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The causes and consequences of venture capital financing. An analysis based on a sample of Italian firms

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THE CAUSES AND CONSEQUENCES OF VENTURE CAPITAL FINANCING. AN ANALYSIS BASED ON A SAMPLE OF ITALIAN FIRMS

By Diana Marina Del Colle*, Paolo Finaldi Russo** and Andrea Generale**

Abstract

The analysis of the determinants and the effects on firm performance of venture capital finance for a sample of Italian enterprises indicates that small, young and more innovative firms are more likely to be financed by a venture capitalist. Our results confirm that venture capital can help reduce financial constraints for firms that are more difficult for external investors to evaluate. We also show that larger firms resort to venture capitalists when their indebtedness with banks is high and we find evidence that venture capital financing is more frequent after periods of high growth and investment, a result that points to the advisory role of the venture capitalist. A novel result emerges: venture capital also finances firms with multiple banking relationships. In the presence of multiple lending, banks could have greater difficulty monitoring firms with asymmetric information; moreover, if firms default, banks are likely to have a weaker bargaining position. In these cases, the amount of bank credit is probably near its limit and firms need to resort to venture capital, a contract that reduces the amount of guarantees needed to access external finance.

JEL Classification: G24, G32.
Keywords: Venture capital; Private equity.

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1. Introduction[1]

A large body of literature has analyzed the relevance of financial factors for firm growth (see Levine, 2004, for a survey). The empirical evidence has shown that where financial systems are more developed, firms more dependent on external finance grow at a faster pace than in countries with less developed financial systems (Rajan and Zingales, 1998).

A related issue concerns the role played by different intermediaries in financing small firms and/or young entrepreneurs investing in projects with high technological or innovative contents. Small and young firms, lacking a long track record, are usually more difficult for external investors to evaluate and therefore may face financial constraints. Active monitoring by banks can prompt the release of information on small and young firms and soften these constraints. However, if the firm does not have a sufficient amount of collateral to pledge against bank debt or if it engages in projects that are too risky in relation to the amount of guarantees, bank finance may not be viable.[2]

Young and small firms in high-tech sectors are more likely to invest in riskier projects and to lack the amount of real assets needed as collateral by banks. Venture capital can help solve the financial problems faced by these firms. Indeed, this form of financing has been very successful in the United States and has spurred the growth of many high-technology firms. Venture capital (VC) contracts share some features with debt contracts and some with equity contracts. The venture capitalist holds a stake in the firm, but his control rights are proportionately greater when the entrepreneur must be induced to put more effort into ensuring the success of the project. Kaplan and Strömberg (2004) refer to this feature as a

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[2] In fact, one of the features of bank contracts is the demand for "hard assets" from the entrepreneur as protection against firm default and to ensure that the entrepreneur is committed to the success of the project. See Aghion and Bolton (1992) and Hart (1995).

separation between control and cash flow rights. Control rights allow the venture capitalist to participate to the main decisions of the entrepreneur.[3]

The empirical evidence for the United States indicates that venture capital financing is mainly directed at small firms operating in high-tech sectors and that the performance of venture-backed firms is significantly different from that of similar firms that did not receive this form of financing. Differences in performance pertain to many aspects, such as R&D intensity, firm sales growth, and investment, which have been found to be generally higher for venture-backed firms than for others.

In the 1990s venture capital and private equity financing developed rapidly not only in the United States, but also in the major European countries (Table 1). Important differences with respect to the United States relate to the size of the market, which is much larger in the United States, the composition of investment – much more tilted towards start-up and high-tech firms in the United States – and the composition of VC resources[4] – with a much larger share coming from pension funds in the United States and the main contribution coming

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[3] The main features of the VC contract are the following. Financing occurs in stages, with the ensuing rounds of financing made conditional on firm performance. For a given financing need, the number of rounds is higher, the greater the risk of the project (Gompers, 1995; Gompers and Lerner, 1999). Staging allows a certain amount of collateral to be accumulated, which will back the next rounds of investment (Neher, 1999). The other important characteristic concerns the convertibility clauses of VC contracts (Gompers, 1999). VC financing occurs more frequently in the form of convertible preferred stock. As Sahlman (1990) notes: "Using a convertible preferred [stock] also provides flexibility in setting the conversion terms. […] If the company does well, the conversion price might be higher, with lower dilution for the management team" (page 510). Convertibility clauses protect the venture capitalist if the project fails, but ensure that the financier enjoys the upside potential of the equity contract and participates in firm profits if the project succeeds (Berglöf, 1994). Another characteristic of VC contracts is the possibility of the participation of more than one venture capital fund in the investment (syndication), which allows the diversification of risk (Lerner, 1994). Other clauses of the VC contract are the possibility to elect board members, to impose non-compete provisions, to obtain full control of the firm if the project badly under-performs. Moreover, venture capital representatives in the board of directors often have a power of veto on some important decisions (Gompers and Lerner, 1996, and Hellmann, 1998). Kaplan and Strömberg (2000) show that the terms and conditions of venture capital contracts are fine-tuned in relation to the performance of the firm; there is also evidence of a direct involvement in decisions relating to executive compensation (see also Gompers and Lerner, 1999). As regards the evidence outside the US, Jeng and Wells (2000) report that in the 21 countries examined venture capitalists are frequently less involved in the strategic decisions of the firm. In contrast with this evidence, Bottazzi, Da Rin and Hellmann (2004), using recent data from a survey conducted by the European venture capital association, find a growing participation by VC in the main decisions of the firm and an increase in their risk tolerance.

[4] Venture capital firms' resources come from investment funds (usually closed-end funds) in which banks, pension funds, private investors, and other institutional investors invest.

from banks in Europe. It has been noted that the US venture capital industry has greatly benefited both from the large presence of pension funds and from a developed stock market.[5]

Given these differences in the industry characteristics one might also think that the determinants and the effects of VC could differ in the European countries compared with what the empirical literature has shown for the United States. In particular, since a substantial part of European VC investments has financed large firms, it is likely that other factors influence the probability of receiving VC funds over and above the need to obtain outside finance for small and risky firms.

The first aim of our paper is to analyze the characteristics of venture-backed firms in Italy and to contrast the results with the US experience. By means of a very rich dataset in which information on venture capital deals has been matched with balance-sheet data for a representative sample of venture-backed Italian firms, we test whether the indications of the theoretical and empirical literature on the determinants and effects of venture capital match the Italian experience. More specifically, the empirical exercises use probit regression analyses to test the relation between the probability of VC deals and a group of variables (such as size, age, level of collateral, etc.) that have been found to be important determinants in the United States. The empirical analysis also compares the performance – in terms of various balance-sheet indicators – of venture-backed firms with that of non venture-backed ones. The ex-post analysis of the performance is also useful to discriminate among different theories.

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[5] On the role of pension funds as providers of funds to the venture capital industry it has been noted (Gompers and Lerner, 1998) that these institutional investors ensure a stable flow of long-term resources to the industry and have a longer-term approach in judging the returns from VC investments. By contrast, in Europe, the participation of investors with a shorter horizon could have determined a preference for investments in larger and more mature firms, usually perceived as more profitable and less risky. Moreover, as noted by Hellmann, Lindsey and Puri (2004), banks "may focus their venture activities towards building relationships for their lending activities, rather than developing the early stage venture capital itself [and…] this is a different role than […] making pioneering investments in early stage ventures." On the role of the stock market, as data show, in the United States exit from VC investments occurs mainly through the equity market (for example in the form of initial public offering). If the stock market is not well developed, exit through an IPO (or, more generally, through a sale of shares) becomes a less likely outcome for the venture capitalist, whereas the main channel remains trade sale, with the firm being sold to another enterprise. If this is the case, the entrepreneur will ex-ante have less incentive to resort to the venture capitalist, given that with a trade sale he risks loosing control over the firm (Black and Gilson, 1998). Finally, another argument put forward to explain the link between the stock market and a well-developed VC industry is that well-functioning equity markets induce more transparency in price formation and permit easier evaluation of the deals.

A second contribution of the paper is the effort to distinguish the determinants and the effects of VC depending on the type of deal. In fact, in our dataset a certain number of deals cannot be termed pure venture capital, but rather private equity financing. These deals are directed at firms that either need to restructure their balance sheets (turnaround operations) or, having been involved in a buy-out operation, need financial assistance and advice. One obvious way to disentangle the determinants and the effects of private equity deals is to test for differential effects by splitting the sample according to a measure of size, given that casual evidence indicates that private equity deals usually involve larger firms. An immediate critique of this testing strategy is that large firms engaging in private equity operations do so for completely different reasons from small firms. In order to address this question we borrow some indications from the ample literature on the determinants of a firm's decision to go public (for the case of Italy and a survey on the determinants and consequences of IPOs, see Pagano, Panetta and Zingales, 1998). We assume that the determinants of private equity financing are analogous to those indicated in the IPO literature and are related to the financial structure of the firm. In particular, private equity deals can be a means to re-balance the firm's financial structure after a period of higher than average growth and, in some cases, VC deals precede flotation on the stock market. We address this question by augmenting our probit specifications with controls such as leverage and profitability measures.

In our data, venture capital operations are also directed at firms that already have access to bank finance. While there is ample empirical evidence on the role of venture capital in reducing asymmetric information problems for small firms lacking collateral and on its role as consultant for young and innovative firms, the evidence on the relation between venture capital finance and bank-firm relations is much more scant. This is presumably because for start-ups in high-tech sectors venture capital finance generally precedes bank debt. In the case of firms that are also financed by banks, the theories that rationalize the role of venture capital as a source of finance when bank credit is not available are not a useful guide in interpreting the role of VC. By stretching the results of Ueda's model (2004), we test whether the intensity of the relationship with the bank has a bearing in explaining the demand for venture capital. When the firm borrows from a multiplicity of banks (multiple lending), bank-firm relationships are probably weak; in this case, it is likely that the firm will

seek the advice of specialized intermediaries such as venture capitalists. Moreover, in the presence of multiple lending the advisory role of the venture capitalist could become particularly important if firms are near their credit limits with the banks or are already highly indebted. Our paper adds to the existing literature by testing the importance of some indicators of the intensity of bank-firm relations and by verifying the interpretation that venture capital is needed when bank-firm relations are weak. The detection of a nexus between VC demand and bank-firm relations may help rationalize the role of venture capital over and above that of providing financial resources to start-up or innovative firms.

Our results confirm that, as in the United States, VC is more likely to finance young, small and riskier firms. We find evidence that is consistent with both the theories of venture capital as a solution to asymmetric information problems and the theories of the venture capitalist as consultant. For larger firms the analysis shows that the need to re-balance the financial structure is one of the main drivers of the deals, consistently with the results of the IPO literature. Moreover, we show that the relations with banks are an important determinant of venture capital finance, given that firms with multiple lending relationships and with tensions on their credit lines appear to ask more frequently for the services of the venture capitalist. This novel result indicates that the lower information disclosure implied by multiple lending relationships can be overcome by resorting to the venture capitalist. Indeed, firms whose projects are difficult to evaluate on the basis of hard information (e.g. balance-sheet data) probably do need an insider investor who can offer better financing conditions than a multiplicity of uninformed financiers.[6] The ex-post analysis indicates that this motivation is probably more important for smaller firms, which significantly reduce, after the deal, both the number of relations with banks and the amount of bank credit they draw.

The paper is organized as follows. Section 2 describes the sources of our data and its main features. In Section 3 we briefly recall various corporate finance theories and empirical

[6] A priori, multiple lending relations do not necessarily reduce the amount of information. If screening and monitoring activities are based on hard information (e.g. balance-sheet data and project prospectuses) multiple lending increases the number of subjects to which information is channeled, thereby implying a wider diffusion of the available information set. On the other hand – and this is the case that we have in mind in this paper – if firms have projects that are difficult to evaluate and if their balance sheets present a large proportion of intangible assets, it is probably more difficult to rely on codified information. From these firms, information to an external investor accrues through a close relationship and monitoring is costly for the financier. In this case, multiple lending is associated to the well-known free-rider problem in the information acquisition process.

evidence that are useful to highlight the likely determinants and effects of VC financing; Section 4 presents the econometric results of the ex-ante analysis, while the results of the performance analysis are discussed in Section 5. Section 6 concludes.

2. Data

2.1 Sample

Information on venture capital deals comes from a variety of sources. For the period 1989-1996 data have been collected by means of a questionnaire sent by the Bank of Italy to the main venture capital intermediaries operating in Italy in those years.[7] We were able to collect information on 98 deals. For the subsequent period (1997-99) data on the year of the deal have been provided by the Italian venture capital association (AIFI). They refer to 243 deals involving non-financial firms.[8] Table 2 shows that in the period considered around 50 firms received more than one financing.[9]

The availability of the year of the deal and of the identification number of the firm (its tax-return code) allows us to merge the information on the venture capital deals with firm balance-sheet data drawn from the Company Account Data Service database ("Centrale dei bilanci" CB) and information on credit relationships drawn from the Bank of Italy's Central Credit Register. We matched about 4,000 firm-year observations for the venture capital sample for the period 1988-2002. For about one-quarter of the observations – mainly

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[7] Specifically, the questionnaire was sent to venture capitalists in 1999 and asked for information about the number of investments each VC firm had made in those years, the date of each deal, the name and the tax-return code of the firm that received financing. Further information was requested on the investment phase (seed, start-up, expansion, buy-out and turnaround deals); unfortunately, we cannot use this more specific information because it is seldom available for the subsequent years (from 1997 onwards). The response rate was quite high (around 90 per cent of the intermediaries who received the questionnaire completed and returned it).

[8] Data published by the Italian venture capital association (AIFI) show a larger number of deals. According to these statistics, in the period 1997-99, 700 firms received venture capital financing. The difference with our data is mainly attributable to the fact that we consider non-financial firms only, while AIFI considers also financial firms, holdings and real-estate brokers. In our sample the much larger number of deals in 1997-99 with respect to the previous period is coherent with what is observed from the aggregate figures showing a rapid increase in this form of financing in the second half of the 1990s.

[9] 47 firms received venture capital financing twice; 4 firms were assisted by the venture capitalist three times. Around 60 per cent of these firms received their next financing one year after the previous round.

regarding small firms that are less frequently present in the CB database – balance-sheet information comes from the Cerved database covering the universe of incorporated business.[10]

In the empirical analysis, the main control sample we use is obtained with a random selection process from clusters of firms of similar size and operating in the same industries as those of our venture capital sample. For the period 1988-2002, this procedure gives us a control sample of around 173,000 observations out of more than 685,000 of the entire CB database. To check for robustness of the results we also use the entire CB database and two other control samples obtained in a similar way to the one just described.

2.2 Descriptive statistics

Some of the venture-backed (VB) firms in our sample are large ones. As we already noted, some of the deals in Europe (and in Italy) were private equity (buy-out or restructuring) rather than venture capital deals. Private equity operations typically involve large firms and it is conceivable that the determinants and the effects of venture capital financing are different between these two categories of firms. It would be advisable to conduct the analysis separately for these deals in order to distinguish more sharply the determinants and the effects of pure venture capital (i.e. the financing of small and riskier firms) from those of private equity (that typically entail a balance-sheet restructuring). Unfortunately, we do not have direct evidence of private equity deals in our dataset. Hence, we try to separate the different types of operations by splitting our sample according to size, given that casual observation indicates that the majority of private equity deals involve larger

[10] The whole CB database available to us covers balance sheets and income statements for some 35,000 non-financial firms from 1982 to 2003. The financial statements are collected by a consortium of banks; firms enter the sample by borrowing from one of the banks in the consortium. Besides the standard financial variables, the database contains balance-sheet items, as well as information on firm characteristics (year of foundation, location, type of organization and ownership status, group membership), employment, flow of funds and the firm's credit score, computed by the CB. The sample has a much broader coverage than most datasets used in economic research, since it includes a large number of unlisted companies and many very small firms. The sample may be biased towards firms with multiple banking relationships, which are in turn more likely to be large firms. For further information on the sample and on data availability, see the Centrale dei bilanci website (www.centraledeibilanci.com). The Cerved Business Information dataset virtually includes the universe of incorporated business in Italy (see www.cerved.com for information); data are available from 1993 onwards, but information on firm balance sheets is less detailed than that of the CB.

firms. We define small and medium firms (SMEs) as those with a value of total assets of less than 20 million euro in the first year in which the firm is present in the database.[11]

Panel A of Table 3 reports the summary statistics on the control sample of SMEs. In Panel A, data are averages over the period 1988-1999, the sample period for the ex-ante analysis (conducted in Section 4). The median firm records a value of sales of 5.3 million euros, total assets of 3.8, 29 employees and is 15 years old. On average, around 3 per cent of the firms are in high-tech sectors. For the median firm, intangible assets represent less than 5 per cent of intangible and fixed assets. As for profitability, the return on equity is 5.7 per cent; the median value added per employee is 3.9 million euros. The median company exhibits a leverage (defined as the ratio of debt over the sum of debt and equity) of 54 per cent, a coverage ratio (the ratio of EBIT over interest expense) of 2.4, and capital expenditures (CAPEX, the rate of change of fixed assets) of 0.4 per cent. The median firm draws credit from 5 banks and the share of credit drawn from the first bank is around 50 per cent. Firms with a ratio of short-term credit drawn to credit granted at least equal to 110 per cent are 4.0 per cent of the sample.

In Panel B we report the statistics for venture-backed SMEs;[12] data refer to the year before the deal. We have 253 such deals involving firms with a value of total assets of less than 20 million euros. For each variable a star indicates whether the difference between the mean of the control sample and that of the VB firms is significant. The first thing to note is that VB firms are younger than in the control sample (median age is 6 years). As regards size – measured either by sales, by total assets or by the number of employees – the median VB firm tends to be larger than in the control sample. This is in contrast with the suggestions of theory and empirical evidence relative to the United States. This result is partially attributable to the fact that some of these firms might have been involved in private equity deals. Thus, even if we have tried to capture this form of financing by splitting our sample

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[11] We used the breakdown according to total assets since information on sales or on the number of employees is less complete. 20 million euros is the value of the 75th percentile of the distribution of total assets for firms with less than 250 employees. Information on deals classified as private equity for 2000-02 (not considered in our sample, given the limited number of operations available) shows that the median value of total assets of these firms is around 25 million euros.

[12] For some of the venture-backed firms we were not able to recover the balance-sheet information. On the whole (i.e. considering the deals involving both SMEs and larger firms), for 319 deals we were able to recover at least the information on the firm total assets; this compares with the total of 341 deals in our initial sample (see Table 2).

according to size, it may well be that even among SMEs, the larger ones have been party to private equity deals. Moreover, one thing worth noting is that in the venture capital sample there is a wider dispersion – as measured by the difference between the 95th and the 5th percentile – of the variables that proxy for size. As for the other variables, as expected, VB firms are more frequent in the high-tech industries and their median share of intangibles is much higher (around 14 per cent) than in the control sample. They are also riskier than those in the control sample: our variable RISK – defined as the standard deviation of ROE at the industry level – is on average 42 per cent, as opposed to 39 per cent in the control sample. As regards performance measures, VB firms show higher growth (in terms of sales), higher investment (CAPEX) and a higher value added per employee (though the latter two differences are not significant). Both profitability and leverage are lower than for firms in the control sample, whereas interest coverage is similar between the two samples. The concentration of bank credit, measured either by the share of the first bank or by the Herfindahl index, turns out to be lower than in the control sample, whereas the percentage of firms in overdraft is similar in the two samples. The share of long-term loans is higher for VB firms.

Turning to large firms (panels C and D), the comparison between VB and non-VB firms indicates that large VB firms are also younger than those in the control sample and have a higher share of intangible assets. They also have a lower value added per employee. Contrary to the evidence for smaller firms, large VB firms are more indebted than those in the control sample; the low concentration of bank credit observed for small firms is even more pronounced for large ones.

Summing up, the descriptive analysis shows that venture-backed SMEs are younger, grow more, have a larger share of intangibles, a lower concentration of bank credit and lower profits than other firms. For larger VB firms another difference with respect to the control sample is the higher level of indebtedness.

3. What theory and (previous) empirical evidence suggest about the role of venture capital

This Section draws on corporate finance theories and previous empirical evidence that we use to select a list of controls capable of explaining the determinants of VC finance and a set of variables likely to be affected by VC deals. There is no single theory that of itself is able to explain the rationale of venture capital contracts, although, as will become clearer when we illustrate the different theories, there is some overlapping among them.

In Table 4 we summarize the main indications that we briefly discuss in this Section. It should be clear from the table that to distinguish among competing theories the empirical analysis has to be devoted not only to the determinants of venture capital deals, but also to their effects on firm performance.

3.1 Asymmetric information

The theoretical literature on venture capital contracts indicates that the direct involvement of these intermediaries in the day-to-day life of the firm gives them an advantage in financing firms that are more difficult for external investors to evaluate. As stressed by Berger and Udell (1998), young and small firms lack the visibility of more established and larger firms, and are more likely to suffer from asymmetric information problems: for the financing of their investments they rely heavily on internal funds and on informal finance.[13] The existence of venture capital might fill the gap in the access to external resources for small firms. 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 share of intangible assets in their balance sheets. Moreover, little availability of real assets reduces the possibility of seizing them in the event of default, thereby giving less credibility to the threat of liquidation by banks. This, in turn, reduces the effort of the entrepreneur and decreases the likelihood of accessing bank finance.

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[13] See also Carpenter and Petersen (2002) and Fluck, Holtz-Eakin and Rosen (1998). For the oversight role of the venture capitalist see Lerner (1995).

In the empirical analysis of the determinants of venture capital, we use the logarithm of firm sales (SIZE) as a proxy for company size. AGE (in logarithm) is calculated using the date of incorporation of the firm. Finally, we use INTANGIBLES, defined as the share of intangible over the sum of intangible and tangible assets, to proxy for the difficulties of external investors in evaluating the activity of the firm. All these variables have an expected positive sign on the probability of VC finance.

Asymmetric information models are also useful to make explicit the likely consequences of venture capital. The certification effect due to the participation of the venture capitalist in the firm should reduce the premium required by external investors and increase the amount of external finance the firm can raise directly on the market or from banks (Holmström and Tirole, 1997). This, in turn, should have a positive impact on firm LEVERAGE. On the other hand, if the firm already has access to bank finance, it could be that venture capital finance substitutes for bank finance and this could imply a contraction of leverage after the deal. With respect to firm performance, profits should increase to remunerate the effort of the venture capitalist.

3.2 Bank-firm relations and venture capital

Ueda (2004) discusses the trade-offs between venture capital financing and bank financing. As in other models of asymmetric information, for bank financing to be viable a certain amount of collateral is needed, since the bank is less informed than the entrepreneur. In her model the venture capitalist and the entrepreneur are equally informed about the projects; this fact facilitates financing to firms with low collateral, but exposes the entrepreneur to the risk of project expropriation by the venture capitalist. The predictions of this model are that the probability of receiving venture capital rather than bank financing is higher for firms perceived as riskier by banks, i.e. those with less collateral.

Stretching Ueda's results and hypothesizing that firms are already financed by banks, it is likely that the quality of information and the amount of collateral available to banks are inversely related to the number of banking relationships the firm has.

More specifically, both the presence of multiple lending relationships and tensions in firms' credit lines with banks are likely explanations of the demand for venture capital

finance. In the first case, if the relationship with banks is characterized by multiple lending, it is likely that the firm – lacking a main bank – will seek the advice of specialized intermediaries such as the venture capitalist.[14] Moreover, for a given limited amount of collateral, the financing of firms that borrow from many banks becomes ex-ante riskier for the bank itself, mainly because of coordination problems in seizing collateral that are likely to be encountered when the number of outside creditors is high (Bris and Welch, 2005). Hence, a testable implication is that, controlling for size, the probability of being financed by a venture capitalist depends positively on the (log of the) number of banks (BANKS).

As for the consequences of VC financing, the model of Ueda predicts that after the deal profits should increase to compensate the entrepreneur for the risk of being expropriated by the venture capitalist. Hence, some measure of profitability (such as ROE – return on equity, or ROA – return on assets, or cash flow) should be comparatively higher than that of the other firms.

3.3 The venture capitalist as consultant

As a form of specialized financing, the venture capitalist gives advice to the firm under many guises. The empirical analysis for the United States has shown that VB firms are more innovative than non-VB ones, whether innovations in production processes or innovative products are considered. They also appear to be faster in implementing new patents (Hellmann and Puri, 2000). For young firms, VC advice includes marketing services and the upgrading of the commercial network; this, in turn, fosters an increase in sales.[15] Moreover, venture capital financing is associated with a higher patenting rate of relevant technological products (Kortum and Lerner, 1998). VC activity should be more likely in innovative industries, which have a high level of R&D expenses, or for firms characterized by high

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[14] As we argued in the introduction, in the case of creditors relying on soft information, multiple lending can reduce the amount of monitoring. Another mechanism that can induce a positive relationship between the number of banks and the demand for venture capital is the one described in Yosha (1995). His model predicts that firms with more sensitive information — e.g. innovative firms, firms in high-tech sectors and firms with high R&D intensity — want to minimize the loss of non-public information. One way to do so is to reduce the number of banks to which information accrues. We did not consider this mechanism explicitly here.

[15] Jain and Kini (1995).

growth, in terms of sales or investment. Indeed, it is likely that enterprises needing to consolidate their results will seek the venture capitalist services.[16]

The direction of causality between venture capital and the degree of innovation is an open issue. Some empirical studies have found that more VC financing fosters innovation (‘*venture capital first’ hypothesis*, e.g. Kortum and Lerner, 1998), while others document that the venture capital deal follows the discovery of a new technology and that venture capital services are needed to market such innovations (‘*innovation first’ hypothesis*, e.g. Hirukawa and Ueda, 2003).[17]

The theories that stress the advisory role of the venture capitalist imply that the likelihood of this form of financing should be higher for firms with high investments or high growth. We calculate firm investment as CAPEX, the rate of change of fixed assets. GROWTH is calculated as the difference between each firm’s sales rate of growth and that of the industry to which the firm belongs. Differences in the intensity of innovation are proxied by the HIGH-TECH dummy, which takes the value of 1 in industries with a high “innovative” content.[18] Finally, the variable INTANGIBLES should be positively correlated with the probability of being assisted by the venture capitalist.

The evidence on the consequences of VC should help shed some light on the direction of causality; if the venture capital first hypothesis dominates in the Italian case, then we should expect an increase in CAPEX, GROWTH, INTANGIBLES and the capital per employee ratio after the operation. If, on the contrary, is the innovation first hypothesis that dominates, we do not expect either the accumulation of INTANGIBLES or GROWTH to continue after the deal. Moreover, in the case of turnaround or buy-out operations

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[16] For a theoretical model, see Casamatta (2003).

[17] Hirukawa and Ueda (2003) find that venture capital 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 the venture capital deal, they find a negative correlation between venture capital financing and the subsequent growth in total factor productivity at the industry level.

[18] Using the four-digit industry codes, we classify a firm to be a high-technology one if it belongs to one of the following industries: chemical and pharmaceutical products, aerospace, electronic equipment, media, telecommunications, software and hardware. In the econometric analysis we also control for other nine industry dummies: agriculture, energy, construction, food, services and the four industries according to the Pavitt classification: traditional manufacturing goods, scale intensive industries, specialized suppliers industries, and other manufacturing.

(presumably for larger firms) we expect an increase in efficiency, which we proxy with the (log of) value added per employee.

3.4 Re-balancing the financial structure

After periods of higher than normal expansion in investment, firms usually have high indebtedness. Moreover, riskier and smaller firms are usually granted short-term debt. VC financing can help by itself to re-balance the financial structure towards equity. Moreover, since one of the successful ways to divest is through flotation on the stock market, a high LEVERAGE firm will try to involve a venture capitalist in its attempt to access the stock market. Pagano, Panetta and Zingales (1998) find for a sample of Italian firms that initial public offerings are above all a means to reduce leverage.

Similarly to the predictions under 3.3, the probability of VC finance should be greater for high growth firms. In the case of financial structure re-balancing, we also expect that if these firms were already financed by banks, the likelihood of demanding VC will be higher if they suffer from tensions on their bank credit lines. Finally, riskier firms should be more willing to re-balance their financial structure: in fact, the desire to raise new capital and reduce leverage should be greater for companies with higher risk, which implies a larger cost of foregone diversification for the entrepreneur. This indication is derived from models of portfolio diversification (Pagano, 1993).

The indications for the consequences of VC deals are, however, different from those discussed in 3.1 and 3.3. If the re-balancing of the financial structure is an important reason for the demand for VC, then we expect a reduction in leverage after the deal. Moreover, it is likely that firms will try to lengthen the maturity of their liabilities, in order to facilitate the completion of projects that usually need a long period of time to break-even. As Bergemann and Hege (1998) note, when a firm finances long-term projects with short-term credit the risk of interruption is high and firms will try to lengthen the maturity of their liabilities.

In the empirical analysis we use LEVERAGE as a proxy of the level of indebtedness. The expected sign of this variable is uncertain (as in paragraph 3.1). In fact, if the re-balancing of the financial structure theory is a valid one, we should expect that more leveraged firms are more likely to be financed by a venture capitalist. On the other hand, a

low leverage can signal financial constraints and the need to resort to alternative sources of finance, such as venture capital. To proxy for tensions in credit lines, we use the dummy OVERDRAFT, which takes the value of 1 if the ratio between credit drawn from banks and the amount of loans granted is at least equal to 110 per cent; we expect a positive sign for this variable. We proxy RISK with the standard deviation of the distribution of profitability (the Return on Equity) for all the companies in the same industry.

As for the consequences of VC operations, we expect a reduction in leverage (in contrast with the predictions under 3.1); as argued in the introduction, this prediction should apply in particular to private equity deals. After the deal, if the theory of the financial structure re-balancing is verified, we also expect an increase in long-term loans as a ratio of total loans (LTLO) and a decrease in the ratio of credit drawn over credit granted (CDCG in the table), as tensions on bank credit lines are likely to be eased.

3.5 Other theories

As should be clear from Table 4, in this Section we have discussed the theories and previous empirical evidence that we judge directly testable given our dataset. In concluding the Section, to give a fair account of the analysis on this form of financing it is useful to present a brief review of other important contributions that unfortunately we are not able to test in the paper. This should also clarify the limits of our data.

Kaplan and Strömberg (2000, 2004) test the importance of different corporate finance and contract theory predictions by analyzing the characteristics of venture capital contracts. By analyzing the allocation of cash flow and control rights between the VC and the firm and the determinants (such as firm performance) that trigger a change in this allocation, Kaplan and Strömberg are able to test the predictions of theoretical models on the optimal allocation of control and cash-flow rights. Moreover, their results suggest that “agency and hold-up problems are important to contract design and monitoring”.

The limits of our dataset – in particular the scant number of pure venture capital deals (i.e. those directed to start-ups) – make it difficult to test the relevance of the staging process in the Italian case. Gompers and Lerner (1999) show that the staging of financing allows the VC to increase his/her information set and monitor the progress of the firm. Unfortunately,

we do not have information on the whole number of financing rounds and cannot test this result for the Italian case. Lacking information of the exit strategy of the VC, we are not able to test the relation between this form of financing and a firm going public decision (Gompers and Lerner, 1999).

Finally, another important issue concerns the composition of venture capital funds according to type of investor (i.e banks, pension funds and other institutional investors). Hellmann, Lindsey and Puri (2004) show that the different composition may have important consequences on the portfolio allocation of the fund. In particular, they find that venture investments are more likely to be directed towards less innovative firms if banks have a major role in the fund. Again, we cannot test this issue for the Italian case as we lack the information on the composition of the funds.

4. The determinants of venture capital financing

4.1 The econometric set-up

The multivariate analysis performed in this Section will allow us to quantify the importance of the different determinants of venture capital financing and examine more thoroughly the competing explanations briefly outlined in Section 3.

Based on the theoretical predictions on the variables that should affect the likelihood of venture capital financing, we estimate various versions of the following probit model:

$$\begin{aligned}\Pr(VB_{i,t}=1) = F(&\alpha_1 SIZE_{i,t-1} + \alpha_2 SIZE^2{}_{i,t-1} + \alpha_3 AGE_{i,t-1} + \alpha_4 INTANGIBLES_{i,t-1} \\ &+ \alpha_5 LEVERAGE_{i,t-1} + \alpha_6 ROE_{i,t-1} + \alpha_7 HIGH-TECH_{i,t-1} + \alpha_8 GROWTH_{i,t-1} \\ &+ \alpha_9 RISK_{i,t-1} + \alpha_{10} BANKS_{i,t-1} + \alpha_{11} OVERDRAFT_{i,t-1} + \\ &\kappa_k Industry_k + \eta_t YEAR_t)\end{aligned} \quad (1)$$

where $VB_{i,t}$ is a variable equal to 0 if company i is not financed by the venture capitalist in that year and equals 1 in the year of the first financing (after a company is financed for the first time, we drop it from the sample). $SIZE_{i,t-1}$ is the log value of the sales of company i in year t-1 and $SIZE^2_{i,t-1}$ is its quadratic form, which is meant to control for the presence of non-linearities. $AGE_{i,t-1}$is the log of firm age. $INTANGIBLES_{i,t-1}$ is the ratio of

intangible assets over the sum of intangible and real assets. $LEVERAGE_{i,t-1}$ is the ratio of debt over the sum of debt plus equity. $ROE_{i,t-1}$ is the return on equity. $HIGH\text{-}TECH_{i,t-1}$ is a dummy equal to 1 for companies in high-tech sectors that we have defined in Section 3. To measure firm expansion we use, alternatively, $GROWTH_{i,t-1}$ (the difference between a firm's sales growth and that of its industry) and $CAPEX_{i,t-1}$ (the rate of change of tangible assets), which proxies for investment activity. $RISK_{i,t-1}$ is the risk of company i, proxied by the cross-sectional variability of the ROE of companies in the same industry; $BANKS_{i,t-1}$ is the (log of the) number of banks that grant credit to the firm. $OVERDRAFT_{i,t-1}$ is the dummy meant to capture the presence of tensions in the credit lines granted by banks. Finally, we control for industry and year dummies. To avoid simultaneity, the firm-specific variables are lagged one year.

The expected signs of the variables are those commented in Section 3. The only variable we have not directly derived from our theoretical survey is profitability. The sign of this control is uncertain: a high ROE could be associated with abundant internal funds and with less need for external finance; if this is the case we should expect a negative sign for this variable. On the other hand, a high ROE could signal high quality firms and might be associated with a higher propensity of the venture capitalist to finance them; in this case, the sign should turn out to be positive.

4.2 Results for the whole sample

Table 5 presents the results obtained estimating equation (1). Column (a) of Table 5 reports the results of our baseline specification using the control sample presented in Table 3. By using the sample selected randomly among firms of similar size and industries as the venture-backed ones, we try to minimize the risk of including in the control sample firms that are not inclined to resort to the venture capitalist and to obtain a sharper comparison among the characteristics of venture-backed and non-venture-backed companies.

In column (a) attention is confined to the variables with the coefficients from α_1 to α_7 (controlling for industry and time dummies). This is done to maximize the number of observations on which estimation is performed; in fact, employing variables such as CAPEX or GROWTH would imply a loss of observations given that they are calculated over year t-1

and t-2. The variables that come from the Central Credit Register imply a loss of observations too, since we were not always able to match the CB database with the former.

Consistently with the theories of asymmetric information, the signs of SIZE and AGE turn out to be negative; the existence of a non-linear relation between the probability of receiving venture capital and size also emerges. Consistently both with asymmetric information theories and with the role of the venture capitalist as consultant, firms with a high share of intangibles and in HIGH-TECH sectors are more likely to be financed by the venture capitalist.[19] In this basic regression, results seem to contradict the theory of financial structure re-balancing, given that the sign of LEVERAGE is negative and marginally significant. This result is consistent with the theory that predicts a higher demand for venture capital finance by firms that encounter more difficulties in accessing debt finance. Finally, profitability is not significant.

We check the robustness of these results in various ways. We re-estimated specification (a) using different lags of the variables. In particular, if SIZE, LEVERAGE and ROE are entered with a lag of two years (results not reported) the basic results are confirmed, with the exception of LEVERAGE – which becomes not significant – and ROE – which becomes negative and significant. The latter result indicates that firms with more internal resources are less likely to ask for venture capital advice.[20] We then estimate a random effects probit model with the same controls as column (a); again in this case results are virtually unchanged.

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[19] By construction the High-tech dummy can be considered an industry like the other nine standard industries described previously. In the probit analysis the other industries considered are: agriculture, energy, food, traditional manufacturing goods, scale intensive industries, specialized supplier industries, other manufacturing industries and services. The dummy for the Construction industry is dropped from the probit.

[20] Moreover, we check that our results were robust when lagging other variables (such as INTANGIBLES) for two years or using averages of the variables over time t-1 and t-2. In these cases too, the main indications reported in column (a) of Table 5 are confirmed. Finally, we re-estimate the model in column (a) using alternative definitions of company size, profitability, leverage, and intangibles. Specifically, we calculate size as the log of total assets; we measure profitability with the return on investment (ROI) or with the return on assets (defined as EBITDA over total assets). We calculate leverage including also commercial debt. Intangible assets are calculated as a fraction of total assets. In all these cases (estimates not reported) the results are coherent with those in column (a) of Table 5.

Column (b) of the table reports the results obtained estimating the baseline model using the whole CB control sample rather than the randomly selected one. The results indicate that the sign and significance of the coefficients are similar to those in column (a).[21]

We then estimate the richer model (c) for the whole set of variables reported in equation (1). As previously noted this implies a substantial loss of observations: the number of venture capital deals over which estimation is performed is almost halved (from 217 to 125 deals) and we lose, in particular, the observations for smaller firms. We use CAPEX to measure the expansion of the firm. Results confirm that firms that are younger and have a high share of intangible assets in their balance sheet are more likely to be financed by a venture capitalist. SIZE, LEVERAGE and the HIGH-TECH dummy turn out to be not significant. We checked that this result was due to the different sample by estimating specification (a) using the observations of specification (c). Indeed, results (not reported) indicate that the loss in significance is attributable to the different sample. As regards the other variables in specification (c), results show that firms' rapid expansion (proxied with the investment rate, CAPEX) is positively associated with venture capital financing. This is consistent with the theories of financial structure re-balancing and of the advisory role of the venture capitalist. As regards the relation with the banks, we show that our proxy of multiple lending (BANKS) is positively related to the probability of VC: firms with multiple lending relationships tend to be financed more frequently by the venture capitalist, a result that is consistent with theories that relate venture capital demand to the type of banking relationships. Finally, the positive sign for the overdraft dummy is consistent with the theories of financial structure re-balancing.

As a last robustness check we control for the fact that one firm can receive venture capital finance more than once. First of all, we re-estimate model (a) by changing our dependent variable and considering the dummy VB equal to 1 also for deals that occur after the first financing operation; in the analysis we control for multiple operations by means of a

[21] With two other random control samples selected in a similar way to the main one results (not reported) also do not change significantly with respect to those presented in column (a) of Table 5.

dummy variable.[22] In this case too (estimates not reported) results of column (a) are confirmed.

Moreover, we estimate a Cox proportional hazard model, where the dependent variable is the time span between one venture capital deal (the failure event) and the other. For the first deal the time span is calculated, at the firm level, as the difference between the year of the first operation and the first available observation. In the case of firms that record more than one deal, the time span is calculated as the interval between one venture capital deal and the other (time since last failure). For firms that were not backed by a venture capitalist during the sample period, the time span coincides with the number of years the firm is present in the database. Multiple failure models are suited to take into account the fact that each firm can be financed more than once. We also control for differences among groups of firms that have received a different number of financings by stratifying the estimation. Results (column (d) of Table 5) are broadly in line with those obtained by means of the probit model, with the exception of LEVERAGE and the HIGH-TECH dummy that are not significant. Furthermore, profitability turns out to be negative and significant. All in all, the duration model confirms that venture capital financing is more likely for smaller, younger and less collateralized firms.

The results of the ex-ante analysis for the Italian case confirm that venture capital is a more frequent form of financing for small, young and innovative firms. The econometric evidence also shows that venture capital is frequently employed when there are tensions on credit lines with banks and when the firm has multiple lending relationships, thereby indicating that the intensity of the relations with banks is inversely related to the demand for venture capital. These findings are broadly consistent with the predictions of the information asymmetries theories.

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[22] Considering the first deal only is equivalent to the hypothesis that the characteristics of venture-backed firms may differ from those of non-venture-backed firms *independently* of the number of times each firm is financed. This hypothesis is plausible since one of the features of venture capital is that financing occurs in stages. Moreover, as we have already noted, the majority of firms in our sample received the next financing after one year and we believe it is highly unlikely that firm characteristics change much during this time span. On the other hand, discarding the subsequent deals from the sample implies a loss of information, a fact that makes it advisable to perform the robustness checks presented in the text.

4.3 Differences according to firm size

As we saw in Section 2 there are large differences in the variables that proxy for the financial structure and bank-firm relationships among smaller and larger firms. In this paragraph we check for the presence of differences in the probability of VC finance according to firm size.

We re-estimate the probit regressions using, in blocks, all the variables listed in model (1) by splitting the sample among small firms (SMEs) and larger ones. The "Dummy Large" is an indicator that takes the value of 1 for firms with at least 20 million euros in total assets. For each specification, the effect on the probability for larger firms is given by the sum of the coefficient in the column "SME" and the coefficient in the column "Dummy Large". Our estimation procedure (i.e. inserting in blocks the various controls) aims to avoid the loss of too many observations; in fact, in the previous paragraph we saw that the number of deals is almost halved when estimating the richest model (see column (c) of Table 5). Moreover, as Table 6 shows, the correlation between some of the variables of model (1) is quite high and significant. Hence, by inserting the variables in blocks we try to minimize the presence of multicollinearity. Finally, we re-estimate the various specifications presented in the table over the same sample; in this way we check whether the different results are driven by the different number of observations.

In column (a) of Table 7 we report the results obtained using the same specification presented in column (a) of Table 5; all the firm-level variables are interacted with the dummy for large firms. The results obtained for the whole sample are confirmed, but unlike small firms, large ones are more likely to be financed by the venture capitalist when they are more indebted rather than less indebted. This result is consistent with the theories of financial structure re-balancing.

In column (b) we add to the basic model one of our firm expansion proxies (GROWTH); as for CAPEX in the previous paragraph, for GROWTH the sign is also positive and significant, a result that is consistent with the theories of financial structure re-balancing and of the advisory role of the venture capitalist. For large firms the effect of growth on the probability of venture capital is larger than for small ones. With specification

(b) LEVERAGE turns out to be not significant, a difference with respect to column (a) that is attributable to the different sample.[23]

Controlling for the investment rate (CAPEX; column (c)) confirms that the rapid expansion of firms is associated with venture capital financing. The sign and significance of all the other variables are the same as those obtained for the baseline model of column (a), with the exception of the differential effect of LEVERAGE for larger firms.[24] In column (d) we add to the baseline specification our proxy of firm risk (RISK); according to the suggestions of the theory, small and riskier firms are significantly more likely to be financed by the venture capitalist, whereas the effect of RISK is almost nil for larger firms. Finally, in column (e) we add the bank-firm relationship variables and the dummy OVERDRAFT. It emerges that both coefficients are positive and that there are no significant differences according to size.

The results for the sample split according to size show that the main difference concerns leverage: in fact, with the specifications in columns (a) and (d) we find that large firms use this form of financing when they are highly leveraged, consistently with the financial structure re-balancing theory. However, this result is not robust to different specifications of the model and we need to turn to the analysis of the effects of venture capital to be better able to disentangle the importance of the different theories.

5. The effects of venture capital on firm performance

5.1 The econometric set-up

The ex-ante analysis of venture capital determinants sheds only partial light on the relative importance of the different theories we have summarized. Moreover, differences between firms according to their size might well be more visible by looking at the

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[23] The estimation (results not reported) of the specification in column (a) on the sample used in column (b) indicates that LEVERAGE turns out to be not significant in this case too.

[24] In this case too the estimation (results not reported) of the specification in column (a) on the sample of specification (c) indicates that the difference regarding leverage is due to the different (smaller) sample.

consequences of venture capital financing on firm performance. It is for these reasons that this Section is devoted to the analysis of the performance – in terms of various balance sheet indicators – of venture-backed firms relative to the companies that did not receive this form of financing.

For the main accounting and financial variables (denoted y_{it}) we estimate the following fixed-effect regression:

$$y_{i,t} = \alpha + \beta_1 VC0 + \beta_2 VC13 + \beta_3 VC4T + u_i + d_t + \varepsilon_{i,t} \qquad (2)$$

where VC0 is a dummy variable that takes the value of 1 in the year of the deal. It should be pointed out that 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. VC13 is a dummy equal to 1 in the three years after the deals and, finally, VC4T is 1 from the fourth year after the deals.[25] This latter variable should capture longer-term effects on the relevant balance-sheet variables. u_i and d_t are, respectively, firm and calendar (year) dummies. Fixed-effect estimation allows us to control for firm-specific characteristics that are time-invariant but that could be correlated with the venture capital deals, such as industry or managerial quality.

The methodology we use for the ex-post analysis is the same as the one presented in Pagano, Panetta and Zingales (1998) in their study on firms' listing decision. In particular, we look at the effects of VC finance on a larger set of variables than that used as controls in the analysis of the determinants of VC finance. This is done to reduce endogeneity problems that arise when fixed-effect estimation is performed using the VC dummies as exogenous variables to explain variables such as ROE or LEVERAGE, which the ex-ante analysis has shown to be correlated with the VC financing event itself.[26] Moreover, we check (regressions not reported) that our results are robust to richer specifications that include not

[25] Overall, in the sample used for the ex-post analysis, 284 firms received at least one financing, 45 were financed twice and only 4 were party to three deals. No firm received financing more than three times. We experimented with alternative definitions of the ex-post dummies to check for the robustness of the results. The first check was performed using separate sets of dummies for each financing operation; we also estimated the fixed-effect regressions by looking at the effects after the first financing operation and, alternatively, after the last financing only. None of the main results that we present in this Section were significantly affected.

[26] In this case, in fact, the VC dummies cannot be considered strictly exogenous, thus violating the fixed-effect model assumption of strict exogeneity of the explanatory variables, Wooldridge (2002).

only the deal dummies (as in model (2)) but also other balance-sheet variables likely to be correlated with each firm variable (y) we are examining.

5.2 Results

Table 8 reports separately the results for small and medium enterprises and for large firms. As for the measure of profitability (ROE), for small venture-backed firms ROE drops with respect to the other firms in the interim period (i.e. from t+1 to t+3). No significant difference among venture-backed and non-venture-backed SMEs emerges either if we consider return on sales (ROS) or value added per employee. We also experimented other variables, such as ROA, Cash flow/Assets or return on investment (results not reported): again venture-backed SMEs do not behave in a significantly different way from firms in the control sample. For venture-backed larger firms a weak increase in profitability shows up if we consider ROE, value added per employee, ROA and ROI (the latter two results are not reported).[27]

As for the other measures of performance, results show that venture-backed SMEs' capital expenditures (CAPEX) grow only in the year of the deal and subsequently decrease. No significant difference emerges for larger firms.[28] As complementary measures to CAPEX, we consider fixed assets per employee and total assets: venture-backed SMEs show an increase in these two variables with respect to the control sample, whereas no significant effect is detected for larger ones.

The share of intangibles assets decreases in the long run for small firms, whereas large firms record an increase in the short-term and in the interim period. Growth in terms of sales of both small and large venture-backed firms contracts in the longer term; this is confirmed whether we look at the differential effect with respect to the industry in which the firm operates (the variable GROWTH)[29] or at the rate of change in sales. Moreover, no long-run

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[27] We enriched the ROE regression controlling for SIZE. Results (not reported) confirm that ROE decreases for venture-backed SMEs and increases slightly for larger ones.

[28] We enriched the CAPEX regression controlling for SIZE and GROWTH (not reported). Again, results are confirmed.

[29] We enriched the GROWTH regression controlling for SIZE (not reported). Results are confirmed.

effect is detected for the rate of growth of total assets and a long-term contraction in the rate of change of employees emerges for SMEs.

The evidence on the ex-post performance, coupled with the results of the ex-ante analysis that showed a significant correlation between growth and the probability of venture capital, seems to indicate that the innovation first hypothesis, rather than the venture capital first hypothesis is validated by our data. Venture capital financing occurs after a period of higher than average investment and growth and contributes to the consolidation of a firm's result, rather than spurring further innovation and growth. Venture capital financing, though not directly affecting the measures of growth, seems to facilitate consolidation in firms' results, as is evident from the long-term effect on size for SMEs.

As for the measures of indebtedness, larger firms reduce their leverage; the effect is also significant in the long run (though at the 10 per cent level). This finding confirms the hypothesis drawn from the ex-ante analysis that it is for large firms (presumably involved in private equity deals) that the theory of re-balancing of the financial structure is valid. For venture-backed SMEs a certification effect seems to be at work, given the increase in their indebtedness. This result has to be interpreted cautiously, given that the results for an alternative indicator of indebtedness (Debt/sales) confirm only the contraction of debt for larger firms.[30]

In the long run small firms significantly reduce the number of banks with which they operate[31] and increase the maturity of bank debt. Both small and large firms reduce their overdraft rate, though the effect is significant for SMEs only. After the deal, the significant increase in debt maturity helps SMEs attain a maturity composition that allows them to engage in long-term investments and to reduce the tensions on bank credit lines.

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[30] Moreover, controlling for SIZE in the leverage regression for SMEs, no significant difference among venture-backed and non-venture-backed firms emerges, whereas the contraction in leverage for larger firms becomes much more significant.

[31] The regression presented in Table 8 also includes the log of sales as a measure of SIZE (the sign of this variable is positive and significant).

6. Conclusion

The analysis of venture capital financing in Italy indicates that this form of finance satisfies a variety of needs. The empirical evidence has shown that small firms and those with more severe asymmetric information problems are more likely to find the support of the venture capitalist, thereby confirming the evidence based on the experience of the United States that venture capital is able to reduce significantly financial constraints for smaller firms.

Our results also rationalize the high frequency with which larger firms resort to the venture capitalist; in this case, results of both the ex-ante and the ex-post analysis indicate that larger firms demand venture capital services in order to re-balance a financial structure that is too far tilted towards debt rather than equity. For small firms venture capital financing is followed by an increase in the maturity of debt.

We also find indirect support for the theories that stress the advisory role of the venture capitalist, as venture capital financing appears to be more frequent after periods of higher than average growth and investment. In particular, the innovation first hypothesis rather than the venture capital first hypothesis seems to be accepted: venture capital follows a period of growth, but after the deal no significant difference in the performance of venture-backed vis-à-vis non-venture-backed companies emerges.

Finally, a novel result is that venture capital finance is also directed at firms with weak relationships with the banks, as approximated by the number of bank relationships. This result needs to be analyzed further in future research, but indicates that venture capital contracts can have a role to play when the relationship between the bank and the firm is weak. In this case, the information set available to the bank and the amount of collateral each bank can seize in case of default may be limited. Moreover, the amount of bank credit is probably near its limit and firms need to resort to venture capital, a contract whose characteristics reduce the amount of guarantees needed to access external finance.

Tables

Table 1

Private equity and venture capital

(aggregate data)

	Italy			European Union [1]			United States		
	1998	2000	2003	1998	2000	2003	1998	2000	2003
Investment:									
Euro millions	944	2,968	3,034	14,077	33,564	28,689	19,141	115,086	16,301
‰ of GDP	0.9	2.5	2.3	1.8	3.9	3.1	2.5	10.8	1.7
Investment share in High-Tech sectors %	11.0	23.0	7.0	26.7	41.8	23.4	69.2	69.3	78.3
Investment share in Seed and Start-up Stages %	12.0	18.2	1.9	11.0	19.1	7.0	34.1	27.5	20.2
Investment share in Seed, Start-Up and Expansion Stages %	43.3	51.0	21.2	40.4	55.8	27.8	84.6	84.8	74.7
Divestments through the Stock market (as a % of investments in the year)	3.2	2.6	1.4	7.1	2.9	5.5	23.7	30.5	10.8
New funds raised (Euro millions)	1,051	2,925	1,937	19,690	45,653	26,189	26,460	114,551	9,535
Share of new funds raised from pension funds %	6.9	4.0	10.0	24.4	22.9	18.3	60.1	40.1	42.3[2]

Sources: National Venture Capital Association (NVCA) for the United States; European Venture Capital Association (EVCA) and AIFI for Europe; AIFI for Italy.
(1) EU15 (data for Luxembourg are not available). – (2) 2002.

Table 2

The sample of venture capital and private equity deals in Italy

Investments granted to non-financial firms. For the period 1989-1996 data on the deals were collected by means of a questionnaire sent in 1999 to the main Italian venture capital firms. For the subsequent period information was provided by the Italian venture capital association (AIFI). We classify a deal as a "first-round" deal when on the basis of available information it appears to be the first time the firm receives such financing.

Year of the deal	Total number of deals	
		Of which: first round deals
1989	5	5
1990	4	4
1991	6	6
1992	8	6
1993	14	11
1994	20	17
1995	18	16
1996	23	18
1997	93	91
1998	91	73
1999	59	43
Total	341	290

Descriptive statistics

In Panel A, the summary statistics refer to the control sample of small and medium enterprises (SMEs; defined as those with less than 20 million euro of total assets). In Panel B data refer to SMEs that received funds from a venture capitalist. In Panel C, they refer to the control sample of large enterprises (defined as those with at least 20 million of total assets). In Panel D data refer to large firms that were financed by a venture capitalist. Data in Panels A and C are averages over 1988-1999; data in Panels B and D refer to the year before the venture capital deal. Leverage is the ratio of debt over debt and equity (at book value). ROE is profit over the book value of equity. Intangibles is the ratio of intangible assets over intangible and fixed assets. Coverage is EBITDA over interest expense. Growth is the difference between each firm's sales growth and that of its own industry. CAPEX is the rate of change of fixed assets. The number of banks refers to those from which each firm draws credit. Overdraft is a dummy equal to 1 if the ratio of credit drawn over credit granted is at least equal to 110 per cent; this ratio is calculated taking into account only short-term loans. The Herfindahl concentration index and the share of the first bank are calculated over the credit drawn by each firm. RISK is the standard deviation of the distribution of ROE for all the companies in the same industry. A * indicates that a test of the equality of means between the control sample and the VB sample is rejected (at least at 5 per cent).

Variable	Number of Obs.	Median	Mean	Std. Dev.	5° pctile	95° pctile
Panel A: Control sample – SMEs						
Sales (€ mill)	120,414	5.3	8.6	24.4	0.6	26.1
Total assets (€ mill)	121,602	3.8	6.5	20.6	0.6	19.7
Number of employees	99,939	29.0	49.6	101.2	4.0	160.0
Age (years)	98,095	15.0	18.0	13.6	3.9	43.9
High-tech sectors (0-1)	121,055	0	0.03	0.17	0.0	0.0
Leverage	117,601	53.7	48.0	32.4	0.0	93.5
Roe	115,326	5.7	3.8	39.6	-43.1	46.6
Intangibles	120,643	4.7	15.3	22.4	0.0	68.0
Coverage	118,175	2.4	8.1	23.4	-1.5	34.2
Growth	102,331	-1.5	2.3	35.1	-39.4	52.6
Capex	95,017	0.4	16.7	63.6	-33.3	115.8
Value added x employee (€ mill)	99,939	3.9	4.9	8.2	1.2	11.5
Number of banks	103,038	5.0	5.6	4.1	0.0	13.0
Overdraft (0-1)	96,410	0	0.04	0.2	0	0
Share of the first bank	96,649	49.6	55.3	26.8	20.0	100.0
Herfindahl index	89,026	35.2	44.5	28.7	12.3	100.0
Credit drawn/credit granted	90,355	30.0	39.9	39.4	0.0	112.7
Long-term loans/Total loans	121,453	4.4	12.1	17.0	0.0	48.0
Risk	121,598	39.2	39.3	6.5	29.4	52.6
Panel B: Venture-backed SMEs						
Sales (€ mill)	210	6.5	15.0*	20.8	0.0	53.4
Total assets (€ mill)	253	7.0	14.3*	28.5	0.1	60.4
Number of employees	137	74.0	123.5*	133.8	15.0	451.0
Age (years)	253	6.0	11.4*	15.4	0.0	39.0
High-tech sectors (0-1)	252	0	0.1*	0.3	0	1
Leverage	245	42.1	38.6*	32.5	0.0	86.2
Roe	242	1.2	-7.0*	46.6	-81.8	29.0
Intangibles	249	13.9	29.9*	33.4	0.1	100.0
Coverage	205	2.3	7.0	21.4	-7.9	39.9
Growth	148	2.1	12.5*	52.1	-29.0	88.3
Capex	160	3.4	27.0	69.3	-17.4	147.2
Value added x employee (€ mill)	137	4.4	5.5	4.4	1.8	14.3
Number of banks	192	5.0	5.9	5.9	0.0	16.0
Overdraft (0-1)	124	0	0.04	0.2	0	0
Share of the first bank	124	41.0	46.6*	24.4	17.4	100.0
Herfindahl index	121	27.4	35.7*	26.6	11.1	100.0
Credit drawn/credit granted	117	34.5	41.0	37.3	0.0	110.9
Long-term loans/Total loans	249	5.0	15.1*	20.9	0.0	59.8
Risk	253	39.7	41.8*	10.6	30.2	72.4

Table 3/ctd

Variable	Number of Obs.	Median	Mean	Std. Dev.	5° pctile	95° pctile
Panel C: Control sample – Large firms						
Sales (€ mill)	8,929	45.5	117.7	568.7	5.1	341.3
Total assets (€ mill)	9,023	48.1	124.3	484.5	18.1	370.9
Number of employees	8,601	227.0	555.8	3013.8	19.0	1600.0
Age (years)	8,442	16.9	24.0	22.2	2.9	74.0
High-tech sectors (0-1)	8,992	0	0.06	0.2	0	1
Leverage	8,712	57.1	52.0	29.3	0.0	93.4
Roe	8,497	4.0	-1.1	44.0	-66.5	40.4
Intangibles	8,952	4.9	16.0	23.7	0.0	74.2
Coverage	8,753	2.2	8.0	24.2	-1.8	37.1
Growth	7,822	-2.3	0.2	33.4	-41.3	45.0
Capex	7,274	0.5	10.5	47.8	-28.4	77.1
Value added x employee (€ mill)	8,601	4.9	7.6	36.5	0.9	17.7
Number of banks	6,752	9.0	10.9	8.6	1.0	26.0
Overdraft (0-1)	6,356	0	0.04	0.2	0	0
Share of the first bank	6,401	45.0	52.5	29.0	15.7	100.0
Herfindahl index	5,968	30.4	41.6	31.1	8.5	100.0
Credit drawn/credit granted	5,855	15.4	30.3	35.1	0.0	100.3
Long-term loans/Total loans	9,015	11.2	18.6	21.3	0.0	65.5
Risk	9,023	39.5	40.0	7.3	30.2	52.6
Panel D: Venture-backed large firms						
Sales (€ mill)	61	49.1	71.7*	86.5	5.6	188.4
Total assets (€ mill)	66	50.4	104.6	229.4	20.3	295.6
Number of employees	59	297.0	411.5*	481.8	49.0	1396.0
Age (years)	66	9.0	20.0	26.2	0.0	86.0
High-tech sectors (0-1)	66	0	0.03	0.2	0	0
Leverage	62	61.3	56.5	25.5	3.7	95.9
Roe	59	2.0	-4.2	45.7	-89.3	43.7
Intangibles	65	13.3	26.9*	30.9	0.4	97.8
Coverage	64	2.3	3.4*	6.5	-2.6	16.4
Growth	45	4.2	11.9*	31.1	-26.5	83.2
Capex	47	-0.05	2.7	25.8	-24.0	59.9
Value added x employee (€ mill)	59	4.5	5.1*	4.7	0.0	16.3
Number of banks	52	11.0	11.7	7.5	0.0	27.0
Overdraft (0-1)	49	0	0.04	0.20	0	0
Share of the first bank	49	38.5	45.8*	28.1	13.1	100.0
Herfindahl index	48	22.2	33.3*	27.8	7.7	100.0
Credit drawn/credit granted	45	18.1	33.8	35.2	0.0	100.4
Long-term loans/Total loans	66	18.1	23.9*	25.6	0.1	86.6
Risk	66	37.9	38.5*	6.6	31.3	48.7

Table 4

Review of theories and empirical evidence on venture capital financing

	References to the literature	Empirical predictions	
		Effects on the probability of VC	Consequences after VC deal
Asymmetric Information	Leland and Pyle (1977) Holmström and Tirole (1997) Berger and Udell (1998) Young and small firms have less visibility than large and mature ones: asymmetric information problems are likely to be more severe for them. In the absence of an adequate amount of collateral the debt contract is unlikely to induce effort by the entrepreneur.	Smaller and younger companies are more likely to receive VC finance. Also firms with low collateral are more likely to be venture-backed. Asymmetric information problems are likely to be more severe for firms operating in high-tech sectors or with high R&D expenses, that are more difficult to evaluate.	The venture capitalist's involvement in the firm implies a certification effect. Information asymmetries are likely to be reduced. If this is the case, the likely consequence is an increase in access to outside finance (both debt and equity) after the deal. If the increase in debt prevails, leverage should increase. With respect to firm performance, profits should increase to remunerate the VC.
Banks and venture capitalists	Ueda's (2004) model is one of asymmetric information. It specifically discusses the trade-offs between bank financing and venture capital financing. Risk of expropriation by an insider venture capitalist has to be weighted with the lack of monitoring by uninformed banks.	In this framework it is likely that the quality of information and the amount of collateral available to banks are inversely related to the number of banking relationships the firm has. VC finance more likely for firms with multiple lending.	Profits should increase to compensate the entrepreneur of the risk of expropriation by the venture capitalist.
VC as consultant	Hellman and Puri (2000); Casamatta (2003); Kortum and Lerner (1998); Hirukawa and Ueda (2003) The venture capitalist participates actively in the management of the firm. In particular, his/her experience helps to bring firms with new ideas (especially young ones lacking experience) to the market and to expand their commercial web.	The VC deal is more likely when the firm (or the entrepreneur) is young, operates in innovative industries with high R&D expenses, and after a period of higher than average growth.	If the participation of the venture capitalist spurs innovation (venture capital first hypothesis) we expect an increase in growth and in intangible assets after the deal. If VC finance follows a period of higher than average growth (innovation first hypothesis), we do not expect any significant difference in performance measures w.r.t non-VB firms.
Re-balancing the financial structure	Pagano, Panetta and Zingales (1998) Bergemann and Hege (1998) Venture capitalists help firms to re-balance their financial structure both in terms of the composition between debt and equity and in terms of their debt maturity.	VC financing more likely for high-debt/high-growth/high-investment firms. The probability should also be higher for firms with a relatively higher share of short-term debt that does not allow the financing of long-term investment.	De-leveraging/lengthening of debt maturity. No particular predictions for firm performance.

Table 5

Determinants of Venture Capital Financing

Columns (a), (b) and (c) report the results of estimating a probit model on the probability of being financed by a venture capitalist. The marginal effects are presented. The dependent variable is 0 if the company is not financed, and 1 in the year of the deal (firms are dropped from the sample after the first VC deal). The control variables are lagged one year. In columns (a) and (c) the control sample is chosen randomly from the CB database among firms of similar size and industry to those that are venture-backed. In column (b) the control sample is the whole CB sample of non-financial firms that are not venture-capital-backed. In column (d) results of a Cox proportional hazard model estimated using the random control sample are reported. In this model the dependent variable is the time span between one operation and the other; the event (failure) occurs in the year the firm is financed by the venture capitalist. A multiple failure model is estimated to take into account that each firm can be financed more than once.

Age is the age of the firm (in logarithm). Size is the log of total firm sales. High-tech is a dummy equal to 1 for companies in high-tech sectors. ROE is profit over equity. Leverage is debt over debt plus equity. Intangibles is defined as the ratio of intangible assets over the sum of intangible and fixed assets. CAPEX is the rate of change of fixed assets. BANKS is the (log of the) number of banks from which each firm draws credit. Overdraft is a dummy equal to 1 if the ratio of credit drawn over credit granted is at least equal to 110 per cent; this ratio is calculated taking into account only short-term loans. RISK is the standard deviation of the distribution of ROE for all the companies in the same industry. In the estimation we control also for industry and calendar effects (results not reported). Estimates are robust to the presence of heteroskedasticity and for clustering of the error term. The symbol *** indicates a significance level of 1 per cent or less; ** between 1 and 5 per cent; * between 5 and 10 per cent. Coefficients and standard errors (in parentheses) in columns (a)-(c) are multiplied by 1,000.

Variable	**(a)**		**(b)**		**(c)**		**(d)**	
Age	-0.856	***	-0.208	***	-0.377	***	-0.890	***
	(0.106)		*(0.025)*		*(0.125)*		*(0.162)*	
Size	-1.106	***	-0.235	***	0.529		-0.768	***
	(0.167)		*(0.034)*		*(0.797)*		*(0.110)*	
Size ^{2}	0.068	***	0.014	***	-0.011		0.050	***
	(0.011)		*(0.002)*		*(0.039)*		*(0.006)*	
Intangibles	0.011	***	0.002	***	0.012	***	0.010	***
	(0.003)		*(0.001)*		*(0.003)*		*(0.003)*	
Leverage	-0.003	*	-0.001	*	-0.003		-0.003	
	(0.002)		*(0.000)*		*(0.003)*		*(0.002)*	
ROE	-0.001		-0.0004		-0.0005		-0.00002	***
	(0.001)		*(0.0003)*		*(0.0014)*		*(0.00001)*	
High-tech	1.169	*	0.392	**	0.696		-0.346	
	(0.887)		*(0.252)*		*(0.843)*		*(0.627)*	
Capex					0.00001	*		
					(0.000009)			
Risk					0.0190	*		
					(0.0108)			
Banks					0.472	***		
					(0.160)			
Overdraft					1.506	**		
					(1.030)			
Number of observations (For column d: Number of t spans)	101,433		416,259		66,768		15,932	
Number of VC deals	217		217		125			
Pseudo R^2	0.1600		0.1381		0.1379			
Observed probability	0.00214		0.00052		0.00187			

Table 6

Correlations coefficients

Age is the age of the firm (in logarithm). Size is the log of total firm sales. Intangibles is the ratio of intangible assets over intangible and fixed assets. Leverage is the ratio of debt over debt and equity (at book value). ROE is profit over the book value of equity. High-tech is a dummy equal to 1 for companies in high-tech sectors. Growth is the difference between each firm's sales growth and that of its own industry. Capex is the rate of change of fixed assets. Risk is the standard deviation of the distribution of ROE for all the companies in the same industry. Banks is the (log of the) number of banks from which each firm draws credit. Overdraft is a dummy equal to 1 if the ratio of credit drawn over credit granted is at least equal to 110 per cent; this ratio is calculated taking into account only short-term loans. A * indicates that the correlation coefficient is significant (at least at the 5 per cent level).

Variable	Age	Size	Intangibles	Leverage	ROE	High-tech	Growth	Capex	Risk	Banks	Overdraft
Age	1.000										
Size	0.1434*	1.000									
Intangibles	-0.1885*	-0.0259*	1.000								
Leverage	-0.0223*	-0.001	0.0189*	1.000							
ROE	-0.0224*	0.0934*	-0.0590*	-0.1695*	1.000						
High-tech	-0.0176*	0.0389*	0.0709*	-0.0054*	0.0022	1.000					
Growth	-0.0074*	0.0137*	0.0148*	-0.0001	-0.0001	0.0059*	1.000				
Capex	-0.0100*	0.001	-0.001	0.001	-0.0030	-0.001	0.0294*	1.000			
Risk	-0.0880*	-0.0232*	0.1817*	-0.0006	-0.0426*	0.1494*	0.0091*	0.0046*	1.000		
Banks	0.1493*	0.3699*	-0.1263*	0.0895*	-0.0034*	-0.0072*	-0.0051*	-0.0034*	-0.1925*	1.000	
Overdraft	-0.0367*	-0.0900*	0.0394*	0.0405*	-0.0684*	-0.0036*	0.0047*	0.0070*	0.0456*	-0.0908*	1.000

Determinants of venture capital financing

(differences between small and large firms)

Probit regression results for the probability of venture capital finance (marginal effects). The dependent variable is 0 if the company is not financed, and 1 in the year of the deal (firms are dropped from the sample after the first VC deal). The regressors are lagged one year. The control sample is chosen randomly from the CB database among firms of similar size and industry as those that are venture-backed. Small and medium firms (SMEs) have less than 20 million euro in total assets. Large firms have assets of at least 20 million euros. Size is the log of firm sales. High-tech is a dummy equal to 1 for companies in high-tech sectors. ROE is profit over equity. Leverage is debt over debt plus equity. Intangibles is the ratio of intangible assets over the sum of intangibles and fixed assets. Growth is the difference between a firm's sales rate of growth and that of its industry. CAPEX is the rate of change of fixed assets. BANKS is the (log of the) number of banks that grant credit to each firm. Risk is the cross-sectional standard deviation of the ROE of companies in the same industry. The dummy Overdraft is 1 if credit drawn over credit granted is at least equal to 110 per cent. In the estimation we control also for industry and calendar effects (results not reported). Estimates are robust to the presence of heteroskedasticity and for clustering of the error term. *** indicates significance level of 1 % or less; ** between 1 and 5 %; * between 5 and 10 %. Coefficients and standard errors (in parentheses) are multiplied by 1,000.

Variables	**(a)**		**(b)**		**(c)**		**(d)**		**(e)**	
	SME	**Dummy large**	**SME**	**Dummy large**	**SME**	**Dummy large**	**SME**	**Dummy large**	**SME**	**Dummy large**
Age	-0.8458 ***	0.3265 *	-0.3884 ***	0.3059	-0.6584 ***	0.3221	-0.8063 ***	0.3498 *	-0.3598 ***	0.0348
	(0.107)	*(0.200)*	*(0.135)*	*(0.258)*	*(0.145)*	*(0.280)*	*(0.104)*	*(0.200)*	*(0.095)*	*(0.177)*
Size	-1.1243 ***	0.3013 *	-1.8233 ***	0.5646 ***	-1.2898 ***	0.3907 *	-1.0940 ***	0.6922 ***	-0.4441	0.5195 ***
	(0.184)	*(0.179)*	*(0.309)*	*(0.222)*	*(0.232)*	*(0.225)*	*(0.176)*	*(0.234)*	*(0.321)*	*(0.171)*
$Size^2$	0.0703 ***	-0.0362 ***	0.1170 ***	-0.0633 ***	0.0857 ***	-0.0450 ***	0.0685 ***	-0.0544 ***	0.0410 **	-0.0493 ***
	(0.013)	*(0.014)*	*(0.019)*	*(0.017)*	*(0.016)*	*(0.017)*	*(0.013)*	*(0.016)*	*(0.018)*	*(0.014)*
Intangibles	0.0093 ***	0.0026	0.0110 ***	0.0051	0.0149 ***	0.0006	0.0078 ***	0.0064	0.0082 ***	0.0025
	(0.003)	*(0.005)*	*(0.003)*	*(0.007)*	*(0.004)*	*(0.008)*	*(0.002)*	*(0.005)*	*(0.002)*	*(0.004)*
Leverage	-0.0044 **	0.0106 **	-0.0035	0.0071	-0.0052 **	0.0083	-0.0038 **	0.0098 **	-0.0031 *	0.0053
	(0.002)	*(0.004)*	*(0.003)*	*(0.006)*	*(0.003)*	*(0.006)*	*(0.002)*	*(0.005)*	*(0.002)*	*(0.004)*
ROE	-0.0016	0.0045	-0.0021	0.0028	-0.0021	0.0032	-0.0012	0.0045	-0.0008	0.0016
	(0.001)	*(0.004)*	*(0.001)*	*(0.004)*	*(0.001)*	*(0.004)*	*(0.001)*	*(0.004)*	*(0.001)*	*(0.003)*
High-tech	1.2802 **		2.6539 **		1.8231 **		0.8641 *		0.6860	
	(0.925)		*(2.127)*		*(1.378)*		*(0.729)*		*(0.756)*	
Growth			0.0032 *	0.0063 **						
			(0.002)	*(0.003)*						
Capex					0.0021 **	-0.0040				
					(0.001)	*(0.003)*				
Risk							0.0350 **	-0.0564 ***		
							(0.009)	*(0.019)*		
Banks									0.3754 ***	-0.1274
									(0.122)	*(0.180)*
Overdraft									1.1563 **	-0.2299
									(0.845)	*(0.277)*
N. of observations	101,433		83,274		76,304		101,431		81,113	
N. of VC deals	170	47	116	31	125	33	170	47	101	37
Pseudo R^2	0.1697		0.1244		0.1275		0.1748		0.1611	
Observed probability	0.00214		0.00177		0.00207		0.00214		0.00170	

Effects of venture capital financing

For each variable listed, we estimated the following specification: $y_{i,t} = \alpha + \beta_1 VC0 + \beta_2 VC13 + \beta_3 VC4T + u_i + d_t + e_{i,t}$

where VC0 is a dummy equal to 1 in every first year of the deal; VC13 takes the value of 1 in the three subsequent years; VC4T is 1 from the fourth year onwards. u_i is a firm-specific effect, d_t is a calendar year-specific effect, ε_{it} 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; in this way we are able to control for firm-specific characteristics which are time-invariant but correlated to VC effects, such as managerial behaviour, etc. Standard errors (in parentheses) are heteroskedasticity adjusted with the White correction and are reported in parentheses. The symbol *** indicates a significance level of 1 % or less; ** between 1 and 5 %; * between 5 and 10 %. The control sample is chosen randomly from the CB database among firms of similar size and industry as those that are venture-backed. Small and medium firms (SMEs) are defined as those with less than 20 million euro of total assets. Large firms are those with at least 20 million euro in total assets. ROE is profit over the book value of equity. ROS is EBITDA over total sales. CAPEX is the rate of change of fixed assets. Leverage is the book value of debt over the book value of debt and equity. Intangibles is defined as the ratio of intangible assets over the sum of intangibles and fixed assets. Growth is the difference between a firm's sales rate of growth and that of the industry in which the firm operates. Number of banks is calculated for banks that grant credit to each firm. LTLO is the ratio between long-term and total bank loans. CDCG is the ratio of credit drawn over credit granted and is calculated taking into account only short-term loans. The Herfindahl concentration index is calculated over the credit drawn by each firm. The column F-test reports the test on the hypothesis that the sum of the coefficients of all the ex-post dummies is equal to zero. *** indicates that the hypothesis is rejected at a significance level of 1 % or less; ** between 1 and 5 %; * between 5 and 10%.

	SME					**Large firms**				
Variables	Number of obs.	Year 0	Years 1-3	Years >3	F-test	Number of obs.	Year 0	Years 1-3	Years >3	F-test
ROE	151,424	1.211	-8.223 **	-4.037	3.20 **	11,385	1.748	7.991 *	-2.253	2.36 *
		(4.292)	*(3.855)*	*(4.203)*			*(5.930)*	*(4.353)*	*(4.948)*	
ROS	156,920	0.558	-0.507	-2.990	0.92	11,815	0.818	2.013	-3.781	1.82
		(2.831)	*(2.314)*	*(2.184)*			*(2.436)*	*(1.979)*	*(2.751)*	
Value added x employee (log)	124,076	0.016	0.004	0.013	0.07	10,586	0.022	0.139 *	0.113	1.83
		(0.042)	*(0.034)*	*(0.043)*			*(0.083)*	*(0.073)*	*(0.080)*	
Capex	128,099	16.035 ***	-6.773 *	-9.197 **	5.16 ***	9,965	7.131	-1.524	-2.838	0.66
		(6.266)	*(4.015)*	*(4.318)*			*(6.054)*	*(4.047)*	*(4.929)*	
Fixed assets x employee	124,835	-0.022	3.991 **	4.711 **	3.32 **	10,288	-0.758	-1.191	-0.001	0.14
		(1.931)	*(1.697)*	*(2.043)*			*(3.075)*	*(2.771)*	*(2.910)*	
Total assets (log)	159,236	0.325 ***	0.562 ***	0.356 ***	17.96 ***	12,099	0.023	0.099	0.051	0.69
		(0.096)	*(0.085)*	*(0.091)*			*(0.134)*	*(0.071)*	*(0.082)*	
Intangibles	157,866	1.374	-2.512 *	-6.154 ***	9.35 ***	11,995	4.592 **	3.225 *	1.882	2.23 *
		(1.651)	*(1.424)*	*(1.543)*			*(2.027)*	*(1.767)*	*(2.012)*	
Growth	128,439	-6.424	-11.911	-23.036 ***	5.07 ***	9,870	7.522	-6.378	-8.344 *	2.17 *
		(7.927)	*(7.614)*	*(7.806)*			*(7.178)*	*(4.291)*	*(4.986)*	
Δ Sales	128,772	-7.006	-11.829	-21.821 ***	4.33 ***	9,881	8.314	-5.850	-8.718 *	2.29 *
		(7.939)	*(7.619)*	*(7.795)*			*(7.183)*	*(4.338)*	*(5.009)*	
Δ Assets	119,425	0.208	-2.597	-2.683	1.40	9,421	6.161 *	0.746	-0.553	1.59
		(1.965)	*(1.627)*	*(1.840)*			*(3.213)*	*(2.221)*	*(2.356)*	
Δ employees	104,769	-2.580	-10.775	-16.233 **	1.57	9,683	28.010	1.567	14.615	0.89
		(10.235)	*(7.398)*	*(8.293)*			*(18.906)*	*(8.999)*	*(22.870)*	

Variables	SME					Large firms				
	Number of obs.	Year 0	Years 1-3	Years >3	F-test	Number of obs.	Year 0	Years 1-3	Years >3	F-test
Leverage	155,430	-1.060	5.056 ***	3.141 *	8.20 ***	11,803	-6.166 **	-3.489	-5.182 *	1.70
		(1.696)	*(1.473)*	*(1.792)*			*(2.929)*	*(2.344)*	*(2.862)*	
Debt/sales	151,752	-0.598	1.996	-0.721	1.89	10,600	-1.850	-3.967 *	-0.464	1.45
		(1.760)	*(1.513)*	*(1.737)*			*(3.492)*	*(2.435)*	*(2.930)*	
LTLO	155,338	4.312 ***	4.866 ***	3.069 **	6.58 ***	11,800	0.185	0.326	2.018	0.47
		(1.389)	*(1.132)*	*(1.333)*			*(2.749)*	*(2.427)*	*(2.544)*	
CDCG (1)	80,763	-5.161	-6.583 **	-2.556	1.77	4,895	2.896	-2.101	-5.807	0.70
		(3.689)	*(3.128)*	*(3.581)*			*(6.510)*	*(4.604)*	*(5.050)*	
Number of Banks (2)	124,653	0.302	0.258	-0.459 **	6.35 ***	8,501	0.671	1.480 **	1.391	2.43 **
		(0.244)	*(0.212)*	*(0.240)*			*(0.647)*	*(0.593)*	*(0.724)*	
Herfindahl	119,772	3.086	-2.208	-0.230	2.65 **	8,518	-0.635	-5.219 *	-2.652	1.27
		(2.199)	*(1.920)*	*(2.183)*			*(3.906)*	*(3.124)*	*(3.316)*	

(1) Only firms with non-negligible values of the credit drawn over credit granted are considered (at least 5 per cent). Data trimmed for extreme values. – (2) The regression includes also a measure of size (log of total sales). Only firms with non-missing values of credit drawn over credit granted are considered. Data trimmed for extreme values.

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