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Importance of the Non-financial Value Added

of Government and Independent Venture Capitalists

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Abstract

This paper compares the post-investment value-added activities performed by governmental venture capital (GVC) and independent venture capital (IVC) for their portfolio companies, and controls for the selection effect that the different investment profiles of these investors might have on the forms of value added. The study uses a unique data set based on a survey addressed to new VC-backed, technology-based firms from seven European countries. The study focused on the importance of the contribution by the first lead investor in a variety of activity areas, as assessed by the investee companies. The study also pays attention to potential adverse effects of the post-investment engagement of the investors on the firm.

Using a composite indicator of the extent of the value added, we find no statistically significant difference between the two types of investors. However, the type of value added differs across investor type and, in particular, IVC's contribution proves to be significantly higher than that of GVCs in a number of areas, including the development of the business idea, professionalisation and exit orientation.

Key words: Venture Capital

JEL: G24, G32, O16

1 Introduction

The academic literature on venture capital (VC) funding has long acknowledged that, in addition to financial resources, VC investors provide portfolio companies with a complex bundle of value-adding activities (e.g. Gorman and Sahlman, 1989; Sapienza, 1992; Sapienza et al., 1996; Denis, 2004; Kaplan and Strömberg, 2004). First, professional investors directly add value to portfolio firms by "coaching", that is, giving them financial, administrative, marketing, strategy and management support, which are lacking especially in young innovative firms operating in high-tech industries. Second, VC fosters the managerial "professionalisation" of young innovative firms (e.g., Hellmann and Puri 2002, Bottazzi et al. 2008), facilitates the access to specialised professional services and establishes alliances with third parties (Lindsey 2002, Colombo et al. 2006, Hsu 2006) thus extending their social capital. Moreover, VC can further signal the quality of the portfolio firms to third parties (i.e. to customers, alliance partners, skilled workers and other financial intermediaries; see e.g., Stuart et al. 1999).

VC investors are, however, a heterogeneous category, especially in Europe (Bottazzi et al. 2008). Besides independent VC (IVC), which is the dominant form of VC in the USA other types of VC investors emerged especially in Europe, including Corporate VC (CVC), Bank-affiliated VC (BVC), Governmental VC (GVC) and University VC (UVC). The latter VC investors differ along several dimensions from IVC, and this suggests the type and extent of value-adding activities they perform could be different. First, venture capitalists differ in the extent to which they possess human capital, which has implications for their ability to provide high-quality value-adding services to portfolio firms (see, e.g., Knockaert et al., 2006). Second, the investment motivations of venture capitalists differ (Hellmann, 2002), and this will have implications for the amount of time and effort they devote to their portfolio firms. Third, venture capitalists have different investment patterns in terms of the types of firms in which they invest (e.g., Siegel et al., 1988), and this will lead to differences in post-investment behaviour; e.g., very young and very early stage portfolio firms are in the greatest need for coaching and guidance. Fourth, the investment horizon varies substantially among different venture capitalists and this translates into different incentives in providing coaching (e.g. having a longer vs. shorter term impact on a firm's performance). There are thus many factors which can interact with investor type in their post-investment activities.

From a policy perspective, perhaps the most interesting and under-researched type of VC investor is GVC. The establishment of GVC funds has characterised most European countries in the past two decades, as part of the effort by governments to fill funding gaps in early stage investments. GVC investors may have varying objectives ranging, for example, from the seeding of the development of a young industry or supporting this industry by providing a credible signal to private investors, to helping regional development and job creation by setting up regional funds (Leleux, Surlemont, 2003). The way in which these overall objectives are translated into investment decisions affecting the post-investment behaviour has not been studied thoughtfully. In this study we aim to address this gap in the literature.

In this paper we will compare the value added by GVC with a "benchmark" provided by IVC. To gauge the extent and the composition of value-adding activities, we submitted a survey with young innovative companies in Europe. A section of the survey questions pertained to interaction with VC investors. The survey data give us a fine-grained assessment by the investee companies of the importance of the contribution of different VC investor types. This allows us to

compare both the overall level and composition of the value added of IVC and GVC. Moreover, we were able to study the potential interaction of value-added with the characteristics of the investee company. Finally, the paper also pays attention to the potential adverse effects which the engagement of VC can cause to the firm (e.g. conflicts with the incumbent management).

2 Related literature and research hypotheses

There are still relatively few studies directly addressing the value-adding activities of different types of investors, and the literature is particularly meagre with respect to GVC in Europe. Overall, the findings indicate that government funds are less engaged in the coaching and value-adding activities in their portfolio firms, which subsequently exhibit worse performance. For example, Brander et al. (2008) found that GVC programmes in Canada performed poorly because of a treatment effect, not selection. They used criteria such as value-creation, as measured by the likelihood and size of IPOs and mergers and acquisitions, as well as innovations, as measured by patents, or simply the survival of the firm. The explanations for the findings included less effective monitoring and other value-adding services provided by government programmes. However, the latter also crowded out private investment. The study, however, does not actually measure monitoring or treatment activities of different investor types, but gauged its magnitude using an instrumental variable approach (ibid., 34).

Knockaert et al. (2006) and Knockaert and Vanacker (2010) found that investment managers of captive funds (including GVC in these) were less involved in value-adding activities than other investors. Schilder (2006) and Schäfer and Schilder (2006) noted that GVC had limited potential for hands-on activities, since they had more portfolio firms per manager, fewer contacts, and were less engaged in such activities. Furthermore, Tykvová and Walz (2007) found that firms backed by foreign and reputable IVC investors performed better than firms with other types of venture capital, especially GVC investor.

With regard to other investor types, Chemmanur et al. (2010) studied CVCs and compared their value creation with IVCs. Their findings indicated that corporate venture capitalists had an important signalling effect, first to the independent venture capitalists prompting them to co-invest in these firms pre-IPO; second, to various financial market players allowing the portfolio firms to access the equity market at an earlier stage in their life-cycle compared to firms backed by IVCs alone; and third, directly to IPO market investors, allowing CVC-backed firms to obtain higher IPO market valuations compared to the valuation of firms backed by IVCs alone. The authors also found that the CVCs created value by investing significant amounts in younger and riskier firms involving pioneering technologies: since many such firms would not have received private equity financing from IVCs, these firms may not have been able to grow and mature without CVC funding. Controlling for selection, however, Bertoni et al. (2010) did not find any superior treatment effect of CVC on a firm's growth in sales and employees. Instead, they found that IVC has a more immediate impact on a firm's growth than CVC, and interpreted this result in terms of the different importance the timing of results has for these two types of investors. Grilli and Murtinu (2011) found that, in terms of growth (sales, employees, total assets) of new technology-based firms, venture capital provided by private VCs outperformed that provided by public VCs but, at the same time, the latter still played a significant role when the investment was directed towards very young ventures and it was provided by GVCs as opposed to university VCs.

Maula et al. (2005) provided evidence that corporate and independent venture capitalists were adding value to their portfolio companies in a complementary way. Independent venture capitalists were more engaged in enterprise 'nurturing' – helping raise additional finance, recruiting key employees, and professionalising the organisation – whereas corporate venture capitalists excelled in building the commercial credibility and capacity and in providing technological support. Tykvová (2006) found that corporate and independent private equity providers played a more pronounced role in corporate governance whereas bank-dependent and government funds often served as bridge investors.

The findings of these studies are not aligned and there is a tendency in these studies to use different classifications or combinations of investors as well as different categories of value-adding activities. Still, we may conclude that, first, investor types indeed have differentiated roles in providing funding and non-financial value added to their portfolio firms. It is also possible that they complement each other (cf. also Luukkonen and Maunula, 2007). Another conclusion is that managers of government funds tend to be less actively engaged in their portfolio firms and that these perform less well than the portfolio firms of other investor types. Here again, we may assume some complementarities between the investor types.

Some of the different impacts of investor types can be related to their different investment patterns. There is evidence of this, for example, the above-mentioned findings of Chemmanur et al. (2010) and those by Tykvová (2006) according to which the role of public VCs is a provider of bridge funding. There is plenty of evidence that the degree of involvement by the investor in the portfolio firm varies by portfolio firm characteristics (Sapienza, Gupta, 1994; Fredriksen, Klofsten, 2001; Sapienza et al., 1996): venture capitalists added most value to companies that were in the early stage and were highly innovative and the value added was strongly related to the extent of time devoted to the portfolio company by the venture capitalist. Thus, investment patterns of different venture capitalist types can interact with their value-adding behaviour patterns and their effects. There are also studies indicating differences among investors with regard to, for example, social capital and knowledge resources of the venture capitalist types (e.g., Maula et al., 2005; Knockaert et al., 2006).

Taking into account the findings from previous research literature, we formulate the following two hypotheses on value adding contributions:

Hypothesis 1: The value added by GVC to portfolio companies is smaller than that by IVC.

Hypothesis 2: The areas of value-adding activities offered by GVC differ from those provided by IVC.

Moreover, VC investors could also be involved in value-subtracting activities. First, the firm management and the investors often have differences of opinion about a firm's strategy (e.g. Higashide and Birley, 2002). Second, VC investments can engender expropriation risk (Ueda, 2004), which could in turn cause an increased cost to protect intellectual property. Accordingly, in this work, we also pay attention to potential adverse effects of venture capitalist involvement on the investee firm, and study whether the type of VC plays a role in that respect. Our assumption is that active post-investment involvement by the investor in the firm can cause friction and other types of adverse effects. However, we do not posit any specific hypotheses but only explore this question.

Finally, in the empirical study we will control for some of the potential interacting factors, namely, the differences both investor types have in their investment patterns, that is, their potential predisposition to invest in particular types of portfolio firms with regard to, for example, the size, stage or other characteristics of the investee firms, that is, we aim to control for the selection effect.

3 Sample and methodology

3.1 Sample construction

The study is based on a survey addressed to a sample of firms retrieved from the VICO database. The VICO data-set was built thanks to the joint effort of nine research partners[1] throughout Europe with the support of the 7th European Framework Programme (Grant agreement no.: 217485). The objective of the data collection process was to build a large sample of new technology-based companies in order to provide a comprehensive picture of VC activity in high-tech sectors in seven European countries: Belgium, Finland, France, Germany, Italy, Spain and the United Kingdom. All companies included in the sample were founded after 1984, were independent at foundation, and operate in the following high-tech sectors: Pharmaceuticals, ICT manufacturing, Robotics, Aerospace, Telecommunications, Internet, Software, Web Publishing, Biotech, and other R&D services. The data-set includes two strata of companies: *Stratum 1* includes a sample of companies which were found to be VC-backed; *Stratum 2* includes a group of companies for which no VC involvement could be identified using available sources.

All companies in Stratum 1 received their first round of VC between 1994 and 2004 and were less than 10 years old at that time. A sample of VC-backed companies was collected at the country level by a dedicated team complementing commercial directories (e.g. VentureXpert) with local sources[2].

Stratum 2 set is composed by allegedly non VC-backed companies (i.e. companies for which we could find no VC involvement by means of all the secondary sources we used to identify the first stratum) deriving from a random extraction (conditional on the criteria reported above) from different calendar year versions of Bureau Van Dijk's Amadeus data-set and complemented with other country-specific sources[3]. The size of Stratum 2 was set to be around 10 times larger than the VC-backed sample.

Eventually, the data-set includes 8,391 new technology-based companies, 761 in Stratum 1 and 7631 in Stratum 2. For each of these companies we searched for an email address of a contact person (founder or manager) or, when unavailable, a generic email address for the company. We collected 5,439 email addresses, which constitute the support (i.e. the universe of reachable companies) for our study.

[1] The nine research partners of the VICO projects are Ecole des Mines de Paris, Politecnico di Milano, Libera Università Carlo Cattaneo, Research Institute of the Finnish Economy, Centre for European Economic Research, Universidad Complutense de Madrid, University College London, Vlerick Leuven Management School, and University of Gent.

[2] e.g. VC investors websites, local Venture Capital associations, press releases, press clippings, IPO Prospectuses, stock exchange records, Zephyr, the Library House, the ZEW Foundation Panel, VCPro-Database, BVK Directory, the Research on Entrepreneurship in Advanced Technologies directory, Private Equity Monitor, José Martí Pellón's VC Database, and Web Capital Riesgo.

[3] Such as industry associations, Chambers of Commerce, commercial firm directories, Zephyr, Creditreform, the ZEW Foundation Panel, and the Research on Entrepreneurship in Advanced Technologies (RITA) directory.

3.2 Methodology

The question of what is the value added by a particular investor is not simple to establish for the reason that often VC investments are syndicated and the composition of the syndicate may vary over time. This makes the identification of the research unit challenging.

The degree of active involvement of investors varies substantially depending upon the importance they have in the syndicate, and the lead investor (an investor which has taken the lead in putting together a syndicate and often is the one sitting on the Board of Directors) is the most actively involved (e.g. Elango et al. 1995). The propensity of IVC and GVC to be the lead in a syndicate may be different and, to avoid a bias in the estimate of the effort spent by each investor category, we focus our analysis on the lead investors only, thus aiming to exclude from the analysis the role of other members of the investment syndicate.

Another source of complexity derives from the fact that in different investment rounds there is turnover: new VC investors enter the consortium and incumbent VC investors exit (Cumming and Dai, 2010). Moreover, empirical findings indicate that the impact of venture capitalists on the firm performance is focused on the first few years after the first round of VC financing (e.g. Chemmanur et al., 2010; Bertoni et al. 2010; Croce et al. 2010). Thus, in order to obtain a valid measure of the value added by different investors – who could differ in their propensity to invest in the first follow-up rounds – we should concentrate on the role of the first lead investor (i.e. the lead investor in the first round of financing).

A web-based questionnaire was sent to each company in early February 2010 requesting them, among other things, to assess the perceived effectiveness of value added by VC differentiating dimensions of activities. Up to four reminders were sent (each an average of three weeks after the previous reminder starting in March 2010. Phone calls to companies in Stratum 1 were also made to raise the response rate in the beginning of May 2010. The questionnaire was closed in September 2010.

The survey was carried out using a web-based survey tool (*LimeSurvey*). The questionnaires were initially developed in English and pre-tested. The questionnaires were translated by local teams participating in the VICO project into the following languages: German, Finnish, French, Italian, and Spanish. In a few cases, when the translation was particularly difficult we checked its correctness by having it retranslated back into English by local academics not directly involved in the formulation of the questionnaire. The re-translated versions and the original version were then compared to highlight and solve possible translation errors or language-specific interpretation problems.

The overall response rate for the two strata of the sample was 15.1% corresponding to the (partial) submission of 820 questionnaires. Table 1 summarises the response rates of the VC-backed firms and the composition of the total VC-backed sample by industry. We contacted 672 firms (column b, representing Stratum 1), of which 226 (column c) at least partially completed the survey. This corresponds to a response rate of 33.6% (column a). Among responding companies identified as non-VC-backed (using all the secondary sources mentioned above, Stratum 2), 58 self-declared to have benefited from some form of venture capital (column d). In these cases other than independent VC investors (mostly GVC) were normally involved, suggesting that secondary sources may severely underestimate the role of the GVC in

Table 1 Response rates of the VC-backed firms by industry

INDUSTRY	(a) = (c) / (b) Response rate (%)	(b) Number of contacted VC-backed firms[a]	(c) Number of VC-backed firms that completed the survey[b]	(d) Number of "non VC-backed firms" that reported to be VC-backed in the survey[c]	(e) = (c) + (d) TOTAL number of VC-backed firms in the sample
Aerospace	33.3 %	3	1	1	2
Biotech	27.8 %	115	32	9	41
Energy	100 %	3	3	0	3
ICT manufacturing	39.1 %	115	45	12	57
Internet	18.8 %	85	16	1	17
Nanotech	100 %	1	1	0	1
Other R&D	36.8 %	19	7	3	10
Pharmaceutical	40.9 %	22	9	2	11
Robotics	50 %	12	6	1	7
Software	37.7 %	228	86	24	110
TLC	29.4 %	34	10	2	12
Web publishing	29.4 %	34	10	2	12
Unknown	0 %	1	0	1	1
TOTAL	33.6 %	672	226	58	284

[a] Column (a) lists the number of reached firms that were categorised as VC-backed firms based on secondary data sources.
[b] Column (b) lists the number of firms that (partially) answered the survey and that were categorised as VC-backed firms based on secondary data sources.
[c] Column (c) lists the number of firms that were originally categorised as non VC-backed firms based on secondary data sources but that reported themselves to be VC-backed firms in the survey.

Europe. This leaves us a total sample of 284 VC-backed firms (column e), of which 14 firms were dropped as they reported that they were not independent at foundation.

Table A1 summarises the descriptive statistics of the full sample and compares the means between the two subsamples of respondents. The first, the "involvement sample", is composed of 136 firms which responded to a section of the questionnaire on the involvement of VC in value-adding activities, phrased through a battery of questions pertaining to the importance which the contribution of the first lead investor had for the various activity areas of the firm. The second subsample, the "non-involvement sample", is composed of 134 firms which did not answer the questions on value added. A two-sided t-test (without assuming equal variances across the two groups) underlines the existence of significant differences between the two subsamples. The first difference is that respondents who were willing to fill in all survey questions were working in the firm at the time of the foundation or at the time of the first VC round. This actually increases the credibility of the answers. Moreover Table A1 highlights significant differences in terms of the education level and experience of the founders (involvement sample has a higher share of founders with an MBA or PhD, and with management and research experience). The involvement sample also exhibits a higher propensity to actively search external financing (in the involvement sample 97% of the firms had sought external financing whereas in the no-involvement sample this share was only 43%). There were also differences in size (on average, firms in the involvement sample had fewer employees), in profits (the net profit of the involvement sample firms was less negative), by type of lead investor (the involvement sample had a higher share of independent lead investors), in industries (the involvement sample had a higher share of firms from the telecommunication industry), and in countries (the involvement sample had no observations from Italy, had a lower share of firms from Belgium and had higher shares of firms from Finland, France, Spain and the UK). These differences between respondents and non-respondents call for consideration of a possible response bias. First, the objective of our paper was to discriminate between IVC and GVC. Accordingly, our results could be biased only if the response bias differs between IVC and GVC-backed

firms. Second, in our multivariate analysis we include as control variables some of the observable firm characteristics which are found to vary between the involvement and non-involvement samples. Since our results are confirmed when these controls are included, we may conclude that differences between IVC and GVC are hardly driven only by response bias.

The involvement sample consists of five types of first-round lead investors: IVC (66 firms), CVC (11), BVC (7), GVC (22), and UVC-backed firms (9). In addition the sample contains 21 observations where the type of first lead investor is unknown. Due to the small number of observations, which does not allow a proper analysis, we excluded CVC, BVC and UVC, and focused on IVC and GVC-backed firms[4]. The remainder of the analysis will focus on 88 firms having a GVC or IVC investor as their first lead investor.

In line with Manigart et al. (2002), who reported a syndication rate of 28.7% in Europe, syndication does not appear to be very common in our sample. From the VICO dataset, we had information about syndication for 70 out of the 88 firms. It turned out that for 71% of the sampled firms the first VC investment was not syndicated, i.e. a single investor was involved. The share of syndicated deals was 34% for IVC and only 12% for GVC. These low shares of syndication during the first round of investment decrease the potential of syndicate partners influencing the findings, thus supporting the robustness of our data and interpretation.

4 Empirical findings

4.1 Value-adding contributions of government VCs versus independent VCs

The survey measures value added by asking how important the contribution of the lead investor was for building up or developing a number of activity areas within the firm. The survey used a scale of 1 (not at all important) to 7 (very important). Value-adding was examined with regard to 28 activity areas grouped into 8 broader categories: (1) strategy, (2) technology position, (3) market position, (4) professionalisation, (5) financial function, (6) quality, (7) internationalisation and (8) exit orientation (see Table 2). The grouping of the activity areas into these eight categories was verified using factor analysis, the findings of which are reported in the appendix (Table A2).

Table 2 includes the total average score of the value added, the average scores for each of the 8 main categories and 28 more detailed forms of value added by VC type. Although the aggregate average value added of GVC is lower than that of IVC, the difference turns out not to be statistically significant (row 1). Strikingly, the lowest average scores for the value-adding activities for both VC types were in internationalisation, but the differences were small. For IVCs the highest average was in the professionalisation category, for GVCs in the financial function. GVCs turned out to have lower average scores than IVCs in 7 out of 8 main categories of value-adding activities, but only two were significantly different: professionalisation and exit orientation. A comparison of the t-test results findings with those of non-parametric tests (Table A3) does not reveal great differences in the test results.

[4] Grouping together BVC and CVC was discarded because the extant literature provides evidence that their investment motivations differ too much to make the combination meaningful (see, e.g., Siegel et al., 1988; Hellmann, 2002; Bertoni and Guerini, 2011). Combining GVC and UVC into a single category was also considered, but discarded after a preliminary analysis revealed persistent differences between both categories of public VCs in several of the sampled countries.

Table 2 The activity areas used as measures of value added categories[a] of GVCs versus those of IVCs (two-tailed t-tests in means)

	Full sub-sample			Government VC's		Independent VC's		
Categories and *forms* of value-added	Obs	Mean	S.D.	Obs	Mean	Obs	Mean	Signif.
TOTAL VALUE ADDING CONTRIBUTION	79	3.21	0.125	18	2.94	61	3.28	
Strategy	88	3.67	0.168	22	3.39	66	3.77	
Business plan	88	4.01	0.196	22	3.55	66	4.17	
Strategic focus	88	3.67	0.194	22	3.36	66	3.77	
Capabilities	88	3.34	0.191	22	3.27	66	3.36	
Technology position	88	2.89	0.150	22	2.61	66	2.98	
R&D function improvement	88	3.02	0.191	22	2.95	66	3.05	
Strong legal IP base	88	2.81	0.177	22	2.59	66	2.88	
Partnerships for technological development	88	2.84	0.178	22	2.27	66	3.03	*
Market position	88	3.43	0.180	22	3.21	66	3.50	
Sales and marketing position	88	2.89	0.187	22	3.00	66	2.85	
First sales pressure	88	3.49	0.206	22	3.27	66	3.56	
Accelerate growth pressure	88	3.91	0.215	22	3.36	66	4.09	'
Professionalisation	88	3.72	0.169	22	3.06	66	3.94	**
Cost base control	88	3.73	0.184	22	3.45	66	3.82	
Corporate governance systems	88	3.86	0.200	22	3.41	66	4.02	
Change in management team	88	3.67	0.206	22	2.73	66	3.98	**
Finding board members	88	3.61	0.206	22	2.64	66	3.94	***
Financial function	86	3.79	0.193	21	3.86	65	3.77	
Obtaining non-equity finance	86	3.69	0.215	21	3.90	65	3.62	
Raising follow-on financing	87	4.01	0.235	21	4.00	66	4.02	
Attracting new venture capital investors	87	3.71	0.226	21	3.67	66	3.73	
Quality	84	3.74	0.155	20	3.56	64	3.80	
Credibility for other investors	85	4.39	0.191	21	3.90	64	4.55	
Credibility for customers	86	3.52	0.173	21	3.43	65	3.55	
Credibility for suppliers and partners	85	3.52	0.181	20	3.25	65	3.60	
Credibility for recruiting employees	86	3.48	0.188	21	3.29	65	3.54	
Internationalisation	83	2.12	0.152	19	1.96	64	2.17	
Finding marketing and distribution channels abroad	85	2.49	0.188	20	2.90	65	2.37	
Seeking equity financing abroad	85	2.19	0.175	21	2.05	64	2.23	
Recruiting management team members abroad	85	2.04	0.164	21	1.76	64	2.13	
Recruiting other staff members abroad	86	1.98	0.150	21	1.76	65	2.05	
Looking for international board members	84	1.98	0.156	20	1.55	64	2.11	*
Exit orientation	83	2.90	0.195	20	2.25	63	3.11	**
Prepare IPO	83	2.61	0.215	20	2.15	63	2.76	'
Finding acquirers for trade sale	84	2.85	0.202	20	2.00	64	3.11	**
Prepare for other exit routes	84	3.29	0.217	20	2.60	64	3.50	*

Note: [a]Each category of value added tabulates the average of all the forms of value added belonging to that category. Respondents answered 28 questions about the importance of the lead investor for different forms of value added on a scale from 1 (not important at all) to 7 (very important). The first row in the above table tabulates the total value adding contribution defined as the average of the 28 forms of value added. Statistical significance: *** p<0.01, ** p<0.05, * p<0.10, + p<0.15, ‘ p<0.20.

To sum up the main findings of our univariate analysis, GVCs scored less highly than IVCs in a number of value added categories; however, the statistical significance of many of the differences was somewhat limited. The weaker performance of GVCs especially held for their contribution to professionalisation. Although GVCs showed a higher average score for obtaining non-equity finance, we found no statistically significant evidence that GVCs would do better than IVCs in any of the 28 forms of value added. This provides thus weak evidence supporting Hypotheses 1 and 2.

In the next section, we pay attention to the value added of lead investors on the investee in a multivariate context.

4.2 Comparing value-adding contributions while controlling for firm characteristics

As expected, the different types of VCs have differences in the profiles of their investee firms (see Box A1). There were several statistically significant differences among the average characteristics of their investee firms. In order to control for the influence of investee firm characteristics (investment profiles), technology field of the investee firm, and the country where the firm is situated, we focused on the relationship between the *VC-type* (GVC and IVC) and the *value-adding contributions* (VAC) of VCs in a multivariate context. We emphasise that we do not wish to give the regression results a causal interpretation but rather use them to uncover partial correlations. The VC type is not assigned randomly to firms, but reflects likely performance, making GVC an endogenous regressor[5].

Estimating an OLS model by taking into account the data availability leaves us with the following specification:

$$VAC\ of\ the\ VC^{*}_{i\,(2010)} = \beta_1 \left(GVC\right)_{i\,(1st\ round)} + \beta_2 X_{i(1stround)} + \varepsilon_i \qquad (1)$$

The left-hand side of the above equation contains a measure of the value added contribution of the first lead investor (VAC). The measure captures the score with which the investees assessed the importance of the value added by their first lead investor. The above equation will be run separately for different categories and forms of value added. A first specification of the regression explains the total value added of the first lead investor. A second set of 8 specifications explains the value added contribution by broad categories: (1) strategy, (2) technology position, (3) market position, (4) professionalisation, (5) financial function, (6) quality, (7) internationalisation and (8) exit orientation. A factor analysis of all 28 available forms of VACs returned 8 factors that support a clear-cut interpretation along the lines of the categories considered (see Table A2). In order to capture all available information, a last set of specifications runs separate regressions for 28 detailed forms of VAC.

The first regressor in equation (1) captures VC-type: $GVC_{i\,(1stround)}$ equalling 1 if the firm *i* had a government VC as a lead investor during the first round of financing or 0 if the first lead investor was IVC. A set of additional controls is included in the equation. Since performance metrics may vary across industries because of the different development pathways and time perspectives, we controlled for the industry. Industries were grouped in four broad categories to obtain sufficient variation in the regressions: (1) Software (reference industry); (2) Biotech, pharmaceutical, nanotech, energy and other R&D; (3) ICT-manufacturing, robotics and web publishing; and (4) Telecommunications and Internet. Country dummies were added to control for potential country-specific variation in the value added which the first lead investor contributes to the portfolio firms. An alternative specification is to control for additional investee firm characteristics, which potentially affect their need for 'coaching': these include measures of firm manager experience (previous founder experience dummy), firm size (number of employees), firm stage (the firm had a product dummy), R&D intensity (share of R&D employees is 1% to 10% dummy), and profits (net profits).

[5] There is a caveat in interpreting the econometric findings because it is based on survey data which can entail many problems (see Bertrand & Mullainathan, 2001).

Applying equation (1) to a construct of total value added does not yield any significant results (Table A4). The relation between the GVC indicator and total value added is, again, negative but not significant. The relation is weakly significant (+p<0.15) only when we controlled for the industry and country (specification b).

The results in Table 3 provide a description of the relationship between investor type and value added outcomes. The table reports the regression results for 8 categories of VACs including a fixed set of variables (industries and countries). The first significant finding of the regression shows that the partial correlation between the GVC indicator and the professionalisation scores is negative and statistically significant (specification d). The second significant finding shows a negative partial correlation between the GVC indicator and exit orientation scores (specification h). The results are in line with the univariate results presented in Table 2. For other categories of value added, the OLS coefficients of the GVC indictor were only weakly or not at all significant.

In addition to industry and country information, we added firm-level information to capture potential differences among the investor types in their selection of investee firms (Table A5). Including the measures described above, that is, founder experience, firm size, firm stage, R&D intensity and profits, weakens the significance of the results somewhat. Nevertheless, the significant negative partial correlation between the GVC indicator and both professionalisation and exit orientation scores turns out to be robust.

The alternative specifications in Table A6 and Table A7 use detailed forms of value-adding categories instead of constructing measures of value-adding activities and showing that the significance of the GVC indicator for professionalisation (Table 3, column d) is driven by the items 'change in management team' and 'finding board members'. The second finding reveals that exit orientation (Table 3, column h) is driven by the item 'finding acquirers for a trade sale'

Table 3 OLS regression results on the relationship between VC type and value-adding contributions controlling for industries and countries

OLS	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Sample of IVC and GVC			Market	Profession-	Financial		Internat-	Exit
Dependent var: Importance of lead investor for:	Strategy	Technology	Position	alisation	function	Quality	ionalisation	orientation
Investor: Lead investor is Government VC	-0.573 '	-0.391	-0.528 '	-0.953 **	-0.098	-0.377	-0.134	-0.804 *
Ind: Bio, Pharma, nano, energy and other R&D	-0.355	0.038	0.191	-0.159	-0.061	-0.462	-0.354	-0.392
Ind: ICT manuf., robotics and web publishing	-1.049 **	-0.684 *	-1.202 ***	-0.896 **	-1.199 **	-0.971 **	-0.811 **	-0.776 +
Ind: Telecommunciations and internet	-0.329	0.075	0.454	0.266	-0.081	0.291	-0.59	-0.27
Country: Belgium	-0.552	-0.114	0.835 +	0.053	-0.863 '	-0.567	-0.464	0.513
Country: Finland	0.355	-0.686 *	0.003	-0.3	0.06	0.45	-0.569 '	-0.768 +
Country: France	-1.147 **	-0.961 **	-1.263 **	-1.15 **	-1.01 *	-0.504	-0.576	-0.379
Country: Germany	0.237	0.782 '	0.95 +	0.142	1.481 **	0.78 '	-0.835 '	1.582 **
Constant	4.43 ***	3.458 ***	3.882 ***	4.486 ***	4.375 ***	4.192 ***	2.892 ***	3.464 ***
Observations	88	88	88	88	86	84	83	83
F-test(Model)	1.659 +	1.858 *	3.467 ***	2.149 **	1.973 *	1.902 *	0.904	2.136 **
R-square	0.14	0.16	0.26	0.18	0.17	0.17	0.09	0.19
Adj. R-square	0.06	0.07	0.19	0.10	0.08	0.08	-0.01	0.10

Notes: The above table tabulates OLS coefficients and significances. Each of the eight columns looks at the relationship between having a government VC as a lead investor and the value added contribution of the lead investor in a specific field, controlling for broad industries and countries. Software is the reference industry, Spain is the reference country. Statistical significance: *** p<0.01, ** p<0.05, * p<0.10, + p<0.15, ' p<0.20.

and 'preparing for other exit routes'. The third significant and robust result shows a negative relation between the GVC indicator and 'accelerating growth pressure'. The final finding shows that GVCs perform less well than IVCs when it comes to offering credibility to other investors.

To summarise, in a multivariate context most of the differences between the two investor types, first observed in a univariate context, are confirmed. IVC generally gave more support than GVC in professionalisation (e.g. changing the management team and finding board members) and exit orientation (e.g. finding acquirers for trade sale). In addition, IVCs were more important for accelerating growth pressure. Results of the multivariate analysis also revealed that IVC is more important than GVC in providing credibility to the investors.

With regard to our hypotheses, we may conclude that there was partial support for our second hypothesis: the government and independent venture capitalists had somewhat different strengths in their value added activities thus evidencing different profiles in their activities and the impact these had. With regard to hypothesis 1 – as the total value added contribution is not significantly different between both VC types, strictly speaking the hypothesis has to be rejected. However, if we test hypothesis 1 by looking at the differences across the 8 categories of value added category by category, GVCs have significantly lower value-adding contributions than IVCs in two of the categories, namely in professionalisation and exit orientation, indicating partial support of the hypothesis.

4.3 Adverse effects on the investee of government VCs versus independent VCs

Comparing adverse effects

The activities of the lead investor may cause friction and adverse effects in their portfolio firms. These are presumably related to an active approach of the investor, since his/her stance may be in conflict with that of the firm management.

Adverse effects were explored by the survey and they referred to problems, tension or pressures, or ill-advised choices. Investees were asked if the first lead investor had adverse effects in four areas: (1) intellectual property rights, (2) business strategies, (3) internationalisation efforts and (4) time spent on the interaction with the venture capitalist. The adverse effects questions were based on a scale from 1 (no negative effects at all) to 7 (very serious effects). The results are given in Table 4.

Overall, the ratings for adverse effects were quite low indicating that the investee firms had not suffered from them a great deal. On average, all the four categories of adverse effects scored lower for GVCs than for IVCs, though the differences were not statistically significant (except for one at the level of $p<0.15$). The results of non-parametric tests are in line with the above findings but also find differences of some significance (at the level of $p<0.05$) in business strategies (Table A8). Furthermore, the overall degree of value-added contributions and a composite index of adverse effects did not correlate with each other (Table A9).

On the basis of the findings we cannot conclude that there were differences between the two investor types in their propensity to have adverse effects on the investee firm or that the value-added contributions would have been strongly correlated with the degree of adverse effects.

Table 4 Comparing adverse effects of Government VCs and Independent VCs on their portfolio firms

	Full sub-sample			Government VCs		Independent VCs		
	Obs	Mean	S.D.	Obs	Mean	Obs	Mean	Signif.
IP issues	86	1.47	0.128	21	1.24	65	1.54	
Business strategies	86	2.37	0.186	21	2.19	65	2.43	
Internationalisation efforts	86	1.77	0.151	21	1.62	65	1.82	
Interaction with venture capitalist	86	2.62	0.201	21	2.10	65	2.78	+
Total adverse effects of lead investor	86	2.06	0.141	21	1.79	65	2.14	

Note: [a]Respondents answered questions about four different forms of adverse effects on a scale from 1 (not negative effects at all) to 7 (very serious effects). The last row in the above table represents the total adverse effects defined as the average of the 4 detailed forms of adverse effects. The last column lists the significance levels of two tailed t-tests in means without assuming equal variances across the groups. Statistical significance: *** p<0.01, ** p<0.05, * p<0.10, + p<0.15, ‘ p<0.20.

Comparing adverse effects controlling for firm characteristics

The final step in our analysis focuses on the relationship between the VC type and the adverse effects of VCs in a multivariate context. The econometric setup used is based on equation (1), where the dependent variable is now the adverse effect score. Once again, results have to be interpreted as partial correlations, rather than causation.

The first regression we ran explains the total value added as a function of VC type (a GVC dummy) and a set of industry and country dummies. Table 5 tabulates its results and shows the relationship between VC type and adverse effects to be only weakly significant (p<0.15). The second set of regressions we ran explain four detailed forms of adverse effects as a function of VC type and firm characteristics. Results are tabulated in Table A10 and show that having a government VC as first lead investor has a negative relationship with the adverse effects arising from the interaction between the VC and the investee, but the findings were only fairly weakly significant.

To summarise we found that government venture capitalists had somewhat fewer adverse effects than independent venture capitalists and only in a couple of dimensions, that is, business strategies and interaction with the venture capitalist. That this is the case seems to reinforce assumptions that less intensive post-investment involvement in the portfolio firm causes less frictions and problems in the interaction, but the other side of the coin is that the portfolio firm obtains less advise, and presumably, less resources for its future development.

Table 5 OLS regression results on the relationship between VC type and adverse effects controlling for firm characteristics, industries and countries

OLS Sample of IVC and GVC Dependent var: Adverse effects of lead investor	Coeff.	Signif.
Investor: Lead investor is Government VC	-0.534	+
Ind: Bio, Pharma, nano, energy and other R&D	0.509	
Ind: ICT manuf., robotics and web publishing	0.053	
Ind: Telecommunciations and internet	-0.824	*
Country: Belgium	-0.306	
Country: Finland	0.081	
Country: France	-0.684	+
Country: Germany	0.497	
Constant	2.284	***
R-square	0.138	
Adj. R-square	0.048	
F-test(Model)	1.539	'
Observations	86	

Notes: The above table tabulates OLS coefficients and significances. The table looks at the relationship between having a government VC as a lead investor and the total adverse effect of the lead investor on its portfolio firms, while controlling for broad industries and countries. Software is the reference industry, Spain is the reference country. Statistical significance: *** p<0.01, ** p<0.05, * p<0.10, + p<0.15, ' p<0.20.

5 Summary and concluding remarks

This paper aimed to find out whether government and independent venture capitalists differed in their value-adding behaviour as assessed by their investee firms, that is, in the 'treatment' they offer to their investee firms, while controlling for the 'selection' effect. The study used a unique data set based on a survey addressed to new VC-backed, technology-based companies in seven European countries[6]. The study focused on the importance of the value added provided by the first lead investors as assessed by investee companies. The contribution of the paper to the extant research literature is a focus on two important specific types of venture capital which potentially have widely different investment motivation, preferences, human capital and investment horizons. A second contribution concerns an exploration of the adverse effects which the involvement of venture capitalists in their investee firms might bring about.

The study first paid attention to whether the two investor types differed in their investment profiles in order to be able to control for the potential selection effect. The investors differed in a number of respects and these findings were used as controls in further analysis.

[6] For the scope of this paper, we have no usable observation for Italy, so that the number of countries actually involved in the present study is six.

The value-adding activities were analysed in a univariate and multivariate context using the variables indicating portfolio selection. In a multivariate context most differences between the two investor types, first observed in a univariate context, were reinforced. The independent venture capitalists were more important in professionalisation, activities such as changing the management team and finding board members as well as in exit orientation (finding acquirers for trade sale). In addition, independent venture capitalists were more important for accelerating the growth of the firms and offering credibility to other investors. Even though the overall value-adding behaviour of the two investor types did not differ – using a composite indicator for value-adding activities – at a statistically significant level, we may judge that independent investors performed better in a number of activities and in those that were of importance for the business activities of the firm. We thus found, at least, partial support for our hypothesis one, namely, that on average the importance of the value-adding contributions of the government venture capitalists was smaller than that of the independent venture capitalists. We also got partial support for our second hypothesis, namely, that the profiles of the value added activities of the two investor types differed.

It was assumed that the activities of the lead investor might have caused friction and adverse effects in the company. However, the study showed that, overall, such effects were minor. There was also little difference between the two investor types in terms of these adverse effects, with the exception that interaction between the investor and the investee suffered from less adverse effects when a government VC was the lead (and often the only) investor. Though it may be difficult to interpret the findings concerning the adverse effects – since our measure concerning involvement entailed a judgment of its importance – our findings provide some support for assuming that active involvement can lead to friction in the relations between the investor and the management of the investee firm.

The fact that we did not obtain larger differences between the two investor types in their value-adding contributions may be related to the fairly small size of the sample and the heterogeneity of the data. The data analysed were from six countries and the nature and behaviour patterns of, for example, government venture capitalists may differ from one country to another. There seems to be a great deal of the intra-investor type of heterogeneity. Whether it is related to the multiple-country context or whether it is independent of it is not known. Nevertheless, one of the findings of this study is that the government venture capitalists, in particular, evidence a fairly modest role in their value-adding behaviour.

Our findings are in broad agreement with previous studies in supporting the view that government venture capitalists provided less value-added to their portfolio firms (e.g., Knockaert et al., 2006 and Knockaert and Vanacker, 2010). The role of the independent venture capitalists in professionalisation is also in agreement with many previous studies (e.g., Ehrlich et al., 1994; Maula et al., 2005). Some of the authors cited in the beginning of this paper regarded different investor types to be complementary since they added value to their portfolio companies in a complementary way (e.g., Maula et al., 2005). Our study could not provide evidence of complementarity because we could not study the complementarity of the behaviour of venture capitalists in one and the same syndicate, the analysed survey data being focused on the lead investors. Furthermore, most of the firms included in our data did not have syndicates, and we were thus able to study only the influence of the lead (or only) investor. Thus, the performance differences between the two investor types studied do not convey to us any informa-

tion of whether another investor filled in the roles and functions that were assessed to be less important in the behaviour of the lead investor.

On the basis of our findings we may raise the question of what might be the most appropriate role for GVC. In the direct investments these seem to perform only in a modest way in providing value-adding support to the portfolio firm management. We may question whether they might be more appropriate in a role as a fund of funds. However, we need more information of their potentially complementary roles within syndicates before we may draw more definite conclusions on the matter. Larger and more robust datasets would also allow for more direct comparisons of the performance of particular investor types in different national contexts.

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Appendix

Table A1 Descriptive statistics of the full sample of VC-backed firms

		Full sample		Involvement sample		No Involvement sample		
Variables	Obs	Mean	S.D.	Obs	Mean	Obs	Mean	Signif.
Respondent: Was working in the company at foundation	208	45 %	0.035	136	61 %	72	15 %	***
Respondent: Was working in the company at 1st round of VC investment	136	63 %	0.042	128	66 %	8	0 %	***
Founder: Had management experience before the foundation	170	66 %	0.036	135	72 %	35	46 %	***
Founder: Had founder experience before the foundation	152	43 %	0.040	135	42 %	17	53 %	
Founder: Had research experience before the foundation	173	42 %	0.038	131	47 %	42	24 %	***
Founder: Obtained an MBA degree before the foundation	166	24 %	0.033	131	29 %	35	6 %	***
Founder: Obtained a PhD degree before the foundation	170	38 %	0.037	132	42 %	38	21 %	***
Founder: Had experience (average)	141	45 %	0.022	128	46 %	13	37 %	
Firm: Foundation year of the company	270	1998	0.314	136	1998	134	1998	
Firm: Was a subsidiary at the end of 2008	207	7 %	0.018	136	5 %	71	10 %	
Firm: The year when the participation became more than 50%	13	2005	0.856	7	2005	6	2004	
Firm: Searched external financing	182	84 %	0.028	136	97 %	46	43 %	***
Firm: Sought equity financing from abroad	140	47 %	0.042	131	47 %	9	56 %	
Firm: Entered a formal negotition with external investor(s)	214	100 %	0.005	136	99 %	78	100 %	
Firm: Successfully negotiated with external investor	213	100 %	0.000	135	100 %	78	100 %	
Firm: Age of the firm at time of investment	213	2.39	0.197	95	2.56	118	2.26	
Firm: Size (in number of employees)[a]	223	26	3.863	104	20	119	31	+
Firm: Size (in sales) (Thousand Euro, Nominal)[a]	196	4939	1537.781	96	4839	100	5035	
Firm: Net profit (Thousand Euro, Nominal)[a]	227	-665	186.066	108	-369	119	-933	+
Investor: Year of the first VC investment	194	2001	0.272	135	2001	59	2001	
Investor: Investor exited from the company	158	32 %	0.037	134	34 %	24	21 %	'
Investor: Year of exit of first VC investor	46	2004	0.596	41	2005	5	2000	*
Investor: Lead investor is corporate VC[a]	270	12 %	0.020	136	8 %	134	16 %	*
Investor: Lead investor is bank affiliated VC[a]	270	7 %	0.015	136	5 %	134	8 %	
Investor: Lead investor is university VC[a]	270	7 %	0.016	136	7 %	134	8 %	
Investor: Lead investor is narrow captive VC (corp, bank)[a]	270	19 %	0.024	136	13 %	134	24 %	**
Investor: Lead investor is broad captive VC (corp, bank or univ)[a]	270	26 %	0.027	136	20 %	134	32 %	**
Investor: Lead investor is independent[a]	270	40 %	0.030	136	49 %	134	31 %	***
Investor: Lead investor is narrow public VC (governm, univ)[a]	270	18 %	0.023	136	16 %	134	19 %	
Investor: Lead investor is broad public VC (governm, univ)[a]	270	25 %	0.027	136	23 %	134	28 %	
Investor: Other lead investor[a]	270	6 %	0.014	136	10 %	134	1 %	***
Investor: Information on type of lead investor is missing[a]	270	11 %	0.019	136	5 %	134	16 %	***
Industry: Biotech[a]	270	14 %	0.021	136	15 %	134	13 %	
Industry: Energy[a]	270	1 %	0.006	136	1 %	134	1 %	
Industry: ICT manufacturing[a]	270	20 %	0.025	136	19 %	134	22 %	
Industry: Internet[a]	270	6 %	0.015	136	3 %	134	10 %	**
Industry: Nanotech[a]	270	0 %	0.004	136	0 %	134	1 %	
Industry: other R&D[a]	270	4 %	0.012	136	5 %	134	2 %	
Industry: Pharmaceutical[a]	270	4 %	0.012	136	1 %	134	7 %	**
Industry: Robotics[a]	270	3 %	0.010	136	3 %	134	2 %	
Industry: Software[a]	270	38 %	0.030	136	40 %	134	35 %	
Industry: Telecommunications[a]	270	4 %	0.012	136	6 %	134	2 %	+
Industry: Web Publishing[a]	270	4 %	0.013	136	6 %	134	3 %	
Broad Industry 1: Bio, Pharma, nanotech, energy and other R&D[a]	270	23 %	0.026	136	23 %	134	24 %	
Broad Industry 2: ICT manufacturing, robotics and web publishing[a]	270	27 %	0.027	136	28 %	134	27 %	
Broad Industry 3: Telecommunciations and internet[a]	270	10 %	0.019	136	9 %	134	12 %	
Country: Belgium	270	26 %	0.027	136	17 %	134	36 %	***
Country: Finland	270	11 %	0.019	136	15 %	134	7 %	**
Country: France	270	15 %	0.022	136	23 %	134	7 %	***
Country: Germany	270	7 %	0.016	136	7 %	134	8 %	
Country: Italy	270	15 %	0.022	136	0 %	134	31 %	***
Country: Spain	270	11 %	0.019	136	16 %	134	6 %	***
Country: United Kingdom	270	14 %	0.021	136	22 %	134	5 %	***

Note: The above table is based on the full sample of VC-backed firms excluding the firms that were subsidiaries at foundation. Statistical significance: *** p<0.01, ** p<0.05, * p<0.10, + p<0.15, ‘ p<0.20. Two tailed t-tests in means. [a]Variable obtained from secondary sources.

Table A2 Loadings of 28 value added variables on 8 factors based on a rotated factor analysis

Factors	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Interpretation of the factors	Internationalisation	Market position	Quality	Professionalisation	Exit orientation	Financial function	Technology position	Strategy
Forms of value added								
Business plan	0.10	0.36	0.11	0.25	0.09	0.11	0.25	***0.56***
Strategic focus	0.17	0.38	0.19	0.28	0.05	0.09	0.05	***0.68***
Capabilities	0.26	***0.41***	0.22	0.25	0.09	0.19	0.15	***0.48***
R&D function improvement	0.01	0.14	0.14	0.04	0.10	0.19	***0.73***	0.03
Strong legal IP base	0.14	0.14	0.27	0.22	-0.02	0.12	***0.66***	0.13
Partnerships for technological development	0.19	0.31	0.09	0.27	0.01	0.17	***0.59***	0.15
Sales and marketing position	0.25	***0.56***	0.16	0.19	0.06	0.06	0.24	0.17
First sales pressure	0.12	***0.81***	0.13	0.17	0.12	0.11	0.10	0.19
Accelerate growth pressure	0.13	***0.79***	0.19	0.26	0.29	0.12	0.13	0.13
Cost base control	0.12	0.39	0.18	***0.50***	0.20	0.35	0.17	0.18
Corporate governance systems	0.26	0.29	0.22	***0.63***	0.20	0.18	0.09	0.06
Change in management team	0.22	0.25	0.15	***0.77***	0.18	0.17	0.11	0.19
Finding board members	0.21	0.21	0.20	***0.66***	0.19	0.09	0.17	0.19
Obtaining non-equity finance	0.13	0.32	0.28	0.18	0.03	***0.45***	0.20	0.10
Raising follow-on financing	0.11	0.19	0.17	0.12	0.14	***0.73***	0.18	0.05
Attracting new venture capital investors	0.24	0.07	0.23	0.22	0.23	***0.73***	0.13	0.09
Credibility for other investors	0.13	0.10	***0.46***	0.17	0.21	***0.45***	0.08	0.14
Credibility for customers	0.15	0.13	***0.84***	0.11	0.03	0.10	0.08	0.07
Credibility for suppliers and partners	0.14	0.12	***0.85***	0.12	0.14	0.11	0.08	0.07
Credibility for recruiting employees	0.21	0.16	***0.73***	0.18	0.08	0.20	0.18	0.10
Finding marketing and distribution channels abroad	***0.59***	0.22	0.19	0.08	0.30	0.00	0.06	0.31
Seeking equity financing abroad	***0.77***	0.13	0.14	-0.01	0.14	0.18	0.00	0.13
Recruiting management team members abroad	***0.90***	0.10	0.08	0.13	0.15	0.12	0.05	0.03
Recruiting other staff members abroad	***0.93***	0.06	0.12	0.12	0.15	0.03	0.08	0.06
Looking for international board members	***0.93***	0.07	0.12	0.15	0.16	0.06	0.04	0.03
Prepare IPO	0.29	0.14	0.07	0.07	***0.66***	0.15	-0.09	0.11
Finding acquirers for trade sale	0.27	0.20	0.11	0.15	***0.82***	0.00	0.14	0.04
Prepare for other exit routes	0.28	0.11	0.08	0.18	***0.82***	0.25	-0.02	0.01

Note: The above table lists the rotated factor loadings of the 8 factors with eigen values greater than 1. Factor loadings higher than 0.4 are printed in italic bold.

Table A3 How do GVCs and IVCs differ in value adding contributions? Comparing the results of a two-tailed t-test with those of non-parametric tests

		Sign.	
	Wilcoxon-Mann Whitney	Wilcoxon-Mann Whitney	
Categories and forms of value-added	Median test	Ranksum test	Two-tailed T test
TOTAL VALUE ADDING CONTRIBUTION			
Strategy			
Business plan		'	
Strategic focus			
Capabilities			
Technology position			
R&D function improvement			
Strong legal IP base			
Partnerships for technological development		*	*
Market position			
Sales and marketing position			
First sales pressure			
Accelerate growth pressure	'	+	'
Professionalisation	**	**	**
Cost base control			
Corporate governance systems			
Change in management team	***	***	**
Finding board members	**	***	***
Financial function			
Obtaining non-equity finance			
Raising follow-on financing			
Attracting new venture capital investors			
Quality			
Credibility for other investors			
Credibility for customers			
Credibility for suppliers and partners			
Credibility for recruiting employees			
Internationalisation			
Finding marketing and distribution channels abroad			
Seeking equity financing abroad			
Recruiting management team members abroad			
Recruiting other staff members abroad			
Looking for international board members		+	*
Exit orientation	**	**	**
Prepare IPO			'
Finding acquirers for trade sale	**	***	**
Prepare for other exit routes		*	*

Note: Each category of value added represents the average of all the forms of value added belonging to that category. Respondents answered 28 questions about the importance of the lead investor for different forms of value added on a scale from 1 (not important at all) to 7 (very important). The first row in the above table represents the total value adding contribution defined as the average of the 28 forms of value added. Statistical significance: *** p<0.01, ** p<0.05, * p<0.10, + p<0.15, ' p<0.20.

Box A1 Investment patterns of government VCs versus independent VCs

Differences in value added can originate from the heterogeneity of the investment patterns of government VCs (GVCs) and independent VCs (IVCs). In order to be able to check the potential influence of investment patterns on the value added, we pay attention to the investment profiles of the two investor types. The table below compares the average characteristics of the firms in GVC portfolios as compared with those in IVC portfolios.

Table Investee characteristics of government VCs versus independent VCs (two-tailed t-tests in means)

	Full sub-sample			Government VC sample		Independent VC sample		
Investee characteristics	Obs.	Mean	S.D.	Obs.	Mean	Obs.	Mean	Signif.
Founder: Had experience[a]	84	0.45	0.0293	22	0.3818	62	0.4742	'
Had management experience before the foundation	88	0.7273	0.0477	22	0.5909	66	0.7727	+
Had founder experience before the foundation	88	0.3864	0.0522	22	0.2273	66	0.4394	*
Had research experience before the foundation	85	0.4588	0.0544	22	0.4545	63	0.4603	
Obtained an MBA degree before the foundation	87	0.2874	0.0488	22	0.3182	65	0.2769	
Obtained a PhD degree before the foundation	86	0.3953	0.053	22	0.3182	64	0.4219	
Firm: Age of the firm at time of investment (in years)[b]	70	2.8286	0.3796	17	3.1765	53	2.717	
Firm: Size (in number of employees)[b]	70	17.7	4.1215	21	9.4286	49	21.2449	+
Firm: Had product at time of first VC investment	85	0.5176	0.0545	21	0.5714	64	0.5	
Firm: Share of R&D personnel is 0%	86	0.0581	0.0254	21	0.1429	65	0.0308	'
Firm: Share of R&D personnel: 1%-10%	86	0.2442	0.0466	21	0.0952	65	0.2923	**
Firm: Share of R&D personnel: 26%-100%	86	0.4884	0.0542	21	0.5714	65	0.4615	
Firm: Net profit (Thousand Euro, Nominal)[b]	71	-361.9296	131.9549	20	73.05	51	-532.5098	***
Industry[c]: Software[b]	88	0.3977	0.0525	22	0.3636	66	0.4091	
Industry[c]: Bio, Pharma, nanotech, energy and other R&D[b]	88	0.1818	0.0414	22	0.3182	66	0.1364	+
Industry[c]: ICT manufacturing, robotics and web publishing[b]	88	0.3068	0.0494	22	0.2273	66	0.3333	
Industry[c]: Telecommunciations and internet[b]	88	0.1136	0.034	22	0.0909	66	0.1212	
Country: Belgium	88	0.1364	0.0368	22	0.1364	66	0.1364	
Country: Finland	88	0.2159	0.0441	22	0.3636	66	0.1667	*
Country: France	88	0.1818	0.0414	22	0.1364	66	0.197	
Country: Germany	88	0.0795	0.029	22	0.0909	66	0.0758	
Country: Spain	88	0.1705	0.0403	22	0.2727	66	0.1364	
Country: United Kingdom	88	0.2159	0.0441	22	0	66	0.2879	***

[a]The experience of the founder was calculated as the simple average of 5 experience dummies (management, founder, research, MBA, PhD). For example 100% is equivalent to all firms having at least one founder that had experience in all 5 experience categories before foundation. [b]Variables were obtained from secondary data sources. [c]Industries were regrouped based on missing observations in certain industries for certain VC types. Statistical significance: *** p<0.01, ** p<0.05, * p<0.10, + p<0.15, ' p<0.20. Obs. Italy does not appear at all in the table because Italian firms did not respond to the involvement question. The UK data did not have any GVCs, and thus, the analysis is based on five countries.

The firms in which GVCs invested had founders with less experience in entrepreneurship. More specifically the founders of the firms in GVC portfolios tended to have less experience in founding companies and to have a shorter track record in management. In addition, the average GVC portfolio firm was significantly smaller (in terms of employees) while its profits tend to be higher. Firms in GVC portfolios also seemed to be characterised by different R&D intensities. The average share of R&D personnel was more often very small (< 1%) or very high (> 26%). The difference in R&D intensities may be related to the distribution of the various industries in their portfolios. In effect, biotech, pharmaceutics, nanotech, energy and other R&D sectors are better represented in the GVC portfolios. A final finding from the subsample described in the above table is that Finnish firms were more numerous in portfolios of GVCs compared with those of IVCs. Because of the small number of firms in our sample we cannot assume normality in the sample distribution. Therefore we also ran non-parametric tests for these findings. Table b shows that the results using the non-parametric Wilcoxon-Mann Whitney median and ranksum tests. The findings are, to a great extent, in line with those of the two-tailed t-test. However, non-parametric tests do not seem to find significant differences between the profits of the two groups of firms generated.

Table Comparing the results of two-tailed t-test with those of non-parametric tests

	Sign.		
Investee characteristics	Wilcoxon-Mann Whitney median test	Wilcoxon-Mann Whitney ranksum test	Two-tailed T test
Founder: Had experience[a]			'
Had management experience before the foundation		*	+
Had founder experience before the foundation	+	*	*
Had research experience before the foundation			
Obtained an MBA degree before the foundation			
Obtained a PhD degree before the foundation			
Firm: Age of the firm at time of investment (in years)[b]			
Firm: Size (in number of employees)[b]	*	**	+
Firm: Had product at time of first VC investment			
Firm: Share of R&D personnel is 0%	'	*	'
Firm: Share of R&D personnel: 1%-10%	+	*	**
Firm: Share of R&D personnel: 26%-100%			
Firm: Net profit (Thousand Euro, Nominal)[b]		'	***
Industry[c]: Software[b]			
Industry[c]: Bio, Pharma, nanotech, energy and other R&D[b]	+	*	+
Industry[c]: ICT manufacturing, robotics and web publishing[b]			
Industry[c]: Telecommunciations and internet[b]			
Country: Belgium			
Country: Finland	*	*	*
Country: France			
Country: Germany			
Country: Spain		+	
Country: United Kingdom	***	***	***

[a]The experience of the founder was calculated as the simple average of 5 experience dummies (management, founder, research, MBA, PhD). [b]Variables were obtained from secondary data sources. [c]Industries were regrouped based on missing observations in certain industries for certain VC types. Statistical significance: *** p<0.01, ** p<0.05, * p<0.10, + p<0.15, ' p<0.20.

To conclude, different types of VCs have differences in the profiles of their investee firms as indicated by several statistically significant differences (at varying levels of significance) among the average characteristics of their investee firms. However, each group exhibits variation and we cannot conclude that they would have preferred just one specific type of investee firm.

Table A4 OLS regression results on the relationship between VC type and total value adding contribution

OLS Sample of IVC and GVC Dependent variable: Importance of lead investor for TOTAL value added*	(a)	(b)	(c)
Investor: Lead investor is government VC	-0.345	-0.433 +	-0.316
Founder: had management experience before the foundation			0.074
Firm: Size			-0.002
Firm: had product			-0.378 '
Firm: Share of R&D personnel: 1%-10%			0.078
Firm: Profits			0.0001
Industry: Bio, Pharma, nano, energy and other R&D		-0.231	-0.193
Industry: ICT manuf., robotics and web publishing		-0.87 ***	-0.916 ***
Industry: Telecommunciations and internet		0.031	0.151
Country: Belgium		-0.135	-0.072
Country: Finland		-0.065	-0.048
Country: France		-0.679 *	-0.736 *
Country: Germany		0.608 '	0.418
Constant	3.284 ***	3.725 ***	3.865 ***
Observations	79	79	79
F-test(Model)	1.348	1.867 *	1.308
R-square	0.017	0.176	0.207
Adj. R-square	0.004	0.082	0.049

Notes: The above table tabulates OLS coefficients and significances. Column (a) looks at the relationship between having a government VC as a lead investor and the total value added contribution of the lead investor without controls, column (b) controls for broad industries and countries while column (c) controls for other firm characteristics too. In column (b) and (c) software is the reference industry and Spain is the reference country. Statistical significance: *** p<0.01, ** p<0.05, * p<0.10, + p<0.15, ‘ p<0.20.

Table A5 OLS regression results on the relationship between VC type and value-adding contributions controlling for firm characteristics, industries and countries

OLS	(a)		(b)		(c)		(d)		(e)		(f)		(g)		(h)	
Sample of IVC and GVC																
Dependent var: Importance of lead investor for:	Strategy		Technology		Market Position		Profession-alisation		Financial function		Quality		Internat-ionalisation		Exit orientation	
Investor: Lead investor is Government VC	-0.473		-0.116		-0.381		-0.806	*	-0.006		-0.255		-0.121		-0.849	*
Founder: had founder experience	0.159		0.507	+	0.46		-0.109		-0.175		0.185		0.374		0.093	
Firm: Size	0.002		0		-0.002		-0.007		-0.002		-0.002		-0.004		0.003	
Firm: had product	-0.286		-0.718	**	0.025		0.204		-0.654	+	-0.591	*	-0.608	*	0.108	
Firm: Share of R&D personnel: 1%-10%	0.243		0.09		0.272		0.577	'	-0.054		0.194		-0.277		0.117	
Firm: profits	0.00003		-0.0003	*	-0.0001		-0.0002	'	-0.0002		-0.00001		-0.0001		-0.0002	
Ind: Bio, Pharma, nano, energy and other R&D	-0.355		0.204		0.298		-0.037		-0.062		-0.464		-0.397		-0.459	
Ind: ICT manuf., robotics and web publishing	-1.11	**	-0.766	**	-1.22	***	-0.778	*	-1.248	**	-1.06	**	-1.006	**	-0.835	+
Ind: Telecommunciations and internet	-0.38		0.412		0.467		0.325		0.191		0.416		-0.387		-0.485	
Country: Belgium	-0.463		0.091		0.733		-0.085		-0.623		-0.432		-0.427		0.503	
Country: Finland	0.334		-0.586	+	-0.02		-0.329		0.143		0.436		-0.584	'	-0.849	+
Country: France	-1.249	**	-1.159	**	-1.368	**	-0.885	+	-1.011	+	-0.595		-0.857	*	-0.454	
Country: Germany	0.134		0.393		0.824		0.227		1.288	*	0.513		-1.259	**	1.648	**
Constant	4.441	***	3.396	***	3.627	***	4.19	***	4.672	***	4.412	***	3.356	***	3.461	***
Observations	88		88		88		88		86		84		83		83	
F-test(Model)	1.067		2.328	**	2.225	**	1.557	+	1.534	+	1.46	'	1.033		1.364	'
R-square	0.158		0.29		0.281		0.215		0.217		0.213		0.163		0.205	
Adj. R-square	0.01		0.166		0.155		0.077		0.075		0.067		0.005		0.055	

Notes: The above table tabulates OLS coefficients and significances. Each of the eight columns looks at the relationship between having a government VC as a lead investor and the value added contribution of the lead investor in a specific field, controlling for broad industries, countries, founder experience, firm size, firm stage, R&D intensity, and profits. Software is the reference industry, Spain is the reference country. Statistical significance: *** p<0.01, ** p<0.05, * p<0.10, + p<0.15, ‘ p<0.20.

Table A6 OLS regression results on the relationship between VC type and 28 forms of value adding contributions, controlling for industries and countries

Category of value added	Form of value added	Government VC		R-square	Adj. R-square	F-test(Model)		Observations
Strategy	Business plan	-0.853	*	0.086	-0.007	0.928		88
	Strategic focus	-0.612		0.146	0.06	1.694	+	88
	Capabilities	-0.256		0.17	0.086	2.027	*	88
Technology position	R&D function improvement	-0.073		0.138	0.05	1.578	+	88
	Strong legal IP base	-0.214		0.135	0.048	1.543	'	88
	Partnerships for technological development	-0.885	**	0.178	0.094	2.131	**	88
Market position	Sales and marketing position	-0.042		0.189	0.106	2.295	**	88
	First sales pressure	-0.509		0.248	0.172	3.254	***	88
	Accelerate growth pressure	-1.032	**	0.286	0.214	3.959	***	88
Professionalisation	Cost base control	-0.676	+	0.231	0.153	2.96	***	88
	Corporate governance systems	-0.693	+	0.137	0.05	1.568	+	88
	Change in management team	-1.196	**	0.176	0.092	2.106	**	88
	Finding board members	-1.249	**	0.139	0.052	1.599	+	88
Financial function	Obtaining non-equity finance	-0.081		0.149	0.06	1.682	+	86
	Raising follow-on financing	-0.089		0.141	0.053	1.604	+	87
	Attracting new venture capital investors	-0.156		0.182	0.098	2.172	**	87
Quality	Credibility for other investors	-0.884	**	0.177	0.09	2.04	*	85
	Credibility for customers	-0.135		0.12	0.029	1.313		86
	Credibility for suppliers and partners	-0.439		0.126	0.034	1.368		85
	Credibility for recruiting employees	-0.301		0.271	0.195	3.571	***	86
Internationalisation	Finding marketing and distribution channels abroad	0.524		0.083	-0.013	0.862		85
	Seeking equity financing abroad	-0.233		0.096	0.001	1.013		85
	Recruiting management team members abroad	-0.242		0.115	0.022	1.24		85
	Recruiting other staff members abroad	-0.232		0.141	0.052	1.586	+	86
	Looking for international board members	-0.452		0.124	0.031	1.332		84
Exit orientation	Prepare IPO	-0.479		0.118	0.022	1.235		83
	Finding acquirers for trade sale	-1.15	**	0.193	0.106	2.236	**	84
	Prepare for other exit routes	-0.876	*	0.206	0.121	2.43	**	84

Notes: The above table tabulates OLS coefficients and significances. Each of the 28 rows looks at the relationship between having a government VC as a lead investor and the value added contribution of the lead investor in a specific field (Business plan, Strategic focus, etc.), controlling for broad industries and countries. Software is the reference industry, Spain is the reference country. Statistical significance: *** p<0.01, ** p<0.05, * p<0.10, + p<0.15, ‘ p<0.20.

Table A7 OLS regression results on the relationship between VC type and 28 forms of value adding contributions, controlling for firm characteristics, industries and countries

Category of value added	Form of value added	Government VC		R-square	Adj. R-square	F-test(Model)		Observations
Strategy	Business plan	-0.681	'	0.13	-0.022	0.854		88
	Strategic focus	-0.479		0.165	0.018	1.122		88
	Capabilities	-0.26		0.186	0.043	1.302		88
Technology position	R&D function improvement	0.123		0.231	0.096	1.707	*	88
	Strong legal IP base	0.006		0.242	0.109	1.822	*	88
	Partnerships for technological development	-0.478		0.296	0.173	2.396	***	88
Market position	Sales and marketing position	0.055		0.245	0.112	1.844	*	88
	First sales pressure	-0.326		0.27	0.142	2.105	**	88
	Accelerate growth pressure	-0.871	*	0.308	0.186	2.532	***	88
Professionalisation	Cost base control	-0.614	'	0.244	0.112	1.841	*	88
	Corporate governance systems	-0.675	'	0.185	0.042	1.294		88
	Change in management team	-0.992	*	0.224	0.088	1.646	*	88
	Finding board members	-0.944	*	0.205	0.065	1.465	'	88
Financial function	Obtaining non-equity finance	0.104		0.187	0.04	1.272		86
	Raising follow-on financing	0.082		0.177	0.031	1.211		87
	Attracting new venture capital investors	-0.142		0.22	0.081	1.585	+	87
Quality	Credibility for other investors	-0.823	*	0.215	0.071	1.495	+	85
	Credibility for customers	0.039		0.188	0.042	1.286		86
	Credibility for suppliers and partners	-0.261		0.153	-0.003	0.983		85
	Credibility for recruiting employees	-0.315		0.306	0.18	2.437	***	86
Internationalisation	Finding marketing and distribution channels abroad	0.452		0.117	-0.044	0.725		85
	Seeking equity financing abroad	-0.234		0.184	0.035	1.236		85
	Recruiting management team members abroad	-0.179		0.202	0.056	1.386	'	85
	Recruiting other staff members abroad	-0.234		0.238	0.101	1.734	*	86
	Looking for international board members	-0.4		0.183	0.032	1.21		84
Exit orientation	Prepare IPO	-0.433		0.138	-0.024	0.85		83
	Finding acquirers for trade sale	-1.205	**	0.207	0.059	1.404	'	84
	Prepare for other exit routes	-1.029	*	0.226	0.082	1.57	+	84

Notes: The above table tabulates OLS coefficients and significances. Each of the 28 rows looks at the relationship between having a government VC as a lead investor and the value added contribution of the lead investor in a specific field (Business plan, Strategic focus, etc.), controlling for founder experience, firm size, firm stage, R&D intensity, profits, broad industries and countries. Software is the reference industry, Spain is the reference country. Statistical significance: *** p<0.01, ** p<0.05, * p<0.10, + p<0.15, ‘ p<0.20.

Table A8 How do GVCs and IVCs differ in the adverse effects they have on their investees? Comparing the results of a two-tailed t-test with those of non-parametric tests

	Significance		
	Wilcoxon-Mann Whitney	Wilcoxon-Mann Whitney	
Different forms of adverse effects	Median test	Ranksum test	Two-tailed T test
Adverse effects		*	
IP issues			
Business strategies	**	'	
Internationalisation efforts			
Interaction with venture capitalist	'	+	+

Statistical significance: *** p<0.01, ** p<0.05, * p<0.10, + p<0.15, ‘ p<0.20.

Table A9 Correlation matrices between value-added categories and adverse effects

A. Correlation matrix	Strat.	Tech. Pos.	Market pos.	Prof.	Fin. Func.	Quality	Internat.	Exit orient.	Adv.Eff.	IP issues	Buss.Strat.	Int.Ef.	I.VC
Strategy	1												
Technology position	0.38	1											
Market position	0.64	0.49	1										
Professionalisation	0.66	0.37	0.57	1									
Financial function	0.45	0.52	0.42	0.57	1								
Quality	0.43	0.48	0.35	0.48	0.59	1							
Internationalisation	0.44	0.23	0.32	0.43	0.34	0.38	1						
Exit orientation	0.35	0.24	0.37	0.49	0.39	0.36	0.51	1					
Adverse effects	-0.03	-0.12	-0.01	-0.03	0.01	-0.12	-0.18	-0.07	1				
IP issues	0.11	-0.09	0.06	0.01	-0.02	-0.05	-0.08	-0.05	0.74	1			
Business strategies	-0.13	-0.13	-0.07	-0.14	0.00	-0.16	-0.22	-0.11	0.89	0.51	1		
Internat. efforts	0.01	-0.06	-0.01	-0.03	-0.03	-0.22	-0.13	-0.14	0.86	0.69	0.65	1	
Interaction with VC	-0.04	-0.13	0.00	0.07	0.06	0.01	-0.16	0.04	0.87	0.44	0.76	0.61	1

B. Spearman correlation matrix	Strat.	Tech. Pos.	Market pos.	Prof.	Fin. Func.	Quality	Internat.	Exit orient.	Adv.Eff.	IP issues	Buss.Strat.	Int.Ef.	I.VC
Strategy	1												
Technology position	0.43	1											
Market position	0.62	0.48	1										
Professionalisation	0.62	0.34	0.53	1									
Financial function	0.49	0.55	0.41	0.56	1								
Quality	0.44	0.50	0.35	0.46	0.58	1							
Internationalisation	0.50	0.27	0.29	0.45	0.39	0.41	1						
Exit orientation	0.36	0.32	0.34	0.47	0.39	0.36	0.56	1					
Adverse effects	0.08	-0.05	0.08	0.08	0.08	-0.04	-0.07	0.01	1				
IP issues	0.16	-0.04	0.14	0.07	0.07	0.01	0.01	-0.02	0.57	1			
Business strategies	-0.08	-0.11	-0.03	-0.13	-0.02	-0.17	-0.18	-0.11	0.89	0.44	1		
Internat. efforts	0.13	-0.01	0.08	0.04	0.04	-0.20	-0.06	-0.06	0.74	0.58	0.60	1	
Interaction with VC	0.04	-0.06	0.06	0.14	0.10	0.03	-0.03	0.08	0.90	0.39	0.73	0.62	1

Table A10 OLS regression results on the relationship between VC type and detailed forms of adverse effects, controlling for firm characteristics, industries and countries

Forms of adverse effects	Government VC		R-square	Adj. R-square	F-test(Model)		Observations
IP issues	-0.34		0.151	-0.003	0.982		86
Business strategies	-0.268		0.159	0.008	1.051		86
Internationalisation efforts	-0.175		0.166	0.016	1.105		86
Interaction with venture capitalist	-0.937	*	0.261	0.128	1.959	**	86

Notes: The Government VC column reports the coefficients of the relationship between having a government VC as a lead investor and the different forms of adverse effects, controlling for founder experience, firm size, firm stage, R&D intensity, profits, broad industries and countries. Software is the reference industry, Spain is the reference country. Statistical significance: *** p<0.01, ** p<0.05, * p<0.10, + p<0.15, ‘ p<0.20.

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