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The Role of Venture Capital and Private Equity for Innovation and Development of SMEs: Evidence from Italian Puzzle

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Abstract

Numerous studies have discussed that even if fundamental for innovation and economic growth, SMEs are often financially more constrained than large firms. Therefore, venture capitalists are often the only available sources of financing to small and young companies. Through the analysis of a database that includes 160 funding deals signed in Italy, we research for empirical evidence of the determinants and effects of VC and PE investments. We find that VC and PE funds are more likely to finance younger and smaller firms. We confirm the presence of the certification effect under new circumstances applying to SMEs.

JEL classification numbers: G24, G30, G31, G32

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1 Introduction

In recent years a significant part of economic literature has highlighted the vital role that small and medium enterprises (SMEs) can play in contributing to economic development and innovation (Audretsch et al., 1999; Thurik et al., 2002). This is particularly true for companies operating in innovative sectors, where generally the values of intangibles are more significant, whilst investments in fixed assets and working capital are lower.

The relevance of SMEs for economic development become particularly noteworthy for countries like Italy, where small and medium-sized enterprises account for the majority of the productive system, with a significant capacity to be present in different geographical areas, as well as to support different features of the industrial districts (Hart and Hanvey, 1995; Callejon and Segarra, 1999).

Although SMEs are considered as particularly useful for economic development, several studies have shown that these firms are often more financial constrained than larger firms (Carpenter and Petersen, 2002a). From this perspective, banks lending often fails to meet the needs for their funding, because they fail to correctly assess the risk profile of such firms, especially for the smaller sized. In addition, smaller companies often lack an adequate historical trend certifying for their creditworthiness. Therefore, a small business with little track record looking for external capital, may face constricted funding sources, deterring the possibility of business to grow.

Because of these circumstances, for entrepreneurs trying to start a company, especially where intangible assets are at the core of the business, venture capitalists (VCs) are often the only available sources of financing. From this perspective, VCs act as professional investors with deep knowledge of the market based on their previous managerial experience. Their involvement usually implies sharp changes to both corporate governance models and relations with stakeholders, factors that are often seen as foundational for better future

performance (Hellmann and Puri, 2002). Similarly, relevant changes also accompany the involvement of private equity firms (PEs), which generally serve larger established companies that need to improve their results or resolve issues of ownership succession.

The US market in this regard constitutes an important example of the vital role that VCs and PEs may have to financing businesses, especially innovative, such as all the major high-tech and internet companies which have developed in last 20 years in the US. On the opposite, very different appears the situation in Europe, particularly in countries like Italy, where the presence of VC and PE players is smaller and where the weight of banks loans to the economy is far more important than in the US. Not surprisingly, in these countries we notice that innovative companies face more difficulties to find the funding for their development, especially in their early stages, reducing their capability to grow as fast as well as they can elsewhere.

For all those reasons, we considered as of particular interest to analyze the Italian market, in order to assess whether in this country the undertaking of VC and PE is actually able to constitute a valuable resource for firms growth, especially for more innovative SMEs, so that they could support economic development and innovation in this economy. Moreover, we consider this finding can be of a general interest also for other countries characterized by developing financial infrastructure or by an extreme reliance on banks in providing financing to the economy.

The first aim of this study is to advance knowledge of the SME financing market in Italy and to compare the results with experiences elsewhere. To obtain a representative sample of Italian firms financed by VC or PE money (backed firms), we used a database in which information about VC and PE transactions has been matched with balance-sheet data. (Data are selected from the PE Monitor yearly newsletters, AIDA and ZEPHIR—Bureau Van Dijk). More

specifically, the empirical exercises use probit regression analysis to test the relation between the probability of VC and PE deals and a group of variables (such as a company's size, age and level of collateral) found to be relevant in the US. The empirical analysis also compares the performances - in terms of various balance-sheet indicators - of backed firms and non-backed firms. To explore these relations, we applied fixed-effect estimation, which controls for unobservable heterogeneity.

The ex post analysis of the performance is also useful to discriminate among different theories. One such theory predicts the so-called "certification effect", the ability of third parties to certify the quality of information issued by relatively unknown firms (Megginson and Weiss, 1991). This notion has been tested and evaluated in many studies. Borisova (2007) apply it to the privatization process that has characterized European countries during the last three decades and find that a one percent decrease in government ownership increases the credit spread (used as a proxy for the cost of debt) by half a basis point. Analyzing another situation, Sufi (2006) examine the introduction of syndicated bank loan ratings by Moody's and Standard & Poor's and find that borrowers who improve their loan ratings gain increased access to the capital of less informed investors, such as foreign banks and non-bank institutional investors.

Many researchers have examined the certification effect in the VC and PE industries. Most have looked at how financial institutions help to resolve the asymmetric information inherent in the Initial Public Offering (IPO) process. Few have examined VCs and PEs as sources of information about the quality of SMEs; and in particular, we found no evaluation of the Italian case. Indeed, this study's second contribution is to perform such an evaluation and to provide solid evidence supporting the view that VCs and PEs do provide such information.

This study adds to the existing literature by testing the certification effect through a combination of variables that previous studies have suggested confirm

individually the effect's presence (Beatty, Ritter, 1986; Del Colle, et al., 2006; Borisova, 2007; Hyytinen and Pajarinen, 2007). In particular, we apply the same econometric procedure for the effects of VC and PE to the proxy variables, access to bank credit and trade credit (defined as the average length of purchases over the fiscal year).

Our results confirm that, as in the US, Italian VCs and PEs are more likely to finance firms that are younger and smaller, and thus riskier. Coupling these results with the phenomenon of sustained investments in intangible assets both before and after the date of funding, we can support the theory that VCs and PEs solve problems of asymmetric information. Looking at patterns of growth, rates of investment and sales recorded after funding, we find evidence consistent with the external investor filling the role of consultant.

Regarding the Italian market, we reject the theory that VC spurs innovation. On the contrary, most funding transactions follow periods of high investment and growth and precede slowdowns of growth and investment in fixed assets. (We interpret these slowdowns as fulfilling an implicit aim to consolidate firms' result). Finally, the results elicit the certification effect, which is confirmed by a broadening of access to bank credit at better terms and the consequent reduction of trade credit; this is consistent with the theory of Petersen and Rajan (1997).

The paper proceeds as follows: Section 2 draws on the main features of SMEs and the financial industry to discuss the potential positive interaction between VC and PE. Section 3 describes the theoretical background and the major contributions of the existing literature. Section 4 briefly reviews corporate finance theories and empirical evidence that help illuminate the likely determinants and effects of VC and PE financing; it also presents relevant econometric models in current use. Section 5 describes the sources of our data, their main features and the results for the econometric analysis on the determinants and effects of VC and PE financing. Section 6 concludes.

2 Constraints and solutions for the financing of SMEs

2.1 The role of SMEs in economic development

During the postwar period, there has been widespread agreement among academics and practitioners that SMEs share several shortcomings when compared to larger firms. Empirical evidence consistently indicated that SMEs were less efficient, paid their employees less, were less innovative; consequently, they hindered economic growth. Generally, small size was perceived as a preparatory step before consolidation into efficient large firms (Audretsch, 2002). Since the 1980s this position has been reconsidered, however, due to the increased numbers and impact of SMEs in the most developed industrial economies.

Recent economic literature cites several reasons for this changed situation. A loosening of the traditionally close relationship between size and efficiency has transformed production processes; this change has especially benefited those who have been able to recognize technological gaps and create flexible organizations. Workers have generally liked this new flexibility and have adapted to it in ways that improve productivity. On the demand side, specialized markets expanded according to changes in customers' tastes; this required specialized production and more highly targeted allocations of resources. With these changed circumstances, in particular the recognition of the importance of a knowledge-based economy, new theories have reappraised SMEs as fundamental contributors to new patterns of economic growth. One key advantage for SMEs is that the tiny revenue margins that flow from continuous incremental improvements to products, materials and processes can often be sufficient for small businesses to be profitable; this is less often the case for large firms.

While SMEs were being reappraised as entities capable of helping to drive the general economy, a large body of literature focused on the financial constraints that may hinder the birth and development of such new businesses. Lack of

internal financial resources especially intensifies operating risks for nascent firms. Young SMEs also face increased financial risks due to market imperfections, such as information asymmetry, transaction and agency costs.

More generally, such enterprises face a financial system that is inadequate to meet their needs. First, smaller and younger firms usually lack managerial skills and the ability to convey structured information to investors (Caselli, 2004). Second, the operations and finances of SMEs are often highly opaque; this is because the identity of owners and managers often coincide. Consequently, backers, while running their evaluations, often privilege real guarantees to the future returns indicated by the firm, because of the difficulty to evaluate it. Finally, the risk of revealing proprietary secrets often makes innovative entrepreneurs reluctant to disclose details of their businesses (Ueda, 2004).

Traditionally, banks have been key players in the financing of SMEs. Under the circumstances outlined above, however, the traditional banking business model appears to be incompatible with meeting the needs of young and small firms (Berger, Udell, 1998). It is in fact more compatible with meeting the needs of established medium-sized firms operating in traditional sectors.

A bank lending to a small business essentially poses a type of agency problem. The bank (as principal) uses the firm (as agent) to generate a return on money advanced. This transaction occurs under conditions of imperfect and asymmetric information (Berger and Udell, 1995; Keasy and Watson, 1993), which relate both to pre-funding evaluation of the project and the entrepreneur (adverse selection) and to the post-funding monitoring of performance (moral hazard). Such information problems are not unique to small firms, but are considerably more prevalent with them because of anticipated higher costs of information collection.

It is generally agreed that information asymmetry can be reduced by two mechanisms (Binks and Ennew, 1996). First, the provision of collateral as part of the debt contract; specifically, low-risk borrowers who leave the market in the

Stiglitz-Weiss model (1981) can signal their status by a willingness to offer appropriate levels of collateral. Second, the development of a close working relationship between the lender and the borrower. A close relationship can provide the bank with a better understanding of a business's operating environment, the owner's managerial attributes and the business's prospects. Stein (2002) stresses this technique, showing that local regional banks have superior skills in acquiring the soft information that flows from ongoing contact with small firms active in the area. The less hierarchical and rigid operational styles of local banks are the key elements that allow for the acquisition of non-computable information which is the typical outcome of the relationship lending business model.

Nevertheless, SMEs have intrinsic characteristics that can hinder the relationship lending process. They face severe adverse selection and moral hazard problems due to the technologically intensive nature of their activities and their lack of track records. In addition, most of their assets are firm specific or intangible and hence cannot be pledged as collateral. Accordingly, credit rationing is especially acute for smaller, younger and independent businesses. In fact, they report more difficulties than other firms when asking for bank credit. Moreover, Del Colle, Finaldi Russo and Generale (2006) show that small business are usually affected by multiple lending relationships with banks, which can imply a lower information disclosure. The last outcome highlights the weaknesses of the relationship lending model, which sees the unique long-term interaction between firm and bank as the way to resolve information asymmetries. Further, the study of Panetta, Schivardi, Shum (2004) on the effects of the concentration of the Italian banking industry suggests that the portion of credit allocated to small business decreases in the long run after a bank merger; this is because the larger more complex organizations make it more difficult for bankers to maintain personal relationships with small entrepreneurial firms.

2.2 VC and PE as a solution for the financing of SMEs

In line with the above, several authors have suggested that VCs and PEs are the financial intermediaries best suited for situations where information is significantly asymmetric. Indeed, these forms of financing have been very successful in the US, having fueled the growth of many high-technology firms. The well known fortunes of such ventures as Yahoo!, eBay, Microsoft and Apple convinced many policymakers and entrepreneurship scholars to regard startups and VCs as driving forces for economic growth, job creation and structural change. Regarding the Italian case, data gathered by the Private Equity Monitor (PEM©) on PE funding transactions occurring in 2005 and 2006 show that most involved firms recorded sales of less than €60 million, confirming the close relationship between SMEs and PE.

There are many factors that favor the involvement of VCs and PEs in funding SMEs. First, they hold stakes in all firms they back, and keep greater control rights where they believe that the entrepreneur must be induced to greater effort to ensure a project's success. Their roll as stakeholder is enforced by an optimal mix of debt securities and equity securities that ensures the possibility that the backer may become a creditor or a partner according to what it perceives is needed to keep the entrepreneur fully engaged (Bernile, Cumming, Lyandres, 2007). Kaplan and Strömberg (2004) refer to this feature as a separation between control and cash-flow rights. Specifically, control rights allow the VC to participate in the entrepreneur's key decisions. Additionally, VCs and PEs often grant capital infusions in stages, periodically reevaluating the firm's prospects before each tranche. The shorter the durations of financing rounds, the more frequently the backer monitors the entrepreneur's progress and the greater the need to gather information (Gompers, 1995). Finally, VCs and PEs serve to provide a certification effect. As we have already argued, the quality of small companies often cannot be observed directly. Thus, evaluators must appraise the company's value based on observable attributes that are thought to vary along with its

underlying but unknown qualities.

The appraisal process involves estimating the conditional probability that the firm will succeed, given a set of the organization's observable characteristics. There are two qualitatively distinct categories of information that influence perceptions of the probability of a young company's success. First, important constituencies such as potential investors and customers make quality judgments through careful consideration of the organization's previous accomplishments. Second, the identity of existing management becomes a primary consideration when potential investors, customers, employees, suppliers and other exchange partners decide whether to commit their resources to a new enterprise.

Since SMEs are greatly affected by information opaqueness and usually lack long track records, we are particularly interested in examining the impact of gaining exchange partners. We start by observing that social or industrial structures can be represented as a set of positions arranged hierarchically according to their occupants' prominence. Baum and Oliver (1991) demonstrate that an organization's ties to an institution signal conformance to institutional prescriptions and thereby help young organizations to acquire legitimacy and other resources. (See also Aldrich and Auster, 1986.)

It is possible to identify three social mechanisms that may lead potential investors, customers and other potential exchange partners to appraise the characteristics of a subject SME's affiliates as they strive to assess the new venture's unobserved and uncertain quality (Stuart, Hoang and Hybels, 1999): (1) relationships have reciprocal effects on the parties' reputations, (2) well known organizations are perceived to have strong evaluative capabilities and (3) relationships with prominent organizations signal a new venture's reliability, and, thus, its high likelihood of survival. Together, these three social processes suggest that gaining a prominent affiliate serves to enhance a small venture's perceptions of quality.

3 Literature review

3.1 Determinants of VC and PE financing of SMEs

The theoretical literature regarding the financing of small firms generally agrees that information opaqueness makes it more difficult for these businesses to obtain external finance (Berger, Udell, 1998). Asymmetric information problems between firms and financiers strongly affect their relationships and shape the contracts between them, especially terms about whether backing takes the form of debt or equity, whether collateral is given for any debt, covenants and the maturity of any loan.

The form of backing can create agency problems. For example, debt increases moral hazard problems. Following Jensen and Meckling (1976), firms can replace low risk investments with high-risk projects, which increase the risk of bankruptcy but offer no offsetting gain to debt holders in the event of success. At the same time, as Carpenter and Petersen (2002b) suggest, a small firm's marginal costs of financial debt could increase quickly because it has fewer tangible assets with which to secure loans. Thus, bank financing may not be viable.

Unlike debt, equity finance does not increase the probability of bankruptcy. Moreover, agency problems are ameliorated because both entrepreneurs and equity investors share in upside returns. Aghion and Bolton (1992) and Aghion et al. (2004) propose a model based on control rights, which concludes that when size of projects becomes sufficiently large or when assets are increasingly intangible, firms will give more control rights to outside investors by issuing new equity.

Inherent characteristics of innovative companies, including unclear growth potential and large investments in intangibles assets (which is common for high-tech companies), tend to create obstacles to raising additional capital. There is increasing empirical evidence confirming the theoretical prediction that innovative firms rely more on internal finance than on leverage. It also seems clear

that, at least in some countries, outside equity is a valuable source for funding innovative firms. Small firms can have more trouble in financing innovative activity. When they need to borrow, they are likely to do so on relatively poor terms (higher interest rates, shorter maturity) due to their asymmetric information problems; accordingly, outside equity seems to be their most suitable source for external financing. Borrowing can be difficult even for larger innovative firms. Based on a panel of publicly traded US high-tech companies, Carpenter and Petersen (2002a) conclude that, although large innovative companies have at their disposal more collateral to pledge against bank debt, difficulty in obtaining outside financing nonetheless constrains their growth.

Myers (1977) argues that a firm whose value largely depends upon investment in future growth options would likely make less use of debt because of a glaring agency problem: the owner/manager can undertake investment strategies that are particularly detrimental to bondholders. Rajan and Zingales (1995) give empirical support to this prediction. Testing the relationship between market-to-book ratios and leverage, they find it to be negative. Similarly, Barclay and Smith (1995) find that debt maturity declines with firms' market-to-book ratio.

The nature of firms' assets can also affect expected agency costs, which opens the door for VCs to step in. Williamson (1988) argues that leverage should be positively related to the liquidation value of assets. In fact, tangible assets are on average easier to sell and receive a higher fraction of repayment than do intangibles assets such as patents or copyrights. Thus, a higher liquidation value implies that default is less costly. Subsequent tests, as in Rajan and Zingales (1995), confirmed that the relationship between liquidation value (measured as the ratio of tangible assets to total assets) and leverage is indeed positive.

The framework presented gives factual hints about the role played by an external financier. Where such conditions are in place, there is scope for VCs and PEs to add more value than other intermediaries (Rennengoog, Simons, Wright,

2007). Screening and monitoring activities, though imperfect (Gorman and Sahlman, 1989; Manigart et al., 2002), and participation in the company's board can potentially overcome most of the problems outlined (Cumming, Siegel, Wright, 2007). This may not apply to banks; because regulations limit banks' ability to hold shares directly, they cannot fund projects through equity. Regarding the Italian market for SMEs funding, Panetta, Schivardi and Shum (2004) find that a bank's merger seems to affect its specialization in terms of credit policy: the portion of credit allocated to small business decreases in the long run. This is due to size change and more complex organizational structure.

In light of the above discussion, a hypothesis on the determinants of VC financing can be tested.

Hypothesis 1 *Given the specific environment in which VCs and PEs operate, it is possible to identify a cluster of variables that affect their investment decisions.*

3.2 The economic impact of VCs and PEs

Literature on economic impacts of VCs and PEs have focused on two issues: outcomes for the general economy and the performance of a small business after acquiring new capital.

Regarding impacts on the general economy, numerous studies show that there is a strong positive correlation between VC and innovation. Hellman and Puri (2000) argue that VC-backed firms appear to implement new patents more quickly. Kortum and Lerner (2000) conclude that a dollar invested by VC is three times more effective in promoting patent creation than a dollar invested from a corporation. Still, the direction of causality between VC and the degree of innovation remains an open issue. Some empirical studies have found that more VC financing fosters innovation ("VC First hypothesis," e.g., Kortum and Lerner, 1998), while others have found that the external financier enters only after the

discovery of a new technology and meets the need to market such innovations (“Innovation First hypothesis”). Hirukawa and Ueda (2003) find that VC financing is more frequent in industries that have had an increase in total factor productivity, which the authors interpret as a proxy for innovation; after funding, productivity decreases.

Regarding macroeconomic job creation, research has focused on understanding the relationship between employment growth and VC/PE funding. Studying a panel of 20 OECD countries, Wasmer and Weil (2000) find evidence of the impact on employment of an increase in the VC investment/GDP ratio. Belke et al. (2003) extend the scope of the inquiry, testing a virtuous circle between entrepreneurial dynamism, innovative startups, dynamic VC industry and job creation. The paper delivered pioneering empirical evidence of such links at the macroeconomic level, showing that VC is able to increase employment growth and new job creation significantly.

Regarding the second focus area, several recent studies have empirically examined the relationship between receiving VC’s finance and firm performance. Sapienza (1992) finds that the performance of backed firms positively relate to the services that VCs provide. Two correlations particularly stand out: The more innovation a venture pursues, the more frequent are contacts between the lead investor and the CEO. And the more open communication is and the less conflict of perspective exists between the VC and the CEO, the greater is the value of VC involvement.

Lerner (1999) evaluates the long-run success of firms participating in the US government’s Small Business Innovation Research (SBIR) program, a major public-assistance initiative for high-tech firms. Those receiving SBIR assistance achieve significantly higher employment and sales growth rates than similar firms that did not receive SBIR assistance. These differences are most pronounced in ZIP codes with high VC activity. Jain and Kini (1995) add that services from VCs can include marketing advice and upgrades of the commercial network, which

foster increased sales. Based on 187 Belgian VC-backed firms, the work of Manigart and Van Hyfte (1999) contrasts partially with the above results. These firms do not achieve significantly higher employment growth compared to non-VC backed firms of the same industries, of similar size and similar age. Higher growth rates in total assets and cash flow, however, are obvious.

Summarizing, many studies have argued and shown that the presence of professional investors can strengthen a company's performance, due to many actions that these investors can take.

Accordingly, we can test the following hypothesis for the case of Italian small businesses:

Hypothesis 2 *It is possible to determine the enhancing role played by VCs and PEs when evaluating the post-investment performances of Italian SMEs.*

3.3 The certification effect

It is widely acknowledged that financial intermediaries can positively contribute as agents able to produce information about firms' qualities. The seminal work of Akerlof (1970) highlights the plausible failures of a market with imperfect information. The model predicts that, without both defined guarantees and distinguishable quality, the market may fail. Only the average quality of the goods will be considered. This causes a "lemon market," in which goods of superior quality are driven out.

Using the same framework, Chan (1983) shows that when all investors have positive search costs (i.e., they are uninformed investors) entrepreneurs will find it in their interests to offer less desirable projects. This leads to the degeneration of projects undertaken. Thus, only "lemons" are offered, and investors will not enter the market. Conversely, when some investors have zero search costs, the allocation of resources is improved in terms of entrepreneurs' efforts to spur

projects with higher investor returns.

Both of the above studies note a lack of guarantees as a feature of imperfect markets. Investigating further, Booth and Smith (1986) find important evidence of the certification effect. The underlying theory derives from the expanding literature on the use of reputational signaling to guarantee product quality. The most notable work is by Klein and Leffler (1981). They demonstrate the conditions under which a non-salvageable capital expenditure can serve as an effective bond to guarantee the quality of a firm's products. In fact, the non-salvageable investment is perceived by customers as a commitment to product quality, which will be rewarded as long as the firm does not cheat.

Booth and Smith extend the reputational capital paradigm to explain the role of the investment banker in certifying the pricing of equity and risky debt issues. In a market where insiders have an information advantage that might facilitate a wealth transfer from outsiders, issuing firms may have the option of "leasing" the brand name of an investment banker to certify that the issue price reflects available inside information. In situations where insiders lack the ability to communicate their beliefs credibly or outsiders lack the ability to buy information, a potential market failure of the type identified by Akerlof (1970) results: Other things being equal, the proportion of over-valued firms seeking new outside equity will be greater than the proportion in the general population, leading outsiders to raise their expected probability that a firm is over-valued. This causes a decline in market value of firms.

The following example helps illustrate the role of an investment banker as a certifying agent by leasing its brand name. Consider a firm that has limited investment opportunities such that, given the scale economies associated with new issues, it will seek new equity infrequently (say, every t years). The bond provided by such a firm is non-utilized except in those infrequent periods when the firm elects to seek new capital. If instead it can lease the use of a bond from an underwriter for the period necessary for inside information to become public, then

a perpetuity of rental payments with frequency t can be substituted for a non-salvageable investment in the determination of the firm value (the virtual guarantee bond suggested by Klein and Leffler, 1981). Thus, n such firms could successively employ the underwriter's bonding investment over a single issue interval of t duration. In this manner, an underwriter can be perceived as a firm specializing in leasing the bonding investment to other firms seeking to raise capital.

In order to test the model's predictions, Booth and Smith developed a testable hypothesis regarding, among other things, the decision to use an underwriter and the amount charged for certification. The analysis provides evidence supporting the certification hypothesis by means of increasing firm value if bonding investments are made to certify the new issue price. In particular, the bond has a greater net benefit when issuing firms employ a specialist (say, an investment banker) who has made the requisite bonding investment.

Most notably, the mechanism works because the financial institution exploits its own established reputation and charges the issuing firm according to the magnitude of asymmetric information. On this topic, we can generalize the contributions of Stuart, Hoang and Hybels (1999) who document how the performance of young biotechnology firms is affected by an inter-organizational certification, or endorsement process, operating in the industry's strategic alliance and equity ownership networks, as well as through the connections between new ventures and the investment banks that underwrite their securities offerings. Several bodies of work followed from the above implications. Some studies examined new models based at least in part on the formal certification hypothesis (James, 1990; Blackwell et al., 1990). Others examined more specifically how financial institutions help to resolve the asymmetric information inherent in the IPO process (Johnson and Miller, 1988; Carter, 1990).

Meggison and Weiss (1991) bring consistent evidence that links the certifying hypothesis and the role played by VCs as better informed agents in the

competitive IPO market. They find that the involvement of a PE fund in an IPO leads to less underpricing. Their substantial contribution is proven by the broad literature aimed at testing their finding under different hypotheses and in different markets. Brav and Gompers (1997) investigate the long-run return for PE-backed (PEB) and non-PEB IPOs. They show that PEB public firms perform better than non-PEB ones; this provides evidence that the book-to-market ratio at the offering date significantly influences aftermarket performance. Dai (2007) finds that stock performance of VC-invested firms is significantly better than hedge-fund-invested firms both in the short run and in the long run. He concludes that coupling the positive role of VCs with substantial ownership, requested board seats and long-term investment works toward the presence of a certification effect.

Also noteworthy are contributions of authors who found different results. Arikawa and Imad'Eddine (2006) discover that only the largest four Japanese VCs have a significantly negative impact on underpricing, while the top three underwriters have a significant positive impact. Munsters and Tourani Rad (1994) have been unable to determine any certification effect for IPOs in the Netherlands. Although this field of study has captured the attention of many researches, as just shown, little work has focused on providing evidence of a certification effect in cases where VCs and PEs back SMEs that are not involved in IPOs. This creates the opportunity to improve previous studies by evaluating eligible variables that can untangle the effects of having such a financial institution certifying a private company's reliability, absent other public information. Therefore, we can test the following hypothesis:

Hypothesis 3 *There is a positive relationship between VC funding and the overall perception of stakeholders, captured by such economic variables as interest costs to total debt, trade credit and access to institutional credit.*

4 Methodology

We have seen in Section 3 that no single theory is able to explain the rationale of VC and PE contracts. Accordingly, in this section we try to draw on corporate finance theories and previous empirical evidence for clues in identifying a list of controls that will help address the hypothesis moved and their relations.

4.1 The determinants

To test for the determinants of VC and PE financing specifically for SMEs, we first must understand what are their main characteristics and which of them might play a relevant role in investment decisions (Cumming, 2006). Therefore, the purpose of this section, along with the theoretical predictions found in the literature, is to present a set of variables that might be suitable for our analysis.

In the field of economic research, it is common practice to use firms' youth and size as proxies for informational opaqueness (Bertoni et al., 2008). This creates a link to the two major outcomes of the well-known asymmetric information theory: adverse selection and moral hazard. Both may arise in any investment environment, but they seem particularly acute in entrepreneurial finance. With large established firms, investments are made safer by the use of existing assets as collateral and by the development of reputation. Collateral and reputation effects can mitigate the negative effects of both adverse selection and moral hazard. An entrepreneurial firm, however, is likely to lack assets to provide as collateral and a track record necessary to establish a reputation. The degree of asymmetric information is also likely to be high for firms whose assets are difficult to evaluate, such as those whose main asset is a new product yet to be launched on the market or those with a large proportion of intangible assets. Thus, the financial literature unsurprisingly contends that VC and PE investors, because of their superior scouting and monitoring capabilities, are able to deal effectively

with the problems of adverse selection and moral hazard (Cumming, Fleming, Schwienbacher, 2006; Nikoskelainen, Wright, 2007).

These first arguments help indicate which variables can serve our purpose. For the empirical analysis of the determinants of VC, we use the logarithm of firm sales (Size) as a proxy for company size. Age (in logarithm) is calculated based on the firm's date of incorporation. We use Intangibles, defined as the share of intangible assets over the sum of intangible and tangible assets, to proxy for the difficulty of external investors to evaluate the firm's activity. It was once considered a close estimate for a firm's efforts at innovation. The Size and Age variables have expected negative signs on the probability of VC and PE finance; that is, the lower the age and the size, the higher the probability. By contrast, Intangibles should have a positive sign; that is, we expect higher rates of Intangibles associated with backed firms.

Information asymmetry affects the decision of choosing internal or external capital. Contrary to the hypothesis of frictionless financial markets, as set forth by Modigliani and Miller (1958), inefficient equilibriums do arise. Consequently, firms adhere to a "pecking order" of sources for financing their investments (Myers and Majluf, 1984). They rely first on internal capital, the financing source with the lowest opportunity cost. After internal capital is exhausted, they turn to the external capital source with the lowest cost, which is usually debt (at least for firms with low leverage). As we have already discussed, however, SMEs (particularly innovative ones) have peculiar characteristics. Accordingly, Sau (2008) revises the pecking order, putting VC ahead of debt financing. On this basis, we introduce the variables Leverage and Short debt (in logarithm), respectively defined as the share of debt over the sum of debt and equity and the overall amount of short-term debt (both commercial and financial debt) granted to the company. As with Age and Size, we expect negative signs (for similar reasons).

An investor may also be interested in the firm's profitability and performance,

although the evaluation of such deals usually focuses on the prospects of future earnings. In consideration of the latter, we elect to use return on equity (ROE) as the basic measure of profitability. In this case, making any predictions on the sign would be difficult because conflicting interpretations coexist a priori: a high value may convey reassuring information on future returns to investors, but it also may be perceived as reflecting an abundance of internal resources, which is negatively related to the probability of venture financing. Furthermore, earnings before interest, taxes, depreciation and amortization (Ebitda) proxies for performance. Provided that it gives insights into the firm's ability to generate cash flows from its core activity, higher values are expected to raise the probability of financing.

Finally, from the strand of research that tries to find connections between VC and PE financing and the degree of innovation, both at aggregate and individual levels, we identify as additional variables of interest Growth (defined as the rate of change of sales for each company), Capex (defined as the rate of change of fixed assets) which proxies for firm investment and the High-Tech dummy, which takes the value 1 in industries with a high "innovative" content⁴. In this case we expect all these variables will have positive sign.

4.2 The effects

In the previous paragraph, we showed that theories regarding asymmetric information affect the characteristics of SMEs. This in turn can shape the sign of the relation between such characteristics and the probability of gaining backing by VCs and PEs. We will find that similar intuitions will drive the expectations regarding the eligible outcomes once the investment occurs. In the first instance,

⁴ Using the four-digit industry codes, we classify a firm as high-technology if it belongs to one of the following industries: chemical and pharmaceutical products, aerospace, electronic equipment, media, telecommunications, and software and hardware.

Ueda (2004) presents a model in which the VC and the entrepreneur are equally informed about the projects; such parity facilitates financing to firms with low collateral but exposes the entrepreneur to the risk that the VC will expropriate a project. Consequently, the model also predicts that after the deal, profits should increase to compensate the entrepreneur for this expropriation risk. Hence, some measure of profitability —such as ROE or return on assets (ROA)—should be comparatively higher than that of their similar firms. These ratios can nonetheless be undermined by other factors that arise after the involvement of the external investor, such as a striking increase in equity as recorded in the balance sheet or an ongoing campaign of asset acquisition.

Let us further develop our inquiry into the presumed impact of VC funding on innovation. Indeed, gathering evidence on the consequences of VC should help us find the direction of causality. If the VC First hypothesis dominates in the Italian case, then we should expect increases in Capex, Growth and Intangibles. The injection of capital would stimulate the acquisition of essential inputs, enabling the manufacture and marketing of the product. If, on the contrary, the Innovation First hypothesis dominates, we would expect neither the accumulation of tangibles assets (measured by Capex) nor Growth to continue after the deal. Instead, we should see figures that indicate a consolidation of these figures. The organization should already have the assets it requires, and it is mainly seeking to boost its sales.

In the Innovation First context, VCs and PEs can also serve as consultants, commonly for upgrading a firm's marketing and expanding its commercial networks. This is especially true for small firms. Both improvements help foster increased sales and respond to a firm's need to improve its results after periods of intensive investment campaigning or growth. VCs and PEs also bring with them new values (efficiency, for example) which they can transfer to backed firms. Under such circumstances, backed firms' Sales should have better results than non-backed firms. Moreover, in the case of turnaround or buy-out operations

(presumably for larger firms), we expect increased efficiency, which we proxy with the (log of) Value added per employee.

Finally, we remark on Hypothesis 3 concerning outcomes of VC and PE financing that can allow for the presence of certification effect. Practice tells us that when unambiguous measures of quality do not exist or cannot be observed, inter-organizational exchange relationships can act as endorsements that influence perceptions of the quality of young organizations. Consequently, the characteristics of a young firm's affiliates sometimes influence valuations of the firm. Because strong relationships with prominent organizations convey the perception that young companies have earned a positive evaluation from experienced and influential actors, associations with high-status organizations elevate new ventures' reputations. Therefore, endorsement by a VC or PE investor makes it easier for backed firms to obtain access to other external financial resources and to other tangible and intangible assets (for example, distribution channels, manufacturing facilities, sales force) possessed by other firms through the establishment of alliances (Colombo et al., 2006; Hsu, 2006). This latter effect further relaxes financial constraints on these firms, as they do not need to build these resources internally.

Accordingly, the first consequence of a relationship with prominent organizations would be a greater expected likelihood of survival. We should be able to trace beneficial effects in the perceptions of suppliers. Accordingly, Trade Credit, a measure in days that represents the average length over the fiscal year of the purchases, would likely increase. Nevertheless, Petersen and Rajan (1997) provide striking evidence for different correlations. They find Trade Credit to be linked to access to bank credit in a way that suppliers could substitute for financial institutions. This is because suppliers have an advantage over traditional lenders in investigating the credit worthiness of their clients, as well as greater ability to monitor and force repayment of credit. Consequently, under this setting, the expected result from our analysis would have a negative sign.

Similar consideration could also apply to the measures related to debt (Debt short and Debt, calculated in logarithm terms), which we consider here as other components of the certification effect. We have already encountered a series of contributions examining the financial constraints on SMEs. According to these studies, VCs and PEs can exploit their established reputations to certify backed firms, and so improve the firms' credit ratings. This can result in the firm gaining broader and better access to bank funds. We can reach opposite findings, however, when interpreting VCs and PEs in their role of helping to rebalance a firm's financial structure. If this certification theory is valid, we would expect to see lower values for both Debt and Debt short. To test whether backed firms improve their credit standing, we apply a definition of 'cost of debt' (Financial Expenses) expressed by the ratio of 'interest costs' to 'total debt'⁵. Hyytinen and Pajarinen (2007) identified this ratio. A negative sign, in particular, coupled with an increase of debt, would give clear evidence of better conditions applied to backed firms, which in turn would indicate the presence of the certification effect.

4.3 The econometric setup

In order to test the outlined hypothesis, we rely on econometric techniques applicable to panel data. This allows us: (1) to control for unobservable individual heterogeneity; (2) to use a large amount of information, including many companies and several years' history for each company (thus increasing the degrees of freedom and reducing colinearity between the explanatory variables); and (3) to analyze the evolution of the variables in a group of companies.

A logarithmic transformation has been applied to most of the variables. This procedure provides such beneficial effects steadying the variance, reducing

⁵ This ratio underestimates actual debt costs because the scaling variables ('total debt') include items that are not interest bearing.

multiplicative effects into additive ones and normalizing distributions. Since the transformation is not feasible when there are null and negative values, we add 100 to each value and then calculate their logarithms. In particular, this was done for variables obtained as variations between two sequential periods such as Growth, Capex and ROE.

4.3.1 Econometric setup for the determinants

In this section, we present a multivariate analysis to test Hypothesis 1 that will allow us to quantify the importance of the determinants for financing through VCs and PEs. Based on the theoretical predictions regarding the variables that should affect the likelihood of external funding, we estimate various versions of the following probit model:

$$\begin{aligned} \Pr(\text{Backed}_{i,t} = 1) = & F(\beta_1 \text{Age}_{i,t-1} + \beta_2 \text{Size}_{i,t-1} + \beta_3 \text{Size}_{i,t-1}^2 + \beta_4 \text{Intangibles}_{i,t-1} \\ & + \beta_5 \text{Ebitda}_{i,t-1} + \beta_6 \text{ROE}_{i,t-1} + \beta_7 \text{Leverage}_{i,t-1} \\ & + \beta_8 \text{High-Tech}_{i,t-1} + \beta_9 \text{Capex}_{i,t-1} + \beta_{10} \text{Growth}_{i,t-1} \\ & + \beta_{11} \text{Short Debt}_{i,t-1} + \kappa_i \text{Area} + \eta_i \text{Year}) \end{aligned} \quad (1)$$

The multivariate probit model uses Backed as a discrete variable representing a choice from a set of mutually exclusive choices: it equals 1 when firms are backed and 0 otherwise. Yet to be described are controls Area and Year. The former focuses on geographical characteristics that may be involved in the investment decision. The firms are divided into three groups according to the location of their registered offices: the macro regions identified are north, center and south. This strategy joins the procedure for the selection of the control group described in Section 4.1. Finally, Year includes the years when the funding deal occurred and controls for specific common effects.

4.3.2 The econometric setup for the effects

In this section, we present the procedure adopted to analyze the performance—in terms of various balance sheet indicators—of backed firms relative to the companies that did not receive this form of financing. For the main accounting and financial variables (denoted $y_{i,t}$), we estimate the following fixed-effect regression:

$$y_{i,t} = \alpha + \beta_1 Deal0 + \beta_2 Deal13 + u_i + d_t + \varepsilon_{i,t} \quad (2)$$

where *Deal0* is a dummy variable that takes value 1 in the year of the deal. If the firm is financed more than once in our sample period, the dummy takes value 1 more than once, specifically in the year of each operation. *Deal13* is a dummy equal to 1 in the three years after the deals, which is considered the average holding period for the VC industry.

Regarding the estimation method, there is a discussion as to whether the individual effects should be treated as fixed or random variables. This is not an important distinction, however, because we can always treat the individual effects as random variables without loss in generality (Woolridge, 2002). It is critical, however, to determine whether these individual effects are correlated with the variables observed. To test for the existence of this correlation, the Hausman (1978) test is usually used. If this test does not reject the null hypothesis that the individual effects are not correlated with the explanatory variables, the most suitable estimation would then be the random-effects model and the best estimator would be Balestra and Nerlove's (1966) generalized least squares estimator. If the null hypothesis is rejected, the within groups ordinary least square estimator would then be the most suitable estimator. More intuitively, implementing a fixed effect regression allows us to control for firm-specific characteristics that are time-invariant but that could be correlated with the deals, such as industry or managerial quality.

5 Dataset and descriptive analysis

5.1 Dataset

The first step was to construct a solid database of firms that received some sort of external financing and for which separate financial accounts exist. Turning to the Italian PE and VC Association newsletter, we were able to identify names of most of the actors involved in the Italian market. Only privately held VCs and PEs were considered; thus, all deals carried out by publicly controlled investors, such as agencies for regional development, were excluded. This is consistent with the research's goal of providing evidence for the VC and PE industry alone. We also excluded all deals not characterized by direct investor involvement, such as acquiring shares of a fund of funds that has as general priority of portfolio diversification. The key objective of this research is to outline a general framework for investment deals realized by VCs and PEs with respect to Italian SMEs; accordingly, foreigner investors operating in Italy were included.

In cases where the information about a deal was not published on the investors' web site, we resorted to ad-hoc databases such as Zephir (© Bureau Van Dijk Electronic Publishing), which specializes in reporting information on merger and acquisition activity, joint ventures and PE deals. For the period 1997-2007, a dataset of 730 deals resulted, including some firms with more than one stage of financing.

To identify a threshold of what to consider as SMEs, we looked at the criterion established by the European Commission, which states⁶:

A medium-sized enterprise is defined as an enterprise which employs fewer than 250 persons and whose annual turnover does not exceed €50 million or whose annual balance-sheet total does not exceed €43 million. A small enterprise

⁶ See Commission Recommendation 2003/361/EC of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises [Official Journal L 124 of 20.05.2003].

is defined as an enterprise which employs fewer than 50 persons and whose annual turnover and/or annual balance sheet total does not exceed €10 million. A micro-enterprise is defined as an enterprise which employs fewer than 10 persons and whose annual turnover and/or annual balance sheet total does not exceed €2 million.

At this stage, we decided to focus only on industrial firms. As Booth and Smith (1986) note, public utilities and banking firms operate in regulated sectors; accordingly, the authors suggest, these firms should show different patterns of firm-specific risk. Moreover, due to regulation, these industries tend to have limited certification costs, one of the very issues this research aims to examine. The presence of leveraged buy-out operations (LBOs) required special attention to the correct identification of the legal entity entitled to issue representative balance-sheet data. If a reverse merger scheme occurred, the target company was the entity of interest; in case of a forward merger scheme, we looked for the balance sheets of both the spinoff (NewCo) and the target company.

In light of the above concerns, we filtered the constructed group of firms and obtained a final sample of 160 VC/PE-backed companies. This number also reflects the availability of sufficient financial data in the database AIDA⁷. Common problems, such as the lack of a sufficient number of observations for each firm and the exclusion of some from the database itself, prevented the sample from being bigger. This may likely be a direct consequence of our focusing on SMEs because looser disclosure policies might apply. Manigart et al. (2005) bolsters this intuition, finding clear evidence that firms generally switch to a higher disclosure policy just one year before a stake acquisition by a PE investor. For a control group, we matched each company in the sample group with a

⁷ © Bureau Van Dijk Electronic Publishing. The financial data are provided by Honeyvem (www.honeyvem.it), which acquires and revises the balance sheets deposited in the Italian Chambers of Commerce. For each company, AIDA includes in a single document the figures of the previous 10 years, or less depending on availability, and adds information on shareholdings and management for the first 20,000 Italian firms.

company with similar characteristics but that had not received VC or PE funding. The control group was selected according to the following method: (1) We picked all companies active in the same region to control for the economic growth in that particular context; (2) We selected those companies that belonged to the same activity sector using the ATECO 2002⁸ codes in four or six digits, depending on the case; (3) We filtered for companies that had similar sales revenues in the year of the funding event; and (4) Finally, we selected the company that was closest in age to that of the sample. In many cases, we found a company established the very same year.

Because growth patterns of companies differ at various stages of development, we classified the VC-PE backed firms and their respective control firm into three groups: startup, growth and late-stage financing. The startup group includes firms that receive the first round of VC funding from the startup point to the moment they reach break-even. The growth stage group includes those firms with track records of earnings, and that receive their first rounds in order to finance expansion through capital increases. Late-stage investments includes buyouts, turnaround and replacement capital deals, which do not generally involve entries of fresh money into firms⁹. The same intuition may apply equally when comparing smaller firms and bigger firms; accordingly, within the sample and the

⁸ ATECO 2002 is the classification proposed by the Italian Institute for Statistics (ISTAT) aligned with the European counterpart, NACE. Under this classification, different economic activities are grouped in sections, subsections, branches, groups, classes and categories. For most of the sample, we were able to identify a control company active in the same region and in the same category of activity. Another classification system, ATECO 2008, became available as of the beginning of 2008; it substitutes a single activity code for the different ones that had been used for statistical purposes and fiscal purposes.

⁹ In cases where there is not public information available, we use the firm's age as a proxy for the stage of investment. In particular, we define early-stage investments as investments of a VC in firms no more than three years old. As a mere approximation, it may fail to state the real nature of the deal. A longer duration between foundation date and beginning of VC involvement, however, makes it more difficult to take into account the initial founding characteristics as crucial determinants for firm growth.

control groups, we divided the firms with total assets of less than €10 million in their first year of presence in the database from those with a value above this threshold amount.

The methodology adopted has some drawbacks that relate mainly to using only public data. Many other studies send questionnaires directly to VCs and PEs to acquire more in-depth information regarding an investment's financing terms, firms' equity ownership and contingencies to future financing. The validity of the samples obtained, however, might be affected by: (1) survivorship bias, in that the survey is delivered only to investors who are still in business and (2) positive bias, because it is likely VCs and PEs report performance only of those firms that are doing well. Conversely, our dataset potentially addresses these issues because it includes information for firms that are either undertaking winding-up procedures or did not perform well. Nevertheless, as already mentioned, we could not track down the financial data of every company for two main reasons: (1) the sources at our disposal were not comprehensive about all the activities and (2) especially for SMEs, some companies are reluctant to publish financial data because of production and publishing costs and because publication and distribution of such information risks raising awareness among its own competitors.

5.2 Descriptive analysis

Table 1 provides an overview of the Italian market for VC and PE, as captured by the firms in our dataset over the survey period 1997-2008. It is showed how the industry behaved by geographical distribution, type of investment and predominant activity sector. Not surprisingly, northern Italy shows a high level of entrepreneurship (101 deals) with Lombardia leading all of Italy in terms of investments attracted. Central Italy accounts for 32.5% of the market, with Emilia-Romagna and Toscana playing significant roles. Southern Italy is characterized by a low level of interest by VCs and PEs. Campania, Puglia and

Basilicata saw only one investment each, and Calabria three. We did not include publicly controlled investors in our survey, however, and so the flow of investments for southern regions should be considered underestimated.

Not surprisingly, Table 1 shows that sectors with high potentials for innovation were preferred targets for backing. The electric, electronic, and optical machinery and equipment sector, by its very nature, is involved in activities more prone to be technology driven. This is particularly true for companies working in fields such as IT solutions for firms and consultancy services, where intellectual capital is fundamental. In the more traditional industrial sector of mechanical machinery and equipment, there is a broad range of activities that imply an intensive use of technology.

Panel A of Table 2 reports the summary statistics of the control sample. The data are averages over the period before the involvement of the external financier. The time span considered is not constant over the firms, but is calculated on the first year each firm is present in the database and the year its deal occurs. The median firm of this group records sales of €12.2 million, total assets of €10.4 million, 50 employees and is 20 years old. Intangible assets represent less than 5% of intangibles and fixed assets. Regarding profitability, the return on equity is 9%, and the median added value per employee is €51,000. In terms of financing, the sample shows a high degree of leverage (defined as the ratio of debt over the sum of debt and equity), mainly related to short-term debt (defined as the sum of commercial and bank debt due within 12 months).

Panel B reports statistics for backed firms. For each variable, an asterisk (*) indicates that the difference between the control sample mean and the backed firms' sample mean is significant at the level of 5%. Backed firms are generally younger (18 years old). They also tend to be bigger. The median firm has higher sales (€13.2 million) and more total assets (€11.9 million) and employees (61). This differs from the suggestions of theory and empirical evidence from the US. Combining these results with the reported means (column two), it can be argued

that there are few big firms that press the averages up. Indeed, in the backed-sample there is a wider dispersion—as measured by the difference between the 99th and 1st percentiles—of the variables that proxy for size. Regarding profitability, ROE and Value added per employee show better performance, though the difference for ROE is not statistically significant. Intangibles are discernibly higher; assuming that Intangibles can proxy for innovation, this result may strengthen the intuition that backed firms tend to be more innovative. The lower level of Leverage is statistically significant; both in terms of overall level and in the short term, the median firm relies less on debt. Trade credit, which is a variable of interest when investigating for the certification effect, lasts longer for backed firms. This is consistent with the intuition pursued by Petersen and Rajan (1997), who find that small firms that lack broad access to credit from financial institutions exploit much more trade credit, while firms with better access to credit offer more trade credit. In confirmation of this view, Debt service for backed firms is discernibly higher than for non-backed firms. This also indicates that backed firms carry greater interest expenses than non-backed firms. Panels C and D focus on the sample's subgroup of large firms. The comparison indicates that backed-companies are younger and bigger, which conforms to results shown in previous panels. Moreover, they show better performance results, though ROE is again not significant. Intangibles remain higher, hinting at a more innovative attitude. Contrary to the evidence for smaller firms, large backed-firms are more indebted than those in the control group. Short-term debt represents the most important source of financing for both groups since the difference is not significant. It is noteworthy that both backed-subgroups grow less in terms of variation of sales, while the better level of marginality is reassuring.

Summing up, the descriptive analysis shows that backed firms are younger, grow less, have a larger share of intangibles and are less profitable. Larger firms also have higher levels of indebtedness than the control sample.

6 Empirical analysis

6.1 The determinants of VC financing

Table 4 presents the results obtained by estimating equation (1). In column (a), attention is confined to the variables with coefficients from β_1 to β_8 (controlling for geographical area and time dummies). This is done in order to maximize the number of observations on which estimation is performed. In fact, employing variables such as Capex and Growth would imply a loss of observations given that they are calculated over year $t-1$.

Consistent with the theories of asymmetric information, the signs of Size and Age are negative; the existence of a non-linear relation between the probability of receiving external capital and size also emerges. For the variable Intangibles, both the sign and the statistical significance are positive. (We will elaborate below on the intuition that banks are more keen to grant credit to firms with higher liquidation value of assets.) For profitability, Ebitda appears to be an important determinant; we can anticipate that its sign and magnitude will be constant in all the model's specifications. Given that Ebitda is a measure widely used in the financial industry to assess a company's value (e.g., the "multiples approach"), this result can be considered consistent with the current state of the art. Conversely, investors seem not to rely much on ROE results and see other variables as more important predictors of a firm's future performance. From its negative sign we conclude that internal finances are insufficient and are curbing the firm's investment decisions, and hence its growth opportunities. (In this way, we would strengthen the theory of Carpenter and Petersen, 2002a). Finally, the negative sign of Leverage supports the intuition that predicts a higher demand for VC finance by firms that encounter more difficulties in accessing debt financing.

We check the robustness of these results in various ways. We re-estimate specification (a) using different variable lags. In particular, if the variables are entered with a lag of one year (results not reported), the basic results are

confirmed. The exceptions are Size and Leverage, which become insignificant. Column (b) of the table reports the results obtained by estimating the richer model for the whole set of variables reported in equation (1). In particular, we introduce Capex and Growth to measure the firm's expansion and Short debt to capture the access to credit. Results confirm that firms that are younger, smaller and have higher proportions of intangibles assets in their balance sheets are more likely to be financed. Leverage is still significant, though at 10% of significance, the dummy High-Tech and ROE are still not significant. Regarding the added variables of specification (b), we find contrasting evidence between the two determinants chosen to proxy for firm expansion: while Capex is positive and not significant, Growth is positive and significant. Accordingly, it is possible to argue that the firms that have as their most valuable asset their knowledge are more likely to gain VC financing. Finally, we find Short debt to be negative and statistically significant. This constitutes solid ground to state that firms with less access to channels of traditional funding will more likely seek capital through issuing equity.

Column (c) shows the results when data for early stage financing are withdrawn. The estimates are consistent with the previous models, except for Leverage, which becomes not significant and changes its sign.

6.2 Differences according to firm size

As already outlined, attitudes of smaller companies may differ substantially from those of bigger ones. Thus, this part provides the same kind of estimations as in the previous section, but applied to a different data sample, firms with total assets of more than €10 million. We run estimations only for specification (a) and (b) because there are no firms in this subgroup that are eligible for early stage financing deals. Moreover, given the sort of firms that we are considering, we see PEs as the main potential backers.

Column (a) presents the estimates for the first block of variables. There are striking differences, such as Age is no longer significant and High-tech is both positive and significant. The first outcome reasonably highlights the positive relation between size and age, where older firms are more likely to be bigger. The second outcome provides a new intuition according to which PEs invest mainly in consolidated high-tech firms that already have feasible markets for their products; this supports the Innovation First hypothesis. Applying this finding, we can understand the lack of significance of High-tech in the case of smaller firms.

Adding the second block of variables does not change the results set forth in the previous paragraph. Conversely, it allows us to draw a final comparison between the two richer models. The estimations show important changes, such as the loss of significance for both Growth and Short debt when compared to column (b) of panel B. A conceivable explanation for the change to Growth, is that firms could operate in mature markets and a PE fund's investment is driven by the need to renew the board of directors or to restructure the company in anticipation of a new phase of expansion. Regarding Short debt, bigger firms have greater access to bank credit; accordingly, short-term debt cannot be a key driver for attracting external capital.

6.3 The effects of VC and PE financing

Table 6 reports the estimates for equation (2) for smaller enterprises against larger firms. We start by addressing the profitability of SMEs. ROE drops with respect to the other firms in the interim period (i.e., from $t+1$ to $t+3$). We confirm this by applying another measure for profitability, ROA, which is negative and statistically significant. At a first glance, this seems to convey bad news. If, however, we couple the estimate of ROA with Total assets, more reassuring evidence emerges: after their deals are sealed, backed firms went through periods of significant investment which shrank the index by increasing the denominator.

As Intangibles shows, the investments applied to both kind of assets.

We tried to untangle the effect on backed firms' performances by using such variables as Sales and Value added per employee. Both have positive signs. The presence of the VC or PE seems to enhance sales effectively during the interim period. As we have already argued, we find that this is due to additional consultancy services provided by the external professional investors. Value added is statistically significant, however, only in the year of the deal. We can try to explain this by looking at the outcome of the variable Employees, which has a positive and significant difference in the first year but not subsequently. Hence, assuming that Employees' role as relative proxy for performance reflects this, we find a sound justification for the change in significance, namely the increased number of employees. Unfortunately, if we assume that this relationship is valid, we cannot outline any interpretation for efficiency.

The next block of three variables allows us to comment on whether the presence of an external financial institution also plays an important role in generating a certification effect. One view is that backed firms gain greater access to credit, and this is shown by the variable Debt, which is positive. This is an important difference because we saw that this was not the case in the ex ante analysis. Moreover, the proxy we use for cost of debt (Financial expenses) has a significant and negative coefficient; this leads us to argue that with the entrance of a professional investor, the firm's credit rating improves and it is charged lower interest rates. Finally, Trade credit is negative and significant. To explain this, we again apply the theory and evidence brought by Petersen and Rajan (1997), which establish a negative relation between the amount of credit granted and the exploitation of trade credit as a form of funding. Accordingly, we conclude that VCs and PEs do in fact help generate certification effects for small firms.

For larger firms, the trends for most of the variables are similar. The variable Debt, however, lends itself to different interpretations that leave some open questions. When comparing results to those of smaller firms, Debt is not

significant during the first period while it becomes so during the following period, though with a smaller magnitude. One could argue that this indicates a need for the intervention of the external financier in rebalancing the financial structure. Nonetheless, large firms that have successfully dealt with PEs often undertake structured operations such as management buyouts (MBOs) or leveraged buyouts (LBOs) that imply a high use of leverage, which then usually shows on the balance sheet. Though this might explain the positive coefficient, our database does not provide us with sufficient information to untangle this issue.

As a final remark, the evidence of pre-backing and post-backing performance combine to show a significant correlation between growth and the probability of VC backing. Accordingly, our data seems to validate the Innovation First hypothesis over the VC First hypothesis. Funding tends to occur after a period of higher than average investment and growth. On the other hand, the rate of change of fixed assets (Capex) decreases, and we cannot assume that the rate of growth for sales is higher than for the control group. These argue for the intuition that VC and PE funding lead firms to consolidate their results, rather than spur them to further innovation and growth.

7 Conclusions

In this paper, we study the characteristics of the relationship between SMEs and VC and PE investors by means of a database that includes 160 funding deals signed in Italy. The empirical analysis has shown that VCs are more likely to step in for firms that are younger, smaller and more endowed with intangible assets than the average. Additionally, it hints at their positive role when asymmetric information problems are of utmost importance and there is broad scope for adding value.

At the same time, the ex post analysis indicates that smaller firms benefit

from VCs. Compared with the control group, they achieve better results in terms of sales, employment and expenditures on innovation. Moreover, considering that the capital infusions appear to be more frequent after periods of higher than average growth and investment, we can argue that larger firms resort to PE with the aim of consolidating their performances. Accordingly, firms value the additional consultancy services that PEs bestow.

We also tested the hypothesis of VCs and PEs as certifying parties. Departing from the traditional background of IPO underpricing, which has been widely investigated, we outlined a new framework based on a cluster of balance sheet indexes. Thus, the original contribution of this study is, in our view, the confirmation of the presence of the certification effect under new circumstances and applying to SMEs, which are seldom considered. To test our results with greater reliability, however, it would be advisable to extend the analysis over a wider geographical area and to verify whether there are similar patterns across different countries.

Finally, the empirical evidence bolsters the thesis that VC backs innovative businesses rather than supports new entrepreneurial ideas from scratch. From a practical viewpoint, it highlights the limits of private initiative only (embodied here by VCs and PEs) in encouraging innovative companies, and leaves to policymakers the task to bridge the gap. Not surprisingly, this is also the position expressed in several official documents issued by the European Commission. In line with the above, we suggest as a future line of research the further investigation of the characteristics of the Italian financial system with an eye to factors that inhibit VC from achieving its full potential. (The experience of Anglo-Saxon countries indicate that this could be attained under proper regulations). This research could include an assessment of the performance of state-owned regional agencies and the role of universities as incubators. Although we did not include these two sorts of organizations in our survey, we perceive their contributions as fundamental supports to startup businesses.

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Annexes

Table 1: Characteristics of backed companies

Distribution by Sector of Activity	Hiring services, IT solutions, research e-services for firms	29	18%	Geographical distribution	North	101	63%
	Electric, electronic, optical machinery and equipment	21	13%		Center	52	33%
	Mechanical machinery and equipment	19	12%		South	7	4%
	Wholesale and retail trade	14	9%		Total	160	100%
	Food and tobacco	12	8%	Stage of financing	Early stage	13	8%
	Metallurgy	11	7%		Expansion	62	39%
	Chemistry	8	5%		Late stage	85	53%
	Others	46	29%		Total	160	100%
Total	160	100%					

Source: Our analysis

Table 2: Descriptive statistics (Panel A, Panel B)

Variable	Number of obs.	Median	Mean	Std. dev.	1st percentile	99th percentile
Panel A: Control sample SMEs						
Age	160	20	23.8	14.9	6	94
Sales (€ mln)	673	12.1	16.2	14.1	0.6	59.8
Ebitda (€ mln)	673	0.9	1.55	21.9	-3.3	9.3
Total assets (€ mln)	673	10.4	14.7	149.0	0.5	71
Equity (€ mln)	673	1.9	3.4	0.0	43.1	19.3
ROE	658	9	11.8	25.9	25.9	91
Intangibles (€ mln)	672	0.1	0.4	10.7	0.0	5.8
Tangibles (€ mln)	673	1.1	2.7	43.3	0.1	23.2
Leverage	673	0.7	0.8	0.17	0.3	0.99
Debt (€ mln)	673	6.3	10.2	12.0	0.3	55.9
Debt short (€ mln)	673	5.5	9.0	115.0	0.0	55.9
Gross margin (€ mln)	673	2.7	4.3	52.5	0.03	33.3
Debt service (€ mln)	673	0.1	0.3	4.1	0.01	1.87
Corporate taxes (€ mln)	673	0.2	0.47	7.3	-0.02	3.6
Growth	574	7.6	17	62.2	-80.3	207.9
Number of employees	648	50.0	85.1	113.2	2	601
Value added x employee	661	51.0	59	37.5	2	263
Capex	527	-0.2	39.3	806.0	-77	110
Trade credit	671	97.5	99.0	98.3	0	434
Net profit (€ mln)	654	0.3	0.6	11.1	-0.2	4.9
Panel B: Backed SMEs						
Age	160	18	21.4*	15.5	2.0	71.0
Sales (€ mln)	573	13.2	18.9*	180.1	0.0	83.9
Ebitda (€ mln)	572	1.7	2.6*	28.5	-1.5	12.8
Total assets (€ mln)	568	11.9	19.7*	27.0	0.3	141.0
Equity (€ mln)	572	3.1	5.2*	72.7	0.0	31.5
ROE	565	12.9	11.6	59.2	-102.7	81.5
Intangibles (€ mln)	567	0.21	1.3*	30.3	0.0	16.4
Tangibles (€ mln)	574	1.4	3.7*	62.8	0.0	25.8
Leverage	571	0.7	0.7*	0.2	0.1	1.0
Debt (€ mln)	572	6.1	9.4*	228.0	0.1	99.0
Debt short (€ mln)	567	5.5	8.9*	131.0	0.0	59.2
Gross margin (€ mln)	572	3.8	6.05*	7.2	63.0	44.7
Debt service (€ mln)	573	0.2	4.4*	7.2	0.0	3.2
Corporate taxes (€ mln)	574	0.4	0.66*	8.7	-0.4	4.4
Growth	471	10.5	15.6	42.2	-92.5	191.2
Number of employees	571	61	107*	13.1	4.0	560.0
Value added x employee	529	56	67*	47.8	0.0	251.0
Capex	449	26	36	71.1	-7.9	146.0
Trade credit	577	109.4	121.1*	150.0	0.0	93.6
Net profit (€ mln)	564	0.3	0.6	13.9	-2.0	4.9

In Panel A, data refer to the control sample of SMEs. In Panel B, data refer to SMEs that received financing. * indicates that a test of the equality of means between the control sample and the backed sample is rejected (at least at 5%).

Table 2: Descriptive statistics (Panel C, Panel D)

Variable	Number of obs.	Median	Mean	Std. dev.	1st percentile	99th percentile
Panel C: Control sample - large firms						
Age	160	21	24.8	14.9	6	94
Sales (€ mln)	815	25.8	27.5	15.0	2.2	0.3
Ebitda (€ mln)	815	2.1	29.7	37.0	-3.3	18.2
Total assets (€ mln)	815	23.2	27.5	191.2	6.2	104.0
Equity (€ mln)	815	5.1	7.1	62.8	0.1	34.2
ROE	801	8.0	9.3	21.3	-63.0	62.0
Intangibles (€ mln)	814	0.2	0.9	24.0	0.0	13.9
Tangibles (€ mln)	814	2.8	5.5	87.6	0.6	47.8
Leverage	673	0.7	0.7	0.17	0.3	0.99
Debt (€ mln)	815	13.7	18.5	17.3	1.6	86.3
Debt short (€ mln)	815	11.4	16.0	164.1	1.1	84.3
Gross margin (€ mln)	815	5.9	7.4	5.6	0.3	27.7
Debt service (€ mln)	815	0.3	0.5	5.5	0.1	2.6
Corporate taxes (€ mln)	815	0.5	0.8	9.2	-0.6	2.9
Growth	815	18.7	30.5	351.3	1.2	64.5
Number of employees	786	110.5	134.3	119.1	14.0	783.0
Value added x employee	801	57.0	65.3	37.1	11.0	229.0
Capex	727	-1.1	32.8	28.7	-84.5	445.5
Trade credit	815	107.0	120.4	91.0	0.0	463.9
Net profit (€ mln)	796	0.4	0.7	16.8	-4.3	6.1
Panel D: Backed-large firms						
Age	160	19	22.4*	15.5	2	71
Sales (€ mln)	1627	26.1	29.8*	23.8	0.5	99.3
Ebitda (€ mln)	1625	25.7	3.5*	43.1	-3.9	20.4
Total assets (€ mln)	1626	25.0	33.3*	297.2	5.7	146.0
Equity (€ mln)	1626	6.4	9.1*	10.0	-0.1	50.4
ROE	1600	7.0	7.1	44.6	-0.1	84.0
Intangibles (€ mln)	1625	0.4	3.5*	90.2	0.0	47.8
Tangibles (€ mln)	1624	3.2	6.3*	93.5	0.06	43.6
Leverage	571	0.6	0.7*	0.2	0.1	1.0
Debt (€ mln)	1626	14.7	21.9*	24.2	2.1	129.0
Debt short (€ mln)	1626	11.9	17.2	17.6	1.6	92.8
Gross margin (€ mln)	1625	6.5	8.6*	7.5	-0.3	39.9
Debt service (€ mln)	1625	0.4	0.6*	9.2	0.03	4.0
Corporate taxes (€ mln)	1627	0.6	0.9	1.1	-0.9	4.6
Growth	1627	11.4	13.9	1.8	9.9	17.3
Number of employees	1594	113.0	145*	3.6	9.0	809.0
Value added x employee	1544	60.0	68.13*	4.1	0.0	234.0
Capex	1432	-0.1	37.6	38.8	-0.8	0.4
Trade credit	1634	109.5	125.3*	106.6	0.0	466.0
Net profit (€ mln)	1594	0.4	0.6	261.3	-6.8	6.2

In Panel C, data refer to the control sample of large enterprises (defined as those with at least €10 million of total assets). In Panel D, data refer to large firms that were financed. * indicates that a test of the equality of means between the control sample and the backed sample is rejected (at least at 5%).

Table 3: Variable definition

<i>Age</i>	log of age
<i>Size</i>	log of total sales
<i>Intangibles</i>	ratio of intangible over the sum of intangible and fixed assets
<i>Ebitda</i>	log of Ebitda
<i>Leverage</i>	debt over the sum of debt and equity
<i>ROE</i>	profit over equity
<i>High-tech</i>	dummy equal to 1 for companies in high-tech sectors
<i>Capex</i>	rate of change of fixed assets
<i>Growth</i>	rate of change of sales
<i>Short debt</i>	log of total short-term debt
<i>Total assets</i>	log of total assets of the firm
<i>Employees</i>	log of total number of employees
<i>Value added x employee</i>	ratio of value added over number of employees
<i>Trade credit</i>	(average of commercial debt over purchases) x 360
<i>Financial expenses</i>	ratio of interest costs over total debt

Table 4: Determinants of investment decisions

Variable	SMEs			Variable	Large firms	
	(a)	(b)	(c)		(a)	(b)
Age	-0.311 *** (0.112)	-0.382 *** (0.121)	-0.382 *** (0.121)	Age	-0.129 (0.148)	-0.181 (0.152)
Size	-2.315 * -1.258	-3.128 *** -1.394	-3.12 *** -1.394	Size	-12.581 ** -5.422	-10.544 * -5.614
Size ²	0.061 (0.039)	0.082 ** (0.042)	0.082 ** (0.042)	Size ²	0.358 ** (0.160)	0.300 * (0.165)
Intangibles	0.572 *** (0.242)	0.773 *** (0.259)	0.773 *** (0.259)	Intangibles	0.629 *** (0.327)	0.810 ** (0.340)
Ebitda	0.429 *** (0.101)	0.582 *** (0.104)	0.582 *** (0.104)	Ebitda	0.478 *** (0.157)	0.642 *** (0.160)
Leverage	-0.544 * (0.329)	-0.424 * (0.309)	0.11 (0.605)	Leverage	-0.375 (0.469)	0.056 (0.809)
ROE	-0.002 (0.002)	-0.001 (0.001)	-0.001 (0.001)	ROE	-0.001 (0.001)	-0.001 (0.001)
High-tech	0.113 (0.131)	0.143 (0.138)	0.143 (0.138)	High-tech	0.365 ** (0.187)	0.323 * (0.193)
Capex		0.0001 (0.0003)	0.000 (0.000)	Capex		0.001 (0.000)
Growth		0.002 * (0.001)	0.002 ** (0.001)	Growth		-0.001 (0.001)
Short debt		-0.470 ** (0.171)	-0.470 * (0.171)	Short debt		-0.255 (0.380)
Number of Obs.	492	453	448	Number of Obs.	268	251
Pseudo R ²	0.1519	0.1625	0.1883	Pseudo R ²	0.1501	0.1296
Observed probability	0.000	0.000	0.000	Observed probability	0.000	0.000

Probit regression results for the probability of VC and PE finance. The dependent variable is 0 if the company is not financed and 1 in the year of the deal. (Firms are dropped after the first deal.) The regressors are lagged one year. Column (a) reports the regression for coefficients from 1 to 8. Column (b) reports the whole model. Column (c) reports the whole model once early stage deals are dropped. The Large firms panel reports only the first two specifications. *** indicates a significance level of 1% or less; ** indicates a significance level between 1 and 5%; * indicates a significance level between 5 and 10%.

Table 5: Correlation coefficients

Variable	Age	Size	Total assets	Intangibles	Ebitda	High-tech	Leverage	Debt short	Capex	Growth
Age	1.000									
Size	0.195 *	1.000								
Total assets	0.226 *	0.877 *	1.000							
Intangibles	-0.224 *	-0.075 *	0.024 *	1.000						
Ebitda	0.204 *	0.758 *	0.739 *	-0.047 *	1.000					
High-tech	-0.157 *	-0.073	-0.063	0.206 *	-0.061	1.000				
Leverage	0.058	-0.072	-0.053	0.021	-0.230 *	0.024	1.000			
Debt short	0.215 *	0.825 *	0.897 *	-0.003	0.610 *	-0.021	0.319 *	1.000		
Capex	-0.015	0.022	0.044	-0.083 *	0.012	0.028	-0.018	0.030	1.000	
Growth	-0.149 *	-0.087 *	-0.145 *	0.009	-0.102 *	-0.001	0.117 *	-0.070	0.080 *	1.000

Table 6: Effects on backed firms

Variable	SME				Large firms			
	Number of obs.	Year 0	Years 1-3	F-test	Number of obs.	Year 0	Years 1-3	F-test
ROE	2817	-2.252 -2.272	-4.820 ** -1.993	3.07 **	1600	-5.034 -3.529	-4.181 -3.016	1.66
ROA	2791	-0.009 ** (0.003)	-0.011 *** (0.003)	7.01 ***	1584	-0.018 *** (0.005)	-0.017 *** (0.004)	12.01 ***
Total assets (log)	2851	0.198 *** (0.041)	0.292 *** (0.035)	38.82 ***	1626	0.142 *** (0.040)	0.148 *** (0.034)	13.12 ***
Intangibles	2847	0.044 *** (0.010)	0.044 *** (0.009)	16.94 ***	1622	0.028 ** (0.012)	0.031 *** (0.010)	6.20 ***
Ebitda	1574	0.122 ** (0.047)	0.155 *** (0.055)	6.22 **	1508	0.065 (0.06)	0.011 (0.051)	0.59
Sales	2884	0.060 (0.044)	0.236 *** (0.031)	18.37 ***	1619	0.041 (0.051)	0.128 *** -43	4.42 **
Employees	2809	0.024 (0.036)	0.221 *** (0.031)	25.07 ***	1593	-0.074 * (0.041)	0.074 *** (0.034)	10.08 ***
Debt short	2783	0.027 (0.046)	0.172 *** (0.040)	9.03 ***	1623	0.015 (0.054)	0.091 ** (0.046)	1.95
Value added x employee	2768	0.092 *** (0.034)	0.032 (0.029)	3.88 **	1562	0.102 *** (0.0409)	0.035 (0.033)	4.5 ***
Trade credit	2431	-0.007 (0.025)	-0.066 *** (0.021)	4.74 ***	1590	0.023 (0.029)	-0.086 *** (0.024)	7.15 ***
Financial expenses	2858	-0.002 ** (0.001)	-0.001 ** (0.001)	3.40 **	1624	-0.005 *** (0.001)	-0.004 *** (0.001)	8.91 ***
Debt	2860	0.113 ** (0.047)	0.268 *** (0.041)	21.36 ***	1626	0.063 (0.055)	0.123 *** (0.046)	3.7 **
Capex	2506	-0.029 (0.043)	-0.061 ** (0.031)	1.39	1432	-0.002 (0.049)	-0.045 (0.041)	0.61
Growth	2544	-0.031 (0.037)	0.005 (0.032)	0.41	1453	-0.033 (0.054)	0.017 (0.045)	0.32

For each listed variable, we estimated the equation: $y_{i,t} = \alpha + \beta_1 \text{Deal0} + \beta_2 \text{Deal13} + \text{ut} + \text{dt} + \varepsilon_{i,t}$, where Deal0 is a dummy equal to 1 in every first year of the deal; Deal13 takes the value 1 in the three subsequent years. ut is the firm-specific effect, dt is the calendar-year effect, $\varepsilon_{i,t}$ is a random error with zero mean. The specification is estimated with a fixed effect method by using each company as control for itself after the deal, which enables to control for firm-specific characteristics that are time-invariant. *** indicates a significance level of 1% or less; ** indicates a significance level between 1 and 5%; * indicates a significance level between 5 and 10%.

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