Venture Capitalists at Work: What Are the Effects on the Firms They Finance?

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May 2015

Abstract

This article documents that Italian startups financed by venture capitalists (VC) experience a faster growth in size compared with other startups. This growth is also sustained by a larger increase in financial debts for VC backed firms, after VC financing, that offsets the rise in equity; their leverage is hence similar to that of other firms. The last evidence could be interpreted as a signalling effect to banks that, in the absence of VC intervention, likely would have not increased their debt by the same amount to finance firms' growth. However, lenders do not change the cost or the maturity of loans to VC-backed firms. Sales are higher for VC financed firms, though only after 4 years from VC financing; as a consequence of this delayed upsurge in sales, the operating profitability of VC backed firms, which was initially worse, also improved and in the end is not different from that of the other startups. We do not detect any significant effect of VC on the survivorship rate and innovation activity, measured by patents, in the companies they finance. These results are obtained by comparing VC backed firms in Italy in the period 2004-2011 with a sample of startups that have been rejected by VC after different stages of the due diligence process and that are similar, before VC financing, in many characteristics to the firms that have been financed. Treated and control firms are therefore very comparable for many observable and unobservable features; specifically, they are similar as for their unobservable desire and determination to grow because all companies have searched for external equity capital.

JEL classification: G21, G24, G32

Keywords: venture capitalists, effects on firm outcomes, rejected businesses.

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1 Introduction

Venture capital (VC) investors provide equity capital to early-stage, high growth potential startup companies that usually develop a new technology or a new business model in high-tech industries. Startup companies could find it difficult to obtain debt capital as banks normally require collateral they might lack of; additionally, debt financing involves the ability to service debt, while startup firms might not generate any cash flow for the initial years of activity. Venture capitalists hope to get a return by selling their shares in the companies through a trade-sale or an Initial Public Offering (IPO). They usually expect important returns on some of their investments to offset the fact that a good amount of their projects will fail.[1] In order to increase the return of the investments, VC investors adopt an active form of financing: almost all of them sit on the board of directors and they provide entrepreneurs with advice and contacts.

VC investors might therefore have important effects on the firms they finance, whose performances are hence expected to be better than those of other similar firms that did not receive VC finance (Gompers and Lerner, 2001). This is not just because the equity capital they provide helps reducing the funding gap of high-tech startup firms, but also due to the fact that VC managerial and financial experience could be very useful in enhancing firms' grow perspectives. Finally they can also improve firms' performances through their network connections and a signaling effect on other financiers, specifically banks. On the other hand, following the VC intervention important conflicts can arise in the governance of the firms, which could be harmful for their performances. First, the aims and strategies of VC investors could be very different from those of the entrepreneurs; specifically, most VC investors could have too a short-term investment perspective compared with that of the entrepreneurs, who can consider this feature detrimental for long-term firm performances. Although VC investors are committed to a company for a long haul, their primary aim is to find a good form of exit from the company.[2] Secondly, appropriability problems can arise as VC investors might just try to capture the innovative idea of the entrepreneurs and exploit it by themselves. The evaluation of VC effects is therefore an empirical question. As a matter of facts, some papers have found no or weak beneficial effects of VC investors on firms' results.

[1] Shikhar Ghosh of Harvard Business School (HBS) found that three-quarters of US startups backed by venture capital failed to return the capital invested in them, let alone generate a positive return; the figure was calculated on a sample of 2,000 companies that received VC funding between 2004 and 2010. Entrepreneurs anonymous, The Economist, Sept 20th 2014.

[2] The US Small Business Administration website reports that on average the exit happens 4 to 6 years after an initial investment; in Italy, AIFI, the Italian Association of Private Equity and Venture Capital, estimates an average holding period of 5 years.

The aim of this paper is exactly to evaluate the VC contributions on the firms they finance. We focus on Italy where the VC market is still very underdeveloped compared with other European countries and the US (Figure 1). The evaluation of VC activity is very important in our country where a public intervention has been suggested in order to provide a kick off to the expansion of this market; exactly with this purpose, a VC fund has recently been created, partially funded with public money.[3]

The most important challenge in this type of analysis is finding an adequate control sample so that a VC treatment effect is detectable, while selection effect is controlled for. Firms that apply for VC funding may be different: the decision to apply may be related to the quality of the new idea and the consequent determination to exploit it. Moreover, VC investors could be smart enough to select the best startup high-tech companies. In other words, there could exist some firm unobservable features (unobservable to the econometrician) that both affect the firm long-term growth prospects and its probability to be financed by a VC. VC treatment could therefore be endogenous. In this case, the effect you find when you compare VC companies with other startups, which have not been financed by VC, could be just the selection effect or a mix of selection and treatment effects.

The empirical literature most related with this paper analyzes US companies. Most of the papers are aware of the selection problem, though very few tackle it in a very comprehensive way. Helmann and Puri use a sample of Silicon Valley startups and do not control for other selection problems; they find that the startups receiving VC financing were faster in reaching the market with their products (Hellmann and Puri, 2000) and that venture capitalists also play an important role in the firm's organization, frequently replacing the founder with an outside CEO (Hellmann and Puri, 2002). Kortum and Lerner (2000) analyze the impact of VC on patents and they control for unobserved factors using a policy shift that freed pension funds to invest in VC in 1979; they find that increases in VC activity in an industry are associated with significantly higher patenting rates. More recently, Puri and Zarutskie (2012) use a longitudinal dataset of private companies and match VC backed firms with others non VC backed firms using only few observable firms' characteristics[4]; they find that VC financed firms achieve larger scale, but are not more profitable; default rates are also lower among VC backed firms. Chemmanur, Krishnan and Nandy (2011),

[3]The Fondo Italiano di Investimento (FIT) in venture capital has been created in September 2014 with an initial funding of 50 million of euro provided by the Cassa Depositi e Prestiti, a state-owned company, while the target funding is 150 million; this is a fund of funds that will invest in other early-stage investors.

[4]For each VC-financed firm they identify a non-VC financed firm that shares the same four-digit SIC code, age, geographical region, and number of employees in the year that the VC-financed firm receives the first round of VC.

using a very similar dataset, but also different empirical strategies to control for unobservable firms' characteristics, confirm that VC backed firms have higher survivorship rate and also find that they reach a higher level of total factor productivity, the main output they focus on. One of the most appealing studies as for the attempt to control for the selection problem is Kerr, Lerner and Schoar (2014). The authors compare firms financed by early stage investors (business angels in their case) with those that have been discarded with a level of score just below a threshold and that are hence very similar, in some observable and unobservable characteristics, to the firms that have been financed; they find that firms receiving financing by business angels have improved survival, exits, employment, patenting, Web traffic, and further equity financing.[5]

Regarding Europe, the results about VC effects are weaker. Bottazzi and Da Rin (2002) develop a unique hand-collected data set recording the companies that went public on Euro.nm market from its inception in 1996 to December 2000[6]; they argue they consider only startups companies to reduce the bias in the comparison, similarly to what Hellmann and Puri (2000) did in the same period in the US. They find European venture capital to have a limited effect on the firms' ability to grow, create jobs and raise equity capital; these results hold after matching firms using few observable characteristics. Weak results of VC on innovation are also found in Popov and Roosenboom (2012) who follow an approach similar to Kortum and Lerner (2000): they work with data on 21 European countries and 10 industries during the period 1991-2005 and use, as an exogenous variation of VC, data on fund-raising and on the structure of private equity funds in each country.[7][8]. They find that VC investments seem to have an effect only in the sub-sample of high-VC countries and in countries with lower barriers to entrepreneurship, with a tax and regulatory environment that welcomes venture capital investments, and with lower taxes on capital gains. A couple of recent papers, mainly based on matching procedures and on the VICO dastaset[9], find that independent VC have effects on sales growth and on the exit performances of financed firms, while no effects are detected

[5]Another interesting paper regards China between 1998 and 2007: Guo and Jiang (2013) use a a propensity score matching and also instrumental variable estimations based on the number of IPO in the stock market. They find that VC-backed firms outperform non-VC-backed in terms of profitability, labour productivity, sales growth, and R&D investments.

[6]Euro.nm was the result of the alliance of Europe's new stock markets for innovative companies in high-growth industries along the lines of America's Nasdaq.

[7]Their idea is that independent funds have to invest within a relatively short time window compared with captive funds that do not have a limited lifespan and do not raise capital from outside investors other than the single owner of the private equity fund (e.g. a bank or insurance company). Therefore, increased flows in venture capital translate into investments in companies at a faster pace when a country has a higher fraction of independent as opposed to captive funds.

[8]They are able to replicate Kortum and Lerner (2000) results for the US in the same period; however, they also show that, even in the US, in a more recent period, VC had a comparably weak impact on innovation.

[9]More than 8,000 European high-tech firms, of which less than 10 per cent are VC-backed.

for government-managed VC (Grilli and Martinu, 2014; Cumming, Grilli and Martinu, 2014). On a similar line of research, Bottazzi, Da Rin and Hellmann (2008), analyzing *only* VC firms, using a hand-collected sample of European venture capital deals[10], find that investors' activism is more widespread among independent than captive VC (bank-, corporate- or government owned) and is positively related to the success of portfolio companies which is measured with a successful VC exit, either through an IPO or an acquisition. However, they do not look at specific different outputs of financed companies and they do not compare VC backed firms with others.

As for Italy, some empirical papers use a dataset built by the Politecnico of Milan, based on a sample of high-tech startups followed between 1993 and 2003, of which around 10 per cent were VC backed.[11] One of the most interesting result is obtained in Bertoni, Colombo and Grilli (2011): after controlling for selection of the unobservable variables with a panel fixed effect estimation, this study finds that VC financing spurs firm growth.

Summing up, struggling more or less fiercely with the selection problem, most of the papers focus on few output indicators. The evidence of important VC effects is stronger in the US experience than in Europe. The most frequent results of the empirical literature are that VC investors tend to largely increase the size of firms they finance and also their survivorship-rate. Effects on other firms' characteristics, such as profitability, productivity, innovation, and, namely, financial structure and governance are sometimes documented, though less frequently analyzed, specifically altogether, due to the difficulty to gather data.

One important contribution of this paper is that we control for the selection effect by comparing VC firms with similar firms that have requested a VC financing, but were not able to get it (discarded firms). Having demanded a VC intervention is a very important control for firm *unobservable* features, mainly the desire and determination to grow and therefore of firm growth perspectives. This strategy is very similar to Kerr et al. (2014) though we also control for unobservable firm's feature fixed over time by exploiting the longitudinal nature of our dataset through a diff-in-diff estimation. Since VC investment is not random, we select our control group by considering only firms that have been discarded at the very late stage of the due diligence process so that the reason for which the deal has not been completed has nothing to do with the lower quality of the firm, but for example could be related to the lack of funds, the realized absence of VC managerial and technical competence in the specific activity of the firm, or the lack of coordinated interest by different investors given that deals are sometimes syndicated. We also ascertain the quality of the firms in

[10] They analyze 1652 companies financed in 17 European countries by 119 venture capitalists between 1998-2001.

[11] The same dataset in included in the VICO dataset at the European level, mentioned in the previous paragraph.

the control sample by verifying that, according to many observable characteristics, they are very similar to VC backed firms, before they receive the financing; on this respect, we use many more controls than previous papers. Finally, we are reassured about the fact that there are almost no differences in observable and unobservable characteristics between our sample of VC backed firms and the control sample given that the average Z-score (a sort of proxy catching-up the risk and quality of the firm), measured using their balance sheets, is very similar across the two samples before VC financing. All in all, the differences that we find between treated and control sample firms *after* financing can hence be considered as a good measure of VC treatment effect.

A second important contribution of this paper is that we consider the entire population of the Italian VC backed firms in the period 2004-2011 (162 startups), as reported in the Venture Capital Monitor by AIFI, the Italian Association of private equity and venture capital investors.[12] After the merge with the Cerved dataset, from which we get firm balance sheets data, the number of VC backed firms decreases to 59; the sample is still representative of the initial population of VC backed firms as far as industries and geographical areas are concerned. Thirdly, unlike other empirical papers, we consider the VC effects on many different firm outputs; in detail, we evaluate the effects of VC investors on firm size, profitability, financial structure, survivorship and innovation. We are specifically interested in the effects on firms' financial structure in order to test whether VC investment creates a sort of signaling effects for other investors, above all banks (Hellmann, Lindsey and Puri, 2008).

As a brief preview of the results, we find that VC investors have a fast and extended positive effect on the size of the firm: during the 4 years after the VC financing total assets increase on average by 5 million of euro more than that of firms that do not receive any VC finance (the average total assets of VC companies before financing is less than 2 million). Results on assets are confirmed by labor costs; there are also some positive effects on sales, though they are visible only 4 years after the VC financing. This is consistent with the fact that we also detect a negative effect on firm profitability, measured by EBITDA/assets, which however vanishes 3 years after the financing. After VC treatment, the leverage of firms tends to be lower, though on the whole period the difference between the two groups of firms is not statistically significant. This is the consequence of an increase in financial debts for VC-backed firms that almost offsets, over the whole period, the increase in equity provided by VC. This could be considered as a VC signalling effect to lenders that, without VC intervention, likely would have not granted the same amount

[12]The analysis excludes corporate VC, i.e. VC investments made by corporations that are not reported by AIFI.

of money to finance the growth of these risky firms. Moreover, there is no effect on the share of bank on total financial debt, and on the maturity and cost of loans. The survivorship rate and innovation activity, measured by patents, are higher for VC backed firms, albeit the differences are not statistically significant at the usual levels. No other relevant differences are discovered.

The plan of this article is as follows. Section 2 explains the data used and presents some descriptive statistics. Section 3 describes the main empirical strategy followed in the analysis. In Section 4 the results obtained when comparing VC treated firms with discarded firms are presented; in Section 5 their robustness is tested using a different methodology where we use a control sample built with matching based on propensity score. Section 6 discusses the results and concludes.

2 Data and descriptive statistics

The data used in the analysis are obtained from four different sources. First, for every company in our study we gather information for the period 2000-2012 using the Cerved database that contains detailed annual balance sheets for all limited liability companies based in Italy. In the analysis we only focus on active firms with available information at least one year before the VC treatment. This reduces considerably the number of ventures in our study, but it is crucial to evaluate the level and trends of the variables of interest since the year before the treatment. As mentioned, we focus on different firm characteristics, such as size, profitability, and financial structure. As for size, we present results on total assets, labor costs and sales; we cannot use the number of employees, frequently missing in Cerved. Our measures of profitability are EBITDA/Assets and ROE, whereas for financial structure we focus on book value of equity, total financial liabilities, and leverage, which is defined as the ratio between financial debts and the sum of equity and total financial liabilities. Moreover, in order to capture the relationship with banks, we also consider the ratio between bank debt and total financial liabilities, the ratio between long term bank debt and total bank debt and the cost of loans.

The second source of data is the annual survey Venture Capital Monitor by AIFI. We use surveys over the period 2004-2011 to identify 162 venture capital investments.[13] For each deal we observe the name and the origin of the target firm, the name and the type of the investors, and, for most of the investments, some other details, such as the amount invested and the share of the firm acquired by VC. More specifically, about one third of the target companies are private enterprises; of the

[13]We do not consider firms financed by VC in 2012 as we do not have any indications of results in the following years given that the most recent balance-sheets are those referring the year 2012.

remaining, one third are corporate spin offs and two thirds are university spin offs. There are 58 different investors: many of them are associated to only one deal, whereas the most active venture capital has invested in 17 different firms. As for deal terms, the amount invested is specified for two thirds of the investments: the average is 3.4 million of euro with a range of 0.1 to 66 millions; 15 deals are syndicated. Regarding the years of investments, prior the financial crises the trend in total number of deals was increasing, a pattern that seems to have recovered starting from 2010: 2011 has seen the greatest number of originations, about 40.

Our group of VC-backed firms is composed by 59 ventures for which we have balance-sheet information in the year before the treatment; they have been financed by VC over the period 2004-2011. Table 1 provides some summary statistics on these VC-backed firms. 56% of them are located in the North of Italy, whereas 25% operate in the Center and 19% in the South. Similarly to the trend that we observe in the AIFI surveys, the number of ventures entering the treated group is increasing until 2008; moreover, 29% of the firms are financed in the year 2011. About 55% of these companies operate in sectors with high-growth potential, that is ICT, scientific R&D and engineering, 15% of them work either in the energy sector or in marketing and consulting, whereas 22% are manufacturers. As expected, these firms are young (4 years on average), small, as the dummy size, which reflects different accounting variables such as assets and labor costs and whose range is between 1 and 4, is on average equal to 1.1, and have a large incidence of intangible assets on total assets (70%). They are also not profitable and, much less expected, their leverage is not low (57.5%). Overall, they are quite risky firms and this is confirmed by the score provided by Cerved. This variable is particularly important as it captures the intrinsic quality of a company; the average rating for the treated firms is 6.3 out of 9, where higher values mean higher risk.[14]

The third source, which we use to build the control group, is from some of the venture capitalists that are members of the AIFI. We asked all the members to share with us some confidential information about the companies that applied for venture capital and their subsequent evaluations. Five of them, which however account for one third of all the investments undertaken in the period 2004-2012, gave us the information we need. We thus know the name of about 4000 companies that applied for this source of financing during the period 2006-2011, the year in which the screening process occurred, and the stage of the process in which the applicant has been rejected. Finally, some of these venture capitalists gave a summary grade to the applicant or a comment about the reasons not to undertake the investment; the structure of these comments is different across

[14]Cerved calculates the Z-score on the basis of different balance-sheet indicators and assigns firms in different 9 risk classes, from safe (1-4), to vulnerable (5-6) and risky (7-9).

investors and hence are not comparable. However, we can use them to identify the best applicants for each of these five VCs that, despite their quality, were not able to get VC financing. We end up with 157 firms in the control group, that account for 1/30 of all applicants for which we have information. Table 2 shows that there are no systematic differences between treated and rejected firms in the year before treatment; we are particularly reassured by the fact that the average rating of the firms in the two groups are almost identical (a bit more than 6), meaning that their underlying risk and, possibly, other unobservable features are very similar.

Finally, for the part of the study related to innovation, we collect patent applications from the European Patent Register, that is kept by the European Patent Office. We focus on patent applications, rather than grants, to conform with most of the empirical literature about innovation. Using this dataset, we augment the Cerved dataset on balance sheets with information about the total number of patent applications at the European Patent Office by each firm in every year.[15]

3 Empirical strategy

To assess whether firms that benefitted from VC financing afterward outperform those that did not receive VC funding is a challenging task. In order to identify the impact of VC financing, recipient and non-recipient firms should differ only for the assignment of the funds. This assumption is not testable and could be affected by two sources of bias that we need to address in order to correctly identify the impact of VC financing. The first source of bias comes from firms' self-selection. Enterprises that apply for VC funding can be different from those that do not. The decision to apply may be related to the quality of the new idea and the willingness to economically exploit it, or to other unobservable characteristics of the firms that are correlated with the firm performance. In these circumstances, comparing the results of recipients with those of non-recipient firms that do not apply for VC funds might produce biased estimates of effects of the VC financing.

The second source of bias is due to the non-random assignment of VC. Recipient firms might be inherently different from those that applied, but were not financed. VC investors could select the best high-tech startups, and unobservable firm features might affect both the firm probability to be financed by a VC and its long-term growth prospects. Again, this type of problem induces a bias in the estimation of the effect of the financing to the extent that firm characteristics for which we are not able to control for are correlated with the firm performance and differ between recipient

[15] As in three out of four sources of data firms' identifiers are names rather than fiscal codes, we double check that merges with the Cerved dataset are correct using the Business Register kept by the Italian Chambers of Commerce ($https://telemaco.infocamere.it.$).

and non-recipient firms. To deal with these issues, we use an identification strategy based on a careful selection of the control group.

The availability of the information on rejected applicant firms allowed us to fully control for the first source of bias, i.e. self-selection. We use rejected applicants as the set of firms from which we choose the control group for financed firms. Since both groups of firms self-select among the applicants they cannot differ in this respect; hence self-selection bias does not occur.

Our strategy tries to control as much as possible also for the second source of bias by taking advantage of the mechanism of the assignment of the funds. As explained in Section 2, we exploit the multi-step screening process of VC's and the grades they assign to the applicants by focusing on firms that were rejected in the final stages (after due diligence) and those with the highest grades.[16] More specifically, VC follow a due diligence procedure based on several steps to identify the firms that deserve to be financed. In each step, VC evaluate the submitted projects and discard a share of them, until they arrive to the last stage in which the funds are finally assigned. We take as a control group for the recipient enterprises only the applicants that arrive to the last stage of this due diligence process, but eventually did not receive the funds. In the last stage we end up with 157 non-recipient firms, which account for less than 1/30 of all the applicant firms. This constitutes our preferred control group for our 59 VC financed firms.

Selecting our control group by considering only firms that have been discarded at a late stage of the due diligence process assures that recipients and discarded firms are very similar in several respects and that the reason for which they have been discarded is not the low quality of the investments, but possibly the lack of fund, or of coordination among different investors, given that VC deals are sometimes syndicated, or the realized lack, at a later stage, of VC managerial and technical competence in the specific activity of the firms.[17]

Ideally, the two groups of firms should differ only for the assignment of the funds. As mentioned, this assumption is not directly testable. However we assess the plausibility of the hypothesis by verifying whether VC-backed firms and those in the control group are similar in terms of a large set of observable characteristics before the VC financing.[18] In other words, the similarity of the main

[16] For some VC, discarded firms are those with the highest grades, for others the descriptions and comments given by the investors implied they were among the best of rejected firms.

[17] In the VC market, investors have a limited amount of funds to invest in risky businesses; they are therefore constrained to select carefully the firms and it is possible that many valuable firms are left behind. The Fondo Italiano di Investimento was created in 2010 with a fund-raising partially covered by public funds (around one third) and operated in the expansion market, i.e. the market where investors by shares in established small and medium size firms that want to grow. When in 2013 this fund relocated 65 million of euro, from its endowment of 1,2 billion, to the VC market, this amount of funds was readily invested.

[18] As explained in Section 2, in order to evaluate our variables of interest before financing or rejection, in the

observable characteristics before the financing among the two groups of firms is a way to evaluate the validity of our identification strategy. Unlike previous studies, we use a large set of firm characteristics such as indicators of size, profitability, financial structure, and some other variables including a synthetic measure of the risk of corporate failure (Z-score calculated by Cerved), which is very useful as it is an index of the overall quality of the firm, able to catch-up some unobservable firm characteristic such as the ability of the firm. The results are very reassuring. Even without any imposed matching, there are no differences between VC-backed and rejected firms (Table 2, but for the initial age of the firm that we hence include in our estimations as control.[19]

Finally, in order to control for time-invariant differences in non-observable firm characteristics between financed and rejected firms, we exploit the longitudinal nature of our data and use the diff-in-diffs (DID) estimation method. Using the DID, the effect of the VC financing is estimated by the change in the difference of the output between recipient and non-recipient firms before and after the VC investment.

Formally,

$$DID = [E(Y^1_{it*+x}) - E(Y^0_{it*+x})] - [E(Y^1_{it*-x}) - E(Y^0_{it*-x})] \quad (1)$$

where E is the expectation operator, Y_i is the outcome variable of the firm i, t* is the year of VC financing, and the top index 1(0) refers to the VC-backed firms (control firms).

The DID method is strongly dependent on the parallel trend assumption, i.e. is based on the assumption that without the VC financing the outcome variables of the two groups would have followed the same time paths. Therefore, we carefully verify this hypothesis by testing the similarity of outcome variable trends in our samples before the treatment. The results are plotted in Figures 2 and 3: they indicate very similar trends before the financing at least for the main outcome variables analyzed in the paper.

In detail, our model looks like

$$y_{it} = const + \sum_{year=2000}^{2012} \beta_t(post_t) + \beta_2(VC_i) + \gamma_t(post_t * VC_i) + \alpha_a * age + \alpha_{year} * dyears + \epsilon_{it} \quad (2)$$

analysis we only focus on firms with balance sheet information at least one year before the treatment. This is crucial for having a good control sample though it reduces significantly the number of firms analyzed.

[19]This identification strategy is very similar in spirit to the approach of Kerr et al. (2014), who analyse business angels and use the rejected applicants as control group, and that of Greenstone, Hornbeck and Moretti (2010), who study the impact of large foreign plant entry in the US counties using as a control group those that did not receive the foreign plants because were dismissed in the last stage of the evaluation process by the foreign enterprises.

where y_{it} are the outcome variables (Assets, Sales, Labor costs, etc.), i is an index for firms, t refers to the different years, We define the variables $post_t$, $t = 0, ..., 4$ as dummies taking values 1 t years after financing/rejection, 0 the year before financing/rejection and missing otherwise. We run 5 different DID estimations with the variable $post_t$ defined as above to study the effects of VC's year by year. The parameter of interest is that of the interaction term $post_t * VC_i$, where VC_i is a dummy for venture-backed firms. Then we also collapse the various $post_t$ in a single dummy *post* and we run a DID regression on this specification as well to capture the overall effect of VC financing. Finally, $dyears$ are year dummies to control for different economic cycles, and age is the firm age at financing/rejection. Standard errors are clustered at firm level to take into account the correlation among the observations of the same firm.

One potential drawback of DID estimates is that they could be biased if the outcome variable of VC financed and VC non-financed firms have different trends. We therefore control for differences in time trends by interacting some pre-financing control variables (geographical areas and sectors) with the pre/post financing dummies. We include in the previous estimation the following control variables:

$$\sum_{sec_i} sec_i + \sum_{area_i} area_i + \sum_{sec_i} (sec_i * post_t) + \sum_{area_i} (area_i * post_t) \tag{3}$$

We also test the sensitivity of the results by changing the control group, relying on a strategy frequently used in this type of analysis. We perform the propensity score nearest neighbor matching, year-by-year and sector-by-sector (4-digit) on the universe of all Italian companies available in our data set that were not financed by VC. Namely, any given business i operating in sector s financed by a VC in year t, is associated to another firm of the same sector and with an estimated probability of financing by VC, given by the propensity score as of year (t-1), that is very similar to the one of the firm i. In the propensity score function we consider many more covariates that in other empirical studies on this topic, including all the balance sheet indicators we have considered to verify the balancing properties of the previous control sample.[20] We prove again the similarity between the financed and non-financed firms by checking the differences in the means of the main firm indicators before the VC investment: they are never significant, but for the ratio of bank loans on total loans (Table 2). Finally, we also check that the main outcome variables followed a similar time path before the investment (Figures 4 and 5).

[20] We have excluded some indicators from the propensity score matching only when it was missing for some firms; this for example happened with the firm leverage.

4 Results with the control sample of discarded firms

In this section we comment the results of the VC effects on firm's activity based on our preferred control sample of discarded firms. From Figures 2 and 3, in which we include mainly graphs for variables that show some changes between VC-backed and non VC-backed firms, the evidence is that after the VC intervention we observe an increase in total assets and labour costs over the entire period of the analysis. There is also a positive effect on firm sales, though only after 3-4 years from VC financing. We also observe a negative trend in the firm profitability (EBITDA/total assets) for VC-backed firms, which however vanishes after 3-4 years since the VC financing, consistently with the surge in sales. Graphs also show that VC-backed firms tend to have a lower leverage for a short while, higher survival rate and more innovation activity.

In Tables 3 to 5 we report the results of the DID estimation (equation 1) where essentially we verify the previous graphical evidence after controlling for differences in economic cycles, with year dummies. and for the age at financing, for which the balancing properties were not satisfied. Some of the results are confirmed. First, we find that VC investors have a rapid and extended effect on firms' size: during the 4 years after the VC financing, total assets increase on average by 5 million of euro more than that of firms not receiving any VC financing (Table 3, the average total assets of VC companies before financing is around 1.8 million).[21] This is the average effect over the 4 years after the VC financing; from the interaction dummies which capture the trends year by year, we elicit that the effect on firm size is increasing over time (more than 20 million of euro after 4 years). The gradual increase in firm size is confirmed by the rise in labor costs: on average roughly 290,000 more for VC-backed firms with respect to an amount of labor costs before VC financing equal to 200,000).[22]

As for sales, the effect of VC is never significant, though is increasingly positive. This could be a consequence of projects financed by VC that take more time to reach the commercialization phase, i.e. projects that are in an earlier stage of their life-cycle and hence riskier. As a consequence of this upsurge in sales, the operating profitability (EBITDA/assets) of firms that got VC financing, which was initially worse than that of control group, improved; after 4 years from financing, the VC effect on operating profitability is even positive, though not significant. Moreover, there are

[21] This is more than the average amount of fund invested by VC over the period of the analysis, which amounts to 3.4 million of euro for the two thirds of the investments for which we have this information; there is therefore a multiplicative effect induced by VC financing.

[22] With the available data we are not able to find out whether the increase in labour costs is due to a rise in the number of employees, given that this variable is almost always not reported in the balance sheets, or to an improvement in the quality of the labor force.

no differences in the return of equity (ROE) of the two groups of firms. Nonetheless, the more emphasized negative trends in operating profitability for VC-backed firms is likely to explain their worse rating, measured by an increase in the Z-score index by 0.7 points more than that of non VC-backed firms.

We then focus on firm financial structure indicators that are seldom analyzed in previous studies (Table 4). We find that firm leverage tends to decrease more for VC-backed firms, though the difference is not statistically significant. We also uncover a relevant increase in the value of financial debts after VC financing: on the whole period, VC-backed firms get around 2.5 million of euro of financial loans more than the other firms (the average amount of financial debt before financing was around half million). This means that after the increase in equity due to the VC intervention, VC-backed firms are able to get more financial debt, from lenders or markets; this keeps their leverage, lower but not too different from firms that did not get any VC financing.[23] Overall, this is a indication of a signalling effect of VC investors to other external financiers that would have not financed the increase in size in such risky firms had not the VC stepped in the firm. Finally, we also uncover that equity increases gradually: the whole increase observed in the 4 years after the first VC financing is higher compared with the control group by the same amount observed for financial debt (2.5 million, with respect to an initial amount of equity of 0.5 million).

As for the other financial structure indicators, the change in the share of bank to total financial debt is very similar in the two groups of firms, signalling no different role for banks with respect to financial markets for VC-backed firms. Analogously, there were similar trends in the incidence of long-term bank loans to total banks loans; the results are confirmed when enlarging the view to the maturity of total financial debts. Therefore, it does not appear like lenders have granted to VC backed firms more long-term loans in order to face their uncertain phase of development and commercialization of products or services. Finally, there are no different trends among the two groups of firms as far as the cost of financial debt is concerned. All in all, lenders do not change the loan terms (debt maturity and cost) as a consequence of the presence of VC investors.

We then deepen the evaluation on innovation activity and survival rates using the DID estimations. Unlike the previous results, for these outputs the evidence is weaker that the one we got from graphical analysis. When considering a dummy equal to 1 for firms that ask for a patent, probit estimations reported in Table 5 show that the effect of VC financing is positive, but never statistically

[23]With DID estimations, we are looking at the differences in the changes of the variable after VC financing for the two groups of firms; however, we know from the analysis of balancing properties in Table 2 that the two groups of firms, VC-backed and not, have on average, before VC financing, the same leverage, and also the same size, profitability and other indicators of financial structure.

significant. However, the increase in cumulated patents is larger for VC-backed firms.[24] Finally, focusing on the survivorship after VC financing, the survival rate are indeed higher for VC-backed firms, though the difference is never statistically significant.

As mentioned in Section 3, one potential drawback of DID estimations is that they could be biased if VC-backed and non VC-backed firms have different trends in the output variable analysed because they belong to geographical areas and industries that have different time trends in this variable. We therefore verify the robustness of the results when controlling for differences in time trends by interacting the area where the firm is located and its industry with pre-post VC financing dummy. In Tables 6 to 8 the previous findings are generally confirmed with some qualifications: the positive effects of VC on sales becomes statistically significant after 4 years from VC financing,[25], the reduction in leverage for VC-backed firms is significant in some years, but never for the whole period after financing, the positive and significant effects on cumulated patents vanish.

5 Results with the control sample of matching firms

The control group used in the previous section, built on firms that have been discarded by VC at a later stage of the due diligence process, is very useful to control for some unobservable firm characteristics that can be correlated with the fact that a firm demanded money to VC, such as the quality of the project and the determination to pursue it. We want nonetheless to evaluate the robustness of the results when using another type of control group that is built, as carefully described in Section 3, only with a matching procedure; this matching control groups are frequently adopted in previous studies. In this case, the similarity of the firms in the two groups, which was almost naturally achieved when considering the discarded firms, is assured by the matching procedure (Table 2).

The graphical evidence on the trends of the main output variables (Figures 4 and 5) is very similar to that concerning the previous control group. Referring to the estimations' results reported in Tables 9 to 11, where we include all controls for different time trends across sectors and areas, we find that previous results are confirmed and are sometimes even stronger. Specifically, the higher increase in sales for VC-backed firms is more rapid and the difference with the others firms is statistically significant for the whole period of the analysis, while with the previous control group

[24] In Table 5 we have reported the results obtained with an OLS estimation; we also verify the evidence with a negative binomial model which similarly shows no significant effect.

[25] The rise in sales for VC-backed firms is 2 million of euro more than those of non VC-backed firms, whereas sales in the year before financing were equal to 770,000.

this was not true. Consistently, the negative effects on operating profitability for VC-backed firms are shorter than in previous estimations. This is also true when we analyze the survival rates for the two groups of firms: in this case they are significantly better for VC-backed firms (over the 4 years after VC financing the survival rate is 13 points higher than for the other firms), confirming the wider differences observed in Figure 5 with respect to Figure 3. Finally, cumulated patents by VC-backed firms are statistically higher than for the other firms.

These enhanced results could however be related to the fact than in previous estimations we control better for the determination to exploit the innovative idea, using in the control group only firms that applied for VC funds; here, on the contrary, we are comparing VC-backed firms with others that do not ask for money to VC and are perhaps still working on the idea or less convinced to exploit it. This could create a positive bias in favour of VC-backed firms, that we have eliminated in previous estimations.

6 Discussion of results and conclusions

In this paper we document that Italian VC investors have important effects on the size of the firms they finance. In the 4 years after VC financing, total assets of VC-backed firms increase on average by 5 million of euro more with respect to firms that have asked for VC finance, but have been rejected despite their overall quality was analogous to those of treated firms. This rise in total assets is remarkable, as the firm average total assets before financing is around 1.8 million, and is not mechanically linked to the amount of funds invested by VC.

There is indeed a multiplicative effect entailed by a rise in financial debts, that was also higher for VC-backed firms. Over the 4 years after VC financing, VC-backed firms get around 2.5 million of euro of financial loans more than the other firms (the average amount of financial debt before financing was around half million). This could be considered as a sort of VC signalling effect on other external investors such as banks, which would have not financed the increase in size in such risky firms had not the VC stepped in the firm (Hellmann et al., 2008).

This result is different from that uncovered by Berger and Schaeck (2011), who analyse a cross-section of 524 small and medium firms in Germany, Italy and UK referring to 2001 and find that venture capital financing is correlated with a lesser need to use bank financing. However, in their analysis they focus not only on early-stage investments, but on all forms of private equity, including buy-outs; moreover, they consider firms that before VC did not have any bank relationship. In general, the unexpected result of our paper is that all the innovative startups analyzed have a high

leverage (around 60%) even in the year before the financing or rejection. This is actually in line with was has been recently discovered in the US by Robb and Robinson (2012), who find that new firms, even the home-based ones, analyzed for the period 2004-2007 rely heavily on external debt sources, such as bank financing: when summing up all forms of debt, it accounts for more than 50 per cent of the total capital of the firm. Still, we focus in this paper on innovative startups, which are riskier and with a high share of intangible assets, for which bank lending is not the more appropriate source of finance. Consistently, Brown, Fazzari and Petersen (2009), find that for the US high-tech listed firms the share of new debt issues on total net finance is very low in the US, less than 2 per cent and that of net on equity is higher (29 per cent); corresponding figures for Italian high-tech listed firms are reversed. All in all, the equity market, and specifically the venture capital market, needs to be developed in Italy in order to assure a potential for higher growth to innovative startups.

Other findings of the paper concerning firm financial structure are that the ratio of banks on total financial debts is not different for VC-backed firms and, more interestingly, there are no changes in the bank loans's maturity and cost. In other words, banks do not improve the terms of loans (longer maturity, lower costs) for VC-backed firms. The signalling effect from VC investors is hence strictly connected with the increase in equity by VC that seems to make banks willing to grant more money, but not at a better terms. Evidence on these issues is very scant (Vacca, 2013).

As for firms' activity, we find a positive effect of VC investors on sales but only after 4 years of VC financing. The impact is not small: around 2 million of euro of more sales compared with rejected firms, with sales before financing hovering around 700,000 euro. The delayed effect on sales could be a consequence of projects financed by VC that take more time to reach the commercialization phase, i.e. projects that are in an earlier stage of their life-cycle and hence riskier. This could be suggestive of the need of a longer horizon required for this type of early stage investments.

As a consequence of the final upsurge in sales, the operating profitability (EBITDA/assets) of firms that got VC financing, which was initially worse than that of control group, improved; after 4 years from financing, the VC effect on operating profitability is even positive, though not significant. The more emphasized negative trends in operating profitability for VC-backed firms is likely to explain their worse rating, measured by an increase in the Z-score index by 0.7 points more than that of non VC-backed firms.

We do not identify any other peculiar impact of VC investors on firms' activity and life. When including all controls in our preferred estimations with the rejected sample of firms, the innovation

of VC-backed firms is not significantly different from that of the other firms. This is true also for the survival rates, which are higher for VC-backed firms, thought the differences are not statistically significant at the usual levels. When using the matching sample as a control group, we find that survival rates are significantly higher for VC-backed firms; similarly, cumulated patents tend to be larger on the whole period. However, we think that the enhanced results obtained with this matching sample could be explained by a sort of positive bias in favour of VC-backed firms when the comparison is done with firms that have not asked for VC financing, as these firms are perhaps still working on their projects or less determined to exploit them.

Overall, venture capitalists in Italy appear to have adopted a rather conservative investment strategy. The startups financed by VC grow much faster than others and this is a positive result in a country where young firms find it very difficult to expand their size. However, these firms do not achieve amazing results in terms of innovation activity and profitability. It is true that it takes time for a firm to reach the point where a patent could be asked for, much longer in Europe than in the US. Our results just point to the fact that VC backed firms do not start to ask for patents more than other firms in the relatively short period (4 years) they are observed after VC financing, which is nonetheless just a bit shorter than the average period of time (5 years) Italian VC held companies in their portfolios. In order to support firms' innovative ideas and profitability, VC investors are likely to need a longer period of time and patience (Mazzuccato, 2013).

References

Berger, A. and Schaeck, K. (2011). Small and medium-sized enterprises, banking relationships, and the use of venture capital, *Journal of Money, Credit and Banking* **43**(2-3): 461–490.

Bertoni, F., Colombo, M. and Grilli, L. (2011). Venture capital financing and the growth of high-tech start-ups: Disentangling treatment from selection effects, *Research Policy* **40**: 1028–1043.

Bottazzi, L. and Da Rin, M. (2002). Venture capital in europe and the financing of innovative companies, *Economic Policy* **17**: 229–270.

Bottazzi, L., Da Rin, M. and Hellmann, T. (2008). Who are the active investors? evidence from venture capital, *Journal of Financial Economics* **89**: 488–512.

Brown, J., Fazzari, S. and Petersen, B. (2009). Financing innovation and growth: Cash flow,external equity, and the 1990s R&D boom, *The Journal of Finance* **64**(1): 161–85.

Chemmanur, T., Krishnan, K. and Nandy, D. (2011). How does venture capital financing improve efficiency in private firms? A look beneath the surface, *The Review of Financial Studies* **24**(12): 4037–4090.

Cumming, D., Grilli, L. and Martinu, S. (2014). Governmental and independent venture capital investments in Europe: A firm-level performance analysis, *Journal of Corporate Finance* **forthcoming**.

Gompers, P. and Lerner, J. (2001). The venture capital revolution, *Journal of Economic Perspectives* **15**(2): 145–168.

Greenstone, M., Hornbeck, R. and Moretti, E. (2010). Identifying agglomeration spillovers: Evidence from winners and losers of large plant opening, *Journal of Political Economy* **118**(3): 536–598.

Grilli, L. and Martinu, S. (2014). Government, venture capital and the growth of european high-tech entrepreneurial firms, *Research Policy* **43**: 1523–1543.

Guo, D. and Jiang, K. (2013). Venture capital investment and the performance of entrepreneurial firms: Evience from china, *Journal of Corporate Finance* **22**: 375–95.

Hellmann, T., Lindsey, L. and Puri, M. (2008). Building relationships early: Banks in venture capital, *The Review of Financial Studies* **21**(2): 513–541.

Hellmann, T. and Puri, M. (2000). The interaction between product market and financing strategy: the role of venture capital, *The Review of Financial Studies* **13**(4): 959–984.

Hellmann, T. and Puri, M. (2002). Venture capital and the professionalization of start-up firms: Empirical evidence, *The Journal of Finance* **57**(1): 169–197.

Kerr, W., Lerner, J. and Schoar, A. (2014). The consequences of entrepreneurial finance: Evidence from angel financings, *Review of Financial Studies* **27**(1): 20–55.

Kortum, S. and Lerner, J. (2000). Assessing the contribution of venture capital to innovation, *RAND Journal of Economics* **31**(4): 674–692.

Mazzuccato, M. (2013). *The Entrepreneurial State. Debunking Public vs Private Sector Myths*, Anthem Press, Wimbledon.

Popov, A. and Roosenboom, P. (2012). Venture capital and patented innovation: Evidence from europe, *Economic Policy* **27**(71): 447–482.

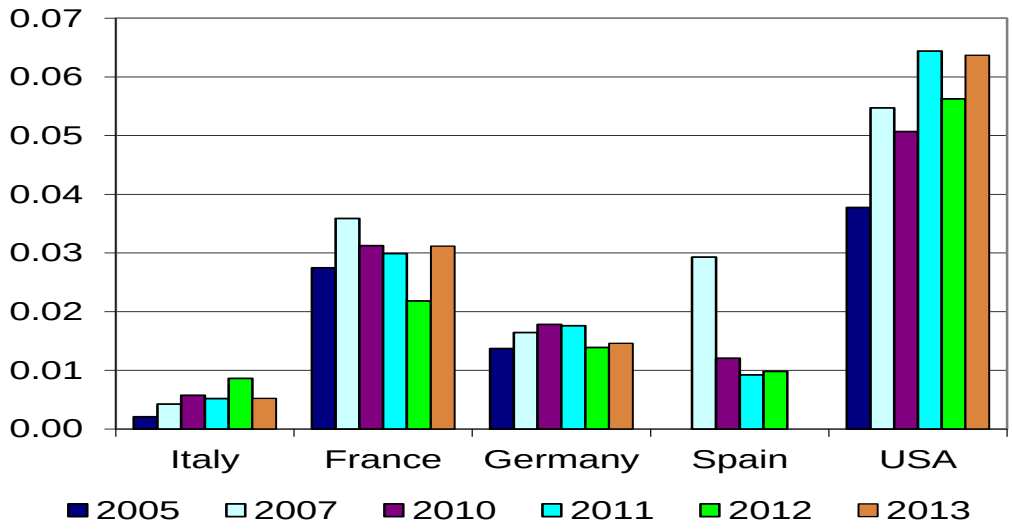
Puri, M. and Zarutskie, R. . (2012). On the life cycle dynamics of venture-capital- and non-venture-capital-financed firms, *The Journal of Finance* **67**(6): 2247–2293.

Robb, A. and Robinson, D. (2012). The capital structure decisisons of new firms, *Review of Financial Studies* **1**(1): 1–27.

Vacca, V. (2013). Financing innovation in Italy: an analysis of venture capital and private equity investments, *Occasional Papers No.209*, Bank of Italy.

Tables and figures

Figure 1: Venture capital investments as a percentage of GDP



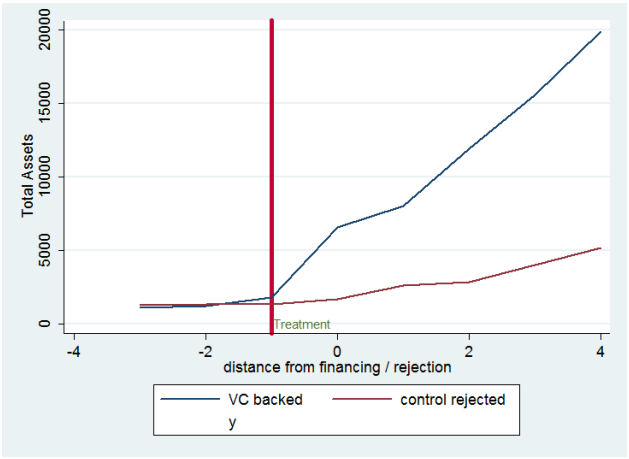
Source: AIFI for Italy, AFIC for France, EVCA-BVKA for Germany, ASCRI for Spain and NVCA for the United States.

Table 1: Summary statistics venture-backed firms

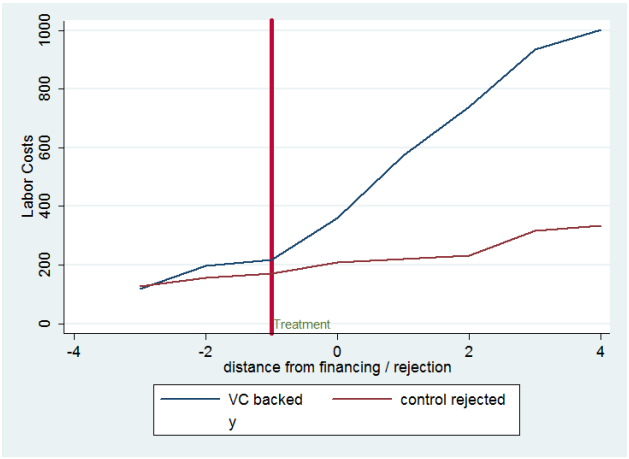
Summary Statistics VC				
Area			**Size**	
North-west	24	41%	Total Assets (*1000)	1792.4
North-west	9	15%	Size dummy	1.1
Center	15	25%	Labor costs (*1000)	218.4
South-islands	11	19%	Sales (*1000)	745.3
Year of Financing			**Profitability**	
2004	3	5%	EBITDA/Assets %	-3.6
2005	3	5%	ROE %	-127.5
2006	5	8%	**Financial structure**	
2007	8	14%	Leverage %	57.5
2008	6	10%	Long-term bank debt/Bank debt %	23.3
2009	5	8%	Equity/Assets %	30.2
2010	6	10%	Financial costs/Financial debts %	5.2
2011	17	29%	**Other characteristics**	
2012	6	10%	Age	4.2
Sector			Intangible assets/Tangible+Intangible assets	69.3
Manufacturing	13	22%	Rating	6.3
Energy	4	7%		
Marketing and consulting	4	7%		
ICT	19	32%		
Scientific research and engineering	14	24%		
Other	5	8%		
N	59			

The statistics on size, profitability, financial structure and other characteristics are averages for the year before treatment

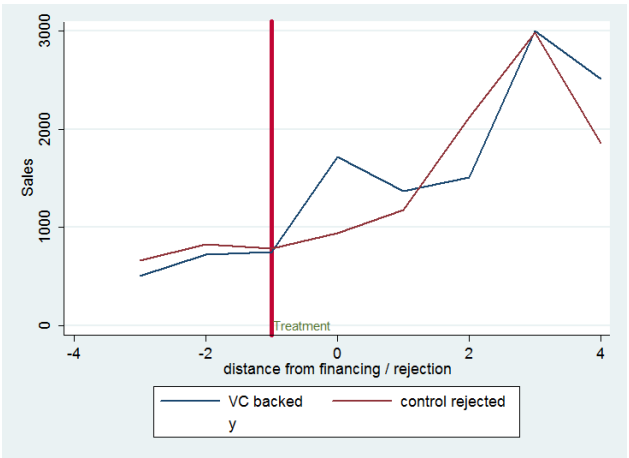
Figure 2: Trends in the output variables: rejected control sample (1)



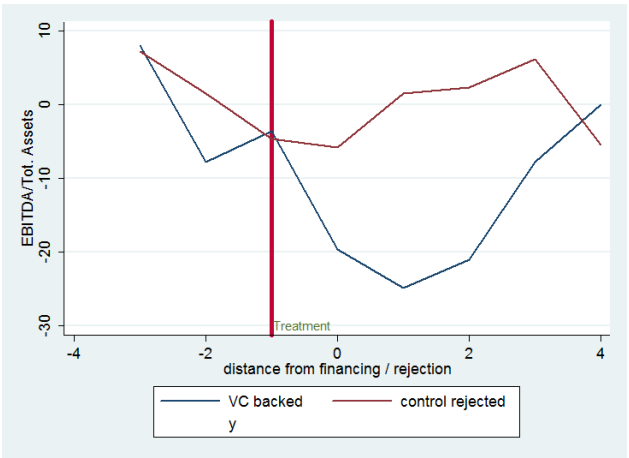
(a) Total Assets



(b) Labor Costs

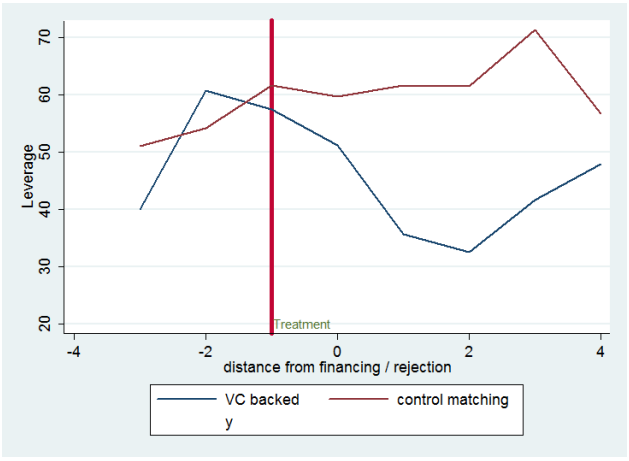


(c) Sales

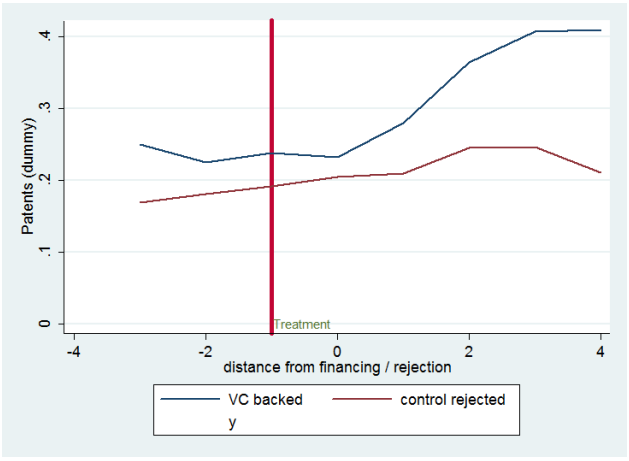


(d) Profitability

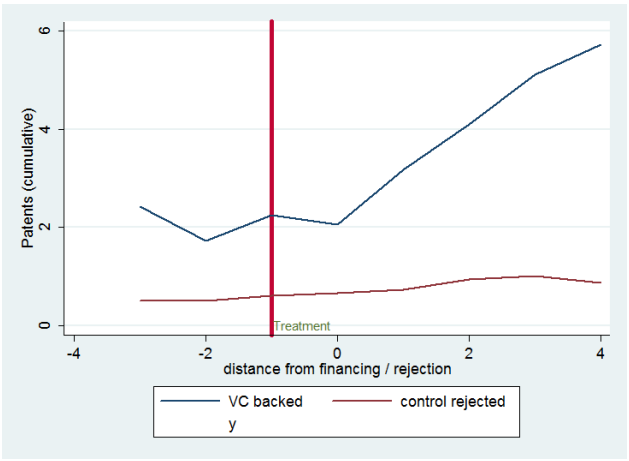
Figure 3: Trends in the output variables: rejected control sample (2)



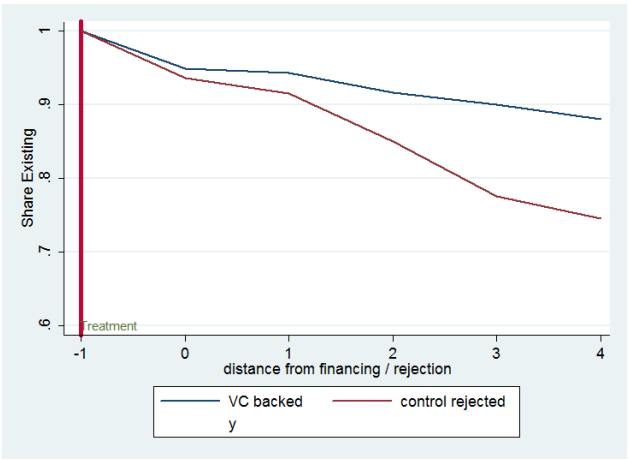
(a) Leverage



(b) Patent-dummy

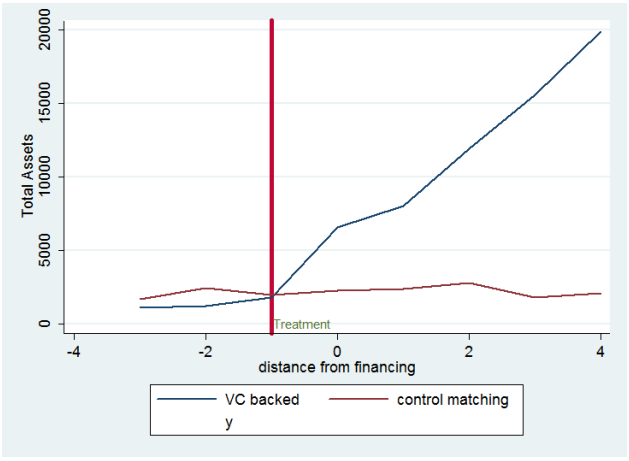


(c) Patent-cumulative

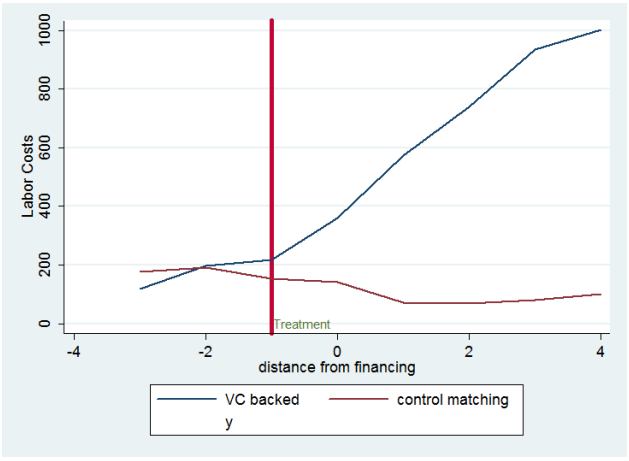


(d) Survivorship

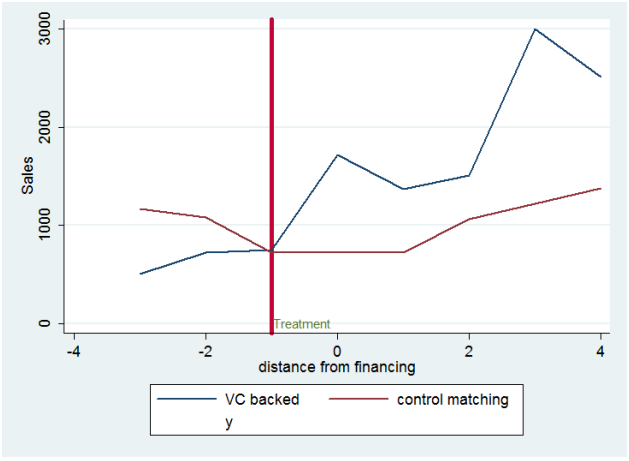
Figure 4: Trends in the output variables: matching control sample (1)



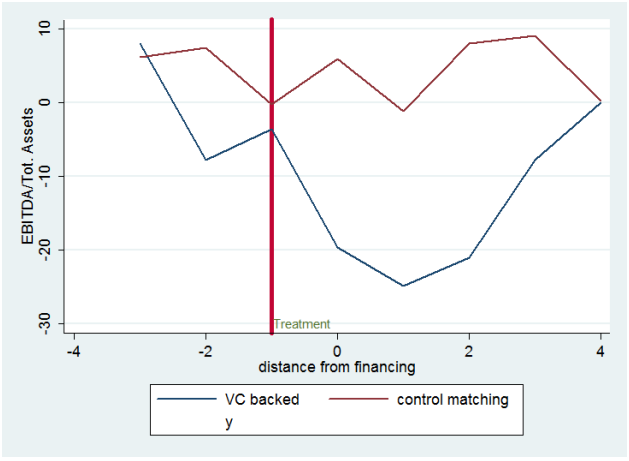
(a) Total Assets



(b) Labor Costs

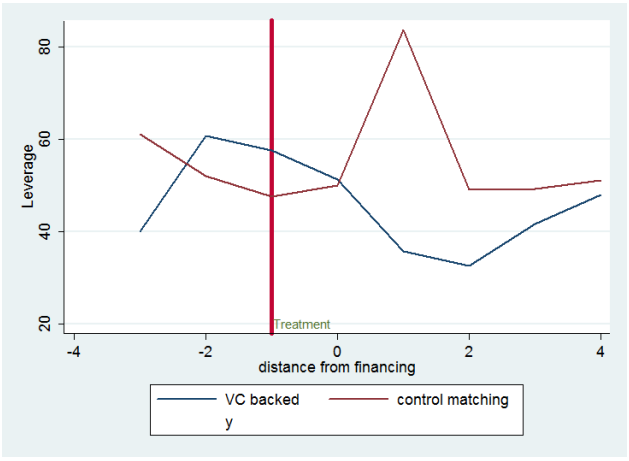


(c) Sales

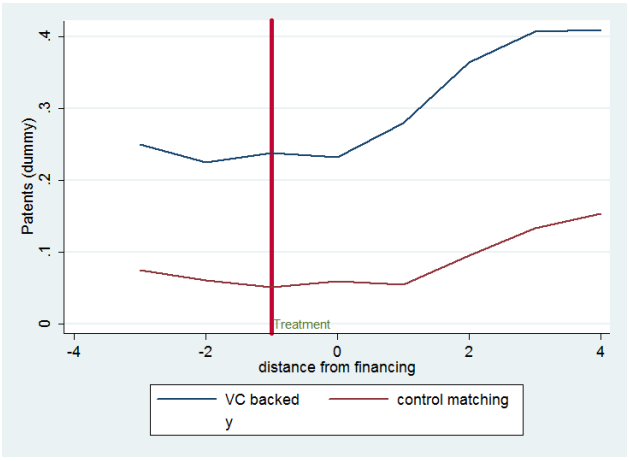


(d) Profitability

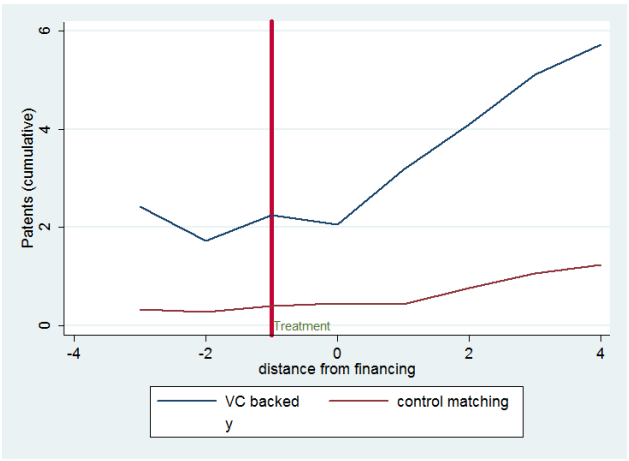
Figure 5: Trends in the output variables: matching control sample (2)



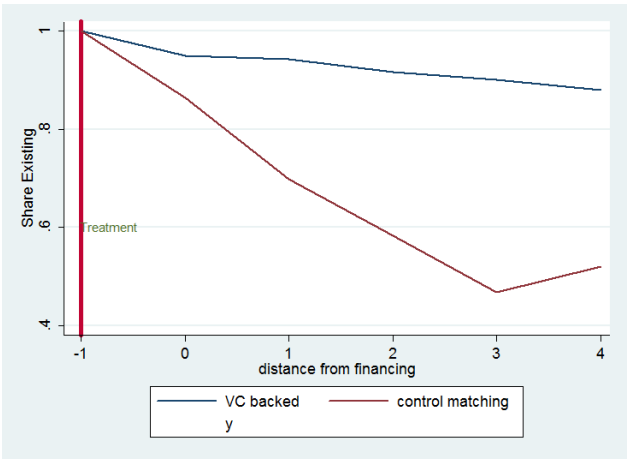
(a) Leverage



(b) Patent-dummy



(c) Patent-cumulative



(d) Survivorship

Table 2: Balancing properties between treated and control groups

	VC-backed(1)	Rejected(2)	Matching(3)	t test (2)-(1)	t test (3)-(1)
Size					
Total Assets(*1000)	1792.4	1340.7	1917.5	1.10	-0.26
Labor Costs(*1000)	218.4	171.8	154.5	0.72	0.84
Sales(*1000)	745.3	783.5	706.2	-0.16	0.10
Profitability					
EBITDA/Assets %	-3.6	-4.7	-1.4	0.17	-0.35
ROE %	-127.5	-93.9	-142.3	-0.76	0.33
Financial Structure					
Leverage %	57.5	61.7	50.0	-0.33	0.49
Financial debts(*1000)	600.2	480.6	832.7	0.54	-0.58
Equity(*1000)	686.0	315.7	503.0	1.96	0.62
Bank debts/Financial debts %	71.6	62.5	48.4	1.23	2.48
Long-term bank debts/Bank debts %	23.3	21.2	31.3	0.33	-0.89
Equity/Assets %	30.2	24.1	30.9	1.14	-0.01
Financial Costs/Financial debts %	5.2	6.0	6.0	-0.87	-0.63
Other characteristiscs					
Age	4.2	4.7	4.9	-1.50	0.18
Intangible assets/Tangible+Intangible assets %	69.3	64.8	62.7	0.86	0.96
Rating	6.3	6.4	6.0	-0.29	0.86
N	59	157	59		

Table 3: Effects of venture capitalists on different firm outputs

	Assets	Labor Costs	Sales	EBITDA/Assets %	ROE %	Rating
average	5,379.4	289.0	330.5	-18.0	9.2	0.7
obs.=398-424	(2,650.7)**	(103.8)***	(517.3)	(5.5)***	(89.4)	(0.2)***
d=0	4,582.3	100.9	824.9	-10.9	85.1	0.3
obs.=382-419	(2,055.3)**	(45.4)**	(764.6)	(5.5)**	(76.1)	(0.3)
d=1	5,190.1	330.2	266.5	-24.9	40.6	0.5
obs.=360-395	(2,710.5)*	(135.8)**	(417.9)	(8.4)***	(67.1)	(0.3)
d=2	9,787.0	536.9	-291.3	-19.3	-297.4	0.7
obs.=321-351	(4,591.3)**	(278.1)*	(1,122.6)	(8.9)**	(328.4)	(0.4)*
d=3	12,296.3	687.4	710.7	-11.2	-75.4	0.3
obs.=284-312	(6,637.2)*	(347.3)**	(3,079.8)	(11.1)	(130.3)	(0.6)
d=4	22,951.1	855.8	1,656.1	19.2	85.2	0.8
obs.=249-276	(10,740.9)**	(486.9)*	(1,036.4)	(16.6)	(85.8)	(0.7)
mean at d=-1	1464.1	184.6	773.0	-4.4	-103.1	6.4
Year, Age at financing	Yes	Yes	Yes	Yes	Yes	Yes
Industry, Industry*post	No	No	No	No	No	No
Area, Area*post	No	No	No	No	No	No

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 4: Effects of venture capitalists on different firm outputs

	Leverage	Tot.Fin.Liab.	Equity	Bank/Tot.Fin.Liab. %	Bank Long/Bank %	Fin. Costs/Tot.Fin.Liab. %
average	-10.6	2,634.2	2,433.5	6.5	-7.3	1.2
obs.=291-424	(17.9)	(1,453.6)*	(1,051.2)**	(6.5)	(6.2)	(0.8)
d=0	-0.4	1,081.2	2,403.7	7.5	-3.9	1.1
obs.=259-419	(29.9)	(715.2)	(1,177.3)**	(7.6)	(6.0)	(0.9)
d=1	-24.1	1,590.5	2,562.0	10.3	-2.3	0.2
obs.=250-395	(18.4)	(868.9)*	(1,195.7)**	(8.1)	(7.4)	(1.1)
d=2	-31.8	2,653.5	4,511.5	17.6	-0.8	0.0
obs.=225-351	(21.3)	(1,506.3)*	(2,012.4)**	(11.1)	(9.2)	(1.2)
d=3	-33.4	4,256.1	6,386.1	5.4	-18.9	0.6
obs.=194-312	(23.5)	(2,882.0)	(2,898.0)**	(12.6)	(11.1)*	(1.3)
d=4	-8.6	12,858.0	7,564.3	-3.5	-8.3	0.5
obs.=172-276	(22.2)	(6,343.3)**	(3,577.9)**	(13.9)	(14.6)	(1.6)
mean at d=-1	60.5	514.9	416.9	64.8	21.8	5.4
Year, Age at financing	Yes	Yes	Yes	Yes	Yes	Yes
Industry, Industry*post	No	No	No	No	No	No
Area, Area*post	No	No	No	No	No	No

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$
Tot.Fin.Liab. stays for Total Financial Liabilities

Table 5: Effects of venture capitalists on different firm outputs

	Survival Rate%	Patents (dummy)%	Patents (cumulative)
average	3.2	2.2	0.22
obs.=216-432	(3.5)	(2.1)	(0.12)*
d=0	2.0	-1.4	0.32
obs.=202-419	(4.2)	(3.0)	(0.38)
d=1	2.7	4.6	0.65
obs.=180-395	(5.0)	(4.8)	(0.28)**
d=2	2.7	4.2	-0.49
obs.=142-351	(8.4)	(6.8)	(0.39)
d=3	8.0	12.1	0.77
obs.=105-312	(11.5)	(9.2)	(0.55)
d=4	4.6	9.8	-0.28
obs.=62-276	(13.6)	(11.7)	(0.62)
mean at d=-1	100	20.4	1.06
Year	Yes	Yes	Yes
Age at financing	No	Yes	Yes
Industry, Industry*post	No	No	No
Area, Area*post	No	No	No

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$
Survival rates are estimated using a probit regression, and in the table we reported the marginal effects. The results for the variable dummy are from Diff-in-Diff using OLS, whereas for the cumulative number of patents we show the results of Diff-in-Diff using a negative binomial regression

Table 6: Effects of venture capitalists on different firm outputs

	Assets	Labor Costs	Sales	EBITDA/Assets %	ROE %	Rating
average	4,518.9	315.2	436.5	-20.9	1.1	0.8
obs.=398-424	(1,884.0)**	(94.7)***	(409.9)	(6.1)***	(91.1)	(0.2)***
d=0	3,913.5	110.8	639.3	-12.7	59.6	0.2
obs.=382-419	(1,505.8)***	(44.3)**	(531.1)	(5.4)**	(73.7)	(0.3)
d=1	4,819.0	326.3	334.4	-27.4	40.5	0.5
obs.=360-395	(2,125.9)**	(123.0)***	(393.4)	(9.4)***	(65.3)	(0.3)
d=2	5,905.2	648.4	-800.3	-20.7	-296.0	1.0
obs.=321-351	(3,349.9)*	(282.9)**	(1,455.6)	(11.4)*	(316.8)	(0.5)**
d=3	6,060.0	754.2	-841.5	-16.8	-54.7	0.6
obs.=284-312	(5,087.2)	(329.6)**	(4,228.7)	(11.9)	(122.8)	(0.6)
d=4	10,815.4	813.6	1,977.6	5.6	12.2	1.6
obs.=249-276	(7,497.1)	(346.0)**	(925.8)**	(11.0)	(111.5)	(0.9)*
mean at d=-1	1464.1	184.6	773.0	-4.4	-103.1	6.4
Year, Age at financing, Industry, Industry*post, Area, Area*post	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 7: Effects of venture capitalists on different firm outputs

	Leverage	Tot.Fin.Liab.	Equity	Bank/Tot.Fin.Liab. %	Bank Long/Bank %	Fin. Costs/Tot.Fin.Liab. %
all	-16.5	1,916.1	2,137.0	2.2	-11.1	1.3
obs.=291-424	(16.0)	(817.8)**	(809.9)***	(6.6)	(7.3)	(0.8)
t=0	-9.2	916.1	2,226.1	5.9	-8.5	1.1
obs.=259-419	(24.0)	(486.6)*	(1,006.0)**	(7.0)	(6.8)	(0.9)
t=1	-28.7	1,372.4	2,438.1	3.8	-7.6	0.3
obs.=250-395	(16.8)*	(647.8)**	(945.0)**	(8.2)	(9.0)	1.1
t=2	-34.9	1,158.7	2,745.0	10.3	-10.4	0.1
obs.=225-351	(21.0)*	(576.9)**	(1,412.3)*	(12.5)	(12.2)	1.3
t=3	-43.7	23.9	4,187.8	-2.3	-27.1	1.2
obs.=194-312	(27.9)	(538.0)	(2,408.0)*	(15.0)	(15.1)*	(1.7)
t=4	-15.3	4,136.4	3,393.2	-8.8	11.7	-0.2
obs.=172-276	(27.7)	(2,910.7)	(2,115.7)	(19.9)	(13.2)	(2.5)
mean at d=-1	60.5	514.9	416.9	64.8	21.8	5.4
Year, Age at financing, Industry, Industry*post, Area, Area*post	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$
Tot.Fin.Liab. stays for Total Financial Liabilities

Table 8: Effects of venture capitalists on different firm outputs

	Survival Rate%	Patents (dummy)%	Patents (cumulative)
average	3.2	1.6	0.10
obs.=216-432	(3.5)	(2.2)	(0.11)
d=0	2.0	-2.1	-0.31
obs.=202-419	(4.2)	(3.6)	(0.28)
d=1	2.7	4.8	0.19
obs.=180-395	(5.0)	(4.9)	(0.33)
d=2	2.7	6.4	-0.70
obs.=142-351	(8.4)	(7.5)	(0.48)
d=3	8.0	17.2	0.03
obs.=105-312	(11.5)	(10.4)	(0.53)
d=4	4.6	16.3	-0.95
obs.=62-276	(13.6)	(13.4)	(0.72)
mean at d=-1	100	20.4	1.06
Year	Yes	Yes	Yes
Industry, Industry*post	No	Yes	Yes
Area, Area*post, Age at financing	No	Yes	Yes

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Survival rates are estimated using a probit regression, and in the table we reported the marginal effects. The results for the variable dummy are from Diff-in-Diff using OLS, whereas for the cumulative number of patents we show the results of Diff-in-Diff using a negative binomial regression

Table 9: Effects of venture capitalists on different firm outputs: matching control group

	Assets	Labor Costs	Sales	EBITDA/Assets %	ROE %	Rating
all	5,376.8	348.2	770.5	-17.4	-105.0	0.8
obs.=215-227	(1,983.7)***	(93.5)***	(304.2)**	(6.6)***	(83.0)	(0.3)**
d=0	3,749.0	162.3	941.0	-17.7	-28.2	0.9
obs.=206-225	(1,583.3)**	(52.2)***	(546.2)*	(7.0)**	(73.2)	(0.4)**
d=1	5,771.6	461.6	921.7	-14.3	-46.0	0.9
obs.=189-205	(2,049.7)***	(137.9)***	(415.8)**	(10.4)	(82.6)	(0.5)*
d=2	4,478.0	644.1	370.1	-13.5	-621.3	1.2
obs.=162-172	(3,632.7)	(329.3)*	(557.1)	(10.2)	(378.3)	(0.6)**
d=3	5,437.5	760.6	301.4	-15.3	-399.4	1.4
obs.=150-160	(4,741.4)	(358.7)**	(1,762.6)	(9.5)	(185.8)**	(0.9)
d=4	6,637.4	1,012.2	1,601.5	5.2	-49.6	1.1
obs.=144-153	(4,298.4)	(355.3)***	(1,068.5)	(9.9)	(87.7)	(0.8)
mean at d=-1	1882.0	186.4	732.0	-1.9	-133.1	6.1
Year, Age at financing, Industry, Industry*post, Area, Area*post	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 10: Effects of venture capitalists on different firm outputs: matching control group

	Leverage	Tot.Fin.Liab.	Equity	Bank/Tot.Fin.Liab. %	Bank Long/Bank %	Fin. Costs/Tot.Fin.Liab. %
average	-12.6	2,447.0	2,339.0	3.1	2.3	1.6
obs.=137-227	(18.8)	(1,167.0)**	(828.4)***	(9.6)	(10.0)	(2.5)
d=0	4.6	777.7	1,975.6	11.7	3.9	0.3
obs.=120-227	(29.3)	(654.6)	(866.5)**	(9.3)	(10.8)	(2.9)
d=1	-36.424	1,782.1	3,136.1	-10.8	-13.1	1.1
obs.=109-227	(25.7)	(1,059.2)*	(966.5)***	(13.5)	(13.2)	(4.2)
d=2	-19.3	394.0	2,387.6	13.9	-22.0	1.4
obs.=93-227	(18.2)	(1,124.4)	(1,474.8)	(16.2)	(20.1)	(4.5)
d=3	-6.2	747.7	2,617.6	-16.8	-9.3	-3.0
obs.=91-160	(20.9)	(718.6)	(2,285.8)	(15.6)	(14.9)	(3.9)
d=4	-6.6	3,541.0	2,156.1	-42.6	-2.4	-0.3
obs.=87-153	(17.1)	(1,919.6)*	(1,405.0)	(16.8)**	(28.7)	(2.7)
mean at d=-1	52.7	724.2	594.5	59.8	25.7	7.3
Year, Age at financing, Industry, Industry*post, Area, Area*post	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$
Tot.Fin.Liab. stays for Total Financial Liabilities

Table 11: Effects of venture capitalists on different firm outputs: matching control group

	Survival Rate%	Patents (dummy)%	Patents (cumulative)
average	13.3	2.8	0.27
obs.=118-236	(6.2)**	(2.0)	(0.11)***
d=0	11.3	-1.3	-0.49
obs.=90-225	(6.8)*	(1.9)	(0.35)
d=1	27.5	4.0	0.53
obs.=94-205	(7.2)***	(4.5)	(0.53)
d=2	31.7	8.1	0.43
obs.=72-172	(7.6)***	(7.9)	(0.74)
d=3	39.4	10.2	-0.16
obs.=60-160	(6.8)***	(10.3)	(0.77)
d=4	34.4	7.0	-0.53
obs.=50-153	(8.6)***	(11.5)	(0.93)
mean at d=-1	100	14.4	1.32
Year	Yes	Yes	Yes
Age at financing	No	Yes	Yes
Industry, Industry*post	No	No	No
Area, Area*post	No	No	No

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$
Survival rates are estimated using a probit regression, and in the table we reported the marginal effects. The results for the variable dummy are from Diff-in-Diff using OLS, whereas for the cumulative number of patents we show the results of Diff-in-Diff using a negative binomial regression