Does venture capital really improve portfolio companies' growth? Evidence from growth companies in Continental Europe

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Abstract

This paper analyses whether the positive impact that venture capital (VC) exerts on investee firms is driven by the screening ability of their managers or by the value added role they typically exert on portfolio companies, thus testing the causality of the impact of VC. This is tested on a panel of 250 Spanish VC-backed companies at the expansion stage invested between 1993 and 1999, following their accounts until 2002. The results show that sales and employment growth of VC-backed companies at the expansion stage is not significantly different from that of comparable non-VC-backed companies prior to the investment, while it is different from that moment on. Therefore, we find evidence that the positive impact of VC is indeed driven by the funding and managerial support provided to portfolio companies.

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1. Introduction

Venture capitalists (VCs) are different from other financial intermediaries in that they provide governance and value added to the companies they invest in (Gompers and Lerner, 1998; Cumming et al., 2004). The interaction of money plus value added is supposed to create value in the investee companies. As a result, it is assumed that there is a positive impact of venture capital (VC)[1] funding on the economy but, as Gompers and Lerner (2001) argue, this is one of the pending issues in VC research. Some academic papers have already addressed this topic since then. However, most of them are focused on the experience of the United States (US, hereafter) and Canada, and are based on early stage investments, as is usual in US research (Wright and Robbie, 1998). Additionally, their samples either concentrate on highly developed areas (Hellmann and Puri, 2000, 2002; Davila et al., 2003; Alemany and Martí, 2005), or on technology-based firms (Bertoni et al., 2005; Kortum and Lerner, 2000), or biotechnology firms (Baum and Silverman, 2004). In Europe, some studies focus on the performance of listed companies (Bottazzi and Da Rin, 2002) and on the impact of venture capital from a macroeconomic perspective (Romain and van Pottelsberghe, 2004; Belke et al., 2003).

The main concern regarding the analysis of the impact of venture capital on investee firms is related to the question of whether VC-backed companies outperform non-VC-backed companies because they are already better, and thus the screening process carried out by venture capitalists is relevant in this context, or, else, because venture capitalists provide funding and advice to the management. This issue constitutes the aim of the paper. In particular, we analyze whether VC-backed companies at the expansion stage outperform similar non-VC-backed ones from the moment they receive the VC funds onwards. This allows us to test if the positive economic and social impact that VC exerts is caused by the financial and managerial support venture capitalists offer to their portfolio companies or, else, by the selection ability of the VC funds. Thus, we address the causality issue on the impact of VC funding on investee companies.

The approach of this paper is different to the existing literature on causality. Previous studies focus either on start-ups, where companies lack historical data, or on high technology firms. Their analyses are based on qualitative data, i.e. technology, management capabilities, alliances, among others. In contrast, this

[1] In this paper, the denomination venture capital includes all investment forms reported to the European Private Equity and Venture Capital Association (EVCA) for publication in their yearly survey. That means early stage venture capital and later stage private equity investments, all types of buyouts and turnaround deals performed by venture capital and private equity funds are included.

paper focuses on firms at the expansion stage, so objective numerical data obtained from public sources are used instead. Furthermore, using a sample of firms at the expansion stages seems more suitable to test the issue of causality. The reason is that for these companies more data on the screening process are available and, therefore, picking the best companies appears to be easier. This perspective is important especially in the European context, where later stage investments are more frequent than early stage ventures (Wright and Robbie, 1998).

This paper uses a unique dataset, which includes a sample of 250 Spanish VC-backed investments, committed from 1993 till 1999, which represents 79.11% of the population of investments at the expansion stage. In order to test the causality issue, the growth patterns of different relevant company variables are analyzed before and after the event of the first VC round, comparing the results with a control group of similar non-VC-backed companies. The results show that venture capital investments do have a significantly positive economic and social impact that is mainly driven by the financial and managerial support that VCs provide to their portfolio companies.

The rest of the paper is organized as follows. The theoretical framework and hypotheses proposed are outlined in Section 2, including a review of the relevant literature on the impact of venture capital, as well as an overview of previous papers that have addressed the causality issue related to the superior performance of VC-backed companies. The third section describes the sample used. Results are shown in section 4. The last section concludes the paper and discusses possible implications and future lines of research.

2. Is the positive impact of VC due to selection or post-investment support? – Literature review and hypotheses

2.1. Impact of venture capital

It is assumed that VC-backed outperform non-VC-backed companies. Seminal studies on this issue based their results on biased samples that concentrated on North American portfolio companies that made it to an IPO (Venture Economics, 1982). Since then, the lack of academic work on this issue was remarked on by Gompers and Lerner (2001), who identify the impact of VC as one of the pending research questions to be addressed. More recently, some papers have been published, thus increasing our knowledge on this important topic. Most of them are focused on the experience of the US and Canada, and their samples either

concentrate on certain geographic areas, mainly highly developed areas, or on particular industry sectors, such as technology-based firms.

Regarding the geographical location, the papers by Hellmann and Puri (2000; 2002) and Davila et al. (2003) concentrate on Silicon Valley–based companies. Hellmann and Puri (2000) provide empirical evidence that innovative firms are more likely to obtain VC than imitator start-ups, and that VC is associated with a significant reduction in the time required to bring a product to the market. The same authors also analyze the impact of VC on the professionalization of company's internal organization and find that VCs support their portfolio companies to build up their human resources within the organization (Hellmann and Puri, 2002). They find that VC-backed companies are more likely to bring in outsiders as CEOs at an early stage. Davila et al. (2003) find that employment of VC-backed firms grows before the first VC round and accelerates in the months afterwards, so the involvement of a venture capitalist helps to attract employees and, thus, to speed company growth. This indicates a signaling value of VC funding on the job market. It should be considered, however, that the positive impact of venture capital could be just related to location. In this sense, Florida and Kenney (1998) find out that the existence of well-developed venture capital networks in technology-based regions significantly accelerates the pace of economic development in those regions. On the contrary, they show that the effect of venture capital is not important in less developed areas.

Regarding the industries analyzed, Kortum and Lerner (2000) investigate the innovation results on a dataset of 122 venture-backed companies versus 408 non-VC-financed firms in high-technology sectors. They show that VC does not only contribute to more patenting but also to higher innovative activity. Nevertheless, they point out that the question of the causality is still open. Baum and Silverman (2004) analyze the evolution of 204 VC and non-VC-backed biotechnology startups in Canada, and provide evidence of a significant positive impact of VC investments on the startups in this sector.

Nevertheless, Manigart et al. (2002) point out that there are significant differences between the venture capital activity in continental Europe and the US or UK experiences. Funds located in Anglo-Saxon countries, which usually require higher returns, are characterized by a higher involvement in the investee company's operations. Moreover, one of the main drivers of fundraising efforts made by those funds is the existence of an active market for Initial Public Offerings (IPOs), plus the regulations that allow pension fund managers to allocate money to VC funds (Gompers and Lerner, 1998). An active venture capital market requires

well developed and liquid stock markets (Black and Gilson, 1999; Armour and Cumming, 2004). On the contrary, IPOs of VC-backed companies in Continental Europe are scarce and the funding is traditionally bank-dominated (Degryse and van Cayseele, 2000). On the investments side, most of the deals closed in Europe in unquoted companies focus on mature, or nearly mature, non-high-technology companies, thus implying that the statistics jointly follow early stage VC investments and later stage private equity investments.

As a result, the impact on those companies, as well as its determinants, could be different from that of VC-backed companies in countries such as the US. Two streams of works have been developed to analyze the VC impact in Europe. First, the impact of VC on aggregate terms has been analyzed for various aspects such as innovation and patents (Romain and van Pottelsberghe, 2004), or employment growth (Belke et al., 2003), comparing several OECD countries. In the same vein, Audretsch and Keilbach (2004) analyze the impact of entrepreneurship capital on the economic performance of several German regions using a longitudinal approach, although this paper focuses on firms at the start-up stage rather than on VC itself.

Second, in-depth studies on the impact of VC at a microeconomic level have been developed in some countries, such as Belgium (Manigart and van Hyfte, 1999), Germany (Engel, 2002; Engel and Keilbach, 2006) and Spain (Alemany and Martí, 2005), showing mixed results. Manigart and van Hyfte (1999) find that Belgian venture-backed companies achieve a higher growth in total assets and cash flow than non-venture backed companies, as do Engel and Keilbach (2006), who find evidence, through a panel data analysis, that German VC-funded firms display higher growth rates. Engel (2002) analyzes the impact of VC on employment growth and shows that surviving venture-backed firms achieve higher growth rates compared to surviving non-venture-backed firms in Germany. Moreover, he finds out that venture capitalists are more able to push the firms to a faster and higher employment growth than other investors. This result is contrary to the one in Manigart and van Hyfte (1999), who do not find different employment growths for a sample of Belgian VC-backed companies compared to non-venture backed firms of the same industries, with similar size and age. Alemany and Martí (2005) carry out the first study on this issue with an unbiased longitudinal dataset of VC versus non-VC-backed companies located in highly developed Spanish regions. They find that the growth of various economic variables such as revenues and assets, as well as the number of employees, is higher in the case of the companies which received VC funding.

In Europe fewer analyses based on listed companies have been carried out than in the US, because the IPO activity is somewhat lower. Nevertheless, Bottazzi and Da Rin (2002) analyze 315 listed high-tech European companies, comparing venture and non-venture backed companies, to investigate the influence of VC on the decision to go public in different countries. In the listed-companies' segment, they find lower returns on assets in the case of the venture-backed companies located in Germany.

2.2. Causality of the VC impact

The positive impact that VC exerts may be due, however, to a proper selection of the winners or, else, to the funding, monitoring and value added services provided by venture capitalists; or to both of them simultaneously. There is literature that provides evidence on both streams. Regarding the first one, the screening abilities of VCs are described in the literature as a key factor determining the superior performance of their portfolio companies. Tyebjee and Bruno (1984) stress the VCs' skills in assessing the entrepreneur's efforts and project quality to determine the perceived risk and expected return. Shepherd et al. (2000) investigate the important criteria in VC decision making, suggesting various factors as critical to achieve a successful selection of portfolio companies. In an extensive analysis of the existing literature on venture capitalists' decision making, Shepherd and Zacharakis (2002) identify as an underlying belief that venture capitalists are professionals able to identify the companies which are most likely to succeed. Nevertheless, they conclude that further research is needed on both the selection capacity and the decision making process that venture capitalists perform. On the other side of the coin it should be remarked, however, that a number of ventures fail to meet expectations and venture capitalists lose their money (Gifford, 1997), thus questioning their picking ability. In this line, Manigart and van Hyfte (1999) find evidence that Belgian venture-backed companies do not show a higher survival rate than comparable non-venture backed companies.

Regarding the value added role provided by venture capitalists, the literature has also analyzed the monitoring and advising role that is provided along with the funding of the venture after the investment is carried out. Hellmann (2000) defines venture capitalists as "coaches" in a review of the special functions developed by these financial intermediaries. He states that the key aspect of VC-backed companies' success is the contribution of professionally managed capital. Specifically, venture capitalists provide managerial support and guidance, which helps to turn the entrepreneurs' efforts into success, which is the same evidence found in Sapienza et al. (1996). Hellmann adds, however, that the monitoring

aspect is also of importance in overcoming the agency costs that are exacerbated due to the private nature of the firm. Gompers (1995) finds out that venture capitalists monitor their portfolio companies more frequently when expected agency costs rise. Hsu (2004) also emphasizes the importance of the managerial support provided by venture capitalists, but he also notes the important impact that the contact network of the venture capitalist has on the performance of investee firms. As a result there could be a link between VCs' reputation and the performance of VC-backed companies (Megginson and Weiss, 1991; Hsu, 2004). All these activities carried out by venture capitalists are positively perceived by the market. In this sense, Davila et al. (2003) find evidence of the signaling effect of VC to potential employees, so that the entry of a venture capitalist should send a positive signal to the market for human resources.

There is also literature that is more related to investigating the role of both the screening ability and the value added role of venture capitalists. The results found, however, are mixed. It remains to be discussed, however, whether the superior performance shown by VC-backed companies is due to a sound screening ability or to the funding plus monitoring and value added to the management. At the macroeconomic level, Ueda and Hirukawa (2003), however, support both hypotheses depending on the industry analyzed. Brander et al. (2002) investigate syndication of venture capitalists using Canadian data, addressing the general question of whether venture capitalists are primarily engaged in venture selection or in managerial support and related activities that add value to individual ventures. They conclude that syndicated investments show higher returns, thus favoring the value-added interpretation. Engel and Keilbach (2006) find further evidence on the specific interest of venture capitalists in supporting the commercialization activity of their portfolio companies in order to maximize sales. This means that they focus on finance, management assistance and awareness of more commercialization channels. They find that VC-backed companies show a higher growth, but no higher innovation than comparable non-venture backed companies.

Baum and Silverman (2004) address this issue on a sample of 204 biotechnology start-ups founded in Canada during the period from 1991 to 2000, and analyze whether venture capitalists pick winners or build them. They focus on three initial start-up characteristics, such as social capital (alliances), intellectual capital (patents) and human capital (management), and analyze if those influence in the same way the financing decision of the venture capitalist and the post investment performance of investee firms. They find that while social and intellectual capital show the same effect on the financing decision and the future performance of firms, the human capital does not. They conclude that the question

of causality remains unsolved, because the results are not clear. Nevertheless, as in previous papers, their study suggests that VC-backed startups outperform non-VC ones.

Finally, Bertoni et al. (2005) analyze whether companies with higher employment growth have an easier access to VC on a dataset of 537 Italian new technology based firms. They find strong evidence of a significantly higher employment growth of VC-backed companies when compared to the non-VC-backed ones, thus confirming the positive impact of VC on employment growth. On the contrary, only weak evidence is provided for the fact that firms' growth prior to the first VC round leads to a greater likelihood of obtaining access to VC financing. This finding supports the view that the financing itself and the managerial support provided explain company's growth to a larger extent than the ability to pick the winners.

2.3. Hypotheses

Assuming that VC-backed companies outperform their non-VC-backed peers, it remains to be explained whether this superior performance is more related to the VC managers' ability to pick the winners or to the effect of funding, advice and monitoring on the investee companies after the investment. If the former is true, then venture capitalists would be able to choose the best companies, as suggested by many authors investigating the venture capitalists' decision making process (Shepherd and Zacharakis, 2002), so VC-backed companies should outperform non-VC-backed companies prior to the event of VC funding. Therefore, a significant positive difference should appear in the growth rates of companies that receive VC funding before that event occurs. In order to check the relevance of the venture manager's ability to select the most promising companies the following hypothesis should be tested:

HYPOTHESIS 1: Before the investment, VC-backed companies do not show a significantly different growth rate to other comparable non-VC-backed companies.

A second issue is to analyze whether the value added role that venture capitalists provide to their portfolio companies enhances their performance. If this is the case, then the growth rate after the investment should be significantly different in the two sets of companies: VC and non-VC-backed ones. Therefore, the second hypothesis to be tested is:

HYPOTHESIS 2: VC-backed companies show a higher, significantly different growth rate to other comparable non-VC-backed ones after the investment.

3. Data and methodology

3.1. Sample and data collection

Since the aim of the paper is to analyze whether VC-backed companies do not outperform their non-VC-backed counterparts before the financing event, while they do from that moment on, a sample of investee companies that were in existence prior to the first VC round is used. Therefore, the study is focused on VC-backed companies at the expansion stage.

The sample is based on a dataset gathered by Prof. Martí (Universidad Complutense)[2] that includes all relevant data of the whole population of VC funds active in the Spanish market since 1985. The time frame is limited to the period from 1993 onwards because we need to have access to accounting data from investee firms prior to the first VC round and unquoted Spanish companies were forced to provide their accounts to an Official Registry only since 1991. Regarding the end of the period, information after the VC funding is required as well, allowing us to consider investments up to 1999, with accounting data up to 2002. Therefore, the study is based on an unbalanced panel of VC-backed companies with accounting data from 1991 until 2002. The population of domestic 1993-1999 investments, excluding real estate and financial firms, is 735 companies, of which 316 were companies at the expansion stage at the time of the first VC round.

A total of 15 companies had to be excluded from the analysis because they were acquired and merged, and there are no stand-alone data available, while others went bankrupt. The former are comprised of firms rapidly divested through a trade sale, which is one of the best exit ways for a VCs (Gompers and Lerner, 2001). The latter are firms which performed poorly and went bankrupt quickly, so they never had the chance to present their annual accounts to the Official Registry and it is impossible, therefore, to track any data about them. Therefore, the panel comprises data on 301 companies, which is a highly representative sample of VC-backed firms at the expansion stage, both successful and unsuccessful ones, thus including high return divestments as well as write-offs.

From this dataset, we searched for comparable non-VC-backed companies. A control group defined on a company-by-company basis was created. Each VC-backed company was matched with a similar non-VC-backed one that was selected

from the SABI database.[3] The matching criteria included the activity code (four-digit CNAE[4] code), the region, as well as the age, the range of gross revenues and headcount at the time of the first VC round. The first three criteria are mandatory, while the other two were taken from the closest available company. Accounting data from both VC and non-VC-backed firms in the pre and post-investment periods were captured from the SABI database and the Official Corporate Registers. Data collection included information contained in P&L accounts and balance sheets, as well as some additional data such as the date of birth, the status of the company and its activity codes.

Table 1

Descriptive statistics of investments for the population and the sample

	Population				Sample				
	N	% of Population	Mean	SD	N	% of Sample	% of Population	Mean	SD
1993	35	11.08%	1,00	1,42	24	9.6%	68.57%	0,92	1,33
1994	36	11.39%	1,40	2,05	26	10.4%	72.22%	1,20	1,60
1995	29	9.18%	1,97	3,29	24	9.6%	82.76%	1,75	2,98
1996	37	11.71%	2,78	6,45	28	11.2%	75.68%	1,95	3,70
1997	54	17.09%	2,32	4,17	48	19.2%	88.89%	2,12	3,83
1998	56	17.72%	1,62	2,55	46	18.4%	82.14%	1,74	2,80
1999	69	21.83%	3,33	6,95	54	21.6%	78.26%	3,52	7,45
Total	316	100%	2,06	3,84	250	100%	79.11%	1,89	3,38

Note: N: Number of investments. SD: Standard deviation. Mean and SD in € million.

The matching criteria allowed us to find comparable non-VC-backed companies for 250 investee firms. This sample represents 79.1 per cent of the population of expansion investments recorded in that period. Table 1 shows that the sample analyzed is highly representative of the population, since it represents from 68.57 per cent in 1993 up to 88.89 per cent in 1997. It also shows the number of investments and the mean committed to companies at the expansion stage for each

[2] He conducts the official surveys on VC in Spain on behalf of the European and the national VC Associations.
[3] The SABI database (Bureau van Dijk and Informa) provides accounting and other relevant data on 650,000 Spanish companies over time.
[4] CNAE stands for National Classification of Economic Activities. It plays a similar role to that of SIC codes.

of the years 1993 to 1999. The number of VC investments carried out on companies has been increasing over time, except for the year 1995, as is usual in maturing markets. The average volume of investments committed for the whole period in firms in the sample is €1.89 million, in constant € 2001, €3.38 million being the observed standard deviation.

In Table 2 more detailed descriptive statistics about the number and volume of investments carried out in the sample analyzed can be observed. The statistics are shown on the basis of different characteristics of the VC-backed firms, such as the age of the company, the activity and the number of employees. All characteristics refer to the year of the first VC round. About 63.6 per cent of the companies are more than five years old at the time of the initial investment. Furthermore, there is a high proportion of companies with more than three years of activity, hence allowing us to test the growth pattern of VC-backed companies at least two years before the investment is made in a number of firms. The mean volume invested is around €1.83 million for firms up to 20 years. However, this amount is more than double for firms over 20 years, showing that older firms receive higher amounts of money. Regarding the sector, more than half of the firms in the sample is classified under industry-related activity codes, whereas the next category with most firms is the services activity with 22 per cent of them. VC-backed firms belonging to the technology sector account for 12.8 per cent of the sample. VCs committed the largest amounts, on average, to this latter group. Finally, nearly half of the firms employ up to 50 people, and around 15.2 per cent of them employ more than 250 people, so the sample of firms that receive VC in the expansion stage is comprised of small and medium-sized firms in terms of employment. Again, it is the firms employing most people which receive the highest amounts of investment in average terms, as those that employ more than 500 people receive, on average, 4.24 times the average volume of investments.

Table 2

Descriptive statistics of investments by age, activity and number of employees of the VC-backed companies.

	Investments (number)	% of total	Mean	SD	Median	Minimum	Maximum
Age (years)							
<= 5	91	36.4%	1,511,329	3,396,910	345,342	1,234	2.33e+07
5-10	47	18.8%	1,665,581	2,714,329	625,580	13,058	1.15e+07
10-20	68	27.2%	2,313,508	6,079,873	783,486	11,999	5.68e+07
> 20	44	17.6%	4,029,245	7,804,492	1,148,065	25,689	4.46e+07
Activity							
Raw materials	11	4.4%	1,486,094	2,707,176	658,781	110,305	1.20e+07
Industry	132	52.8%	1,877,550	3,927,082	598,191	2,034	4.10e+07
Technology	32	12.8%	2,531,996	6,186,225	619,040	1,234	4.46e+07
Services	55	22%	2,515,237	6,903,057	399,529	2,326	5.68e+07
Trade	20	8%	3,542,882	6,299,489	957,338	29,245	2.53e+07
Number of employees							
< 10	31	12.4%	1,296,044	3,310,308	147,073	1,234	1.56e+07
11-50	82	32.8%	728,971	1,301,067	320,965	4,808	1.20e+07
51-100	58	23.2%	1,285,762	1,608,107	702,202	11,999	9152155
101-250	36	14.4%	3,700,379	7,426,875	979,357	75,453	4.46e+07
251-500	22	8.8%	4,258,002	5,255,736	3,191,106	57,440	2.53e+07
> 500	16	6.4%	7,999,374	1.20e+07	2,884,616	25,689	5.68e+07
Unknown	5	2%	655,490	1,138,227	294,500	22,061	3218197
Total	250	100%	1,886,578	3,384,163	652,905	2,034	4.46e+07

Note: All data refers to the year of investment. Data in € year 2001.

Table 3 shows a comparison between VC-backed companies and comparable companies that are included as a control group on variables such as age, gross revenues, earnings before interest and taxes (EBIT), total assets and number of employees. As expected, no significant differences are found between the ages of VC and non-VC-backed companies. Nevertheless, the mean of gross revenues, EBIT, total assets and headcount are higher in the group of VC-backed companies.

The standard deviation is also much higher, showing a greater dispersion in the observed values on the VC-backed group. Therefore, it seems that, on average, VC-backed companies are larger, when measured by gross revenues and total assets, than the Control Group companies at the time of the first VC round. Nevertheless, these differences comply with the matching criteria applied, when attempting to find the best comparable company in the same region, in the same four-digit activity code and with a similar age, it being impossible also to match sales and employment at the same time.

Table 3

Descriptive statistics of several corporate variables of the VC backed companies.

Variable	Company	Mean	SD	Median
Age company	VC backed	14	14	10
	Non VC backed	14	11	11
	p-value	0.4162		
Gross revenues	VC backed	23,016,976	77,685,588	5,526,655
	Non VC backed	13,415,566	36,172,295	3,235,132
	p-value	0.0000		
EBIT	VC backed	1,284,566	4,896,738	325,229
	Non VC backed	803,561	2,543,064	118,005
	p-value	0.0001		
Total assets	VC backed	24585644	80642148	6,527,713
	Non VC backed	11337361	32528755	2,185,557
	p-value	0.0000		
# employees	VC backed	220	923	60
	Non VC backed	102	267	35
	p-value	0.0000		

Note: All data refer to the year of investment. Data in € year 2001.

The differences in levels, however, are not relevant in this context if the growth patterns of the pairs of similar companies are not significantly different

before the first VC round. In particular, the impact of VC will be analyzed by studying the growth of two corporate variables: gross revenues and number of employees. Some descriptive statistics of these two endogenous variables are shown in Tables 4 and 5. Table 4 shows the evolution of the average absolute growth of gross revenues both for VC-backed companies at the expansion stage and its peer group, for each of the three years before and after the VC investment. The p-value of the test for the difference in means is reported for each group and year. As expected, the difference in means[5] for both groups is not significant for either of the three years before the VC investment. In contrast, the absolute growth of gross revenues is significantly higher for the VC-backed firms in each of the three years after the VC investment, providing evidence of a positive impact of VC for those firms that receive the investment.

Table 4
Descriptive statistics of absolute growth of gross revenues for VC versus non VC-backed firms at the expansion stage.

Panel A: Before the VC investment event

Type of Firm	**1 year**		**2 years**		**3 years**	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
VC-backed	2,440,916	11,755,346	2,314,813	10,382,481	2,123,609	9,798,752
Non-VC-backed	1,652,081	12,617,712	1464407	11,134,164	1,440,098	10,613,429
p-value	0.2153		0.1312		0.1544	

Panel B: After the VC investment event

Type of Firm	**1 year**		**2 years**		**3 years**	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
VC-backed	7,098,277	27,996,928	7,492,332	50,140,041	6,397,827	43,702,028
Non-VC-backed	2,281,353	13,850,048	1,694,971	10,729,259	1,319,779	11,828,969
p-value	0.0138		0.0110		0.0026	

Table 5 shows the evolution of the mean growth value of the number of employees in absolute terms for both VC and non-VC-backed firms for one, two and three years before and after the VC investment. The average growth in the number of employees is always higher for those firms receiving VC, both before and after the investment. However, while before the investment this difference is only significant at the 10 per cent level, the significance of this difference rises for the three years after the VC investment. Thus, although VCs seem to invest in companies with higher rates of growth in the number of employees, they also seem to have an impact on this growth after the investment is carried out.

[5] As in the previous case, a test of equality of variances was carried out previously, showing the p-values for the difference in means according to these results.

Table 5
Descriptive statistics of absolute growth of employment for VC versus non VC-backed firms at the expansion stage.

Panel A: Before the VC investment event

Type of Firm	1 year		2 years		3 years	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
VC-backed	33.24753	190.23426	25.21147	163.95218	22.29448	151.97382
NonVC-backed	9.07368	93.92581	7.40891	82.59697	7.35556	79.13562
p-value	0.0575		0.0553		0.0725	

Panel B: After the VC investment event

Type of Firm	1 year		2 years		3 years	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
VC-backed	50.21097	264.10165	45.55882	252.73557	61.61290	454.14382
NonVC-backed	-4.10651	162.74008	-0.16954	114.71693	5.27933	129.68151
p-value	0.0091		0.0003		0.0009	

3.2. Methodology

We assess the impact through two different variables, namely, sales and employment growth of VC-backed firms. We aim to find whether the evolution over time of these variables prior to the VC funding event is not statistically different in a VC and a comparable non-VC-backed group of companies, whereas it is different after that event occurs. Several regressions before and after the VC investment is carried out are run, using as dependent variables the evolution of sales and employment growth in absolute terms. As Baum and Silverman (2004) point out measuring growth in relative terms would imply a distorting effect on the averages when the changes from one period to another are high enough.

As data refers to the evolution of company's activity over time, then panel data methodology was used to estimate the models, which take the following general form:

$$y_{it} = \alpha + \beta x_{it} + \eta_i + \nu_{it}; \qquad i = 1,2,...N; \quad t = 1,2,...T$$

where i denotes the firms and t the years. η_i denotes the unobservable individual heterogeneity, which is different for each firm but is constant over time within a firm. ν_{it} represents the disturbance of the model, with mean zero and variance σ^2_{ν}.

The set of independent variables includes two control variables and a dummy. The first control variable is the growth of total assets, since either sales or employment growth are related to the variation in the assets held by the company.

Provided that growth patterns are also affected by the current economic situation, the second control variable is the growth of GDP. The third variable is a dummy that equals one if the company is VC-backed, or zero otherwise.

The causality of impact is, thus, measured through this latter dummy. If VCs just choose the companies with better prospects, then this dummy should be significant before and after the VC investment is carried out, as this would mean that companies that receive VC funding were already growing at a higher rate. On the contrary, if venture capitalists add value to the investee firms through the different tasks they perform, then this dummy should be significant only after the VC investment is carried out.

In order to estimate this model, the random effects approach has been considered. The reason is that the variable of interest in this analysis is the dummy that represents whether the firm has received VC. If a fixed effect approach is employed, all variables with constant values over time are dropped from the analysis, and thus the dummy can not be estimated. From a different perspective, since the model is tested on a representative sample of VC-backed companies the results would not change if a given individual (investee company) is randomly replaced by another.

4. Results

The regression results of sales growth before and after the VC investment event are shown, respectively, in Panels A and B of Table 6. Panel A results indicate that sales growth in VC and non-VC-backed companies depend on the growth of total assets, as expected. It should be noted, however, that the coefficients are higher in the post-investment period. The increase could be related to the effect of the investment committed in the VC-backed group. The other control variable, namely GDP growth, is only significant prior to the investment event.

Regarding the dummy that identifies VC and non-VC-backed companies, it is not significant when the regression is performed for different time windows from four to one years prior to the VC funding event. This indicates that VC-backed companies and their similar non-VC-backed ones do not grow at different rates before the VC investment, so VCs would not be investing in those companies that outperform. Therefore, this finding confirms Hypothesis 1 (H1) on the models that analyze sales growth.

In Panel B, however, the regression results after the investment show that the same dummy is positive and significant from year two to year four, thus indicating

that, as expected, VC-backed companies outperform sales growth of non-VC-backed companies. Therefore, evidence is found that the 'coaching' skills (Hellman, 2000), in addition to funding, make the difference in the evolution of the company, as suggested in the descriptive analysis. This finding also confirms Hypothesis 2 (H2) on the models related to sales growth.

This Table also shows that the control variable related to growth of total assets is significant in the pre and post-investment periods, with the coefficients being higher after the first VC round. This result may be indicative of the effect of the funding alone on the growth patterns of investee firms.

Further evidence is found when employment growth is analyzed on the same set of companies before and after the VC event. Panel A of Table 7 shows that the dummy that equals one for VC-backed companies is not significant in any of the time windows before the VC funding. This result, which is in accordance with the evidence provided by Davila et al. (2003) on US start-ups, also confirms H1 in the models related to employment growth. As we do for Spanish VC-backed companies at the expansion stage, they find that VCs do not choose companies which show higher employment growth before the first VC round.

On the contrary, employment growth after the investment is positively related to the dummy that identifies VC-backed companies, thus also confirming H2. Therefore, the presence of venture capitalists spurs employment growth of the companies they invest in, showing evidence of their positive impact on this variable and the lack of the inverse causality problem.

Table 6

Regression results on sales growth of VC versus non-VC-backed companies

Panel A: Before the VC investment event

	Dependent variable: Sales growth			
Independent variables	4 years	3 years	2 years	1 year
Growth in total assets	0.3560***	0.2623***	0.2575***	0.4144***
	(0.0265)	(0.0210)	(0.0221)	(0.0292)
GDP growth	3.97E+07*	5.54E+07**	5.91E+07**	5.34E+07*
	(2.10E+07)	(2.18E+07)	(2.49E+07)	(3.13E+07)
Dummy VC	476741	886728	945073	409370
	(641060)	(687500)	(760070)	(886760)
Constant	-420867	-1097377	-1282701	-1388368
	(874292)	(922051)	(1070551)	(1366562)
R^2	0.242	0.163	0.165	0.266
Companies	340	340	340	339
Observations	989	925	807	597

Panel B: After the VC investment event

	Dependent variable: Sales growth			
Independent variables	1 year	2 years	3 years	4 years
Growth in total assets	0.6645***	0.5943***	0.6387***	0.6885***
	(0.0311)	(0.0239)	(0.0216)	(0.0211)
GDP growth	-6.05E+07	-5.10E+07	-2.26E+07	-1.25E+07
	(4.19E+07)	(3.32E+07)	(3.27E+07)	(3.06E+07)
Dummy VC	1353759	1483080**	1452676**	1381226**
	(1032069)	(728918)	(720958)	(690693)
Constant	3116466*	2555198*	1177561	639912
	(1801036)	(1426317)	(1394258)	(1312995)
R^2	0.377	0.347	0.357	0.367
Companies	456	477	488	491
Observations	781	1239	1691	2046

GLS random effects regression of the model $y_{it} = x_{it}'\beta + \varepsilon_{it}$; $\varepsilon_{it} = \eta_i + v_{it}$, with *i* denoting company and *t* denoting year. The dependent variable is *sales growth* (in constant currency absolute terms). The independent variables are (1) Growth in total assets from "t-1" to "t" (in constant currency absolute terms), (2) GDP growth from "t-1" to "t" (in relative terms) (3) Dummy that equals 1 for VC-backed companies or zero otherwise. Standard errors in brackets.

***= significant at 1%, ** = significant at 5%, * = significant at 10%.

Table 7
Regression results on employment growth of VC versus non-VC-backed companies
Panel A: Before the VC investment event

	Dependent variable: Employment growth			
Independent variables	4 years	3 years	2 years	1 year
Growth in total assets	2.85E-06***	2.75E-06***	2.76E-06***	3.26E-06***
	(2.84E-07)	(2.90E-07)	(3.08E-07)	(4.24E-07)
GDP growth	472.80	497.20	540.25	548.12
	(384.37)	(400.70)	(474.14)	(661.27)
Dummy VC	11.70	14.27	16.27	17.71
	(9.41)	(9.66)	(10.83)	(14.39)
Constant	-15.62	-16.68	-19.559	-21.48
	(16.30)	(16.98)	(20.40)	(29.23)
R^2	0.147	0.140	0.141	0.141
Companies	252	252	249	236
Observations	621	592	524	390

Panel B: After the VC investment event

	Dependent variable: Employment growth			
Independent variables	1 year	2 years	3 years	4 years
Growth in total assets	5.40E-06***	4.33E-06***	5.70E-06***	5.58E-06***
	(4.21E-07)	(3.23E-07)	(5.04E-07)	(4.54E-07)
GDP growth	-726.16	-710.38	-22.29	-33.20
	(746.24)	(5581.32)	(927.62)	(788.46)
Dummy VC	37.45**	32.17***	41.86**	36.59**
	(15.69)	(12.30)	(17.69)	(15.71)
Constant	21.96	23.51	-3.78	-4.05
	(32.97)	(25.76)	(40.09)	(34.14)
R^2	0.231	0.185	0.093	0.089
Companies	380	410	435	448
Observations	599	985	1375	1684

GLS random effects regression of the model $y_{it} = x_{it}'\beta + \varepsilon_{it}$; $\varepsilon_{it} = \eta_i + v_{it}$, with *i* denoting company and *t* denoting year. The dependent variable is *employment growth* (in constant currency absolute terms). The independent variables are (1) Growth in total assets from "t-1" to "t" (in constant currency absolute terms), (2) GDP growth from "t-1" to "t" (in relative terms) (3) Dummy that equals 1 for VC-backed companies. Standard errors in brackets.

***= significant at 1%, ** = significant at 5%, * = significant at 10%.

5. Discussion and conclusion

The study of the impact of VC funding on the economy is important for investors, VC organizations and government authorities. Even though the first survey dates back to 1982, the lack of unbiased data implied a delayed interest of academic literature on this issue (Gompers and Lerner, 2001). Although several relevant studies have been developed so far, the question that still remains to be addressed is related to the possibility that the better performance of VC-backed companies is associated with the VCs' ability to select the best companies, rather than to the managerial support venture capitalists offer to their portfolio companies.

Some papers have already addressed this issue. Davila et al. (2003) focus on employment growth in Sillicon Valley start-ups, finding that VC-backed companies do not show headcount growth patterns different to those of non-VC-backed companies. Baum and Silverman (2004) study the causality issue on Canadian biotechnology start-ups, relying on hand-collected, qualitative data because companies at this stage are newly born. Bertoni et. al. (2005) concentrate on the same issue on Italian new technology-based firms. They find that VC-backed firms do not have a significantly higher growth rate prior to the first VC round.

The contribution of this paper to the existing literature can be outlined in several ways. First, we rely on numerical data obtained from an objective source rather than basing the analysis on qualitative, hand-collected data. Second, we address the causality problem from a different perspective. We run regressions before and after the funding event on VC and non-VC-backed companies so as to test whether the former do not perform significantly better than the latter prior to the event and that they do after the event. Since it would not be possible to obtain relevant financial data on the pre-investment period on start-ups, the scope of the study is companies at the expansion stage. Third, the impact of VC funding is measured through two variables, sales and headcount growth, whereas most of the existing literature concentrates on the later. Furthermore, the models are tested on companies at the expansion stage, mostly non-high technology firms, whereas previous studies mainly focus on early stage high technology companies.

We find evidence that both sales and headcount growth in VC-backed companies is not significantly different from non-VC-backed ones prior to the VC investment event, but it is from that moment onwards. This evidence is in line with the findings of Davila et al. (2003) and Bertoni et al. (2005), although both the focus and the methodology are different. There are several implications of these results. First, VC is a suitable tool to foster economic growth since funded

companies at different stages, with and without a technological base, outperform similar non-VC-backed companies. Second, the combination of funding plus value added VC adds value to portfolio companies.

It is worth noting that the analysis is performed in a complete unbiased sample of VC investments at the expansion stage in a country that ranks third in the Continental Europe VC and Private Equity market. This means that the inverse causality issue does not apply to more developed companies and/or non high technology firms in a different geographical area. As regards the limitations, the missing data on some VC-backed companies limits the number of individuals considered in the pre-investment period. More research is merited on this issue using a larger sample of years/countries to reaffirm the findings.

Future research could focus on several issues, such as the differences between types of firms, sectors analyzed, investment stages; or different characteristics of venture capitalists. First, it may be possible, for example, that the impact of VC is higher in larger and older firms, since the networks and structures of these firms are more prepared to take advantage of it. However, one may argue the opposite, since a younger firm has more to learn from a VCs than an older one. Second, most papers in literature have analyzed the impact and/or causality of VC in certain industries. The impact of VC, however, may well be different depending on the sector they invest in. Finally, it could also be worth to analyze if different kinds of venture capitalists, for example private versus public-sector-backed funds, enhance the performance of their portfolio companies in the same way. This topic is important because, as Leleux and Surlemont (2003) point out, the intensity of public-sector VC in Europe is high. Public-sector-backed VC is often used as a tool to foster regional development (Marti, 2002). Thus it seems to be the case that public funds have different aims to those of private funds, and this could lead to differences in the impact of their acting.

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