In accordance with the data obtained from the Spanish Private Equity and Venture Capital Association (ASCRI), 2,651 VC investments were recorded in

[22] SMEs are defined according to the European Union criteria. A SME provides work for fewer than 250 employees and has an annual turnover not exceeding 50 million Euros or total assets not exceeding 43 million Euros.

Spain in that period, including all stages but excluding the financial and real estate sectors. Finding information on these was possible in the case of 2,230 firms on the AMADEUS Database, which records information on 1,202,363 Spanish firms. 757 of them were at the expansion stage[23] at the time of the initial VC investment.

In order to have sufficient information about the pre-investment period, 413 firms which did not have at least three years of accounting data before the initial VC investment were dropped from the sample. We also restrict sectoral heterogeneity by focusing on the manufacturing sector. The previous process reduced the sample to a total of 168 firms, accounting for 22 per cent of the population, even though some of them have missing data about some variables.

To test the investment-cash flow sensitivity as a common characteristic of SMEs, 168 firms with no VC funding and comparable one-by-one with the previously identified firms were selected. Comparable firms were randomly chosen from the AMADEUS Database, matching the sector, by means of the NACE Rev2 code (4-digit code), the number of employees, the revenues, the asset volumes, and the age, whenever possible, in the year before the initial VC investment performed, as well as its location in a geographical area with a similar level of development, when possible.

[23] Firms at the expansion stage are defined by EVCA (2007) as operating firms that require financing for growth, and which may or may not be breaking even or trading profitably. According to NVCA (2009), these firms are characterised by a complete management team and a substantial increase in revenues.

3.3.2. METHODOLOGY

According to Fazzari et al. (1988) the presence and importance of financial constraints in the firms analysed depends on the relationship between investment, as the dependent variable, and internally generated resources and growth opportunities, as independent variables. Investment refers to the formation or net increase of capital. Changes in fixed assets are interpreted as a reflection of conscious decision-making by the managers (Kadapakkam et al., 1998).

Regarding the independent variables, the capacity to generate resources internally is proxied by cash flow. Given the limited access to external finance, the firm's capability of taking advantage of growth opportunities might be heavily dependent on cash flow.

Originally, Fazzari et al. (1988) used the Market-to-Book ratio as a proxy of growth opportunities, because their sample records data from listed firms. This ratio has the advantage of incorporating market judgment regarding the future profit-generating capability of the firm (Kadapakkam et al., 1998; Andrés-Alonso et al., 2000), which could then reduce the difficulties found in accessing additional finance. On the contrary, if growth opportunities are not very promising, access to external funding is limited. Vogt (1994) finds evidence that the latter happens in firms with low Tobin q ratios.

We do not have any listed firms in our sample for which we could obtain a market value. Therefore, regarding the numerator, we could estimate market values by applying average EBITDA multiples selected from merger

and acquisitions (M&A). The multiples obtained would then be used to estimate the market values of the firms in the sample, all of them unlisted and with no observable market value. As a result, it would be possible to have a market value estimate for each firm analysed that changes over time. Nevertheless, since this reference is based on the firm's EBITDA, the result would be highly correlated with a key independent variable: cash flow. As a result, we use the EBITDA multiple alone as a measure of the aggregate shifts in economic prospects.

We also add a dummy variable to the original approach by Fazzari et al. (1988), which takes the value 1 when the firm receives a VC investment. Additionally, we include the interaction between this latter variable and cash flow to test whether firms that later receive VC exhibit a different investment-cash flow sensitivity when compared with the non-VC ones. Likewise, other variables are added to control for size, age and the geographical location of the firm. The model, which would also incorporate time dummies, would be represented as follows:

$$I_{it} = \beta_0 + \beta_1 CF_{it} + \beta_2 EBITDA_{it} + \beta_3 Size_{it} + \beta_4 Age_i + \beta_5 R_i + \beta_6 VC_i + \beta_7 VC_i * CF_{it} + \varepsilon_{it} \quad (3.1)$$

where *i* is the firm's indicator and *t* is a time indicator, which is set to 0 in the year of the initial VC investment for both the firm that later receives VC and the one-by-one matched control group firm. The investment variable (I_{it}) is given by the ratio of the difference between the book value of the net fixed assets of the firm in year *t* and *t-1* plus the depreciation expenditure of the

year *t* (Morgado and Pindado, 2003; Pawlina and Renneboog, 2005; Bertoni et al., 2008), divided by the beginning-of-period-*t* total assets of the firm *i*. Cash flow (CF_{it-1}) is measured by the ratio of the firm's net earnings in year *t* plus the depreciation of the firm's assets in year *t-1* (Carpenter and Petersen, 2002a; Shin and Kim, 2002) divided by the beginning-of-period-*t* total assets of the firm *i*.

Regarding EBITDA multiples, the source of information is the Mergermarket Database, from which 2,887 complete M&A in non-financial Spanish firms for the period 1992-2007 are taken. From this sample, a random selection is made of at least one deal per sector and year. In parallel, the accounting information is extracted for each of the selected acquired firms to calculate the EBITDA multiple of the transaction. The source of accounting information is the AMADEUS Database. This operation is repeated for all the Mergermarket Database subsectors, and an average of the EBITDA multiples for each of the years being studied is calculated.

We also control for size, age, and location of the firm. $Size_{it}$ is measured by the natural logarithm of the total number of employees of the firm in the period *t* and Age_{it} is measured by the age of the firm at the period *t*. The variable R_i is a dummy taking value 1 if the firm is located in a region of Spain with per capita income below 75 per cent of the European Union average (Objective 1 region), or zero otherwise. VC_i takes value 1 if the firm receives VC funding in the following years, or 0 otherwise.

The previous model can be completed to control for the effect of leverage

on investment. As Lang et al. (1996) argue, a relation should exist because high leveraged firms might not be able to take advantage of growth opportunities. Thus, Hovakimian (2009) follows this approach and, as well as Lang et al. (1996), measures leverage using the total debt ratio. Following Hovakimian (2009), there may be diverse effects from the interaction of leverage with available cash flows. Low debt levels may be interpreted as a signal of financial constraints and, at the same time, as evidence of limited access to funds provided by borrowers. However, high levels of debt reduce future available cash flow for investment.

Nevertheless, we find that SMEs mostly rely on short term debt rather than on long term debt. Furthermore, most of the short term debt is represented by commercial debt, namely accounts payable. Since our purpose is to measure long term investment sensitivity to cash flow, the controlling role of debt should be played by long term debt. In this case, the model to be estimated is the following:

$$I_{it} = \beta_0 + \beta_1 CF_{it} + \beta_2 EBITDA_{it} + \beta_3 LTD_{it} + \beta_4 Size_{it} + \beta_5 Age_i + \beta_6 R_i + \beta_7 VC_i + \beta_8 VC_i * CF_{it} + \varepsilon_{it} \quad (3.2)$$

where LTD_{it-1} is the ratio between the long term debt and the total assets, both at the beginning of year *t*.

The use of the estimated EBITDA multiples found in M&A, however, might not properly represent market value multiples in our sample, which only includes unlisted firms. A further extension is applied in the two models outlined above introducing intangible assets as an alternative approach to

control for growth opportunities. Fama and French (2002) argue that Research and Development (R&D) expenditures generate future investments, thus, they indicate the growth potential of firms (Manigart et al., 2003). Therefore, following Michaelas et al. (1999) and Manigart et al. (2003), we use the volume of intangible assets as a proxy of growth opportunities.[24] Intangible assets ($Intang_{it}$) are defined by the ratio between net intangible assets of the firm *i* in year *t*, and the beginning-of-period-*t* total assets of the firm *i*. Table 3.1 summarises the definition of the variables to be used.

TABLE 3.1.
DEFINITION OF THE VARIABLES

VARIABLE	*DESCRIPTION*
I_{it}	Increase in book value of net fixed asset plus depreciation divided by beginning-of-period total assets.
CF_{it}	Net earnings plus depreciation divided by beginning-of-period total assets.
$EBITDA_t$	Average EBITDA multiple for the period.
$Intang_{it}$	Intangible fixed assets normalised by beginning-of-period total assets.
LTD_{it}	Total long term debt divided by the beginning-of-period total assets.
$Size_{it}$	Natural logarithm of total the number of employees of the firm *i* in the period *t.*
Age_i	Age of the firm *i* at the period *t*.
VC_i	Dummy variable that takes value 1 if the firm was subject to a VC investment in the following years.
R_i	Dummy variable that takes value 1 if the firm is located in a region classified as Objective 1.

Since our data refer to time series observations on a number of unlisted firms, the panel data methodology will be employed to estimate the models.

[24] Titman and Wessels (1988) introduce the percentage of change in total assets as an alternative measure of growth opportunities. Nevertheless, this measure could be more representative of past growth (Balboa et al., 2009).

Regarding the estimation method, some papers have discussed whether the individual effects should be treated as fixed or random variables. However, this is not an important distinction because we can always treat the individual effects as random variables without loss of generality (Mundlak, 1978; Arellano and Bover, 1990). Furthermore, one of the variables of interest in this analysis is the dummy that represents whether the firm later receives VC. If a fixed effect approach is employed, all variables with constant values over time are dropped from the analysis. From a different perspective, since the model is tested on a representative sample of unlisted firms, with and without VC involvement, the results would not change if a given individual were randomly replaced by another.

3.3.3. DESCRIPTIVE STATISTICS

Table 3.2 shows the descriptive statistics for the whole sample, for the subsample of firms that later receive VC backing and for the subsample of firms which do not have any VC involvement. All ratios are winsorised at the 2 per cent threshold. All accounting information is shown in constant 2005 Euro using the Harmonised Consumer Price Index as deflator. Accounting information includes data from 1991 to 2007.

TABLE 3.2.
DESCRIPTIVE STATISTICS OF THE VARIABLES FOR THE SAMPLE OF MANUFACTURING UNLISTED SPANISH SMES (PRE-INVESTMENT PERIOD)

VARIABLES	*OBSERVATIONS*	*FIRMS*	*MEAN*	*STD. DEVIATION*
Investment				
All firms	2,046	336	0.1181	0.1967
VC-backed firms	1,048	168	0.1348	0.2110
Non-VC-backed firms	998	168	0.1006	0.1789
Difference	2,046	336	0.0343***	0.0086
Cash flow				
All firms	2,046	336	0.0976	0.0861
VC-backed firms	1,048	168	0.0930	0.0836
Non-VC-backed firms	998	168	0.1024	0.0884
Difference	2,046	336	-0.0094*	0.0038
EBITDA multiple				
All firms	2,342	336	6.0302	1.7304
VC-backed firms	1,195	168	6.0159	1.7182
Non-VC-backed firms	1,147	168	6.0451	1.7436
Difference	2,342	336	-0.0292	0.0716
Intangible assets				
All firms	2,046	336	0.0559	0.0886
VC-backed firms	1,048	168	0.0664	0.0959
Non-VC-backed firms	998	168	0.0449	0.0788
Difference	2,046	336	0.0215***	0.0039
Debt				
All firms	2,046	336	0.7904	0.3564
VC-backed firms	1,048	168	0.8531	0.3600
Non-VC-backed firms	998	168	0.7246	0.3405
Difference	2,046	336	0.1286***	0.0155
Short term debt				
All firms	2,046	336	0.6331	0.2935
VC-backed firms	1,048	168	0.6732	0.3021
Non-VC-backed firms	998	168	0.5909	0.2781
Difference	2,046	336	0.0824***	0.0128
Long term debt				
All firms	2,046	336	0.1512	0.1601
VC-backed firms	1,048	168	0.1723	0.1606
Non-VC-backed firms	998	168	0.1290	0.1566
Difference	2,046	336	0.0433***	0.0070

The table reports descriptive statistics on winsorised (2% each tail) values of the variables. Except Market value and EBITDA multiple, all variables are normalised by using beginning-of-period-*t* stock of total assets. We test the null hypothesis that means are equal between VC-backed and Non-VC-backed groups assuming unequal variance. ***, ** and * indicate, respectively, significance levels <1%, <5% and <10%.

On average, the investment ratio of firms that were subject to VC backing later is relatively high compared to that for firms without VC

involvement (0.1348 against 0.1006). Even though both groups include growth firms, the greater investment ratio found in firms that later receive VC might be a sign of the faster expansion process of this latter group, which triggers the need to obtain external funds. Conversely, the cash flow ratio for non-VC-backed firms (0.1024) is, on average, greater than that of firms which become VC-backed later (0.0930), with the difference being significant at the 10 per cent level.

Regarding the proxies to control for growth opportunities, the market value reference estimated is not significantly different between firms that later receive VC and the control group. Nevertheless, the average of intangible assets stands at 0.0664 in the former, which is significantly greater than the 0.0449 found in the latter.

Regarding debt, we also find significant differences between both groups, which may also be interpreted as a signal of the greater need to access external equity to fund further growth. Firms that later receive VC are more levered than those belonging to the control group, with total debt ratio representing 0.8531 of total assets. The reference in the control group is estimated at 0.7246 of total assets. Regarding long term debt, firms that were later subject to a VC investment exhibit a higher ratio than control group firms, with the values being 0.1723 and 0.1290 of total assets, respectively.

Interestingly, both groups of firms show high levels of short term debt, with the group of firms which are not subject to a VC investment later showing a greater share of short term rather than long term debt. When we compare

short and long term debt in both groups, we find that, on average, short term debt represents 80.32 per cent of total debt in firms that later receive VC, whereas it accounts for 84.14 per cent in the group without VC-backing.

Pairwise correlations among all variables are reported in Table 3.3.

TABLE 3.3.
CORRELATION MATRIX

	CASH FLOW	*EBITDA MULTIPLE*	*INTANGIBLE ASSETS*	*LONG TERM DEBT*
CASH FLOW	1.0000			
EBITDA MULTIPLE	-0.0168 0.4488	1.0000		
INTANGIBLE ASSETS	0.2753* 0.0000	0.0214 0.3339	1.0000	
LONG TERM DEBT	0.0959* 0.0000	0.0311 0.1597	0.2646* 0.0000	1.0000

The table reports pairwise correlations among all independent variables. The variables are: (1) *Cash flow:* net earnings plus depreciation divided by beginning-of-period total assets; (2) *EBITDA multiple*: average EBITDA multiple for the period; (3) *Intangible assets:* intangible fixed assets normalised by beginning-of-period total assets; (4) *LTD*: total long term debt divided by the beginning-of-period total assets. * indicates significance levels of <10%.

3.4. RESULTS

Table 3.4 shows the results obtained from the estimation of the models specified for the whole sample. As expected, all the models provide evidence of a positive, significant relationship between available cash flow and investment, thus verifying our Hypothesis 3.1. According to Fazzari et al. (1988), this circumstance would be signalling the presence of financial constraints in firms in the sample, although significant differences seem to appear in the two groups being analysed.

TABLE 3.4.
REGRESSION RESULTS OF THE INVESTMENT-CASH FLOW SENSITIVITY FOR THE FULL SAMPLE OF UNLISTED SPANISH SMES (PRE-INVESTMENT PERIOD)

	DEPENDENT VARIABLE: INVESTMENT			
INDEPENDENT VARIABLES	***WITHOUT THE EFFECT OF LONG TERM DEBT***		***WITH THE EFFECT OF LONG TERM DEBT***	
CF_{it}	0.5099***	0.4788***	0.4691***	0.4615***
	(0.1087)	(0.1086)	(0.0979)	(0.0990)
$EBITDA_{it}$	0.0069		0.0049	
	(0.0077)		(0.0068)	
$Intang_{it}$		0.4733***		0.1414*
		(0.0820)		(0.0849)
LTD_{it}			0.6167***	0.5951***
			(0.0479)	(0.0524)
$Size_{it}$	-0.0234***	-0.0204***	-0.0201***	-0.0194***
	(0.0074)	(0.0069)	(0.0067)	(0.0066)
Age_i	-0.0018***	-0.0015***	-0.0008*	-0.0007*
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
R_i	0.0006	0.0125	-0.0073	-0.0035
	(0.0140)	(0.0134)	(0.0125)	(0.0121)
VC_i	0.0188	0.0065	-0.0054	-0.0083
	(0.0171)	(0.0162)	(0.0169)	(0.0165)
VC_i*CF_{it}	0.2329**	0.2311**	0.2209*	0.2206*
	(0.1198)	(0.1156)	(0.1215)	(0.1209)
Time dummies	Yes	Yes	Yes	Yes
Intercept	0.1438***	0.1458***	0.0537	0.0756**
	(0.0548)	(0.0320)	(0.0475)	(0.0301)
Nº observations	2,028	2,029	2,028	2,029
Nº groups	335	335	335	335

The table reports Generalised Least Squares, random effects, estimation of the model. The dependent variable is the ratio between investments (i.e. increase in net fixed assets of the firm *i* in year *t* plus depreciation in year *t*) and beginning-of-period total assets of the firm. The independent variables are: (1) CF_{it-1}: net earnings plus depreciation divided by beginning-of-period total assets; (2) $EBITDA_{it}$: average EBITDA multiple for the period; (3) $Intang_{it}$: intangible fixed assets normalised by beginning-of-period total assets; (4) LTD_{it-1}: total long term debt divided by the beginning-of-period total assets; (5) $Size_{it}$: natural logarithm of total the number of employees of the firm *i* in the period *t*; (6) Age_i: age of the firm *i* at the period *t*; (7) R_i: dummy variable indicating firms located in Objective 1 region; (8) VC_i: dummy variable indicating firms in the VC-backed group (i.e. 0 for firms in the control group). All ratios are winsorised at the 2% threshold. Robust standard errors are reported in parenthesis. ***, ** and * indicate, respectively, significance levels of <1%, <5% and <10%.

Regarding our proxies measuring growth opportunities, the EBITDA

multiple is not significant in any of the models, either with or without debt. This finding might be caused by the inability of the measure to estimate the market value of these unlisted firms. Nevertheless, when growth opportunities are proxied by intangible assets, the coefficient of this variable is positive and significant. Since our sample firms are not traded on the stock market, this latter measure could be more representative of their growth opportunities.

When the long term debt is brought into the estimation process, we find evidence of its positive effect on investment. Given the limited access to debt and the low level of available cash flow, this result may explain why entrepreneurs access VC investors as an alternative source for financing the expansion process.

The results obtained are robust after controlling for size, age and time dummies, as well as dummies relative to the location of the firm.

But our purpose is to check whether the sensitivity between investment and cash flow is significant in the supposedly more constrained firms, namely the group that receives VC backing later. The positive coefficient found in Table 3.4 anticipates significant differences in the investment-cash flow relationship between the groups of firms with and without VC involvement (see Tables 3.5 and 3.6, respectively). For the subsample of firms that later receive VC funding, the results of which are recorded in Table 3.5, the existence of financial constraints is confirmed by the presence of a positive and significant cash flow coefficient. Furthermore, its value is much greater than the one registered for the sample of SMEs as a whole and for the firms

without VC involvement. This finding is robust in the two models considered, which also include time and location dummies. These results provide evidence of the difficulties involved in obtaining additional funds, either because they are not available or because the cost is high.

In the same vein, long term debt exhibits a positive coefficient in both groups of firms. Nevertheless, the coefficients found in firms that later receive VC are much greater than those of the firms without VC involvement. This finding supports the idea of firms accessing VC funding to go ahead with their expansion projects when they exhaust their debt capacity. Conversely, lower cash flow and long term debt coefficients are consistent with a gentle growth rate in firms that are not subject to VC investments in the near future.

3.5. CONCLUSIONS AND DISCUSSION

The controversy about the link between financial constraints and investment-cash flow sensitivity has basically relied on listed firms that were subject to some qualitative or quantitative pre-classification procedures. While Fazzari et al. (1988) maintain that the relationship between investment and cash flow explains financial constraints, Kaplan and Zingales (1997) affirm that the former relationship does not necessarily explain that a firm is financially constrained. Since all sample firms were listed, with potential access to long term external funding, the pre-classification was a requisite so as to define which of them were supposedly financially constrained.

TABLE 3.5.
REGRESSION RESULTS OF THE INVESTMENT-CASH FLOW SENSITIVITY FOR THE SUBSAMPLE OF UNLISTED SPANISH SMES THAT WERE SUBJECT TO A VC INVESTMENT LATER (PRE-INVESTMENT PERIOD)

	DEPENDENT VARIABLE: INVESTMENT			
INDEPENDENT VARIABLES	***WITHOUT THE EFFECT OF LONG TERM DEBT***		***WITH THE EFFECT OF LONG TERM DEBT***	
CF_{it}	0.7252***	0.6891***	0.6810***	0.6670***
	(0.1365)	(0.1290)	(0.1290)	(0.1268)
$EBITDA_{it}$	0.0122		0.0076	
	(0.0117)		(0.0106)	
$Intang_{it}$		0.6142***		0.3380***
		(0.1059)		(0.1062)
LTD_{it}			0.6437***	0.5866***
			(0.0649)	(0.0692)
$Size_{it}$	-0.0343***	-0.0284***	-0.0226**	-0.0205**
	(0.0104)	(0.0096)	(0.0102)	(0.0097)
Age_i	-0.0021***	-0.0016***	-0.0015***	-0.0013**
	(0.0006)	(0.0005)	(0.0006)	(0.0005)
R_i	-0.0220	0.0015	-0.0267	-0.0150
	(0.0194)	(0.0176)	(0.0177)	(0.0163)
Time dummies	Yes	Yes	Yes	Yes
Intercept	0.1947**	0.1922***	0.0690	0.0869*
	(0.0857)	(0.0461)	(0.0743)	(0.0461)
Nº observations	1034	1034	1034	1034
Nº groups	167	167	167	167

The table reports Generalised Least Squares, random effects, estimation of the model. The dependent variable is the ratio between investments (i.e. increase in net fixed assets of the firm *i* in year *t* plus depreciation in year *t*) and beginning-of-period total assets of the firm. The independent variables are: (1) CF_{it-1}: net earnings plus depreciation divided by beginning-of-period total assets; (2) $EBITDA_{it}$: average EBITDA multiple for the period; (3) $Intang_{it}$: intangible fixed assets normalised by beginning-of-period total assets; (4) LTD_{it-1}: total long term debt divided by the beginning-of-period total assets; (5) $Size_{it}$: natural logarithm of total the number of employees of the firm *i* in the period *t*; (6) Age_i: age of the firm *i* at the period *t*; (7) R_i: dummy variable indicating firms located in Objective 1 region; (8) VC_i: dummy variable indicating firms in the VC-backed group (i.e. 0 for firms in the control group). All ratios are winsorised at the 2% threshold. Robust standard errors are reported in parenthesis. ***, ** and * indicate, respectively, significance levels of <1%, <5% and <10%.

TABLE 3.6.
REGRESSION RESULTS OF THE INVESTMENT-CASH FLOW SENSITIVITY FOR THE SUBSAMPLE OF UNLISTED SPANISH SMES WITHOUT FUTURE VC INVOLVEMENT (PRE-INVESTMENT PERIOD)

	DEPENDENT VARIABLE: INVESTMENT			
INDEPENDENT VARIABLES	***WITHOUT THE EFFECT OF LONG TERM DEBT***		***WITH THE EFFECT OF LONG TERM DEBT***	
CF_{it}	0.6097***	0.5942***	0.5532***	0.5688***
	(0.1229)	(0.1243)	(0.1054)	(0.1050)
MB_{it}				
$EBITDA_{it}$	0.0005		0.0020	
	(0.0100)		(0.0088)	
$Intang_{it}$		0.1805*		-0.2204*
		(0.1060)		(0.1157)
LTD_{it}			0.5645***	0.5982***
			(0.0709)	(0.0769)
$Size_{it}$	-0.0119	-0.0114	-0.0169**	-0.0178**
	(0.0089)	(0.0088)	(0.0084)	(0.0085)
Age_i	-0.0018***	-0.0017***	-0.0001	-0.0002
	(0.0006)	(0.0006)	(0.0006)	(0.0006)
R_i	0.0264	0.0292*	0.0128	0.0085
	(0.0177)	(0.0177)	(0.0159)	(0.0160)
Time dummies	Yes	Yes	Yes	Yes
Intercept	0.1097**	0.1004***	0.0284	0.0508
	(0.0612)	(0.0402)	(0.0556)	(0.0364)
Nº observations	994	995	994	995
Nº groups	168	168	168	168

The table reports Generalised Least Squares, random effects, estimation of the model. The dependent variable is the ratio between investments (i.e. increase in net fixed assets of the firm *i* in year *t* plus depreciation in year *t*) and beginning-of-period total assets of the firm. The independent variables are: (1) CF_{it-1}: net earnings plus depreciation divided by beginning-of-period total assets; (2) $EBITDA_{it}$: average EBITDA multiple for the period; (3) $Intang_{it}$: intangible fixed assets normalised by beginning-of-period total assets; (4) LTD_{it-1}: total long term debt divided by the beginning-of-period total assets; (5) $Size_{it}$: natural logarithm of total the number of employees of the firm *i* in the period *t*; (6) Age_i: age of the firm *i* at the period *t*; (7) R_i: dummy variable indicating firms located in Objective 1 region; (8) VC_i: dummy variable indicating firms in the VC-backed group (i.e. 0 for firms in the control group). All ratios are winsorised at the 2% threshold. Robust standard errors are reported in parenthesis. ***, ** and * indicate, respectively, significance levels of <1%, <5% and <10%.

Our approach is to focus on unlisted SMEs, which do not have access to capital markets, to be better able to test the investment-cash flow sensitivity as a signal of the presence of financial constraints. Even if we assume that most SMEs are potentially financially constrained, due to the limited access, if any, to long term external sources of finance, we also need some sort of pre-classification. One source of external funds available in developed countries is VC, which aims to invest in growing SMEs on a temporary basis. When approaching a venture capitalist, SMEs aim to raise funds as well as to benefit from the value-added that the former may provide. Therefore, one of the key reasons for SMEs' accessing VC is the lack of internally generated funds to finance their growth. As a result, we adopt a pre-classification procedure of SMEs by selecting a group of firms that were later subject to a VC investment.

We conduct our analysis on a representative sample of 168 Spanish manufacturing SMEs at the expansion stage that received a VC investment over the period 1995-2007. We compare the results with a one-by-one matched sample of similar SMEs with no VC involvement, which was randomly selected from the AMADEUS Database. We find evidence of a positive and significant relationship between investment and cash flow when all firms, both VC- and non-VC-backed, are included in the analysis. We also find that the investment dependency on internally generated funds in the firms that later received VC is greater than that found in control group firms.

Our results also show a positive coefficient of the long term debt, which provides evidence of the positive effect of debt on future investment. Nevertheless, the use of debt might not be a viable financial resource for

SMEs, which are the most affected by information asymmetry problems. This fact may be interpreted as one of the reasons that entrepreneurs have to approach VC investors.

Regarding growth opportunities, the EBITDA multiple is neither significant for the whole sample nor for the subsamples of firms with and without VC involvement. This can be motivated by the estimation procedure applied, since no observable market value is available on all sample firms. Nevertheless, the variable measuring growth opportunities through intangible assets is significant for the whole sample and also for the two subsamples considered individually, with the coefficients being greater in the group of firms that later receive VC.

The contributions of this chapter are three. First, we provide an empirical financial justification to explain VC intervention, since SMEs with high investment-cash flow sensitivity may solve their financial constraints by accessing an external source of funds. Second, we provide new evidence to the controversy about the sensitivity between investment and cash flow. To identify the presence of financial constraints we rely on VC involvement as a pre-classification procedure of more financially constrained firms. Finally, we test our hypotheses on unlisted European SMEs that were later financed by a venture capitalist. With the exception of Manigart et al. (2003), Bertoni et al. (2008), Guariglia (2008), and Engel and Stiebale (2009), the previous literature focuses on listed firms. Furthermore, none of these papers addresses the analysis of the dependency between investment and cash flow prior of the VC investment event.

Regarding the limitations, since we focus on unlisted firms, we do not have access to market values to represent growth opportunities through the Market-to-Book ratio. We had to estimate market values by computing EBITDA multiples in acquisitions disclosed in the media over the whole period. Those multiples were then used to estimate the evolution of market values of unlisted firms over time. A second limitation is related to the methodology, since we base our estimation on static random effects models, due to the lack of sufficient observations per firm in our sample.

The implications of the chapter are various. For policymakers and practitioners, the investment sensitivity to changes in cash flow could be viewed as a tool for identifying financial constraints in SMEs. Additionally, our findings could be interpreted as a way to justify the role of venture capitalists in covering the financing gap of SMEs in their growth process.

For future research, new proxies for growth opportunities should be tested in order to better explain the evolution of investments in unlisted firms. Similarly, when more observations are available, it would be interesting to check the robustness of our findings using dynamic models. Finally, it should also be interesting to test whether our findings, which are related to Spanish SMEs, could also be similar to those found in other developed countries.

3.6. REFERENCES

Almeida, H. and Campello, M. (2007) 'Financial constraints, asset tangibility, and

corporate investment', The Review of Financial Studies, 20(5): 1429-1460.

Alti, A. (2003) 'How sensitive is investment to cash flow when financing is frictionless?', The Journal of Finance, 58(2): 707-722.

Andrés-Alonso, P.; Azofra-Palenzuela, V. and Rodríguez-Sanz, J.A. (2000) 'Endeudamiento, oportunidades de crecimiento y estructura contractual: Un contraste empírico para el caso español', Investigaciones Económicas, XXIV(3): 641-679.

Ang, J.S. (1991) 'Small business uniqueness and the theory of financial management', The Journal of Small Business Finance, 1(1): 1-13.

Ang, J.S. (1992) 'On the theory of finance for privately held firms', The Journal of Small Business Finance, 1(3): 185-203.

Arellano, M. and Bover, O. (1990) 'La Econometría de Datos de Panel', Investigaciones Económicas, XIV(1): 3-45.

Ascioglu, A.; Hegde, S.P. and McDermott, J.B. (2008) 'Information asymmetry and investment-cash flow sensitivity', Journal of Banking and Finance, 32(6): 1036-1048.

Balboa, M.; Martí, J. and Tresierra, A. (2009) 'Capital structure determinants in growth firms accessing venture funding' (February 16, 2009). URL (consulted January, 2010): http://ssrn.com/abstract=1344267.

Berger, A.N. and Udell, G.F. (1998) 'The economics of small business finance: The roles of private equity and debt markets in the financial growth

cycle', Journal of Banking & Finance, 22(6-8): 613-673.

Bertoni, F.; Colombo, M.G. and Croce, A. (2008) 'The effect of venture capital financing on the sensitivity to cash flow of firm's investments'. European Financial Management, forthcoming, URL (consulted June, 2009): http://www3.interscience.wiley.com/journal/121452842/abstract/.

Bond, S.; Elston, J.A.; Mairesse, J. and Mulkay, B. (2003) 'Financial factors and investment in Belgium, France, Germany, and the United Kingdom: A comparison using company panel data', The Review of Economics and Statistics, 85(1): 153-165.

Carpenter, R. and Guariglia, A. (2008) 'Cash flow, investment, and investment opportunities: New tests using UK panel data', Journal of Banking and Finance, 32(9): 1894-1906.

Carpenter, R.E. and Petersen, B.C. (2002a) 'Is the growth of small firms constrained by internal finance?', Review of Economics and Statistics, 84(2): 298–309.

Carpenter, R.E. and Petersen, B.C. (2002b) 'Capital market imperfections, high-tech investment, and new equity financing', Economic Journal, 112(477): F54–F72.

Chemmanur, T.J.; Krishnan, K. and Nandy, D. (2009) 'How does Venture Capital financing improve efficiency in private firms? A look beneath the Surface', URL (consulted March, 2010): http://ssrn.com/abstract=1025322.

Chittenden, F.; Hall, G. and Hutchinson, P. (1996) 'Small firm growth, access to capital markets and financial structure: Review of issues and an empirical investigation', Small Business Economics, 8(1): 59-67.

Cleary, S. (1999) 'The relationship between firm investments and financial status', Journal of Finance, 54(2): 673–692.

Cleary, S. (2006) 'International corporate investment and the relationships between financial constraint measures', Journal of Banking & Finance, 30(5): 1559–1580.

Devereux, M. and Schiantarelli, F. (1990) `Investment, financial factors, and cash flow: Evidence from U.K. panel data'. In: Hubbard, R.G. (Ed.), *Asymmetric information, corporate finance, and investment*, University of Chicago Press and NBER (Chicago).

Engel, D. and Stiebale, J. (2009) 'Private Equity, Investment and financial constraints: Firm-level evidence for France and the United Kingdom' (July 23, 2009). Ruhr Economic Paper No. 126. URL (consulted January, 2010): http://ssrn.com/abstract=1438037.

EVCA (2007) 'Guide on Private Equity and Venture Capital for entrepreneurs: An EVCA special paper' (November 2007). URL (consulted March, 2010): http://www.cvca.cz/miranda2/export/sites/www.cvca.cz/cs/sys/galerie-download/Guide_on_PEandVC_for_Entrepreneurs.pdf.

Fama, E.F. and French, K. (2002) 'Testing Trade-Off and Pecking Order predictions about dividends and debt', The Review of Financial Studies,

15(1): 1-33.

Fazzari, S.M.; Hubbard, R.G. and Petersen, B.C. (1988) 'Financing constraints and corporate investment', Brooking Papers on Economic Activity, 1998(1): 141-206.

Gilchrist, S. and Himmelberg, C. (1995) 'Evidence on the role of cash flow for investment', Journal of Monetary Economics, 36(3): 541-572.

Gompers, P. and Lerner, J. (1998) 'What Drives Venture Capital Fundraising?', Brookings Papers on Economic Activity. Microeconomics, 1998): 149-204.

Gompers, P. and Lerner, J. (2001) 'The Venture Capital Revolution', Journal of Economic Perspectives, 15(2): 145-168.

Gregory, B.T., Rutherford, M.W., Oswald, S. and Gardiner, L. (2005) 'An empirical investigation of the growth cycle theory of small firm financing', Journal of Small Business Management, 43(4): 382-392.

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

Hellmann, T. and Puri, M. (2002) 'Venture Capital and the professionalization of start-up firms: Empirical evidence', The Journal of Finance, LVII(1): 169-197.

Hogan, T. and Hutson, E. (2005) 'Capital structure in new technology-based firms: Evidence from the Irish software sector', Global Finance Journal,

15(3): 369-387.

Holmes, S. and Kent, P. (1991) 'An empirical analysis of the financial structure of the small and large Australian manufacturing enterprises', Journal of Small Business Finance, 1(2): 141-154.

Hoshi, T.; Kashyap, A. and Scharfstein, D. (1991) 'Corporate structure, liquidity, and investment: Evidence from Japanese industrial groups', The Quarterly Journal of Economics, 106(1): 33-60.

Hovakimian, A. and Hovakimian, G. (2009) 'Cash flow sensitivity of investment', European Financial Management, 15(1): 47-65.

Hovakimian, G. (2009) 'Determinants of Investment Cash Flow Sensitivity', Financial Management, 38(1): 161-183.

Hsu, D. H. (2004) 'What do entrepreneurs pay for Venture Capital affiliation?', The Journal of Finance, LIX(4): 1805-1844.

Hubbard, R.G. (1998) 'Capital-market imperfections and investment', Journal of Economic Literature, 36(1): 193–225.

Jain, B.A. (2001) 'Predictors of Performance of Venture Capitalist-backed Organizations', Journal of Business Research, 52(3): 223-233.

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

Kadapakkam, P., Kumar, P. and Riddick, L.A. (1998) 'The impact of cash flows

and firm size on investment: The international evidence', Journal of Banking & Finance, 22(3): 293-320.

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

Kaplan, S. and Zingales, L. (2000) 'Investment-cash flow sensitivities are not valid measures of financing constraints', Quarterly Journal of Economics, 115(2): 707-712.

Lang, L.; Ofek, E. and Stulz, R. (1996) 'Leverage, investment, and firm growth', Journal of Financial Economics, 40(1): 3-29.

López-Gracia, J. and Aybar-Arias, C. (2000) 'An Empirical Approach to the Financial Behaviour of Small and Medium Sized Companies', Small Business Economics, 14(1): 55-63.

Manigart, S.; Baeyens, K. and Verschueren, I. (2003) 'Financing and investment interdependencies in unquoted Belgian companies: The role of venture capital'. In: Butzen, P. and Fuss, C. (Ed.) *Firms' investment and finance decision*, Edward Elgar (Cheltenham).

Michaelas, N.; Chittenden, F. and Poutziouris, P. (1999) 'Financial policy and capital structure choice in U.K. SMEs: Empirical evidence from company panel data', Small Business Economics, 12(2): 113-130.

Morgado, A. and Pindado, J. (2003) 'The underinvestment and overinvestment

hypothesis: An analysis using panel data', European Financial Management, 9(2): 163-177.

Moyen, N. (2004) 'Investment-cash flow sensitivities: Constrained versus unconstrained firms', Journal of Finance, 59(5), 2061-2092.

Mundlak, Y. (1978) 'On the pooling of time series and cross section data', Econometrica, 46(1): 69-85.

Myers, S.C. (1984) 'The capital structure puzzle'. The Journal of Finance, 39(3, Papers and Proceedings, Forty-Second Annual Meeting, American Finance Association, San Francisco, CA, December 28-30, 1983. (July 1984): 575-592.

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

NVCA (2009) National Venture Capital Asociation Yearbook 2009. Virgina (US).

Paul, S.; Whittam, G. and Wyper, J. (2007) 'The Pecking Order hypothesis: does it apply to start-up firms?', Journal of Small Business and Enterprise Development, 14(1): 8-21.

Pawlina, G. and Renneboog, L. (2005) 'Is investment-cash flow sensitivity caused by agency costs or asymmetric information? Evidence from the UK', European Financial Management, 11(4): 483–513.

Sahlman, W.A. (1990) 'The structure and governance of Venture-Capital Organizations', Journal of Financial Economics, 27(2): 473-521.

Shin, H. and Kim, Y.H. (2002) 'Agency costs and efficiency of business capital investment: Evidence from quarterly capital expenditures', Journal of Corporate Finance, 8(2): 139-158.

Shin, H. and Park, Y. (1999) 'Financing constraints and internal capital markets: Evidence from Korean 'Chaebols'', Journal of Corporate Finance, 5(2): 169-191.

Stiglitz, J.E. and Weiss, A. (1981) 'Credit rationing in markets with imperfect information', The American Economic Review, 71(3): 393-410.

Titman, S. and Wessels, R. (1988) 'The determinants of capital structure choice', The Journal of Finance, 43(1): 1-19.

Vogt, S. (1994) 'The cash flow/investment relationship: evidence from U.S. manufacturing firms', Financial Management, 23(2): 3-20.

Wald, J.K. (1999) 'How firm characteristics affect capital structure: An international comparison', Journal of Financial Research, 22(2): 161-187.

Whited, T.M. (1992) 'Debt, liquidity constraints, and corporate investment: Evidence from panel data', The Journal of Finance, 47(4): 1425-1460.

CHAPTER 4
FINANCIAL MARKET IMPERFECTIONS, CONTROL AVERSION AND VENTURE CAPITAL IN SPANISH SMALL AND MEDIUM-SIZED ENTERPRISES[**]

[**] This work has been accepted for publishing in the journal 'Corporate Ownership and Control' in 2010. We would like to thank Álvaro Tresierra Tanaka for his research assistance (Universidad de Piura).

4.1. INTRODUCTION

Access to external financing is particularly difficult for Small and Medium-Sized Enterprises (SMEs, hereafter). Due to information asymmetries and control aversion, internal and external finance are not perfect substitutes and the former is usually preferred to the latter. On the one hand, SMEs are particularly exposed to information asymmetries which make external financing more costly (Ang, 1991; Chittenden et al., 1996; Berger and Udell, 1998; Carpenter and Petersen, 2002a). On the other, most SMEs are owned and managed by entrepreneurs who are reluctant to dilute their ownership and lessen their control (Holmes and Kent, 1991; Chittenden et al., 1996) and prefer to rely upon internal finance rather than be subject to scrutiny and interference by external investors (López-Gracia and Aybar-Arias, 2000; Hogan and Hutson, 2005; Chittenden et al., 1996). As a consequence, investment expenditures of SMEs rely primarily on internally generated resources.

Under some circumstances, however, SMEs find it optimal to seek external financing. This occurs when the expected return of investment opportunities which would be unattainable without external financing offsets both the additional cost of external money due to information asymmetries and the loss in control which is implied by the involvement of external investors. As to this latter aspect, it should be noted that entrepreneurs differ both in terms of their attitude towards interference from external stakeholders (Berggren et al., 2000) and in their strong ambition to grow (Olofsson, 1994) so that when the former is low and the latter high, they will exhibit a stronger

propensity to look for financial intermediaries able to alleviate and manage information asymmetries (Gompers, 1995; Wright and Robbie, 1998; Gompers and Lerner, 2001; Hsu, 2004).

As specialised investors, Venture Capital (VC, hereafter) institutions are the best option for fast-growing firms (Carpenter and Petersen, 2002a). In addition to financial resources, VC investors provide value-added services that help firms to raise additional long-term funds to finance their growth and add value through monitoring and mentoring initiatives (Sahlman, 1990; Gompers and Lerner, 1998).

As a consequence, VC-backed SMEs should be able to reduce their natural dependency on internally generated funds to finance their growth opportunities. The aim of this chapter is to verify the positive role played by VC on investee firms by testing the relationship between investments and cash flows on a sample of unlisted Spanish SMEs. We study the extent to which VC changes the sensitivity to cash flows of firm's investments in a sample composed of 322 SMEs that received VC between 1995 and 2004 and on a one-by-one matched sample of similar SMEs that did not receive VC in that period.

Only a few papers have focused on the investment sensitivity to cash flow in VC-backed firms and they obtained mixed results about the actual impact of VC (Manigart et al., 2003; Bertoni et al., 2008; Engel and Stiebale, 2009). Notably, this is the first work that analyses the change in the investment sensitivity to cash flow in Spanish growing SMEs, including both VC

and comparable non-VC-backed firms.

Our results strongly confirm that VC does reduce SME's investment dependency on internally generated funds. We find consistent results across different specifications that SMEs at the expansion stage exhibit a positive and significant relationship between investments expenditures and cash flow prior to the VC deal. This investment dependency on cash flows becomes less significant in the post-investment period. VC-backed firms show a positive, significant relationship between investment and intangible assets, as a proxy of growth opportunities. By splitting the sample across sectors, we find that results are particularly strong for low and medium tech manufacturing and services firms.

The rest of the chapter is organised as follows. Section 4.2 presents a brief review of the literature and develops our research hypotheses. Section 4.3 describes the sampling process and the econometric methodology, and reports descriptive statistics and preliminary evidence of the evolution of investment patterns due to VC investment. Results of econometric models are presented in section 4.4. Finally, the main findings are highlighted and discussed in section 4.5.

4.2. LITERATURE REVIEW AND RESEARCH HYPOTHESES

SMEs are typically owner-managed (Ang, 1991; Cressy, 1995). For many entrepreneurs, the primary motive for starting a business is the desire for

'independence' (Cressy, 1995; Paul et al., 2007). Since the key source of financing for these firms comes from the entrepreneur's savings (Ang, 1992; Berger and Udell, 1998), the distinction between entrepreneur's and firm's resources fades and, at the same time, business risk is no longer separable from personal risk (Ang, 1992). In addition to personal wealth of the entrepreneurs, financing is often provided by their family and friends (Berger and Udell, 1998).

As firms grow, additional funds are required. Nevertheless, entrepreneurs tend to be reluctant to take on external finance (Cressy, 1995; Reid, 1996). Equity financing is often considered as an intrusion into the business (Paul et al., 2007), whereas debt is usually available only against personal collateral and guarantees given by the entrepreneurs (Berger and Udell, 1998). Once personal resources are exhausted, investment opportunities depend on available internally generated funds (Chittenden et al., 1996; Michaelas et al., 1999; Carpenter and Petersen, 2002b; Watson and Wilson, 2002; among others). These resources may still not be sufficient, especially when growth opportunities are significant, in which case SME's growth and, sometimes, survival depend on their access to external funds (Cressy, 1995) which, in turn, depend on information asymmetries and control aversion. Whereas conservative entrepreneurs remain independent to external control, at the expense of limiting firm growth (Cressy, 1995), entrepreneurs that believe that a firm's growth is necessary (or who perceive a firm's investment opportunities as above-average) will do whatever is necessary to grow (Berggren et al., 2000). This group of entrepreneurs is less reluctant to raise

funds from external sources. Control aversion typically decreases over time, and, alongside, the level of external financing increases (Cressy, 1995).

VC is a source of long term financing, usually supplied in the form of equity, or quasi-equity, instruments that involves holding minority stakes in growing SMEs (Sahlman, 1990). Venture capitalists do not aim to become permanent shareholders in investee firms but, rather, help entrepreneurs in developing their growth potential and, then, sell the shares received at the time of the investment (hopefully realising a capital gain). This minority and temporary approach may limit an entrepreneur's reluctance to let an external investor become a permanent shareholder of the firm.

Nevertheless, prior to the entry of VC investors, the dependency of investments on internally generated funds would apply in all growing SMEs, regardless of the future involvement, or not, of a VC investor. Accordingly, we expect the following.

Hypothesis 4.1: The relationship between investments and cash flows should be positive and significant in all non-VC-backed SMEs, regardless of whether they will eventually receive VC or not.

Once entrepreneurs decide to access external funds, they actively seek for investors that provide both financial resources and value-added (Paul et al., 2007; Hsu, 2007). In presence of asymmetries in information, venture capitalists are the best agents to address adverse selection and moral hazard problems found in SMEs (Carpenter and Petersen, 2002a). Hogan and Hutson (2005) and Paul et al. (2007) find that equity issues are the main source of

external financing for VC-backed firms, rather than debt. VC is an alternative financing source for small and recently created fast-growing firms, which typically posses few tangible assets, operate in markets that change very rapidly, are plagued by high levels of uncertainty, and have large information asymmetries between entrepreneurs and investors (Gompers and Lerner, 2001). VC investors also provide non-financial services which contribute significantly in the development and success of the investee firm (Tyebjee and Bruno, 1984; Sahlman, 1990; Gompers and Lerner, 1998; Wright and Robbie, 1998; Hellmann and Puri, 2000). After the initial investment, VC investors monitor a firm's performance, help in recruiting managers, and providing strategic financial and legal advice (Gorman and Sahlman, 1989; Kaplan and Strömberg, 2001). Besides, VC makes it easier for investee firms to find additional long-term resources (Sahlman, 1990; Admati and Pfleiderer, 1994; Wright and Robbie, 1998; Gompers and Lerner, 2001, Tykvová, 2007). With access to external financial funds, the level of liquidity of fast-growing SMEs increases and the investment dependency on their internally generated funds diminishes. On these grounds, our second hypothesis is the following.

Hypothesis 4.2: After VC financing the relationship between investments and cash flows should be significantly reduced, or even disappear, in VC-backed growing SMEs.

The empirical evidence of investment-cash flow sensitivity on VC-backed firms is very limited and shows mixed results. Manigart et al. (2003) study the investment-cash flow sensitivity in unlisted Belgian VC-backed firms and a matched sample of non-VC-backed firms. Contrary to expectations, their

results provide evidence of an increase in the sensitivity after the initial VC investment. Nevertheless, their results might be affected by the heterogeneous nature of VC investments included in their sample, ranging from early stage financing to buyouts. Furthermore, financial constraints faced by all firms during the 1991-1995 economic crisis may affect most of their post-VC investment observations and, thus, their empirical results.

Bertoni et al. (2008) analyse the dependency of investment on cash flows on VC-backed and non-VC-backed unlisted Italian high-tech firms. They find that, before receiving VC money, firms suffer from appreciable financial constraints. Nevertheless, after receiving VC financing, firms exhibit low and statistically not significant investment-cash flow sensitivity when the investor involved is an independent VC firm. Their results are similar to what we expect to find. Conversely, in firms backed by a corporate VC, investment remains sensitive to shocks in cash flow, indicating that investment constraints are not completely removed.

More recently, Engel and Stiebale (2009) find that UK and French portfolio firms display positive and significant investment sensitivity to cash flow before expansion financing. On the other hand, investee firms display higher investment levels and a lower dependence on internal funds after VC investment. These findings are in line with our hypotheses.

4.3. DATA AND METHODOLOGY

4.3.1. THE SAMPLING PROCESS

The presence of investment-cash flow sensitivity on SMEs is tested in a sample of unlisted Spanish SMEs at the expansion stage. The sample includes firms which received VC expansion investments during the period 1995-2004 and a matched sample of non invested firms.

In accordance with data obtained from the Spanish Private Equity and Venture Capital Association (ASCRI), between 1995 and 2004, 1,572 VC investments were recorded in Spain, including all stages but excluding financial and real-estate sectors (Martí et al., 2010). For 259 firms we could not find any accounting information, which reduces the accessible population to 1,313 VC-backed firms (83.5 per cent of the initial population). Out of these, we drop 575 early stage deals and 159 buyouts and are left with 579 expansion investments. From the remaining firms in this latter group, we gather accounting information from the AMADEUS Database, which records information on 1,202,363 Spanish firms. In order to make estimation more robust, we select only firms for which at least three consecutive years of accounting data, including the year in which VC investment occurs, are available. Some six firms operating in the primary industry are excluded from the analysis since they would constitute a very different category from the rest of the sample which would however be characterised by too few observations to be studied separately. This leads us to a sample of 322 firms, accounting for 56 per cent of the fully identified firms that were financed at the expansion

stage in Spain between 1995 and 2004.

A one-by-one matched sample of 322 firms with no VC funding was then created. Comparable firms were drawn from the AMADEUS Database among those matching the investee firm sector (NACE Rev2 4-digit code). Among this cohort of firm-year observations, we select the one which is closer to the characteristics of the investee firm in the year before VC investment (number of employees, revenues, total asset, age). When possible we also selected firms incorporated in areas with the same level of local development (Objective 1 region[25] or not). To check the robustness of the matching process we control ex post that the characteristics in the year before VC investment are the same between the two cohorts. We perform t-tests on number of employees, revenues, total asset, age and a dummy indicating whether the firm is incorporated in an Objective 1 region, and in no case did we find any significant difference between the two groups.[26] For further robustness we also perform a joint test by estimating a probit model where the dependent variable is a dummy indicating whether a firm is in the VC-backed group or in the control group and the dependent variables are, again, number of employees, revenues, total asset, age and a Objective 1 region dummy. A Wald test reveals that we cannot reject the null hypothesis that all the coefficients are jointly zero ($\chi^2(5)=8.82$; *p-value* 0.14). Table 4.1 reports the distribution of sample firms across industries.

[25] Objective 1 regions are defined as those regions that exhibit an average income below 75 per cent of the European Union average.

[26] T-tests are performed under the conservative assumption of unequal variances. *p-values* for the null hypothesis that the mean is equal between the two samples are the following: number of employees 0.17; revenues 0.39; total asset: 0.20; age 0.91; Objective 1 region 0.62.

TABLE 4.1.
DISTRIBUTION OF SAMPLE FIRMS ACROSS SECTORS

SECTOR	*TOTAL SAMPLE*		*VC-BACKED FIRMS*		*NON-VC-BACKED FIRMS*	
	n	***%***	***n***	***%***	***n***	***%***
Technology, media and telecommunications	92	14	46	7	46	7
Medium and Low Tech Manufacturing	336	51	168	26	168	26
Medium and Low Tech Services	216	33	108	17	108	17
Total	**644**	**100**	**322**	**50**	**322**	**50**

The table reports the distribution according to industry of a sample of 656 unlisted Spanish firms. Percentages in the 'Total sample', 'VC-backed firms' and 'Non-VC-backed firms' columns are related to the total number of sample firms.

4.3.2. METHODOLOGY

In order to analyse the relationship between investments and cash flows in VC- and non-VC-backed firms we build on the classical approach by Fazzari et al. (1988). Models to estimate investment sensitivity to cash flows (see Fazzari et al., 1998 and Bond and Van Reenen, 2007 for a review and in-depth discussion) consider investments as a dependent variable and internally generated resources and growth opportunities as key independent variables (alongside other control variables). Broadly speaking these models differ in the way in which they measure unobserved growth opportunities. When using panel data with a sufficiently long time span, dynamic models (e.g. Euler equation and sales accelerator) can be used to control for unobserved growth opportunities. However when data are cross-sectional or, as in our case, do not have a sufficient time breadth, static models have to be used, as in the original work by Fazzari et al. (1988). Investments are normally measured by changes in fixed assets, and the capacity to generate resources internally is

proxied by cash flows. Fazzari et al. (1988) measure growth opportunities by including in the estimates firm Tobin's q. The use of Tobin's q (which is also criticised by many, see for instance Bond and Van Reenen, 2007) is impossible in our sample since it only includes unlisted firms. We thus need to rely upon an alternative measure of growth opportunities. Fama and French (2002) argue that R&D expenditures signal firm's unobserved growth opportunities. Building on this idea, and following Michaelas et al. (1999) and Manigart et al. (2003), we use the volume of intangible assets (normalised by total assets) as a proxy of growth opportunities.[27]

We include, as control variables, firm size and age.[28] The model that we estimate is then the following:

$$I_{it} = \beta_0 + \beta_1 CF_{it} + \beta_2 Intang_{it} + \beta_3 Size_{it} + \beta_4 Age_{it} + \beta_5 VC_i + \beta_6 VC_i * CF_{it} + D_{it} + \varepsilon_{it} \quad (4.1)$$

where i is the firm's indicator while t is a time indicator which is set to 0, for VC-backed firms, in the year of VC investment and, for control group firms, in the year in which they are matched to their VC-backed 'twin' firm. Negative (positive) values of t indicate years before (after) the investment event occurs. I_{it} is the ratio between investments (i.e. increase in net fixed assets of the firm i in year t plus depreciation in year t) and beginning-of-period total assets of the firm. CF_{it} is the ratio between firm's cash flows (i.e. net earnings

[27] Several other measures for growth opportunities exist. Following Titman and Wessels (1988), we also consider asset growth as a measure of future growth opportunities (this approach is however criticised by Balboa et al., 2009). Results are qualitatively similar to the ones presented here and are available from authors upon request.

[28] Firm investments could also be affected by leverage, as argued by Lang *et al.* (1996) and Hovakimian (2009). However, leverage (i.e. total debt over total assets) proves to be excessively correlated with other regressors (especially cash flows and intangible assets) to be included in the analysis.

plus depreciation) in year *t* and beginning-of-period total assets. $Intang_{it}$ measures the ratio between intangible assets and total assets in year *t*. $Size_{it}$ is measured by the natural logarithm of firm's employees in year *t*. Age_{it} is the firm's age in year *t.* D_{it} is a set of year dummies; formally $D_{it}=\tau_y d_{ity}$ where τ_y is a parameter capturing calendar year-specific shocks in investments (i.e. the fact that, other things being equal, aggregate investments fluctuate over time according to changes in expectations about, for instance, future economic growth of the economy as a whole) and $d_{ity}=1$ if year *t* for firm *i* corresponds to calendar year *y*.

The most important variable in equation (4.1), for the purpose of this work, is VC_i: a dummy variable that takes value 1 if firm *i* is in the VC-backed group. The dummy is included both in level and in interaction with cash flows, to control respectively for a different intercept and slope of investment-cash flow sensitivity relationship. Specifically β_5 captures the extent to which firms in the VC-backed group invest more than firms in the control group, other things being equal. Coefficient β_6, instead, captures the difference in the sensitivity to cash flows of investments for firms in the two subsamples, with negative values indicating that sensitivity is lower for firms in the VC-backed group.

We also estimate an augmented version of equation (4.1) in which we control for possible differences between investment patterns in high tech and non high tech (i.e. medium and low tech) firms. This control is particularly crucial since VC investments span a wide variety of sectors characterised by substantially different levels of information asymmetry which might also differ

in the extent of financial frictions. Moreover, in Continental Europe, the fraction of VC investments in low and medium technology sectors is not negligible. We then add to equation (4.1) a dummy variable (TMT_i), both in level and in interaction with cash flows, which takes value 1 if the firm operates in technology, media and telecommunications (TMT) sector, and 0 otherwise. Finally, we also estimate equation (4.1) separately on different sectors.

Table 4.2 summarises the definition of the variables to be used.

TABLE 4.2.
DEFINITION OF THE VARIABLES

VARIABLE	*DESCRIPTION*
I_{it}	Increase in book value of net fixed asset plus depreciation divided by beginning-of-period total assets.
CF_{it}	Net earnings plus depreciation divided by beginning-of-period total assets.
$Intang_{it}$	Intangible fixed assets normalised by beginning-of-period total assets.
$Size_{it}$	Natural logarithm of the number of employees of the firm *i* in year *t*.
Age_{it}	Age of the firm *i* at time *t.*
TMT_i	Dummy variable indicating firms which operate in the technology, media and telecommunications.
VC_i	Dummy variable indicating firms in the VC-backed group (i.e. 0 for firms in the control group).

We estimate equation (4.1) separately for $t<0$ (pre-investment period) and $t\geq 0$ (post-investment period). Let us indicate with a '-' and '+' superscript the parameters estimated in the two time subsamples. We can translate Hypotheses 4.1 and 4.2 reported above in terms of parameters in (4.1) estimated in the two subsamples. First, according to Hypothesis 4.1, cash flow

sensitivity should be positive in both groups leading to $\beta_1^- > 0$ and β_6^- not significantly different from zero. Note that we have no hypothesis on β_5^- (i.e. the extent to which investment of firms which eventually receive VC is higher, other things being equal, than those of control group firms). However, if firms which receive VC are characterised by better investment opportunities, which are not completely captured by their level of intangible assets, this parameter should be positive. When estimating equation (4.1) on the post-investment period, instead, we should find, according to Hypothesis 4.2, that $\beta_6^+ < 0$, which means that the reliance upon internally generated funds is lower for VC-backed firms than for control group firms after VC is received.

Equation (4.1) is estimated on a panel dataset, which means that error terms ε_{it} should not be considered i.i.d. but, rather, potentially correlated over *i.* As regards the estimation method, we opt for a random effects model which splits the error term into two components $\varepsilon_{it} = \eta_i + \mu_{it}$, where η_i is a firm-specific error term and μ_{it} is an idiosyncratic white noise. Provided that η_i is independent from the vector of covariates, the estimator is consistent and does not require individual fixed effects to be estimated (see Mundlak, 1978; Arellano and Bover, 1990). Including fixed effects would shrink the time dimension even further (if using first-differences) or, similarly, increase the number of parameters to estimate by an order of magnitude (if using firm-specific dummies). Moreover we would not be able to directly observe the impact of time-constant firm characteristics on firm's investments.

4.3.3. DESCRIPTIVE STATISTICS

Table 4.3 shows the descriptive statistics for the whole sample, the subsample of VC-backed firms, and the non-VC-backed firms selected as control group distinguishing between the pre-investment (Panel A) and the post-investment (Panel B) period. All ratios are winsorised with a 2 per cent threshold cut-off for each tail, to reduce the potential influence of outliers. All accounting information is converted in real terms (constant 2005 Euro) using the Harmonised Consumer Price Index as deflator. Accounting information includes data from 1991 up to 2007 whenever possible. On average, we have about 5 years of observation in both the pre- and the post-investment period per firm.

Focusing on Panel A, we observe that during the pre-investment period, for the pooled sample, investments are on average 0.1245, which is higher than cash flows 0.0968. This indicates that firms in our sample have recourse to external financing only marginally since internal cash flows can potentially cover more than three quarters of firm's investments. On average, the investment ratio of firms that eventually become VC-backed is 0.1444, which is significantly larger than that of firms in the control group 0.1039. This may well be a sign that firms which receive VC have better investment opportunities.

TABLE 4.3.
DESCRIPTIVE STATISTICS BY PERIOD

PANEL A: PRE-INVESTMENT PERIOD ($t<0$)				
VARIABLES	***OBSERVATIONS***	***FIRMS***	***MEAN***	***STD. DEVIATION***
Investment				
All firms	3,115	643	0.1245	0.2175
VC-backed firms	1,584	322	0.1444	0.2344
Non-VC-backed firms	1,531	321	0.1039	0.1965
Difference	3,115	643	0.0404***	0.0078
Cash flow				
All firms	3,115	643	0.0968	0.1152
VC-backed firms	1,584	322	0.0908	0.1187
Non-VC-backed firms	1,531	321	0.1031	0.1112
Difference	3,115	643	-0.0122**	0.0041
Intangible assets				
All firms	3,113	643	0.0637	0.1077
VC-backed firms	1,584	322	0.0800	0.1191
Non-VC-backed firms	1,529	321	0.0467	0.0915
Difference	3,113	643	0.0333***	0.0038
PANEL B: POST-INVESTMENT PERIOD ($t\geq0$)				
VARIABLES	***OBSERVATIONS***	**FIRMS**	***MEAN***	***STD. DEVIATION***
Investment				
All firms	3,345	644	0.1026	0.1841
VC-backed firms	1,629	322	0.1307	0.2115
Non-VC-backed firms	1,716	322	0.0759	0.1487
Difference	3,345	644	0.0548***	0.0064
Cash flow				
All firms	3,345	644	0.0776	0.1076
VC-backed firms	1,629	322	0.0619	0.1101
Non-VC-backed firms	1,716	322	0.0924	0.1029
Difference	3,345	644	-0.0305***	0.0037
Intangible assets				
All firms	3,346	644	0.0695	0.1110
VC-backed firms	1,630	322	0.0913	0.1231
Non-VC-backed firms	1,716	322	0.0489	0.0936
Difference	3,346	644	0.0423***	0.0038

The table reports descriptive statistics on winsorised (2% each tail) values of the variables. All variables are normalised by using beginning-of-period stock of total assets. We test the null hypothesis that means are equal between VC-backed and Non-VC-backed groups assuming unequal variance. ***, ** and * indicate, respectively, significance levels <1%, <5% and <10%.

Interestingly, on average, cash flows to total assets are significantly larger for firms in the control group (0.1031) than for those in the VC-backed

group (0.0908). In other words, firms in the VC-backed sample invest more and with lower cash flows in the pre-investment window, which means they have to rely more heavily on external financing. This could lead to both lower control aversion of entrepreneurs and higher benefit from VC, making these firms more prone to seek VC in the first place. Intangible assets are also significantly larger for firms in the VC-backed groups (0.0800 against 0.0467 for the control group) and this, again, supports the idea that these firms have better investment opportunities.

Moving to the post-investment period (Table 4.3, Panel B) we see that VC-backed firms are still investing significantly more than control group firms (0.1307 against 0.0759) and that the wedge between the two groups has actually widened (from 0.0404 to 0.0548). Moreover, cash flows to total assets of VC-backed firms continue to be significantly lower than those of control group firms (0.0619 against 0.0924) and, again, the difference is wider than before the investment event (-0.0305 vs. -0.0122). A similar pattern is found for the ratio of intangible assets, which is still significantly higher in VC-backed firms (0.0913 against 0.0489) and even higher than before investment (0.0423 vs. 0.0333). VC seems to amplify the differences in the investment pattern between VC-backed and matched firms.

To have more robust, yet still descriptive, evidence on this, we estimate a difference-in-difference (diff-in-diff) model on investments, cash-flows, and intangible assets. The diff-in-diff approach consists of comparing the different change in one variable between the pre and post-investment period across the two groups. To avoid potential underestimation of standard errors due to

serially correlated outcomes (see Bertrand et al., 2004), we average figures in the pre and post-investment windows for each firm and then estimate diff-in-diff on these averaged values. Results are reported in Table 4.4.

TABLE 4.4.
DIFFERENCE-IN-DIFFERENCE OF KEY PARAMETERS

INDEPENDENT VARIABLES	*INVESTMENT*	*CASH FLOW*	*INTANGIBLE ASSETS*
VC	0.0487 *** (0.0154)	-0.0091 (0.0080)	0.0326 *** (0.0082)
Post	-0.0579 *** (0.0098)	-0.0121 ** (0.0051)	-0.0065 (0.0044)
*Post*VC*	0.0082 (0.0155)	-0.0237 *** (0.0078)	0.0133 * (0.0072)
Intercept	0.1312 *** (0.0102)	0.1031 *** (0.0051)	0.0542 *** (0.0053)
Nº observations	1,311	1,311	1,311

The table reports Ordinary Least Square diff-in-diff regression on firm's investments, cash flows and intangible assets. *Investment* is defined as the increase in book value of net fixed asset plus depreciation divided by beginning-of-period total assets, *Cash flow* as net earnings plus depreciation divided by beginning-of-period total assets, *Intangible assets* as intangible fixed assets normalised by beginning-of-period total assets. *VC* and *Post* are dummy variables which identify respectively firms in the VC-backed group and observations in the post-investment window, respectively. All ratios are winsorised at the 2% threshold. Each observation in the regression is the average of the respective variable in the relative (i.e. pre- or post-investment) period. Standard errors are robust and clustered by firm. ***, ** and * indicate, respectively, significance levels <1%, <5% and <10%.

Diff-in-diff regression broadly confirms the intuition obtained by comparing the descriptive statistics across groups. The diff-in-diff coefficient (*Post*VC*), which indicates the different change in the outcome (namely investments, cash flows or intangible assets), always exhibits the same sign as the *VC* coefficient, which indicates the average difference between the two groups. In other words, between the pre and post-investment period differences between the two groups are amplified. The coefficient is significantly different from zero at conventional levels only in the cash-flow and intangible asset regressions, while it is not significant for investments.

Overall these results are consistent with the idea that VC does allow VC-backed firms to maintain their above-average investment level and to grow in assets far quicker than their growth in cash flows (which explains why cash flow ratio to total assets decreases in the post-investment window for VC-backed firms); this increase in investments seems to be relatively more concentrated in R&D, which is consistent with the increase in the fraction of intangible assets in the post-investment window.

It is also worth analysing whether some differences across sectors can be found. Descriptive statistics by sector, period and group are reported in Table 4.5.

Figures in Table 4.5 confirm that results shown in Table 4.4 are robust across sectors. In all sectors firms in the VC-backed group invest more that control group firms despite their having lower cash flows to total assets and the differences grow larger after the investment event. We observe, however, that TMT firms exhibit more extreme behaviour.

TABLE 4.5.
DESCRIPTIVE STATISTICS BY SECTOR AND PERIOD

PANEL A: PRE-INVESTMENT PERIOD ($t<0$)

	SECTOR					
	TECHNOLOGY, MEDIA AND TELECOMMUNICATIONS		MEDIUM AND LOW TECH MANUFACTURING		MEDIUM AND LOW TECH SERVICES	
VARIABLES	N	MEAN	N	MEAN	N	MEAN
Investment						
All firms	66	0.1471	300	0.1165	190	0.1202
VC-backed firms	33	0.1725	150	0.1328	95	0.1419
Non-VC-backed firms	33	0.1188	150	0.0992	95	0.0987
Difference	66	0.0537**	300	0.0336***	190	0.0432***
Cash flow						
All firms	66	0.1325	300	0.0936	190	0.0923
VC-backed firms	33	0.1240	150	0.0904	95	0.0870
Non-VC-backed firms	33	0.1420	150	0.0969	95	0.0976
Difference	66	-0.0180**	300	-0.0065**	190	-0.0106**
Intangible Assets						
All firms	66	0.1020	300	0.0560	190	0.0596
VC-backed firms	33	0.1291	150	0.0742	95	0.0730
Non-VC-backed firms	33	0.0718	150	0.0370	95	0.0462
Difference	66	0.0573***	300	0.0372***	190	0.0268***

PANEL B: POST-INVESTMENT PERIOD ($t\geq0$)

	SECTOR					
	TECHNOLOGY, MEDIA AND TELECOMMUNICATIONS		MANUFACTURING		SERVICES	
VARIABLES	N	MEAN	N	MEAN	N	MEAN
Investment						
All firms	66	0.1293	300	0.0901	191	0.0985
VC-backed firms	33	0.1615	150	0.1177	95	0.1184
Non-VC-backed firms	33	0.0979	150	0.0637	96	0.0799
Difference	66	0.0636***	300	0.0540***	191	0.0385***
Cash flow						
All firms	66	0.0948	300	0.0760	191	0.0710
VC-backed firms	33	0.0746	150	0.0668	95	0.0507
Non-VC-backed firms	33	0.1144	150	0.0847	96	0.0899
Difference	66	-0.0398**	300	-0.0179***	191	-0.0392***
Intangible Assets						
All firms	66	0.1274	300	0.0530	191	0.0688
VC-backed firms	33	0.1689	150	0.0736	95	0.0936
Non-VC-backed firms	33	0.0871	150	0.0334	96	0.0456
Difference	66	0.0818***	300	0.0402***	191	0.0480***

The table reports descriptive statistics on winsorised (2% each tail) values of the variables. All variables are normalised by using beginning-of-period stock of total assets. We test the null hypothesis that means are equal across different Period subsamples. ***, ** and * indicate, respectively, significance levels of <1%, <5% and <10%.

While investment ratios are higher for VC-backed firms in all sectors, the wedge between the two groups is particularly wide in the TMT sector (0.0537 pre-investment which increases to 0.0637 post-investment period). At the same time TMT firms are those for which the difference in the (negative) cash flow ratio between VC-backed and control group firms is larger in absolute terms and becomes sizeably larger after-investment (-0.0180 vs. -0.0398). The intangible assets ratio for VC-backed firms is always higher than for control group firms, regardless of the sector, and again TMT sectors show the most extreme difference (0.0573 and 0.0818 in the pre and post- investment periods respectively).

4.4. RESULTS

Table 4.6 shows the results obtained from the estimation of the models described in section 4.3.2 on the whole sample, splitting the pre and post-investment period.

Consistently with Hypothesis 4.1, we find evidence of a positive and significant relationship between investments and cash flows in both specifications and sub-periods. Non-VC-backed firms in our sample, thus, seem to be significantly financially dependent on internally generated cash flows. In the pre-investment period the *VC* coefficient is positive and significant while the *VC*CF* interaction term is not significant. Firms which eventually receive VC, thus, invest more but do not appear to be more sensitive to their level of cash-flows than control group firms.

TABLE 4.6.
REGRESSION RESULTS OF THE INVESTMENT-CASH FLOW SENSITIVITY FOR PRE AND POST-INVESTMENT PERIOD: WHOLE SAMPLE DIVIDED BY INVESTMENT PERIOD

	DEPENDENT VARIABLE: INVESTMENT			
INDEPENDENT VARIABLES	***PRE-INVESTMENT PERIOD***		***POST-INVESTMENT PERIOD***	
CF_{it}	0.4335 ***	0.4598 ***	0.2339 ***	0.2384 ***
	(0.0602)	(0.0621)	(0.0465)	(0.0454)
$Intang_{it}$	0.8930 ***	0.8990 ***	0.5946 ***	0.5986 ***
	(0.0688)	(0.0685)	(0.0519)	(0.0534)
$Size_{it}$	-0.0093	-0.0084	-0.0010	-0.0009
	(0.0063)	(0.0063)	(0.0030)	(0.0030)
Age_{it}	-0.0022 ***	-0.0023 ***	-0.0008 **	-0.0008 **
	(0.0007)	(0.0007)	(0.0003)	(0.0003)
TMT_i		-0.0236		-0.0112
		(0.0215)		(0.0115)
$TMT_i * CF_{it}$		-0.0435		0.0375
		(0.0400)		(0.0341)
VC_i	0.0252 *	0.0234 *	0.0403 ***	0.0421 ***
	(0.0137)	(0.0137)	(0.0081)	(0.0081)
$VC_i * CF_{it}$	0.0001	0.0018	-0.0472 **	-0.0762 ***
	(0.0063)	(0.0046)	(0.0224)	(0.0295)
Intercept	0.1096 ***	0.1084 ***	0.0849 ***	0.0855 ***
	(0.0260)	(0.0269)	(0.0182)	(0.0185)
Nº observations	3,088	3,088	3,324	3,324
Nº groups	639	639	643	643

The table reports the Generalised Least Squares, random effects, estimation of the model. The dependent variable is the ratio between investments (i.e. increase in net fixed assets of the firm *i* in year *t* plus depreciation in year *t*) and beginning-of-period total assets of the firm. The independent variables are: (1) CF_{it-1}: net earnings plus depreciation divided by beginning-of-period total assets; (2) $Intang_{it}$: intangible fixed assets normalised by beginning-of-period total assets; (3) $Size_{it}$: natural logarithm of total the number of employees of the firm *i* in the period *t*; (4) Age_i: age of the firm *i* at the period *t*; (5) TMT_i: dummy variable indicating firms which operate in the technology, media and telecommunications.; (6) VC_i: dummy variable indicating firms in the VC-backed group (i.e. 0 for firms in the control group). All ratios are winsorised at the 2% threshold. Robust standard errors are reported in parenthesis. ***, ** and * indicate, respectively, significance levels of <1%, <5% and <10%.

In the post-investment period, instead, VC-backed firms continue to invest more than control group firms (and the wedge seems to have widened, consistently with preliminary evidence presented in section 4.4) and, more interestingly, their investment level is less sensitive to current cash flows, as

shown by the negative and significant coefficient of the *VC*CF* covariate. This is consistent with our Hypothesis 4.2: after VC financing the relationship between investments and cash flows is significantly reduced.

Our control for growth opportunities, the ratio of intangible assets, is always positive and significant, reassuring us on the fact that it captures firm's investment opportunities as suggested by Manigart et al. (2003). *Age* and *Size* are, as expected, negative (older and larger firms invest relatively less) despite only *Age* being significant at usual confidence levels.

Surprisingly the coefficients of *TMT* and *TMT*CF* are negative, although not significant. TMT firms, contrary to expectations, do not seem to invest more than medium and low tech firms once investment opportunities have been controlled for, and they do not seem to be more dependent on cash flows. This might be reflecting easier access to alternative sources of money, such as innovation subsidies provided by public-sector-related bodies, as argued by Di Giacomo (2004).

To control for possible biases in our results due to possible imperfections in the matching process (which is by definition only made on observable characteristics), we also estimate equation (4.1) (and its augmented version including *TMT* and *TMT*CF*) on the restricted sample of VC-backed firms, excluding the control group (Table 4.7). We find that the *CF* coefficient is positive and highly significant before VC investment (consistently with Hypothesis 4.1), and that, while it is still positive after VC investment, it shows a sharp reduction, consistently with Hypothesis 4.2. Other variables

follow a similar pattern to that shown in Table 4.6, thus confirming that our results should not be driven by unobservable and uncontrolled differences between the two samples.

The significance of the *TMT*CF* term in Table 4.7 suggests that investment patterns, as well as cash flow sensitivity, might be substantially different across industries. Accordingly, we re-estimate equation (4.1) splitting by sectors on the whole sample (Table 4.8) and on the VC-backed sample only (Table 4.9).

The pattern found in firms belonging to the manufacturing and service sectors shown in Table 4.8 is similar to that shown in Table 4.6. Firms included in those two groups experience a sharp reduction in the *CF* coefficient after the investment occurs even though with a different dynamic: VC-backed manufacturing firms are more dependent on cash flows before VC investment than control group firms while this difference disappears after the initial VC investment; VC-backed service firms do not exhibit a different sensitivity before investment but a lower sensitivity after the VC investment. In either case, though, VC reduces investment sensitivity. These results are confirmed by figures shown in Table 4.9, where a substantial reduction in the *CF* coefficient is found in the period after the investment in both groups.

TABLE 4.7.
REGRESSION RESULTS OF THE INVESTMENT-CASH FLOW SENSITIVITY FOR VC-BACKED FIRMS FOR PRE AND POST-INVESTMENT PERIOD

	DEPENDENT VARIABLE: INVESTMENT			
INDEPENDENT VARIABLES	***PRE-INVESTMENT PERIOD***		***POST-INVESTMENT PERIOD***	
CF_{it}	0.4274 *** (0.0847)	0.5088 *** (0.0857)	0.2073 *** (0.0646)	0.2394 *** (0.0643)
$Intang_{it}$	0.9383 *** (0.0847)	0.9247 *** (0.0825)	0.6864 *** (0.0718)	0.6928 *** (0.0734)
$Size_{it}$	-0.0156 * (0.0090)	-0.0123 (0.0091)	-0.0096 * (0.0056)	-0.0102 * (0.0056)
Age_{it}	-0.0026 * (0.0008)	-0.0027 *** (0.0008)	-0.0011 ** (0.0005)	-0.0010 ** (0.0005)
TMT_i		-0.0427 (0.0268)		-0.0161 (0.0195)
TMT_i*CF_{it}		-0.1211 *** (0.0209)		-0.0382 ** (0.0177)
Intercept	0.1617 *** (0.0387)	0.1468 *** (0.0399)	0.1671 *** (0.0337)	0.1670 *** (0.0341)
Nº observations	1,572	1,572	1,614	1,614
Nº groups	320	320	321	321

The table reports the Generalised Least Squares, random effects, estimation of the model. The dependent variable is the ratio between investments (i.e. increase in net fixed assets of the firm *i* in year *t* plus depreciation in year *t*) and beginning-of-period total assets of the firm. The independent variables are: (1) CF_{it-1}: net earnings plus depreciation divided by beginning-of-period total assets; (2) $Intang_{it}$: intangible fixed assets normalised by beginning-of-period total assets; (3) $Size_{it}$: natural logarithm of total the number of employees of the firm *i* in the period *t*; (4) Age_i: age of the firm *i* at the period *t*; (5) TMT_i: dummy variable indicating firms which operate in the technology, media and telecommunications.; (6) VC_i: dummy variable indicating firms in the VC-backed group (i.e. 0 for firms in the control group). All ratios are winsorised at the 2% threshold. Robust standard errors are reported in parenthesis. ***, ** and * indicate, respectively, significance levels of <1%, <5% and <10%.

As regards *TMT*, results are, again, different from those found in the other two sectors and somewhat less clear-cut. In Table 4.8, results show that the *CF* coefficient is only significant in the period before the investment and becomes insignificant after the investment. When only the TMT VC-backed group is considered, in Table 4.9 however, in neither of the two periods is the *CF* coefficient significant; yet, the limited number of observations of this group limits the validity of this result. The interaction term between VC and cash flow

shows a negative sign in both periods in Table 4.8. This result may reinforce evidence shown in Table 4.7, and could be compatible with TMT firms getting sizeable subsidies that distort investment sensitivity to cash flows. An alternative explanation could be related to the low cash flow generation of TMT firms in the early stages, when these firms rely much more on entrepreneur's personal resources than on firm's cash flows. In this phase cash flows could not be a valid proxy for the availability of financial resources.

TABLE 4.8.
REGRESSION RESULTS OF THE INVESTMENT-CASH FLOW SENSITIVITY FOR PRE AND POST-INVESTMENT PERIOD: WHOLE SAMPLE DIVIDED BY SECTOR

	Dependent Variable: Investment					
Independent variables	***Technology, media and telecommunications***		***Manufacturing***		***Services***	
	Pre-investment period	***Post-investment period***	***Pre-investment period***	***Post-investment period***	***Pre-investment period***	***Post-investment period***
CF_{it}	0.2850 ***	0.1297	0.5791 ***	0.1623 *	0.5076 ***	0.2780 ***
	(0.1077)	(0.0881)	(0.1023)	(0.0917)	(0.1013)	(0.0672)
$Intang_{it}$	0.8891 ***	0.7313 ***	0.7042 ***	0.4867 ***	1.1312 ***	0.6223 ***
	(0.1376)	(0.0801)	(0.0956)	(0.0865)	(0.1083)	(0.1011)
$Size_{it}$	0.0072	-0.0023	-0.0279 ***	-0.0084 **	0.0040	0.0046
	(0.0148)	(0.0113)	(0.0098)	(0.0048)	(0.0096)	(0.0039)
Age_{it}	-0.0035 **	-0.0001	-0.0017 **	-0.0006	-0.0020	-0.0012 **
	(0.0016)	(0.0012)	(0.0007)	(0.0004)	(0.0014)	(0.0006)
VC_i	0.0126	0.0248	0.0282	0.0416 ***	0.0355	0.0273 **
	(0.0376)	(0.0253)	(0.0173)	(0.0133)	(0.0250)	(0.0134)
VC_i*CF_{it}	-0.1030 ***	-0.0299 **	0.0080 ***	0.1304	-0.0837	-0.0935 ***
	(0.0226)	(0.0137)	(0.0028)	(0.1182)	(0.0666)	(0.0166)
Intercept	0.0664	0.0979 *	0.1672 ***	0.1018 ***	0.0334	0.0926 ***
	(0.0583)	(0.0511)	(0.0416)	(0.0251)	(0.0400)	(0.0350)
Nº observations	356	473	1,674	1,732	1,048	1,119
No groups	91	92	334	335	212	216

The table reports the Generalised Least Squares, random effects, estimation of the model. The dependent variable is the ratio between investments (i.e. increase in net fixed assets of the firm *i* in year *t* plus depreciation in year *t*) and beginning-of-period total assets of the firm. The independent variables are: (1) CF_{it-1}: net earnings plus depreciation divided by beginning-of-period total assets; (2) $Intang_{it}$: intangible fixed assets normalised by beginning-of-period total assets; (3) $Size_{it}$: natural logarithm of total the number of employees of the firm *i* in the period *t*; (4) Age_i: age of the firm *i* at the period *t*; (5) TMT_i: dummy variable indicating firms which operate in the technology, media and telecommunications.; (6) VC_i: dummy variable indicating firms in the VC-backed group (i.e. 0 for firms in the control group). All ratios are winsorised at the 2% threshold. Robust standard errors are reported in parenthesis. ***, ** and * indicate, respectively, significance levels of <1%, <5% and <10%.

TABLE 4.9.
REGRESSION RESULTS OF THE INVESTMENT-CASH FLOW SENSITIVITY FOR PRE AND POST-INVESTMENT PERIOD: SAMPLE OF VC-BACKED FIRMS DIVIDED BY SECTOR

	Dependent Variable: Investment					
Independent variables	*Technology, media and telecommunications*		*Manufacturing*		*Services*	
	Pre-investment period	*Post-investment period*	*Pre-investment period*	*Post-investment period*	*Pre-investment period*	*Post-investment period*
CF_{it}	0.0463 (0.1445)	0.0957 (0.1091)	0.5839 *** (0.1337)	0.2809 ** (0.1178)	0.4210 *** (0.1447)	0.2850 *** (0.1010)
$Intang_{it}$	1.1362 *** (0.1502)	0.9093 *** (0.1114)	0.7344 *** (0.1195)	0.5554 *** (0.1062)	1.1973 *** (0.1418)	0.7677 *** (0.1493)
$Size_{it}$	-0.0093 (0.0213)	-0.0098 (0.0248)	-0.0351 ** (0.0148)	-0.0204 ** (0.0092)	-0.0024 (0.0124)	-0.0025 (0.0068)
Age_{it}	-0.0011 (0.0019)	0.0003 (0.0020)	-0.0019 ** (0.0009)	-0.0006 (0.0006)	-0.0042 ** (0.0019)	-0.0023 *** (0.0009)
Intercept	0.1646 * (0.0852)	0.1266 (0.0933)	0.2319 *** (0.0638)	0.1746 *** (0.0482)	0.0991 * (0.0561)	0.1963 *** (0.0623)
Nº observations	188	230	853	842	531	542
No groups	46	46	167	167	107	108

The table reports the Generalised Least Squares, random effects, estimation of the model. The dependent variable is the ratio between investments (i.e. increase in net fixed assets of the firm *i* in year *t* plus depreciation in year *t*) and beginning-of-period total assets of the firm. The independent variables are: (1) CF_{it-1}: net earnings plus depreciation divided by beginning-of-period total assets; (2) $Intang_{it}$: intangible fixed assets normalised by beginning-of-period total assets; (3) $Size_{it}$: natural logarithm of total the number of employees of the firm *i* in the period *t*; (4) Age_i: age of the firm *i* at the period *t*; (5) TMT_i: dummy variable indicating firms which operate in the technology, media and telecommunications.; (6) VC_i: dummy variable indicating firms in the VC-backed group (i.e. 0 for firms in the control group). All ratios are winsorised at the 2% threshold. Robust standard errors are reported in parenthesis. ***, ** and * indicate, respectively, significance levels of <1%, <5% and <10%.

To sum up, we find firm evidence that investments are sensitive to cash flows in all SMEs, including firms that are later invested by VC, consistently with Hypothesis 4.1. Regarding the period after the investment, we find that the investment-cash flow sensitivity is significantly reduced in the VC-backed group, with the interaction term showing a significantly smaller dependency in that group when compared with the control group, consistently with our Hypothesis 4.2. VC institutions thus effectively alleviate the investment dependency on internally generated funds in growing SMEs. Finally, all the results shown in this section are robust to an alternative measure of growth opportunities, namely growth of sales. The regressions are available upon request to authors.

4.5. CONCLUSIONS AND DISCUSSION

SMEs have a difficult access to external funding due to both problems stemming from information asymmetries, which limit the supply of external capital towards them, and problems deriving from control aversion of entrepreneurs, which limit their own demand for external capital in the first place. Information asymmetries cause suppliers of financial resources to demand enough assets as to be used as collateral and high interest rates, thus conditioning the ability of SMEs to take advantage of their growth opportunities. The fear of losing control on their businesses also limits the interest of entrepreneurs in finding external equity. As a result, most SMEs basically rely on their internally generated funds to finance growth.

VC is a long term source of external equity, which also brings value-added in the form of corporate governance and mentoring activities. Those value-added activities enhance the reliability of investee's financial statements and of the business itself. The increased equity base and the more solid accounts help entrepreneurs to raise long term resources, thus reducing the investment dependency on internally generated funds. Additionally, the temporary nature of the holding period of minority stakes by VC investors, also diminishes the control aversion shown by entrepreneurs.

In this work we analyse to what extent VC investors reduce the investment dependency on cash flow in fast-growing SMEs. We carry out our analyses on a sample of 322 growing Spanish SMEs that received a VC investment over the period 1995-2004. Our results are compared with a one-by-one matched sample of similar SMEs with no VC involvement.

After controlling for growth opportunities, size, age and sector, we find evidence of a positive and significant relationship between investment and cash flow when all firms, both VC-backed and not, are included in the analysis. As regards VC-backed firms, a significant reduction in the investment dependency on cash flows is found after the initial VC investment event. Although the relationship between investment and cash flow is positive and significant in both pre and post-investment periods, except in the group of TMT firms, the value of the coefficient decreases sharply after the entry of venture capitalists.

Our contribution to the literature is threefold. First, we provide new

evidence to the scarce and mixed results found in this field (Manigart et al., 2002; Bertoni et al., 2008; and Engel and Stiebale, 2009). Second, we provide a separate view in different sectors, highlighting the role of VC investors in low and medium technology sectors such as manufacturing and general services, while the sectoral dimension is often neglected in the literature. Finally, this is, to our knowledge, the first study about the investment behaviour of VC- and non-VC-backed Spanish SMEs and, as such, it is based on a totally unexplored population.

Regarding our limitations, we base our analyses on a static random effects model, building on the classical model by Fazzari et al. (1988), and using an alternative measure of growth opportunities. Since we aim to fully separate the pre and post-investment periods, the lack of data prevents us from using other approaches, such as the sales accelerator model (Abel and Blanchard, 1988) or the Euler equation model (Bond and Meghir, 1994), which require a larger time window to converge. However, our results are consistent across estimates and are not significantly affected when we estimate the models on difference sub-samples, which reassures us on their robustness.

4.6. REFERENCES

Abel, A. and Blanchard, O. (1988) 'Investment and sales: Some empirical evidence', in Barnett, W.A.; Berndt, E.R. and White, H. (Ed.), Dynamic econometric modelling, Cambridge University Press, Cambridge (UK).

Admati, A.R. and Pfleiderer, P. (1994) 'Robust financial contracting and the role of venture capitalists', The Journal of Finance, 49(2): 371–402.

Ang, J.S. (1991) 'Small business uniqueness and the theory of financial management', The Journal of Small Business Finance, 1(1): 1–13.

Ang, J.S. (1992) 'On the theory of finance for privately held firms', The Journal of Small Business Finance, 1(3): 185–203.

Arellano, M. and Bover, O. (1990) 'La econometría de datos de panel', Investigaciones Económicas, XIV(1): 3–45.

Balboa, M.; Martí, J. and Tresierra, A. (2009) 'Capital structure determinants in growth firms accessing venture funding' (February 16, 2009). URL (consulted January, 2010): http://ssrn.com/abstract=1344267.

Berger, A.N. and Udell, G.F. (1998) 'The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle', Journal of Banking & Finance, 22(6-8): 613-673.

Berggren, B.; Olofsson, C. and Silver, L. (2000) 'Control aversion and the search for external financing in Swedish SMEs', Small Business Economics, 15(3): 233–242.

Bertrand, M.; Duflo, E., and Mullainathan, S. (2004) 'How much should we trust Differences-in-Differences estimates?', The Quarterly Journal of Economics, 119(1): 249-275.

Bertoni, F.; Colombo, M. G. and Croce, A. (2008) 'The effect of Venture Capital

financing on the sensitivity to cash flow of firm's investments', European Financial Management, forthcoming.

Bond, S.R. and Meghir, C. (1994) 'Dynamic investment models and the firm's financial policy', The Review of Economic Studies, 61(2): 197–222.

Bond, S.R. and Van Reenen, J. (2007) 'Microeconometric models of investment and employment', in Heckman, J.J. and Leamer, E.E. (Ed.) Handbook of econometrics, Volume 6, Elsevier, Amsterdam.

Carpenter, R.E. and Petersen, B.C. (2002a) 'Capital market imperfections, high–tech investment, and new equity financing', Economic Journal, 112(477): F54–F72.

Carpenter, R.E. and Petersen, B.C. (2002b) 'Is the growth of small firms constrained by internal finance?', Review of Economics and Statistics, 84(2): 298–309.

Chittenden, F.; Hall, G. and Hutchinson, P. (1996) 'Small firm growth, access to capital markets and financial structure: Review of issues and an empirical investigation', Small Business Economics, 8(1): 59–67.

Cressy, R. (1995) 'Business borrowing and control: A theory of entrepreneurial types', Small Business Economics, 7(4): 291–300.

Di Giacomo, M. (2004) 'Public support to entrepreneurial firms: An assessment of the role of Venture Capital in the European experience', Journal of Private Equity, 8(1): 22–38.

Engel, D. and Stiebale, J. (2009) 'Private Equity, investment and financial constraints: Firm–level evidence for France and the United Kingdom' (July 23, 2009). Ruhr Economic Paper No. 126. URL (consulted January, 2010): http://ssrn.com/abstract=1438037.

Fama, E.F. and French, K. (2002) 'Testing Trade–Off and Pecking Order predictions about dividends and debt', The Review of Financial Studies, 15(1): 1–33.

Fazzari, S.M.; Hubbard, R.G. and Petersen, B.C. (1988) 'Financing constraints and corporate investment', Brooking Papers on Economic Activity, 1998(1): 141–206.

Gompers, P.A. (1995) 'Optimal investment, monitoring, and the staging of Venture Capital', The Journal of Finance, 50(5): 1461–1489.

Gompers, P.A. and Lerner, J. (1998) 'What drives Venture Capital fundraising?', Brookings Papers on Economic Activity. Microeconomics, 1998(1998): 149–192.

Gompers, P.A. and Lerner, J. (2001) 'The Venture Capital revolution', Journal of Economic Perspectives, 15(2): 145–168.

Gorman, M. and Sahlman, W.A. (1989) 'What do venture capitalists do?', Journal of Business Venturing, 4(4): 231–248.

Hellmann, T. and Puri, M. (2002) 'Venture Capital and the professionalization of start–up firms: Empirical evidence', The Journal of Finance, LVII(1): 169–197.

Hogan, T. and Hutson, E. (2005) 'Capital structure in new technology–based firms: Evidence from the Irish software sector', Global Finance Journal, 15(3): 369–387.

Holmes, S. and Kent, P. (1991) 'An empirical analysis of the financial structure of the small and large Australian manufacturing enterprises', Journal of Small Business Finance, 1(2): 141–154.

Hovakimian, G. (2009) 'Determinants of investment cash flow sensitivity', Financial Management, 38(1): 161–183.

Hsu, D.H. (2004) 'What do entrepreneurs pay for Venture Capital affiliation?', The Journal of Finance, LIX(4): 1805–1844.

Kaplan, S.N. and Strömberg, P. (2001) 'Venture capitalists as principals: contracting, screening, and monitoring', The American Economic Review, Papers and Proceedings of the Hundred Thirteenth Annual Meeting of the American Economic Association (May, 2001), 91(2): 426–430.

Lang, L.; Ofek, E. and Stulz, R. (1996) 'Leverage, investment, and firm growth', Journal of Financial Economics, 40(1): 3–29.

López–Gracia, J. and Aybar–Arias, C. (2000) 'An empirical approach to the financial behaviour of small and medium sized firms', Small Business Economics, 14(1): 55–63.

Manigart, S.; Baeyens, K. and Verschueren, I. (2003) 'Financing and investment interdependencies in unquoted Belgian firms: The role of

Venture Capital', in Butzen, P. and Fuss, C. (Ed.) Firms' investment and finance decision, Edward Elgar, Cheltenham (UK).

Martí, J.; Salas, M. and Barthel, D. (2010) Economic and social impact of Venture Capital & Private Equity in Spain. Survey, Spanish Venture Capital & Private Equity Association, Madrid (Spain).

Michaelas, N.; Chittenden, F. and Poutziouris, P. (1999) 'Financial policy and capital structure choice in U.K. SMEs: Empirical evidence from firm panel data', Small Business Economics, 12(2): 113–130.

Mundlak, Y. (1978) 'On the pooling of time series and cross section data', Econometrica, 46(1): 69–85.

Olofsson, Ch. (1994) 'Små och medelstora företags finansiella villkor – en enkätstudie' ('Financial conditions for SMEs – A survey') in Näringsdepartementet (Ministry for Trade and Commerce) (Ed.) Småföretagens riskkapitalförsörjning ('Risk capital supply for SMEs'), Stockholm.

Paul, S.; Whittam, G. and Wyper, J. (2007) 'The Pecking Order hypothesis: does it apply to start–up firms?', Journal of Small Business and Enterprise Development, 14(1): 8–21.

Reid, G.C. (1996) 'Financial structure and the growing small firm: Theoretical underpinning and current evidence', Small Business Economics, 8(1): 1–7.

Sahlman, W.A. (1990) 'The structure and governance of Venture Capital

organizations', Journal of Financial Economics, 27(2): 473–521.

Titman, S. and Wessels, R. (1988) 'The determinants of capital structure choice', The Journal of Finance, 43(1): 1–19.

Tyebjee, T. and Bruno, A. (2003) 'A model of venture capitalist investment activity', in Venture Capital, Volume 1, Elgar Reference Collection, Cheltenham (UK) and Northampton (Massachusetts).

Tykvová, T. (2007) 'What do economists tell us about Venture Capital contracts?', Journal of Economic Surveys, 21(1): 65–89.

Watson, R. and Wilson, N. (2002) 'Small and medium size enterprise financing: A note on some of the empirical implications of a Pecking Order', Journal of Business Finance & Accounting, 29(3–4): 557–578.

Wright, M. and Robbie, K. (1998) 'Venture Capital and Private Equity: A review and synthesis', Journal of Business Finance & Accounting, 25(5/6): 521–570.

CHAPTER 5
VENTURE CAPITAL, PRIVATE EQUITY AND INVESTEE FIRM'S INVESTMENT SENSITIVITY TO CASH FLOW[***]

[***] This work was submitted to the '37th Annual Meeting of the European Finance Association' (Frankfurt, August 2010) and to the 'Workshop and Small Business Economics Special Issue: Reassessing the Relationships between Private Equity Investors and Their Portfolio Companies' (Ghent, September-October 2010). We would like to thank Álvaro Tresierra Tanaka for his research assistance (Universidad de Piura).

5.1. INTRODUCTION

Venture Capital (VC, hereafter) is a source of external equity aiming at new firms with high growth potential. These unlisted firms are often considered to be financially constrained. On the one hand, they have very limited access to both debt and external equity when compared with listed firms. On the other hand, their ability to generate free cash flows from operations (i.e. internal financing) is often, especially for high-tech firms, out of reach (Carpenter and Petersen, 2002b). In parallel, the Private Equity (PE, hereafter) focus of investments moved away from newly created fast-growing firms and increasingly oriented towards large, mature firms, mostly related to low and medium technology sectors (EVCA, 1988-2008). In most cases the purpose of PE transactions is to provide an exit for the existing shareholders in firms that are no longer experiencing high growth rates, but have stable cash flows to pay back debt.

VC and PE investments include a wide scope of activities in firms at different stages, from funding start ups or firms at the expansion stage to structuring levered acquisitions, and the role played by these investors changes dramatically as well. VC and PE investments are also performed in a wide variety of sectors, including low and high technology, with the former having, at least in Europe, a larger share.

The aim of this chapter is to identify the different role played by VC and PE investors by analysing the investment-cash flow sensitivity in investee firms operating in low and medium technology firms, before and after the

investment event. We centre on a very large sample of Spanish low and medium tech manufacturing and services firms that were invested in between 1995 and 2004 at the expansion (VC) or buyout stages (PE). We estimate several specifications of an Euler equation relying on different assumptions about the extent of the 'structural break' which is caused by VC and PE investments.

We find consistent results across different specifications that low and medium technology firms at the expansion stage that were eventually funded by VC investors showed a positive and significant relationship between investments and cash flows before the investment event. Investment-cash flow sensitivity becomes almost insignificant in the post-investment period, suggesting that VC does reduce firm's dependency of investments on internally generated cash flows. On the contrary, we find that late stage low and medium tech firms did not show any significant investment-cash flow sensitivity before they were acquired by a PE investor but that positive relationship between investment and cash flows emerges subsequently. This latter piece of evidence is particularly new to the literature and is consistent with our hypotheses (see the discussion in section 5.2). VC invests in firms that exhibit a positive correlation between investments and cash flow, and subsequently eases that dependency. PE, on the contrary, invests in firms that are not dependent on internally generated cash flows, and engages in asset management activities which, combined with a substantial increase in leverage, put managers under the pressure of debt repayment. In other words, we show that while VC is eventually successful in alleviating the above-

mentioned dependency faced by new unlisted firms at the expansion stage (Carpenter and Petersen, 2002a), PE causes investment-cash flow sensitivity to wipe up management conservatism in consolidated firms.

5.2. RESEARCH HYPOTHESES

Obtaining financing is one of the necessary conditions to spur growth in fast-growing firms. These firms face important information asymmetries (Frank and Goyal, 2003), due to both the lack of a reliable financial track record (Ang, 1991; Chittenden et al., 1996; Berger and Udell, 1998) and the uncertainty of future growth opportunities (Berger and Udell, 2002), which derive from adverse selection and moral hazard problems that limit their ability to attract funding from traditional external sources. As a result, these firms are likely to be more constrained than others in financing their growth opportunities with only internally generated funds. VC, however, arises as an alternative source of external equity for a number of fast-growing firms. Allegedly, firms which eventually are invested in by venture capitalists, should then exhibit high investment sensitivity to cash flows. Hypothesis 5.1 follows naturally from this discussion.

Hypothesis 5.1: The relationship between cash flow and investment should be positive and significant in firms that are either funded by a VC institution later or not.

The contribution of PE to the investment-cash flow sensitivity of mature

firms is likely to be dramatically different from that of VC. Before the acquisition by a PE organisation, mature firms are far less dependent on external financing to finance their investment projects because they are less affected by information asymmetries than newly created firms without any track record (Frank and Goyal, 2003). These firms have a relatively longer operating history (Jelic et al., 2005), assets that can be used as collateral (Harris and Raviv, 1991), low gearing (Smith, 1990; Wright, Gilligan and Amess, 2009), stable cash flows, and more limited investment opportunities (Smith, 1990; Wright et al., 2001; Jelic et al., 2005). As Wright et al. (1992) point out, these target firms exhibit great capacity to generate financial resources, together with limited growth prospects. On these grounds, no significant dependence between investments and cash flows should be found in these firms before the PE investment event. Eventually, the reason itself why PE investors find these firms an interesting target might be the fact that they are not sufficiently 'under pressure' from financial constraints and, hence, end up being managed with excessive conservatism, as suggested by their low pre-investment productivity (Litchenberg and Siegel, 1987; Harris et al., 2005). Accordingly, we expect the following.

Hypothesis 5.2: Before a PE acquisition the dependency of firm's investments to cash flows should be marginally significant.

Moving now to the post-investment period, significant changes are expected in both VC and PE-backed firms. As an alternative source of external funding, and unlike other financial intermediaries, VC investors can also alleviate the problems of information asymmetries in fast-growing firms

(Gompers and Lerner, 2001; Hsu, 2004) by gaining private information on projects during the pre-investment screening (Rajan, 1992; Admati and Pfleiderer, 1994; Reid, 1996). In parallel, they add value to the firms they invest in (Sahlman, 1990; Gompers and Lerner, 1998; Jain, 2001; Hellmann and Puri, 2002; Chemmanur et al., 2009; among others).[29] The value-added by VC investors is positively perceived by both the entrepreneurs (Hsu, 2004) and other stakeholders (e.g. signalling effect: Megginson and Weiss, 1991; Stuart et al., 1999). The impact of VC on firm's financial constraints is, hence, expected to result in a very strong reduction in the extent to which firms have to rely on internally generated cash flows to fund their investments.

Hypothesis 5.3: After VC financing the sensitivity of firm's investment to cash flows should be significantly reduced, or even disappear.

Money committed by PE investors is, instead, mainly spent in buying existing shares from incumbent shareholders, with leverage representing 60 to 90 per cent of the price paid (Kaplan and Strömberg, 2009). This implies that normally no financial resource is conveyed to the firm itself. PE investors commit their share alone or accompanied by new and/or the existing managerial team. After the acquisition, there is active asset management aimed at enhancing the return on assets and raising cash to deleverage. Similarly, there is an active involvement in the management of the firm to control and monitor operational cash flow generation. In parallel, the high debt

[29] As active investors, venture capitalists provide many value added services to investee firms such as monitoring and advisory services, as well as reputational capital (Sahlman, 1990; Gompers and Lerner, 1998). The type of assistance included (Gorman and Sahlman, 1989): help with obtaining additional financing; strategic planning; management recruitment; operational planning; introductions to potential customers and suppliers; and resolving compensation issues.

levels limit the possibility of accomplishing high growth rates after the acquisition.[30] As a result, due to the asset management activities performed, which usually involve selling non-core assets (Wright et al., 2009), and the limited capacity to attract additional long term financing, we may find that positive investment sensitivity to cash flow arises after the acquisition. We hence expect the following.

Hypothesis 5.4: After a buyout in mature firms, the high level of debt used in the acquisition and the tight asset management carried out should lead to positive and significant investment-cash flow sensitivity.

5.3. METHODOLOGY

Several econometric models have been developed and adopted in the past few years to analyse the investment–cash flow sensitivity of firms (see Hubbard (1998), and Bond and Van Reenen (2007) for extensive reviews on this topic). The main distinction among different models is how they control for unobservable investment opportunities (which determine how much a firm should invest if no financial constraints were present). Controlling for investment opportunities is fundamental in this field, since they are likely to be correlated with current cash flows, which are used as a measure of the availability of internal capital. Consequently a relationship between current

[30] The exception to that rule is Buy and Build operations, also known as Leveraged Build-ups, where the leverage raised is used to spur growth though simultaneous acquisitions to gain size rapidly.

investment and cash flows can be nothing but a spurious correlation due to time varying unobserved heterogeneity (e.g. an increase in productivity will increase the profitability of investment opportunities, which will in turn translate into higher investments, and, at the same time, will boost cash flows; thus a positive correlation between investments and cash flows would be found even in the absence of financial constraints). In theory, investment opportunities could be captured by including the firm's marginal Tobin's q in the model. This is, however, difficult to estimate empirically, even for listed firms (see Hubbard, 1998), and virtually impossible for unlisted firms. Other alternative approaches have been proposed in the literature. For instance, Abel and Blanchard (1988) used a sales accelerator model which, with some modifications, is adopted by Manigart et al. (2003) and by Engel and Stiebale (2009). An alternative approach is to estimate an Euler equation (Bond and Meghir, 1994). This latter approach is followed by Whited (1992), Bond and Meghir (1994), Alti (2003), Whited and Wu (2006), and Bertoni et al. (2008), among others. In addition to the alternative reference to the Tobin's q as an estimate of growth opportunities, properly controlling unobserved growth opportunities, the effects of debt may also be assessed.

The basic specification of the Euler equation for firm's investments is as follows (Bond and Meghir, 1994):

$$\frac{I_{i,t}}{K_{i,t-1}} = \alpha_i + \beta_1\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right) + \beta_2\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right)^2 + \beta_3\left(\frac{CF_{i,t}}{K_{i,t-1}}\right) + \beta_4\left(\frac{S_{i,t}}{K_{i,t-1}}\right) + \beta_5\left(\frac{D_{i,t}}{K_{i,t-1}}\right)^2 + \varepsilon_{i.t} \qquad (5.1)$$

where $I_{i,t}$ measures the level of investments of firm i in period t, $K_{i,t}$ is the end-

of-period-t net value of firm i's invested assets; $CF_{i,t}$ is firm i's cash flow in period t; $S_{i,t}$ is firm i's sales during period t and $D_{i,t}$ is firm i's end-of-period-t total debts. If there are capital market imperfections and the external capital supply curve is upward sloping, β_3 should be positive and statistically significant, otherwise it should not be statistically different from zero. Equation (5.1) includes the lagged value of the dependent variable (and its square) among the regressors and, consequently, needs to be estimated by using a technique which controls for endogeneity since both Ordinary Least Square (OLS) and fixed-effects panel estimates would be biased (Bond et al., 2001). The technique which is most often used in recent years is the Generalised Method of Moments (GMM) estimation. In this work we use two step System-GMM estimation (Arellano and Bover, 1995; Blundell and Bond, 1998) with finite-sample correction (Windmeijer, 2005). The choice of System-GMM, as opposed to Difference-GMM, is motivated by the better performance in terms of precision of estimates which this technique is commonly found to give, especially when the dependent variable, as in this case, is highly persistent.[31]

To understand whether investment–cash flow sensitivity is affected by VC and PE financing, we estimate a set of augmented versions of equation (5.1), each of them corresponding to different hypotheses regarding the evolution of the parameters. The most general version of our model is as follows:

$$\begin{cases} \dfrac{I_{i,t}}{K_{i,t-1}} = \alpha_i^{PRE} + \beta_1^{PRE}\left(\dfrac{I_{i,t-1}}{K_{i,t-2}}\right) + \beta_2^{PRE}\left(\dfrac{I_{i,t-1}}{K_{i,t-2}}\right)^2 + \beta_3^{PRE}\left(\dfrac{CF_{i,t}}{K_{i,t-1}}\right) + \beta_4^{PRE}\left(\dfrac{S_{i,t}}{K_{i,t-1}}\right) + \beta_5^{PRE}\left(\dfrac{D_{i,t}}{K_{i,t-1}}\right)^2 + \varepsilon_{i,t} & \text{for } t < t_{INV_i} \\ \dfrac{I_{i,t}}{K_{i,t-1}} = \alpha_i^{POST} + \beta_1^{POST}\left(\dfrac{I_{i,t-1}}{K_{i,t-2}}\right) + \beta_2^{POST}\left(\dfrac{I_{i,t-1}}{K_{i,t-2}}\right)^2 + \beta_3^{POST}\left(\dfrac{CF_{i,t}}{K_{i,t-1}}\right) + \beta_4^{POST}\left(\dfrac{S_{i,t}}{K_{i,t-1}}\right) + \beta_5^{POST}\left(\dfrac{D_{i,t}}{K_{i,t-1}}\right)^2 + \varepsilon_{i,t} & \text{for } t \geq t_{INV_i} \end{cases} \quad (5.2)$$

[31] We also run all our estimates using Difference-GMM and the results are surprisingly similar to the ones we find using System-GMM.

where t_{INV_i} is the time when a VC or PE investor first invests in the firm. Equation (5.2) allows all parameters to vary throughout the investment. Our hypotheses can be easily translated in terms of tests made on coefficients in equation (5.2). The parameter of interest for Hypotheses 5.1 and 5.2 is β_3^{PRE}, which is expected to be positive and significant in the expansion sample and non significantly different from zero in the buyout sample. Hypotheses 5.3 and 5.4 translate, instead, in tests on β_3^{POST} and the extent to which it is different from zero. According to Hypothesis 5.3, β_3^{POST} should be close to zero, or at least positive but smaller than β_3^{PRE}, in the subsample of VC-backed firms at the expansion stage. According to Hypothesis 5.4, β_3^{POST} should be positive and significant, or at least greater than β_3^{PRE}, in the subsample of PE-backed buyouts.

Estimating equation (5.2) proves to be complicated by the fact that t_{INV_i} itself is not exogenous but endogenous, i.e. correlated with unobservable shifts in investment opportunities (which increase investments and attract external investors). To circumvent this problem we rely on different estimates for (5.2) and expect that results which hold across different models are, indeed, robust.

First, we estimate the two equations separately on the pre-investment and post-investment window. This estimation allows all coefficients to vary and would lead to correct estimates if t_{INV_i} was exogenous. However, even with an exogenous timing of investment, this technique leads to a serious

reduction in the efficiency of estimates. Making no assumptions at all on the coefficients of (5.2) leads to a serious reduction in the degrees of freedom available. This is true especially for the two α parameters which capture, broadly speaking, the 'trend' in firm's investments. By allowing α_i^{PRE} to differ from α_i^{POST}, we basically allow *each* firm to change its trend in investment after it receives VC or PE. While this is clearly a more conservative assumption than imposing a fixed structure on the relationship between α_i^{PRE} and α_i^{POST} it calls for the estimation of $2N$ intercepts, where *N* indicates the number of firms in the panel. Imposing more structure, for instance by allowing $\alpha_i^{POST} = \alpha_i^{PRE} + \delta$, would only entail the estimation of $N+1$ parameters. When *N* is large (in our case *N=324*) and *T* (the time horizon) is short (in our case it averages at 9.5), the loss of efficiency freedom is huge. This is made even worse by the fact that equation (5.2) includes the lagged dependent variable among the regressors. This means that in the post-investment period all observations in time $t = t_{INV_i}$ are dropped from estimation, thus reducing degrees of freedom by a further *N*.

At the other extreme, we estimate a model in which only the cash flow coefficient and the intercept are allowed to change across the VC or PE investment.

$$\frac{I_{i,t}}{K_{i,t-1}} = \beta_1\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right) + \beta_2\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right)^2 + \beta_4\left(\frac{S_{i,t}}{K_{i,t-1}}\right) + \beta_5\left(\frac{D_{i,t}}{K_{i,t-1}}\right)^2 + \left(1 - I_{t\geq t_{INV_i}}\right)\cdot\left(\alpha_i^{PRE} + \beta_3^{PRE}\left(\frac{CF_{i,t}}{K_{i,t-1}}\right)\right) + I_{t\geq t_{INV_i}}\cdot\left(\alpha_i^{PRE} + \delta + \beta_3^{POST}\left(\frac{CF_{i,t}}{K_{i,t-1}}\right)\right) + \varepsilon_{i,t} \quad (5.3)$$

where $I_{t\geq t_{INV_i}}$ is an indicator (dummy) variable which equals 1 after the investment is made and $\delta = \alpha_i^{POST} - \alpha_i^{PRE}$ is the acceleration (assumed constant across firms) in firms' investments after the investment is made. Equation (5.3) has two significant advantages over the splitting of the sample. The first is that equation (5.3) allows a significant increase in efficiency estimation, including only 2 parameters to estimate on top of those of a pooled equation and there is no loss of observations across t_{INV_i}. The second, methodologically more interesting, advantage is that some control for the endogeneity of t_{INV_i} can be included in the estimates. The main advantage of the GMM approach is that it allows for a vast flexibility about the assumption on the exogeneity of each variable. By assuming that $I_{t\geq t_{INV_i}}$ is endogenous, and hence including its lagged values as instruments in the first differenced equations and its lagged first differences as instrument for the level equations, we can control, albeit imperfectly, for the endogeneity of external investments. However, we reckon that equation (5.3) does impose an excessive structure on the model by forcing all other coefficients in (5.2) not to vary after the investment is made.

The intertemporal first-order condition from which the Euler equation derives, suggests to us that changes in firm's productivity or cost of capital will translate into shifts in the coefficients and, especially in β_4 and β_5. We hence estimate the following specification of equation (5.2):

$$\frac{I_{i,t}}{K_{i,t-1}} = \beta_1\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right) + \beta_2\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right)^2 + \left(1 - I_{t\geq t_{INV_i}}\right)\cdot\left(\alpha_i^{PRE} + \beta_3^{PRE}\left(\frac{CF_{i,t}}{K_{i,t-1}}\right) + \beta_4^{PRE}\left(\frac{S_{i,t}}{K_{i,t-1}}\right) + \beta_5^{PRE}\left(\frac{D_{i,t}}{K_{i,t-1}}\right)^2\right) + I_{t\geq t_{INV_i}}\cdot\left(\alpha_i^{PRE} + \delta + \beta_3^{POST}\left(\frac{CF_{i,t}}{K_{i,t-1}}\right) + \beta_4^{POST}\left(\frac{S_{i,t}}{K_{i,t-1}}\right) + \beta_5^{POST}\left(\frac{D_{i,t}}{K_{i,t-1}}\right)^2\right) + \varepsilon_{i.t} \quad (5.4)$$

Equation (5.4) allows, according to us, to the best compromise between model flexibility and estimation efficiency. It also allows us, just as we had for equation (5.3) to include the presence of an external investor as endogenous variable, thus allowing us to partially control for the endogenous switching between the 'non-invested' and the 'invested' status.

As will be shown in section 5.4, although our VC and PE subsamples are quite balanced across industries, so that biases arising from different sectoral compositions are unlikely to arise, we include a further estimate to control how cash flow sensitivity pre and post-investment evolves in different industries. This allows us to see whether VC and PE backed firms in different industries exhibit different investment behaviours before and after they are invested. To do so, we augment equation (5.3) by including sectoral interaction terms:

$$\frac{I_{i,t}}{K_{i,t-1}} = \beta_1\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right) + \beta_2\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right)^2 + \beta_4\left(\frac{S_{i,t}}{K_{i,t-1}}\right) + \beta_5\left(\frac{D_{i,t}}{K_{i,t-1}}\right)^2 + \alpha_i^{PRE} + I_{t\geq t_{INV_i}}\cdot\delta + \sum_s I_{s=s_i}\left[\left(1 - I_{t\geq t_{INV_i}}\right)\cdot\beta_3^{PRE,s}\left(\frac{CF_{i,t}}{K_{i,t-1}}\right) + I_{t\geq t_{INV_i}}\cdot\beta_3^{POST,s}\left(\frac{CF_{i,t}}{K_{i,t-1}}\right)\right] + \varepsilon_{i.t} \quad (5.5)$$

where $I_{s=s_i}$ is an indicator (dummy) variable equal to 1 when firm *i* is in sector *s* and zero otherwise. The reason why we chose equation (5.3) as the basis to build equation (5.5), rather than using equation (5.4) which is more general,

is that interacting coefficients with sectoral classification boosts geometrically the number of coefficients to estimate. We hence only decided to allow the interaction of the cash flow coefficient with sectoral dummies. We acknowledge that, with a higher number of observations, a more general model would have been preferable. However, considering the small differences we find in estimates between equation (5.3) and (5.4) we are quite confident that results from equation (5.5), which we use only as an additional evidence and robustness test, are sufficiently sound.

Finally, a further note on the instrument's set which is used in System-GMM estimations is due. We include among exogenous variables time dummies, sector dummies and (in equations in which stages are pooled, as in Table 5.4) stage dummies. In addition to the presence of the external investor, we include all the covariates in the set of endogenous variables, such as (lagged) investments, cash flows, sales and debt. This might be considered a somewhat excessively cautious assumption. However, the studies mentioned in section 5.2 do not propose a unanimous theoretical argument about which variables should be considered endogenous and which ones can be considered as exogenous or predetermined. We hence decided for the most general assumption. To limit the number of instruments and reduce overidentification, we limit the number of lags included in the regressions to 3 (i.e. lagged investments are used as instruments from t-2 to t-5 in differences for the level equations and from t-3 to t-6 in levels for the first differenced equations). We are still left with a sufficiently rich number of instruments without including very weak instruments such as remote lags of the covariates. To enhance

comparability we maintain the same set of instruments in all our specifications. The Hansen tests never reject the validity of the overidentifying restrictions, reassuring us about the soundness of our results.

5.4. SAMPLE AND DESCRIPTIVE STATISTICS

5.4.1. THE SAMPLING PROCESS

The sample used in this paper is based on unlisted Spanish firms that were subject to expansion (VC) and later stage (PE) investments between 1995 and 2004. In accordance with the data obtained from Spanish Private Equity and Venture Capital Association (ASCRI), in that period 1,572 VC and PE investments were recorded in Spain, including all stages but not counting firms belonging to the finance and real-estate sectors (Martí et al., 2010). We include in the population 1,313 of these firms. The remaining 259 firms include firms that never reported to the Official Register, for which accounting information is unavailable, and firms that were acquired less than three years after the PE investment, for which the post-investment window is too short to be significant. Regarding the former group some firms did not report on purpose, whereas others were early stage firms that never made it to the first or the second year. Regarding the latter, the acquired firms were mostly firms at the expansion or late stages that were subject to a rapid acquisition by a third party and in which PE only played the role of bridge financing. As a result, firms excluded from the sample do not seem to introduce a significant success bias in our analysis. For all 1,313 firms we take accounting

information from the AMADEUS Database, which records information on 1,202,363 Spanish firms.

Since the aim of this chapter is to analyse the change in the investment-cash flow sensitivity in VC- and PE-backed firms, we need to have a sufficient number of pre-investment observations, which would not be the case for early stage firms. After excluding 575 early stage firms from the sample, the remaining 738 firms belong to the expansion (579 firms) and buyout (159 firms) stages. We also restrict sectoral heterogeneity by focusing on the most typical sectors in which VC and PE invest. Accordingly we exclude from the sample 98 VC-backed and 12 PE-backed firms in the following sectors: Research & Development, High-tech manufacturing, and Primary.

In order to properly address the requirements of the dynamic models that are required in the empirical work, we only retained those firms for which we could have at least six consecutive years with complete accounting data. A huge effort was spent in tracking these firms over time since most VC and PE investors create new vehicles to pursue their acquisitions. Combining accounting data from the pre and post-investment period was however not always possible. In some cases, information was available in consolidated accounts but not in both the pre and post-investment period. In other cases, investors acquired two (or more) firms which were merged immediately afterwards. As a result, we were able to get reliable accounting data on six or more consecutive years, including the investment year, for 246 firms at the expansion stage and 78 firms that were subject to a buyout deal, representing 51.1 per cent and 53.1 per cent of the number of fully identified firms in their

respective categories.

Sample firms operate in the following low and medium research-intensive manufacturing and general services sectors (Dunning, 1986; Cantwell and Barnard, 2008): provision of electricity, gas, water, etc.; construction; wholesale and retail trade; hotels and restaurants; transportation; food products; beverages; textiles; clothing; leather and leather-type products; wood and wood products; paper and paper products; furniture and recycling; chemicals and chemical products; rubber and plastic products; building materials; basic metals and metal products; and motor vehicles and other transportation equipment.

5.4.2. DESCRIPTIVE STATISTICS

Table 5.1 reports the distribution of sample firms. Panel A shows the distribution of sample firms across sectors and Panel B reports the industry distribution of firms by stage. During the period 1995-2004, the VC investment in sample firms concentrates on low research-intensive manufacturing and general services (36.1 per cent and 33.6 per cent, respectively). Basically, these external investors invest more in firms at the expansion stage than at the buyout stage (75.9 per cent and 24.1 per cent, respectively).

TABLE 5.1.
DISTRIBUTION OF THE SAMPLE FIRMS

PANEL A: *DISTRIBUTION OF THE SAMPLE FIRMS ACCORDING TO INDUSTRY*

SECTOR	***TOTAL SAMPLE***	
	n	***%***
General services	109	33.6
Low research-intensive manufacturing	117	36.1
Medium research-intensive manufacturing	98	30.3
Total	**324**	**100.0**

PANEL B: *DISTRIBUTION OF THE SAMPLE FIRMS ACCORDING TO INDUSTRY BY STAGES*

Stage	***Total sample***		***General services***		***Low research-intensive manufacturing***		***Medium research-intensive manufacturing***	
	n	***%***	***n***	***%***	***n***	***%***	***n***	***%***
Expansion	246	75.9	83	33.7	90	36.6	73	29.7
Later stage	78	24.1	26	33.3	27	34.6	25	32.1
Total	**324**	**100.0**	**109**	**33.6**	**117**	**36.1**	**98**	**30.3**

Panel A shows the distribution according to industry of a sample of 324 unlisted Spanish firms that were subject to a VC and PE investment during the period 1995-2004.
Panel B shows the sectoral distribution across different stages. Percentages in 'Total sample' column are related to the total number of sample firm. Percentages in the 'General services', 'Low research-intensive manufacturing' and 'Medium research-intensive manufacturing' columns are related to the total number of the firms in respectively the expansion or later stage.

It is quite important for our purposes to underline that the sectoral composition of VC and PE investments in our sample is similar. A χ^2 test does not reject the hypothesis that the two samples come from the same underlying sectoral distribution ($\chi^2(2)=2.65$). This reassures us that our results will not be driven by differences in investment-cash flow sensitivity across sectors. Still, as an additional robustness check, we will control for sectoral specificities by estimating equation (5.5). It should be noted, however, that the similarity in sectoral distribution in our sample should not be generalised to the whole VC and PE industry but is mainly the result of our choice to exclude from the analysis high-tech and Research and Development

(R&D) firms, where VC is far more specialised than PE.

Tables 5.2 and 5.3 report some descriptive statistics for the pre and post-investment periods, respectively. The descriptive statistics of investment is shown in Panel A, whereas those related to cash flow are shown in Panel B. The statistics are broken down by stage and sector. All variables are normalised using end-of-period-*t-1* stock of fixed assets. To control for the potential influence of outliers (which are extremely relevant when dealing with accounting ratios), all the variables are winsorised at a 2 per cent cut-off value for each tail. In other words, we truncate the distribution of each variable and impute to all observations falling beyond the 2nd and 98th percentiles the respective threshold levels.[32] The accounting information on the related firms was expressed in constant 2005 Euros using the Harmonised Consumer Price Index as deflator. Accounting information includes data from 1991 up to 2007, whenever possible.[33]

[32] This technique is usual in this field of analysis. See Cleary (1999) and Bertoni et al. (2008), among others. We replicate all the regressions using 1 per cent and 5 per cent winsorising thresholds and obtain fairly similar results.
[33] In a few firms data about 2008 are also included.

TABLE 5.2.
DESCRIPTIVE STATISTICS ON INVESTMENT AND CASH FLOW (PRE-INVESTMENT PERIOD)

PANEL A: *DESCRIPTIVE STATISTICS ON INVESTMENT ACCORDING TO INDUSTRY ACROSS STAGES*

Stage	***Total sample***	***Sector***		
		General services	***Low research-intensive manufacturing***	***Medium research-intensive manufacturing***
Expansion				
Observations	1,213	432	466	315
Mean	0.5044	0.6116	0.4431	0.4481
Std. Deviation	0.9279	1.0567	0.8363	0.8548
Later stage				
Observations	410	147	131	132
Mean	0.3732	0.5360	0.2440	0.3200
Std. Deviation	0.6366	0.7614	0.3235	0.6828
Total sample				
Observations	1,623	579	597	447
Mean	0.4712	0.5924	0.3994	0.4103
Std. Deviation	0.8654	0.9900	0.7585	0.8092

PANEL B: *DESCRIPTIVE STATISTICS ON CASH FLOW ACCORDING TO INDUSTRY ACROSS STAGES*

Stage	***Total sample***	***Sector***		
		General services	***Low research-intensive manufacturing***	***Medium research-intensive manufacturing***
Expansion				
Observations	1,213	432	466	315
Mean	0.3079	0.3537	0.2636	0.3107
Std. Deviation	0.4851	0.5779	0.4326	0.4086
Later stage				
Observations	410	147	131	132
Mean	0.3356	0.4658	0.2280	0.2973
Std. Deviation	0.4159	0.5422	0.2089	0.3700
Total sample				
Observations	1,623	579	597	447
Mean	0.3149	0.3821	0.2558	0.3068
Std. Deviation	0.4686	0.5707	0.3946	0.3972

The table reports descriptive statistics on winsorised (2% each tail) values of the variables. All variables are normalised by using beginning-of-period stock of fixed assets.

TABLE 5.3.
DESCRIPTIVE STATISTICS ON INVESTMENT AND CASH FLOW (POST-INVESTMENT PERIOD)

PANEL A: *DESCRIPTIVE STATISTICS ON INVESTMENT ACCORDING TO INDUSTRY ACROSS STAGES*

Stage	***Total sample***	***Sector***		
		General services	***Low research-intensive manufacturing***	***Medium research-intensive manufacturing***
Expansion				
Observations	1,951	676	683	592
Mean	0.3471	0.3924	0.3167	0.3304
Std. Deviation	0.7329	0.8196	0.7361	0.6132
Later stage				
Observations	605	210	210	185
Mean	0.6542	0.4607	0.2732	0.3252
Std. Deviation	0.8041	0.9929	0.6582	0.6996
Total sample				
Observations	2,556	886	893	777
Mean	0.3488	0.4086	0.3064	0.3292
Std. Deviation	0.7502	0.8637	0.7184	0.6343

PANEL B: *DESCRIPTIVE STATISTICS ON CASH FLOW ACCORDING TO INDUSTRY ACROSS STAGES*

Stage	***Total sample***	***Sector***		
		General services	***Low research-intensive manufacturing***	***Medium research-intensive manufacturing***
Expansion				
Observations	1,951	676	683	592
Mean	0.1660	0.1315	0.1615	0.2107
Std. Deviation	0.3662	0.4044	0.3464	0.3372
Later stage				
Observations	605	210	210	185
Mean	0.2392	0.3743	0.1200	0.2211
Std. Deviation	0.4284	0.5998	0.2929	0.2431
Total sample				
Observations	2,556	886	893	777
Mean	0.1834	0.1890	0.1518	0.2132
Std. Deviation	0.3830	0.4694	0.3349	0.3172

The table reports descriptive statistics on winsorised (2% each tail) values of the variables. All variables are normalised by using beginning-of-period stock of fixed assets.

During the pre-investment period, the average investment ratio (cash flow ratio) is higher (lower) for firms at the expansion stage than for firms at the buyout stage, as expected. The average investment ratio of firms at the expansion stage is 50.4 per cent, with the cash flow ratio being 30.8 per cent. Regarding buyouts, the average investment ratio stands at 37.3 per cent, whereas the cash flow ratio is 33.6 per cent. These findings might be reflecting the fast-growing process in the first group of firms, and the low growth rates and high level of available cash flow in mature, large firms during the period prior to the VC or PE investment, respectively.

According to the industry, the situation previously described is evidenced for firms in every sector, namely general services, low research-intensive manufacturing, and medium research-intensive manufacturing. Thus, the average investment and cash flow ratios are greater for firms at the expansion stage than are those at the buyout stage. It is worth noting that firms belonging to the general services category exhibit the greatest level of investment and cash flow in the whole sample. This holds true both in expansion and buyout firms.

As regards the post-investment period, the average investment and cash flow ratios are lower for firms at the expansion stage than they are for firms at the buyout stage. The average investment ratio of firms at the expansion stage is 34.7 per cent, with the cash flow ratio being 16.6 per cent. Turning to buyouts, the average investment ratio is 65.4 per cent, whereas the cash flow ratio stands at 23.9 per cent. After receiving VC funds, the growing process seems to be gradually absorbed in firms at the expansion stage, since they are

no longer experiencing high growth rates. Conversely, after a buyout deal, target firms exhibit a greater investment ratio and smaller cash flow ratio. These results may signal the active asset management carried out by PE managers after a buyout deal.

5.5. RESULTS

We begin the analysis of the evolution of cash flow sensitivity across VC and PE investments by reporting, in Table 5.4, the estimates of the models described in section 5.3 without any distinction between VC and PE investments. Estimates are obtained by including all firms in the regressions, regardless of their stage (namely expansion or buyout). We begin by noticing that Hansen, AR(1) and AR(2) tests respect in all models the expected level of significance. The Hansen test never rejects the null hypothesis of the validity of overidentifying restrictions, and errors exhibit a AR(1) structure but no higher order autocorrelation. Focusing on the coefficients of cash flow, we observe that, regardless of the model we consider, pre-investment sensitivity to cash flow is, on average, positive and significant and that post-investment sensitivity is still positive and significantly different from zero in two out of the three specifications of the model. Following our hypotheses, these results should be driven by the fact that we are pooling expansion and buy-out stages: the former are cash flow sensitive before the investment and the latter after the investment, resulting in a pooled sensitivity which is positive all over the interval.

TABLE 5.4.
CASH FLOW SENSITIVITY BEFORE AND AFTER VC AND PE INVESTMENTS

INDEPENDENT VARIABLES	EQUATION (5.1)		EQUATION (5.3)	EQUATION (5.4)
	PRE-INV	POST-INV		
Investments(t-1)				
Pre-Inv	0.2129 (0.141)			
Post-Inv		0.1896 * (0.101)		
Pooled			0.1436 * (0.076)	0.1377 * (0.075)
Investments(t-1)²				
Pre-Inv	-0.0240 (0.038)			
Post-Inv		-0.0250 (0.028)		
Pooled			-0.0080 (0.022)	-0.0067 (0.022)
Cash flows				
Pre-Inv	0.5635 *** (0.177)		0.6145 *** (0.177)	0.8391 *** (0.161)
Post-Inv		0.3637 * (0.210)	0.4581 ** (0.222)	0.2325 (0.257)
Sales				
Pre-Inv	-0.0061 (0.010)			-0.0080 (0.009)
Post-Inv		0.0065 (0.013)		0.0157 (0.015)
Pooled			0.0039 (0.009)	
Debt²				
Pre-Inv	0.0247 ** (0.010)			0.0272 *** (0.009)
Post-Inv		0.0305 *** (0.008)		0.0368 *** (0.009)
Pooled			0.0305 *** (0.006)	
δ			0.0930 * (0.053)	0.0246 (0.056)
Intercept	0.1519 *** (0.044)	0.0829 *** (0.029)	-0.0016 (0.046)	0.0360 (0.047)
Observations	1,285	1,926	2,971	2,971
Firms	255	321	324	324
Hansen	217.7	266.7	309.5	309.8
Hansen d.o.f.	217	252	324	322
Hansen p-value	0.4745	0.2524	0.7100	0.6763
AR(1)	-4.0930 ***	-6.5963 ***	-7.3612 ***	-7.1539 ***
AR(2)	-1.5577	0.1897	-0.5336	-0.8289

The table reports two-step System-GMM estimates with finite sample correction estimates on equations (5.1), (5.3) and (5.4) presented in section 5.3. The dependent variable is firm *i*'s investment ratio at time *t*. The independent variables are defined as: *Cash flow* is firm *i*'s cash flow in period *t*, *Sales* is firm *i*'s sales during period *t,* and *Debt* is firm *i*'s end-of-period-*t* total debts. Standard errors are reported in parentheses. ***, ** and * indicate, respectively, significance levels of <1%, <5% and <10%. AR(1) and AR(2) are tests of the null hypothesis of, respectively, no first- or second-order serial correlation. Hansen is a test of the validity of the overidentifying restrictions based on the efficient two-step GMM estimator. *Investments*, *Cash flows*, and *Debt* are all normalised by beginning of period level of fixed assets. Pre- and Post-row report estimates of coefficients respectively before or after the investment event. Pooled rows refer to coefficients which are assumed to remain constant.

To ascertain whether our hypotheses are correct we perform all estimates separately on the expansion and buyout samples. Results are reported in Table 5.5. Panel A shows the estimates of different models on the sample of expansion stage deals. Again, all diagnostic tests are within the acceptable limits. Coherently with Hypothesis 5.1, and with the results of related works, the investment-cash flow sensitivity of firms at expansion stage before receiving VC is positive and strongly significant in all models, ranging from 0.7072 in the split estimate of model (5.1) to 0.9683 in the estimation of equation (5.4). The post-investment sensitivity to cash flow is remarkably lower, ranging from 0.3409 in equation (5.4) to 0.4546 in equation (5.3). Moreover, it is not statistically different from zero in two of the three models, and retains a weak significance (*p-value* 8.7 per cent) in one case (equation 5.3). This is fully in line with our Hypothesis 5.3: after VC financing the sensitivity of firm's investment to cash flow is significantly reduced and, almost, disappears.

TABLE 5.5.
CASH FLOW SENSITIVITY FOR VC-BACKED AND PE-BACKED FIRMS BEFORE AND AFTER THE INVESTMENT EVENT

	PANEL A: EXPANSION			
INDEPENDENT VARIABLES	EQUATION (5.1)		EQUATION (5.3)	EQUATION (5.4)
	PRE-VC	POST-VC		
Investments(t-1)				
Pre-VC	0.3242 **			
	(0.146)			
Post-VC		0.2529 **		
		(0.112)		
Pooled			0.1297	0.1326
			(0.086)	(0.084)
Investments(t-1)²				
Pre-VC	-0.0524			
	(0.041)			
Post-VC		-0.0327		
		(0.032)		
Pooled			0.0012	0.0001
			(0.025)	(0.025)
Cash flows				
Pre-VC	0.7072 ***		0.7695 ***	0.9683 ***
	(0.198)		(0.224)	(0.175)
Post-VC		0.4048	0.4546 *	0.3409
		(0.256)	(0.265)	(0.286)
Sales				
Pre-VC	-0.0152			-0.0078
	(0.011)			(0.010)
Post-VC		0.0129		0.0173
		(0.012)		(0.013)
Pooled			0.0045	
			(0.008)	
Debt²				
Pre-VC	0.0377 ***			0.0321 ***
	(0.009)			(0.009)
Post-VC		0.0192 ***		0.0220 ***
		(0.007)		(0.007)
Pooled			0.0273 ***	
			(0.005)	
δ			0.1006 *	0.0579
			(0.054)	(0.059)
Intercept	0.1314 **	0.0542	-0.0149	0.0035
	(0.052)	(0.034)	(0.044)	(0.045)
Observations	918	1,417	2,156	2,156
Firms	190	244	246	246
Hansen	184.4	236.0	234.9	236.7
Hansen d.o.f.	216	250	321	319
Hansen p-value	0.9418	0.7286	0.9999	0.9998
AR(1)	-3.7536 ***	-5.2356 ***	-5.8554 ***	-5.7656 ***
AR(2)	-1.3772	-0.3159	-1.0394	-1.1553

The table reports two-step System-GMM estimates with finite sample correction estimates on equations (5.1), (5.3) and (5.4) presented in section 5.3. The dependent variable is firm *i*'s investment ratio at time *t*. The independent variables are defined as: *Cash flow* is firm *i*'s cash flow in period *t*, *Sales* is firm *i*'s sales during period *t,* and *Debt* is firm *i*'s end-of-period-*t* total debts. Standard errors are reported in parentheses. ***, ** and * indicate, respectively, significance levels of <1%, <5% and <10%. AR(1) and AR(2) are tests of the null hypothesis of, respectively, no first- or second-order serial correlation. Hansen is a test of the validity of the overidentifying restrictions based on the efficient two-step GMM estimator. *Investments*, *Cash flows*, and *Debt* are all normalised by beginning of period level of fixed assets. Pre- and Post- row report estimates of coefficients respectively before or after the investment event. Pooled rows refer to coefficients which are assumed to remain constant.

TABLE 5.5. (CONT.)
CASH FLOW SENSITIVITY FOR VC-BACKED AND PE-BACKED FIRMS BEFORE AND AFTER THE INVESTMENT EVENT

	PANEL B: BUYOUTS			
INDEPENDENT VARIABLES	EQUATION (5.1)		EQUATION (5.3)	EQUATION (5.4)
	PRE-PE	POST-PE		
Investments(t-1)				
Pre-PE	0.1293 (0.127)			
Post-PE		-0.0588 (0.121)		
Pooled			-0.0194 (0.085)	0.0481 (0.073)
Investments(t-1)²				
Pre-PE	-0.0122 (0.029)			
Post-PE		0.0136 (0.034)		
Pooled			0.0115 (0.025)	-0.0079 (0.020)
Cash flows				
Pre-PE	0.1313 (0.159)		0.1422 (0.171)	0.1234 (0.229)
Post-PE		0.4798 *** (0.185)	0.4360 *** (0.169)	0.4945 ** (0.193)
Sales				
Pre-PE	0.0188 (0.015)			0.0283 (0.020)
Post-PE		-0.0116 (0.017)		-0.0130 (0.019)
Pooled			0.0089 (0.011)	
Debt²				
Pre-PE	0.0007 (0.013)			-0.0090 (0.014)
Post-PE		0.0634 *** (0.013)		0.0729 *** (0.013)
Pooled			0.0372 *** (0.014)	
δ			-0.0301 (0.078)	-0.0531 (0.088)
Intercept	0.1525 ** (0.063)	0.1213 ** (0.055)	0.1346 * (0.071)	0.1391 ** (0.060)
Observations	367	509	815	815
Firms	65	77	78	78
Hansen	60.2	67.1	66.9	62.4
Hansen d.o.f.	194	223	310	308
Hansen p-value	0.9999	0.9999	0.9999	0.9999
AR(1)	-2.3610 **	-4.0443 ***	-4.3393	-4.3466 ***
AR(2)	-0.9557	-0.8584	-0.2537	-0.9328

The table reports two-step System-GMM estimates with finite sample correction on equations (5.1), (5.3) and (5.4) presented in section 5.3. The dependent variable is firm *i*'s investment ratio at time *t*. The independent variables are defined as: *Cash flow* is firm *i*'s cash flow in period *t*, *Sales* is firm *i*'s sales during period *t,* and *Debt* is firm *i*'s end-of-period-*t* total debts. Standard errors are reported in parentheses. ***, ** and * indicate, respectively, significance levels of <1%, <5% and <10%. AR(1) and AR(2) are tests of the null hypothesis of, respectively, no first- or second-order serial correlation. Hansen is a test of the validity of the overidentifying restrictions based on the efficient two-step GMM estimator. *Investments*, *Cash flows*, and *Debt* are all normalised by beginning of period level of fixed assets. Pre- and Post- row report estimates of coefficients respectively before or after the investment event. Pooled rows refer to coefficients which are assumed to remain constant.

Interestingly, results reported in Panel B, which focuses on later-stage PE investments, depict a markedly different story. Pre-investment cash flow sensitivity is never found to be statistically significant at conventional confidence levels. This is exactly what we expect from Hypothesis 5.2: investment expenditures of buyout firms do not exhibit any significant sign of being hampered by cash flow before they are PE-backed. The estimates of post-investment cash flow sensitivity are, instead, large and highly statistically significant, ranging from 0.4360 (equation 5.1, post investment subsample) to 0.4945 (equation 5.4). It is also interesting to observe that the coefficient of firm's debt is positive and significant after firms receive PE, evidencing that this form of financing dramatically changes firm's financial structure and, accordingly, the relative coefficient in the Euler equation.

Finally, we move to the estimates of equation (5.5), in which investment-cash flow sensitivity before and after VC/PE involvement is allowed to change across sectors. In Table 5.6, we observe that our results are confirmed to be particularly strong in services and mid-tech, while they appear to be less significant for low-tech manufacturing firms.

As regards Hypotheses 5.1 and 5.2, they are confirmed in each sector: VC-backed and PE-backed firms exhibit, respectively, strong and weak cash flow sensitivity before the investment event. Hypotheses 5.3 and 5.4 are only confirmed in general services and mid-tech manufacturing firms. In both cases investment-cash flow sensitivity disappears from VC-backed firms and emerges in PE-backed firms. Results for low-tech manufacturing seem instead to show no significant changes in the significance of cash flow sensitivity

across investment.

TABLE 5.6.
CASH FLOW SENSITIVITY EVOLUTION FOR DIFFERENT STAGES AND SECTORS

INDEPENDENT VARIABLES		*TOTAL SAMPLE*	*EXPANSION*	*LATER STATE*
Investments(t-1)		0.1495 *	0.1405	-0.0240
		(0.082)	(0.092)	(0.095)
Investments(t-1)²		-0.0058	0.0005	0.0146
		(0.023)	(0.027)	(0.026)
Cash flows				
General services	*Pre-Inv*	0.4193 *	0.5845 *	0.1106
		(0.236)	(0.299)	(0.215)
	Post-Inv	0.2261	0.0088	0.4168 *
		(0.234)	(0.269)	(0.250)
Low-tech manufacturing	*Pre-Inv*	0.5038	0.5906 *	-0.1838
		(0.319)	(0.358)	(0.588)
	Post-Inv	0.8444 **	0.9160 *	0.5978
		(0.355)	(0.374)	(0.521)
Mid-tech manufacturing	*Pre-Inv*	1.5834 ***	1.4882 ***	0.0601
		(0.408)	(0.435)	(0.335)
	Post-Inv	-0.0416	0.3038	0.7083 **
		(0.342)	(0.548)	(0.303)
Sales		0.0138	0.0137	0.0108
		(0.011)	(0.010)	(0.013)
Debt²		0.0262 ***	0.0259 ***	0.0329 ***
		(0.006)	(0.005)	(0.012)
δ		0.1906 ***	0.1932 ***	-0.1126
		(0.066)	(0.065)	(0.106)
Intercept		-0.1063	-0.1183 *	0.1925 *
		(0.069)	(0.065)	(0.113)
Observations		2,971	2,156	815
Firms		324	246	78
Hansen		268.7	237.4	68.7
Hansen d.o.f.		273	270	259
Hansen p-value		0.5624	0.9244	0.9999
AR(1)		-7.2387 ***	-5.8854 ***	-4.4287 ***
AR(2)		-0.4212	-0.7506	-0.0807

The table reports two-step System-GMM estimates with finite sample correction estimates on equation (5.5) presented in section 5.3. The dependent variable is firm *i*'s investment ratio at time *t*. The independent variables are defined as: *Cash flow* is firm *i*'s cash flow in period *t*, *Sales* is firm *i*'s sales during period *t,* and *Debt* is firm *i*'s end-of-period-*t* total debts. Standard errors are reported in parentheses. ***, ** and * indicate, respectively, significance levels of <1%, <5% and <10%. AR(1) and AR(2) are tests of the null hypothesis of, respectively, no first- or second-order serial correlation. Hansen is a test of the validity of the overidentifying restrictions based on the efficient two-step GMM estimator. *Investments*, *Cash flows*, and *Debt* are all normalised by beginning of period level of fixed assets. Pre- and Post- row report estimates of coefficients respectively before or after the investment event.

5.6. CONCLUSIONS AND DISCUSSION

The aim of this chapter is to assess how the differences of VC and PE deals translate into different impacts on firm's cash flow sensitivity. We hypothesise that the participation in growing firms will alleviate the dependency on internally generated resources whereas in levered acquisitions, popularly known as buyouts, we hypothesise an opposite change. Levered transactions are performed in firms that have stable cash flows and non-core assets. In such firms no significant sensitivity is expected before the acquisition. Nevertheless, after the acquisition the burden imposed by the huge amount of debt raised to finance the deal will restrict the access to additional external resources to finance additional growth and put managers under the pressure of debt repayments, thus removing excessive conservatism.

We test our hypotheses on a firm-level large panel dataset on a representative sample of Spanish VC- and PE-backed firms that were subject to the initial investment between 1995 and 2004 in low and medium tech industries. Firms analysed were at the expansion or buyout stages and belonged to general services, low-tech manufacturing and medium-tech manufacturing sectors. To have better comparability and to be able to compare investment-cash flow sensitivity before and after VC/PE intervention, we exclude firms at the start-up stage (because no pre-investment data is available) and high tech manufacturing and service firms (where VC is more active than PE).

Our results confirm that there is a significant reduction in the investment-cash flow sensitivity in firms at the expansion stage after the VC deal. Regarding buyouts, we do not find a significant sensitivity before the investment event whereas a positive value is found after the acquisition. Results are robust to various specifications of the econometric model. This work contributes to the previous literature in several ways. First, it adds to the limited literature on investment-cash flow sensitivity in unlisted firms (Manigart et al., 2003; Guariglia, 2008; Bertoni et al., 2008; Engel and Stiebale, 2009). Regarding PE literature, we analyse a period that is long enough to avoid the distortion of the investment-cash low sensitivity due to short term economic conditions (as could be the case in Manigart et al., 2003). Furthermore, we explore the sensitivity in the most widely invested sectors in Europe, when the change was only previously analysed in VC- and non-VC-backed high tech firms (Bertoni et al., 2008). Finally, we also differentiate the role played by VC and PE, as in Engel and Stiebale (2009), but using an alternative methodology that allows the inclusion of debt and including at least six consecutive observations per firm. Our results are consistent with the evidence they provide on firms at the expansion stage, but differ with regards to buyouts.

Our results confirm the role of VC as a tool to fill the equity gap in firms at the expansion stage. Nevertheless, it remains to be explained whether the positive investment-cash flow sensitivity found after a buyout transaction is good or bad for the firm and the economy as a whole. We argue that the lack of sensitivity before the acquisition could be caused by the existence of stable

stream of cash flows in firms with low debt and excessive non-core assets generating below-market return on equity. Nevertheless, it remains to be proved whether these firms are able to perform better in the long run after the acquisition.

5.7. REFERENCES

Abel, A. and Blanchard, O. (1988) 'Investment and sales: Some empirical evidence', in Barnett, W.A.; Berndt, E.R. and White, H. (Ed.) *Dynamic econometric modelling*, Cambridge University Press, Cambridge (UK).

Admati, A.R. and Pfleiderer, P. (1994) 'Robust financial contracting and the role of venture capitalists', The Journal of Finance, 49(2): 371-402.

Alti, A. (2003) 'How sensitive is investment to cash flow when financing is frictionless?', The Journal of Finance, 58(2): 707-722.

Ang, J.S. (1991) 'Small business uniqueness and the theory of financial management', The Journal of Small Business Finance, 1(1): 1-13.

Arellano, M. and Bover, O. (1995) 'Another look at the instrumental variables estimation of error-components models', Journal of Econometrics, 68(1): 29–51.

Berger, A.N. and Udell, G.F. (1998) 'The economics of small business finance: The roles of Private Equity and debt markets in the financial growth cycle', Journal of Banking & Finance, 22(6-8): 613-673.

Berger, A.N. and Udell, G.F. (2002) 'Small business credit availability and

relationship lending: The importance of bank organisational structure', Economic Journal, 112(477): F32-F53.

Bertoni, F.; Colombo, M.G. and Croce, A. (2008) 'The effect of Venture Capital financing on the sensitivity to cash flow of firm's investments', European Financial Management, forthcoming, URL (consulted June, 2009): http://www3.interscience.wiley.com/journal/121452842/abstract/

Blundell, R. and Bond, S.R. (1998) 'Initial conditions and moment restrictions in dynamic panel data models', Journal of Econometrics, 87(1): 115–143.

Bond, S.R. and Meghir, C. (1994) 'Dynamic investment models and the firm's financial policy', The Review of Economic Studies, 61(2): 197–222.

Bond, S.R. and Van Reenen, J. (2007) 'Microeconometric models of investment and employment', in Heckman, J.J. and Leamer, E.E. (Ed.) *Handbook of econometrics*, Volume 6, Part 1, Elsevier, Amsterdam.

Bond, S.R.; Hoeffler, A. and Temple, J. (2001) 'GMM estimation of empirical growth models' (November 2001), CEPR Discussion Paper Nº 3048. URL (consulted January, 2010): http://ssrn.com/abstract=290522.

Cantwell, J. and Barnard, H. (2008) 'Do firms from emerging markets have to invest abroad? Outward FDI and the competitiveness of firms', in Mendoza, Kristin and Ince, Irmak (Ed.) *The Rise of Transnational Corporations from Emerging Markets: Threat or Opportunity?*, Studies in International Investment, Cheltenham (UK) and Northampton (Massachusetts).

Carpenter, R.E. and Petersen, B.C. (2002a) 'Capital market imperfections, high-tech investment, and new equity financing', Economic Journal, 112(477): F54–F72.

Carpenter, R.E. and Petersen, B.C. (2002b) 'Is the growth of small firms constrained by internal finance?', Review of Economics and Statistics, 84(2): 298–309.

Chemmanur, T.J.; Krishnan, K. and Nandy, D. (2009) 'How does Venture Capital financing improve efficiency in private firms? A look beneath the Surface', URL (consulted March, 2010): http://ssrn.com/abstract=1025322.

Chittenden, F.; Hall, G. and Hutchinson, P. (1996) 'Small firm growth, access to capital markets and financial structure: Review of issues and an empirical investigation', Small Business Economics, 8(1): 59-67.

Cleary, S. (1999) 'The relationship between firm investments and financial status', The Journal of Finance, 54(2): 673–692.

Dunning, J.H. (1986) 'The investment development cycle and third world multinationals', in Khan, Khushi M. (Ed.) *Multinationals of the South: New actors in the international economy*, St. Martin's Press, New York.

Engel, D. and Stiebale, J. (2009) 'Private Equity, Investment and financial constraints: Firm-level evidence for France and the United Kingdom' (July 23, 2009). Ruhr Economic Paper No. 126. URL (consulted January, 2010): http://ssrn.com/abstract=1438037.

EVCA (1988-2008) EVCA Yearbooks 1988-2008. EVCA, Zavetem, Belgium.

Frank, M. and Goyal, V. (2003) 'Testing the Pecking Order theory of capital structure', Journal of Financial Economics, 67(2): 217-248.

Gompers, P.A. and Lerner, J. (1998) 'What drives Venture Capital fundraising?', Brookings Papers on Economic Activity. Microeconomics, 1998(1998): 149-192.

Gompers, P.A. and Lerner, J. (2001) 'The Venture Capital revolution', Journal of Economic Perspectives, 15(2): 145-168.

Gorman, M. and Sahlman, W.A. (1989) 'What do venture capitalists do?', Journal of Business Venturing, 4(4): 231-248.

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

Harris, M. and Raviv, A. (1991) 'The theory of capital structure', The Journal of Finance, 46(1): 297-355.

Harris, R.; Siegel, D. and Wright, M. (2005) 'Assessing the impact of management Buyouts on economic efficiency: Plant-level evidence from the United Kingdom', Review of Economics and Statistics, 87(1): 148-153.

Hellmann, T. and Puri, M. (2002) 'Venture Capital and the professionalization of start-up firms: Empirical evidence', The Journal of Finance, LVII(1): 169-197.

Hsu, D.H. (2004) 'What do entrepreneurs pay for Venture Capital affiliation?',

The Journal of Finance, LIX(4): 1805-1844.

Hubbard, R.G. (1998) 'Capital-market imperfections and investment', Journal of Economic Literature, 36(1): 193–225.

Jain, B.A. (2001) 'Predictors of performance of venture capitalist-backed organizations', Journal of Business Research, 52(3): 223-233.

Jelic, R.; Saadouni, B. and Wright, M. (2005) 'Performance of private to public MBOs: The role of Venture Capital', Journal of Business Finance and Accounting, 32(3-4): 643-681.

Kaplan, S.N. and Strömberg, P. (2009) 'Leveraged buyouts and Private Equity', Journal of Economic Perspectives, 23(1): 121-146.

Litchenberg, F.R. and Siegel, D. (1987) 'Productivity and changes in ownership of manufacturing plants', Brookings Papers on Economic Activity, Special Issue(3): 643-673.

Manigart, S.; Baeyens, K. and Verschueren, I. (2003) 'Financing and investment interdependencies in unquoted Belgian companies: The role of Venture Capital', in Butzen, P. and Fuss, C. (Ed.) *Firms' investment and finance decision*, Edward Elgar, Cheltenham (UK).

Martí, J.; Salas, M. and Barthel, D. (2010) 'Economic and social impact of Venture Capital & Private Equity in Spain'. Survey, Spanish Venture Capital & Private Equity Association, Madrid (Spain).

Megginson, W.L. and Weiss, K.A. (1991) 'Venture capitalist certification in

initial public offerings', The Journal of Finance, 46(3): 879-903.

Rajan, R. (1992) 'Insiders and outsiders: The choice between informed and arm's length debt', The Journal of finance, 47(4):1367-1400.

Reid, G.C. (1996) 'Fast growing small entrepreneurial firms and their Venture Capital backers: An applied principal-agent analysis', Small Business Economics, 8(3): 235-248.

Sahlman, W.A. (1990) 'The structure and governance of Venture Capital organizations', Journal of Financial Economics, 27(2): 473-521.

Smith, A.J. (1990) 'Corporate ownership structure and performance: The case of management buyouts', Journal of Financial Economics, 27(1), 143-164.

Stuart, T.E.; Hoang, H. and Hybels, R. (1999) 'Interorganizational endorsements and the performance of entrepreneurial ventures', Administrative Science Quarterly, 44(1): 315–349.

Whited, T.M. and Wu, G. (2006) 'Financial constraints risk', Review of Financial Studies, 19(2): 531-559.

Whited, T.M. (1992) 'Debt, liquidity constraints, and corporate investment: Evidence from panel data', The Journal of Finance, 47(4): 1425-1460.

Windmeijer, F. (2005) 'A finite sample correction for the variance of linear efficient two-step GMM estimators', Journal of Econometrics, 126(1): 25-51.

Wright, M.; Gilligan, J. and Amess, K. (2009) 'The economic impact of Private Equity: What we know and what we would like to know', Venture Capital,

11(1): 1-21.

Wright, M.; Hoskisson, R.E.; Busenitz, L.W. and Dial, J. (2001) 'Finance and management buyouts: Agency versus entrepreneurship perspectives', Venture Capital, 3(3): 239-261.

Wright, M.; Thompson, S. and Robbie, K. (1992) 'Venture Capital and management-led leveraged buyouts: An European perspective', Journal of Business Venturing, 7(1): 47–71.

CONCLUSIONS

Information asymmetry problems impede the SMEs' access to long term financial sources. Therefore, SMEs with growth opportunities are usually restricted to a non-optimal choice, which is limited to only two alternatives. The first one is to finance growth with short term debt, if this possibility is available. The implication of this approach is that the firm adds more risk to the average risk faced in any investment, since it is funded with debt, rather than equity, and the maturity of the debt is not matching the time required to pay back the investment. The latter means that the SME is in deep trouble if the creditor chooses not to renew the loans granted. This may happen due to external events even if the firm was fully meeting the agreed payments of the previous debt. The second alternative is to limit growth to the owners' wealth plus the internally generated resources, which could limit firm growth and involve not taking advantage of growth opportunities.

An additional alternative is found with the emergence of VC, which is a long term source of external equity for innovative, fast-growing SMEs at the seed, start-up or expansion stage. In addition to funding, VC investors also provide value-added services, among which contacts with investment bankers to access other sources of money should be highlighted. As a result, the natural dependency of investments to cash flow could be reduced, or even eliminated, when SMEs approach VC firms to fund their investments.

But VC has evolved since the 1980s to investments in large and mature firms, with a new term, namely Private Equity, being widely accepted. Those firms do not experience the same problems when accessing long term sources of funds. Some of them were even listed on the stock exchange before the

entry of the external investor. Mature firms generate stable cash flows and do not have many growth opportunities with positive net present values. Nevertheless, when ownership is dispersed, managers may choose to over-invest to increase the size of the firm beyond optimal levels. Different problems arise in closely-held mature firms, because owner-managers may become conservative over time, keeping large inventories and cash holdings, at the cost of reducing the return on assets. In both cases, the investments should not be significantly related to the cash flow available. The dependency may arise after the entry of a PE investor as the result of the enhanced asset management.

Most of the literature about the investment-cash flow sensitivity focuses on listed and large firms. From the perspective of VC and PE, just a few papers have addressed this issue so far and they show mixed results. Our research pretends to contribute to filling this gap.

The main aim of this research is to identify the effects of VC and PE institutions on the investee firms. Focusing on the impact exerted on the investment-cash flow sensitivity, we expect different effects on that relationship since VC and PE play different roles in the investee firms. Whereas VC supplies financing funds as well as non-financial services to growing SMEs, without access to additional external resources, PE firms are involved in highly leveraged deals on mature, large firms with stable cash flows and non-core assets.

Before the investment event, growth opportunities of SMEs basically are

financed by internally generated funds. This investment dependency might be reduced by the presence of VC investors not only by the financial resources provided but also by the value-added that increases the firms' credibility. In the case of PE transactions, the effect of investment dependency on cash flow is the opposite. In addition to a high level of cash flows, mature, large firms have access to external financial resources since they are less affected by information asymmetries. After a PE deal, the high levels of debt restrain the internally generated funds to face the burden of leverage and restrict the access to additional external financial funds.

The central hypothesis is tested in three different empirical exercises. We focus on unlisted Spanish firms at the expansion and later stages, which do not have access to capital markets, to be better able to identify the investment-cash flow sensitivity. The VC and PE investments recorded in Spain were obtained from the Spanish Private Equity and Venture Capital Association (ASCRI), and the accounting information of investee firms was taken from the AMADEUS Database. Additionally, a one-by-one matched sample of similar SMEs with no VC involvement was randomly selected from the AMADEUS Database.

The empirical results confirm our central research hypothesis. First, we analyse the investment dependency on cash flow in a sample of Spanish manufacturing SMEs at the expansion stage that received a VC investment over the period 1995-2007 and on a one-by-one matched sample of similar SMEs that did not receive VC in that period. Our analysis is based on the Q Model of investment which considered the availability of investment

opportunities, proxy by Tobin's q, as well as internally generated funds, measured by cash flow (alongside other control variables). For the purpose of this empirical work, we used a yearly average EBITDA multiple as proxy of Tobin's q. We also use the volume of intangible assets as a proxy of growth opportunities since our sample includes only unlisted firms. After controlling for growth opportunities, size, age and sector, we find evidence of a positive and significant relationship between investment and cash flow, with the manufacturing firms that were later subject to a VC investment showing a significantly greater coefficient.

The previous results are confirmed in our second empirical work. We analyse to what extent VC investors reduce the investment dependency on cash flow in a sample of Spanish SMEs at the expansion stage that receive a VC investment over the period 1995-2004 and on a one-by-one matched sample of similar SMEs with no VC involvement. A positive and significant relationship between investment and cash flow is found in all firms before the VC investment event. After the investment, VC-backed firms exhibit a significantly lower investment dependency on cash flow. This result is robust even when the sample is divided by activity sector.

On a third empirical work, the different role played by VC and PE investors is identified by analysing the investment-cash flow sensitivity in investee firms operating in low and medium technology firms, before and after the investment event. The analysis is carried out on a sample of Spanish low and medium tech manufacturing and services firms that were invested in between 1995 and 2004 at the expansion (VC) or buyout stages (PE). The

'structural break' caused by VC and PE investments is tested through several specifications of an Euler equation. As in the previous empirical work, a significant reduction in the investment dependency on cash flows is found in firms at the expansion stage after the initial VC investment event. Nevertheless, firms that were the object of a buyout deal do not exhibit a significant relationship between investment and cash flow, whereas investment-cash flow sensitivity emerges after the transaction.

This work contributes to the previous literature in several ways. First, regarding VC, we provide an empirical financial justification to explain VC intervention in SMEs exhibiting a high investment dependency on cash flow. Second, it adds to the limited literature on investment-cash flow sensitivity in unlisted firms. Third, the new evidence is in accordance with the agency theory (VC investments) and the free cash flow theory (PE investments), thus contributing to the clarification of the mixed results found in the scant VC literature on this issue. Fourth, we explore the sensitivity in the most widely invested sectors in Europe, which include low and medium technology sectors such as manufacturing and general services. Finally, this is the first study about the investment sensitivity to cash flow in VC- and non-VC-backed Spanish SMEs at the expansion stage and Spanish PE-backed mature firms at the buyout stage. As a final contribution, we find that both static and dynamic approaches lead to similar results. The former is usually conducted due to the lack of a sufficient number of time series observations,

Regarding our limitations, the sample size of buyout firms is limited to only 78 firms for which we have the minimum desirable number of time series

observations. Similarly, regarding VC investments, the results found on technology, media and telecommunications (TMT), when this group is analysed separately, could be affected by the limited number of firms available.

For future research, it is necessary to check the increased dependency of investment to cash flow found after a buyout deal performed by PE firms and the effect of that dependency on returns over time. Similarly, we found negative signs in the relative investment-cash flow dependency of VC-backed TMT firms. It should be important to test whether this result is caused by the distorting effects of subsidies that those firms obtain from public authorities.

ANNEX

The Venture Capital (VC, hereafter) and Private Equity (PE, hereafter) industry in Spain has been represented, managed and defended by the Spanish Private Equity and Venture Capital Association (ASCRI). In addition to the promotion on the sector and the help provided in the creation of VC firms, ASCRI conducts surveys and publishes reports, bulletins, books and surveys, edited or financed by the Association, alone or in collaboration with other institutions.

In order to continuously monitor the VC and PE activities, ASCRI requires updated information about the industry. All the documents and publications of ASCRI are based on the list of VC and PE investments carried out in Spain. This list was originally collected by José Martí Pellón, Professor of Financial Management at the Universidad Complutense de Madrid since 1986. Since 2001, this effort is jointly conducted with www.webcapitalriesgo.com, in close collaboration with ASCRI. A detailed survey is carried out every year on all active Spanish VC and PE firms, with the result being a yearly activity report published by ASCRI and www.webcapitalriesgo.com.

The types of institutions considered include independent VC funds, independent PE funds, corporate VC funds, bank-owned VC firms, governmental VC firms, and university seed funds.

The VC and PE transactions are identified from the list that includes all investments performed. Additional data are collected from press releases published by participants in the VC or PE investment, references found in printed media and/or on the Internet, and consultations by the Centre for

Management Buy-out and Private Equity Research (CMBOR) on commercial databases that track all kinds of corporate acquisitions and sales.

The data collection process allows the investments to be distinguished by different stages of development. VC activities involve the financing of firms at the seed, start-up and expansion stages. Investments in either the seed or the start-up stage are also referred to simply as early stage investments. Later stage investments include turnaround, replacement and buyout transactions in mature firms older than five years at the time of funding.

The investments are also classified by the industry sector. This classification includes 18 categories, namely computer related, electronics, industrial products and services, consumer related, agriculture/fishing, energy and resources, chemicals and materials, construction, health care, hospitality-leisure, communications, biotechnology, industrial automation, financial services, other services, transportation, other, and other manufacturing.

Accounting information of the investee firms is taken from the AMADEUS Database. Firms are excluded if it were not possible to complete data for any of the following reasons. In some cases the accounting information is unavailable since firms do not comply with the obligation to report their accounts in the Official Trade Register. On the other hand, when firms are acquired by some other firm before reaching the third year, it is difficult to consider them as a separate entity. Firms are also excluded if they disappear without reporting accounts to the Official Trade Register, or only for one or two of the years.

Once investee firms are identified, firms with no VC funding and comparable one-by-one with the VC/PE-backed firms are selected. Comparable firms are randomly chosen from the AMADEUS Database, matching the sector, by means of the NACE Rev2 code (4-digit code), the number of employees, the revenues, the asset volumes, and the age, whenever possible, in the year before the initial VC investment was performed, as well as its location in a geographical area with a similar level of development, whenever possible.